

Development of Concept Mining and Online Indexing System for Manusmṛiti

Dissertation submitted to University of Delhi in partial fulfillment of the requirements for award of the degree of

MASTER OF PHILOSOPHY

by

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2022



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Date: 22.07.2022

DECLARATION

The dissertation entitled “**Development of Concept Mining and Online Indexing System for Manusmṛiti**” carried out by me is a presentation of my original research work. Wherever contributions of others are involved, every effort is made to indicate this clearly, with due reference to the literature and acknowledgement of collaborative research and discussions. The work was done under the supervision of Dr. Subhash Chandra, Assistant Professor at the Department of Sanskrit, University of Delhi, Delhi. This is my original work. The research work is not published completely or partially in the form of books, monographs or articles.

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In our capacity as advisors of the candidate’s dissertation, I certify that the above statements are true to the best of our knowledge.

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Certificate of Originality

The research work embodied in this dissertation entitled “**Development of Concept Mining and Online Indexing System for Manusmṛiti**” has been carried out by me at the Department of Sanskrit, University of Delhi, Delhi, India. The Manuscript has been subjected to plagiarism checked by **Ouriginal Software**. The work submitted for consideration of award of M.Phil. is original.

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Dissertation Title	Development of Concept Mining and Online Indexing System for Manusmṛiti
Year of Award	2022

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Following four (5) Research papers based on this research have been published in the international peer reviewed journals and one (1) is published in international conference proceedings:

1. Nigam Arooshi and Chandra Subhash. (2021). धर्मशास्त्रीय ज्ञान परम्परा का डिजिटलीकरण एवं ऑनलाइन खोज तन्त्र का विकास. *Research Review International Journal of Multidisciplinary (RRIJM)*, 2455:3085 (Online), Volume 06, Issue 08, August 2021, pp.53-58. Impact Factor: 5.214. , UGC Listed: UGC Journal No. 44945. DOI: <https://doi.org/10.31305/rrijm.2021.v06.i08.010>.
2. Nigam Arooshi and Chandra Subhash. (2022). **Digitization and Instant Reference System for Dharmasāstric Knowledge Tradition.** *Language in India*, ISSN 1930-2940, Volume 22:02, pp.-66-72. URL: <http://languageinindia.com/feb2022/arooshidigitizationdharmaatextsfinal.pdf>
3. Nigam Arooshi and Chandra Subhash. (2022). मनुस्मृति में मानवीय स्वास्थ्य चिन्तन एवं प्रबन्धन. *Shodhsamhita: Journal of Fundamental & Comparative Research*, Vol. VIII, No. 1(X): 2022, ISSN 2277-7067, pp.-50-56.

4. Nigam Arooshi and **Chandra Subhash**. (2022). **Environmental Awareness and Protection in Ancient Bharat based on Dharmasāstric Literature**. *Zeichen Journal*, Volume 8 Issue 3, ISSN 0932-4747, pp.- 354-366. URL: <http://www.ezeichen.com/gallery/2480.pdf>
5. Arooshi Nigam and **Chandra Subhash**. (2022). Digital Accessibility and Information Mining of Dharmasāstric Knowledge Traditions. In Girish Nath Jha, Sobha L, Kalika Bali and Atul Kr. Ojha (Eds.), *Proceedings of the 6th Workshop on Indian Language Data: Resources and Evaluation (WILDRE-6 2022), LREC 2022 Workshop Language Resources and Evaluation Conference 20-25 June 2022, Marseille, France: European Language Resources Association (ELRA), ISBN: 979-10-95546-87-0, (pp.42-47).*

Following five (6) Research papers based on this research have been presented in the conferences:

1. Digital Accessibility and Information Mining of Dharmasāstric Knowledge Traditions. In *the 6th Workshop on Indian Language Data: Resources and Evaluation (WILDRE-6 2022), LREC 2022 Workshop Language Resources and Evaluation Conference 20-25 June 2022, Marseille, France.*
2. Creating Digital Platform for Manusmṛti to enhance teaching learning process in higher education” Presented in *The Online Teaching-Learning on the Quality of Higher Education in India organized by Gautam Buddha Government Degree College, Ayodhya, Uttar Pradesh, Mar 28, 2022.*
3. Perspective of Dharmashastras in Scientific World” Presented in *Second International Sanskrit Conference On Sanskrit studies Across the World organized by Department of Sanskrit, Maitreyi College, University of Delhi, New Delhi on Mar 01, 2022.*

4. Digital Access and Online Search for Dharmashastric Key Texts of Indian Intellectual Tradition” Presented in *the 25th International Congress of Vedanta, Vedāntic Approach for Health and Education in Modern Times* organized by Centre for Indic Studies at University of Massachusetts Dartmouth, Institute of Advanced Sciences, Jawaharlal University, New Delhi on Oct 28, 2021.
5. Digitization and Instant Reference System for Dharmashastric Knowledge Tradition” Presented in *Bharat Manthan* organized by Indraprastha Adhyayan Kendra, New Delhi on May 29, 2021.
6. Development of Information Extraction System for Manusmriti for Instant Reference” Presented in *the International Webinar, Under the UGC approved NSQF Courses* organized by G.M.N College, Ambala on Feb 4, 2021.

This published works have been included in the dissertation and has not been submitted for any degree to any University/institute.

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Acknowledgement

Nothing is possible without the will and blessings of the almighty, so I'd like to pay respect to the Supreme Father, the Supreme Soul, who endowed me with this life and blessed me with the strength and capability to complete this research work effortlessly. Alongside, I consider it my humble duty to express my heartfelt gratitude to all my teachers, parents, elders and friends, with whose inspiration and help, this research work has claimed its prime.

In the profound learning process from primary to higher education, the intelligence of a novice is probably fully developed when the learner enters the field of research. Research ingresses the nature of synthesis-analysis and develops rationalism and introspective thinking. This development is not possible without motivation, excellent guidance, adequate time, a stimulating learning environment and a passion for new learning. These can be obtained only from the guidance of a skilled and research-oriented, fully dedicated and mature research director with expert subject knowledge. Finding a dynamic, capable and interdisciplinary research-oriented research supervisor was not an easy task for me. This was in itself, short research for me to fulfill my innovative ideas and research ambitions. Finally, I witnessed such qualities in **Dr. Subhash Chandra**, Associate Professor, Department of Sanskrit, University of Delhi. This dissertation would not have been possible without his continuous support.

Guidance is essential for the beginning and completion of any task. I witnessed all these extraordinary qualities in **Dr. Subhash Chandra** for his tireless support, encouragement, guidance, faith and trust in researchers. My heartfelt salute to you who played an eminent role in this research and in the absence of your guidance and continuous support this research would have been impossible. Your encouragement for everything helped me, ignited my lost self-confidence and strengthen my confidence in many achievements and further research. Your support was instrumental in boosting my confidence to achieve many accomplishments. You were very patient with repeated proofreadings. You proofread my work word by word and enlightened me with your valuable suggestions and yet motivated me to pursue. Moreover, your innovative ideas,

pragmatic approach and extraordinary knowledge of various Sanskrit fields were telling. Your research acumen, enthusiastic nature and extraordinary knowledge of various fields of Sanskrit such as Grammar, Linguistics, Literature, Dharmashastras etc. have me spellbound and very inspiring. There were times during the research period when, I felt lost, arid and incapacitated. You motivated and encouraged me, re-ensured and ignited my strength and treated me as an equal and boosted my confidence. Your trust and confidence in me made my difficult research journey easy. Your step-by-step guidance has helped me write this study efficiently. I was unacquainted with the knowledge of the computer programming language and web technology. You taught me the core concepts of the Python programming language and the postulation of web technology. You helped me design software, create text files, and develop databases and other language resources. You have provided constant assistance in programming, coding, and Computational Linguistics techniques and have created solutions to many complications. You have not only trained me in the CL techniques but also given me the platform to present my skills to build my confidence, enhance my presentation skill and also honed my research paper writing skills. Dr. Chandra your guidance and input were invaluable to the quality and contribution of the work presented in this dissertation as well as in other publications, carried out during my research period. I could not imagine a better supervisor for my research.

Of course, research requires feedback, guidance and the innovative vision of many scholars. **Prof. Daya Shankar Tiwary** and **Dr. Avadhesh Pratap Singh** of the research advisory board helped me to innovate my archaic ideas for this research. Both of you were a source of valuable advice, ideas, insights and feedback during my research journey, without both of you this research would not have shaped well. I would like to make a special mention to Prof. Tiwary for introducing a fresh approach and annexing scientific and mathematical perspectives into the traditional exercises. Your valuable scientific knowledge of the Sanskrit text illuminated the new dimensions of the research. Dr. Singh also gave his valuable suggestions to correlate the dharmashastric knowledge tradition with many other shastras. Both of you reviewed my progress monthly and enhanced my knowledge through your suggestions to shape up the work. I thank both of you for devoting your time to going through my chapters

and imparting state-of-the-art reviews and providing genuine suggestions on how to enhance the conformation of this dissertation.

This dissertation would not have been possible without the support of many laureates. I would like to thank you all very much and express my heartfelt gratitude. I would like to convey my special thanks to **Prof. Ranjan Kumar Tripathi**, Professor, Department of Sanskrit and Joint Dean of Colleges, University of Delhi, who tutored me on the wider scope of theological studies and pursued me to take up research in the Dharmashastric literature. I thank you for your relentless support and continuous encouragement. And, also hope that your blessings will always edify me in future.

I also appreciate our head of department, **Prof. Omnath Bimali** for his encouragement, devotion and for allowing me to pursue research on this topic. I am also grateful to the faculty members of the department of Sanskrit, at the University of Delhi especially Prof. Bhartendu Pandey, Prof. Meera Dwivedi, Prof. Purnima Kaul, Prof. Satyapal Singh, Prof. Ved Prakash Dindoriya, Prof. Ranjit Behera, Dr. Tek Chand Meena, Dr. Balram Shukla, Dr. Dhananjaya Kumar Acharya, Dr. Somveer, Dr. Karuna Arya, Dr. Mohini Arya, Dr. Umashankar, Dr. Shruti Rai, Dr. Vijay Shankar Dwivedi, Dr. Rajeev Ranjan, Dr. M. Kishan, Dr. Ajit Kumar, Dr. Abhineet Kumar Srivastav, Dr. Meenakshi, Dr. Monica Kuwar Rathode and Dr. Saurabh Ji for their support and help.

I'm also beholden to the departmental M.Phil research committee for handling the administrative issues and allowing me to carry out my research on the contemporary topic., especially **Prof. Ranjeet Bahera** for convening the committee and sparing time from his busy schedule for proofreading my chapters and pitching his divine vision and keeping me apprised of how to improve the dissertation's conformation and contents.

I thank my parents and brother Anukool Nigam for their unconditional love, care and support. My parents deserve all the credit and I am eternally grateful to all of you for guiding me and showing me the right path. A huge thanks to my father Mr. Anoop Nigam for pursuing me to be an academician but it is my dearest mother Mrs. Bhavna Nigam that I will forever be appreciative of, for all your sacrifices, continuous help and support throughout my journey of academics.

I am also appreciative of my immediate seniors Dr. Vivek Kumar, Assistant Professor, Department of Higher Education, Government of Uttarakhand and Dr. Anju

who passed on the baton to me. Ph.D. research scholars Mr. Sumit Sharma and Ms. Sanju, have been great friends and gave invaluable feedback on this dissertation and research. They have always encouraged me and proofread the thesis from time to time. I take the liberty of thanking my cousin Mr. Aditya Caroli (B.Tech Computer Science Engineering) and dearest friend Mr. Asim Verma (B.Tech Computer Science Engineering and Senior Data Analyst at Delhivery) for helping me round the clock with the pertinent computational tasks of this dissertation.

I express my heartfelt gratitude and pay due respects to Dr. Nidhi Subhash Chandra Ma'am, Assistant Professor, Microbiology, Ramlal Anand College, University of Delhi, the wife of my supervisor, for moral encouragement and affectionate behaviour throughout my research journey. I am also grateful to Dr. Pankaja Ghai Kaushik, Assistant Professor, Sanskrit, Lady Shriram College, University of Delhi, for her encouragement, blessings and good wishes.

The developed web-based information retrieval system is the result of this research and is hosted exclusively on the special departmental website at: <http://cl.sanskrit.du.ac.in>. I am grateful to the Delhi University Computer Centre for providing me with the platform to host it. I'm also grateful to the scholarship cell for providing financial aid imperative to this research.

I express my sincere thanks and appreciation to the entire non-teaching and administrative staff of the department of Sanskrit namely Mr. Pratap Singh, Mrs. Monika Chaturvedi and Mr. Sandeep for providing me with administrative set-up to smoothen the functioning of my research. I am also thankful to Delhi University Central Library system for providing me with reference books and academic support.

Lastly, I am extremely grateful to all those who directly or indirectly mediated support in my entire research journey.

Arooshi Nigam

Date: 22.07.2022

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08, August 2021, pp.53-58. Impact Factor: 5.214. , UGC Listed: UGC Journal No. 44945. DOI: <https://doi.org/10.31305/rrijm.2021.v06.i08.010>.

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Nigam Arooshi and **Chandra Subhash**. (2022). **Environmental Awareness and Protection in Ancient Bharat based on Dharmaśāstric Literature**. *Zeichen Journal*, Volume 8 Issue 3, ISSN 0932-4747, pp.- 354-366. URL: <http://www.ezeichen.com/gallery/2480.pdf>

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Creating Digital Platform for Manusmṛti to enhance teaching-learning process in higher education” Presented in *The Online Teaching-Learning on the Quality of Higher Education in India organized by Gautam Buddha Government Degree College, Ayodhya, Uttar Pradesh, Mar 28, 2022.*

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Perspective of Dharmashastras in Scientific World” Presented in *Second International Sanskrit Conference on Sanskrit studies Across the World organized by Department of Sanskrit, Maitreyi College, University of Delhi, New Delhi on Mar 01, 2022.*

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Fifth Presentation.....209-209

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Development of Information Extraction System for Manusmriti for Instant Reference” Presented in <i>the International Webinar, Under the UGC, approved NSQF Courses organized by G.M.N College, Ambala on Feb 4, 2021.</i>	

Acronyms and Abbreviations

CL	Computational Linguistics
CSS	Cascading Style Sheets
DBMS	Database Management System
DS	<i>Dharmaśāstras</i>
HTML	Hypertext Markup Language
ICT	Information and Communication Technology
JS	Java Scripts
MS	<i>Manusmṛti</i>
MT	Machine Translation
NLP	Natural Language Processing
PSP	Python Server Page
RDBMS	Relational Database Management System
SaHiT	Sanskrit-Hindi-Machine-Translator
SI	Social Institutions
SCL	Sanskrit Computational Linguistics

Introduction, Scope of the Research, Problem Statement and Methodology

Smṛtis have played an important role in the development of Indian history. Our culture is preserved in the *smṛtis*. Both *śruti* and *smṛti* have been acknowledged as the sources of cultural and moral development of humans. For insight on duties, responsibilities and the knowledge of ethics, the magnanimous knowledge of *śruti* and *smṛtis* is instrumental because the basis prescribed by *Śruti* and *Smṛti* is *Dharma*. According to *Manusmṛiti* (MS), the ethics as stated in the *Vedas* and *Smṛtis* are declared to be the supreme *dharma*. *Vedas*, *Smṛtis*, conduct and satisfaction of self, four are reckoned as the true characteristics of *Dharma*. MS proclaims that *Vedas*, *śruti* and *Dharmaśāstras* (DS) should all be cumulatively known as *smṛti* literature, they are not worthy of any sort of adverse argument as *dharma* has originated from them. The goal of all the *smṛtis* is the development of cultural, moral, religious, practical and social life. MS is the science of the general laws of self and society, the process of human thought and cognition. MS, the great epic of India ascribed to Manu, can assertively be given the honour of being the sociological encyclopedia of ancient Bharat. The MS tradition has been passed down to us in a classical canon of about 2700 Sanskrit verses divided into 12 chapters. It is an evolutionary text of Indian knowledge tradition and has remained colossally influential in determining the structure and the function of Indian society. The work holds a significant place in the cultural, sociological and political history of India. MS is neither historical in the modern sense of the term, nor a chronicle and neither a sociological gazette. But it stands in incomparable isolation, defying all definitions of the aforesaid terminologies. It is a veritable encyclopedia comprising heterogeneous particulars from all branches of knowledge. Several branches of knowledge including philosophy, sociology, politics, law, ethics, statecraft, warfare and ethnology are all embodied in its structure. It is the text that is most sought to enrich cultural, social and any type of knowledge possibly existent in Indian civilization.

The radical evolution of information technology germinates genuine postulates to infuse and reveal valuable knowledge from MS. The knowledge storehouse of MS

is primarily contrived only through traditional paper-book methods. The amount of reading material available for Sanskrit texts, contemporaneously, is in manual or handwritten formats such as manuscripts etc., while we are living in the age of Information Technology. The amazing growth of information that is being generated, shared and stored today is all digital, electronically dependent and via online mediums. The significant texts of Sanskrit such as MS, lack digitalization and lose the front of automatic searching, and accurate and instant information retrieval. The textual data in natural language form is increasing exorbitantly, but a human's ability to understand and process this information remains constant. A human editor can only recognize these terms or concepts by carefully following all the written or other printed textual data sources. But, this is inadequate for the volume and complexity of the information involved in MS. Thus, the need for automated extraction of useful knowledge from huge amounts of textual data to retrieve accurate information from MS is apparent.

It makes available information an important issue to organize and analyze. The most viable method to derive relevant information today is by using digital consortiums and one such colloquial technique is text mining. It is the most prevalent medium of information access and retrieval. Text Mining is an automated technique that aims to discover high-level information in a huge amount of textual data and present it to the potential user. However, users always ask for further intelligent methods of text analysis such as an automated machine that can understand textual information and extract the meaning out of texts. A user desires to get a lot more information than just a few words, that too with a minimum time and minuscule effort. S/he may want to query an idea. It searches the pre-created digital databases of MS and retrieves relevant information from the user. This procedure would provide a new efficient mechanism for navigation through texts. By this mechanism, word, phrasal or concept searching within MS can be carried out automatically. Moreover, with the help of a cluster and classified documents, exact information based on the user's query can be mined, and appropriate and accurate knowledge based on the meanings and explanations required can be expeditiously retrieved. Achieving this functionality could have great practical application for our daily text processing activities. While on the one hand, the text is eminent, on the other, it is quite huge that it becomes practically impossible for anyone to search for a specific keyword or a required concept in it. The indices thus prepared

will constitute a separate text in itself due to the size of the MS and will be of tremendous use to the researchers and scholars.

The scope of the present research is to develop a relational database system for the storage and interactive indexing of the MS. As per my exhaustive survey which is presented in chapter two of this dissertation, there is no online indexing system for the texts of Indian heritage as revered as MS, which comprehensively allows for automatic search along with its translation, and transliteration and exegesis either statically or dynamically. The core objective of the present research is to develop a web-based system for instant information retrieval from MS text. The proposed model can be perused by all theological enthusiasts, linguists, historians and researchers willing to garner accurate information and references in MS. It will act as an e-tool in the field of Sanskrit education and aid a step forward in the digital connotations of Sanskrit.

In the forthcoming years, the other major texts of DS can also be digitized and a search engine-based system for the DS tradition can be developed. This system will make an insinuating impact on the accessibility of Sanskrit studies and DS texts on the global platform in the field of arts, culture, science and technology. It will prove to be very useful for teachers, scholars and especially for researchers in the field of Sanskrit and e-learning, as at present, there are no efficient online tools developed to access Indian knowledge tradition.

Brief Organisation of the Dissertation

The present research project is a perfect alliance of tradition and modern, theoretical and practical. It is broadly bifurcated into major sections; one is the theoretical description and another section deals with the applied research aspects. The present thesis is divided into five chapters. It begins with the introduction incorporated within the contents and preface. The rearmost segment includes the conclusion, upcoming possibilities, prospects and future direction of the research, Appendixes, list of paper publications and certificates of presentation during the period of M.Phil enrollment.

The first chapter of this dissertation titled “Introduction to *Dharmaśāstric* Literature and *Manusmṛiti*” presents in-depth deliberation on *Dharmaśāstric* Literature, an overview of *Smṛiti* Tradition and a detailed description of *Manusmṛiti*. This chapter,

broadly dissected into two parts, begins with the introduction of *dharma* and its proposition in ancient Bharatiya culture and traditions. Propagation of *dharma* in various religions is also highlighted within the chapter. It enlightens the scholars on the nuances of the *Dharmaśāstric* origination and its sources. It discusses the evolution and chronology of *Dharmaśāstras*. The number of *smritis*, key texts of *Dharmaśāstras* namely Gautama, Baudhāyana, Āpastamba, Vāsiṣṭha, Yājñavalkya, Nārada and a brief general introduction of each is also mentioned. The second part of this chapter is an Introduction to *Manusmṛti*. This segment examines the period and moves on to discuss the structure and chapter-wise conformation of *Manusmṛti*. It is followed by the available translations and commentaries on *Manusmṛti*. Major subject themes such as traditional topics namely *varṇa*, *Āpaddharma*, *Āśrama*, *puruśārtha*, *Samskāras* (sacraments), *Vivāha* (marriage) etc. and contemporary themes of *Manusmṛti* such as Environment, Natural Resource Protection, medical and clinical sciences, mathematical sciences etc. are also deliberated. This dissertation was written to adduce a scientific perspective on the traditional scenario.

Likewise, the second chapter titled “Brief Introduction of Indexing and Online Indexing, Concept Mining and Survey of Related Researches” is also segmented into two parts. The initial section furnishes a brief introduction to Indexing, Online Indexing and Concept Mining. This chapter begins with the introduction and history of Indexing in ancient Sanskrit Literary Tradition. Similarly, the history of Indexing in western literary tradition is also briefly introduced in this chapter. Based on the introductory deliberation on general indexes, types and classifications of indexes are also well presented. This chapter opens the avenues of the practical aspect of this dissertation with an extensive discussion on Online Indexing and Concept Mining. It discusses the significance, types and features of online indices. It propounds a schematic comparison between manual and online indexing. It further presents an expansive survey of related traditional subjects, contemporary themes of *Dharmaśāstras*, as mentioned above and a critical review of literature in the areas of Sanskrit computational linguistics namely; text mining, text clustering, text categorization, text retrieval, natural language understanding focussing on thematic field and knowledge representation. It discusses the recent developments in computational linguistics and the importance of lexical resources. It also illustrates lexicographic and searches engine methods and techniques.

The third chapter is titled “Data Collection, Digital Databases and Research Methodology for Concept Mining and Online Indexing”. This chapter discusses all the indispensable prerequisites for developing any web-based digital system. It incorporates information regarding the data, primary and secondary texts used for and data collection and construction of digital databases. This chapter deliberates on the various search strategies and research methodology adopted for online indexing and concept mining.

The fourth chapter entitled “Computational Platform for Online Indexing System for *Manusmṛiti*” elicits a detailed description of the development of the computational platform, various front-end techniques such as HTML-CSS-Java script, creation of backend server operations, python programming language and methodology applied for developing the web-based system.

The last chapter titled “Introduction to Online Indexing and Concept Mining System for *Manusmṛiti*” talks about the implementation aspects of the front end, Java objects, lexical resources and how they work. It majorly outlines the proposed indexing-based model and its main components such as transliteration module, preprocessor, information and output generator, script validator, in particular the concept-based analyzer and concept extractor in enhancing the quality of the text clustering, categorization, and retrieval. This chapter dispenses compelling features of this online indexing system.

In the concluding part of the dissertation, results from the practical application of the system and future prospectives have been summarized. The appendices contain the sample data of the MS used to develop the indexing and mining module for MS. In the future, it is planned to digitize the other major texts of DS and develop a search engine-based system for the DS tradition. This system will make an insinuating impact on the accessibility of Sanskrit studies on the global platform in the field of arts, culture, science and technology. It will prove to be very useful for teachers, scholars and especially for researchers in the field of Sanskrit and e-learning, as at present, there are no efficient online tools developed to access Indian knowledge tradition.

Research Methodology adopted for Online Indexing and Concept Mining for MS

Web Search engine techniques are applied to produce the result (Patil, Pawar and Patil 2013). The system does not use any sort of pre-developed index to search the query in MS text. It searches instantly when a query from the user interface is received and generates the result corresponding to the query for display (Bhatia, et al. 2011). System search and ranked the result in four ways. It includes Search by whole Word, Search by Starts with Input Word, Search by Ends with Input Word and Search Input Word anywhere in the Word.

There are many methods used for concept mining. Text Clustering (Cutting, Karger, Pedersen, & Tukey, 2017; G & Lekha, 2014) methods are used to extract information from unstructured data. In the case of this research, the concept tagging is done manually for each verse of MS. Based on tagging technique, the system produces an accurate result. We present the algorithms for the tag-based text clustering method (Zamir and Etzioni 1998). The tag is created manually in MS verses to denote the particular concepts. The detailed methodology can be seen in chapter three.

Chapter One

Introduction to Dharmaśāstric Literature and Manusmṛiti

Dharmaśāstra (DS) is a genre of Sanskrit compendium exclusively privé to *dharma* and an idiosyncratic writing style of Sanskrit texts depicting the Indian knowledge tradition of society management. These texts are numerous. DS's are ideated, envisaged and composed by scholars based on *Dharmasūtra* texts, those of which egressed from the *Kalpa* literature. *Kalpa* is one of the six components of *Vedāṅga* studies which was instituted to enhance the understanding of the *Vedas*. *Dharmaśāstra* is composed of the conjoining of two words “*dharma*” and “*śāstra*”. The word *dharma* originated from the “*dhṛ*” verb root in the Sanskrit, which means to uphold, support or sustain or nourish. *Shāstra* roots from the “*śas anuśiṣṭau*” with the “*śtrana*” suffix. It means “which has been instructed and rescripted”. *Śāstras* is the scripture that preaches humanity, initiation into any action or withdrawal from a particular action¹ (Gautam, 2014). In Sanskrit literature, *dharma* is considered the major goal of life and substantial behaviours that are conceived as per *Ṛta*, which means the regular or daily occurrence, are the rules that reform human behaviour, life and the proper functioning of the universe. It encompasses duties and responsibilities, rights, laws, conduct, moral excellence and an appropriate way of living. *Vājasaneyā saṃhitā* is indicative of the rule of conduct and represents *dharma* as a right way of living (Dubey, 2012). Chambers Dictionary of Etymology (Barnhart, 1998) states that the word “*dharma*” is related to the Latin word “*firmus*” which means stable. The word “*dharman*” shaped up in the Vedic literature and it is used either as an adjective or a noun and is estimated to have been used around fifty-six (Kane, 1930; काणे, 1963) to sixty-three times in *ṛgveda* (Brereton, 2004). In Prakrit and Pali languages, it is pronounced as *dhamma*. In some contemporary Indian languages and dialects, it alternatively occurs as “*dharma*” (Kane, 1930). Many scholars, researchers, translators, and linguists have mistranslated *dharma* into English as “Religion”. It is not an easy task to translate the Sanskrit conceptual terminologies into any European and British

¹ प्रवृत्तिर् वा निवृत्तिर् वा नित्येन कृतकेन वा । पुंसां येनोपदिश्येत तच्च द्वास्त्रमभिधीयते ॥ भामती,
ब्रह्मसूत्रशाङ्करभाष्यव्याख्या 1.1.4

acknowledged languages. Therefore, especially western scholars failed to render accurate meaning to represent the same concept for any term in English, German or any other language. It is gruesome to furnish a single concise definition for the word *dharma* in other languages, as the word integrates and represents the specific process in the Indian knowledge system. In most cases, the meaning of *dharman* is religious ordinances², traditional or cultural rites, fixed laws or principles³ or rules of conduct (क्राणे, 1963; Kane, 1930). In *ṛgveda*, it denotes the meaning of the sustainer and maintainer. *Atharvaveda* indicates *dharma* to be virtuous rituals. In ancient Indian knowledge tradition, *dharma* is one of the four components of the *puruṣārtha*. *Puruṣārtha* connotes the supreme objective of human pursuit and refers to the proper goals or aims of human life. The four *puruṣārthas* are *dharma* (righteousness, duties, laws, conduct, virtues, moral values), *artha* (prosperity, financial security, wealth, economic values), *kāma* (physical and sensory pleasure, emotions of love, psychological values) and *mokṣa* (liberation, spiritual values, self-actualization).

The term *dharma* is also conceived as the cardinal concept in Buddhism. The sermons and teachings as expressed by the Buddha, pointing toward the true nature of the universe, are known as the *dharma*. It is the term used for phenomena and also signifies cosmic law and order. In Buddhist philosophy, *dhamma* is considered as the means to escape agony. Practicing the habits of ethical conduct, thought, meditation and following the Eightfold Path consisting of right understanding, right intention, right speech, right action, right livelihood, right effort, right mindfulness and right concentration is the noble Buddhist philosophy (Laumakis, 2008).

Dharma in Jainism refers to the teachings of Jain philosopher called as “*Tirthankaras*” and the body of doctrine pertaining to the depuration and moral purgation of human beings. In Sikhism, *dharma* means the path of righteousness, proper religious practice and one’s own moral duties towards God (Rinehart, 2014). For the simpletons, the term *dharma* is inferred as worship only. Whereas, in the ancient Indian tradition, the meaning of the word *dharma* is very extensive. According to Swami Vivekananda, *dharma* is the development of the divinity inherent in man.

² प्रथमा धर्मा । ऋग्वेद ३.१७.१, सनता धर्माणि । ऋग्वेद 3.3.1

³ धर्मणा मित्रावरुणा विपश्चिता व्रता रक्षेथे असुरस्य मायया । ऋग्वेद 5.63.7 । अचित्ती यत्तव धर्मा युयोपिम मा नस्तस्मादेनसो देव रीरिषः। ऋग्वेद 7.89.5

Dharma is a natural element of life and an intent to attain perfection in the self. It's a wish to have eternal life and a desire to gain knowledge and pleasure (Mishra J., 2012). Primarily there are two distinctions of the term *dharma*, *lokadharmā* (generic) and *śāstradharmā* (prescriptions mentioned in the ancient scriptures). *Lokadharmā* represents the idea of worshipping an unknown, invisible and obscure potential controller with sorrow or hope, to attain salvation or any other desired outcome. On the other hand, *śāstradharmā* is a practical approach based on *āśrama* philosophy which elucidates the attainment of salvation through social administration and living a socially disciplined life. Majorly the national- regulatory, socio-regulatory, family-regulatory, body-sensory-psycho regulatory systems are the various categories that fall under the *śāstradharmā* framework (Kaunḍinnyāyana, 2014). The term *dharma* is used in many diverse facets and to satisfy various disparate prospectives; *atharvaveda* deliberates *dharma* as qualities acquired by executing religious rituals⁴. Similarly, *Aitareya brāhmaṇa* propounds *dharma* as a religious duty⁵ (Horsch, 2004). *Chāndogyaopaniṣad* emphasizes that *dharma* has three branches; the first one is constituted by *yajna*; study and charity, the second one is constituted by the activities of austerities and the third is the *brahmacārī* (celibate) dwelling in the place of his teacher⁶. Therefore, *dharma* in *Chāndogyaopaniṣad* symbolizes *yajña*, study, charity, austerity and ideals (Jha G. , 1942). *Taittirīyopaniṣad* describes *dharma* in the simplest version and portrays it in the form of teachings which makes it easier for the children to grasp the concept of right and wrongdoings⁷ (Kane, 1930). *Purāṇas* are *dharma* dominant texts, in them, devotion, philosophy, Sankirtan, idol worship, the importance of pilgrimages etc. are deliberated. *Brahmavaivarta Purāṇa*, *Padma Purāṇa*, *Vāmana Purāṇa* etc. all the *Purāṇas* reckon Vedas to be the genesis of *dharma* (Goindka , 2016). According to the *Purāṇas*, *dharma* surpasses all four *puruṣārthas*. *Purāṇas* deliberate that one should religiously practice his *dharma*⁸. Observance of one's *dharma* is assumed to be the most

⁴ ऋत सत्यं तपो राष्ट्रं श्रमो घर्मश्च कर्म च। भूतं भविष्यदुच्छिष्टे वीर्यं लक्ष्मीर्बले बलं । अथर्ववेद 9.9.17

⁵ धर्मस्य गोसाजनीति तमभ्युत्कृष्टमेवंविदभिषेक्ष्यन्नेतयार्चाभिमन्त्रयेत् । ऐतरेय ब्राह्मण 7.17

⁶ त्रयो धर्मस्कन्धा यज्ञोध्ययनं दानमिति प्रथमस्तप एवेति द्वितीयो ब्रह्मचार्याचार्यकुलवासी तृतीयोऽत्यन्तमात्मानमाचार्यकुलेऽवसादयन् । सर्व एते पुण्यलोका भवन्ति ब्रह्मसंस्थोऽमृतत्वमेति । छान्दोग्योपनिषद् 2.23

⁷ सत्यं वद, धर्मं चर । तैत्तिरीयोपनिषद् 1.11

⁸ श्रूयतां धर्मसर्वस्वं श्रुत्वा चाप्यवधार्यताम् । आत्मनः प्रतिकूलानि परेषां न समाचरेत् ॥ सृष्टिखण्ड 19.357-358

optimum, for those who practice deeds against *varṇāśrama dharma* go to the inferno. *Vāyu* (Sharma S. K., 2020; Singh S. J., 2020) and *Brahmāṇḍa Purāṇa* (Shastri J. L., 2017) determine *dharma* as something which holds, protects life and avoids degradation⁹. According to the *Bhaviṣya Purāṇa* (Khandelwal, 2017; Vedyasa, 2015), whatever immovable and movable exists in the entire world, it is only *dharma* that upholds it. Dharma is a power devoid of beginning and end. It is an eternal and infinite power¹⁰. In the *Mahākāvya*s such as *Rāmāyaṇa* and *Mahābhārata* etc., there are various instances where references related to *dharma* are found. In due course of time, these epics were counted under *smṛti* literature. *Mahābhārata* is proclaimed as DS in the *ādiparva*. One of the celebutantes of *Mahābhārata*, *Vidura*, has proclaimed the *dharma* to consist of eight characteristics namely; *ijyā* (*yajña-yāga*, worship, adoration of demigods etc.), *adhyayana* or devotion to studies, *dāna* known as charity or giving alms, *tapa* or austerity, *satya* means to always follow the path of truthfulness, *dayā* or mercy, *kṣamā* is forgiveness and *alobha* means to have strict control of desires, such a person is free from any sort of greed and guilt (Sukthankar, 2019). Thirty characteristics of *Sanātana dharma* have been described in the seventh skandha of *Śrīmadbhāgavata* and they are of great importance¹¹ (Tilak, 2020; Gurumaa, 2016). *Rāmāyaṇa* secures an imperial position in *vaidika dharma*. Due to the superlative and comprehensive ideals present in the *Rāmāyaṇa* (Debroy, 2017; Egenes & Reddy, 2016), it is also considered the basis of *dharma*. *Rāmāyaṇa* opines that *dharma* and conduct are intimately related and mutually dependent on each other. More emphasis has been given to non-violence, truth, self-restraint, tolerance, mercy and charity.

The *smṛti* tradition represents *dharma* as a symbol of *varṇāśrama dharma*. The *smṛtis* are valid prescriptions concerned with imparting instructions related to *varṇa* and *āśrama*. *Manusmṛti* (MS) (Mishra J., Pāraskaragr̥hyasūtram, 2018) expounds *dharma* to be five-fold; *varṇa dharma*, *āśrama dharma*, *varṇāśrama dharma*,

⁹ धारणाद् धृतिरित्यर्थाद्भातोः धर्मशब्दः प्रकीर्तितः । अधारणेऽमहत्त्वे च अधर्म इति चोच्यते ॥ वायु पुराण प्रक्रिया 59/28

¹⁰ धर्मेण धार्यते सर्वं जगत्स्थावरजङ्गमम् । अनादिनिधना शक्तिः सैषा ब्राह्मी द्विजोत्तमाः ॥ कूर्मपुराण पूर्वभाग 2.59

¹¹ सत्यं दया तपः शौचं तितिक्षेक्षा शमो दमः । अहिंसा ब्रह्मचर्यं च त्यागः स्वाध्याय आर्जवम् ॥

संतोषः समदृक् सेवा ग्राम्येहोपरमः शनैः । नृणां विपर्ययेहेक्षा मौनमात्मविमर्शनम् ॥

अन्नाद्यादे संविभागो भूतेभ्यश्च यथार्हतः । तेषात्मदेवताबुद्धिः सुतरां नृषु पाण्डव ॥

श्रवणं कीर्तनं चास्य स्मरणं महतां गतेः । सेवेज्यावनतिर्दास्यं सख्यमात्मसमर्पणम् ॥

नृणामयं परो धर्मः सर्वेषां समुदाहृतः । त्रिशल्लक्षणवान् राजन् सर्वात्मा येन तुष्यति ॥ श्रीमद्भूगवत 7.1.8-12

naimittika dharma and *guṇa dharma*. *Mahābhārata*¹² (Ganguly, 2021; Sukthankar, 2019) has stated unilateral¹³ (Ganguly, 2021) characteristics of *dharma* (Kovács, 2012). There are some other prominent definitions of *dharma* that are found in the later period of Sanskrit literature. *Vaiśeṣikasūtra* states that *dharma* leads to the attainment of happiness, selflessness and eternal bliss¹⁴ (Muni, 1961). According to the philosopher Jaimini, *dharma* is the sense of motivation¹⁵ (Sampurnanada, 1855), whereas according to the philosopher *Laugakshibhaskar*, the purposeful means or a desirable goal as enunciated in the *Vedas* is called *Dharma*¹⁶ (Mishra K. , 2018).

1. Evolution of Dharmaśāstras:

The concept of the *dharma* is well known and widely discussed in Indian culture and public behavior (*lokavyavahara*). From time to time, the influence of *dharma* is strongly embedded in our society and is visible in Indian literature, philosophy, politics, economics and cultural development. The inclusion of elements like *ṛta*, *satya*, *ahimsā* etc. in the Indian social and political framework proves that the Vedic, philosophical, theological and religious aspect of Indian culture is constantly flourishing. Swami Vivekananda (Ramakrishnan, 2016) says that Bharata is not only an ancient country but a holy land. Geographically, India is divided (Tiwari & Sharma, 2002) based on urban, rural and tribal areas (the said demarcations are done based on the geopolitical guidelines) whereas sociologically Bharat is stratified based on *varṇa* and *āśrama* system, different religions, language diversity etc. *Vedas* are considered the world's ancient text and the most credible source of *dharmaśāstras* (DS). The *Vedas* not only provided mediated skills to mankind but also laid down suitable goals and objectives for human life. DS is considered to be originated from the *Vedas*. *Vaidika vāṇmaya* holds an important place in the perspective of the genius experiences of Indian sages.

The four *Vedas* namely; *ṛgveda*, *Yajurveda*, *Sāmaveda* and *Atharvaveda*, are considered the root of our ancient Indian religious and cultural prescriptions. In the

¹² अहिंसा परमो धर्मः । अनुशासनपर्व 115.1, आनुशंस्यं परो धर्मः । वनपर्व 373.76

¹³ परोपकारः पुण्याय पापाय परपीडनम् । धारणाद् धर्ममित्याहुर् धर्मो धारयते प्रजाः । शान्तिपर्व 109.12

¹⁴ यतोऽभ्युदयनिश्चयेयससिद्धिः स धर्मः । वैशेषिकसूत्र 1.1.2

¹⁵ चोदनालक्षणोऽर्थो धर्मः । जैमिनीय धर्ममीमांसासूत्र 1.1.2

¹⁶ वेदप्रतिपाद्यः प्रयोजनवदर्थो धर्मः । अर्थसंग्रह 2

Indian knowledge system, the 4 *Vedas* are distinguished texts, they are honored and every single word mentioned in each of the *Vedas* is considered sacred. They are considered amongst the oldest religious works in the world. They are commonly referred to as ‘scriptures’, as they contain divine prescriptions and adorations for various deities. Unlike the scriptures of other religions, the *Vedas* are believed to have always existed and were apprehended by sages. The *Vedas* existed in oral form and were passed down from enlightened sages to celibate students for generations. They were carefully preserved orally as teachers would have their students memorize them forward and backward with emphasis on exact pronunciation to keep what was originally heard intact. Between 5000-500 BCE, now known as the *vaidika* Period, the writing of Vedic knowledge began. Any kind of changes, moderations or modifications in the *Vedas* is strictly not acceptable. To preserve the form, structure, significance, interpretation and meanings of the *Vedas*, the *vedāṅga* literature was created. *Vedāṅgas* are six auxiliary disciplines developed in connection with the study of the *Vedas* (Morgan, 1953). This subsidiary *Vedic* literature was developed in the period of *upaniṣad*. The very first mention of the *vedāṅgas* and their accurate sequence was found in the *Muṇḍakopaniṣada*.¹⁷ Under the *aparā vidyā*, the six auxiliary disciplines namely; *śikṣā*, *kalpa*, *vyākaraṇa*, *nirukta*, *chanda* and *jyotiṣa*¹⁸ have been discussed.

1. **śikṣā**: This auxiliary discipline is focused on phonetics, phonology and pronunciation of the Sanskrit alphabets, accent, quantity, stress, melody and rules of euphonic combination of words during a *vaidika* recitation.
2. **Chandas**: This auxiliary discipline is focusses on the poetic meters and prosody, which means the rhythmic structure of a *vaidika* verse.
3. **Vyākaraṇa**: This auxiliary discipline deals with the rules of grammar and linguistic analysis of any language.
4. **Nirukta**: This subsidiary discipline focuses on linguistic analysis to help establish the most accurate meaning of the words. It deals in the area of etymology and

¹⁷ तत्रापरा ऋग्वेदो यजुर्वेदः सामवेदोऽथर्ववेदः शिक्षा कल्पो व्याकरणं निरुक्तं छन्दो ज्योतिषमिति । मुण्डकोपनिषद 1.1.5

¹⁸ छन्दः पादौ तु वेदस्य हस्तौ कल्पोऽथ पठ्यते, ज्योतिषामयनं चक्षुर्निरुक्तं श्रोत्रमुच्यते ।

शिक्षा घ्राणं तु वेदस्य मुखं व्याकरणं स्मृतम् , तस्मात्सांगमधीत्यैव ब्रह्मलोके महीयते ॥ पाणिनीय शिक्षा 41-42

explanation of words, particularly those words, which are archaic and have ancient uses with unclear meanings.

5. **Kalpa**: This field focuses on standardizing procedures for *vaidika* rituals, rites of passage, social rituals associated with major life events such as birth, wedding and death, as well as discussing the personal conduct, behavioral rules and proper duties of an individual in different stages of his life.
6. **Jyotiṣa**: This ancillary science deals in astrology and astronomy. Its major focus is to calculate and determine the auspicious time for conducting various *vaidika* rituals.

Each *vedāṅgas* has its unique characteristics and holds its own distinct importance.

The main purpose of the cumulative *vaidika* literature is the ritual of oblations, homage and holy sacrifices. The auxiliary genre that tends to do this is *Kalpaśāstra*. The term *kalp* is derived from the root *klṛp*. The etymological meaning of the *kalpa* is 'कल्प्यते समर्थ्यते यागप्रयोगोऽत्र' which means to promote the activities of austerities or oblations. *Nārada Purāṇa* mentions the five types of *kalpas* namely the *nakṣatrakalp*, *vedakalp*, *saṃhitākalpa*, *āṃgirasakalp* and *śāntikalpa*. *Kalpaśāstra* is a text which deals with the chronological arrangement of the deeds and rituals prescribed in the *vedas*¹⁹ (Verma, 2011). The *Kalpaśāstra* though being a primary text yet holds an eminent position in *sūtra* literature and is considered to be the most important compendium (Mishra J. , Pāraskaraghyasūtram, 2018). *Kalpaśāstras* are composed in the form of *sutras*, or short verses. Aphorisms which are laid out in very few letters or words is concise, succinct, simple, very certain, faultless and yet imparts greater or a lot of knowledge, such a rule or principle is called a *sūtra*²⁰. The four main distinctions of the *Kalpasūtra* are:

1. *Śrautasūtra*:

The *yajña-yāgādi vidhi* is described in detail in the *vaidika saṃhitās* (compendiums or scriptures) and a concise compilation of the *yāgādi* rituals performed by the sacred fire that is mentioned in the Brahmanical texts, a collection of such texts

¹⁹ कल्पो वेदविहितानं कर्मणामानुपूर्व्येण कल्पनाशास्त्रम् । ऋक्प्रातिशाख्य वर्ग 2

²⁰ स्वल्पाक्षरमसन्दिग्धं सारवद् विश्वतो मुखम् । अस्तोभमनवचं च सूत्रं सूत्रविदो विदुः ॥

are referred to as *śrautasūtra*. The *yajña* which have been prescribed in the *śrautasūtras* are as follows:

Darśa, Paurṇamāsa, Dākṣāyaṇa Yajña, Āgrayaneṣṭi, Cāturmāsya, Nirūḍha, Paśubandha, Somayāga, Ekāha, Ahīna (*yajña* lasting from 2 to 11 days), *Satra* (*yajña* lasting from 12 days to 1 year or more), *Gavāmayana* (*yajña* lasting for one whole year), *Vājapeya, Rājasūya, Agnicayana, Sautrāmaṇī, Puruṣamedha, Abhicāra, Atirātra, Aptoyāma, Pravargya*. Although the subject matter of the *śrautasūtras* is very complex, its application and propagation are equally rare (Sharma K. L., *Śrautasūtra*, 2004). Only by the perusal of these *śrautasūtras*, we can be successful in understanding the religious practices, traditions, laws and beliefs of that era (Mishra H. , 1985; Dubey, 2012). The most prominent *śrautasūtras* available under each Veda are as follows:

- ***ṛgveda*** - *āśvalāyana śrautasūtra, śāṅkhāyana* and *kauṣītaki*
- ***Yajurveda*** – *kātyāyana, bodhāyana, āpastamba, hiraṇyakeśi, (satyāśāḍha) vaikhānasa, bhāradvāja, mānava, varāha* and *vādhūla*
- ***Sāmaveda*** - *ārṣeya, lāṭyāyana, drāhyāyana* and *jaiminīya*
- ***Atharvaveda*** – *vaitāna*

2. *Gṛhyasūtra*:

Enumeration and consideration of the required rituals related to the sacrificial fires, as well as the description of sixteen rites are done under the *gṛhyasūtras*. Among the major *gṛhya* deeds, the *brahmayajña, devayajña, pitryajña, atithiyajña* and *balivaiśvayajña*, together known as *pañcamahāyajña* are the prime actions that must be performed daily. All the works or domestic chores related to household life such as housebuilding, home welcoming or house warming rituals, animal husbandry, seven *yajña* related to cooking, land traction, agricultural work and cultivation, curative works, domestic medicines and ancient healing techniques are carried out under *gṛhyasūtras*. The most prominent *gṛhyasūtras* of each Veda are as follows:

- ***Rgveda*** - *Āśvalāyana Gṛhyasūtras, Śāṅkhāyana* And *Kauṣītaki*
- ***Yajurveda*** – *Bodhāyana, Āpastamba, Hiraṇyakeśi, Bhāradvāja, Mānava, Pāraskara* and *Kāthaka*
- ***Sāmaveda*** – *Gobhila, Khādir* And *Jaiminīya*

- *Atharvaveda – kauśika*

3. *Dharmasūtra*:

The attempt to solve the complexities of the growing religious and social problems of the developing society is reflected in *dharmasūtras*. That is why the vision of change, possibilities of additions, editing and scope of acceptance of the opinions is visible in these *dharmasūtras*. *Dharmasūtras* are the most glorious part of *Kalpaśāstra*. These are a memorandum of the duties, conduct and ethical behavior of the four *varṇas* and the four *āśramas*. The *Dharmasūtras* were developed based on the *Vedas* (Sharma K. L., *The Dharma Sutras*, 2006). The word *dharma* has been used at many instances in the *Vedas*, for e.g. the adjective *dharmavattāhas* (*dharmavattau*) has been used for *Aśvinīkumāras*. Similarly, the word *dharmakṛta* was used for *vipra* in *ṛgveda*²¹. It shows as a piece of clear evidence that the word *dharma* was used in the sense of conduct from the time of *ṛgveda*. Apart from *ṛgveda*, the word *dharma* has been used in other *saṃhitās* as well. In the *brāhmaṇikala* and *upaniṣadika* period, the word *dharma* began to be used in the sense of a management system. *Dharma* was articulated in a scientific form. Although the *dharma* tradition had started taking a scientific form in the *brāhmaṇikala* and *upaniṣadika* era, the task of scripting and comprehending the rules of *dharma* began only in the *sūtra* period itself. Till the *upaniṣad* period, the principles of *dharma* were scattered here and there. It was crucial that these be collected and preserved. The complexities of society were increasing day by day. New problems were arising every day. To solve them, it was constitutive to regulate social life and manage society. The judicial system had become essential to end disputes and ensure the proper functioning of society. To safeguard and secure the interests of the subjects, it was important to regularize the duties of the king. The subjects also had duties towards society, state and nation. That is why it was required to set a code of conduct for them too. It thus, became a pre-requisite to regularize the *dharma* specific to every social being. The compilation of these rules was called *Dharmasūtras*. Apart from the code of conduct, *rājadharmā* has also been included in the purview of the *dharmasūtras*. Rules of mutual interaction, duties of the king, relationship with the

²¹ इन्द्राय साम गायत विप्राय बृहते बृहत् । धर्मकृते विपश्चिते पनस्यवे ॥ ऋग्वेद 8.98.1

subjects, rules of cleanliness, the law of atonement, daily and routine chores, human duties at the social level, social administration etc are the various contents of study that falls under the subject fields of *dharmasūtras*. Gautama *dharmasūtra* opines that the conduct of the *Vedas* and their tradition is the root of *dharma*. The *Āpastamba dharmasūtra* too holds similar views²² (Pandey U. C., *Āpastamba Dharmasūtra with the Ujjwala Commentary of Shri Haradatta Misra*, 2016). *Vasiṣṭha dharmasūtra* is a very prestigious text. Despite being a short narrative, it is abundant and grandiose in its quality and characteristics. This is the precept to lead a virtuous life and preaches to avoid desires and cravings. Today, *dharmasūtras* for each branch of *Veda* are not available. For example, the *Mānavadharmasūtras*, based on which MS was composed over time, are unavailable to date. Some commentators and critics do not consider *Hiranyakeśi Dharmasūtra* as an independent *dharmasūtra*. The reason is that hundreds of *sutras* of *Hiranyakeśi Dharmasūtra* are found literally in *Āpastamba Dharmasūtra*, it is, therefore, considered a brief discourse of *Āpastamba Dharmasūtra* itself. Available *dharmasūtra* of each are listed below:

- *Ṛgveda - Vasiṣṭha Dharmasūtra*
- *Yajurveda – Hārīta, Śaṅkha, Bodhāyana, Āpastamba, Hiranyakeśi, Vaikhānasa and Viṣṇu Dharmasūtra.*
- *Sāmaveda – Gautama Dharmasūtra.*

Atharvaveda is the only *Veda* that doesn't have any *dharmasūtra*.

4. *Śulvasūtra*:

The *Śulvasūtra* is an introductory text to ancient Indian geometrical science. *Śulvasūtra* holds scientific importance due to the geometrical aspects, numerical and calculations. Vidyadhar Sharma, the commentator of *kātyāyana Śulvasūtra* (Khadilkar, 2003), has considered the *Śulva* as a means of measuring. The construction of a *yajña* altar is a pre-requisite to kindle (*agni prajvalana*) the sacred fire namely; *gārhyapatyāgni*, *āhavanīyāgni* and *dakṣiṇāgni*. *Śulvasūtras* are the instructional text of the measurement and the construction of altars. They especially describe the measurement and construction method of *yajña* altars. The experts in this field are

²² धर्मज्ञसमयः प्रमाणं वेदाश्च । आपस्तम्ब धर्मसूत्र 1.1.2-2

known as *śulvavid*, *śulvapariṣcchaka*, *saṃkhyājñā*, *parimāṇajñā* and *samasūtramniramcha*. It is the duty of the *Adhwaryu* to conduct the *yajña*. Therefore, the responsibility for building the altar for *yajña* also lies on the *Adhwaryu*. Till date only a total of nine *Śulvasūtras* namely *Kātyāyana*, *Bodhāyana*, *Āpastamba*, *Mānava*, *Pāraskara*, *Vārāha*, *Satyāśāḍha*, *Vādhūla* and *Maitrāyaṇi Śulvasūtras* are known. The *Bodhāyana*, *Āpastamba*, *Satyāśāḍha*, *Vādhūla*, *Mānava*, *Maitrāyaṇi* and *Vārāha* belong to the *Kṛṣṇa Yajurveda* and the *Kātyāyana Śulvasūtras* falls under the *Śukla Yajurveda* (Kulkarni, 2003). Only five out of the above-mentioned eight are available as follows (Dubey, 2012; Mishra H. , 1985; Kulkarni, 2003).

- *Kātyāyana Śulvasūtra*,
- *Bodhāyana Śulvasūtra*,
- *Āpastamba Śulvasūtra*,
- *Mānava Śulvasūtra*
- *Pāraskara Śulvasūtra*.

2. Dharmasūtra versus Dharmasāstras:

Dharmasūtras are the oldest theological texts in the ancient Indian knowledge tradition. *Dharmasūtras* are an integral part of *Kalpasāstra* and are code of ethics and conduct. In the *dharmasūtras*, a systematic discussion of the law and order of the society, behavioral conduct, conscientiousness, loyalty to one's own duties, power accumulation, and moral and religious acts are found. There are many discussions available in *dharmasūtras* on topics like homage to manes, the process of welcoming the guests and offering of the *madhuparka*, marriage, graduation, studies, the concept of edible and non-edible, atonement etc. *Samayācārika dharma* (tradition-based *dharma*) has been instructed in the *dharmasūtras*. *Smṛti* is thus, the name of DS. It is therefore called *smārta dharma*. In the DS, along with the duties, deeds and obligations of the *varṇa*, *rājadharmā* is also the chief subject theme of DS. Similarly, the division of property amongst the sons, process of inheritance, condition of women, atonement for adultery, rules of *niyoga*, daily routine chores, duties of householders etc. are discussed in the DS. There are a few specific characteristics by which the internal differences can be presented between the *dharmasūtras* and DS. Mostly all the *dharmasūtras* are either the components of the various stages of *Kalpasāstra* or are

intimately linked with the *gṛhyasūtras*. The *dharmasūtras* tend to show supreme partiality towards their respective *Vedas* and *vaidik* quotations. The *dharmasūtras* are composed in prose or are a mixed version of prose and verses while the DS is composed only in verse format. The language of the *dharmasūtras* is more archaic in comparison to the *śāstras*. As per the history of the evolution of *smārta dharma*, *dharmasūtras* are written before the *śāstras*. *Dharmasūtras* are primitive whereas DS is modernist and developed on the framework of the *dharmasūtras*. The *sūtras* literature does not follow the primaevial arrangement of contents, while the *smṛti* literature arranges its subject matter under three principal divisions; Each *smṛti* is broadly divided into three parts; Ethics, Behavior and Atonement (Dhole, 2017). DS has showcased *dharma* in the form of mandates or orders. Both Manu²³ and Yājñavalkya²⁴ describe *dharma* in a similar way as they consider *Vedas*, *smṛti*, *ācāra* and satisfaction for self as aid or primary sources of *dharma*. The word *smṛti* is derived from the summation of verb root *smṛ* and *ktina* suffix. The semantics of the term *smṛti* is understood as memory, retention, learning capacity, contemplation, recall, rumination etc (Singh D. K., 2008). The *Vedas* have been prevalent from time immemorial through the oral tradition. Hence they are renowned as texts of *śruti* tradition. The classical rules and traditions, which were written, comprehended and kept alive under the oral tradition, have been called *smṛti*. There is another aspect of *smṛti* stating that the ancient traditions which are attained and remembered by the primitive sages through self-realization are also known as *smṛti*. *Smṛtis* are an embodiment of ethics and a tangible version of the culture and traditions. *Smṛtis* are invoked as DS²⁵ (Kaunḍinnyāyana, 2014; Olivelle, *Dharmasutras: The Law Codes of Apastamba, Gautama, Baudhayana and Vasistha*, 2000). Although 4 *Vedas*, 6 auxiliary disciplines of *Vedas*, 18 *Purāṇas*, 18 *Upapurāṇas*, *Dharmamīmāṃsāsāstra*, *Brahmamīmāṃsāsāstra*, *Dharmasūtra* and *smṛtis*, *Rāmāyaṇa*, *Mahābhārata* etc. are all included in DS, however, *smṛtis* such as *Vāsiṣṭha*, MS, *Yājñavalkya* etc are only known as the form of DS.

²³ वेदोऽखिलो धर्ममूलं स्मृतिशीले च तद्विदाम् । आचारश्चैव साधूनां आत्मनस्तुष्टिरेव च ॥ मनुस्मृति 2.6

²⁴ श्रुतिः स्मृतिः सदाचारः स्वस्य च प्रियमात्मनः । सम्यक् संकल्पजः कामो धर्ममूलमिदं स्मृतम् ॥ याज्ञवल्क्यस्मृति 2.7

²⁵ श्रुतिस्तुवेदो विज्ञेयो धर्मशास्त्रं तु वै स्मृतिः । मनुस्मृति 2.10

2.1 The Smṛti Tradition:

Smṛtis have made a huge contribution to the development of Indian history, politics, economics, culture and traditional value system. Indian culture is preserved in these *smṛtis*. Both *śruti* and *smṛtis* are said to be the means of cultural and moral development of human beings in society. To attain the knowledge of duties, the knowledge of *smṛtis* is necessary. Similarly, knowledge of *śruti* and *smṛtis* is very essential to acquire the knowledge of conduct and behavior, because the basis of *śruti* and *smṛtis* is *dharma*. A person who performs the rituals as mentioned in the *śruti* and *smṛtis* is bestowed with illustrious glory and fame in this world and unparalleled happiness in the afterlife²⁶. In the history of DS, *vaidika dharmasūtra* are followed by *smṛtis*. The word *smṛtis* has been used in context to show a stark contrast from *śruti*. The conduct prescribed by *śruti* and *smṛtis* is called *Dharma*²⁷ (Sarma, 2018). The meaning of *Vedas* is taken from *śruti* and the word *smṛti* has been used for literature different from the contents of *śruti* i.e. the literature illuminated from the divine²⁸. In the broader sense, *śruti* is the subject of hearing, contemplation and *nidhidhyāsana*, whereas, *smṛti* is the subject of remembrance and it is the traditional theological literature. In the narrow sense, there is not much difference between *smṛtis* and DS. After the *Vedas*, Manu considered the *smṛtis* to be the basis of *dharma*. The *Vedas* are termed as *śruti* and the developed phase of *śruti* can be witnessed in *smṛtis*. According to MS, the advent of *dharma* can be seen from *śruti* and *smṛtis*. Despite the existence of the *Vedas*, the reason for the creation of the *smṛtis* was that in due course, maximum people were unable to understand the deep complex subject of the *Vedas*. Hence, the composition of *smṛtis* took place. *Smṛtis* mainly render the *vaidika* knowledge system and explain the exponentials of *vaidika dharma*. *Smṛtis*, in a way are an elucidation of *śruti*. All those elements which are briefly mentioned in the *Vedas* are followed with a detailed discussion in the *smṛtis*²⁹ (Tripathi S. , 2020). Pandey (2017) states that, *smṛti* means the recollection of prior knowledge of the subject or a memory of a previous experience³⁰ (Pandey R. , Hindu

²⁶ श्रुतिस्मृत्युदितं धर्मं अनुतिष्ठन्ति मानवः । इह कीर्तिमवाप्नोति प्रेत्य चानुत्तमं सुखम् ॥ मनुस्मृति 2.9

²⁷ श्रुति स्मृतिविहितो धर्मः । वसिष्ठ धर्मसूत्र 1.4.6

²⁸ श्रुतिस्तु वेदो विज्ञेयो धर्मशास्त्रं तु वै स्मृतिः । मनुस्मृति 2.10

²⁹ श्रुतेरिवार्थं स्मृतिरन्वगच्छत् ॥ रघुवंश 2.2

³⁰ अनुभूतप्रियादीनामर्थानां चिन्तनं स्मृतिः । तत्र कंपाङ्गवैवर्यण्वापनिःश्वासितादयः ॥ हिन्दू धर्मकोश पृ. 682

Dharmkosh, 2017). *Smṛtis* are bifurcated into two types namely; minor *smṛtis* and major *smṛtis*³¹ (Ganguly, 2021). *Nīlakaṇṭha* considers *vedāṅgas* as major *smṛti* and *smṛtis* such as *Vāsiṣṭha*, *MS*, *Yājñavalkya-smṛti* as minor *smṛtis*. The *śrautasūtra* and the *gṛhyasūtras* are considered major *smṛtis*, which are available in the form of the *vedāṅgakalpa*, and are recited by the *saptarṣi* (enlightened sages) and their descendants. The *smṛtis* that represent the conduct and behavior are considered to be propounded by Manu, Yājñavalkya, Vāsiṣṭha, Nārada etc.³² (Tagare, 2014; Shastri J. L., 2017). The subjects of all the *smṛtis* can be divided into 3 segments. Ethics (known as *ācārādhyāya*), Behaviour (known as *vyavahārādhyāya*) and Atonement (known as *prāyaścītādhyāya*) (Kaunḍinnyāyana, 2014). In the *ācārādhyāya*, code of conduct, the description of good manners, etiquette and all the rituals are discussed. The conduct of the monarch, ruler, polity, governance, offences, punishments and penalties, rules of property division, ownership and moral behavior have been outlined in the *vyavahārādhyāya*. In *prāyaścītādhyāya* there is a provision of atonement for all kinds of sins and their liberation.

2.2 Number of Smṛtis

Initially, the count of *smṛtis* was scanty. There is no unanimous proof regarding the number of *smṛtis*. Different *ācāryas* have disparate theories regarding the number of *smṛtis*. Although Gautam has given only the name of Manu as a *smṛtikār*, while the ancient *Gautamsmṛti* mentioned around 56 names of DSs. *Bodhāyana* mentions the name of 7 DS authors; Aupajamghani, Kātyayana, Kāśyapa, Gautama, Prajāpati, Maudgalya and Hārīta. Vāsiṣṭha has quoted 5 names; Gautama, Prajāpati, Hārīta, Manu and Yama. Manu mentions 6 DS authors namely; Atri, son of Utathya, Bhṛgu, Vaikhānasa, Śaunaka and Vāsiṣṭha. Parāśara³³ and Yājñavalkya³⁴ mention the name of

³¹ महास्मृतिं पठेद् यस्तु तथैवाऽनुस्मृतिं शुभाम् । तावप्येतेन विधिना गच्छेतां मत्सलोकताम् ॥ शान्तिपर्व 200.30

³² दाराग्निहोत्रसम्बन्धमृग्यजुःसामसंहितम् । इत्यादिलक्षणं श्रौतं धर्मं सप्तर्षयोऽब्रुवन् ॥

परम्पराऽऽगतं धर्मं स्मार्तं चाऽऽचारलक्षणम् । वर्णाश्रमाचारयुतं मनुः स्वायम्भुवोऽब्रुवन् ॥ ब्रह्माण्डपुराण 2.29.44-45

³³ श्रुता ये मानवाधर्मा वसिष्ठाः काश्यपास्तथा । गार्गेया गौतमाश्चैव तथा चौशनसाः स्मृताः ॥

अत्रेर्विष्णोश्च साम्बर्ता दाक्षा आङ्गिरसास्तथा । शातातपाश्च हारीता याज्ञवल्क्यकृताश्च ये ॥

कात्यायनकृताश्चैव प्राचेतसकृताश्च ये । आपस्तम्बकृता धर्माः शङ्खस्य लिखितस्य च ॥

श्रुता ह्येते भवत्प्रोक्ताः श्रौतार्थास्तेन विस्मृताः । अस्मिन्मन्वन्तरे धर्माः कृतत्रेतादिकर युगे ॥ पराशरस्मृति 13-16

³⁴ मन्वत्रिविष्णुहारीतयाज्ञवल्क्योशनोगिराः । यमापस्तम्बसंवर्त्ताः कात्यायनबृहस्पती ।

पराशरव्यासशङ्खलिखितादक्षगौतमौ । शातातपो वशिष्ठश्च धर्मशास्त्रप्रयोजकाः ॥ याज्ञवल्क्यस्मृति 1.4-5

20 DS authors, including each of their names in the list too. Kumaril mentions 18 *dharmasaṃhitā* in his work entitled “*Tantravārtika*”. In the opinion of Aparārka 36 *smṛtis* are named in the *Bhaviṣya Purāṇa*. Similarly, Paiṭhīnasi in *Samskāramayūkha* also mentions the number of *smṛtis* to be 36, which includes the name of *Bṛhaspati* as well. The names of 18 *smṛtis* are listed in *Garuḍa Purāṇa* and 20 *smṛtis* in *Agni Purāṇa*.

Vīramitrodaya has named 18 major *smṛtis*, 18 minor *smṛtis* and 21 miscellaneous *smṛtikārs* in *Prayogapārijāta*³⁵ (Nath, 1987). The 18 major *smṛtis* (Kane, 1930; कणे, 1963; Tripathi S. , 2009) are Manu, Bṛhaspati, Dakṣa, Gautama, Yama, Aṃgirā, Yogīśvara, Pracetā, Samvarta, Śātātapa, Parāśara, Āpastamba, Uśanasa, Hārīta, Atri, Viṣṇu, Śaṃkha and Likhita. 18 minor *smṛtis* (Dutt, 2010) are Jābāli, Naciketā, Skanda, Laugākṣi, Kaśyapa, Vyāsa, Sanatkumāra, Sumanta, Pitāmaha, Vyāghra, Kārṣṇājini, Jātūkarna, Kapijala, Baudhāyana, Kaṇāda, Viśvāmitra, Paiṭhīnasi and Gobhila. The 21 *smṛtikārs* mentioned in the *Prayogapārijāta* are as follows; Vasiṣṭha, Nārada, Sumantu, Pitāmaha, Viṣṇu, Kārṣṇājini, Satyavrata, Devala Jamadagni, Pulastya, Pulaha, Kratu, ātreya, Gaveya, Marīcivatsa, Pāraskara, Śrgna and Vaijavāpa.

3. Key texts of Dharmasāstras

Since various DS authors and scholars have different and contrasting views about the number of *Smṛtis*, there is no unanimous decision about the total enumeration of the *Smṛtis* obtained to date. However, based on the various factors and standards, a handful of *smṛtis* are deemed as key texts of DS knowledge tradition. The major reason for considering any *smṛti* to be a key text or a prominent text is only when there is a complete certitude of its availability. Prominency of any *smṛti* depends on whether or not, the original manuscripts of that particular text are obtained in its archetypal or primaeval form. The second important factor in accrediting any text to be a key text is that the particular text should be attached with the fulfillment of a purpose for a greater good and large-scale social welfare. The DS authors often write with a strong wit aiming to provide facts about the various topics that are essential for character building, informing the citizens about the right and wrongs, imparting moral education and

³⁵ वीरमित्रोदय, परिभाषा प्रकरण पृष्ठ सं. 18

persuading them to abide by the conformation norms for the development of society. *Smṛtis* are written with the aim of social management, cultural development, deciphering the general code of conduct and ethical behaviors. The next standard for declaring the prominence of any *smṛti* is its level of informativity. Another fundamental characteristic primary in attributing significance to any *smṛti* is its excessive scalability of reading, studying, editing, manuscripts and scope for further continuous research on that particular *smṛti*.

3.1 Most Prominent *Smṛtis*

Hemādri has mentioned four types of *saṃhitās* of DS³⁶ namely; the *Bhārgavī Manusamhitā*, the *Nāradīya Manusamhitā*, the *Bārhaspatyā Manusamhitā* and the *Āṅgirasī Manusamhitā*. The MS available today, consisting of the teachings of Manu and being orated by Bhṛgu is known as *Bhārgavī Manusamhitā* (Kaunḍinnyāyana, 2014). Minor textual differences are found in different editions of MS. Some of the *ślokas* mentioned in the form of statements from the DS interpreters, commentators or essayers such as Viśvarūpa, Vijñāneśvara, Lakṣmīdhara, Devaṅṇabhaṭṭa, Hemādri, Caṇḍeśvara Ṭhakkura, Mādhava, Raghunandana, Kamalākarabhaṭṭa etc. are unobtainable in the present MS text. Whereas, in the textual versions of Bhārucci, R̥juvimala, Medhātithi, Govindarāja, Sarvajñanārāyaṇa, Kullūkabhaṭṭa, Rāghavānanda, Nandana, Rāmacandra etc textual variations are often rarely found. The second is, *Nāradīya Manusamhitā*, famously known as *Nāradīyasmṛti* (Swain, 2008). Two versions of this *Manusamhitā* namely major and minor texts are available. Asahāya exegesis is found in some parts of this *smṛti* but the ancient exegesis of Bhavasvāmī is completely available. *Bārhaspatyā Manusamhitā* is originally unavailable. As the words found in the scriptures, which are cited under the name of *Bārhaspatyā*, are considered to be of this *Bārhaspatyā Manusamhitā* (Aiyangar K. R., 1941). A collection of such verses is published in the form of Śrīraṃgasvāmī's collection in the name of *Bṛhaspatismṛti* in 1998 from Baroda. *Āṅgirasī Manusamhitā* appears to be available in the form of *Āṅgirasī Smṛti* (Aiyangar A. K., 1954). It has two segments;

³⁶ भार्गवी नारदीया च बार्हस्पत्याऽऽङ्गिरस्यपि । स्वायम्भुवस्य शास्त्रस्य चतस्रः संहिता मताः ॥ चतुर्वर्गचिन्तामणि, दानखण्ड पृष्ठ सं. 528

Pūrvāṅgīrasa and *Uttarāṅgīrasa*. *Uttarāṅgīrasa* is a text majorly devoted to atonement systems. It is printed in the *smṛtisandarbhā* of *Manasukharāya Mora*. It appears to be the most cardinal *smṛti* of the atonement system. The essayists and commentators deliberating on the concept of atonement have taken the words of this *smṛti* as veritable proof.

As per the *smṛtis* listed in the previous section 2.2, the following *smṛtis* are proclaimed as prominent texts because they meet the above-stated standards in all respects. Every single *smṛti* cataloged below is procured in printed form and as well as accessible for reading, studying and dwelling in further researches. All these *smṛtis* discuss values, ethics and deliberate on the social conduct and welfare ethos; MS, *Nāradaśmṛti*, *Atriśmṛti*, *Atrisamhitā*, *Prathama Viṣṇuśmṛti*, *Viṣṇuśmṛti*, *Samvartasṛti*, *Dakṣasṛti*, *Āṅgīrasasṛti*, *Śātātāpasṛti*, *Vṛddhahārītāsṛti*, *Laghuhārītāsṛti*, *Parāśarasṛti*, *Brhatparāśarasṛti*, *Yājñavalkyasṛti*, *Kātyāyanasṛti*, *Āpastambasṛti*, *Śaṅkhasṛti*, *Laghuśaṅkhasṛti*, *Likhatasṛti*, *Śaṅkhalikhitasṛti*, *Brhaspatīsṛti*, *Laghuvyāsasamhitā*, *Vyāsasṛti*, *Devalasṛti*, *Prajāpatīsṛti*, *Yājñavalkyasṛti*, *Brhadhyogīyājñavalkyasṛti*, *Vasiṣṭhasṛti*, *Budhasṛti*, *Laghu Āśvalāyanasṛti*, *Baudhāyanasṛti*, *Gautamasṛti*, *Vṛddha Gautamasṛti*, *Yamasṛti*, *Laghu Yamasṛti*, *Brahmuktayājñavalkyasamhitā*, *Kāśyāpasṛti* and *Vyāghrapādasṛti*.

3.1.1 Gautama Dharmasūtras

Gautama is considered to be one of the seven greatest sages of the present *Vaivasvata Manvantara*³⁷. His origin is believed to be the psychic creation of Brahma. Gautama is considered to be an embodiment of detachment, renunciation, and the manifestation of austerity and righteousness. His name is revered with the greatest honor among the oldest theological leaders. A *Dharmasūtras* and a *smṛti* in the name of *maharṣi* Gautama are currently available. *Gautama Dharmasūtras* is the most antiquated and considered very authentic of the existing *Dharmasūtras*. It is especially read by the adherent of *Sāmaveda*. It's composed only in prose. Haradatta and Maskarī

³⁷ कश्यपोऽत्रिर्वशिष्ठश्च विश्वामित्रोऽथ गौतमः। जमदग्निर्भरद्वाज इति सप्तर्षयः स्मृताः॥ श्रीमद्भागवत 8.13.5

are the chief commentators on Gautama *Dharmasūtras* (Pandey U. C., Gautama Dharma Sutra, 2013). According to the commentator Haradatta, there are 28 chapters in the Gautama *Dharmasūtras*. In the Calcutta edition, another chapter called ‘*Karmavipaka*’ has been added which comes after the 19th chapter. Gautama *Dharmasūtras* consists of 3 *praśnas* which are divided into 28 chapters. The first and second *praśnas* consist of 9 chapters each and the third *prashna* consists of 10 chapters (Kumari, 2002). The subject matter of Gautama *Dharmasūtras*, very briefly is as follows; The sources of *dharma*, the rules of interpretation, the period of upanayana of the four *varṇas*, the appropriate girdle assigned for each *varṇas*, the rules of defecation and *achaman*, the method of approaching the guru, rules of celibacy, the control of students, the time of study, the duties of the four ashrams, rules of the householder, marriage, eight types of marriage, sub-castes, the rules of intercourse after marriage, 40 rites and 8 spiritual qualities (such as mercy, forgiveness etc.), unique duties of the four castes, responsibilities of the king, taxes, factors of ownership, treasury or property, property division, women’s wealth, twelve type of sons, the rules of impurity at the time of birth and death, discussion about women’s duties, niyoga and its benefits, atonement for drinking of liquor and other sins, fornication, unnatural offences, and many kinds of contraventions committed by a celibate (Kane, 1930).

The *smṛti* obtained in the name of *maharṣi* Gautama is called “*Vṛddha Gautamsmṛti*”. This entire *smṛti* is composed in the form of a dialogue between Śrīkrṣṇa and *dharmarāja* Yudhiṣṭhira. There are a total of 22 chapters, in which glory of *dharma* and conduct, charity, characteristics of celibates, five great *yajñas*, methodology of food, description of auspicious and inauspicious deeds, the glory of pilgrimages and devotion are discussed in great length (Kumari, 2002).

3.1.2 Baudhāyana Dharmasūtras

Baudhāyana *Dharmasūtra* is a part of the *Kalpasūtra* associated with the *Kṛṣṇa Yajurveda*. The complete text of the Baudhāyana literature has not yet been fully procured and it is not carefully preserved as the *sūtras* of Āpastamba and Hiranyakeśī. (Kane, 1930). According to Burnell, there are 6 episodes in the *sūtras* of Baudhāyana; *Śrautasūtra* consists of 9 *Praśnas* (chapters), *Karmāntasūtra* has 20 chapters, *Dvaidhasūtra-Gr̥hyasūtra-Dharmasūtra* consists of 4 *Praśna* (chapters) and *Śulvasūtra*

have 3 chapters (Maxmuller, 1896). There is more use of verses than prose in Baudhāyana *Dharmasūtra* and the language is similar to the linguistic structure of *Purāṇas*. Baudhāyana's *dharmasūtras* are simple yet elaborate and detailed (Gupta, 2013). Govindaswamy is the commentator of the Baudhāyana *dharmasūtra*, whose commentary is factual and full of prudence and wisdom. The language of Baudhāyana's *sūtras* appears to be prior to Pāṇinī.

Sources of dharma, different practices of northern and southern India, studenthood, time of upanayana, the girdle, skin and staff appropriate to each caste, physical and mental purification, impurity on birth and death, rules of inheritance, purification of clothes, ground, grass, fuel, vessels and articles used in sacrificial rituals, the duties of kings, atonement for adultery by men and women, regulations about dinner, the daily duties of the householder such as bathing, giving food etc. are discussed in this text (Gupta, 2013; Kane, 1930).

3.1.3 Āpastamba Dharmasūtras

Āpastamba, a very primitive *vaidika* sage was a great yogi, an excellent scholar of *Vedas* and *Vedānta* philosophy and a most compassionate *Mahātmā*. *Maharṣi* Yājñavalkya has taken the name of Āpastamba with utmost respect amongst the distinguished theologians in his *Yājñavalkya-smṛti*³⁸. Āpastamba is considered one of the chief masters of *Kṛṣṇa Yajurveda* and his name has also been enumerated in Pāṇinī's *Vidādi Gaṇasūtra*³⁹. He was extremely divine-sighted and very merciful. Compendiums available by the name of *maharṣi* Āpastamba are *Āpastamba Dharmasūtras*, *Āpastamba Grhyasūtras*, *Āpastamba Śulvasūtra*, *Āpastamba Yajñaparibhāṣāsūtra* and *Āpastambasmṛti*. All these texts are of primary importance as they are deemed to be regulatory texts for living the cultured way of life. *Āpastambasmṛti* consists of ten chapters and about 200 verses. Its major area of focus is the various atonement laws. In this *smṛti*, cow slaughter is declared to be the greatest sin. While describing the eminence of cow rearing, *maharṣi* Āpastamba, states that medication and therapy of cows are a great virtue⁴⁰. *Āpastamba Dharmasūtras* are

³⁸ मन्वत्रिविष्णुहारीतयाज्ञवल्क्योशनोङ्गिराः । यमापस्तम्बसंवर्ता कात्यायनबृहस्पति ॥ याज्ञवल्क्य 1.4

³⁹ अन्तृष्यानन्तर्ये विदादिभ्योऽञ् । सिद्धान्तकौमुदी 4.1.104

⁴⁰ यंत्रणे गोचिकित्सार्थे मृतगर्भविमोचने । यत्रे कृतेविपत्तिश्चेत् प्रायश्चित्तं न विद्यते ॥ आपस्तम्बस्मृति 1/32.2

authoritative since ancient times. It is related to the *Taittirīya śākhā* of *Kṛṣṇa Yajurveda*. *Āpastamba Dharmasūtras* is divided in two *praśnas*. Each of the two *praśnas* is further subdivided into eleven *paṭala* (chapter). In both the *paṭalas* there are consecutively 32 and 29 *kaṇḍikās*. It is a part of the main *kalpa* of the *Ṛtvija* named *Adhvaryu*. 27th Chapter is declared as *Āpastamba Gr̥hyasūtras*, it is followed by *dharmasūtras*. With respect to *Śukla Yajurveda*, according to *Caraṇavyūha*, *Āpastamba* branch is one of the 5 branches of the *Khaṇḍikīya* branch. *Khaṇḍikīya* is a subsection of *Taittirīya Śākhā*. Chronologically, *Āpastamba dharmasūtras* are composed later than *Baudhāyana dharmasūtras* but prior to *Hiraṇyakeśī*. The eighth *paṭala* of the first *praśna* is reputed for the aspect of spirituality and is known as ‘*Adhyātmajñāna Paṭala*’. Under this *paṭala*, special emphasis has been given to *yoga*. Out of all the *dharmasūtras* that exist today, the *Āpastamba* is composed in a more concise and organized style. Its language is more archaic and appears very distant from the rules of *Pāṇinī*. Although this *dharmasūtra* is composed mostly in prose, verses are also found in the text. As the interpreter of *Āpastamba Dharmasūtra*, *Haradatta*’s *Ujvalā īkā* is considered the most prominent.

The *Āpastamba Dharmasūtras* contains the diverse topic of the DS such as sources of *dharma*, the definition of *ācārya* and their importance, atonement for the violation of the proper time of *Upanayana*, rules for graduation, Rules regarding the study of Vedas, rules for the prohibition of purchase and sale of certain articles; Theft, killing a celibate, murder, foeticide, fornication, drinking alcohol etc. are considered as serious sins, other minor sins, rules of household conduct regarding eating, fasting, sexual intercourse, hospitality appreciation, offering of food to a celibate, householder, companion etc, law and other punishment according to crime, six types of marriages, charity, rules of the monk, appreciation of the virtuous rulers and condemning the wicked kings, specific rules for the king and the foundation of the palace, donation of land and money, protection of the public and subjects, exemption from tax, punishment for adultery and humiliating women etc.

3.1.4 Vasiṣṭha Dharmasūtras

Maharṣi Vasiṣṭha, a true embodiment of renunciation, austerity, contentment and forgiveness, his virtuous devotion has always been considered ideal and exemplary

for the adherents of *dharma*. He is proclaimed to be the son of *Mitrāvaruṇa* in the *Vedas*. His character is often described in some form or the other in Sanskrit literature. He is one of the eminent *vaidika* seers. The seventh division of *R̥gveda* has been named under him and is known as *Vāsiṣṭha maṇḍala*. 2 texts available to his name are; *Vāsiṣṭha Dharmasūtra* and *Vāsiṣṭhasmṛti*. *Vāsiṣṭha Dharmasūtra* consists of 30 chapters and it is composed in the form of *sūtras*. Verses are also found within the text. The description style of this text is simple, beautiful and easy to grasp. It is not available today as an independent text. There is no *śrautasūtra* or *gṛhyasūtra* available in the name of *Vāsiṣṭha*. *Vāsiṣṭha Dharmasūtra* has described *dharma* as '*śrutismṛtivilhito dharmah*'. *Vāsiṣṭhasmṛti* is divided into seven chapters consisting of 1150 verses. This *smṛti* primarily predicates *vaiṣṇava dharma*, devotion and philosophy. It discusses *vaiṣṇava*'s virtues and worship.

Vāsiṣṭha Dharmasūtras also incorporates all the topics of DS such as the Definition of *Dharma*, Limitations of Aryavarta, sinners and sins, six types of marriages, the religious rituals before the *Upanayana* ceremony, the privileges and duties of the four castes, in calamity, purification on birth and death, rules of conduct for menstruating women, the rules of courtesy and good families, hospitality, rules for ascetics, the rules of conduct for graduates, The rules for starting the study of *Vedas*, rules regarding the administration of justice, the king as the guardian of the minors, three types of evidence, eligibility of witnesses, the duty of the king to protect and punish, the importance of the priest, atonement for deeds done knowingly and unknowingly, atonement for the adultery and consuming the forbidden food, appreciation of *dharma*, truth etc.

3.1.5 Manusmṛti

MS is the most acceptable and prominent text of DS. It is the most revered and cardinal text of DS. MS is the most primordial of all the available *smṛtis*. That is why its importance is also comparatively much more than other *smṛtis*. It is divided into 12 chapters and consists of all the topics of DS. A detailed description of this MS is discussed in this chapter in section 2.

3.1.6 Yājñavalkyasmṛti

Yājñavalkya comes under the *vaidika* sage tradition. He is believed to be the narrator of Śukla Yajurveda. In the *smṛti* literature, the name of *Yājñavalkya* is found in two versions. One is *Yājñavalkya* and the other one is *yogī Yājñavalkya*. Some scholars consider them to be separate individuals, whereas, in the opinion of a few other scholars, they are the names of the same person. Maharishi Yājñavalkya was a great sage. The contemporary *Yājñavalkyasmṛti* available today begins by addressing Yājñavalkya as *Yogīśvara*⁴¹. Currently, the *Yājñavalkyasmṛti* includes the Nirnayasagara edition of 1892, the Trivandrum edition and the Anandasrama edition of Vishwaroop, having 1010, 1003 and 1006 verses respectively. It is broadly divided into 3 treatises *ācārādhyāya*, *Vyavahārādhyāya* and *Prāyaścītādhyāya*. It has about 1000 verses and each treatise consists of separate chapters. The first treatise includes 13 chapters. The second treatise is the most lengthy consisting of 25 treatises, whereas, the third treatise is the shortest having only 6 chapters in it. It holds verbal authority over *Agni* and *Garuḍa Purāṇa* and remained propagative and proliferating for the later compendiums.

The fourteen disciplines; The twenty analysts of *dharma*, *saṃskāras* from conception to marriage, Upanayana and its timings; ceremonial duties of a celibate, prohibited substances and deeds for the celibate, student period, marriage, eligibility of a marriageable girl, eight types of marriages and the spiritual benefits derived from them, major and minor castes, household duties, privileges and duties of the Four Varnas, ten principles of conduct for all; household profession, the rules of consummation, Rajdharma; qualities of the king-minister-priest, King's duty to protect, administration and justice, taxes and expenses, conflict between theology and economics, means of evidence, witnesses and proprietorship, title and rights, types of Court, fraud, misappropriation and other causes of non-compliance, receipt of goods, fund-loan-interest rate, deposition, three types of mortgages, pledge, deposit, oath taking, forgery, division of property, border disputes, sale without ownership, names of 21 type of hells, alcoholism, atonement for humane and mortal sins and various kinds of animal-killings, purification according to time, place, state and capacity etc are

⁴¹ योगीश्वरम् याज्ञवल्क्यं सम्पूज्य मुनयोऽब्रुवन् वर्णाश्रमेत्राणाम् नो ब्रुहि धर्मान्शेषतः ॥ याज्ञवल्क्य 1.1

described in *Yājñavalkyasmṛti*. MS is deliberated as the first step of the generation of the *smṛti* literature. *Yājñavalkyasmṛti* is enshrined in the next step, belonging to the same generation of *smṛti* literature. From the perspective of significance, *Yājñavalkyasmṛti* incarcerates much higher practical importance than MS. By looking at its subject matter, it is clear that *Yājñavalkyasmṛti* was a post-MS composition.

3.1.7 Nāradaśmṛti

Nāradaśmṛti is a very ancient *smṛti* consisting of 1028 verses. It has two commentaries written by Asahāya (AD650-750) and Bhavasvāmin (AD700-1000) respectively. The treatise on *Nāradaśmṛti* is similar to MS. Entire *Nāradaśmṛti* is composed in *anuṣṭupa chanda*. This *smṛti* is focused only on law and the determination of justice. Nārada supported the remarriage of widows. Some of the subjects dealt with in this text are the recovery of debts, deposits and lending, gifts and resumption, breach of contract of service, and sale without ownership, violation of convention of guilds, settlement of boundaries, partition and inheritance, marital relations, crimes and punishments, social conduct, defamation etc.

3.1.8 Parāśaraśmṛti

Maharṣi Parāśara was the grandson of the idol of penance and austerities *Maharṣi* Vasiṣṭha, the son of *Mahātmā* Śakti, the father of *Kṛṣṇādvaiṣṇava* Vedavyāsa and the great-grandfather of the supreme knowledgeable Śukadeva. The meaning of the term “Parāśara” is ‘पराश्रृणाति पापनिति पराशरः’ which means the one who destroys all the sins just by mere sight and remembrance⁴². It is believed that *Maharṣi* Parāśara was a well-becoming of his name due to his rigorous penance and magnificent virtues. How instrumental and lucrative the theological arrangements of such a *Maharṣi* would be, can thus, be easily estimated. Many texts are available in the name of Parāśara, one of which is *Viṣṇu Purāṇa*. This *purāṇa* is the foundation of Vaishnavism. The name of *Gītā*, found in chapters 290-295 of *Śāntiparva* of *Mahābhārata*, is called *Parāśara Gītā*. The major focus of *Parāśaraśmṛti* is the practice of the *dharma* (Tiwari P. , 2011).

⁴² पराशातयिता यातुनाम् इति पराशरः । ...शातयिता विनाशकः ॥ निरुक्त 6.30

It preaches that the best way to attain welfare is through virtue and righteousness⁴³. Several texts related to Parāśara are known: *Bṛhatparāśara Horāsāstra*, *Laghupārāśarī*, *Bṛhatpārāśarīya Dharmasaṃhitā*, *Parāśarīya Dharmasaṃhitā*, *Parāśara Saṃhitā*, *Parāśara Purāṇa*, *Parāśarauditam Nītiśāstram*, *Parāśaroditam Vāstuśāstram*. Two eminent *smṛtis* are also available to his name; *Parāśarasmṛti* and *Bṛhatpārāśarasmṛti*. The available *Parāśarasmṛti* is divided into 12 chapters and contains total 513 verses. Amongst the other *smṛtis* currently available, it is considered particularly important. In this *smṛti*, only ethics and atonement are discussed. *Bṛhatpārāśarasmṛti* is composed of 12 chapters having innumerable verses. *Mahātmā Suvratā* is proclaimed to be the orator of *Bṛhatpārāśarasmṛti*⁴⁴. In this *smṛti*, auxiliary pointers have been forecited on cow-rearing and agriculture.

It majorly focused on the description of four Yugas, the six types of worship, the livelihood of varnas, Grihasthandharma, Agriculture, 5 types of inadvertently fatal deeds towards animals, the sanctification of impurity caused by birth and death, purification of simple things, such as dog bites, purification on killing, cleaning of utensils made of metal, wood, etc, council formation, the rules regarding what to eat and what not to eat etc.

Based on the above discussion and the topics deliberated we can conclude that almost all the *smṛtis* have a homogenous index of topics. They discuss the code of conduct, ethics, the concept of *dharma*, atonement, distinctive welfare activities, duties of the king and citizens, purification systems, economics and financial aspects, religious conditions, customs and traditions, the culture of marriage, its types and family structure, social norms, inheritance, the status of women etc.

4. Introduction to *Manusmṛti*

Intellectual genius *Ācārya* Manu is not only considered the father of mankind but he is also reckoned to be the undisputed scholar (*śāstā*) of human conformation. The word *śāstā* is derived from the word *śāstr* (*śāsa + tr*) which implements the

⁴³ धर्म एव कृतः श्रेयानिहलोके परत्र च । तस्माद्धि परमं नास्ति यथा प्राहुर्मनीषिणः ॥ महाभारत शान्तिपर्व 290/6

⁴⁴ पराशरोदितं धर्मशास्त्रं प्रोवाच सुव्रतः । बृहद् पराशरस्मृति 12.377

meaning of teacher, educator, instructor, master, king⁴⁵, ruler⁴⁶, lord and father. There is no room for difference of opinion in the fact that Manu is highly respected in all the above senses and is accepted as the cicerone of mankind. *R̥gveda* proclaims Manu as the primordial father of mankind⁴⁷. He is inbred in the lineage of *mānasa* sons of *Brahmā*. Therefore, being born from Manu, we are all called *manuṣya* or human⁴⁸. Pāṇini in his grammarian *sūtra* also affirms a similar fact⁴⁹. The *Purāṇas* have also described Manu as the Guru of mankind, declared him to be instituted in every *manvantara* and described the apprehender of the religious duties of mankind⁵⁰. *Ācārya* Kauṭilya, the author of *Arthaśāstra* a pioneer in economics and commerce, has used the word ‘*mānavāh*’ as the followers of Manu. *Maharṣi* Yāska infers Manu as a *smṛtikāra*⁵¹. Manu determined the system of life and the ethics of humanity. The social management system established by him laid the path of welfare for future progeny⁵². It is clear that the system constituted by Manu for social welfare and public discipline provided it in the form of a bequest to the future generation⁵³. There is a considerable difference of opinion among scholars regarding the authenticity of *smṛtis*, but still, the authenticity of MS is universal. It would be expedient to accept that multitude of *smṛtis* were written in accordance with the changing social dynamics and to cater to the needs of different periods. Therefore, the appropriateness, adequacy, authenticity and usefulness of the *smṛtis* should be perceived in the context of different eras and time periods⁵⁴. Keeping a similar principle in view, *maharṣi* Parāśara has described the major *smṛtis* to be valid in different eras⁵⁵. As far as the historical authenticity of MS is concerned, we shall scrutinize the ancient sources. It is aforementioned in the

⁴⁵ पराकृतयुगे राम मनुर्दण्डधरः प्रभुः । वाल्मीकि रामायण उत्तरकाण्ड 78.5

⁴⁶ तस्या मनुर्वैवस्वतो वत्स आसीत्पृथिवी पात्रम् । अथर्ववेद 8.10.4.10

⁴⁷ यामथर्वा मनुष पिता दध्यङ्घ्रिमत्रत । तस्मिन् ब्रह्माणि पूर्वथेन्द्र उक्त्वा समगमतार्चन्नु स्वराज्यम् ॥ ऋग्वेद 1.80.16

मृळा नो रुद्रोत नो भयस्कृधि क्षयद्वीरीय नमसा विधेम ते । यच्छं च योश्च मनुरायेजे पिता वदश्याम तव रुद्र प्रणीतिषु ॥ ऋग्वेद 1.114.2

⁴⁸ मानव्यो हि प्रजाः ॥ तैत्तिरीय संहिता 1.75.1.3

⁴⁹ मनोरपत्त्यं पुमान् मानवः । सिद्धान्त कौमुदी 4.1.92

⁵⁰ मा न पथः पित्र्यान्मानवादधि दूरं नैष्ट परावतः । ऋग्वेद 8.30.3

⁵¹ अविशेषेण पुत्राणां दायो भवति धर्मतः । मिथुनानां विसर्गादौ मनुः स्वायम्भुवोऽब्रवीत् ॥ यास्क निरुक्त 3.1

⁵² यद् वै किञ्च मनुरवदत् तद्भेषजम् । तैत्तिरीय संहिता 2.2.10.2

⁵³ मनुर्वै यत् किञ्चावदत् तत् भेषज्यायै । ताज्य महाब्राह्मण 23.16.17

⁵⁴ अन्ये कृतयुगे धर्मास्त्रेतायां द्वापरेऽपरे । अन्ये कलियुगे नृणां युगहासाऽनुरूपतः ॥ मनुस्मृति 1.85

⁵⁵ कृते तु मानवा धर्मास्त्रेतायां गौतमाः स्मृताः । द्वापरे शङ्खलिखिताः कलौ पाराशराः स्मृताः ॥ पराशर स्मृति 1.24

Mahābhārata that the *Brahmā* constituted the DS text consisting of 1 lakh verses, in which the propounded *dharma* is professed by the *svambhū* Manu. It is distinctly accepted in MS that *Brahmā* first taught this scripture to Manu and then he further, preached it to other sages such as Marīci etc. Similarly, It is said in *Nāradaśmṛti*, that Manu composed the DS consisting of 1 lakh verses, 1080 chapters and 24 episodes. Manu gave it to Nārada, who abbreviated this scripture into 12000 verses. Nārada passed it onto Mārkaṇḍeya who subdued it to 8000 verses. Followed by, Sumatibhārgava, who received this DS from Mārkaṇḍeya and further summarized it in 4000 verses. From the above-forecited excerpts, it can be concluded that the DS which *svambhū* Manu composed on the basis of the scriptures received from *Brahmā*, is the foundation and origin of the presently obtained MS. It would also not be inconsistent to accept here, that according to the time afflux and changing of requirements from time to time, some new interventions must have been added to the original MS.

The importance of the *śmṛtis* such as those of Manu and Yājñavalkya including their commentaries and digests remains intact even today. In the *śmṛti* tradition, MS, also known as *mānava dharmasāstra* or *manu saṃhitā*, is considered to be the most ancient, valid and authentic compendium. Its position is unprecedented in Indian DS tradition. In other *śmṛtis*, also it has been accepted as a certified scripture. The recognition of its superiority has been indispensable in the Indian knowledge tradition. The *Vedas* have clearly coronated the teachings of Manu as the ultimate welfare of humanity. This *śmṛti* is approved by the *vedas*, comprises of an explanation relevant at all times and is the best legislation for Indian lands. It is a composite text including all the focal elements of sociology, ethics, economics, politics, administration, philosophy and theology. It is thus, regarded as the fundamental text of the social system. Bṛhaspati⁵⁶ and Laugākṣi⁵⁷ credit special recognition to MS amongst all other *śmṛtis*. Hemādri has also penned remarkable words declaring the primacy of MS⁵⁸. The importance of MS has been accepted (1964) not only by Indian scholars but also by western scholars. Mackenzie says “*To the western world, the code of Manusanhita is*

⁵⁶ वेदार्थोपनिबद्धत्वात् प्राधान्यं हि मनोः स्मृतम् । मन्वर्थविपरीता तु या स्मृतिः सा न शस्यते ॥ कुल्लुकभट्ट टीका 1.1

⁵⁷ स्मृत्योर् विरोधे सम्प्राप्ते मनुवाक्यस्य सम्मतिः ॥ स्मृतिसन्दर्भ षष्ठ भाग पृष्ठ सं. 278

⁵⁸ मनुस्मृतिर् हि स्वाध्यायात् प्रसिद्धत्वाद् बहुभिः सम्प्रदायेन पठ्यमानत्वादपभ्रष्टपाठाऽसम्भवाद्....बलीयसी ॥

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the best work of its kind. It is the oldest known book on Hindu law” (Brown, 1964). The ascendancy of MS can literally be witnessed outside India as well. The influence of MS can be clearly witnessed in the South Asian counterparts as the present legal codes and laws of Burma, Cambodia, Laos and Thailand still have elements of law indigenous to MS and related law compendiums (Bhattacharya, 1993). Many verses in an inscription of Champa match with the *śloka* of MS. Similarly, The doctrine of *dharma* known as “*Dhammaṭhaṭ*” in the Burma region is also based on the ancient principles of Manu. The contemporary Burmese government still functions and administers on the basis of the primitive fundamentals of *Dhammaṭhaṭ*. Likewise, the law of Bali is based on the principles of MS.

The first and the foremost aim of Manu was to preserve the *Vaidika* thoughts by comprehending the MS. The second most important aspect was to present the outline of a society in which issues of caste, racism and personal disputes are comparatively less and a healthy society can be formed with the superlative development of the individual. Just as Brahmā constituted the four varṇas; *Brāhmaṇa Kṣatriya Vaiśya* and *śūdra*, for the purpose of enhancing the world, his son Manu composed the DS to make that enhanced world well organized, well regulated and well developed. The code of conduct established by Manu in his MS is relevant even today. It is articulated that the purpose of Manu’s sermon was not only to protect the *vaidika dharma*, ethics and ideological system but also to develop a society completely deficient in caste and ethnic disputes, as well as the virtues like cooperation, harmony and affection can be established in the society.

4.1 Period of *Manusmṛti*

There is no unanimity amongst scholars regarding the time frame of the creation of MS. Nowhere in the book, has been explicitly mentioned its creation, so the arguments presented by the critics regarding the time-determination of MS are on the basis of internal and external evidence. Bühler (Maxmuller, 1896) determines the time period of the text probing the second century BC as the eastern limit and the second century AD as the western limit. Bühler (Maxmuller, 1896) opines that the present form of MS has been resolute and stable after several amendments, but Kane (1930) propounded that the amendment betides only once and determined the time frame of

MS to be from 200 BC to 200 AD. Jayaswal (1934) accepts the eastern boundary of the time period as determined by Bühler (Muller, 1886), but narrows the western limit and proclaimed it to be the beginning of the AD era.

In the form of external pieces of evidence, among the many commentators of MS, the oldest commentator is Medhātithī, whose time is considered to be 925-1000 AD. Therefore MS, as per this probation is a composition prior to his commentary *Manubhāṣya*. Likewise, Viśvarūpa, the commentator of *Yājñavalkya Smṛti*, has quoted multiple examples from MS, hence MS is supposed to be a composition before him. *Ācārya Śaṅkara* has duly mentioned Manu in his commentary of *Vedāntasūtra* and the ideas propounded by him seem to be based on MS. Therefore, the composition of MS dates back previous to *Ācārya Śaṅkara*. Kumārila Bhaṭṭa proclaims MS as the most ancient text, in his work “*Tantravārtika*”. Therefore, the availability of MS before Kumārila Bhaṭṭa is absolutely certain. In the ninth chapter of *Prchhakatik*⁵⁹ (7th century) the punishment alleged by Śūdraka for a sinful Brahmin is propounded according to MS, hence it is reckoned as a composition former to *Mṛcchakaṭikam*. Dhārasena the king of *Vallabhī* (571 AD) also mentioned MS in his inscription. Similarly, the *Mīmāṃsaka Śabara Svāmī* (500 AD) cited the evidence of MS in the commentary of *Jaiminī Sūtra*. The great Buddhist poet Aśvaghōṣa (3rd century) quoted several verses found in MS, in his work *Vrajakopaniṣad* speculating that MS might have been available prior to Aśvaghōṣa. It is, therefore clear that many writers, after the second century, have cited or instanced MS directly or indirectly in their works and they have considered it as an authentic book.

A thorough understanding of the references in the original text puts forward some iterations which facilitate internal pieces of evidence. Many castes such as *Yavana*, *Kamboja*, *Śaka*, *Pahalavā* etc. have been mentioned in MS. The origination of these classes is from outside of Bharat. *Yavana*, *Kamboja* and *Gandhāra* have also been mentioned in the fifth stone inscription of the Maurya ruler Ashoka (3rd century BC), so chronologically, it would be inappropriate to fix the time of MS prior to the third century. Secondly, the subject rendering of MS far is more extensive than the other

⁵⁹ अयं हि पातकी विप्रो न वध्यो मनुब्रवीत । राष्ट्रदस्मात्तु निर्वास्यो विभ्रवैरक्षतैः सह ॥ मृच्छकटिक अध्याय 9

DSs, whose time is fixed between 600 BC-300 AD. It is thus, assumed to be a later creation than the 600 BC (Pralayankar, 2004).

Almost all scholars hold unanimous views about the eastern time limit and have come to terms with the argument that MS was inscribed after the composition of AS. The time of Chandragupta Maurya has been assumed to be 326 BC. The mutual relation between Chandragupta Maurya and Kauṭilya is an established historical fact. Jayaswal (1934) made an informed comparison between the AS of *Kauṭilya* and MS, witnessing the extraordinary dominance of *brāhmaṇa* in MS, (Jayaswal, 1934) concluded that MS was drafted during the period of *brāhmaṇa* king Puṣyamitra and his descendants. He further indicates that the influence of Kauṭilya on MS is evident and Kauṭilya's opinion has also been refuted in various instances. Rangaswami (Aiyangar K. R., 2019) puts forward a rebuttal to Jayaswal's view and states that it is not appropriate to determine the relation between *Kauṭilya* and MS. Similarly, hundreds of verses are found in *Mahābhārata*, which are similar to MS. Although there is no mention of *Manu* there. Bühler perorates that in three *parvas* namely; *vana*, *śānti* and *anuśāsana*, there are 260 such verses of MS, which are either transcribed as whole or in parts. Kane thus, proves that in this regard, MS is stronger in antiquity than *Mahābhārata* (Kane, 1930). Kane is of the clear opinion that the present MS is composed prior to the present *Mahābhārata*.

Smith (2003) mentioned, that MS is dated 200 BC, according to the Hindu way of life. William Jones has dated MS to 1250 BC, while Schlegel mentions it to be 1000 BC. Monier Williams dates the time of MS to 500 years BC, while Weaver mentions the time after the *Mahābhārata* as the time of MS (Berry, 1971). Based on the above deliberations, we can conclude that MS was constituted somewhere around 200 BC.

4.2 Structure of *Manusmṛti*

The appellation of *Manu* has been infested at various collocations in the Vedas⁶⁰, scriptures and the following literary traditions. *Taittirīya Saṃhitā* reckons that

⁶⁰ यामर्थर्वा मनुष्पिता दध्यङ् घियमन्नत । तस्मिन् ब्रह्माणि पूवथैन्द्र उक्त्वा समग्मतार्चन्ननु स्वराज्यम् ॥ ऋग्वेद 1.80.16
याभिर्नरा शयवे याभिरत्रये यामिः परा मनवे गातुमोषयुः याभिः शारीराजतं स्यूम रश्मये ताभिरुषु ऊतिभिररिवनागत
। ऋग्वेद 1.112.16

*Manu*⁶¹ entrusted his property to his sons. *Bhagavadgītā* mentions the name of *Vaivasvata Manu* and his son *Ikṣvāku*⁶². Likewise, *Yāska* has mentioned the name of *Manu* in his reputed composition *Nirukta*⁶³ and *Gautama* has directed the opinion of *Manu* in his *dharmasūtra*⁶⁴. Thus, the authority of *Manu* is conspicuous and incontestable. It is also a proven fact, that *Manu* was the originator of *dharma* and his opinion has been accepted by almost all the later preachers of *dharma*. The present form of MS is based on archaic traditions and it is a collection of rules propounded by *svāyambhuva Manu*. Radhakrishnan (2004) considered MS as a book similar to the *Mahābhārata* and the *purāṇas*. He interprets the MS as a bridge between law and religion. Explaining MS further, he said that it is basically a scripture and a set of moral rules. Similarly, Gairola (1978) says that Vedic method and philosophical ideologies are included in the discussion of the subject of MS.

The explorations done by Western scholars such as Bühler and Max Müller despite being commendable are considered to be erroneous in various segments. The major reason for the exegesis to be flawed is that these western laureates lack wholesome knowledge of the Indian text creation style as well as are unfamiliar with the primitive traditional sensibilities. Hence, unable to develop an understanding of the Indian perspective accurately.

MS is a primary text of the DS, it is an ancient legal text divided into 12 chapters (*adhyayas*). The text is composed in metric *ślokas* (verses), in the form of a dialogue between an exalted teacher and disciples who are eager to learn about the various aspects of *dharma*. The first 58 verses are attributed to Manu, while the remaining more than two thousand verses are attributed to his student *bṛgu*. (Olivelle, 2005). It contains special sections on social laws, consumer laws, tribal community laws and related legal procedures. While there are a total of 2703 *ślokas* in MS, Bühler (Maxmuller, 1896) has considered many segments of the present MS as *prakṣipta*

⁶¹ मनुः पुत्रेभ्यो दार्यं व्तभजत् ॥ तैत्तिरीय संहिता 1.14

⁶² इमं विवस्वते योगं प्रोक्तवानहमव्यवयम । विवस्वान् मनवे प्राह मनुर्िक्ष्वाकवेऽब्रवीत् ॥ भगवद्गीता 4.1

⁶³ अविशेषण मिथुनाः दायद इति । तदेतच्चक्षोकाभ्यामुक्तम् । अंगादंगात्संभवसै हृदयादधिजायसे । आत्मा वे पुत्रनामासि स जीव शदरः शतमिति अविशेषेण पुत्राणां दायो भवति धर्मतः मिभुनानां विसंगोदो मनुः स्वायंभुवोऽब्रवीत् । निरुक्त, 3, 4, पृष्ठ सं. 241

⁶⁴ त्रीणि प्रथमानि अनिर्देश्यानि मनुः गौतम धर्मसूत्र 21.8

(projected to be appended later). Content-wise distribution of each chapter is as discussed:

The **first chapter** discusses the genesis of the universe, the conscience of righteousness and falter, the creation of heaven and land, the conformation of the *Veda* trio, the creation of divine deities, the advent of five elements of nature and their characteristics, the origin of living beings and living organisms, the essence of life, creation of man and women, origination of ten Manus, division of time and centuries, calculations of light-years and eras, the fourfold system of *varṇas* and *āśrama*, duties of four *varṇas*, the superiority of brahmins, four types of *yugas*, quadrilaterals of *dharma* and its decrement in corresponding eras.

The **second chapter** explains about features and sources of *dharma*, characteristics of *dharma*, vedicism of *dharma*, 4 major authentications of *dharma*, definition of *śruti* and *smṛti*, geographical mapping of parts of ancient Bharata such as *madhyadeśa* and *āryavarta*, concept of *saṃskāra*, namely; *Garbhādhāna*, *Jātakarma*, *Nāmakaraṇa* *Niṣkramaṇa*, *Annaprāśana*, *Cūḍākarāṇa*, *Karṇāvedhana*, *Vidyārambha*, *Upanayana*, *Vedārambha*, *Keśānta* or *godāna*, *Samāvartana* *vivāha*, *antyeṣṭi*, *ācamana* *vidhi*, *guru vaṃdanā* (adoration or singing praises) *vidhi*, etiquettes of eating and prohibition of overeating, methodology of studying the *vedas*, procedure and methods of observing vows and performing ceremonies, student- guru bond, service to guru, rules of greeting the guru and elders, precept regarding the ethics of begging alms, methods of greeting and its results, morning and evening worship, results of *yajña*, importance of *ācārya*, *upādhyāya*, guru, *ṛtvika*, concept of *vrātya*, *brahmacarya* *vidhi* and attributes of *brāhmaṇa*, types of *brāhmaṇa*, precepts of *brāhmaṇa*, *prāṇāyama* and its importance, the code of conduct with respect to guru's son and wife, prohibition of condemnation of Guru, commendation of *praṇava*, condemnation of fools and atheists and so on.

The **third chapter** talks about the *gṛhastha* and *brahmacharya* *dharma* and *gṛhastha* *āśrama*, the entry-level phase of *gṛhastha* *āśrama*, descriptions of defects in women, characteristics of girls eligible to marry, eight types of marriages; *brāhma*, *deva*, *ārṣa*, *prājāpatya*, *asura*, *gāndharva*, *rākṣasa* and *paiśāca*, condemnation of *paiśāca* and *asura* marriage, prohibition of selling of girls and usurping of women's wealth, five types of *mahāyajña*

The **fourth chapter** is a continuation of the previous chapter discussing the *gṛhasṭha āśrama*, the concept of edible and non-edible, charity and prohibition of charity to the undeserving etc.

The **fifth chapter** elaborates on the *gṛhasṭha āśrama*, its time period and various duties and responsibilities attached to it, householder-ship and its objectives, selection of the clan, concept of edible and non-edible, methods of eating non-vegetarian, process of *śauca* and *śuddhi*, condemnation of meat-eating and garlic worshipping and paying respect to women in the society, purification of natural resources, grains, clothes, land and water, purification of utensils made of wood, conch, ivory, leather, copper etc., 12 types of faeces, the *dharma* of women, hospitality towards guests, service to the master, commendation of the master, types of marriages, pacification of the deceased, livelihood aspect of life, good and bad conduct.

The **sixth chapter** deals with the *vānaprastha vidhi*, rules of *vānaprastha*, hosting of guests, *parivrājaka-dharma*, *saṃnyāsa*, prohibition of honey, meat, scents, kohl, umbrella etc, abstemiousness, abstaining from senses of pleasures, period of begging alms, appreciation of *prāṇāyama*, the concept of *mahāprasthānam*, (*mokṣa*)salvation), methods to attain salvation, the superiority of *gṛhasṭha āśrama*,

The **seventh chapter** talks about the ruler, state-ship and kingdom, duties of the king and its subjects.

The **eighth chapter** deals with *vyavahāra darśana* i.e monetary, financial and fiscal department, revenue and expenditure, commercial activities, oaths and truth, witnesses, 18 types of *vyavahāras* namely; indebtedness, deposits, non-proprietary sale, resurgence, pay exchange, contract default, merchandising rules, border dispute system theft, adultery, frauds in business etc.

The **ninth chapter** discusses the duties of the men and women, division of property, twelve types of sons, *niyoga*, property or inheritance of women known as *strīdhana*, elimination of criminals and treatment of *vaiśyas* and *śūdras*.

The **tenth chapter** liberally discusses the inter-caste marriages and duties of four *varṇas* during emergency times. It condemns the inter-caste marriages, six deeds of *brāhmaṇa*, modes of livelihood for *brāhmaṇa*, and deeds of *kṣatriya* and *vaiśyas*.

The **eleventh chapter** is dedicated to the arrangement of donations, charity and penance. This chapter describes the method of atonement for various sins such as killing

or a *brāhmaṇa*, consumption of alcohol and drugs, murdering a *kṣatriya*, consumption of foods that are prescribed inedible, and adultery and having intimate relations (physical or marital) with degenerates.

The **twelfth chapter** describes the penance that a man must observe to repent the sins he had committed either knowingly or unknowingly. It talks about both direct and indirect penance, means of salvation, the concept of sins, deeds and misdeeds, sinful conduct, charity, the concept of the soul and unification with the supreme soul. It elucidates the appreciation of Vedas, three types of qualities; *sāttvika rājasika* and *tāmasika* and their features.

5. Commentaries of *Manusmṛti*

There are numerous commentaries composed on the MS to date. There are 25 commentaries available. These commentaries are broadly divided into three categories. Initial 11 commentaries and digests are completely available and also printed manuscripts are obtained. Out of which the 3 namely; *Medhātithī*, *Govindarāja* and *Kullūkabhaṭṭa* are very prominent as these are the most read and critiqued. Another probable reason for their prominence is that continuous editions and repeated publications of these explanations are being done. Apart from the previously named three commentaries, approximately 10 to 12 other digests are also available which are comparatively lesser-known. Nonetheless, a brief description of the various interpretations of MS available today is being discussed below.

Description of the most prominent commentaries:

1. ***Manubhāṣya* by Medhātithī** - Medhātithī mentions the name of Kumaril in his commentary and by proclaiming the name of Medhātithī by *Mitākṣarākara* Vijñāneśvara, the time period of Medhātithī can be appraised between the *kraistābda* of ninth to the tenth decade. Out of all the available interpretations of the MS, the commentary of *bhaṭṭavīrasvāmisūnu* Medhātithī is the most ancient and well renowned. It was printed in the compendium called “*Mānavadharmasāstram*” by Viśvanātha Nārāyaṇa Maṇḍalika in Mumbai in the *vikrama saṃvata* 1943. This commentary is elaborate, extensively detailed, critical and very significant in the field of DS studies, but in some places, especially in chapters eighth, ninth and twelfth, there are a few textual variations. Jagannātha Raghunātha Ghārapure also

got the interpretation of Medhātithī published. *Manubhāṣya* was also printed under the editorship of Gaṅgānātha Jhā between the *vikrama saṃvata* 1989-1996. Manasukharāya Mora of Kolkata also got it printed between the *vikrama saṃvata* 2026-2028.

2. ***Manvāśayānusāriṇī Manuṭkā* by Govindarāja** - The time of bhaṭṭamādhavātmaja Govindarāja, a resident of *Gaṅgātīra*, is deliberated to be later than Vijñāneśvara but prior to Jīmūtavāhana. Therefore, his time is considered to be the *kraistābda* of the 11th century. Kullūkabhaṭṭa has repeatedly cited Govindarāja’s exegesis in his commentary “*Manvarthamuktāvalī*”. *Manvāśayānusāriṇī* is printed a bit differently in the “*Mānavadharmasāstram*” by Viśvanātha Nārāyaṇa Maṇḍalika. It is also published in the 6 volumed MS containing 9 interpretations and is published from Bharatiya Vidyabhavan which is established in Mumbai. This commentary is very brief and is basically a gist of Medhātithī annotation providing a complete essence of *Manubhāṣya*. It is also published in the 6 volumed MS containing 9 interpretations and is published from Bharatiya Vidyabhavan which is established in Mumbai. This commentary is very brief and is basically a gist of Medhātithī’s annotation providing a complete essence of *Manubhāṣya*. It is also published in the 6 volumed MS containing 9 interpretations and is published from Bharatiya Vidyabhavan which is established in Mumbai. This commentary is very brief and is basically a gist of Medhātithī annotation providing a complete essence of *Manubhāṣya*. However, this commentary holds special characteristics of its own. The manuscripts of this commentary is extremely rare to find. The text is also profane in some instances. From the 72nd verse of the ninth chapter until the termination of the ninth chapter, this commentary is unavailable.
3. ***Manvarthamuktāvalī* authored by Kullūkabhaṭṭa** - He was a brāhmaṇa resident of Varanasi belonging to the Vārendra clan of Bengal. His time period is articulated to be between the *vikrama saṃvata* 1207- 1357. It is abbreviated, compendious, logical and very clear. Although Kullūkabhaṭṭa has cited Medhātithī and Govindarāja approximately 80 and 100 times consecutively, however, at various instances, he has also severely criticized Medhātithī and Govindarāja. Exegesis of Bhojadeva is also mentioned by Kullūkabhaṭṭa. The verses and sentences of Govindarāja have also been cited innumerable times. It is published in Calcutta in

vikrama saṃvata 1887. It was inscribed in *vikrama saṃvata* 1915 in Mumbai by Sadashiv Shetty. In *vikrama saṃvata* 2003, the tenth edition of MS along with the *Manvarthamuktāvalī* was printed from Nirṇayasāgara Printing Press. *Manvarthamuktāvalī* is also included in the Maṇḍalika's edition. Over fifty manuscripts of the MS are known today, but the earliest discovered, most translated and presumed authentic version since the 18th century has been the commentary of Kullūkabhaṭṭa is the most hyped, publicized, read and studied.

4. **Manvarthavivṛti authored by Sarvajñanārāyaṇa** - Sarvajñanārāyaṇa's time period is said to be between *vikrama saṃvata* 1157-1357. This explanation too has been incorporated in the "*Mānavadharmasāstram*" of Maṇḍalika. It is a very concise explanation and the influence of Medhātithī and Govindarāja is apparent. In various instances, this commentary proves to be providing a way better explanations than Medhātithī, Kullūkabhaṭṭa or Govindarāja.
5. **Manusāstravivaraṇa authored by Bhāruci** - This interpretation finds its mention in the *Mitākṣarā* of Vijñāneśvara. Although this interpretation (obtained from the ninth verse of the sixth chapter till the end) was made available by the scholar named John Duncun Martin Derrett (Derrett, 1973) and also, based on the only procured manuscript folio which is scribed in Malayalam script, printed in Germany. This interpretation is not well-known. J. D. M. Derrett states Bhāruci's time period to be between 500 to 650 AD. The scholars belonging to *Prājñapāṭhaśālāmaṇḍala* indicted his time to be between *vikrama saṃvata* 800-882. It is also called *Rajvimala*. It is published in the 6 volumes, MS containing 9 interpretations, which is published from Bharatiya Vidya bhavan, Mumbai. The manuscript of Bhāruci's "*smṛtisārasamuccaya*" is said to be existent in the Sarasvatīmahala Library of Tanjore. Medhātithī has mentioned Bhāruci's name⁶⁵ at the cessation of the eighth chapter of the german printed manuscript.
6. **Manvarthacandrikā authored by Rāghavānandasarasvatī** - Rāghava's time period is said to be after *vikrama saṃvata* 1457. His exegesis has also been published in the "*Mānavadharmasāstram*" of Maṇḍalika. This is a very brief

⁶⁵ "भारुचेः कृतौ", "भारुचिकृते" । मनुशास्त्रविवरण अध्याय 8

explanation and has some special features of its own. The allocation appears to be congruent with the *Advaitavedānta*.

7. **Nandinīṭīkā** authored by **Nandanācārya** - This commentary is also published in the “*Mānavadharmasāstram*” of Maṇḍalika. It is a very brief explanation with special features of its own.
8. **Sukhabodhinī** authored by **Maṇirāmadīkṣita** - This explanation is published in the classical description of MS stated in the third part of the Kāṇe's theological bibliography. It is also published in the 6 volumed MS containing 9 interpretations and is published from Bharatiya Vidyabhavan which is established in Mumbai. However, it is cited in the bibliography of Apharekṭa, much is not known about this interpretation.
9. **Exegesis of Rāmacandra** – This exegesis is also published in the “*Mānavadharmasāstram*” of Maṇḍalika. It is a very brief explanation with few special characteristics.
10. **Ciraprabhāvyaḅhyā (Vaṅgānuvādādisahitā) authored by Kāśicandra Vidyāratna** - This interpretation was printed in *vikrama saṃvata* 1977 and is currently available in the Kāśīviśvanātha library (also known as Goenka Pustakālaya) established by Gaurishankar Goenka. In this interpretation, the opinion of Medhātithī is said to be supported.
11. **Exegesis of Kṛṣṇanātha** - It is mentioned in the bibliography of Apharekṭa.
12. **Exegesis of Rucidatta** - It is also cited in the bibliography of Apharekṭa.
13. **Exegesis of Nārāyana** was written in 1497 A. D. and is cited by Bhaṭṭoji in his commentary on the *caturviṃśatimata*.
14. **Exegesis of Kāśmīraka** – Dr. Jolly published some excerpts from this explanation which were initially made by an anonymous Kashmiri Pandit in *Manuṭīkāsaṅgraha*. The evidence of this publication is found in the description of MS stated in the Kāṇe's theological bibliography. Julius Jolly published a short collection of MS interpretations of Medhātithī, Govindarāja, Nārāyaṇa, Rāghavānanda, Nandana and a Kashmiri Pandit (whose name is unknown) up to three chapters from Asiatic Society in the *vikrama saṃvata* 1942- 1946.

In addition to the previously discussed 14 commentaries, there are few interpretations and commentaries of MS which are known by their aforementioned names only.

1. Exegesis of **Asahāya** is mentioned by Viśvarūpa and Medhātithī.
2. Exegesis of **Upādhyāya**
3. Exegesis of **Yajva**
4. Exegesis of **rju** (this can supposedly be the *Manuśāstravivarāṇa* of rjuvimala)
5. Exegesis of **Dharaṇīdhara** is mentioned by Kullūkabhaṭṭa.
6. Exegesis of **Bhāguri**
7. Exegesis of **Udayakara** is mentioned in *Vivādaratnākara* by Caṇḍeśvara.
8. Exegesis of **Śrīkara** is also mentioned by Caṇḍeśvara in *Rājanītiratnākara*. It is also mentioned in *Mitākṣarā* of Vijñāneśvara.
9. Exegesis of **Viśvarūpa**
10. Exegesis of **Bhojadeva** is also mentioned by Kullūkabhaṭṭa.
11. Exegesis of **Mādhavācārya**
12. Exegesis of **Śrīdharasvāmī**

Viśvanātha Nārāyaṇa Maṇḍalika has written in the preface of the first segment of his edition of MS that the names of the last four explanations (Viśvarūpa, Bhojadeva, Mādhavācārya, Śrīdharasvāmī) listed above are mentioned in their corresponding DS essays.

6. Translations of *Manusmṛti*

- i. **Sacred Books of the East: The Laws of Manus** (Muller, 1886): It is an English translation of all twelve chapters of MS by G. Bühler.
- ii. ***Manusmṛti* with the “*Manubhāṣya*” of Medhātithī** (Jha G. , 1920): Ganganatha Jha's multi-volume MS, originally published by the University of Kolkatta between 1920 and 1939 is deciphered by its subtitle “The Laws of Manu with the commentary of Medhātithī”, is predominantly an edition and translation of the original text together with the exegesis of the most celebrated commentator. Medhātithī's *Manubhāṣya* has been characterized as a large repository of fundamental issues of *Dharma* and Law by one of the leading scholars on DS named J. Duncan M. Derrett (Derrett, 1973). The present work is divided into three segments; the *mūla*)original(Sanskrit Text, its Translation

in English and the third segment including notes and footnotes. These three segments comprise two, five and three volumes respectively, making it a total of ten volumes. The first two volumes are entirely devoted to the mūla. The first volume consists of the initial six chapters and the subsequent volume carries the remaining six chapters. It also includes a detailed Index for both volumes. The succeeding five volumes (ie. Vol. 3 to 7) are concerned with English Translations. Vol. 3 carries chapters one and two, Vol. 4 contains chapters three and four, Vol. 5 has chapters five to seven, Vol 6 consists of only chapter 8 and Vol. 7 has the last four chapters ninth to twelfth. Each of the volumes contains a detailed Index. The last three volumes 8 to 10 are devoted to detailed notes, textual explanations and comparative analysis conducive to understanding the theme of the *smṛti* and making the subject more interesting and understandable.

- iii. ***Manusmṛti with Commentary of Kullūkabhāṭṭa*** (Shastri & Banerji, 2010): It is an English translation of all twelve chapters of MS by Jagdish Lal Shastri. The first edition was rolled out between 1972- 1974 and has been reprinted by Motilal Banarsidass ever since.
- iv. ***Manu's Code of Law: A Critical Edition and Translation of the Mānava-Dharmaśāstra*** (Olivelle, 2005): It is one of the most important texts in the Sanskrit canon, indeed one of the most important surviving texts from any classical civilization. It paints an astoundingly detailed picture of ancient Indian life, covering everything from the constitution of the king's cabinet to the day-to-day routine of humans, domestic life, economical aspect and its law-based doctrines have been central to Indian thought and practice for over centuries. Despite its importance, however, until now no one has produced a critical edition of this text. In this volume, Olivelle has assembled the critical text of Manu, including a critical apparatus containing all the significant manuscript variants, along with a reliable and readable translation, copious explanatory notes, and a comprehensive introduction to the structure, content, and socio-political context of the treatise. The result is an outstanding scholarly achievement that will be an essential tool to understand the law annexures and construct the chronologically correct history of classical India.

- v. ***Manusmṛti* with a commentary called *Manvarthamuktāvalī*** (Pandya, 1913):
This is also an English translation.
- vi. ***Manusmṛti*** (Alakhadhari, 1879): is an attempt to translate the selected institutes of Manu into the Urdu language.

7. Topics in Manusmṛti

DS has made a huge contribution to the field of social institutions (SI). DS or theological texts cover a wide range of subjects. SI is an eminent and an integral topic of DS. SI ensures the social structure and mechanism for positive growth and formation of the society. SI organizes, directs and executes the multifarious activities required to fulfill basic human needs. Although the concept of social formation and SI was conceived in the Vedic period itself, it was appropriately recognized and documented in the DS literature. Our society includes individuals from different castes, creeds, races, religious groups and socio-economic backgrounds. Every individual practices their own culture, family traditions and customary norms. The cultural traditions of India are considered to be the oldest and richest. Since ancient times, India has represented a very distinct tradition of civilization, social development and community life. According to sociologist Bogardus (1924), SI is a structure of society that is organized to meet the needs of people chiefly through well-established procedures. The concept of social structure embraces the concept of SI. The social values of India are based on certain principles from ancient India. Traditions, customs and principles are the basic instruments that bind society together. The most imp SIs deliberated in MS are *Varṇa*, *Āpaddharma*, *Āśrama*, *Puruṣārtha*, *Mahāpātaka*, *Anupātaka*, the concept of marriage, the birthing of progeny, *Rājadharmā* etc. DS embraces both traditional moral values as well as modern scientific aspects. Concerning the traditional SIs, many contents and topics are contemporary such as medical sciences, environmental sciences, cleanliness and hygiene, mathematical sciences, social management and economics, law and legal studies etc.

Brief descriptions of a few of the above-mentioned topics are as follows:

7.1 Varṇa

Although the word “*varṇa*” endures multiple meanings, the connotation of the term “*varṇa*” here refers to the bifurcation of human beings into four categories. There are only four *varṇas* in the sociological arrangement system as propounded in MS namely *brāhmaṇa*, *kṣatriya*, *vaiśya* and *śūdra*. The first *varṇa* belongs to the *brāhmaṇa*, who is the creator and controller of the *dharma* (duties or responsibilities) of the society. The rules and regulations prescribed made by him are valid for all. He holds no interest in luxuries and nor is he entitled to accumulate wealth. He subsists on fruits-root-tubers-herbs and shrubs. Engaged in penance, religious practices, acquisition of knowledge and vision is his only focus. *Brāhmaṇa* was assigned six deeds namely studying and the teaching of the *Vedas*, performing holy sacrifices for themselves and others, giving and accepting alms⁶⁶. Three out of the six prescribed deeds namely; teaching of the *Vedas*, performing *yajñas* for the householders and receiving charity are associated with the livelihood or the social subsistences of *brāhmaṇas*⁶⁷. The *kṣatriyas* were duly assigned with the social responsibility to protect the citizens, to bestow gifts (donations and charity), to offer sacrifices, to study (the *Vedas*, six *vedāṅgas*, *Dhanurveda*, *Nītiśāstra*, warfare, weaponry, administration etc) and to abstain from attaching himself to sensual pleasures⁶⁸. The *kṣatriyas* are endowed with the specific characteristics and qualities of bravery, brilliance, stamina, efficiency, immovable tendency in battles, warfare, weaponry and charity etc. Accordingly, he collects the tax and spends the amount collected from the tax in the interest of the people. The *kṣatriyas* are only the follower, administrators and protectors of the rules. The right to be a king, according to the *varṇadharmā*, is the *kṣatriyas*, therefore Manu has represented the *kṣatriyas* sect as *rājadharmā*. The ruler protects the society from anti-social elements. It is the right of *kṣatriyas* to punish the criminal and reward the virtuous. He punishes the wrongdoers but does not himself frame the rules regarding punishments. The *vaiśyas* are responsible to tend cattle, donations and charity, offering sacrifices, studying (the *Vedas*, six *Vedāṅgas*, *Arthaśāstra* (AS), *Vāṇijyaśāstra*, commerce, accounting, trading,

⁶⁶ अध्यापनमध्ययनं यजनं याजनं तथा । दानं प्रतिग्रहश्च चैव षट् कर्माण्यग्रजन्मनः ॥ मनुस्मृति 1.88

⁶⁷ षण्णां तु कर्मणानस्य त्रीणि कर्माणि जीविका । याजनाऽध्यापने चैव विशुद्धाच्च प्रतिग्रहः ॥ मनुस्मृति 10.76

⁶⁸ प्रजानां रक्षणं दानमिज्याऽध्ययनमेव च । विषयेष्वप्रसक्तिश्च क्षत्रियस्य समासतः ॥ मनुस्मृति 1.89

craftsmanship etc.) to trade, to lend money and to cultivate the land (agriculture)⁶⁹. It was only the responsibility of *sūdras* to provide service⁷⁰ to the previously mentioned three *varṇas*. Among the several occupations as deliberate, the most commendable is the teaching of the *Veda* for a *brāhmaṇa*, protecting the citizens or a *kṣatriya* and trading for a *vaiśya*⁷¹.

7.2 Āpaddharma

Manu is a visionary theologian. He imparted the concept of “*Āpaddharma*” for the sustenance of the *varṇas* in the circumstances of emergence. The concept of “*Āpaddharma*” elucidates that if a *brāhmaṇa* is unable to sustain himself by the deeds and modes of livelihood prescribed for the *brāhmaṇas*, then in times of distress he can subsist on the *kṣatriya*⁷² and *vaiśya*⁷³ disposition. A *brāhmaṇa* can earn his livelihood through the means of agriculture, rearing of cattle and prescribed mode of business activities of pure pursuits. Yet, *sūdravṛtti* i.e. act of service and labor has been completely forbidden for *brāhmaṇas* even in times of calamities⁷⁴.

7.3 Āśrama and Puruṣārtha

Āśrama is an important institution of Hindu social organization which is intimately associated with *varṇa*. The term *āśrama* depicts the idea of human training, which is unique in the entire history of world ideology. The life of every human being is believed to be of training and self-governance. During this phase of training, humans supposedly pass through four stages. Each of these four stages is called *Āśrama*. The origin of the word “*āśrama*” is from the root “*śrama*” which means hard work or effort. The commentator of *Amarakośa*, Bhānujī Dīkṣita has defined the word “*āśrama*” as a pitstop where appropriate kind of efforts is made for the successful performance of

⁶⁹ पशूनां रक्षणं दानमिज्याऽऽययनमेव च । वणिक्पथं कुसीदं च वैश्यस्य कृषिमेव च ॥ मनुस्मृति 1.90

⁷⁰ एकं एव तु शूद्रस्य प्रभुः कर्म समादिशत् । एतेषां एव वर्णानां शुश्रूषां अनसूयया ॥ मनुस्मृति 1.91

⁷¹ वेदाऽभ्यासो ब्राह्मणस्य क्षत्रियस्य च रक्षणम् । वार्ताकर्मैव वैश्यस्य विशिष्टानि स्वकर्मसु ॥ मनुस्मृति 10.80

⁷² अजीवंस् तु यथोक्तेन ब्राह्मणः स्वेन कर्मणा । जीवेत् क्षत्रियधर्मेण स ह्यस्य प्रत्यनन्तरः ॥ मनुस्मृति 10.81

⁷³ उभाभ्यामप्यजीवंस् तु कथं स्यादिति चेद् भवेत् । कृषिगोरक्षमास्थाय जीवेद् वैश्यस्य जीविकाम् ॥ मनुस्मृति 10.82

⁷⁴ न श्ववृत्त्या कदाचन ॥ मनुस्मृति 4.4

one's own duties⁷⁵. Thus, *āśramas* are the phases or steps where the efforts are made. *Ācārya* Manu has also divided the *āśramas* into similar similar cognition. He has presented a well-planned system, in the form of four *āśramas* for the simple, clear, organized and uninterrupted operation of the life of the individual as well as the smooth working of the society. Through this program, Manu has tried to systemize the life of the individuals for society to function ideally. Manu has divided the *āśramas* into four equal parts and each part has been linked to one *āśramas*. Manu conceptualized the span of ages to be varied in corresponding eras. In *Kaliyuga*, considering man's entire age cycle to be of hundred years⁷⁶, every *āśrama* phase is subjected to be of 25 years. The *Aitareya brāhmaṇa* also supports the claim of Manu in this context⁷⁷. The number of *āśramas* discussed in MS is four- *Brahmacarya*, *Gṛhastha*, *Vānaprastha* and *Yati*⁷⁸ which is synonymous to *Samnyāsa*. Manu has planned the entire human life in such a way that the problems such as generation conflict, unemployment (lack of livelihood), population growth, criminal nuisance, and student and labour unrest which are haunting the whole world today are automatically resolved. The psychological- moral basis of the *āśramas* system is *puruṣārthas* namely the *dharma-artha-kāma-mokṣa* which helps in organizing and operating the individual's life through *āśramas*. *Āśramas* are considered to have a close relationship with *puruṣārthas*. According to the *Hindu dharmakośa* (Pandey R., Hindū Dharmakośa, 1998), *āśramas* were related to developmental work as well as the fundamental aims of life reckoned as *puruṣārtha*. Thus, *āśramas* and *puruṣārthas* are intimately associated with each other. The principle of *puruṣārtha* is introduced to fulfill human needs through dharma in ancient Indian society. The various efforts that a human undertakes to achieve his desires are known as a *puruṣārtha*. It makes a person aware of his ultimate goals and inspires him to perform their fundamental duties (Singh R. , 2013). In the *upaniṣada*, *gītā* and *smṛti*; *dharma*, *artha*, *kāma* and *mokṣa* are addressed as *puruṣārthas*. It is only by attaining these four *puruṣārthas* that a man can free himself from the repeated cycle of birth and

⁷⁵ आश्राम्यन्त्यत्र अनेन वा श्रमु तपसि घञ् यद्वा आसमन्ताद्धमोऽत्र स्वधर्मसाधनक्लेशात् । अमरकोश 4.7 पर भानुजी दीक्षित की टीका

⁷⁶ अरोगाः सर्वसिद्धार्थाश् चतुर्वर्षशतायुषः । कृते त्रेतादिषु ह्येषां आयुर्हसति पादशः ॥ मनुस्मृति 1.83

⁷⁷ शतायुर्वैपुरुषः । ऐतरेय ब्राह्मण 4.19

⁷⁸ ब्रह्मचारी गृहस्थश्च वानप्रस्थो यतिस्तथा । एते गृहस्थप्रभवाश्चत्वारः पृथगाश्रमाः ॥ मनुस्मृति 6.87

death (Rani, 2004). Toomey (1976) states that *rtha* and *kāma* are basic yet essential needs of every human and they should be achieved as per the prescriptions of dharma.

The stage of *brahmacharya* is the initial preparation for salvation whereas, the *saṃnyāsa āśrama* is the stage dedicated to attaining final salvation. Manu has duly discussed the *āśrama* system. Although the period from birth to twenty-five years of age is considered the period of *brahmacharya*, however, the name “*brahmacharya*” is annotated only after some preliminary rites. In this *āśrama*, the child is sent to the Guru’s hermitage to receive education. This ritual is an initiation into education. MS propounds a detailed description of the *brahmacharya āśrama* and prescribes specific rules and regulations ranging from conduct, ethics and behavior to food, clothes and even the methodology for appropriate worship. In fact, “*brahmacharya āśrama*” is the time to acquire knowledge, develop the characteristics of self-control and learn the art of conduct-behavior. It is directed that the celibate scholar should study for thirty-six years (12 years in the order of each Veda) or half of it or quarter of the time or till the period he has grasped the three Vedas in the presence of his teacher⁷⁹. Manu prescribes the second phase of the age cycle as the period of “*Gṛhastha āśrama*”. In this second *āśrama*, Manu ordains that a celibate scholar who just graduated his academics is now primed and equipped to shoulder the responsibilities of a family. He should marry a girl with scriptural qualities and allowed her to reside as a householder, produce progeny and earn livelihood for their sustenance. Manu opines that *Gṛhastha āśrama* is superior in comparison⁸⁰ to all other *āśramas*. MS mentions a comprehensive and exhaustive description of the ethics and rituals prescribed for the householders. The other three ashrams namely; *Brahmacharya*, *Vānaprastha* and *saṃnyāsa āśrama* are dependent on the householders for alms, food, water, basic amenities, agricultural produce⁸¹ etc. Regarding the third *āśrama*, Manu announces when a householder reaches the age of 50, his skin is wrinkled and aged, his hair has turned white and has witnessed the birth of his grandchildren, then he must resort to the forest-dwelling⁸², renunciate the worldly

⁷⁹ षट्त्रिंशदाब्दिकं चर्यं गुरौ त्रैवेदिकं व्रतम् । तदर्धिकं पादिकं वा ग्रहणाऽन्तिकमेव वा ॥ मनुस्मृति 3.1

⁸⁰ यथा नदीनदाः सर्वे सागरे यान्ति संस्थितिम् । तथैवाश्रमिणः सर्वे गृहस्थे यान्ति संस्थितिम् ॥ मनुस्मृति 6.90

⁸¹ यथा वायुं समाश्रित्य वर्तन्ते सर्वजन्तवः । तथा गृहस्थं आश्रित्य वर्तन्ते सर्व आश्रमाः ॥ मनुस्मृति 3.77

⁸² गृहस्थस् तु यदा पश्येद् वलीपलितमात्मनः । अपत्यस्यैव चाऽपत्यं तदाऽरण्यं समाश्रयेत् ॥ मनुस्मृति 6.2

pleasures and begin to live his as a celibate⁸³. He should perform the five great sacrifices according to the prescribed rules and sustain various kinds of pure food fit for ascetics such as herbs, roots and fruit⁸⁴. The *vānaprasthi* shall wear a skin or a tattered garment and bathe twice in the evening as well as in the morning, his hair locks should always be braided⁸⁵, and he should perform the *Bali*-offering and give alms according to his ability. The *vānaprasthi* must honour all those who come to his hermitage with alms desiring water, roots, herbs and fruits⁸⁶. Thus, having passed the third phase of his age cycle, the *vānaprasthi* may continue to live as an ascetic during the fourth part of his existence; the age of 75-100, following the strict regimen of celibacy⁸⁷ and devoting his life to the attainment of salvation.

7.4 Saṃskāras

The word *saṃskāra* is composed using the prefix ‘*kr*’ and adding the suffix ‘*ghañ*’ in the root, which literally means sophistication, purification, cleanliness or purity. In the traditional Hindu system, rituals were prescribed to purify the body of an individual so that it could become suitable for personal and social development. *Saṃskāras* is a central concept in social science. They play an important role in society. DS explains the rites as the basis for human beings to lead a better life. *Saṃskāras* are those religious activities that purify the body, mind and intellect. The parallel term used in English for *saṃskāra* is “Sacraments” which means religious rituals. There are different views regarding the number of *saṃskāras* in different Hindu religious texts. These are approximately about 16 to 40 in number. *Gr̥hyasūtras* have mention 18-21 *saṃskāras*. While 13 of them are explained in MS and 40 in *Gautama Gr̥hyasūtra*. The 16 *saṃskāras* promulgated by *Maharṣi Dayānanda* are widely accepted and the same sixteen *saṃskāras* are also accepted and explained by Ayurvedic scholars (Arun Raj , Shailaja , & Rao, 2013). These 16 *saṃskāras* are often known as the *ṣoḍaśa saṃskāras*. The 16 *saṃskāras* are majorly divided into 5 types-

⁸³ सन्त्यज्य ग्राम्यमाहारं सर्वं चैव परिच्छदम् । पुत्रेषु भार्यां निक्षिप्य वनं गच्छेत् सहैव वा ॥ मनुस्मृति 6.3

⁸⁴ मुन्यन्नैर् विविधैर् मेध्यैः शाक-मूल-फलेन वा । एतानेव महायज्ञान् निर्वपेद् विधिपूर्वकम् ॥ मनुस्मृति 6.5

⁸⁵ वसीत चर्म चीरं वा सायं स्नायात् प्रगे तथा । जटाश् च विभूयान् नित्यं शमश्रु-लोम-नखानि च ॥ मनुस्मृति 6.6

⁸⁶ यद् भक्ष्यं स्यात् ततो दद्याद् बलिं भिक्षां च शक्तितः । अम्-मूल-फल-भिक्षाभिरर्चयेदाश्रमाऽऽगतान् ॥ मनुस्मृति 6.7

⁸⁷ वनेषु च विहृत्यैवं तृतीयं भागमायुषः । चतुर्थमायुषो भागं त्यक्त्वा सङ्गान् परिव्रजेत् ॥ मनुस्मृति 6.33

- **Pre-birth rituals:** *Garbhādhāna* (conception), *Pusaṃvana*, *Sīmantonmayana*.
- **Infancy Rituals:** *Jātakarma*, *Nāmakaraṇa* (naming of the newborn), *Niṣkramaṇa* (Stepping out in the external environment for the first time), *Annaprāśana* (Introduction to solid food items), *Cūḍākarāṇa*, *Karṇāvedhana*
- **Educational rituals:** *Vidyārambha*, *Upanayana*, *Vedārambha*, *Keśānta* or *Godāna*, *Samāvartana* (graduating ceremony)
- **Domestic rites:** *Vivāha* (marriage)
- **Posthumous rites:** *Antyeṣṭi* (funeral)

According to Manu, the sacraments purify the body and promote an all-around advancement of the personality of man. Though MS has not provided any specific number of total saṃskāras but has aforementioned their names such as; By the performing of oblations, *Jātakarma* (the ceremony after birth), the *Cūḍākarāṇa* (cutting the newborn's hair for the very first time) and the ceremony of *mauñjīnibandhana*⁸⁸ in which the sacred girdle of Munga grass is tied during (the mother's) pregnancy, helps to eliminate the defects pertaining to fertilization of the ovum, sperms and the bearing of the child in the womb⁸⁹. The ritual called *Jātakarma* is performed before the detachment of the placenta (attached to the naval cord), thereafter along with the recitation of mantras the newborn must be fed with a mixture of gold particles, honey, and curd and ghee or clarified butter⁹⁰ (Nigam & Chandra, 2022). MS then talks about the *nāmadheyam* ceremony, the father performs the ritual of naming the child on the tenth or twelfth (day after the birth of the baby), on an auspicious day in an auspicious time frame and under an auspicious constellation⁹¹. The naming of the child should be done in such a way that it reflects his personality traits such as a name of a *brāhmaṇa* child should denote auspiciousness, *kṣatriya*'s be connected with power, *vaiśya*'s with wealth and that

⁸⁸ तत्र यद्ब्रह्मजन्माऽस्य मौञ्जीबन्धनचिह्नितम् । तत्राऽस्य माता सावित्री पिता त्वाचार्य उच्यते ॥ मनुस्मृति 2.170

⁸⁹ गार्भेर् होमैर् जातकर्म-चौड-मौञ्जीनिबन्धनैः । वैजिकं गार्भिकं चैनो द्विजानामपमृज्यते ॥ मनुस्मृति 2.27

⁹⁰ प्राङ्नाभिवर्धनात् पुंसो जातकर्म विधीयते । मन्त्रवत् प्राशनं चाऽस्य हिरण्यमधुसर्पिषाम् ॥ मनुस्मृति 2.29

⁹¹ नामधेयं दशम्यां तु द्वादश्यां वाऽस्य कारयेत् । पुण्ये तिथौ मुहूर्ते वा नक्षत्रे वा गुणान्विते ॥ मनुस्मृति 2.30

of *sūdra's* must express something contemptible⁹². *Brāhamaṇa's* name shall include Sharma, *kṣatriya's* name shall include words that imply a sense of protection, *vaiśya's* must incorporate a term expressive of thriving and a *sūdra's* name must have an expression denoting service⁹³. Similarly, The names of girl children should be easy to pronounce, shall not imply anything dreadful, have a simple meaning yet auspicious, be pleasing to hear, end in long vowels and contain a word of benediction⁹⁴. These sacraments are followed by the *Niṣkramaṇa* and *Annaprāśana*⁹⁵. MS instructs the performance of the *Niṣkramaṇa* ceremony in which the mother and child step out of the house for the first time since the child is born to be performed in the sixth month and the *Annaprāśana* ceremony in which the child is fed solid food such as rice, kheer etc for the first time. The *Cūḍākaraṇa* must be performed in the first or third year after the birth of the child⁹⁶. Manu has been very liberal in the context of *saṃskāras* as he has provided the options to the family to follow their customs and traditions and perform the auspicious ceremonies as per their will. MS has directed the age limitations for the performance of the *Upanayana* ceremony. It is the rite pertaining to the initiation of a child into education. It states that in the eighth year after the conception, the *bhrāhamaṇa's* *Upanayana* must be conducted, in the eleventh year after conception that of a *kṣatriya* and in the twelfth year of a *vaiśya*⁹⁷. Exclusive provisions for the conduction of *Upanayana* have been prescribed in MS under special requirement conditions such as a *brāhamaṇa* who desires proficiency in sacred learning, his *Upanayana* should be conducted in the fifth year instead of eighth after conception, that of a *kṣatriya* who desires power and strength in the sixth year and a *vaiśya* who longs for wealth, his *Upanayana* shall take place in the eighth year after conception⁹⁸. The cessation time period of *Upanayana saṃskāra* is also instructed

⁹² मङ्गल्यं ब्राह्मणस्य स्यात् क्षत्रियस्य बलान्वितम् । वैश्यस्य धनसंयुक्तं शूद्रस्य तु जुगुप्सितम् ॥ मनुस्मृति 2.31

⁹³ शर्मवद् ब्राह्मणस्य स्याद् राज्ञो रक्षासमन्वितम् । वैश्यस्य पुष्टिसंयुक्तं शूद्रस्य प्रैष्यसंयुतम् ॥ मनुस्मृति 2.32

⁹⁴ स्त्रीणां सुखोद्यमकूरं विस्पष्टार्थं मनोहरम् । मङ्गल्यं दीर्घवर्णान्तमाशीर्वादाभिधानवत् ॥ मनुस्मृति 2.33

⁹⁵ चतुर्थे मासि कर्तव्यं शिशोर् निष्क्रमणं गृहात् । षष्ठेऽन्नप्राशनं मासि यद्वेष्टं मङ्गलं कुले ॥ मनुस्मृति 2.34

⁹⁶ चूडाकर्म द्विजातीनां सर्वेषामेव धर्मतः । प्रथमेऽब्दे तृतीये वा कर्तव्यं श्रुतिचोदनात् ॥ मनुस्मृति 2.35

⁹⁷ गर्भाष्टमेऽब्दे कुर्वीत ब्राह्मणस्योपनायनम् । गर्भादिकादशे राज्ञो गर्भात् तु द्वादशे विशः ॥ मनुस्मृति 2.36

⁹⁸ ब्रह्मवर्चसकामस्य कार्यं विप्रस्य पञ्चमे । राज्ञो बलार्थिनः षष्ठे वैश्यस्येहार्थिनोऽष्टमे ॥ मनुस्मृति 2.37

in MS⁹⁹. The ceremony called *Keśānta* in which chopping of the hair is ordained for a *brāhmaṇa* in the sixteenth year from conception, for a *kṣatriya*, in the twenty-second year and for a *vaiśya*, two years later than that¹⁰⁰. After the successful completion of *Upanayana saṃskāra* the child is granted the right to study the Vedas of his tradition. This educational ritual is called the *Vedārambha saṃskāra*¹⁰¹. Then with the permission of his teacher, the celibate student should take the final bath, which is performed according to the prescribed rules and this rite is called *Samāvartana saṃskāra*, in which the child leaves his teacher's hermitage and returns home after graduation. He is then expected to enter into *gṛhastha āśrama*, marry an auspicious woman¹⁰², perform the domestic rites and carry the social responsibilities and fulfill all the prescribed social obligations.

7.5 Vivāha

The concept of marriage is a major SI as it maintains the social structure and ensures family development. Manu has propagated eight types of marriages namely; the rite of *brāhma*, that of the *deva*, that of the *ārṣa*, that of *prājāpatya*, that of the *asura*, that of the *gāndharva*, that of the *rākṣasa* and the eighth kind of marriage known as the *paiśāca*¹⁰³. Manu asserts that the first six types of marriages, according to the order stated above are considered lawful for a *brāhmaṇas*, and the last four are considered lawful for a *kṣatriyas*. For *vaiśyas* and *śūdras*, out of the last four types of marriages, barring the *rākṣasa* tradition, the remaining three kinds of marriages are declared to be following the dharma¹⁰⁴. The sages recommend the first four types of marriages (*brāhma*, *deva*, *ārṣa* and *prājāpatya*) are approved for *brāhmaṇas*. Only the *rākṣasa* tradition of the marriage is recommended for *kṣatriyas* and *vaiśyas* and *śūdras*, only the *Asura* marriage is stated¹⁰⁵. The offering

⁹⁹ आ षोडशाद् ब्राह्मणस्य सावित्री नाऽतिवर्तते । आ द्वाविंशात् क्षत्रबन्धोरा चतुर्विंशतेर् विशः ॥ मनुस्मृति 2.38

¹⁰⁰ केशान्तः षोडशे वर्षे ब्राह्मणस्य विधीयते । राजन्यबन्धोर् द्वाविंशे वैश्यस्य द्वाधिके ततः ॥ मनुस्मृति 2.38

¹⁰¹ कृतोपनयनस्याऽस्य व्रताऽऽदेशनमिष्यते । ब्रह्मणो ग्रहणं चैव क्रमेण विधिपूर्वकम् ॥ मनुस्मृति 2.173

¹⁰² गुरुणाऽनुमतः स्नात्वा समावृत्तो यथाविधि । उद्वहेत द्विजो भार्यां सवर्णां लक्षणाऽन्विताम् ॥ मनुस्मृति 3.4

¹⁰³ ब्राह्मो दैवस् तथैवाऽऽर्षः प्राजापत्यस् तथाऽऽसुरः । गान्धर्वो राक्षसश्चैव पैशाचश् चाऽष्टमोऽधमः ॥ मनुस्मृति 3.21

¹⁰⁴ षडानुपूर्व्या विप्रस्य क्षत्रस्य चतुरोऽवरान् । विद्शूद्रयोस्तु तानेव विद्याद् धर्म्यान्राक्षसान् ॥ मनुस्मृति 3.23

¹⁰⁵ चतुरो ब्राह्मणस्याऽऽद्यान् प्रशस्तान् कवयो विदुः । राक्षसं क्षत्रियस्यैकमासुरं वैश्यशूद्रयोः ॥ मनुस्मृति 3.24

of a daughter after decking her up with expensive silken garments and royal jewels as a bride to a man (groom) who is well learned in the *Vedas*, is of good conduct and admirable character, whom the father himself invites, honours and offers *madhuparka* is called as the *brāhma* tradition of marriage¹⁰⁶. The daughter who has been decked with ornaments is gifted to a priest who is duly officiating at a sacrifice, during its performance; is called the *Deva* tradition of marriage¹⁰⁷. When the father, gives away his daughter by accepting one or two pairs of cow and oxen according to the rule, for the fulfillment of the dharma, it is named the *ārṣa* tradition of marriage¹⁰⁸. When the father gives away his daughter to the groom, honors him, blesses the couple and addresses them by saying that “may you both perform your duties together”, it is termed as the *prājāpatya* tradition of marriage¹⁰⁹. When the groom marries a girl only after having given as much wealth as he can afford and is willing to pay for the bride and her kinsmen, it is called the *Asura* tradition of marriage¹¹⁰. The voluntary union of the bride and the groom is known as the *gāndharva* tradition of marriage¹¹¹; as it springs from desires of lust and the purpose of sexual gratification. The forced abduction of a girl from her home, while she cries, weeps and protests, killing or slaying her kinsmen and breaking the doors, windows or walls of her house to marry her, is called the *rākṣasa* tradition of marriage¹¹². If a man seduces and conforms to sexual intercourse with a girl who is deeply asleep, intoxicated, intellectually unstable or is incapable to protect her modesty, her valor or stealth, is known as the *paiśāca Vivāha*. It is the most sinful tradition of marriage¹¹³.

¹⁰⁶ आच्छाद्य चाऽर्चयित्वा च श्रुतिशीलवते स्वयम् । आहूय दानं कन्याया ब्राह्मो धर्मः प्रकीर्तितः ॥ मनुस्मृति 3.27

¹⁰⁷ यज्ञे तु वितते सम्यगृत्विजे कर्म कुर्वते । अलङ्कृत्य सुतादानं दैवं धर्मं प्रचक्षते ॥ मनुस्मृति 3.28

¹⁰⁸ एकं गोमिथुनं द्वे वा वरादादाय धर्मतः । कन्याप्रदानं विधिवदार्षो धर्मः स उच्यते ॥ मनुस्मृति 3.29

¹⁰⁹ सहोभौ चरतां धर्ममिति वाचाऽनुभाष्य च । कन्याप्रदानमभ्यर्च्य प्राजापत्यो विधिः स्मृतः ॥ मनुस्मृति 3.30

¹¹⁰ ज्ञातिभ्यो द्रविणं दत्त्वा कन्यायै चैव शक्तितः । कन्याऽऽप्रदानं स्वाच्छन्द्यादासुरो धर्म उच्यते ॥ मनुस्मृति 3.31

¹¹¹ इच्छयाऽन्योऽन्यसंयोगः कन्यायाश्च वरस्य च । गान्धर्वः स तु विज्ञेयो मैथुन्यः कामसंभवः ॥ मनुस्मृति 3.32

¹¹² हत्वा छित्त्वा च भित्त्वा च क्रोशन्तीं रुदतीं गृहात् । प्रसह्य कन्याहरणं राक्षसो विधिरुच्यते ॥ मनुस्मृति 3.33

¹¹³ सुप्तां मत्तां प्रमत्तां वा रहो यत्रोपगच्छति । स पापिष्ठो विवाहानां पैशाचः प्रथितोऽधमः ॥ मनुस्मृति 3.34

8. Scientific Concepts in *Manusmṛti*

DSs are an extraordinary amalgamation of arts and science. It consists of traditional and scientific knowledge of all major fields, hence, the importance of DSs is well renowned. In the passing years, there has been a tremendous body of work which is being conducted on various scientific fields with respect to DS such as computational linguistics and spatial data mining, medical sciences, military and mathematical sciences, environmental sciences etc. The philosophical influence of Sanskrit is visible in the field of psychological studies health and physiological sciences. The ancient asceticism and healing traditions of Sanskrit scriptures have found their way into modern health and clinical sciences. These concepts are studied not only by Sanskrit scholars but also by sociologists, experts of management sciences, political scientists, economists, legal experts, *āyurveda ācāryas*, and various science experts globally.

8.1 Environmental Awareness

The environment has been given utmost importance in ancient Indian culture. Traditional Indian society has always been spiritualistic about the environment, thus, it is environmentally friendly. The lifestyles and conventions of the practice for the environment by individuals were the supreme motive of the ancient society administrators, thinkers, intellectuals and rulers for the sustainable development of the society. The people of the DS period were duly aware of the environmental concepts, natural resources and measures to conserve them. Indian society has always protected natural resources through its unique religious practices and appropriate behaviors as a way of environmental management. Many references are found in the DS and other eminent texts of ancient Bharata on environmental protection, ecological balance, weather cycle, the occurrence of rainfall, hydrological cycle and all the subjects related to them. The concern for the protection of environmental health, preservation of natural resources, proper public sanitation and the concept of cleanliness is deeply rooted in the MS. The entire chapter 5th of MS is dedicated to the concept of external cleanliness and sanitation.

MS verses 5.111¹¹⁴-112¹¹⁵ and 5.114¹¹⁶ have given various measures on how to sanitize and purify the vessels made of valuable natural resources MS presents perception on viable environmental perspectives, new approaches and dimensions to enhance the knowledge of ancient aspects of environmental science, natural healing techniques, conservation, climatology, and preservation measures of natural resources. MS verse 5.124¹¹⁷ elucidates the traditional methods of cleaning the floor and sanitizing the residential areas by sweeping, coating of soil liquids by sprinkling water, scratching or raking and by the abode of cows for one whole day and night.

8.2 Natural Resource Protection

The principal components of the environment namely; Sun, Moon, vegetation, medicinal herbs and roots, water, energy, air, heat, land, fuel and minerals are called natural resources. A very modern contemporary concept of “live and let live” has been highlighted by an ancient text like MS. Verse 5.45¹¹⁸ has strictly forbidden violence and killing of animals. Wildlife is also one of the major natural resources. Conservation of wildlife promotes biodiversity and prevents the entire ecosystem from being harmed. The few animals such as cows, goats and sheep were also major sources of milk products, and oxes, camels, elephants and horses were used as transportation and in warfare. DS texts have ordained poaching and killing of animals to be illegal and a sin.

8.3 Medical Sciences

Ancient India was very advanced in the field of medicine. The main objective of the *saṃskāras* is the proper development of the child after birth, to develop proper eating habits, to ensure adequate nutrition, to develop its physical and intellectual capabilities, to successfully prepare him for life and to build a strong character. In a nutshell, *saṃskāras* refers to those religious rites and procedures by

¹¹⁴ ऋव्यादाञ्छकुनान् सर्वास्तथा ग्रामनिवासिनः । अनिर्दिष्टांश्चैकशफांश्च टिट्ठिभं च विवर्जयेत् ॥ मनुस्मृति 5.11

¹¹⁵ कलविङ्कं प्लवं हंसं चक्राह्वं ग्रामकुक्कुटम् । सारसं रज्जुदालं च दात्यूहं शुकसारिके ॥ मनुस्मृति 5.12

¹¹⁶ बकं चैव बलाकां च काकोलं खञ्जरीटकम् । मत्स्याऽदान् विड्वराहांश्च मत्स्यानेव च सर्वशः ॥ मनुस्मृति 5.14

¹¹⁷ सम्मार्जनीपाञ्जनेन सेकेनोल्लेखनेन च । गवां च परिवासेन भूमिः शुध्यति पञ्चभिः ॥ मनुस्मृति 5.124

¹¹⁸ योऽर्हिसकानि भूतानि हिनस्त्यात्मसुखेच्छया । स जीवांश्च मृतश्चैव न क्वचित् सुखमेधते ॥ मनुस्मृति 5.45

which the body, mind and intellect are sanctified. All the sacraments mentioned in the DS play a major role in child health and overall development at each stage of life. Some glimpses of medical science and health management prevalent in ancient India have been presented in MS. It provides references that explore child development, old age health, medicinal ideas, environmental cleanliness, defecation and sanitation in ancient India. In DS, sanitation is considered an important element to lead a pious and healthy life. Hindu scriptures repeatedly emphasize the importance of cleanliness. It is clearly stated MS, the literal meaning of *śauca* in both cleanliness and purity. *śauca* refers not only to the cleanliness of one's own surroundings but also to the purity of mind and healthy functioning of the body. MS emphasizes the importance of the health system in ancient India and announces the significance of Lifestyle changes for healthy living, purification therapies, spiritual and mental health and a positive attitude. MS gives strict instructions to avoid overeating¹¹⁹, consume a seasonal diet¹²⁰ and practice yoga. MS propounds the medicinal properties of gold and discusses the importance of gold ash in *svarnaṇaprāśana* for child's immunity.

8.4 Mathematical Science

DS encapsulates features of mathematical sciences, which are distinctively described in chapter one of MS. It showcases the division of time, centuries and calculations of light-years and eras mathematically.

Apart from the above-discussed topics, there are uncountable topics in MS that will be listed in the appendix.

¹¹⁹ अनारोग्यं अनायुष्यं अस्वर्ग्यं चातिभोजनम् । अपुण्यं लोकविद्विष्टं तस्मात्तत्परिवर्जयेत् ॥ मनुस्मृति 2.57

¹²⁰ स्थलजाउदकशाकानि पुष्पमूलफलानि च । मेध्यवृक्षोद्भवान्यद्यात्त्रेहंश्च फलसंभवान् ॥ मनुस्मृति 6.13

Chapter Two

Brief Introduction of Indexing and Online Indexing, Concept Mining and Literature Review

Indexing is a list or an arrangement of words in a designated order. Indexing is a methodical arrangement of names, definitions or titles, typically, in an alphabetical order to assist or guide researchers to find craved content with as less time as possible. The word “index” has a Latin origin (Knight, 1979) and it denotes the meaning “to indicate”. It exhibits an alphabetical list of names, subjects, etc. with reference to the pages on which they have appeared or an alphabetical list by title or author. J. Rothman (1974) defined an index as “A device that serves as a pointer or an indicator, more often an alphabetic list that includes subjects and names of people and places that are considered to be of significance in a graphic record”. According to Harper (2017), “Indexer is the one who points out, discloser, discoverer, informer, forefinger (indicates its use in pointing), pointer, sign, title, inscription, list”. Anderson (1997) defines it as “a systematic guide designed to indicate topics or features of documents in order to facilitate retrieval of documents or parts of documents”. Taube (1953) furnishes a technically evasive definition of an index as an array of symbols, systematically arranged, together with a reference from each symbol to the physical location of the item symbolized. The items themselves may be stored in any arbitrary arrangement and yet located by virtue of the correspondence between them and their symbols. When names or verbal descriptions constitute the symbols, the established order of letters in the alphabet provides a convenient, searchable order of arrangement. Weinberg (2017) suggested that an index leads from a known order of symbols to an unknown order of information. It is in a different order from the document or collection to which it provides access. A few of the synonyms used for the term “index” are register, listing, directory, sequencing of contents, etc. In terms of publishing, an “index” is a list of words or phrases and associated pointers or assigned locators to discover useful information related to that particular heading to be found in a document or an extensive collection of documents. An Index is a systematic guide to items contained in, or

concepts derived from a collection (Mani, 2008). These items or derived concepts are represented by entries in a known or stated searchable order such as alphabetical, chronological, or numerical (Borko & Bernier, 1978). In general, the listing of topics, phrases, technical terms, contents and themes and placing them with information in a particular group or collection is called indexing. Nowadays, traditional indexing is being replaced with online indexing and search. It is the process of analysing the informational records of knowledge and depicting the informational content in the language of the indexing system (Mani, 2008). It plays an important role in search engines and databases. It involves:

- a) Selecting indexing concepts in a document
- b) Expressing these concepts in the language of the indexing system such as index entries and an ordered list.

It is the set of designated procedures prescribed for organizing the contents of records of knowledge for purposes of retrieval and dissemination. It can be done manually or by the means of a machine. Indexing originally referred to as “Cataloguing”, is the oldest technique to identify the contents of items to assist in their retrieval. The objective of cataloguing is to give access points to a collection that are expected and most useful to the users (Baburaj, 2020). It was formerly known as a “Concordance”. A concordance is an alphabetical list of the principal terms used in a compendium or an enormous body of work, listing every instance of each word with its immediate context. Concordances are compiled only for compositions of exceptional eminences, such as the Vedas (Bloomfield, 1990), Bible, Quran or the works of Shakespeare, James Joyce or other classical Latin and Greek authors (Wisbey, 1962). India has seen excellent strides in Information and Communication Technological (ICT) applications for Indian Languages in general and for Sanskrit in particular. Since Machine Translation (MT) from Sanskrit to other Indian Languages is often the desired goal, traditional Sanskrit lexicography and indexing have attracted a lot of attention from the ICT and Computational Linguistics (CL) community. While several attempts are being made to build word nets, search engines and indices on traditional Indian epistemological and logical principles, there have been no serious efforts for generating

a cross-referential indexing system to create lexical resources for knowledge tradition (Mani, 2008).

1. Indexing in Sanskrit Knowledge Tradition

Memoirs of nature, chronicles of mankind, religious instances, philosophy, ethics and cultures, scientific traditions and the genesis of the world have been extensively compiled in Vedic literature and following primitive DS texts. The proper knowledge of which is possible only through the perusal of *Vedas*. As previously discussed in chapter one, the studying and teaching of *Vedas*, since ancient times, has been conducted under the *śruti* tradition, due to which *Vedas* are reckoned as *śruti* (Witzel, 2008). *Vedas* are utilitarian for human welfare and beneficial from the perspective of history, religion, philosophy and culture. *Vedas* were composed to understand the meanings and sentiments of enlightened sages. *Vedangas*, the auxiliary texts of *Vedas*, facilitated the understanding of Vedic *mantras*, deliberations of the divinity, sages and appropriations (Rawat, 2015). Multiple efforts were made to preserve the eminent knowledge stream. In order to preserve the *Vedic* knowledge tradition and to prevent the possibility of errors, fend the flaws and incommode the disparities in the meanings, alterations and interpolations of *Vedic mantras* over due course of time, the primitive sages composed exemplary index literature in addition to the six *Vedangas*.

Indexing in Sanskrit literary tradition was also introduced to maintain the enumeration of the *mantras*, their chronological order, and the numerical sequencing, to keep track of the number of times a verse appears and to assure the universal knowledge approach of the text. The indexes are also comprehended to indicate the authenticity of the available text of the *Vedas* (Upādhyāya & Pāṇḍeya, 1997; Rawat, 2015). Thus, it is appropriate to state that indexes were first proliferated for the perusal of *Vedas* and to intercede the true knowledge of the DS scriptures (Kumar, 2016).

1.1 History of Indexing in Ancient Indian Tradition

The term used for indexing in Sanskrit and Hindi is “*Anukramaṇikā*”. The word “*anukramaṇikā*” is composed of two terms; prefix “*Anu*” conjoined with the verb root “*Krama*”, in summation it denotes the meaning of pursuance or to follow. The literal

meaning of index is a systematically organised, methodically ordered bibliography or a list of contents in a book or a table of subject headings (Upādhyāya & Pāṇḍeya, 1997; Rawat, 2015). Fundamental lists of each *mantra*, letter, verse, deity, *ṛṣi*, term etc. of the *saṃhitās* are categorically maintained in the *anukramaṇikā* and all these *mantras* are catalogued in the same order as they have been accustomed in the *Vedic Saṃhitās* (Sahay, 1978; Tiwari, 2014). Each *saṃhitā* has its unique index in the form of aphorisms, in which the complete description of *ṛṣis*, deities, verses etc. related to that *saṃhitā* is given in a designated sequence (Avasthī, 1983; Goel, 1999). The symbol of each hymn, the reference number of the *mantras*, the verses, the name of the sages, the *gotra* and the description of the narratives adapted according to the context are also found in the indexed literature. The emergence of index literature is perhaps, the reason that even after the passing of a millennium, defects in the form of omissions, alterations and lapses have not appeared in a single line of the Vedic literature (Rawat, 2015; Upādhyāya & Pāṇḍeya, 1997; Dwivedi, 2010). Following the indexed literature, Western and Indian scholars of the present era have also understood the importance of such works and have garnered awareness in this direction (Rawat, 2015; Upadhyay, 2006). In the present context, *Vedic Concordance* and *Vedic Padānukramakośa* are the authentications and valid proofs of this.

The above discussion advocates that, the tradition of indexing rudiments from the Vedic period. The first available index is the *Ṛgveda Anukramaṇikā* authored by Śaunaka. Among the ancient indexers; Śaunaka, Kātyāyana and Mādhavabhaṭṭa are the most prominent and Śaunaka are acclaimed to be the pioneer of the three. There are ten indexes accredited in the name of Śaunaka such as; *Ārṣānukramaṇī*, *Chando'nukramaṇī*, *Devatānukramaṇī*, *Anuvākānukramaṇī*, *Sūktānukramaṇī*, *Ṛgvidhāna*, *Pādavidhāna*, *Bṛhaddevatā*, *Prāṭisākhya* and *Śaunakasmṛti*. *Vāyupurāṇa* (Shastri, 2005) proclaims Śaunaka to be the son of *Bhṛguvamśī* king Śunaka. He is called “*Kṣatropetaṃ*”, “*Dvija*”, “*Mantrakṛt*”, “*Madhyamādhvaryu*” and “*Kulapati*”¹²¹ (Satavlekar & Sharma, 1968)”. Kātyāyana is the author of the renowned index called *Sarvānukramaṇī*. Baldev Upadhyaya (2006) alleges that Pāṇini had borrowed his technical terminologies from *Vājasaneyi Prāṭisākhya*, which is composed by

¹²¹ लोमहर्षण उगश्रवाः सूतः पौराणिको । नैमिषारण्ये शौनकस्य कुलपतेर्द्वादशवार्षिके सत्रे ॥ महाभारत 1.1.1

Kātyāyana. Upadhyaya (2006) considers Kātyāyana, the creditor of *Vājasaneyi Prātiśākhya*, to be distinct from that of the *Vārtikakāra* Kātyāyana and prior to Pāṇini (Upadhyay, 2006). Mādhavabhaṭṭa is the author of *Ṛgarthadīpikā* (Swaroop, 1939). The name Mādhavabhaṭṭa is mentioned in the *Ṛgveda* commentary composed by Sāyaṇa. The tradition of indexes has been very extensive since ancient times. Even today, the significance of indexes remains intact and integrated as it was in ancient times. Beginning, from the Vedic Concordance of Maurice Bloomfield written in the year 1906 until “*Prasthāna Trayī Padānukramakoṣa*” authored by Prof. Gyanprakash Shastri and Dr. Vijay Kumar Shastri in 2014 propounds the importance of hierarchical corpus indexes. These indexes have been published under different names, but all are similar in terms of methodology, structure etc. but have rendered some new topics in it. Most of the indexes and corpus texts published between 1906 and 2014, of which, the Vedic Index of names and subjects (Macdonell & Keith, 1958), the *Vaidika Koṣaḥ* (Dutt & Hansraj, 1926), the *Taittirīya Saṃhitāyāḥ Padānukramaṇī* (Shastri P. , 1930), the *Vaidika Padānukramakoṣaḥ* (Vishvabandhu, 1955), A Practical Vedic Dictionary (Kant, 1981), the *Vaidika Kośa* (Upadhyay & Upadhyay, 1995), the *Vaidika Pādānukrama Kośa* (Bimali & Upadhyay, 2005), An Update Vedic Concordance written in the Roman script (Franceschini, 2007), *Bṛhad Vaidika Saṃhitā Dhātukoṣaḥ* (Kumar P. , 2011), *Vaidika Kośa* (Kant, Vaidika Kośa, 2012), *Ṛgbhāṣya-Padārtha-Kośa* (Shastri & Kumar, 2013), *Prasthāna Trayī Padānukramakoṣa* (Shastri & Tyagi, Prasthāna Trayī Padānukramakoṣa, 2014) and Vedic Index (Rai, 2014) are the prominent ones.

Names of the earliest and most eminent indices available in Sanskrit Literary Tradition are as follows:

1. **Ṛgvedic Indices:** *Ārṣānukramaṇī*, *Chando'nukramaṇī*, *Devatānukramaṇī*, *Anuvākānukramaṇī*, *Sūktānukramaṇī*, *Ṛgvidhāna*, *Pādānukramaṇī* or *Pādavidhāna*, *Bṛhaddevatā*, *Ṛksarvānukramaṇikā* and *Mādhavīyānukramaṇī* (Also known as *Ṛgarthadīpika*), *Ṛkpadavarṇānukramaṇī/Aṣṭākṣarī* or *Baiṭha Paribhāṣā* or *Padavarṇalakṣaṇaparibhāṣā*, *Ṛgvedīya hilānukramaṇī*, *Nītimañjarī*, and *Caraṇavyūhasūtra*.
2. **Yajurvedīya Indices:** *Śukla Vājasaneyi Sarvānukrama* (*Sarvānukramasūtra* or *Sarvānukramaṇī*), *Śukla Vājasaneyi Anuvāka Saṅkhyā* (*Anuvākānukramaṇī* *Yā*

Anuvākādhyāya), *Śukla Kāṇva Kāṇvānukramasūtra*, *Kṛṣṇa Taittirīya Kāṇḍānukrama* and *Cārāyaṇīyārṣānukramaṇikā* or *Mantrārṣādhyāya*.

3. **Sāmaveda Indices:** *Sāmasarvānukramaṇī*, *Naigeya Śākhānukramaṇī*, *Sāmavedārṣeya Dīpa*, *Kalpānupadasūtram*, *Upagranthasūtra*, *Anupadasūtra*, *Nidānasūtra*, *Upanidānasūtra*, *Tāṇḍyalakṣaṇam*, *Dhātulakṣaṇam*, *Pañcavidhasūtram*, *Mātrālakṣaṇam*, *Stobhānusaṃhara* and *Gāyatravidhānasūtram*
4. **Atharvaveda Indices:** *Bṛhatsarvānukramaṇikā*, *Pañcapāṭalikā* and *Dantyoṣṭhyavidhi*

1.2 History of Indexing in Western Tradition

Modern printing technology emerged in 1440, which resulted in a wide array of medical texts being published. In 1460, the era of printed book indexes emerged and the first Bible concordance was published in the year 1544. Among all the versions of concordances, “Complete concordance of the Holy Scriptures” published in 1737 by Alexander Cruden is currently available today. The first-ever index introduced in the English Language was printed in 1755 in “A dictionary of the English Language” by Samuel Johnson. In 1877, the Index Society was founded in London with the intention of creating a general index for universal literature. With the assistance of Dr Henry Wheatley, an eminent bibliographer, author, editor and indexer with a strong interest in language and literature, the aforementioned society continued up to 1890. Eventually, women began contributing to the codifying of indexes, which resulted in the formation of the “Society of Indexers” in Great Britain in the year 1957. While Britain was advancing on this front, William Frederick Poole commenced his index in the United States which was published under H.W. Wilson Company (Holley, 1976). It was during this time that a visionary indexer Paul Otlet instituted a universal index known as the Universal Bibliographic Repertory. This was the only index that incorporated over eleven million entries. He also anticipated the emergence of the internet in which he described that an individual would be able to access indexed knowledge via a digital medium (Otlet, 1934). Since the conception of computers and the internet, primary printed indexes have assisted remarkably in creating huge databases of digital indexes. It has facilitated in making a paramount of information accessible to researchers and

scholars making the profession of indexing crucial. There are various types of indexing that have emerged over time, as a way of sharing knowledge and ideas (Maliakkal, 2019).

1.3 Types of Indexes

Based on the introductory deliberation on general indexes, indexes may be classified by three overall sets of criteria:

- **Criteria related to the kinds and attributes of source documents:** This includes indexes of disparate domains and genres, such as historical (Towery, 1998), medical (Wyman, 1999) and legal indexes (Kendrick & Zafran, 2001) or indexes of court decisions. Such indexes are known to incorporate analytical as well as comprehensive entries. The most important categories of index that falls under this criterion are book indexes (Mulvany, 2010), journal indexes (Fugmann, 1997), image indexes for both still (Jørgensen, 2017) and moving images (Turner, 2017), sound and music indexes (Keyser, 2012), multimedia and non-text indexes (Rafferty, Pauline & Hilderley, 2005; Neal, 2012), database indexes and computer-web indexes (Keyser, 2012; Lewandowski, 2014). There are journals devoted entirely to web indexing namely; the Journal of Internet Cataloguing from the year 1997 to 2007 and 2008 named Journal of Library Metadata.
- **Criteria related to the attributes of the target documents:** The type of indexes that plummet under this category may be broadly classified according to their organization such as; alphabetical indexes and systematic indexes. Systematic indexes can be arranged according to a subject, chronology or place classification or according to the kinds of signs used. This is particularly, visible in the case of picture indexing. A back-of-the-book index is generally based on the same signs as used in the book itself (Chu, 2001). According to the information they provide in annotated indexes and naked indexes. According to their medium/physical form, e.g. printed indexes, card indexes and electronic indexes. Lastly, According to whether they are static in the form of a printed index or dynamic in which new links between source documents and indexes are added, deleted or changed.

- **Criteria related to the indexer, the indexing process, the context in which the indexing is taking place and the tools used:** Indexes may be classified as human-based indexes and computer-based indexes (Smiraglia & Cai, 2017). Softwares are often used in indexing, either for automatic indexing or as a tool in the manual indexing (Browne, Glenda & Jerney , 2007; Schroeder, 2003). It can also be categorised as a “derived” (Stock & Stock, 2013) or an “extracted” index where all the symbols used as headings in the index are taken directly from the source documents versus the “assigned” index where the indexer assigns terms or symbols that do not occur in the source documents.

2. Introduction to Online Indexing

Due to the acute growth of the development of IT, traditional indexing is now being supervised by online indexing and search engines etc. In the digital network era, information sources are growing at an exorbitant rate, available in many forms and formats, and accessible through various channels (Bichindaritz & Akkineni, 2006). Moreover, recent advancements in Information and Communication Technology (ICT) help in the integration of different information sources and processing them on a larger scale. The results of ICT applications in library activities are related to the development of wider and more efficient information services. Remote database search service (RDBS) can be both bibliographic as well as full-text databases, it is possibly one of the most prominent products of ICT-enabled library services. The investigations of computerised indexing date back to the late 1950s. With the introduction of digital information retrieval technologies in the 1950s, Hans Peter Luhn, an IBM engineer, presented a computer-produced index in 1958 called KWIC (Key Word in Context) indexing. The system was based on simple, mechanical manipulations of terms derived from document titles. It was the earliest and the most primitive form of computerised indexing method relying on the power of computational technology. The initial stage of online indexing which commences from 1957 to 1958, its peak can be seen from the beginning of the 21st century.

Computers are now being increasingly used to aid indexing, relying on stored dictionaries of synonyms and homonyms etc. They are also used for automatically arranging entries in alphabetical order or subordinating subheadings and cross-

references in exact sequence under a heading, and performing many other functions that previously had to be done manually and therefore were quite expensive, time-consuming and often subjected to errors. In the late nineties, after the introduction of Unicode (a 2 byte-oriented) encoding standard that can represent all characters of all scripts of the world) as a text encoding standard, computerised indexing systems are able to store, process and retrieve multilingual documents available in different scripts. Digital Indexers effectively index large electronic document depositories, thus, making data searchable Online. Automatic indexing became essential to maintain the ability to find relevant information. Building on Weinberg's (2017) definition, an index can be considered a kind of document, whether an independent document (e.g., printed or electronic as a database), a part of a document (e.g., a back-of-the-book index) or a structure embedded in a document (e.g., in an XML document). The function of indexes is to provide access to information in or about other documents. (Hjørland, 2018).

The process of collecting, parsing and storing data to provide immediate and accurate retrieval of information, is called indexing. Depending on the data collected, several indices may be created. The process can be manual or automatic. Manually generated indices include web directories, back-of-book-style indices, and metadata. Automatically generated indices are normally associated with the infrastructure of search engines (Moura & Cristo, 2009).

2.1 Importance of Online Indexing

The basic function of indexing is to aid in finding relevant information from one or different documents in very less time. Online indexing is currently embedded in all search engines, through which it takes very little time to search (Tiwari A. , 2011). Automatic indexing has greatly contributed to the increase in the promulgation of information globally. Technological advancements have resulted in an explosion of information and made information quickly and easily available to potential users. The availability of innumerable documents on the web leads to the search for “state-of-the-art” technologies, which reduce the time taken to process and disseminate information. Thus, the way has been paved for quick dissemination, automatic information acquisition, processing and retrieval of information. Therefore, automatic indexing is

helpful as it helps to obtain accurate information from various materials in less time (Adetoro, 2014). The benefits of indexing are described in the following indicators:

1. Provides guidance to the user for articles and other documents.
2. The index provides the exact content that the user wants to access in a very short time. Even the information which is unknown to the user can also be obtained through it.
3. Online Indexing saves up a lot of time, by providing relevant information to the searcher, thus, motivates in the actual search. Without indexing, it would be practically impossible for the searchers and researchers to extract the required information of a specific concept from various different documents. This would hamper the user's time to search for the required content. They would have to read and study the textbooks page-by-page, search every related text, sort, label, list the references, catalogue the study materials, and physically make the efforts to visit libraries, study centres, translations and epigraphy hubs to collect information. Thus, digital indexing is very time effective.
4. Through the index, useful information about the research area, subject fields, words etc. is obtained with concrete evidence and accurate references.
5. Facts of any subject area can be searched in cross-reference through an online index. The search can also be done through the synonyms of the words that have been searched.
6. An index helps the user to get the latest information about any subject and the results are obtained expeditiously (Seth, 2004)
7. Indexing surpasses the language barrier, the main function of the index is to solve the problems arising in the published materials in different languages.
8. Indexing plays a major role in helping the user determine the actual content of an article.
9. Presently there is a multitude of documents available on the web. In all these documents any single word and concept can be adroitly searched in less time through online indexing.
10. Indexes are very important for researchers. For example, if a researcher is willing to do research on an area of DS, then he can easily procure information

about DS through any popular search engine, whereas without an index it would not be possible.

2.2 Types of Online Indices

Automatic text analysis became a subject of significance in the late 1950s and a major focus within the then-emerging field of information science. Initially, the goal was to provide expedited and wholesome access to the scientific and engineering literature. The second factor was the availability of computers and the recognition of the fact that these machines are capable of processing words as well as numbers. The third influence was the emergence of a new field of study called computational linguistics, led by notable laureates such as Noam Chomsky (1957) and Zellig Harris (1962). Lastly, the fourth thrust was the research developments and advances in the fields of artificial intelligence and self-organizing systems. Studies on automatic indexing, automatic abstracting, machine translation and various other information-processing and retrieval activities blossomed during this period. The literature on automatic indexing is voluminous. Two excellent state-of-the-art reviews have been prepared by Stevens (1970) and Sparck-Jones (1974). In addition, there is the series *Annual Review of Information Science and Technology*, as well as a number of relevant books (*Machine Indexing*, 1961; Borko, 1967; Salton, 1971).

The E-index is a computer program that collects, parses, and stores data to facilitate fast and accurate information retrieval. Index design incorporates interdisciplinary concepts from linguistics, cognitive psychology, mathematics, informatics, physics and computer science. An alternate name for the process in the context of e-index designed to catalogue any document on the Internet is Web indexing. The e-index is embedded in two modes;

- **Static indexing system:** it shows queries on the basis of compiled data. A static indexing system stores the data in a simple text file and displays the result if the query exists in the file database (Carmel, et al., 2001; Büttcher & Clarke, 2006).
- **Dynamic indexing system:** it works on a running data basis. It is based on RDBMS technology in which data are stored in several tables and all the tables are adjoined to each other.

Automatic indexing is the process of determining and organizing index terms (lists) for natural language without human intervention (Tiwari, 2011). It is constructed using algorithms, a method of CL. This method works on the basis of the collection of databases, which includes the full text of the document, reference list, images, audio and video etc. Automatic indexing is a digital skill by which a large number of documents are searched for terminology, classification, lexicographies or dictionaries or ontologies. This search process happens very quickly and effectively. With the increasing number of documents on the Internet nowadays, automatic indexing has become imperative for search engines. Without this, it may not be possible to find the word and related information in all the documents immediately. Automatic indexing is based on two assumptions:

1. It is a collection of documents in which each document contains information on one or more subjects.
2. This collection also contains a list of indexes in which one or different terms are described.

Thus, online indexing can either be “keyword indexing”, “derived or derivative indexing” and “assigned or assignment indexing” (Gibb, 1992).

2.2.1 Keyword Indexing

It is based on the usage of Natural language terminology for generating the index entries. The term ‘Keyword’ refers to a significant or memorable word (also called ‘catchword’) that serves as a key term in denoting the subject taken from the title or abstract or text of the document. It is, therefore, called the title index. Although, common words like articles (a, an, the) and conjunctions (and, or, but) are not treated as keywords because they are inefficient in doing so. This system is also known as Natural or Free Indexing language. It is to be pointed out here that the concept of keyword indexing is not new and it existed in the nineteenth century as a ‘catchword indexing (Harter, 1975; Olsgaard & Evans, 1981; Hulth, Karlgren, Jonsson, Boström, & Asker, 2001).

2.2.2 Derivative Indexing

Derived indexing is a method of indexing in which a human indexer or a computer extracts the required information from the title or the text from a document under which entries are made such as one or more words or phrases to represent the subject theme of the work (Gibb, 1992). It is also known as *extractive indexing*. In derivative indexing, terms that are to be used to represent the content of the document are derived directly from the document itself. Here only the information which is manifested in the document itself is mined for the user's perusal. Index terms are derived directly from the title or text of the document. It requires the least intellectual effort on the part of the indexer. Mechanical devices and computers are used in abundance to carry out the burden of index preparation as well as the tasks of matching these with the queries put to the system by the user. Examples of derivative indexing are keyword indexing, citation indexing, automatic indexing, etc. (Balasubramanian et al, 2004).

2.2.3 Assigned Indexing

Assigned indexing is also known as "concept indexing" because it involves identifying concepts associated with the content of each document. It is a method of indexing in which a human indexer selects one or more subject headings or descriptors from a list of controlled vocabulary to represent the various subject ideations of a work. The indexing terms selected to represent the content need not appear in the title or text of the document indexed. Yet, it is accurately catalogued and furnishes the appropriate information. Here, an indexing language is designed and it is used for both indexing and searching. Some notable examples of assignment indexing are chain indexing, PRECIS, POPSI, classification schemes, etc (Field, 1975; Burnett et al, 1979).

2.3 Features of Online Indexing

Computerised indexing can be defined as the process whereby a computer is used to process a natural language text that is already in machine-readable form so that indexing terms are allocated to its content without direct human intervention (Grishman, 1986; Mitkov, 2004). The features of computerised indexing are:

- Computerised indexing is instant indexing of any words.

- It usually results in much better performance.
- It makes it possible to quickly and instantly retrieve the data and information.
- As the computer generates the result instantly so it is dynamic. The result appears based on the size of the data.

2.3.1 Manual Indexing Versus Online Indexing

Described below is the comparison between Manual and Computerised Indexing and highlights the features of both the indexing systems (Sahoo & Kumar, 2020; Salton, A comparison between manual and automatic indexing methods, 1969);

Manual selection and analyses of texts and terms for indexing. Semantic, syntactical as well as contextual considerations govern the selection of indexing terms. Disagreement among indexers on the determination of the subject of a document as the process of determination of subjects may vary from one indexer to another indexer. Selected index terms less in numbers. It is extremely time-consuming and expensive. It is very difficult to maintain consistency in manual indexing. Relevancy of results is not always ensured. Generally shows high recall and low precision.

Computers can select words by employing statistical techniques. Computer algorithms are drawn to select or exclude a term by following the rules of semantic, syntactical and contextual connotations. Determination of the subject of the document is a mechanical process, hence the output will be congruent and consistent. Selected index terms are far more in number. It is very time efficient and index entries can be produced at a minimal cost. Consistency in indexing is dexterously maintained. Relevancy and accuracy of results are ensured. Generally maintains a balance in recall precision (Mani, 2008).

3. Introduction to Concept Mining

Concept mining is the process of searching documents or unstructured text for ideas and topics. Similar to text mining and data mining, concept mining involves creating a mining model and applying artificial intelligence (AI) to it. However, concept mining focuses on finding intent and deep-rooted meaning rather than extracting

explicit information. Text mining is the process of extracting important information and knowledge from unstructured text. This was first proposed by Feldman and Dagan (1955). Text Mining is a field that is at the intersection of many other research fields and is christened with disparate terms like data mining, knowledge discovery from databases, information extraction, information retrieval etc. (Feldman, Dagan, & Hirsh, Mining text using keyword distributions). The main difference between text mining and data mining is that data mining tools are designed to deal with structured data from databases or XML-based files. However, text mining deals with unstructured or semi-structured data such as text documents, HTML files, and emails. Thus, text mining is a much more generalized solution for text, where large volumes of different types of information should be consolidated, managed, merged and retrieved. To facilitate effective and efficient learning, text mining attempts to discover new, previously unknown information by applying techniques from natural language processing (NLP) and implying data mining techniques (Shehata, 2009).

4. Literature Review

This segment deals with the survey of research performed and published previously. It furnishes a detailed description of such researches. The focus of the research survey is that it summarizes and organizes recent researches resulting in a novel understanding of work in that specific subject field. The survey section of any research dissertation is a theoretical exhibition of general knowledge of the subject area. It emphasizes the classification of the existing literature, developing a perspective on the area and evaluating trends. To provide a structural form to any research work, it is imperative to conduct a comprehensive research survey as it helps in differentiating the present research theory from other related works. A meticulous research survey also supports the authentication and validation of the research being conducted. It dispenses a systematic discussion on the related topics and inspiration for interdisciplinary researches. It also furnishes an insight into different perspectives, new angles and dimensions to the previously deliberated concepts and provides state-of-the-art views about the researches already conducted (Fischer et al, 2020).

The major concepts collected in this survey are structured on the basis of published conference proceedings, chapters and abstracts published books, research

papers, scholar and journal articles, reading materials, government-aided research projects, published and unpublished M.Phil. dissertations and PhD theses of scholars all around the world. In the present survey, a brief survey of research works related to DS, MS, its concepts and ancient philosophy, terminology, contemporary contents with respect to the scientific streams, computational linguistics, digital indexes etc. have been carried out.

Descriptive, analytical, exploratory, comparative, critical, theoretical and qualitative research methodologies have been adopted including the study of secondary or auxiliary sources to make this study well organised and multidimensional. Majorly, historical analysis and comparative fundamentals have been perused in formulating the present research diagnosis.

The detailed exhaustive survey is broadly classified under following three headings:

1. A brief survey on traditional aspects and concepts of MS.
2. A brief survey of contemporary themes of DS
3. A comprehensive survey on the computational aspect of indexing, search and concept mining

4.1 A Brief Survey on Traditional Aspects and Concepts of MS.

So far, innumerable works have been conducted on the traditional aspects and significant concepts of MS in the country and abroad. Comparative, critical, descriptive, theoretical and qualitative research have been carried out in this subject area. In this section, a detailed survey of the research works done on the traditional subjects and major concepts of MS have been interrogated.

4.1.1 Dharma

An in-depth discussion of *dharma* has been done in the previous chapter, following is a brief theoretical survey of laureates in this regard. Lee (2022) is in agreement with the definition of dharma as stated by the eminent theologian Kane (1930) but presents it as the principle of self-denial and emptiness. Srivastava's (1968) Indian Social Structure, Kane's (1930) History of *Dharmaśāstra*, Dubey's (1964) perspective of social system, Bhatt's (1965) views on ancient Indian culture and Swami Vivekananda's important book named "*Hindu Dharma*" are the most notable texts with regard to the definition and description of *dharma*. The views of few other scholars

(Mishra & Mishra, 2001; Mishra V. N., 2008) on the status of Indian society, Hindu customary traditions and *sanātana dharma* are also noteworthy. Sturgess (2015) presented a comprehensive and engaging account of *rājayoga* and *kriyāyoga*. These authentic forms represent true Yoga, and their practice provides spiritual seekers with the ultimate pathway towards self-realisation, inner freedom and ineffable peace and joy. He depicted *sanātana dharma* as a spiritual path to attain eternal truth.

4.1.2 Varṇa System

In ancient Indian civilisation, to make human life civilised, cultured and well-planned, the *varṇāśrama* system was introduced. *Varṇa* is considered as the classification of the major responsibilities held by the individual of the society in Ancient India. It basically manages the society through appropriate distributions of the duties to everyone ensuring their rights and safeguarding the interests of every individual in the society. *Brahma* created four *varṇas* namely *brāhmaṇa*, *kṣatriya*, *vaiśya* and *śūdra* from his mouth, arms, thighs and feet respectively¹²². If we demurely study and contemplate the arrangements of MS, we receive a clear insight that fundamentally the number of *varṇas* was not four, but two. The supposedly two *varṇas* are *dvija* or *dvijāti* and *śūdra*¹²³. *Dvija* or *Dvijāti* covers the first three of the four major *varṇas*: *brāhmaṇa*, *kṣatriya* and *vaiśya*. *Manu* also conformed to the same *varṇa* classification on the basis of the citizens bearing the corresponding social responsibilities. *Manu* says that this segmentation is divine division. In all the scriptures such as MS, *yājñavalkyaśmṛti* etc. brief but accurate description of Vedic, *Sanātana*, Hinduism, domestic rituals (Elder, 2006), *varṇāśrama dharma*, the origin of *varṇa*, prescribed duties and responsibilities for each *varṇa*, *āśrama* system and human conduct are provided (Chaubey, 2005).

Dwivedi (2018) has given the classic description of *varṇa* and Hindu marriage, *varṇa* and social corruption and the relation of *varṇa* to Hindu deities and their duties. Over the course of time, rapid changes and distortions began in the *varṇa* system and the caste system was then, formed out of those *varṇas*. Based on this system, Saxena and Indoliya (2011) did an analytical study on the characteristics, merits, qualities and

¹²² लोकानां तु विवृद्ध्यर्थं मुखबाहुरुपादतः । ब्राह्मणं क्षत्रियं वैश्यं शूद्रं च निरवर्तयत् ॥ मनुस्मृति 1.31

¹²³ ब्राह्मणः क्षत्रियो वैश्यस् त्रयो वर्णा द्विजातयः । चतुर्थं एकजातिस् तु शूद्रो नास्ति तु पञ्चमः ॥ मनुस्मृति 10.4

possibilities of *varṇa*, caste and clan has been presented. It also gives detailed information about the five basic principles of the origin of the *varṇa* system. Apart from this, the qualitative analysis of *varṇa*, caste and the importance of *varṇa* in the contemporary perspective is also presented. B eteille (1965) outlined the structural changes in castes and changes in the inter-caste power structure. Damle (1955) has shed light on the peculiarities of the caste system in Indian villages. Olcott (1944) postulated an exhaustive theory on the caste structure of India, based on the substrata of primitive DS prescriptions. He has exhibited the hierarchy based on birth and reincarnation, talked about the minorities and outcastes, compelling religious sanctions, endogamy etc.

Tiwari (2014) discusses the Origin of *varṇa* and *br ahmaṇa* institutions, the concept of *br ahmaṇism* in *smṛti*, *br ahmaṇa* institution in Indian politics and its social status. He further implores the contribution of *br ahmaṇa* in the field of education and preservation of culture. In Sanskrit literature, the *br ahmaṇas* have been described as the most supreme out of the four *varṇas*. Since ancient times, their position in society was the most respected and the special rights to study as well as, to teach were reserved exclusively for the *br ahmaṇa*. The position of *br ahmaṇa* in the traditional Brahminical society, followed by its social institution in Indian politics (Elder J. W., 2006) is widely explored. Elder (2006) analyses the main elements of the traditional Brahminical society, followed by the instructions for human conduct and domestic rituals described in the DS. In ancient Sanskrit literature from *Vedas* to *smṛti*, *ś udras* have been considered as minor division. * c rya* Manu refers to *ś udra* only as servants. According to MS, the only duty of the *ś udra* is to serve the three upper divisions, whereas, Kauṭilya acknowledges the *ś udra* to be an integral part of the Aryan community. Jaiswal (1980) presented a credible sociological research study of *ś udra* in chronological order. They attain a complete demonstration of how the pitiable conditions of *ś udra* changed from the Vedic period up till the commencement of the medieval period. They further outlined the concept of the medieval *varṇa* system and *varṇa saṃkarat *.

There are a lot of noticeable disparities in the education system in India. Education in India may be widespread but not everyone has equal access to it. The lower-middle and working labour class of our society refrain from sending their children to school and rather have them work and earn as daily wagers. The three

imperial SIs namely *vidyā* (education), *Vedas* (religion) and *varṇa* (caste) are interlinked in our society. These three are considered to be mutually dependent on each other. Borooah & Iyer (2005) presented an article that examines whether, and to what extent, the enrolment of children at school in India is influenced by community norms such as those of religion (Hinduism, Muslim, Sikhism, Christianity etc.) and *varṇa* or castes (Scheduled or non-Scheduled).

4.1.3 Aśrama System

Just like the ancient Indian society was distributed into four *varṇas*. Similarly, an individual's life was divided into four stages known as the *āśrama* system. According to the DS, an ideal life span of a human is a minimum of 100 years. This period of 100 years is divided into equal parts of four. These were given the name of *āśrama*. It includes *brahmacaryā* (training and education period), *gṛhastha* (household), *vānaprastha* (retirement) and *saṁnyāsa* (life of renunciation) (Olivelle, 1993). The concept of the *āśrama* system in accordance with *dharma* is also very popular in ancient scriptures (Jayapalan, 2001). According to the AS, the strict observance of the duties of the four *varṇa* and *āśrama* system 'leads us to heaven' and bestows eternal bliss (Chander, 2015). The Vedic seers gave deep thought to the problems of old age and evolved a social order, which provided social security and respect to the elders. It is natural for the physical and mental health of a man to deteriorate in old age. Texts like *āyurveda*, *Suśruta Saṁhitā*, *Carakasamhitā*, *Smṛtis*, *Pātañjala Yogadarśana* and *Upaniṣada* etc. impart advice on the appropriate way of life and importance of *aṣṭāṅga* (the eightfold system of) yoga for the elderly people who are in the stage of *vānaprastha* and *saṁnyāsa āśrama*. Indian health system emphasises lifestyle changes for healthy living, purification therapies, spiritual and mental health, positive attitude, seasonal diet, exercises, yoga and virtue for people in old age (Tiwari & Pandey, 2013). Presenting the concept of *karma* and *dharma*, this paper focuses on the four *āśramas*, and the duties assigned to them, followed by the *vānaprastha* and *saṁnyāsa āśrama*. Raveesh (2014) has explored the scientific dimensions of the *āśrama* system such as old age and Indian culture, the concept of life cycle, organisation of health systems, inter-generational relationships, nature of family life etc. Jayapalan (2001) laid out detailed work on *varṇāśrama dharma*. Apart from

this, he further talks about the characteristics of Indian society, Hindu social organisation, caste, the social importance of the *āśrama* system, values of the Indian social system, marriage, efforts, rituals etc. Bronkhorst (Olivelle, Reviews of books- The Two Sources of Indian Asceticism by Johannes Bronkhorst, 1995) gives a very unique spin to his deliberation of the *āśrama* system. He puts forward a perspective of Indian asceticism in connotation with the ancient *āśrama* system.

Sarada et al (2018) provided a new direction in showing the relevance of the *āśrama* system prevalent in Indian Vedic culture. It provides a comparative view of the Indian *āśrama* system and Maslow's study. This research provides a holistic universal approach, spiritualism and psychological dimensions of the studies conducted by Maslow. Scholar Lee (2022) postulated a sui generis theory by depicting *dharma* as a doctrine of self-denial and emptiness. He further elucidates *āśrama dharma* and *puruśārtha* as the core of Hindu ethics. Excogitating self-denial and self-sacrifice as the essence of *dharma* is an eccentric approach towards the primitive theological axioms (Lee, 2022).

4.1.4 Puruśārthas

The principle of *puruśārtha* is introduced to fulfill the basic needs of the human being under the control of *dharma* in ancient Indian society. The various efforts that a human undertakes to achieve his desires are known as a *puruśārtha*. It makes a person aware of his ultimate goals and inspires him to perform their fundamental duties (Singh R. , 2013). In the *upaniṣada*, *gītā* and *smṛti*; *dharma*, *artha*, *kāma* and *mokṣa* are addressed as *puruśārtha*. It is only by attaining these four *puruśārthas* that a man is able to free himself from the repeated cycle of birth and death (Rani, 2004). Toomey (1976) states that *Artha* and *kāma* are basic yet essential needs of every human and they should be achieved as per the prescriptions of *dharma*. *Puruśārtha* is the cause of both worldly pleasures and welfare during his lifetime and achieving eternal happiness in the afterlife. All-round development of human life is possible only through these *puruśārthas*. The concept of *puruśārtha* signifies the aims and objectives of human endeavour (Singh S. , In Progress). Critical and psychological analysis of *puruśārtha* reveals that *puruśārtha* usually refers to the fulfillment of human needs, without which proper physical and social development is not possible. *Artha* and *kāma* are the most

important out of the four *puruṣārtha*. *Kāma* is a physical necessity which is also helpful in carrying forward the generation. *Artha* is the factor for performing all kinds of social work. *Dharma* is the way for man to attain *artha* and *kāma*. *Mokṣa* is the result of dharma-based *artha* and *kāma*. Bhatt (2018) provides a scheme of value-based education. The cardinal Indian theories of *puruṣārthas* and *karma* are discussed with their educational implications. The four *puruṣārthas* are expounded in their proper perspective. These values of life are further reinterpreted in terms of contemporary needs and aspirations.

4.1.5 Saṃskāras

Saṃskāras hold a very important place in human life. Actions that emanate merit are called sacraments. Chastity, purity, righteousness and theism are the main characteristics of the *saṃskāra*. *Saṃskāras* are those activities and religious rituals which enhance the beauty of the soul. The life of each individual is arranged in a harmonious manner according to different phases. These are various types of religious rituals which bring continuous positive changes in the physical body, intellectual capacity and personality development. The first classical description of the *saṃskāra* is found in the *bṛhadāraṇyakopaniṣada*. According to Gautam *dharmasūtra*, the number of *saṃskāras* is considered to be 40, MS considers 13. But Swami Dayanand, Vyāsa and *Smṛticandrikā* consider the number of sacraments to be 16. In the Indian tradition, the 16 *saṃskāras* are broadly divided into five parts; pre-natal rites, childhood rites, educational rites, family rites and posthumous rites (Guar & Ojha , 2018). Roy (2017) attempts to explore the need for rituals in modern society and the importance of human and moral values in a global society. Likewise, Sitholey et al (2013) describes the 12 *saṃskāras* on the basis of MS and state that the *saṃskāras* not only instil good qualities in a child but also remove bad habits. The work of Rajbali Pandey (2004) on the scientific and relevance of these 16 *saṃskāras* is commendable. Similar work has been presented by Prasoon (2009). Similarly, Gatrad et al (2004) also present a critical study of ancient rituals.

4.1.6 Vivāha (Marriage), Family Arrangement and Household Ethics

Marriage is a socially approved way of establishing a medium of procreation. Although its purposes, functions and forms may differ from society to society, it is present everywhere as an institution (Johny, 2003). Marriage is a universal institution where the qualities of love, devotion, cooperation and sacrifice are found (Paul, 2017). Marriage is not merely a sacred union, but a sacrament to sanctify the body (Harman, 1987). The work of Singh (1992) on the marriage ceremony propounds its social and scientific importance. Marriage is imperative to produce progeny and begin a family, which further leads to the growth of society. According to the Hindu tradition, the need for progeny can only be fulfilled by a marriage. Merchant's (1935) book "Changing Views on Marriage and Family" is an important compendium in regards to the Hindu Marriage system. He distinctively authored his ideology on marriage and family based on the thought process of young women. Hindu women's legal right to inherit property has been restricted from the earliest times in Indian culture. DS provided women with property known as *strīdhan* which mainly comes from gifts like clothes and jewellery bestowed during the wedding rituals. The present laws are more liberal than those of the ancient Hindu society (Kumar & Halder, 2019). They critically examine the evolution of Hindu women's succession from ancient to modern times from a feminist point of view. It also scrutinizes the present status of women as the owners of the property whereas Adhikari (2020) analyses the status, power, and authority of females in terms of the explanation of MS. Borah et al (2020) examines the interplay between femininity, the over the assertion of misogyny and psychological oppression of women. They state that MS is responsible for the derogatory position conferred to women and sheds light on the vilification of women and sexist slurs across contexts and the social acceptability of it.

4.1.7 Rājadharmā, Politics, Ruling and Duty of the King

The concept of good governance in the ancient Hindu system is based on Brahminical notion of '*Yogakṣema*' which means the wellbeing of people. The administrative system of ancient India can be traced back to Hindu jurisprudence texts, which describes the characteristics of a global society and the legal system. In all the scriptures like MS, *Yājñavalkya*, AS, *Śukranīti*, *Rājadharmā* has been a very crucial

topic. Major topics which come under *rājadharmā* such as the concept of state and nation, concept of religion, art of governance, duties of the ruler, democracy or public happiness, social philosophy of fundamental rights, art and science of governance, electoral reforms, National unity, religious minorities and secularism, *yogakṣema* and *pañcāyatī rāja* etc. are all included in these *smṛtis* (Sankhder, 2003). AS, deals extensively with law and order, political and bureaucratic accountability, elaborate legal framework, human resource management and prevention of corruption. Traditional Indian culture and administration have laid emphasis on peaceful and harmonious social order, delivery of justice, checking corruption, citizen participation, maintaining a balanced environment and collective welfare. Similar issues are described in MS, *yājñavalkyaśmṛti*, *Atrīśmṛti* etc. MS and AS are two prime examples of the DS which deals with state policy and theory of punishment so that society does not deviate from the dharma. It is the responsibility of the state government to ‘regulate’ its subjects yet ensure their welfare. Regulations help in achieving social goals, provide consumer protection and improve economic performance by promoting commercial competition. However, it also creates barriers for trade and business. Modern state regulators are often confronted with many dilemmas as to whether where a decision must be rolled out or not. Anuradha (Guru, 2008) dwells on this topic and discusses the neoteric regulatory act with age-old policy-making procedures. She compares the contemporary Regulatory Impact Assessment (RIA) with the traditional legal prescriptions. It further articulates that the DS provides the best possible solutions for problems such as policy issuing dilemmas, accountability etc. (Guru, 2008). The ideals of governance and the main elements that constituted the art of the ancient Indian rulers such as people-centred, minimal corruption, sensitivity, eco-friendly activities, global society, and the administration system of ancient India on the basis of *Bhagavad Gītā*, *Mahābhārata*, *Śāntīparva*, *Rāmāyaṇa*, AS, MS, *Atrīśmṛti* and have been well described by Nath (2019). Goel (2003) has presented exemplary research in this area. The work is divided in to nine chapters covering the wide range of topics such as good governance, leadership, financial and personnel administration, administrative ethics and human excellence on the basis of ancient Sanskrit texts. The fundamental principles for effective governance are participation, accountability, maximisation of citizen’s welfare and protecting their dignity and honour, justice and sensitivity towards the

aspirations of the common people (Goel S. L., 2007; Mukherjee, 2010). Dwivedi (1990; 1987) talks about the contemporary administration and politics in the light of the ancient *dharma* system. He discusses the five main aspects of the duties of elected and appointed public officials, administrative theology, the role of politicians in the administrative domain and nation building. MS is considered a symbol of the organisational philosophy of law and governance.

In MS, *danda* is superior to *dharma*. *Dharma* can legitimise the use of the power of punishment. The state is the promoter of *dharma* but protects *dharma* by maintaining discipline through issuing *danda* (Meena, 2005). Kumar and Halder (2019) presented a critical analysis of the criminal justice principles as depicted in the MS. There is a detailed discussion on the expected characteristics, ethics and qualities required of any leader in the DS. The king has been described as *dharmarāja*, glorious, powerful and the protector of the subjects in MS. According to *atrismṛti* (Verse-28) to punish the wicked, to respect the good, to enrich the treasury by fair means, to be just to the litigants and to protect the state, these are the five *yajña* (i.e. Selfless duties) to be performed by the ruler. According to Sivakumar and Rao (1996; 1996) perseverance, humility, patience, consistency, non-violence, self-restraint, sense of universal goodness, positive attitude, quick-witted, sense of justice, sharpness of mind, enthusiasm, generosity, punctuality are the supreme qualities of a respected king.

4.2 A Brief Survey of Contemporary Themes of DS

The previous segment depicts the survey of research works that have been conducted on the traditional aspects. In this section, a detailed survey of the research works done on the contemporary concepts from MS has been interrogated.

4.2.1 Cleanliness and Environmental Awareness

The environment has been given utmost importance in Hindu culture. The Vedic age is considered to be the oldest and the most ancient in the world. Vedic literature is a storehouse of various types of knowledge and science. The people of the Vedic period were duly aware of the environmental concepts, natural resources and their conservation measures (Sarma, 2015). The concern for the protection of environmental health and proper public sanitation is deeply rooted in ancient Indian customs and

traditions. Many references are found in the DS on environmental protection, ecological balance, weather cycle, the occurrence of rainfall, hydrological cycle and all the subjects related to them. Which indicates the extreme level of environmental awareness of the sages of the time and their remedies (Padhy et al, 2006). Various references to environmental concepts are found in the Vedas and other Sanskrit texts.

The sanctification and purification of holy rivers are discussed in DS signifying the perpetual value of the rivers, ponds and fountains and their eminence for nature, the environment and mankind. Natural resources are considered to be sacred. So that it can be protected and used only as needed. The protection of essential elements for society is well described in the Indian traditional texts like MS, AS etc. The concept of cleanliness and hygiene is not new to the world. The knowledge about cleanliness is firmly rooted in Indian tradition since the beginning. The term used for cleanliness in ancient texts is *svacchatā* which holds a very profound meaning. Kannan (2017) has proposed the solution for waste management as mentioned in DS texts. AS emphasises that sanitation is essential and inviolable. Likewise, MS prohibits the contamination of water bodies and has made it to be a punishable offence (Kannan, 2017). The research presented by Pushpangadan et al (1987) on environmental health is very useful to understand the traditional way of environment conservation. In MS, concepts related to waste management and water conservation have been presented through SI and duties.

The environmental rules of the time were taught as a medium of behaviour, moral responsibilities and remedial instructions. Along with this, there was also a law of supernatural and transcendental punishment (sins and virtue) so that citizens realise the importance of the environment (Padhy et al, 2006). AS talks about rainfall patterns, forest inhabitants, soil types as well as appropriate irrigation techniques. It has divided the world's landmass into seven major parts (Anand, 2020). He further ordains appointing supervisors for protecting wildlife and preventing poaching of wild animals, ensuring adequate rationing and proper care of animals. Anand (2020) states that both MS and AS mention punishments of different kinds for causing harm to plants and trees. He states that forest areas and water reservoirs are prominent ecological spaces and an indispensable part of the agrarian economy. These should not be destroyed by human intervention. Rajkhowa (2020) presented a detailed study on MS and its environmental reciting. It provides moral lessons to take care of the nature and

protection of ecological reserves, especially water and trees. In this paper, an effort is made to understand the environmental awareness that was prevalent in the MS. Surender Kumar (1988) discusses the definition of *dharma*, various fasts, festivals, *samvatsaras*, days, months etc. all based on the theological texts and Puranas.

4.2.2 Economics and Management Sciences

For every society, the vital task is to arrange and maintain the provision of food, clothing, and shelter for its members. Business management, finance psychology, and accounting all are imperative for a country's economic condition. Kautilya highlighted the relevance of economics and management science to contemporary society. Its main subjects are economy, state, the science of business management, financial management during the Maurya period, education and training for effective governance, marketing strategy, management of political economy for contemporary society as described by Manu and Kautilya etc. (Chamola, 2007). It deals with diverse economic affairs such as commerce, accounts and the coinage (Irani & Silver, 1995). Saputra and Anggiriawan (2021) explore the concepts of Accounting, Auditing and Corruption from Kautilya's point of view and also suggests ways to prevent corporate corruption and tax evasion as per the guidelines of AS. Bobade (2019) highlighted the ancient Indian administration system based on MS. Basu and Sen (2008) presented their views on the current relevance of the ancient Indian economic system as explained in MS and Kautilya AS. A review article on Basu and Sen (2008) was also presented by Panchmukhi (2010). According to AS, the complete economic policy was regulated and under the control of the state. The economy was divided into 3 major blocks agriculture, cattle breeding and trade. Byramjee (2005) did his research in the field of marketing and economic policies. He presented an exemplary outlook describing the functional principles and processes of the marketing field during the medieval period which includes a broad discussion on the role of transportation, warehousing, monopoly and consumer rights based on the rules of AS. Sivakumar (2009) gives complete information on Corporate Governance and Laws. His research paper further emphasises the value-based corporate governance structures and the protection of all investors and stakeholders. Sharma (2016) talks of growth in taxation, finance and revenue collection on the basis of AS and MS etc. Research carried out by Vadapalli (2019) propounds the

importance of Kauṭilya's economic structure, economic ideals, ancient state and military strategies etc. for students in the field of commerce and management. These articles throw light upon the Kauṭilya's social, economic, management and developmental ideas which are relevant to the curriculum of business schools. Similarly, to understand the proper way of conducting trade and commerce, the study of ancient scriptures is necessary for students studying commerce, business studies, financial management, economics etc. Similarly, Donald (2017) imparted knowledge on business ethics, capitalism, livelihood, government, means of existence, trade and merchant world, production, commerce, ancient Indian economy and commercial exchanges on the basis of scriptures like *Mahābhārata*, MS, *Nāradaśmṛti*, AS etc. He talks about the commercial laws prevalent in medieval India and draws parallels between the profit-maximizing capitalist businesses and the ancient system of marketing based on needs and ethics. *Śukranītisāra* addresses issues such as governance, expansion of businesses and sciences, public finances, prices, markets, contracts, labour relations, etc. Some of the economic policies mentioned in *Śukranītisāra* are elaborate, though different from AS but are still relevant today. Based on this text, Deodhar (2020) explained his views on ancient economic policy in detail. The relevance of economic elements, in particular, has been considered in the second section of the paper. Further, in the third and fourth sections, the governing structure of the economy, the industrial and scientific complexities of economic structures have been highlighted and the religious role of the king and his ministers in the smooth working of the economy has also been discussed. Similarly, unique descriptions on the subjects of economy, financial management, tax system, penal system, revenue collection etc. are provided by Sharma (2016). Modern public finance is regulated by government measures to establish a rational relationship and balance between national income and expenditure. It discusses the taxation and revenue collection in Mahabharata, financial administration in MS, public finance in *Śukranītisāra* and laudable discussion on revenue collection in AS. The labour theory of property as proposed by Kauṭilya and the contract envisaged by him, economic laws relating to property and promote ethical behaviour and economic efficiency. Apart from this, it also covers social order and prosperity, general access to justice, emerging capitalism, urbanisation, the relationship between morality and economics, business ethics, validity

or sanctity of contracts, requirements for a valid contract, agreements on loans and deposits, the liabilities of debtors and creditors, debt contracts etc. Sihag (2009) carried out extensive research to find out the status of economic analysis of laws related to property and contracts in India during ancient times.

Sivakumar and Rao (1996) presented different components of value-based management such as organisational philosophy, value-based leadership, internal corporate culture, fulfilment of corporate objectives, crisis management, community development work, insurance against loss, employee and consumer welfare, feedback from stakeholders etc. on the basis of the guidelines from the famous ancient Sanskrit text Kautilya's *AS*. It discusses value-based business management and an application of Kautilya's social management. *MS* is a very valuable resource related to leadership, in this we can get important insights about various aspects of leadership. One can also see the understanding of 'transformative' and 'visionary' leadership in *MS*. Bansal (2010) imparts the concepts and practical processes of self-management and lessons on leadership delivered by Manu through Indian psycho-philosophical ideas. Wani (2017) laid out a unique explanation of the judicial system prevalent in ancient India. It studied how our ancestors understood the complex problems of society and laid down rules to regulate society and social behaviour. It further discusses the ancient Indian judicial system, administrative units, judicial process, appointment of judges, panchayats, and various crimes in the *Maurya* period and the appropriate penal system. *DS* has proved its eminence not only in India but also in foreign lands. The development of indigenous law in Asian counterparts namely; Burma, Laos, Thailand and Cambodia is strongly influenced by the legal theory of Indian *DS*. This influence is still visible in their present legal codes. In all these countries, the name Manu is associated with the origin of law. Bhattacharyya (1993) has derived the commonalities showcasing the influence of ancient Indian *DS* on Burmese Legal texts. The research of Gray (2014) critically examines the realistic political views of Kautilya and Machiavelli and employs a new analytical approach. It is a uniquely critical and comparative study between the secular ethics of Machiavelli and the political-religious ethics of Kautilya, who followed the traditional Brahminical beliefs.

4.2.3 Medical and Health Sciences

The *samskāras* are important from the perspective of child health and provide an opportunity for regular monitoring of the baby's growth and developmental pattern at regular intervals. The purpose of the various *samskāras* is to provide the infant with the right food, the ability to adapt to the external environment, ensure adequate nutrition, prevent diseases, strengthen immunity and educate the child (Guar & Ojha, 2018). These *samskāras* are basically the powers inherent in a man and help him in achieving his goal. They also remove the obstacles in the life of a person and ensures the path of his progress is smooth. It is also a medium of spiritual development. For the development of a healthy child, it is essential that the mother is healthy. *Garbhādhāna samskāra* is, therefore, one of the most important *samskāra* that is done to ensure maternal care which leads to the birth of healthy progeny. Patil and Kesur (2020) opine that the physiological and psychological development of pregnant women is necessary. In their article, the three eminent stages (before, during and after conception) of *garbhādhāna samskāra* are presented. They have further mentioned the benefits of Yoga during the period of pregnancy and provided a list of specific *āsanas* recommended in each trimester. The scientific purpose of *samskāras* is that they should be carried out at the right time to fulfil the needs embedded in the physical and mental development of the child. The 16 *samskāra* prescribed by *Maharishi Dayanand* are widely accepted even by *āyurvedic ācārya* (Arun Raj et al, 2013). Many research works have been done on the scientific and psychological aspects of *samskāra*. Kumar (2017) believes that newborn care, adolescent health care, mental health problems, behavioural disorders, stress, anxiety, depression etc. can be taken care of by proper implementation of the *samskāras*. Guar and Ojha (2018) and Tale (2020) have propounded the medical importance of these *samskāras*. Chakrapani (2013) has acknowledged the medical importance of *jātakarma samskāra* and believes that it helps in increasing the initial immunity of the newborn. *Āyurvedic ācāryas* have described the concept of *phalaprāsana* and *annaprāsana*. It is important for fulfilling the need for nutrients and micronutrients required by the baby (Kumar, 2017). Swaminathan (2015) considers *samskāra* to be innate in the nutritional aspect. She states the utility of food in the rituals and proposes measures to remove malnutrition. She conveys the Vedic view of nutrition and the continuing importance of food and nutrition which resonates appropriately

through the practice of *saṃskāras*. The concept of immunity is of utmost importance in the daily well-being of human beings. *Annaprāśana* is one such traditional ritual in which the infant is fed edible food for the first time. The intake of gold has always been considered to have strong therapeutic efficacy. From ancient times, gold is believed to have medicinal properties. For this reason, extract of the gold, honey and ghee are fed to the infant during his *annaprāśana saṃskāra* (Singh & Verma, 2012). Many scholars believe that the mixture of gold, honey and ghee is useful in increasing intellectual and digestive powers (Somaji et al, 2014). Ancient paediatrics mention that *svarnaṇaprāśana* enhances immunity, and nutrition, improves memory, intelligence and appetite and tones up the skin (Chakrapany, 2013). Kumar et al (2013) and Nelaturi et al (2021) discussed the therapeutic benefits of this *saṃskāra* at great length. The classical description of Kumar et al (2013) implicates that the ingestion of gold extracts modulates the immune mechanism of the newborn and helps him to fight any sort of ailments. Individual resistance to any infectious disease in clinical terms is known as immunomodulation (Nelaturi et al 2021). Warad et al (2014) made an attempt in proving the significance of *svarnaṇaprāśana* by supplementing a shred of statistical evidence and its analysis. They presented a study that aimed to prepare and evaluate the traditional formulation, *svarnaṇaprāśana* for its nootropic efficacy on learning and memory by employing external and interceptive behavioural models. The importance of health, vitality, nutrition and healing is deeply embedded in the native medical systems of ancient India. Likewise, even western medicine has now partially, adopted a holistic approach to psychology and medicine. Thus, giving rise to clinical psychology, positive psychology, health psychology, and developmental psychology. Sitholey et al (2013) studied ancient Indian mental concepts of children and adolescents in the light of MS. He gathered information from the MS on the basis of *saṃskāras* and proclaimed that adopting *saṃskāras* from the beginning to develop child's mental strength and eliminate the chances of psychological disorders. Kapur (2018) has attempted to draw upon the distinctive features of *Āyurveda*, *Unani*, *Siddha* and Tibetan medicine and propound its relevance in the contemporary times. Sitholey et al (2013) aetiology and treatment of physical and mental disorders was in accordance with the overall scientific development of those times.

4.3 A Brief Survey of Computational Aspects of DS

Computational linguistics is the technical, scientific and engineering discipline concerned with understanding written and vocal language from a computational outlook and constructing artefacts that helpfully develop and generate language, either in bulk or in a dialogue setting. (Schubert, 2019). Sanskrit Computational Linguistics is an interdisciplinary emerging area of study where the computational model, logic, techniques and principles are applied on the Sanskrit language for linguistic analysis. The works on Machine Translation (MT) started in the 1950s and 60s. It brought into the picture a more complete term which could include the fundamental research in languages as well along with mechanistic processes (Ruslan, 2005). Especially, the work on MT gave birth to Computational Linguistics in the 1960s. This field is advancing day by day with increasing automation capacity and started focusing on practical applications in the field of Cognitive Science and Artificial Intelligence.

The survey of research works that have been conducted on the traditional and contemporary themes was discussed in the previous segments. In this section, a detailed survey of the research works done for DS in technological advancements such as searching in texts, digitization, digital access, online indexing, knowledge mining and other computational applications have been presented. There are a plethora of traditional and technological research works conducted in various languages and eminent texts of disparate subjects other than Sanskrit are carried out worldwide. However, very few works in the field of CL are available on texts appertained to Sanskrit DS texts.

The history of traditional textual indexing is very rich in India. *Śaunaka*, a great scholar of Vedas, made a Vedic index named *Sarvānukramaṇī*. Book Indexing of *Mahābhārata* is an ongoing project at *Sanskrit evam Prācyā Vidyāsansthāna*, Kurukshetra University. They did the indexing of first two *Parvas* (i.e., *Ādīparva* and *Sabhāparva*) of *Mahābhārata* which is based on BORI's critical edition of *Mahābhārata*. A western scholar S. Sørensen created an index of "Names in the *Mahābhārata*" published from Motilal Banarasidas. For Sanskrit Informatics, it is necessary to make indices available online. Commentaries presented by western scholars on *Ṛgveda*, *Yajurveda*, *Atharvaveda*, *Sāmaveda*, *Śatapatha Brāhmaṇa*, *MS*, *Gṛhyasūtra*, *Viṣṇu Sūkta*, *Purāṇa*, *Mahābhārata*, *Rāmāyaṇa*, *Bhāgavata Gītā*, *Vedānta*

Sūtra, *Kālidāsa* etc have been included in the web indexes of Internet sacred text archive¹²⁴. This web page contains an independent available collection of texts in electronic form about religion, mythology, legends, folklore, and occult and esoteric subjects. The texts have been translated into English and wherever possible they have also been presented in the original language. The Linguistics Research Centre¹²⁵ of the University of Texas has made various subjects available in Roman script in an effort to keep the supposedly dead languages alive.

Unfortunately, the area of electronic indexing for Indian Heritage is not well explored. However, a brief discourse of some efforts that are investigated in this area is accounted for in this survey section. There are many research institutes not only in Bharat but abroad that are working in the area.

The foremost work in the area of digitization and automatic indexing is the *Online Indexing of Indian heritage* which has been conducted at the University of Goettingen, Germany. It includes the complete word indexing of *Mahābhārata* in Roman (IAST) transliteration. The database used is stored in the form of text files. The work is in two styles, one is in alphabetical order and another is in *Parva* style¹²⁶. Another module named “Multimedia Database to Sanskrit drama” has been developed by the Indology Department of the University of Wuerzburg, Germany. The developed system is mainly focused on *word indexing* of Bhāsa’s drama but also includes *Mudrārākṣasa* of Viśākhadatta¹²⁷. Professor John Smith of Cambridge University developed an electronic text of the Critical Edition of the *Mahābhārata*. The unique feature of this digital system is that it is available in downloadable text format in several commonly-used encodings such as; *Unicode Devanagari*, *Unicode Roman*, *ISCII*, *ASCII*, *Norman* etc¹²⁸.

In Bharata, the leading institutes working in the area of computational Sanskrit are School of Sanskrit and Indic Studies, Jawaharlal Nehru University, New Delhi¹²⁹, The Department of Sanskrit Studies, University of Hyderabad¹³⁰ and Department of

¹²⁴ <http://www.sacred-texts.com/index.htm>

¹²⁵ <http://www.utexas.edu/cola/centers/lrc/>

¹²⁶ http://www.sub.unigoettingen.de/ebene_1/fiindolo/gretil/1_sanskr/2_epic/mbh/sas/mahabharata.html

¹²⁷ <http://www.indologie.uni-wuerzburg.de/bhasa/index.html>

¹²⁸ <http://bombay.indology.info/index.html>

¹²⁹ <http://sanskrit.du.ac.in>

¹³⁰ <https://sanskrit.uohyd.ac.in/scl/>

Sanskrit, University of Delhi, Delhi¹³¹. The contribution of Sanskrit World website, the Sanskrit world¹³² Place for Sanskrit Lovers by Mr. Dhaval Patel in the area of Sanskrit computation is also worthy of finding its mention here. Dr. Dhaval Patel has developed a web portal for Sanskrit language technology. Books and texts, *laghuśodha*, digital Sanskrit literature and Sanskrit tools related to Sanskrit language and literature are available on this web portal. These electronic tools are- *Sandhi Nirmāpaka* (Sandhi Generator), *Subanta Nirmāpaka* (Subanta Generator), *Tiñanta Nirmāpaka* (Tiganta Generator), *Uccāraṇa Nirmāpaka* (Accent Generator), *Kośa Khoja* (Thesaurus/Dictionary Or Lexical Search) etc. This website consists a huge collection of 229 religious Literature, 82 poetry, 21 puranas, 198 philosophical texts, 14 DS texts, 5 grammatical texts, 10 Epics etc.

IIT Bombay¹³³, IIT Hyderabad¹³⁴, Indian Language Technology Centre for Dissemination and Extension, Technology Development for Indian Languages (TDIL) etc. have also done commendable work in the field of Sanskrit CL. The government of India provides ample funding for conducting research and development related to Indian languages, under which many tools for Sanskrit languages have been developed¹³⁵. Apart from India, much research related to the Sanskrit language is also being done in foreign countries. Many works related to computational Sanskrit are in progress such as; Sanskrit Sentence Seema System, the Sandhi System (Hellwig, 2015), Sanskrit POS Tag (Hellwig, 2007; 2008) Sanskrit Corpora (Hellwig, 2010) have also been developed (Hellwig, 2016). Systems developed by Gérard Huet (2005) such as Sanskrit Language Analyst (2003; 2006; 2009), Sanskrit PoS Tagger (2003), and Sanskrit Lexical Database (2004) are notable works.

The Department of Sanskrit Studies, University of Hyderabad¹³⁶ is striding forward in developing various computational tools for the analysis of Sanskrit texts of Indian grammatical tradition. Many tools related to Sanskrit grammar are also available on the website called “*Samsādhinī*”¹³⁷. The lexical tools developed by this department

¹³¹ <https://cl.sanskrit.du.ac.in>

¹³² <https://www.sanskritworld.in/>

¹³³ <https://www.iitb.ac.in/>

¹³⁴ <https://www.iith.ac.in/>

¹³⁵ <http://tdil-dc.in/san>

¹³⁶ <https://sanskrit.uohyd.ac.in/scl/>

¹³⁷ <https://sanskrit.uohyd.ac.in/scl/>

under the guidance of Prof. Amba Kulkarni are *Amarakośa*¹³⁸ and *Dhātuvṛttis*¹³⁹. A search engine for Sanskrit scriptures has also been developed by this centre through which words from Sanskrit texts can be searched. The E-version of the *Amarakośa* allows the search of synsets and provides access to various other related words in the *Amarakośa* is developed by Sivaja S. Nair (Nair 2011). This web tool is an effort to make the implicit knowledge in *Amarakośa* explicit. Further, the lexical entries in *Amarakośa* are also classified according to extended Vaisheshika Ontology¹⁴⁰. *Amarakośa* can be used for a variety of Natural Language Processing tasks including information retrieval, semantic tagging, disambiguation, ontologies etc. this web-based system provides access and easy searching of various related terms in the *Amarakośa*. Similarly, the work Concordance of *Pāṇinian Dhātuvṛttis* by N.Shailaja (N. 2014) displays the *dhatu*s with *pada* and *set/anit* information with links to *Mādhavīyā Dhātuvṛtti* by Sāyaṇa, *Kṣīratarāṅgiṇī* by Kṣīrasvāmin and *Dhātupradīpa* by Maitreyarākṣita to explore the knowledge of Sanskrit verb roots¹⁴¹. The system for *Dhātuvṛttis* are very informative and produces the reference numbers to the *sūtras* in the three *vṛttis* which is linked with a corresponding part of the commentary. The verb roots are also linked with the verb conjugator after clicking on it, the user gets the generated forms of the verb. The first Search Engine for Sanskrit called *Gaveshika* allows users to search a Sanskrit word in various Sanskrit corpora developed by the centre through *pratipadikam* and *dhaatu*¹⁴².

The School of Sanskrit and Indic Studies, Jawaharlal Nehru University is a prominent institute working on Sanskrit language technology under the supervision of Prof. Girish Nath Jha. The school started their journey from 2002 and developed many tools for Sanskrit. The primary focus of this institute initially was on Sanskrit-Hindi Translator (popularly known as SaHiT). Any machine-oriented translation incorporates two major components. Analysis of a source language and the creation of target language. For the fulfilment of this objective, the purpose of analyzing the Sanskrit language, a number of tools and resources have been developed under the scope of

¹³⁸ <https://sanskrit.uohyd.ac.in/scl/amarakosha/frame.html>

¹³⁹ <https://sanskrit.uohyd.ac.in/scl/dhaatupaatha/index.html>

¹⁴⁰ <https://sanskrit.uohyd.ac.in/scl/amarakosha/frame.html>

¹⁴¹ <https://sanskrit.uohyd.ac.in/scl/dhaatupaatha/index.html>

¹⁴² <https://sanskrit.uohyd.ac.in/scl>

MPhil and PhD research. These tasks mainly include four types of syntactic tools. First Language Processing Tools, Second Lexical Resources and Search, Third Online Corpora and Fourth Multimedia Based E-learning tools. This department is accredited with the introduction of Sanskrit CL in Bharat namely, the *Subanta Viśeṣaka*¹⁴³ (Chandra, 2006; Chandra, 2007; Chandra, 2007; Chandra, 2011 & Chandra And Jha, 2006), *Sandhi Vicchedaka And Nirmāpaka*¹⁴⁴ (Kumar S. , 2007), *Tiñanta Viśeṣaka*¹⁴⁵ (Agrawal, 2007), *Kṛdanta Viśeṣaka*¹⁴⁶ (Singh, 2008), *Kāraka Viśeṣaka*¹⁴⁷ (Mishra S. K., 2007; Mishra & Jha, 2004), *Strīpratyayānta Viśeṣaka* (Bhadra, 2007), *Subanta Nirmāpaka*¹⁴⁸ (Jha, 2003), *Tiñanta Nirmāpaka*¹⁴⁹.

Online indexing and search are very essential tools developed for various texts by the school. An Online Multilingual *Amarakośa* system is based on the archaic text *Amarakośa*, the Sanskrit thesaurus ascribed to *Amarasimha*. It is developed using RDBMS techniques. The system facilitates storing up to 50 synonyms with category, gender, number information and detailed glosses, with cross-referencing among synonyms, search capability in the supported Indian languages and ontology display. Any word found in the text of *Amarakośa* can be searched online¹⁵⁰ using this system. It is designed to produce multilingual output, in which the word can be searched as well as, the translation of the searched word is received in many languages like Sanskrit, Hindi, English, Bangla, Punjabi, Assamese, Oriya, Maithili and Kannada etc. After searching for a word, its context along with other information like synonyms, grammar, etc. is also made available to the user in the form of the output (Jha, Girish Nath, 2006; Chandrashekar et al, 2010; Chandrashekar et al, 2009).

Similarly, Tripathi (2008) conducted the task of online search and indexing for *Mahābhārata* Search. Through this system any word available in *Mahābhārata* can be searched online at any given time. All the search words are hyperlinked and thus, provide the complete reference and context of the searched word. By clicking on the

¹⁴³ <http://sanskrit.jnu.ac.in/subanta/rsubanta.jsp>

¹⁴⁴ <http://sanskrit.jnu.ac.in/sandhi/gen.jsp>

¹⁴⁵ <http://sanskrit.jnu.ac.in/tanalyzer/tanalyze.jsp>

¹⁴⁶ <http://sanskrit.jnu.ac.in/kridanta/ktag.jsp>

¹⁴⁷ <http://sanskrit.jnu.ac.in/karaka/analyzer.jsp>

¹⁴⁸ <http://sanskrit.jnu.ac.in/subanta/generate.jsp>

¹⁴⁹ <http://sanskrit.jnu.ac.in/tinanta/tinanta.jsp>

¹⁵⁰ <http://sanskrit.jnu.ac.in/amara/index.jsp>

link, the corresponding verse is also obtained (Mani, Singh, Sinha and Jha, 2009; Mani & Jha, 2006). Likewise, the *Āyurveda* Search system¹⁵¹ is based on the composition of *Caraka* and *Suśruta saṃhitā*. Rajnish Kumar Pandey (2011 and 2012) worked on *Suśruta saṃhitā*¹⁵² and Archana Tiwari (2011) worked on the *Carak saṃhitā*¹⁵³. Through this system, any word in these texts can be accurately searched online.

Vedānta Search¹⁵⁴ is a digital search mechanism wherein any given word in *Vedānta* texts in *Vedas*. Indexing work for the *Bhāvaprakāśa-Nighaṇṭu* (Khandoliyan, 2009-2011), *Arthaśāstra* (Nripendra, 2009), *Nirukta* (Soni, 2009), *Medinīkośa* (Dwivedy, 2009), *Halāyudhakośa* (Khandoliyan, Pandey, Meena, Pandey, & Kumar, 2009), *Maṅkhakośa* (Kumar A., 2009) are also conducted, these systems aid enhanced searching and any word used in these texts can be traced at any time (Mani et al, 2009; Jha, 2010).

Department of Sanskrit, University of Delhi started research and development in the field of Computational Sanskrit in 2014 with the objective of developing online tools for Sanskrit and creating an e-learning platform for Sanskrit. The department has developed many grammatical tools for Sanskrit. It includes a variety of systems. The *Subantarupsiddhi* system (Chandra et al, 2015; 2016; 2017; 2018) provides a web-based analysis of any *Subanta* verse in described in *Laghusiddhānta Kaumudī* based *Subantaprakaraṇa*. This system is a hybrid model, based on the rules and examples mixed methods. It is an online system that accepts input in Unicode Devanagari (UTF-8) format with the help of a user interface. This system performs three functions: firstly, identification of the *Subanta*, secondly its analysis and thirdly, the formulation of the derivational process. The derivation is displayed in a tabular format in which each of the *sūtras* and verbs used are hyperlinked. Complete explanation is displayed on a new webpage. This system is very useful for Sanskrit students and teachers. In the field of online indexing and search the department has developed *Paurāṇika* Search. It is an instant search system where information related to available *purāṇas* can be extracted by this system¹⁵⁵ (Chandra & Anju, Puranic Search: An Instant Search System for

¹⁵¹ <http://sanskrit.jnu.ac.in/ayurveda/index.jsp>

¹⁵² <http://sanskrit.jnu.ac.in/susruta/index.jsp>

¹⁵³ <http://sanskrit.jnu.ac.in/caraka/index.jsp>

¹⁵⁴ <http://sanskrit.jnu.ac.in/vedanta/index.jsp>

¹⁵⁵ <http://cl.sanskrit.du.ac.in/purana>

Purana, 2017). It is a web based information extraction tools from the Puranic texts. Right now this system is limited to *Agnipurāṇa* only. User can search any word available in any *purāṇas* and get the complete reference of that word. Data of the *purāṇas* are stored in a database with complete detail in UTF-8 format in Devanagari script.

Likewise, *Ṛgvedika* Search is an instant search system for *Ṛgveda*¹⁵⁶. The main objective of this system is to develop a web-based search and online indexing system for *Ṛgveda* by preparing a computerized database of *Ṛgveda saṃhitā*. Through which the *mantras* and words of *Ṛgveda saṃhitā* can be searched at any time to get immediate reference (Kumar J. , 2016). The information form any of *mantra* of *Ṛgveda* can be searched in many ways such as deity, *maṇḍala*, *rṣī* etc.

The creation and continuous use of definitional terms has been prevalent in the world of Sanskrit knowledge tradition and philosophy since its inception. The list of words used in a particular discipline of knowledge with their appropriate definitions is called glossary. Indian philosophy also uses disparate palate of definitions to establish a specific concept of ancient Indian Philosophy. Usually, some words in colloquial language denote a particular meaning but, the exact same word conveys a different meaning in a specific area of knowledge. There are many definitional dictionaries available in the printed format related to Indian Philosophy. In this era of information technology, everyone is willing to share and receive information via digital platforms. For this purpose, e-kosha and an online search system is developed for the definitions used in the philosophy of *sāṃkhyā-yoga*. Through the system “Digitization and Online Search for Terminological Knowledge of *sāṃkhyā and yoga* Philosophy” knowledge of *sāṃkhyā-yoga* can be made available in just one click. For this purpose, the online search system has been developed for the terminology used in *sāṃkhyā-yoga* Philosophy. This system is completely different from all the definitions available in printed and other online forms. Words related to *sāṃkhyā* and *Yoga* Philosophy can be searched. In this system a total of 385 definitional words have been analyzed. In this study *sāṃkhyā sūtra*, *sāṃkhyā kārikā*, *sāṃkhyā pravacanabhāṣya* have been made the basis of *sāṃkhyā* philosophy. The *Yoga sūtras*, *Vyāsa bhāṣya*, *Bhojvrisha*, *Tatvayavadi*

¹⁵⁶ <http://cl.sanskrit.du.ac.in/rveda>

and Yogavarshak have been made the basis of Yogadarshan. This system presents the characteristics of any given terminology word with its associated origin, commentary, exegesis and its full reference with Hindi translation. With this system, the user can easily understand any technical term and can also get more useful information in that context. (Anju & Chandra, 2018).

Computational lexicography emerged as a separate discipline within CL with the appearance of machine-readable dictionaries, starting with the creation of the machine-readable tapes of the *Merriam-Webster Seventh Collegiate Dictionary* and the *Merriam-Webster New Pocket Dictionary* in the 1960s at System Development Corporation (Webster, 1967). Computational lexicographies have contributed to the enhanced understanding of the content and surpassed the limitations of print dictionaries for computational purposes. Online Macdonell Sanskrit-English Dictionary¹⁵⁷ system is developed on ‘*A practical Sanskrit dictionary*’ authored by Arthur Anthony Macdonell with transliterations, accentuations and etymological analysis throughout. The system includes both Devanagari and Roman alphabets. Cologne Digital Sanskrit Lexicon & Capeller’s Sanskrit-English Dictionary lexicon¹⁵⁸ developed by the Institute of Indology and Tamil Studies, Cologne University, is based on Monier William’s Sanskrit-English dictionary and contains 166,434 entries while the online Capeller’s dictionary is based on Capeller’s 1891 Sanskrit-English Dictionary which includes 37,413 entries. In both the digital dictionaries, the English description contains translation, grammatical and other information listed in their respective printed form. One may search it in its entirety from both languages. For the Sanskrit query, the transliteration is based on the Harvard-Kyoto (HK) convention. The Online Apte English-Sanskrit Dictionary is a computerized program¹⁵⁹ built by the Institute of Indology and Tamil Studies, Cologne University elicited on the Vaman Shivaram Apte’s English-Sanskrit Dictionary. The output can be seen in Unicode Devanagari, Roman Unicode, HK and ITRANS. It also contains a scanned copy of the original dictionary by clicking the page numbers which is attached in the parenthesis along with the English words. The Online Apte Sanskrit-English Dictionary is also an

¹⁵⁷ <http://dsal.uchicago.edu/dictionaries/macdonell/>

¹⁵⁸ <http://webapps.uni-koeln.de/tamil/>

¹⁵⁹ <http://www.sanskrit-lexicon.uni-koeln.de/aequery/index.html>

online dictionary, similar to the previous work, which is based on the revised and enlarged edition of Vaman Shivaram Apte's (1858-1892) *The Practical Sanskrit-English Dictionary*. This program, which takes input in Devanagari and Roman alphabets, is developed by the 'South Asia Language and Area Centre' at the University of Chicago, Columbia University, and the Triangle South Asia Consortium in North Carolina under a project entitled '*Digital Dictionary of South Asia*'. The main definitions of all the sects of Indian Philosophy have been compiled in alphabetical order in a dictionary called '*Bhāratīya darśana pirabhāṣā kośa*'.

Simultaneously, the etymology of those words and their literal meanings have been considered so far. Only the main definitional words are included in this book, consisting of 296 pages. In this, the meaning of each term is given very briefly. Another Lexical "*Vyākaraṇa Darśana Kośa*" is such a text, in which there is a collection of 282 words related to Grammar Philosophy and references have been given to all the lines expressing the ideas propounded in various Grammar Philosophical texts about these words (Panda, 2017). In this, the lines of the texts have been mentioned from the epistemological order.

Many people have worked in the field of digitalization of Sanskrit texts. The primitive technique in this area is of scanning the ancient Sanskrit texts and making them available online. Some of the works namely; Arya Prakash¹⁶⁰, established by the Aryasamaj Jamnagar, have made concerted efforts in providing scanned transcripts of all *Vedas*, *Satyārthaprakāśa*, *Rgvedādibhāṣyabhūmikā*, *Vaidika Saṃskāra*, *Aṣṭādhyāyī*, texts composed by *Dayānanda*, *Yoga*, *Nyāya*, *Sāṃkhya*, *Vaiśeṣika* and *Vedānta Darśana* etc. and making them available for the general public. A web page called Literature¹⁶¹ incorporates the scanned copies of all the *Vedas* and other texts which can be helpful for researchers and learners. Many texts¹⁶² have been included in this, out of which scanned scripts of four *Vedas* nuncupated by Shri Ram Sharma, *Purāṇas*, philosophy, scientific spiritualism, inspirational stories, *amṛtavāṇī* etc. have been included¹⁶³. The contribution of Vedicgranth¹⁶⁴ website in this area is also

¹⁶⁰ <http://www.aryasamajjamnagar.org/>

¹⁶¹ <http://literature.awgp.org/>

¹⁶² <http://literature.awgp.org/books>

¹⁶³ <http://literature.awgp.org/hindibook/>

¹⁶⁴ <http://www.vedicgranth.org/>

commendable, where scanned copies of texts related to the four *Vedas*, *Upvedas*, *vedāṅga*, *brāhmaṇa*, *āraṇyaka*, *sūtra*, *smṛti*, Philosophy, Upanishad, History, Policy etc. are made available for the public use. A web page named “Sanskrit web” has been established which includes the scanned transcripts of four Vedas, *Rāmāyaṇa*, *Mahābhārata*, *upinaṣada*, *koṣa* etc. “*Digital Library in India*” provides online access to the documents of many languages and areas through the internet with its 21 participating centres for the Govt. of India¹⁶⁵. A website for Sanskrit documents¹⁶⁶ is available in which many texts are received, some of which are available in the form of scans while some are available in Unicode script. Scanned copies of works related to *śruti*, *smṛti*, History, *śāstra*, Language, Literature, *Tantra*, *Vedānta*, *Yoga*, *koṣa*, Grammar etc. have been installed in this system.

4.3.1 E-learning Tools

All the previously mentioned pioneer institutes working in this field namely, The Department of Sanskrit, University of Delhi¹⁶⁷ under the supervision of Dr. Subhash Chandra, School of Sanskrit and Indic Studies, Jawaharlal Nehru University, under the supervision of Prof. Girish Nath Jha and the University of Hyderabad under the supervision of Prof. Amba Kulkarni have touched extreme greatness in the area of the modern learning environment by developing various useful E-learning tools. The main objective of these departments of premium institutes is to create tools for online teaching and the development of e-tools to enhance the Sanskrit teaching-learning process in this age of information technology. Sanskrit Dictionary¹⁶⁸ website has prepared some online tools, in which Sanskrit OCR, Panini Research Tool, Root search, Sandhi Calculator etc. This calculator expects two characters or words in the language of IAST, Harvard-Kyoto, ITRANS, SLP1, Devanagari or English as input.

“Ontological Knowledge Base for selected verbs of Sanskrit and Bangla” this ontological system was developed for an exclusive selection of verbs related to Sanskrit and Bengali languages (Chandra, 2012; Chandra, 2016; Chandra & Bhattacharya, 2011; 2010; Chandra & Jha, 2010).

¹⁶⁵ <http://dli.iiit.ac.in/>

¹⁶⁶ <http://sanskritdocuments.org/>

¹⁶⁷ <http://cl.sanskrit.du.ac.in>

¹⁶⁸ sanskritdictionary.com

Sanskrit text to speech (TTS) is another eminent research work carried out by this department. This research resulted in the conversion of Sanskrit-specific language text into speech (Mishra et al, 2011; 2013; Mishra, 2012; 2015; Kumar et al, 2008). This system proves to be extremely useful and imperative for visually impaired students, research scholars and teaching faculties. Kumar (2007) has completed his dissertation ‘*Sandhi Splitter and Analyzer for Sanskrit (with special reference to aC sandhi)*’ under the direction of Prof. Girish Nath Jha. This dissertation is divided into four chapters. The purpose of this computational research is to create and develop a system that identifies the term of the sandhi and presents its exact breaking points, as well as the formula of the sandhi on the basis of which the term of the *sandhi* is formed. This system is a major e-learning tool for analysis and identification of the Sanskrit *sandhi* knowledge. Another sandhi-based e-learning system titled “Issues and Challenges in Computational Processing of *Vyañjanā Sandhi*” was developed by Diwakar Mishra (2009) at the School of Sanskrit and Indic Studies, Jawaharlal Nehru University under the chairmanship or guidance of Prof. Girish Nath Jha. This dissertation, divided into four chapters, describes the construction of a system that identifies the junctions in the disjunctive terms and presents the syntactic term analyses. K. Kalpana (2016) completed her “*Sandhi Based Grammar Checker for Tamil Language using Classical information retrieval of Natural Language Processing*” thesis under the direction of Assistant Professor K. Nirmala, Department of Computer Science Research, University of Madras. Through this research, NLP using classical information retrieval, a grammar checker for the Tamil language has been built, based on *sandhi* grammatical rules This dissertation is divided into seven chapters and covers NLP, Tamil Unicode, Tamil Language Computation, Character Analyzer and Word Analyzer. There is a detailed discussion of *Sandhi Analyst* in this thesis. Similar, sandhi-based research was done by the Department of Computer Science and Engineering, at the Indian Institute of Technology, Kanpur (Nangia, 1996). The title of this research is “Sandhi Analysis using two-level rules”. This dissertation is divided into five chapters. In this research, the computational techniques and method of the Paninian sandhi rules have been demonstrated in detail. In the list of sandhi E-learning tools, another *sandhi vicchedaka* system is being developed by the Karnataka Sanskrit

University. The system is currently under development. This work is being developed to analyze the accurate *sandhi* junctions (Kulkarni, Ramanuja, & Riemen, in progress).

Many works related to Computational Sanskrit were completed by these institutions and made available in the form of e-tools. In the present times of information and communication technology, the Sanskrit R&D department of Jawaharlal Nehru University plays a major role in digital research related to Sanskrit. Many works related to the Sanskrit language have been executed and successfully achieved in this centre. Most of the tools developed by this centre are on Sanskrit grammar and are also available online.

Various computational tools have been developed through research and development in the last six years by the department of Sanskrit at Delhi University. To make the teaching and learning of Sanskrit grammar easy and accessible, the department developed a set of tools for different types of CL approaches. The five types of computational tools are namely; the Language Analyzer tools, Language Generator, E-Text and Search, E-Learning and Research tools etc. Almost all the tools have been developed with the aim of making Sanskrit grammar accessible and adaptable as per the Delhi University curriculum. The *Subant-Rupsiddhi* (Chandra et al, 2015) system is a specialized e-learning tool which presents the Sasutra derivational process of any *Subant* verse prescribed under *Laghusiddhāntakaumudī subanta prakaraṇa*. The user can enter the input in Unicode Devanagari (UTF-8) format to get the complete derivational process of the given *Subant* term based on the formulas of Pāṇinī. Every *sūtra* and *vārtika* used in this system is hyperlinked. Then the meaning of a *sūtra* or *vārtika* appears when the cursor is moved and its complete explanation is displayed on a new webpage when clicked. Example and rule-based methods have been used in the development of this system¹⁶⁹. The Sanskrit *tiñantarūpa siddhi* process (Kumar, 2019), has been developed for the derivation of verbs¹⁷⁰. The Sanskrit *strīpratyayāntaśabda rūpasiddhi* process (Upreti, 2020) deals with the derivational process of feminine words¹⁷¹. To understand the meaning of Sanskrit texts, it is imperative to understand the concept of *sandhi*. Therefore, to garner the knowledge of *sandhi*, a system has also

¹⁶⁹ <http://cl.sanskrit.du.ac.in/supSiddhi>

¹⁷⁰ <http://cl.sanskrit.du.ac.in/tinSiddhi>

¹⁷¹ <http://cl.sanskrit.du.ac.in/stri>

been developed for the derivational process of *sandhi*¹⁷². In Sanskrit literature, the use of participles is seen in abundance. Therefore, for its knowledge also, *kr̥dantarūpasiddhi* process system¹⁷³ has been developed, through which its knowledge can be easily obtained. The Research and development of *Chandasūcanā* system under the e-learning undertaking of this department is noteworthy. With the help of this system, the knowledge of the rules and identification of *Chandas* included in the syllabus of Delhi University's B.A programme can be obtained very easily with examples of all the verses (Meena R. K., 2015)

The present survey is a collection of the secondary research data works, summarises and meticulously organises the research conducted on various aspects of SI as depicted in DS and specifically MS. It further, analyses the available literary concepts in MS and helps the upcoming researchers to explore this research area more effectively. The discussion above clearly highlighted the fact that different scholars presented diverse ideas and very different aspects of the traditional concepts of MS. Different types of research theories and trends were introduced, investigated, envisaged and analysed to explore new ideas of research. It also explored the avant-garde dimensions concomitant to philosophical, political, economic, psychological, medical and environmental aspects. Research works of Elder (2006), Kumar (2014), Sankhder (2003), Saxena and Indoliya (2011) deals with the primitive knowledge tradition implored in the MS. On the other hand, Bansal (2010), Chamola (2007), Donald (2017) etc. discusses the modern themes of MS.

On evaluating the trends, it was found that majorly the researchers conducted in the past are theoretically exhaustive and qualitative in nature. Comparative, critical, analytical and descriptive methodologies have also been adopted globally to study the various concepts found in MS. Critical and analytical evaluation of the research is imperative as it helps building integrated understanding of different perspectives in DS. Thus, on the basis of the above survey it can be concluded that lot of digital efforts and computational researches have been conducted on disparate areas but digitalisation of DS is barely touched upon. Hence, information retrieval system for MS including

¹⁷² <http://cl.sanskrit.du.ac.in/LearnSandhi>

¹⁷³ <http://cl.sanskrit.du.ac.in/kritSiddhi>

features like online indexing and concept mining will prove to be pioneer and paramount in the field of Sanskrit CL.

Chapter Three

Data Collection, Digital Databases and Research Methodology of Online Indexing and Concept Mining

The objective of the present research is to develop a web-based system for instant information retrieval from the MS text. Information retrieval system retrieves the information from the unstructured data of MS text (Anju and Chandra, 2019). In the case of current research, the data extracted is the entire text of MS which includes 2700 verses categorised into 12 chapters denoting various concepts related to social management and institutions of ancient India. These texts not only expound knowledge on social management but it can be also considered as the viable source of various sciences. The protection of natural resources were key focus of the society mentioned in MS. The MS was selected for online indexing because it incorporates several branches of knowledge including philosophy, law and legal aspects, management and economics, ethics and rules for greeting, government, politics, electoral system, statecraft, warfare, history, religion, elements of social management such as; family-marriage-kinship-household norms, environment and health care and ethnology etc. MS text is not only eminent but is also very large. Therefore, it becomes impossible for someone to search for a specific keyword in it. The main objective of this research is to gain familiarity with the phenomenons in DS and to achieve new insights into MS. Online indexing and information retrieval will be of tremendous use to the researchers and users to work on any specific concepts and to procure accurate data and information of the particular terms of MS.

1. Data and the Data Collection

The foremost requisite to conducting any research is the collection and sorting of data. Data collection is the gathering of useful information related to the topic of the research (Wilson & Fox, 2013). It is invariably an essential part of conducting any research. The most critical objective of data collection is ensuring that the data collected is information-rich, accurate, valid, authentic, relevant and reliable (Morgan & Harmon, 2001). To carry out the present research 2703 *ślokas* have been rendered from MS

(Sapsford & Jupp, 1996; Weller & Romney, 1988). The chapter-wise distribution of the verses data of MS is shown in table 3.1.

CHAPTERS	NO. OF VERSES
1	119
2	249
3	286
4	260
5	169
6	97
7	230
8	420
9	336
10	131
11	286
12	120
TOTAL	2703

Table 3.1: Manusmṛiti Verses Data

1.1 Primary and Secondary Text used for Data Collections

The MS text explained by the Kauṇḍinnyāyana (2014), Pravin Pralayankar (2010) and *Viśuddha Manusmṛiti* by Prof. Surendra Kumar (1996) have been selected as primary texts for original text and Hindi translation. Though the English translation is done by the researcher based on translation done by Buhler (2004). The exegesis of all the *ślokas* has been done using the *Medhātithi Manubhāṣya* (Jha, 2016) and *Kullukabhaṭṭa's Manavarthamuktāvali* (Kauṇḍinnyāyana, 2014). The other eminent texts in this field are MS authored by Rajveer Shastri (2000), Pt. Rameshwar Bhatt (2015), *Manusmṛiti With Manvartha Muktavali* by Rakesh Shastri (2005), Conceptualizations in the *Manusmṛiti* by Parnasabari Bhattacharya (1996), *Manu-Manusmṛiti an Appraisal* by Dr. Urmila Rustagi and Dr. Sudesh Narang (1996), *Sixteen Minor Smṛtis* (Vol. 1 and 2) by Manmatha Nath Dutt (2006), *Manusmṛiti: Sanvay*

Anuvadmanushyabhasikabhavavagaahineebhashatikopata by Dr. Urmila Rustagi (2003), *Manusmṛti Eka Mulyāṅkana* and *Manusmṛtiḥ* (Vol. 1-13) by Dr. Urmila Rustagi and *Kalyāṇa Viśeṣāṅka Dharmank* published by Gita Press, Gorakhpur was used as secondary texts for the data collection, translation, explanation and analysis.

As these texts are available in printed form. First, all the above-mentioned textbooks were collected, their contents were extracted and then the verses of the entire MS text were digitized in UTF-8 Devanagari format and stored in an exclusive text file. These text files incorporate the chapter and verse information for accurate referencing. Each and every verse in the MS database is assigned a unique id. The format and description of the digital databases are shown in section 2.

2. Digital Databases for MS

As discussed above, the information mining system mines information from the MS text. Therefore, to extract the exact information various databases are created for a specific task. Currently, the data is stored in text files and finally, it will be exported in the database. In computational terminology, a database is an organized collection of data stored and accessed electronically. Small databases can be stored on a file system while large databases are hosted on computer clusters or popularly known as cloud storage. Digital Databases are a set of computerised collections used to record and store information digitally and accessible through the computer program for specific purposes. These are a comprehensive, sometimes exhaustive, collection of computer files or computer records pertaining to a specific subject. Thus, Verses of MS are stored in a digital database with its reference in UTF-8 format in Devanagari script. In layman's language, data or the collection of MS *ślokas* are extracted, proofread and digitally stored.

The entire collection of all the original verses of Sanskrit, references, the concepts extracted from the verses, Its Hindi and English translation and the detailed analysis of each *śloka* is based on the above texts. All the databases are designed in a specific format and that particular database structure has been replicated in the databases to follow. Each database contains a serial number, verse, English or Devanagari translations, chapter number and verse number, all of which are separated by a single tab, as demonstrated in table 3.2. The major reason for following the similar

structure in all the different databases is that it ensures the analogous relationship between different computational axioms, maintains affinity and homogeneity, and perpetuates the congruence and parallelism between all the divisions imperative to the research data. There are various digital databases developed to serve disparate purposes, yet, it streamlines and perseveres the smooth working of the web-based system.

SR	Sanskrit Verse	Chapter No.	Verse No.
1	मनुमेकाग्रमासीनमभिगम्य महर्षयः । प्रतिपूज्य यथान्यायमिदं वचनमब्रुवन् ॥	1	1
2	भगवन् सर्ववर्णानां यथावदनुपूर्वशः । अन्तरप्रभवाणां च धर्मान् नो वक्तुमर्हसि ॥	1	2
3	त्वमेको ह्यस्य सर्वस्य विधानस्य स्वयम्भुवः । अचिन्त्यस्याऽप्रमेयस्य कार्यतत्त्वार्थवित् प्रभो ॥	1	3
4	स तैः पृष्टस् तथा सम्यगमितौजा महात्मभिः । प्रत्युवाचाऽऽर्च्य तान् सर्वान् महर्षीञ् श्रूयतामिति ॥	1	4
5	आसीदिदं तमोभूतमप्रज्ञातमलक्षणम् । अप्रतर्क्यमविज्ञेयं प्रसुप्तमिव सर्वतः ॥	1	5
6	ततः स्वयम्भूर् भगवानव्यक्तो व्यञ्जयन्निदम् । महाभूतादि वृत्तौजाः प्रादुरासीत् तमोनुदः ॥	1	6
7	योऽसावतीन्द्रियग्राह्यः सूक्ष्मोऽव्यक्तः सनातनः । सर्वभूतमयोऽचिन्त्यः स एव स्वयमुद्भवौ ॥	1	7
8	सोऽभिध्याय शरीरात् स्वात् सिसृक्षुर् विविधाः प्रजाः । अप एव ससर्जाऽऽदौ तासु बीजमवाऽसृजत् ॥	1	8
9	तदण्डमभवद् धैमं सहस्रांशुसमप्रभम् । तस्मिञ् जज्ञे स्वयं ब्रह्मा सर्वलोकपितामहः ॥	1	9
10	आपो नारा इति प्रोक्ता आपो वै नरसूनवः । ता यदस्याऽयनं पूर्वं तेन नारायणः स्मृतः ॥	1	10

Table 3.2: Sample of MS Database

2.1 MS *mūla ślokas* Database/Text File:

A total of 2703 *mūla ślokas* from MS as depicted in table 3.1 have been digitalized. The development structure for this database is developed in the format of a series of the serial number (SR), the original verse in the Sanskrit language, chapter number and verse number, all of which are separated by a tab. The entire collection of the verses along with its corresponding reference data has been preserved in properly designated databases. This database is maintained in the Devanagari script. The sample of tabular format is given in table 3.2.

2.2 English Translation Database / Text File:

This system is capable enough to provide the English translation of each verse of MS or any concept available in the MS. The English translation is done by the scholar herself on the baselines of Buhler (2004). The developmental structure for this database is also similar to the previous database. It is formatted in the orderly fashion of a serial number (SR), followed by the English translation, chapter number and verse number, all of which are separated by a tab. The entire collection of the English-translated verses along with their corresponding reference data has been preserved in designated databases. This database is maintained in roman (IAST format) script. The sample of tabular format is given in table 3.3.

SR	Translation of the Sanskrit Verse	Chap No.	Verse
1	The great sages (saints) approached Manu, who was seated very calmly and with a collected composed mind. They paid their tributes and having duly worshipped Manu, spoke as follows:	1	1
2	The Rishis (sages, saints) requested Manu (the divine one), to explain the tenets of Laws and sacred principles-practices, pertaining to Varn-division (caste system); and of the intermediate ones.	1	2
3	The Rishis praised Swayambhu Manu for the knowledge-enlightenment attained by him. According	1	3

	to them he alone, was aware of the purport (wish, object, tenor, longing, desire, intent, significance, knowledge) of the soul. They desired to know the whole ordinance of the Self-existent (Swayambhu), which is unknowable and unfathomable.		
4	He, whose power (knowledge) is measureless, pleased and obliged by the high-minded great sages, duly honoured them, and answer; listen!	1	4
5	The (universe) existed in the complete Darkness, unperceived, destitute of distinctive marks, unattainable by reasoning, unknowable, wholly immersed, as it were, in deep sleep.	1	5
6	Then the divine Self-existent, Almighty (Svayambhu), indiscernible, appeared with (creative) power, revealed-evolved himself along with the basic elements (components essential for life; earth, water, fire, sky and air) dispelling the darkness.	1	6
7	He who can be perceived by the internal organ (alone), who is subtitle, indiscernible, and eternal, who contains all created beings and is inconceivable, shone forth of his own will.	1	7
8	With the resolution of the genesis of the universe, he, desired to produce beings of many kinds. Thus, from his own body, created the waters, and later, placed seed in it.	1	8
9	That (seed), in brilliancy equal to the sun; manifested into a golden egg. From that egg Brahman; the progenitor of the whole world, the creator of all abodes self- evolved from it.	1	9
10	The waters are called narah, (for) the waters are, indeed, the offspring of Nara; as they were his first residence (ayana), he thence is named Narayana.	1	10

Table 3.3: Sample of English Translation Database

2.3 Database / Text File for Hindi Translation:

The Hindi translation of MS has been done on the basis of *Medhātithi's Manubhāṣya* (Jha, 2016). Initial working of the translations was carried out in separate text files in the UTF-8 *Devanagari* format. The development structure for this database is also similar to the previous databases in the format of a series of the serial number (SR), Devanagari translation, chapter number and verse numbers, all of which are separated by a tab. The entire collection of Hindi translations along with the corresponding reference data has been preserved in designated databases. This database is maintained Devanagari script. The sample of tabular format is given in table 3.4.

SR.	TRANSLATION OF THE SANSKRIT VERSE	Chapter No.	Verse No.
1	एकाग्रचित्त और सुख से बैठे हुए मनु महाराज के पास जाकर यथोचित रूप में प्रतिपूजन करके महर्षि लोग इस वचन को बोले ॥	1	1
2	हे भगवन्, ब्राह्मणादि चारों वर्णों के (ब्राह्मण, क्षत्रिय, वैश्य और शूद्र के) और वर्णों के अन्तराल में जनमे हुए मूर्धावसिक्त, अम्बष्ट, निषाद, सूत, मागध, वैदेह इत्यादि जातियों के भी धर्मों को यथार्थरूप में क्रमशः बताने के लिए आप योग्य)समर्थ(हैं ॥	1	2
3	हे प्रभो, आप अकेले ही अचिन्त्य और अप्रमेय स्वयम्भू)अपौरुषेय(वेद के अग्न्याधानादि कृत्यरूप तथा परब्रह्मतत्त्वरूप अर्थ को जानने वाले हैं ॥	1	3
4	महात्मा महर्षियों द्वारा उस प्रकार से पूछे गये अपरिमित तेज वाले उन मनु ने उन सभी महर्षियों का सत्कार करके 'सुना जाय' ऐसा कहकर उत्तर दिया ॥	1	4
5	यह संसार तमोरूप में स्थित, अज्ञात, ज्ञापक लिङ्ग से रहित, तर्क का अविषय, शब्द से भी अविज्ञेय तथा सर्वथा सुप्तावस्था में अवस्थित जैसा था ॥	1	5

6	उस के बाद भगवान्, अव्यक्त, व्यापक सृष्ट्यादिसामर्थ्य वाले, प्रकृति के प्रेरक, स्वयं होने वाले परमेश्वर इस आकाशादि-महाभूतादि जगत् को व्यक्त करते हुए प्रकट हुये थे ॥	1	6
7	जो ये इन्द्रियों से ऊपर के मन से वेद्य, सूक्ष्म, अव्यक्त, सदाकाल रहने वाले, सम्पूर्ण भूतों के समष्टिरूप में स्थित, अचिन्त्य परमात्मा हैं वे अपने आप प्रकट हुए ॥	1	7
8	उन परमेश्वर ने सृष्टि का सङ्कल्प करके विभिन्न प्रकार की प्रजाओं की सृष्टि करने की इच्छा करते हुए ब्रह्माण्डसृष्टि के आदि में अपने शरीर से जल की सृष्टि की और उन में बीजे(को छोड़ा ॥	1	8
9	वह बीज सूर्य के समान प्रकाश से युक्त स्वर्णमय अण्ड हो गया, उस में सब लोक के पितामह)सृष्टि करने वाले(ब्रह्मा अपने आप उत्पन्न हुए ॥	1	9
10	आपो नारा इति प्रोक्ता आपो वै नरसूनवः । ता यदस्याऽयनं पूर्वं तेन नारायणः स्मृतः ॥	1	10

Table 3.4: Sample of Hindi Translation Database

2.4 Database / Text File of Concept List:

The system is extremely efficient in mining the query of each concept. Therefore, a list of the concepts depicted in MS is collected manually and kept in a text file in specific format with unique id of each concepts. This database boosts concept aided searching and thus, provides relevant and appropriate information. Since the users can search any concept of the MS, complete listing of concepts and themes from MS is created and along with its unique identification (ID) tags, it is also stored in a separate database. All the concepts listed in this file are maintained in Hindi (Devanagari UTF-8 format) and International Alphabet of Sanskrit Transliteration (IAST) which is equivalent to global English language. It also helps to validate the concepts researched in MS and unique ID helps in finding the exact information corresponding to it. Descriptive Samples of the aforementioned databases are shown in table 3.5.

SR	CONCEPT	IAST	ENGLISH
1	वर्ण	Varṇa	Varna
2	संस्कार	saṃskāra	Sacraments
3	नैमित्तिक कर्म	naimittika karma	
4	आश्रम	Āśrama	Ashrama
5	राजधर्म	rājadharmā	Duties of king
6	महायज्ञ	mahāyajña	Sacred oblations
7	पुरुषार्थ	puruṣārtha	Purushartha
8	भक्ष्याभक्ष्य	Bhakṣyābhakṣy	Edible and non-edible
9	शौच	Śauca	Cleanliness
10	अशुद्धि	Aśuddhi	Impurity
11	स्त्रीधर्म	strīdharmā	Duties of women

Table 3.5: Sample of the Concept Database

2.5 Database / Text File of Concept Tagging:

Concept mining mines the information from unstructured data. MS contains many concepts but the word denoting the specific concepts does not necessarily, appear in the text directly. In such cases, direct indexing methods completely fail to render the conceptual information. Therefore, the concept mining techniques are used to mine such types of verses of MS. A database of the concept tagging is created and stored in a text file in a specific format. This database helps to mine the complete information for any MS concepts. The sample of the database is shown in table 3.5.

manu_id	Concept_id
1	1,1
2	58,20
3	4,1

4	5,6
5	20, 82
6	20, 82, 32
7	20, 82
8	7,10
9	1,5
10	3,8

Table 3.6: Sample of the Concept tagged Database

3. Research Methodology Adopted for Online Indexing and Concept Mining

There is a huge amount of data available in the Information Industry today. This data is of no use until it is converted into useful information. It is necessary to analyze the huge amounts of data and extract the most relevant and appropriate information from it. Due to the increase in the amount of information, the number of text databases is growing tenfold. Data Mining as defined in the previous chapter is the procedure of extracting information from huge sets of data. In other words, we can say that data mining is extracting relevant knowledge from the pool of data. Text databases consist of a huge collection of documents. They collect this information from several sources such as news articles, books, digital libraries, e-mail messages, web pages, etc. In many of the text databases, the data is semi-structured. For example, a document may contain a few structured fields, such as title, author, publishing date, abstract etc. But along with the structured data, the document contains unstructured text components as well (Mohotti, Lukas, & Nayak, 2019). Without knowing what could be in the documents, it is difficult to formulate effective queries for analysing and extracting useful information from the data. Users require tools to compare the documents and rank their importance and relevance. Therefore, text mining has become popular and an essential theme in IR. IR deals with the retrieval of information from a large number of text-based documents (Aggarwal, 2015).

Data mining deals with the kind of patterns that can be mined. Based on the kind of data to be mined, there are two categories of functions involved in Data Mining

- Descriptive
- Classification and Prediction

Thus, this research aims to develop a web-based search (Anju & Chandra, 2018), IE, and an instant IR system for MS. This IR system automatically extracts the available information from mechanical documents or other e-sources. This process is accomplished through a “Natural Language Processing (NLP)”. (Chandra, 2021). It is an automated or implicitly, digital system of accepting inputs and generating outputs.

3.1 Research Methodology Adopted for Online Indexing for MS

Online indexing for MS searches the whole database of MS verses where the searched text appears directly and produces the information with complete reference. Web Search engine techniques are applied to produce the result (Patil, Pawar and Patil 2013). The system does not use any sort of pre-developed index to search the query in MS text. It searches instantly when a query from the user interface is received and generates the result corresponding to the query for display (Bhatia, et al. 2011). Traditionally any search engine works in three stages:

Crawling: Search engines collect text or information available in another format such as images, and videos from the internet. Typically it collects the information with the help of automated programs called crawlers (Olston & Najork, 2010; Raghavan & Garcia-Molina, 2000).

Indexing: Search engines analyse the crawled text, images, and video files and store the information in the search engine index list. A search index is a large database for a particular search engine.

Serving Search Results: The search engine returns the information that is relevant to the particular user’s query. Relevancy is determined by many factors such as the user’s location, language, mode of the device, etc.

The current system follows all three stages mentioned above to produce the research of searched query. The only difference is that search engines produce the information of the documents, where that particular word appears. But this system

furnishes the particular verses where the searched text appears. As this process does not serve the complete task, it only produces the verses that are directly available in the search query, it does not show the result of those sentences in which the tagged verse is not directly available. Therefore, concept mining techniques are applied here.

To search any given word in MS, the system creates the word index of each verse of MS automatically and instantly. For information extraction, the first step is the verification of the input. If the input is found to be accurate, then the index of each word is automatically generated. Based on this index, the information is searched in associated databases. The received information is sent to display. For creating an index list of each verse, preference is given to those words which are found in the form of exact and complete words as inscribed in the sources of the texts. Second preference is given to the words starting with the searched word coming in first in the string of *śloka*. Similarly, the searched word appearing at the end of the string is ranked in the third order and lastly, if the word searched is found in the middle or anywhere else, in the *śloka* string is ranked fourth. The system uses four types of major methods to create the instant index and display the result.

3.1.1 Search by whole Word

In this method, the index of all the words in which the word searched by the user is automatically generated in the format of a whole word. The term matching is a very important subject in the wider domain of text processing. This is particularly evident in literature or linguistics where data are composed in huge corpus and dictionaries. This applies as well to computer science where a large amount of data are stored in linear files. For example, if the input query of the user is “*varṇa* or वर्ण”, then the result will contain an index of all those verses wherever the term “*varṇa* or वर्ण” appears as a complete word¹⁷⁴. This technique is popularly known as an exact word search.

¹⁷⁴ शूद्रो गुप्तं अगुप्तं वा द्वैजातं वर्णं आवसन् । अगुप्तं अङ्गसर्वस्वैर्गुप्तं सर्वेण हीयते ॥ मनुस्मृति 8.374

3.1.2 Search by Starts with Input Word

The second method of automatic indexing is the method where the result for the input query submitted by the user, is produced based on the hierarchy of the position or placement of the term in that particular word of any verse. In such case, the automatically created index will consists of those verses where the words searched by the user will be placed at the beginning of the word displayed in the *ślokas*. For example, if the input query of the user is “*varṇa* or वर्ण”, then the result displayed in this case will contain an index of all those verses beginning with the term “*varṇa* or वर्ण”¹⁷⁵.

3.1.3 Search by Ends with Input Word

The third search technique is online searching of input query by ends with. By this method, the concept or the term that the user search, appears at the end of the word adduced in the *ślokas*, thus, the index is automatically generated with that particular word in focus. For example, if the input given by the user is “*varṇa* or वर्ण”, then wherever the words ending with “*varṇa* or वर्ण”, are found in the *ślokas*, all those verses will be automatically indexed¹⁷⁶ and the result obtained will be displayed in the form of the output.

3.1.4 Search Input Word anywhere in the Word.

In this method, the term or the concept searched by the user is placed in the middle of the word received in the *ślokas*, then the index is automatically generated with the whole word. For example, if the input given by the user is “*varṇa* or वर्ण”, then the word “*varṇa* or वर्ण”, is found in the *ślokas*, all those verses will be automatically indexed¹⁷⁷ and the result obtained will be displayed in the form of the output. The methodology can be understood with the help of the flowchart shown in Figure 1.

¹⁷⁵ एषा धर्मस्य वो योनिः समासेन प्रकीर्तिता । संभवश्चास्य सर्वस्य वर्णधर्मान्निबोधत ॥ मनुस्मृति 2.137

¹⁷⁶ गोमूत्रं अग्निवर्णं वा पिबेदुदकं एव वा । पयो घृतं वा मरणाद्गोशकृद्रसं एव वा ॥ मनुस्मृति 11.91

¹⁷⁷ बाह्यैर्विभावयेल्लिङ्गैर्भावं अन्तर्गतं नृणाम् । स्वरवर्णेङ्गिताकारैश्चक्षुषा चेष्टितेन च ॥ मनुस्मृति 8.25

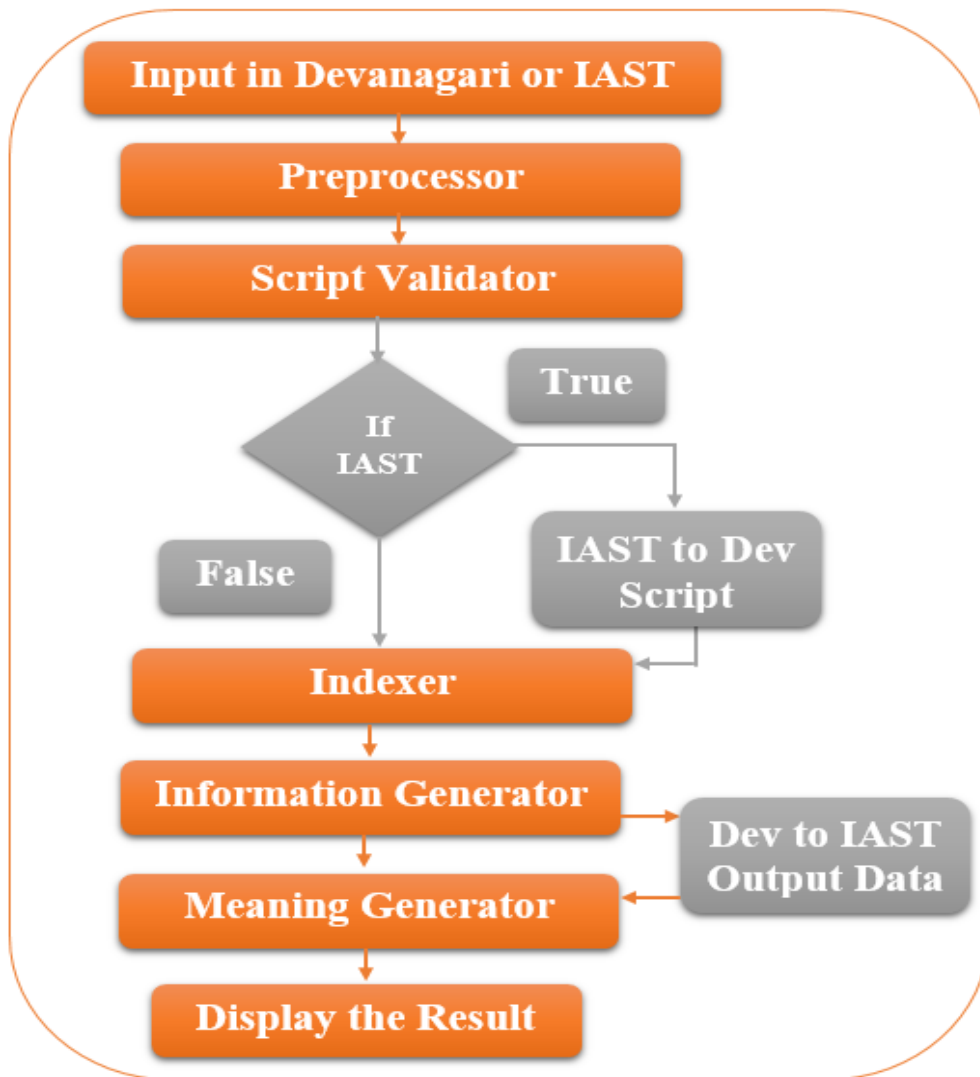


Figure 1: Flowchart of Online Indexing

3.2 Research Methodology Adopted for Concept Mining from MS

Concept mining is a subtask of information extraction that mines the information automatically and extracts relevant terms from a given corpus (Bichindaritz & Akkineni, 2006). There are many methods used for concept mining. Text Clustering (Cutting, Karger, Pedersen, & Tukey, 2017; G & Lekha, 2014) methods are used to extract information from unstructured data. In the case of this research, the concept tagging is done manually for each verse of MS. Based on tagging technique, the system produces an accurate result. We present the algorithms for the tag-based text clustering method (Zamir and Etzioni 1998). The tag is created manually in MS verses to denote

the particular concepts. The sample of the tag is shown in table 3.5. Based on these tags all verses of the MS are tagged with the unique id based on the subject matter discussed in each verse of MS. The sample of this database is shown in table 3.6.

To mine the verses of any concept from MS, the system first check the input concept and assign a unique id, then the system searches for this unique id in the tagged verses. After matching any tags, the system collects the corresponding verses and sends for further process.

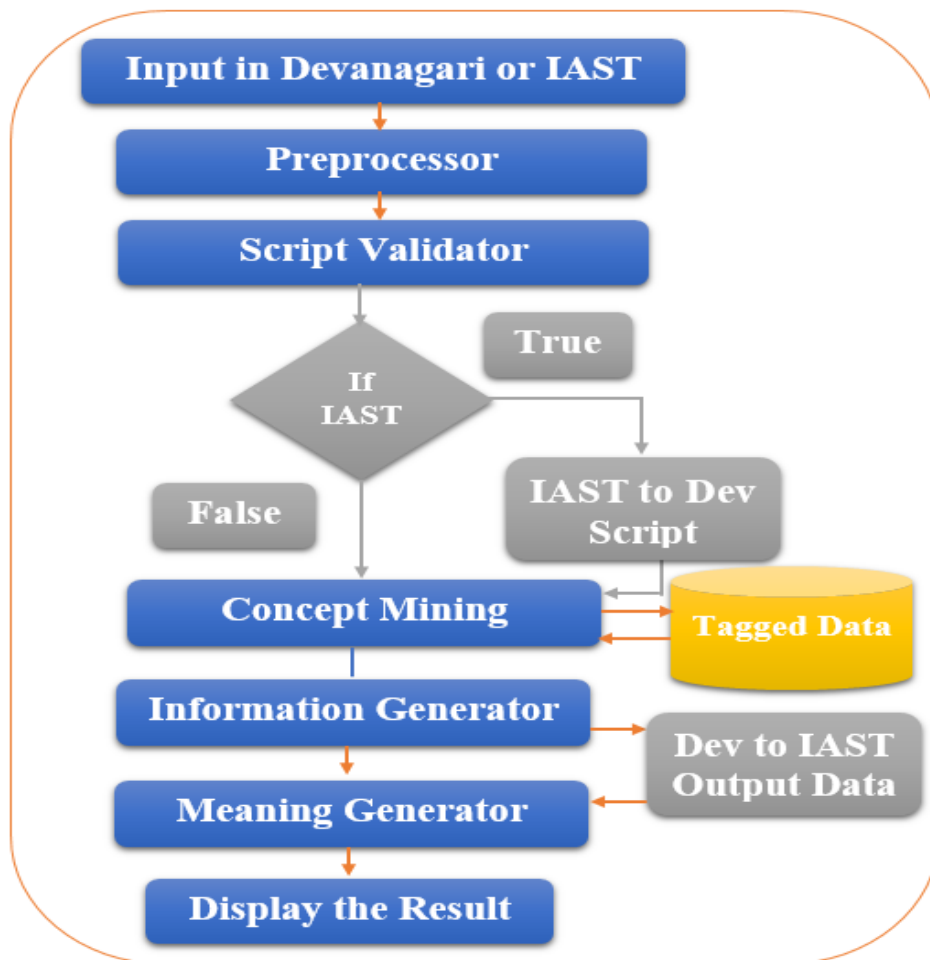


Figure 2: Flow Chart of Concept Mining

Chapter Four

Computational Platform for Online Indexing System for Manusmṛiti

The extensive cultural history encapsulates the treatises of Ancient Indian Social Institutions (SI) and is widely discussed in MS. It carries viable ancient Indian knowledge tradition as depicted in MS. It incorporates a variety of genres for sciences and arts such as family law and legislation, civilization, culture, ritualistic procedures, environment, economics, commerce and finance studies, management, mathematical and medical sciences etc. SI represents a distinct tradition of civilization formation, society development and community living. The texts of the MS are in the Sanskrit language and due to its expansive subject stream, it is later translated into various other languages globally. With the emersion of the internet, the advancement of digital technologies and the IT boom, information is accessed and exchanged via digital platforms. MS texts are studied not only by Sanskrit scholars but also referred by historians, sociologists, political scientists, economists, law enthusiasts and linguists globally. Despite its eminence source of knowledge and variety of topics, there is a major setback in digitizing and online information mining for MS texts. The major problem is that the MS text is neither available online to access nor any information mining systems are available where researchers can find the information for further research. Therefore, the objective of digitization and development of an online system for instant information retrieval for the MS text is to provide access to the MS globally.

To achieve this goal, the text of MS is digitized and other information is stored in a specific format as discussed in chapter 3. The web-based user interface fulfills the requirement to give the input and receive the output. The web-based system describes the communications between applications, middleware systems and databases to ensure that the multiple applications work simultaneously. Typically, when anyone browses the Internet, they use Web Browser softwares such as Internet Explorer, Google Chrome, Microsoft Edge, Safari or Mozilla Firefox. The computer where the user uses a browser to obtain the web pages is called a client-side. And the machine which

provides Web pages is called a server-side. In technical parlance, the client side is called the front-end and the server side is known as the back-end.

Components of Web-based Applications

Generally, web-based applications encompass several components. It can be categorized into two major areas; User Interface or Front End Components and Structural or Back-end Components. There are two different sub-programs running side-by-side in any typical web application. These are as follows:

- **Client-side Programs:** The program for the browser responds to some user input. The client component is developed in CSS, HTML, and JS. As it exists within the user's web browser, there is no need for an operating system or device-related adjustments. The client component is a representation of a web application's functionality that the end-user interacts with.
- **Server-side Programs:** The program for the server responds to the HTTP requests. The server component can be built using one or a combination of several programming languages and frameworks, including Java, .Net, NodeJS, PHP, Python, and Ruby on Rails. The server component has at least two parts; program logic and database.

How do Web Applications Work?

A typical web application works step by step in an orderly fashion. A user or client sends a request to a web server using the internet through either a web browser or the user interface of any app. The request submitted by the user is forwarded to the corresponding web application server by the webserver. Then the web application server performs the requested task and then generates the appropriate results. After that, the generated results are sent from the web application server to the webserver. The web server then responds back to the client and the requested information is displayed to the user. Any programming language can be used for developing any web app. User interface is generally developed using HTML because it supports the browser. In other words, HTML relies on web browsers to make the app executable. A web server is required in order to manage client-side requests, as well as an application server to

perform the relevant tasks. Sometimes a database may also be needed to store the huge data.

Since it's an online system, it is imperative to understand the web technology applied to develop this system, where the user can submit input and receive output. The technology adopted for this is the creation of an HTML page, server, computer program, etc., through which information is retrieved and conceptual information is mined from digitally extracted data of MS text. There are majorly two dominant components in any web technology, that is; Front End and Back End. Both of them are auxiliary to each other, and possess salient features which are exclusive to self, yet are mutually independent and in conjunction, as they, play a principal role in web development. In technical parlance, the front-end is also known as the 'client-side'. On contrary, everything that happens in the foreground is denoted as Back-end. It is considered the core component of web development. Front-end can be defined as an all-visual aspect of the website that is the electronic page appearing on the user's screen which he can see, interact with and have an experience. All the techniques that are used to create front-end webpages and make them look more attractive, is the responsibility of the backend processes which are not visible to the users.

What is Front End Development?

The objective of designing any website is to ensure that when the users visits the site, the information they witness is relevant and in a format that is easy to read and understand. Front-end development is a style of computer programming that deals with customer-facing services and visual aspects. It focuses on the coding and creation of elements and features of a website that will be seen by the user. The front end visible to the user is called as User Interface. Front-end developers make sure the site is easy to interact with while also running smoothly. It transfigures the complicated backend processes to a simpler understandable user's perspective through graphical ways. It aims at achieving a perfect user interface, speed, performance, and availability of the webpages. Also known as client-side interface, front-end developers garner expertise in HTML, CSS and JS for the creation of websites and apps. These technologies adopted for front-end development constructs the base platform for page rendering and front-end engineering.

Apart from these three components, the front-end family includes a variety of libraries and dialects. It includes visual elements like a landing page, buttons, forms, layouts, navigations, menus, and aesthetics such as images, videos, graphics, animations, etc. There are disparate front-end techniques and technologies that are used in the development of web and mobile-based apps. It includes JavaScript, HTML, CSS, ReactJS, React Native, Angular, Flutter, Node Package Manager (NPM), Vue.js, Ionic, BootStrap etc.

What is the Back End Development?

Pursuits that are carried out at the rear-end of the computer programming which is invisible to the users are referred to as back-end development. Back-end development covers server-side web application logic, integration and activities, like writing APIs, creating libraries and working with system components. Backend stores and analyses data and it is the server-side of the software. It also ensures smooth application performance. Backend development sends and receives information, communicates with the frontend and displays the data as a web page. Backend technologies are the backbone of the software development process. Backend is the only technology that makes the website or application perform well, be responsive, fast, and functional. A backend developer creates code that does relational mapping to retrieve data from a database. MySQL, PostgreSQL, SQL SERVER, MongoDB and Oracle Database are some of the most widely used DBMS. There are many backend programming languages available such as JavaScript, Python, Ruby, PHP, Java, Golang etc. The Backend technologies and tools vary for different types of development, such as for mobile development the back end can be developed in Ruby, Node.js, Django, and PHP. There is no single best language for the backend, as it depends on the type of the application.

Computational Platform used for Online Indexing System for MS

The online indexing and concept mining system for MS is a web-based system. A user interface has also been developed for the purpose of searching for the user to interact and submit their query. The system facilitates two kinds of input options and furnishes analysed output in the corresponding format. The first input mechanism is

‘Direct Search’ where the user can enter any keyword in Devanagari UTF-8 or in Roman IAST and receive all the references, translations and exegesis from the MS of the input word. The second input option is a ‘Dropdown Menu’ facility where one can just select the keyword from the list of pre-created concepts of MS and quickly obtain accurate information related to it. Clicking on an indexed word, the system displays the details with the śloka in which it occurs. The user interface accepts the input given by the user, pre-processes it and produces the corresponding output on the same page. A screenshot of this user interface is shown in Figure 4.2.

Since it’s an online system, it is imperative to understand the web technology applied to develop this system, where the user can submit input and receive output. The technology adopted for this is the creation of an HTML page, server, computer program, etc., through which information is retrieved and conceptual information is mined from digitally extracted data of MS text. This can be understood visually from Figure 4.1.



Figure 4.2: Typical Web page Development

There are majorly two dominant components in any web technology, that is; Front End and Back End. Both of them are auxiliary to each other, possess salient features which are exclusive to self, yet are mutually independent and in conjunction,

they, play a principal role in web development. In technical parlance, the front-end is also known as the 'client-side'. On the contrary, everything that happens in the foreground is denoted as Back-end. It is considered the core component of web development. Front-end can be defined as an all-visual aspect of the website that is the electronic page appearing on the user's screen which he can see, interact with and have an experience.

1. The Front End (Client Side):

The front-end is the part of an online system that a user can see and interact with directly. In a more technical sense, it is known as 'client side' programming. The front-end includes everything that users feel and experience directly. Such as text colour, styles, images, graphs and tables, buttons, colours, and navigation menus. The front end is developed using HTML, CSS and JavaScript languages. It also includes all the structure of the website, design, behaviour, and content seen on the browser screen when websites, web applications, or mobile applications open. The front end should be attractive, user-friendly and responsive. The appearance of the website on any screen and device should be rendered properly.

The front end of the Concept Mining and Online Indexing System for Manusmṛiti is developed in Hypertext Mark-up Language (HTML5) scripting language. Cascading Style sheets (CSS) are used to make the web pages more attractive utilitarian, advantageous and useful. It is used for describing the presentation of a document written in an HTML. Java Script (JS) is used with HTML and CSS. JS, is a programming language that is one of the core technologies of the World Wide Web, alongside HTML and CSS. CSS and JS aid the beautification of a basic HTML webpage. The sample of front-end format is shown in figure 4.1.

1.1 Hyper Text Mark-up Language (HTML)

HTML, an acronym for Hypertext Mark-up Language is a pseudo name for a webpage. Its main function is to render the page on the web browser based on the written instructions. It was developed by Berners-Lee in late 1991. It was initially

released in 1993. It is a mark-up language used to create web pages and web-based apps.



Figure 4.3: Front End of the Concept Mining and Online Indexing System for Manusmṛiti

When a web browser opens a website page, its web server is sent as HTML. It describes the structure of a Web page, consisting of a series of elements that are responsible for instructing the browser on how to display the prescribed content. So far it has 5 versions, the latest version is HTML 5. It is more robust and has browser support. Unlike, programming language, it is a mark-up language and which identifies and describes the various components of a document such as headings, paragraphs, lists and becomes even more utilitarian including CSS and JS in HTML pages. Maintaining HTML and CSS Standards. The World Wide Web Consortium (W3C) maintains the standards for HTML and CSS. The sample of the HTML code is shown in Figure 4.3.

```

<!--[if IE 7]><html class="ie ie7" lang="en"><![endif-->
<!--[if IE 8]><html class="ie ie8" lang="en"><![endif-->
<!--[if (gte IE 9)|!(IE)]><!--><html lang="en"><!--<![endif-->

<head>
<!-- Basic Page Needs-->
<meta charset="utf-8">
<title>Information Extraction System for Manusriti</title>
<meta name="description" content="Department of Sanskrit, Delhi University">
<meta name="keywords" content="Sanskrit, MA, Ph.D, Dr. Subhash Chandra, Delhi University" />
<meta name="author" content="du.ac.in">

<!-- For Mobile Specific Metas-->
<meta name="viewport" content="width=device-width, initial-scale=1, maximum-scale=1">

<link href="static/css/bootstrap.css" rel="stylesheet" media="screen" />
<link rel="stylesheet" href="static/css/file/css/serpgrid.css">
<link rel="stylesheet" href="static/css/file/css/style.css">
<link rel="stylesheet" href="static/css/file/css/responsive.css">
<link rel="stylesheet" href="static/css/file/css/responsiveslides.css" />

<link rel="stylesheet" type="text/css" href="static/css/Menu/css/font-awesome.css">
<link rel="stylesheet" type="text/css" href="static/css/Menu/css/menu.css">

<script type="text/javascript" src="static/css/file/Menu/js/jquery.js"></script>
<script type="text/javascript" src="static/css/file/Menu/js/function.js"></script>

<link rel="stylesheet" href="http://www.jacklamoore.com/colorbox/example1/colorbox.css" />
<link href="favicon.ico" rel="icon" type="image/x-icon"/>

<script src="static/js/responsiveslides.js"></script>
<script src="static/js/bootstrap.min.js"></script>

<script>
$(function () {
  $("slider").responsiveSlides({
    auto: true,
    speed: 200,
    timeout: 500,
    min: 1,
    max: 1,
    nav: true,
    pager: true,
    keyboard: true,
    navPage: true,
    pagerPage: true,
    navArrows: true,
    slideEasings: 'ease',
    responsiveSlides({
      width: 1000,
      height: 250,
      border: 1,
      bordercolor: 'darkgray',
      borderwidth: 1,
      cellpadding: 0,
      cellspacing: 0,
      width: '95%',
      height: '25%'
    })
  })
})
</script>

<table border="1" class="main" bordercolor="darkgray" border="1" cellpadding="0" cellspacing="0" width="95%" height="25">
<tr>
<td class="main" width="100%" align="center" colspan="3">
<p class="fontHead" align="center"><b>मनुस्मृति के लिए सूचना निष्कर्षण</b></p>
<p align="center">Information Extraction System for Manusriti</p>
<p class="fontInfo" align="justify">
The <b>Digitization and Development of Information Extraction System for Manusriti (धर्मशास्त्रीय अद्ययन एवं सफ़ियन प्रोजेक्ट)</b> is a result of the research (R&D) carried <a href="mailto:mp11">Ms Arooshi Nigam</a> (M.Phil. 2021-2023) under the supervision of <a href="mailto:subhash">Dr. Subhash Chandra</a> with advisorship of <a href="http://sanskrit.du.ac.in/web/index.php?page=faculty">Prof. Daya Shankar Tiwary</a> Department of Sanskrit, University of Delhi, Delhi for the award of M.Phil. Degree. The title of dissertation is <a href="mailto:mp11">Development of Concept Mining and Online Indexing System for Manusriti</a>. The code were prepared by Research Scholar <a href="mailto:mp11">Ms. Arooshi Nigam</a> and <a href="mailto:mp11">Ms. Arooshi Nigam</a>. Data set and rules were prepared by Research Scholar <a href="mailto:mp11">Ms. Arooshi Nigam</a> and <a href="mailto:mp11">Dr. Subhash Chandra</a>.
</p>
</td>
</tr>
<tr>
<td class="samkhyas" width="100%" align="center" colspan="3">
<p class="fontInfo" align="center">
<b>धर्मशास्त्रीय अद्ययन एवं सफ़ियन प्रोजेक्ट के लिए सूचना निष्कर्षण का नाम चुनकर या आईएसटी (रोमन) में कोई शब्द लिखें जवाब अद्ययन का नाम चुनकर या आईएसटी (रोमन) में कोई शब्द लिखें जवाब अद्ययन में से चुनें</b>
</p>
<p align="center">(Type the word in Unicode or IAST (Roman) in the textarea or select the concept dropdown menus)
</p>
</td>
</tr>
<tr>
<td class="samkhyas" width="20%" valign="middle" align="center">
<form action="manu" method="POST">
<textarea name="itext" cols="35" rows="3" style="border:solid 2px #4b545f; font-family: Arial Unicode MS; color:black; font-size:20px"></textarea>
</td>
</tr>
</table>

```

Figure 4.4: Sample of the HTML Code used in Concept Mining and Online Indexing System for Manusmṛiti

1.2 Cascading Style Sheets (CSS)

While HTML is used to describe the content in the webpage, it is CSS that expounds on how that content should look and appear. Cascading Style Sheets are customary to display various elements of an HTML page such as screen, page or other media etc. Often we use it when there are many pages on a website and its style is the same, then instead of writing the code of HTML on all the separate pages, we write it in CSS. It is basically a time-saving technique as it controls the layout and formatting

of multiple web pages at once. CSS can be used on any platform, such as Windows, Linux, Macintosh etc. It was produced by Håkon Wium Lie on 10 October 1994.

```
/* ----- */
table.rstudent{
    border-collapse: collapse;
    border:2px solid navy;
    border-bottom-left-radius: 25px;
    border-bottom-right-radius: 25px;
}
th.rstudent {
    border:1px solid navy;
    font-size: 15px;
    font-weight: bold;
}

hr {
    display: block;
    margin-top: 0.5em;
    margin-bottom: 0.5em;
    margin-left: auto;
    margin-right: auto;
    border-style: inset;
    border-width: 1px;
}
p.fontHead{
    font-weight: strong;
    line-height:1;
    font-size: 35px;
    font-family: Arial, Helvetica, sans-serif;
```

Figure 5.4: Sample of the CSS

Fonts, colours, page layout, line spacing, background images and so on are all controlled by CSS. The most recent version ie. CSS3 supports special effects and basic animation can be embedded in the developed webpage. It is an eminent proficient tool for designing webpages and websites. CSS is edited in plain text editors like notepad etc, and then saved with the extension .css. It does not require any special editing tools. Style sheets are supported by all modern browsers such as chrome etc. CSS is maintained by the W3C's own CSS working group. CSS functions in three main ways.

- **Inline:** It is used in web pages where it is needed. You can use it to resize a particular HTML element.
- **Internal:** Its code is written within the `<style >` element in the middle of the head section at the top of the page and it is used by calling id or class anywhere in the same HTML page.
- **External:** It is most commonly used. This style is written in a .css file at some other place and when required it is linked with the full path within the `<link>` element in any HTML page and can be used by calling id or class anywhere in that file.

In current research Inline, Internal and External CSS is used. A sample of the CSS page is shown in Figure 4.4. The style.css, bootstrap.css, font-awesome.css, gallery.css, menu.css, responsive.css, responsiveslides.css, tooltip.css and zerogrid.css are used to complete the requirement of the current website.

1.3 Java Script (JS)

JavaScript also known as Dynamic Computer Programming Language, is a scripting language that is used to add interactivity and behaviours to web pages, manipulate the elements on the web page, the styles applied to them, or even the browser itself. There are other web scripting languages, but JavaScript (also called ECMAScript) is the standard and most ubiquitous. Java Script was invented by Brendan Eich in 1995 and was initially named Mocha. Later changed to LiveScript and finally to JavaScript. It is edited in the form of plain text with some special syntax. JavaScript allows the insertion of dynamic texts into HTML pages. Although JS has nothing to do with the programming language called Java, the syntax of both Java and JavaScript is influenced by the syntax of the C language. Over 97% of websites use JavaScript on the client side for web page behaviour. All major web browsers have a dedicated JavaScript engine to execute the code on users' devices.

The website of the Current system is uses JS for many purposes. Website Menu, Header, Footer, Gallery, Latest News, Responsive slides, and tooltips are designed using JS. A sample of the JS code of Menu.js is shown below.

```

document.write("<nav id='navigation'>");
    document.write("<ul id='main-menu'>");
        // Button 1 ## Home
        document.write("<li>                class='current-menu-item'><a
href='http://localhost:5000'>Home</a>");
            document.write("<ul class='sub-menu'>");
                document.write("<li><a
href='http://sanskrit.du.ac.in'                target='_blank'>Sanskrit
Department</a></li>");
                    document.write("<li><a
href='http://www.du.ac.in'                target='_blank'>Delhi
University</a></li>");
                        document.write("<li><a        href='abtus'>About
Us</a></li>");
                            document.write("<li><a        href='contat'>Contact
Us</a>");
                                document.write("<li><a
href='feedback'>Feedback</a></li>");
                                    document.write("</ul>");
                                        document.write("</li>");

        // Button 2 ## Language Analyzer
        document.write("<li class='parent'><a href='#'>Language
Analyzer</a>");
            document.write("<ul class='sub-menu'>");
                document.write("<li><a
href='sandhiAna'>Sandhi Splitter <br>(सन्धि विच्छेदक) </a></li>")
                    document.write("<li><a        href='supAna'>Subanta
Analyzer <br>(सुबन्त विश्लेषक) </a></li>")
                        document.write("<li><a        href='tinAna'>Tiñanta
Analyzer <br>(तिङन्त विश्लेषक) </a></li>")
                            document.write("<li><a
href='sanAna'>Sanādyanta Analyzer <br>(सनाद्यन्त विश्लेषक) </a></li>")
                                document.write("<li><a href='kritAna'>Kṛdanta
Generator <br> (कृदन्त विश्लेषक))</a></li>");

```

```

        document.write("<li><a
href='taddhita'>Taddhita Analyzer <br> (तद्धित विश्लेषक) </a></li>")

        document.write("<li><a
href='striAna'>Strīpratyānta Generator <br> (स्त्रीप्रत्यान्तरूप
विश्लेषक) </a></li>");

        document.write("</ul>");
        document.write("</li>");

// Button 3 ## Language Generator
        document.write("<li class='parent'><a href='#'>Language
Generator</a>");
        document.write("<ul class='sub-menu'>");
        document.write("<li><a
href='pratyahar'>Pratyahar Generator <br> (प्रत्याहारकर्ता) </a></li>");
        document.write("<li><a href='sandhi'>Sandhi
Generator <br> (सन्धिकर्ता) </a></li>");
        document.write("<li><a href='supGen'>Subanta
Generator <br> (शब्दरूपनिर्मापक) </a></li>");
        document.write("<li><a href='tinGen'>Tiñanta
Generator <br> (क्रियारूपनिर्मापक) </a>");
        document.write("<ul class='sub-
menu'>");
        document.write("<li><a
href='tinGen'>Primary Tiñanta <br> (धातुरूपनिर्मापक) </a></li>");
        document.write("<li><a
href='sanGen'>Secondary Tiñanta <br> (सनाद्यन्तधातुरूपनिर्मापक) </a></li>");
        document.write("</ul>");
        document.write("</li>");
        //document.write("<li><a
href='http://localhost:8000/kridanta/kritGenerator.spy'>Kṛdanta
Generator <br> (कृदन्तरूपनिर्मापक) </a></li>");
        //document.write("<li><a
href='http://localhost:8000/taddhita/taddhitaGenerator.spy'>Taddhita
Generator <br> (तद्धितरूपनिर्मापक) </a></li>");

```

```

//document.write("<li><a
href='http://localhost:8000/stri/striGenerator.spy'>Stripratyanta
Generator <br> (स्त्रीप्रत्यान्तरूपनिर्मापक)</a></li>");

document.write("</ul>");
document.write("</li>");
document.write("</ul>");
document.write("</nav>");

```

Output of the above JS code is shown in figure 4.5.

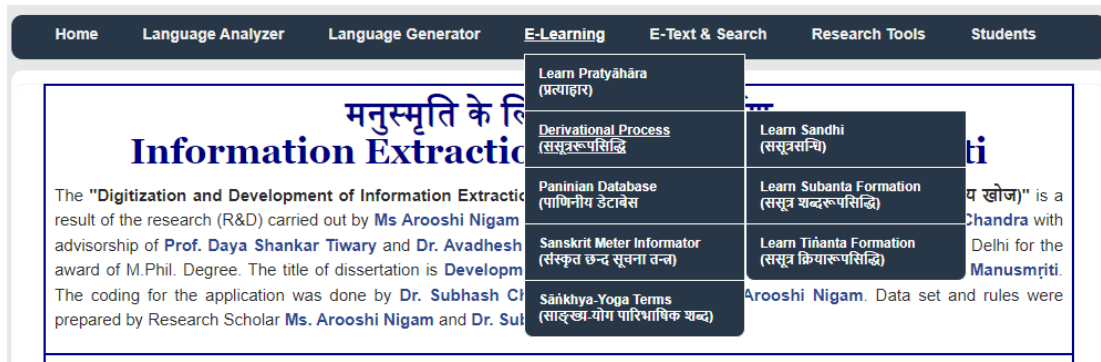


Figure 4.6: Menu Bar of the System developed in JS

2. The Back End or Server-side Programming:

Any web based system has various processes orchestrating in the background are called back-end. This is also known as server side. Back end basically deals with the entire foreground programming of the developed search mechanism based on the process of online indexing of the database. The server-side programming composes of various minor components to develop the final output for online indexing and concept mining system. User gives the input through User interface, pre-processor verifies the input, deletes all blank spaces and extra lines automatically. Other significant components such as script validator checks or validates the script of the given inquiry input; e.g. Devanagari (वर्ण) (or IAST (used for roman input such as English: *varna*). The detailed description of all these components shall be propounded later in the last chapter. This section focuses on the digital framework or techniques adopted to create and develop those components.

Back-end in any web-based system mainly concatenates computer programs, databases and webpages to any web server such as Apache, Apache Tomcat, Flask, Django etc. are used. Although, any programming language like C++, JAVA, Python etc. can be used for developing web-based systems, ideally, the web server is designated according to the selected programming language. For our system, Python as the programming language is selected for the development of web-based systems, MySQL for the database and Flask server to support Python. The general introduction of these is as follows:

2.1 Programming Language: Python

Python is a popular programming language. It is the most simple, uncomplicated and powerful programming language to learn and use. It is an interactive object-oriented, scripting language suitable for general purposes and common tasks at beginner's level and as well for high level programming projects. This programming language was created by Guido van Rossum and released in 1991. It is used for web development, system scripting, can be used for rapid prototyping, or for production-ready software development and software development to create workflows, create web applications, it is capable of handling big data and perform complex mathematical calculations technically. Python is compatible and works on different platforms such as Windows, Mac, Linux, Raspberry Pi, etc. It is actually a programming script, in which the code does not need to be precompiled to run the program. The language's design philosophy emphasizes code readability. Python claims that its syntax is very clear, its standard library is large and comprehensive. The prototyping for Python is very quick as it runs on an interpreter system, implying that the code can be executed as soon as it is formulated. It has a simple syntax very similar to the British language such as English and is comparatively easier than many other complex programming languages because it has syntax that allows developers to write programs with fewer lines and elementary coding. Python can be treated in a procedural; an object-oriented way or a functional way which makes this programming language easy to read, write and understand. Python can connect to larger database systems and it can also read and modify files. Python 2.0 was released in 2000 and introduced new features such as list

comprehensions, reference counting, cycle-detecting and Unicode support. Python 3.0, released in 2008, is the most recent major version of Python, which is quite popular. Readability and simplicity is the USP of python language. Ideally, Python is written in an Integrated Development Environment (IDE), such as Thonny, Pycharm, Netbeans or Eclipse which are particularly useful when managing larger collections of Python files but for the basic general purposes such as development of this system, the programming language Python is written in a text editor. Python can be downloaded for free of charge from the official python website¹⁷⁸. Among the institutions that use it extensively are Google, New York Stock Exchange, Magic, Coral, D-Link, Eve Online, Gaming, Hacking etc. MMORPG, Honeywell, HP, Industrial Lighting & Music, Philips and United Space Alliance etc. It is a free open source software. It can be used on Linux, Windows, MacintoshOS, Solaris, Amiga, AROS, AS 400, BeOS, OS / 390, Z/OS, are compatible and can use Python on PalmOS, QNX, BMS.

The system is developed in Python 3.9.6. There are many functions are developed in python to completing the various task for Online Indexing and Concept mining System for Manusmṛiti. The reason to choosing behind that is python is easy to learn and very powerful language for AI. Sample of the Python code is shown below:

```
import InfoExtractor, MeaningGenerator
def PrePro(inp):
    inpWrdLst = []
    inp = inp.strip()
    inp = inp.replace("\t", " ").replace("\r\n", "\n")
    inpFn = inp.replace(" + ", "+").replace("+", "+").replace(" +", "+").strip()
    lst = inpFn.strip().split(" ")
    for i in lst:
        if len(i)<1: continue
        inpWrdLst.append(i.strip())
```

¹⁷⁸ www.python.org

```

return inpWrdLst

def manuMain(UsrInp):
    result = []
    inpList = PrePro(UsrInp)
    for inp in inpList:
        IndexInfo = InfoExtractor.InpSearch(inp)
        if IndexInfo:
            #totalNm = str(len(IndexInfo))
            #IndexCount = "मनुस्मृति में
<b><i>'"+inp+"'</i></b> शब्द कुल निम्नलिखित
<b>"+totalNm+"</b> श्लोकों में प्रयुक्त हुआ है:"
            #result.append("".join(IndexInfo))
            for ln in IndexInfo:
                SR,Sandata = ln.split("##")
                hnEngMean =
MeaningGenerator.main(SR,Sandata)
                if hnEngMean:
                    result.append("".join(hnEngMean))
    return result

```

2.2 Web Framework - Flask:

Flask is a micro web framework written in Python. It does not require any special library or tool. It is the back-end of any website development. The flask web server was created by Armin Ronacher. Armin Ronacher was a member of Pocoo, an international Python enthusiast organization. Flask swiftly became popular among Python programmers and was named the most popular web framework in the Python Developers Survey 2018. This Micro Web Framework is based on two components Werkzeug and Jinja. Werkzeug is a useful library for the Python programming language. In other words, it is a toolkit for Web Server Gateway Interface (WSGI) applications and is certified under a BSD License. It supports Python 2.7, 3.5 and later

versions. Jinja has also been produced by Ronacher. It is a template engine for the Python programming language. The global Applications called Pinterest and LinkedIn also run on the Flask framework. The current system also runs on Flask as shown in Figure 4.6.

```

from flask import Flask, render_template, request
from eTools import eTools
from UG_PG import UG_PG
from eTexts import eTexts

app = Flask(__name__)
app.register_blueprint(eTools,url_prefix="")
app.register_blueprint(UG_PG,url_prefix="")
app.register_blueprint(eTexts,url_prefix="")

if __name__ == '__main__':
    #app.run(debug=True)
    app.run(use_reloader = True, debug = True,host='0.0.0.0')

####4.6 Functions for Manusmriti under EText and Search Tab
@eTools.route('/manu', methods=["GET"])
def Manu():
    import sys
    sys.path.append(sys.path[0]+"/tools/ETextSearch/manusmriti")
    from ConceptList import Main
    dropMenuItem = Main()
    return render_template('manusmriti.html', drop=dropMenuItem)

@eTools.route('/manu', methods=["POST"])
def ManuTxt():
    import sys
    sys.path.append(sys.path[0]+"/tools/ETextSearch/manusmriti")
    from ManuMain import manuMain
    from ConceptList import Main
    dropMenuItem = Main()
    manTxt = "{}".format(request.form['itext'])
    conceptNm = "{}".format(request.form['ConceptName'])
    if (manTxt != "") or (conceptNm != ""):
        if manTxt:

```

Figure 4.7: Sample of the Web Framework: Flask

2.3 Database and Text Files

Web-based systems use huge data to generate the information to render on the user interface. It uses a database to store the information in the back-end. A current system uses much data to extract information on a particular concept from the MS text. Currently, data is stored in various text files. The details descriptions of the files are

discussed in chapter 3. These files will be exported into the databases during the deploying the system. MySQL database will be used to export the text files.

Based on the above details the HTML, CSS and JS are used to develop the front end of the system. Python as a Programming language, Flask as a Web framework, and MySQL as a database are used to develop the back end of the system.

Chapter Five

Introduction to Online Indexing and Concept Mining System for Manusmṛiti

The result of the present research is to develop a web-based system for instant information retrieval on the basis of indexing and data mining techniques for MS text. It describes the partial implementation of the Online Indexing and Concept Mining system rendered for MS as part of the present M.Phil R&D. This chapter in particular delineates the digital implementation of the development of the indexing system for MS, using the methods of indexing and information retrieval of CL (Voorhees, 1999; Lewis & Jones, 1996). The computational model uses Python in the web format for the indexing of words that occurs through the identification and connection with original *ślokas* that are stored in the databases as explained in the previous chapter. The computational format for indexing uses the Python programming language (Zelle, 2004) to program.

This system is the by-product of Research and Development conducted by the Computational Linguistics R&D of the Department of Sanskrit, Faculty of Arts, University of Delhi. As part of this research project, a compilation of the uncountable concepts of MS, its extraction and retrieval, English and Hindi translations, descriptive exegesis in layman's language, and simple and proper analysis has been presented on the basis of various original texts, digests and commentaries. To make the MS concepts easily accessible and understandable by the masses, a web-based system has been developed, which is available under E-Text and Search at <http://cl.sanskrit.du.ac.in>. This system is very useful in the field of e-learning. A screenshot of the system can be seen in Figure 5.1. On this page, the user can give input and can also receive the result in the form of output here.

Components of the Online Indexing and Concept Mining System

The front-end is developed in HTML (Hypertext Markup Language). To make this HTML page more attractive, utilitarian, advantageous and useful, CSS (Cascading Style sheets) and JS (Java Script) codes are included in it. CSS and JS aid the

beautification of a basic HTML webpage. The sample of the front-end format is shown in figure 5.1.

Figure 5. 1 Front End of the Concept Mining and Online Indexing System for Manusmṛiti

1. The Front End or Client-Side Programming:

1.1 User Interface

User Interface (UI) is the point through which a user interacts with a computer, website or application. An impressive UI aims to make the user's experience easy, interactive, and intuitive and requires minimum effort on the part of the user to achieve the maximum desired results.

A user interface for this online system has been developed for the purpose of searching via the medium of digital interaction and submitting their queries. The user interface of the present system is developed using Form-based user interface technology, where users can provide input through text area and dropdown menu. The system accepts two kinds of search queries as input (through text area and dropdown

menu) and generates the output to furnish it in the corresponding format. The first input mechanism is the text area where the user can enter any keyword in Devanāgarī UTF-8 or Roman IAST and receive all the references, translations and exegesis from the MS. The second input option is a ‘Dropdown Menu’ where one can just select the keyword from the list of pre-created concepts of MS and quickly obtain accurate information related to it. Clicking on an indexed word, all related details with the *śloka* in which it occurs are displayed. The user interface accepts the input given by the user, preprocesses it and produces the corresponding output on the same page. A screenshot of this user interface is shown in the Figure 5.2. Both of which are discussed below:

मनुस्मृति के लिए सूचना निष्कर्षण
Information Extraction System for Manusmriti

The "Digitization and Development of Information Extraction System for Manusmriti (धर्मशास्त्रीय अवधारणा एवं साहित्य खोज)" is a result of the research (R&D) carried out by **Ms Arooshi Nigam** (M.Phil. 2021-2023) under the supervision of **Dr. Subhash Chandra** with advisorship of **Prof. Daya Shankar Tiwary** and **Dr. Avadhesh Pratap Singh**, Department of Sanskrit, University of Delhi, Delhi for the award of M.Phil. Degree. The title of dissertation is **Development of Concept Mining and Online Indexing System for Manusmṛiti**. The coding for the application was done by **Dr. Subhash Chandra** and partially by **Ms. Arooshi Nigam**. Data set and rules were prepared by Research Scholar **Ms. Arooshi Nigam** and **Dr. Subhash Chandra**.

धर्मशास्त्रीय अवधारणा एवं साहित्य खोज के लिये यूनिकोड या आईएएसटी (रोमन) में कोई शब्द लिखें अथवा अवधारणा का नाम ड्रॉपडाउन मेनू से चुनें ।
(Type the word in Unicode or IAST (Roman) in the textarea or select the concept dropdown menus)

अथवा
(OR)

अवधारणा का नाम यहां से चुनें ▼

मनुस्मृति में खोज के लिए क्लिक करें

Figure 5. 2 User Interface of the Concept Mining and Online Indexing System for Manusmṛiti

1.1.1 Text Area

A rectangular-shaped textbox is available on the user’s webpage to accept input given by the user. It is known as a Text area. A text area facilitates user to give the input for instant indexing and concept mining system for MS, in which the user can submit their query related to the verses, references or concepts of MS. At present, this system accepts input in the form of typed words in both Hindi (Devanagari) or English. The input can be given in Unicode UTF-8 format in Devanagari script or in Roman which is IAST script. The text area is shown in Figure 5.3.

International Alphabet of Sanskrit Transliteration (IAST) is a transliteration scheme that allows the lossless romanization of Indic scripts as employed by Sanskrit

and related Indic languages. IAST makes it possible for the reader to read the Indic text unambiguously, precisely as if it were in the original Indic script. It is this faithfulness

धर्मशास्त्रीय अवधारणा एवं साहित्य खोज के लिये यूनिकोड या आईएएसटी (रोमन) में कोई शब्द लिखें अथवा अवधारणा का नाम ड्रॉपडाउन मेनू से चुनें।
(Type the word in Unicode or IAST (Roman) in the textarea or select the concept dropdown menus)

अथवा (OR) अवधारणा का नाम यहां से चुनें

मनुस्मृति में खोज के लिए क्लिक करें

Figure 5. 3 Text Area of the Concept Mining and Online Indexing System for Manusmṛiti

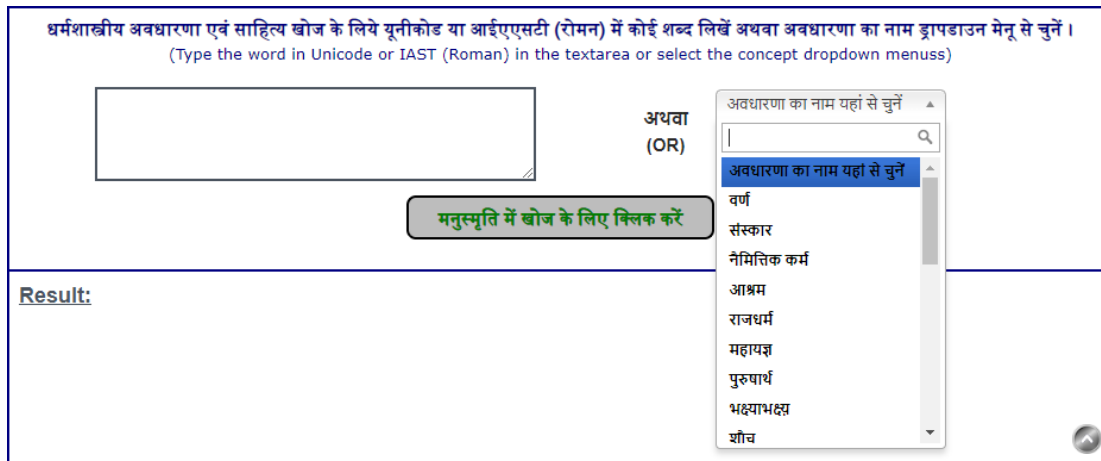
to the original scripts that accounts for its continuing popularity amongst scholars. Scholars commonly use IAST in publications that cite textual material in Sanskrit, Pali and other classical Indian languages. IAST is also used for major e-text repositories such as SARIT, Muktabodha, GRETIL, and sanskritdocuments.org.

This web-based system is uniquely developed, if a person wants to obtain information about more than one terminology simultaneously, it is possible via this input-output system. Provision is provided to submit more than one word, conceptual term, phrase or verse. More than one word can be typed in this text area with a space or a tab and the corresponding information is received on the UI.

1.1.2 Dropdown Menu

A drop-down menu is a list that displays the items to be selected through a GUI-based application, It is basically, a menu that offers a list of options. Generally, the title of the menu, or the default selected item in the list, is always displayed. On clicking on it, displays the other items that can be chosen for further processes. Generally, it is developed in HTML using JS and CSS to make it more dynamic, powerful and advanced. The sample of the HTML code is shown below. In order to make the input mechanism more user-friendly a searchable list of the concepts of MS is provided as a drop-down menu on the right side of the UI. On clicking on it, a list of conceptual terms

of MS appears, where the user can easily select desired a single or multiple concepts to give the input. The dropdown menu is very useful for the person who is unable to type



The screenshot shows a web form with a text input field and a dropdown menu. The text input field is empty. To its right, there is a label "अथवा (OR)". Below the text input field is a button with the text "मनुस्मृति में खोज के लिए क्लिक करें". To the right of the button is a dropdown menu with the title "अवधारणा का नाम यहां से चुनें". The dropdown menu is open, showing a search bar and a list of options: "वर्ण", "संस्कार", "नैमित्तिक कर्म", "आश्रम", "राजधर्म", "महायज्ञ", "पुरुषार्थ", "भक्ष्याभक्ष्य", and "शौच". Below the form is a section labeled "Result:".

Figure 5. 4: Dropdown Menu

in Unicode in Devanagari script or Roman in IAST script and it proves to be utilitarian for those who are unaware of the in-depth concepts available in MS. The sample of the dropdown menu is shown in Figure 5.4.

```
Select a Choice:  
<select name="example">  
  <option selected="selected" value="one">Choice 1</option>  
  <option value="two">Choice 2</option>  
  <option value="three">Choice 3</option>  
</select>
```

1.1.3 Submit Button

Submit button is one type of attribute of the input element of any HTML form. An HTML form is used to collect user input from the client-side or front end. The <form> element is a container for various types of input elements, such as text fields, checkboxes, radio buttons, submit buttons, etc. Submit buttons attribute displays a clickable button that is used to pass the data to the server for further process. Submit button is created in HTML using `<input type="submit">` for submitting the form data to a form-handler that is typically a file on the server with a script for processing input

data. The form-handler is specified in the form's action attribute. The following code is used to create a simple submit button on HTML but it can be personalised using JS and CSS.

```
<input type="submit" value="Submit">  
<input name="dd" type="submit" value="मनुस्मृति में खोज के लिए क्लिक करें" >
```

The submit button is used to send the user-supplied input to the next process. By clicking on the submit button the input received from the user is sent to the back-end program for further processing. The submit button which reads as “मनुस्मृति में खोज के लिए क्लिक करें” is shown in Figures 5.3 and 5.4.

2. The Back End or Server-Side Programming:

As previously mentioned the various processes running in the background are called back-end programming. Backend is technically responsible for the development of the search mechanism based on the process of online indexing of the databases, information extraction and retrieval module. The server-side programming composes of various minor components to develop the final output for the online indexing and concept mining system. Back-end programming for the present web-based system concatenates computer programs, databases and hosting of local webpages to global web consortiums.

The chapter four focussed on the digital framework and techniques adopted to create and develop all the above-mentioned files and components. Python as a programming language is used for developing the present web-based system and python supported Flask is adopted as the web server. This section intends to provide a detailed exegesis of all these components, propounded as follows:

2.1 Preprocessor

The preprocessor examines the text entered by the user and separates the user-entered terminology input from miscellaneous or unnecessary data. It automatically deletes all extra spaces, blank lines, newlines, etc. After the required modifications are done, the preprocessor then communicates it to the next step and sends it for the further process. A sample code of it can be seen below-

2.3. Information Extractor

Information extractor extracts the information from unstructured textual sources to enable finding entities as well as classifying and storing them in a database. Information Extractor is the core component of the system which is the outcome of the current research. This component generates the information from the MS with complete verses and corresponding Hindi and English translations. There are two ways to generate the information from MS regarding the given input.

2.3.1 Instant Indexing

After getting the input, the system generates the information in an instant and live indexing. It searches the input in MS texts if the input matches with any words used in MS then it produces a whole verse with reference and Hindi and English translations.

2.3.2 Concept Mining

The system also mines the data/information of the given input based on AI-based techniques with the help of a conceptual tag database and generates the information. It searches the input in the concept database if the input matches any concept then it produces a whole verse with reference and Hindi and English translations that denote the concept of input words. This is an advanced-level search and works based on tagged data set.

2.4. Meaning Generator

Information Extractor extracts the information only as MS verses in Sanskrit. The information generated by the Information Extractor is translated by this component. It is the task of the meaning generators to provide English and Hindi translations and explanations. There are two sub-components of the meaning generator. MeaningGenerator.Hindi generates the translations in the Hindi language and MeaningGenerator.English generates the translation of particular verses in the English language. These translations are done with the help of a translation database.

2.5. Script Converter

As the data of the MS is stored in Sanskrit in UTF-8 Devanagari script only. If the user provides the input in Devanagari then the system produces the result without doing any effort. But in case, the user provides the input in Roman script then before mining

the information it converts the input in Devanagari script and then goes on to search in the MS database and generates the output in Devanagari format only but before displaying the result, the script converter converts the output in Roman script.

2.6. Output Generator

The system generates the information in the raw format the Output Generator format the information in tabular format to display. Actually, it arranges the information format systematically. It also rearranges the information in a specific order.

3. How System Works?

The Instant search and Retrieval system for MS is a cohesive mechanism working with the help of multifarious digital components. Once the input is provided, multiple exiguous programs work simultaneously to give the output. Initially, the “App.Manu” is an App file created using a python program that automatically renders the user interface page created in the HTML page for the very first time on a web browser such as chrome, safari, Microsoft Edge, Firefox, Internet Explorer, etc. This is the page where users can give their input. User inputs the query, for which two types of methods have been devised. One is the text area and another is a dropdown menu. The Dropdown menu is dynamic and searches the list of the items stored in the text files. After giving the input and clicking on the submission button a JS code verifies the input and sends it to another process. The “ManuMain” program is the manager of the system which received the input and sends it to the various processes and receives the outputs. The input is then sent to the preprocessor to remove the extra spaces and other white spaces. Output received from the preprocessor is then sent to ScriptValidator to validate the script and then if the user-given input is found to be in the Devanagari script, the data is directly sent to InfoExtractor for information extraction directly. If the user-given input is found to be in Roman or IAST then the input is initially, sent to the Script Converter to convert the input into Devanagari script as the InfoExtractor components extract the information only in Devanagari script. Then it sends it to the InfoExtractor and extracts the information through instant indexing and concept mining. Now, the received information is further, sent to the MeaningGenerator for English and Hindi meaning generation. Finally, all the output is again sent to the script convertor to

convert the output script according to the user's input script. All the management is done by the manuMain program. After receiving the output this program sends the output to the output generator to generate the result as per a specific format to display on the user interface. All the components work with the help of the various data/rule file stored in the text file that can be exported to the database later. The workflow of the system can be understood with the help of figure 5.5.

The process of initial search mechanism is summed up and the desired output is created, ameliorated, formatted and generated at the backend. The complete desired output is displayed at the user's end.

4. Understanding the Generated Information as a Result

Before understanding the Generated Information as Result by the Online Indexing and Concept Mining System for MS it is important to know what information is being produced by the system? What information is included in the result? Actually, the major objective of the research is to generate all the information that can help any user who wants to know about any concept of MS for further studies. Therefore, maximum information is being produced by the system. The system provides the following information.

- Full text of the specific concepts or words in MS with complete references such as chapter number and verse number.
- The English and Hindi meanings of any verse appear by taking the cursor over it.
- After clicking on any verse the complete English and Hindi meaning with explanation also appear with complete reference in the next window.
- The output can be downloaded in the text file as well and kept for future reference.

5. Features of the Concept Mining and Online Indexing System

Web-based Concept Mining and Indexing System is an online information retrieval system. The user can search for any term, concept or phrase available in the MS text.

Complete analysis of that terminology or the information regarding a particular concept can be obtained through this system. The result is obtained in Devanagari

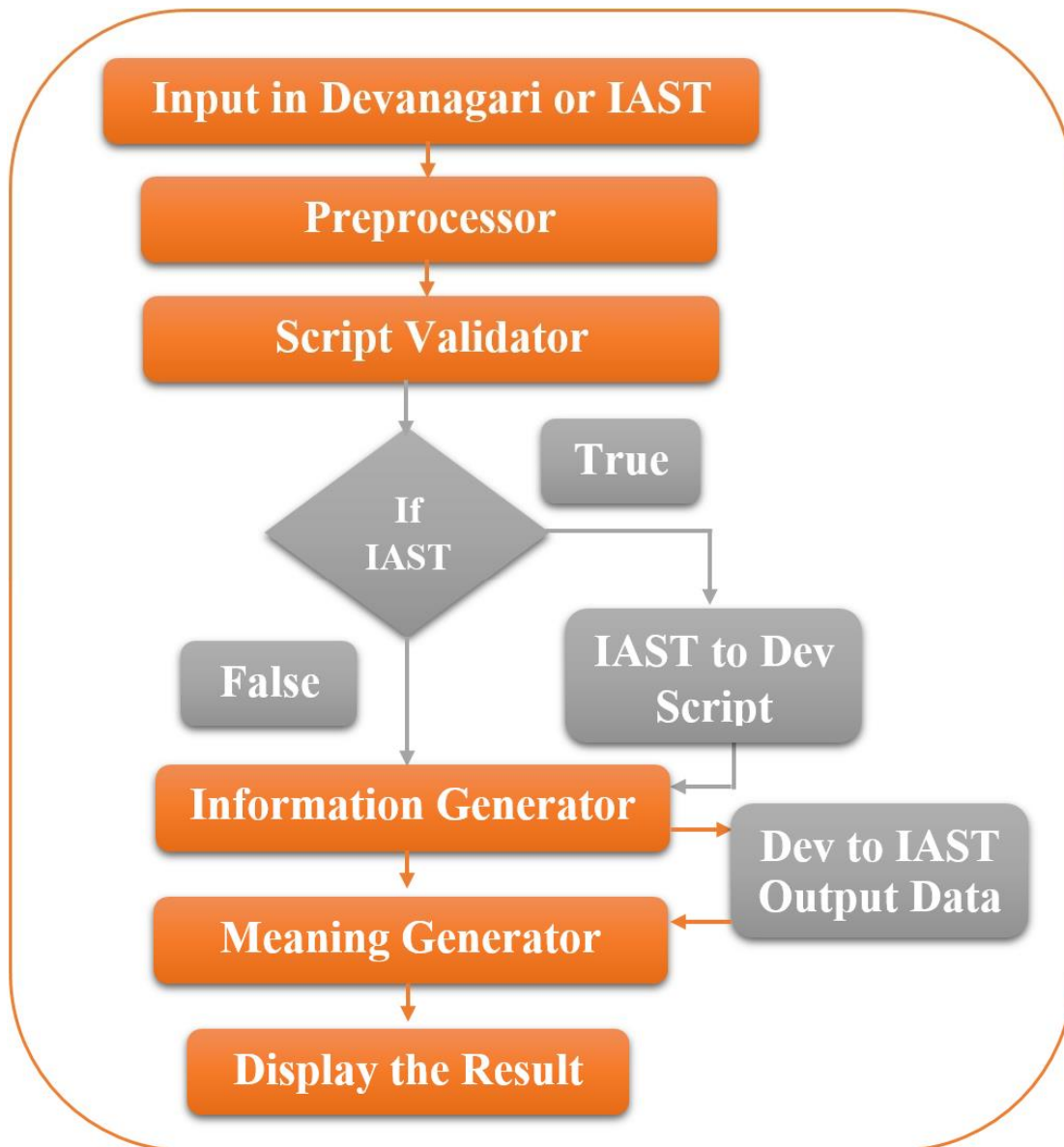


Figure 5. 5 How System Works

script with full description in UTF-8 or IAST format. This is an extremely intelligent system, as the user is supposed to only provide the input manually. The system collects information from different databases of *mūla śloka*, translations and analysis, as described in chapter 3. The entire processing, such as the identification of the term, validation of the script, investigation of the conceptual term and analysis, generating

the output, all this and more is done automatically by the system itself and reveals the complete information to us in the form of results. In the future, this type of work can be done for other DS texts as well. Following are the features of this developed system:

5.1 User-Centric and friendly

The web-based system is designed in such a manner that it has an interactive data search, which gives the system a very user-friendly and easy-to-navigate approach. The MS instant referencing system is an input-output generating system. It provides the options of keyword, conceptual or Phrasal searching for the feasibility of the user. It takes the input from the user, the researcher can give the input in either roman or Devanagari based upon his or her language convenience and generates the corresponding output. Keeping in mind the, user's convenience a dropdown menu is also created. If an individual is unfamiliar with the specific terminologies of MS or is unable to type in Devnagari or IAST roman, then the user can just click and select the words which s/he is willing to study from the pre-created dropdown menu and obtain the accurate information related to the searched term. Apart from this, other functions such as identification, symptoms and analysis are done by the system itself through the database. Therefore, this system has been designed keeping in mind the problems of an ordinary student and the general user, in view. The option of downloading the results as a text file/ pdf is also available at one's disposal. Thus, we can call it a digitally intelligent system.

5.2 Multi Script Input and Search

The system can mine the information from MS in two scripts; Devanagari and Roman. This system is developed with the aim of user usability, so this characteristic is also reflected in its input-output mechanism. This digital system accepts input in both Hindi and English, depending on the user's language comfort. Keeping the user's understandability in mind, the system produces the output also in the corresponding language. The system exhibits output in the searched scripts and translations in English and Hindi also be produced.

5.3 Analysis of Searched Terms or Concepts with Complete Reference

The system presents the complete and accurate references of any given word with its original verse, chapter number and *śloka* number. The full context with Hindi and English translation based on the prominent commentaries is also provided. By which the user can easily gather useful information by going into that context. This system also provides a simple, easy, clear, and detailed analysis of any given terminology. This makes it easy for the aspirants to understand the concepts of MS. If a technical term appears in any analysis, then by clicking on it, information about that word can also be obtained via the hyperlinked pages. The system produces information in two ways, one is instant indexing and the second is concept mining. In some cases, instant indexing does not produce complete information. It is unable to generate those *ślokas* where the searched word isn't visible directly in the verse. In this case, concept mining works. Conceptual searching is a special feature of this system. Therefore, Information retrieval is quick and error-free. The feature of referencing index is very useful as it provides the researcher with accurate reference numbers of all the *ślokas* of MS (Khandoliyan et al, 2012). The option of downloading the results as a text file/ pdf is also available at one's disposal. As a result, this system displays the characteristics and complete analysis of the searched word, according to the original and secondary texts.

5.4 Wider Accessibility and Increased Efficiency

The opulent knowledge system composed in the Sanskrit language is grasped and understood by only that section of the population that is traditionally trained in the grammar and linguistics of this primitive language. The accessibility of this knowledge tradition is also limited due to its distance, language and medium barriers. These texts are not widely available. Apart from the linguistics challenge, scholars have also noted the physical impediments of traditional textbook searching methodologies, such as time constraints, lack of enthusiasm for new innovative research ideologies, unvaried search outputs, the process of inquiry is monotonous and tedious, mentally strenuous and physically exhausting. Web-based systems make ancient texts available worldwide. It makes the resources far more accessible online for distance research. Better access and ease of use for the community and beyond. Provides easier access to information.

Digitization would allow us to extend our access to fragile resources and also the resources that are difficult to access.

The access to the knowledge found in MS is very limited in the printed version as instant search is intangible. The hardcopies pose some gruesome challenges as manuscripts are perishable and ephemeral, books are not very durable, to study a particular concept the whole text needs to be scrupulously read, conscientiously scrutinized, it is prone to printing and typing mistakes, it is not feasible to carry the books around and the non-availability of books at numerous instances. Whereas on other hand the digital version of these manuscripts tackles all the above aforesaid problems placidly. Information retrieval system grants easy and effortless searching, low-maintenance, high durability, ceaseless and completely error-free.

5.5 Utilitarian E-Learning Tool

In this era of information technology, everyone wants to obtain information online. For this purpose, this online search system has been developed for the terms and concepts used in the MS text. This will act as a type of learning material that can be made available through the internet in just one click. Through this system, scholars can procure traditional as well as contemporary knowledge of DS concepts by self-studying and teachers can utilize this system as a digital Assistant for teaching students in the classroom. Because the explanations of all the *ślokas* are hyperlinked, on pointing the cursor, their meanings appear by clicking on the *ślokas*. The complete explanation of the related verses becomes available in a new window.

Therefore, in the present environment of computer and E-learning, students and teachers of Sanskrit and other languages and linguists can also gain access to ancient knowledge traditions and be able to understand the concepts of MS.

Conclusion and Future Directions of Research

The tradition of DS carries an extensive history of Indian philosophy, religion, social issues and community laws. It is a collection of many theological texts and contains treatises on ancient Indian Social institutions and the duties of individuals. *Dharma* is a key concept of the text and it signifies the behaviour that is considered to be in accordance with the 'right way of living and the 'path of righteousness. DS covers a wide range of topics and is particularly divided into three major areas as *ācāra* (Customs), *vyavahāra* (stated legal procedures) and *prāyaścita* (penance/atonement). The texts of the DS are primarily written in the Sanskrit language and later translated into various languages.

DS texts are not only studied and inferred by Sanskrit scholars but also referred to by historians, sociologists, political scientists, economists, law enthusiasts and linguists worldwide. It is reckoned as one of the major subject streams in Sanskrit and political science departments in India and abroad. MS as a text along with its commentaries is precisely taught as a component subject at the postgraduate level at various departments in all major universities worldwide having Sanskrit or Indic languages departments. In the contemporary era of IT and digitalization, with the worldwide influx of internet and technological innovations, the entire world is connected by a click of a button, people of one city are associated with the citizens of another continent, and every individual today, is a world citizen, the world news is generated, accessed and received through web consortiums, traditional classroom teaching methodologies and lecture-based pedagogies have pivoted to digital learning and electronic tools, primitive physical libraries have transposed into digital athenaeums, yet it is cataclysmic that hitherto we do not have any instant information retrieval system or online indexing apparatus based on DS texts, where desired information appertained to this specific knowledge field can be attained. Today, there is a continuous surge in demand for educational materials to be made available online, scholars prefer E-books and PDF versions to burdensome textbooks, but the availability of Sanskrit texts in the form of e-content is extremely scarce. Due to the rapid growth of information, there is a considerable need to extract and discover valuable knowledge from available literary sources.

The Digitization of MS and making its availability online can play a very significant role to protect and access the knowledge tradition as described in MS. The extent of global access to these texts can be increased and the critically correct knowledge of the subject be made available to everyone. The digital system is formulated uniquely in that it can produce output analogous to the user's query. As previously discussed, since, the system accepts input in the two major scripts namely; Devanagari and roman (IAST), the result is also generated in the corresponding script. The multitude of DS concepts, disparate *ślokas*, or words in MS can be easily searched using information mining, online indexing and tagging techniques. The developed system has a very user-friendly and easy approach. Thus, the system dispenses keyword, concept and phrasal searching using the online indexing modules. The result engendered by the system includes complete information regarding the searched query. It includes the *mūla* (original) *ślokas* along with its complete accurate reference. The referencing index exhibits the serial number of the chapter, followed by the verse number of that particular *śloka*. Each *śloka* is hyperlinked to determine the word meanings and complete exegesis. On projecting the cursor over the *śloka*, a bilingual explanation of that verse automatically appears. By clicking on the particular *śloka*, the interpretation of that verse will be obtained in Hindi and English. The results obtained by this system are very informative. This system works on the precise conceptual information retrieval module. Deriving complete information of any concept with its original *ślokas*, its bilingual translations and interpretations prove the utility of the developed system. Therefore, the Information retrieval is quick and error-free.

For a particular DS concept, there are many verses that are available in MS but the word given in the input query does not necessarily appear in that particular verse directly. Therefore, in cases like these, DS concept tagging of the MS is done to fetch those verses as well. For example, if a researcher is keen on studying the concept “*varṇa*”, only those *ślokas* that have the term *varṇa* directly available in them will be showcased. But there are many verses in MS, which clearly denote the concept of the *varṇa* system but the word “*varṇa*” does not appear directly. Thus, the general index will not work to fetch those verses for the concept “*varṇa*”. These types of verses can be searched using the concept mining system. Conceptual searching is a special feature of this system and it can be easily used via this system. Concept Mining is creating

technology that combines the human way of understanding with the speed and accuracy of a computer. Concept mining is related to the understanding of the meaning of a text. Inferencing the knowledge from a particular text is a central step for machine understanding. Any word we use might have multiple meanings, and we use contextual references to disambiguate what is meant. Thus, in the present concept mining module, we formalized the idea of any concept and retrieved the corresponding information by linking meanings deducing the idea of the searched concepts and multiple words that might be used to represent a particular concept. Therefore, there is a need for a representation that captures the semantics of text in a formal structure. This need arises from the necessity to perform a variety of tasks that involves the meaning of the linguistic input.

The developed system is available on the website <http://cl.sanskrit.du.ac.in> of the Computational Linguistics R&D, Department of Sanskrit, University of Delhi.

Future Directions of Research

The area of digitization and computation for DS texts is untouched by the researchers. This is the primary work in this field. Therefore, it evolves viable dimensions of the new research in this field. It opens new areas of research on DS texts. The following work can be carried out:

1. Development of Multilingual System

The system currently accepts only two languages and scripts namely; Hindi in Devanagari script and English in roman IAST script. In the coming future, input-output methods of this system can also be made multilingual such as in; Punjabi, Sanskrit, Bangla, Telugu, Tamil, Kannada, etc. This system has the scope for developing multi-language and multi-script searches in near future.

2. Development of the System for other DS texts

In the future, it is planned to digitize the other major texts of DS like *Nāradasmṛti*, *Yājñavalkyasmṛti*, *Arthaśāstra* etc. and all the concepts mentioned in these *smṛti* can be searched online using this system.

3. Part of Global Digitalization

This is a web-equipped system, hence it can easily be made available and accessible globally. Digitalization is a major highlight, it thus provides for global public access. It will hopefully be a major contribution to the Government of India-run Digital India scheme and it will be a major educational tool in helping both teachers and the students equally around the globe.

4. E-Learning tools for DS texts

The rapid progress in the technological sector paved the way for the IT boom which resulted in massive advancement in the educational facet. Electronic learning systems, are now embraced by the masses. The introduction of computers was the basis of this revolution and over time, books are gradually being replaced by electronic educational tools such as pen drives or optical discs, hard drives and cloud storage apps. Knowledge today is continuously being shared via the Internet, which is accessible 24/7, anywhere, anytime. Smartphones, tablets, Ipads all serve as cardinal instruments in the medium of E-learning. DS is reckoned as one of the major subject streams in Sanskrit and political science departments in India as well as, abroad. It is precisely taught as a component subject at various departments in all major universities worldwide having Sanskrit or Indic languages departments. DS although, is primarily concerned with the right course of conduct in every manner but it also constitutes the postulates for legal administration, though courts and their procedures which are comprehended minutely in these scriptures. The development of an indexing system for MS as discussed in this dissertation is one such example. In future, this system can be used as an E-learning system for texts apart from DS textual contents. This system will undoubtedly, act as a basis or general prototype for the development of different online

indexers, E-readers or conceptual mining for technical terms of varied texts and different areas of studies such as political science, literature-based contents of various languages, medical texts, law textbooks etc.

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Appendix-I
List of the Concepts of MS

SR	Concept Name	SR	Concept Name
1	अतिक्रम दोष	45	प्राणीप्रकार
2	अनध्याय	46	प्रायश्चित्त व्रतादि
3	अभिवादन नियम	47	ब्रह्मचर्याश्रम
4	अशौच	48	ब्राह्मण
5	अस्वामी विक्रय	49	भक्ष्याभक्ष्य
6	अहिंसा	50	भोजन-आचमन विधि
7	आचार	51	भौगोलिकायाम
8	आचार्यादि	52	मोक्ष
9	आपद्धर्म	53	यज्ञ
10	आश्रम	54	युगचतुष्टय
11	ऋणादान	55	राजधर्म
12	एकादशेन्द्रीय	56	राजनीति एवं वित्तीय पक्ष
13	कण्टकशोधन	57	राजा एवं कर्तव्य निरूपण
14	कालगणना	58	राष्ट्र
15	क्रयविक्रयानुशय नियम	59	वर्ण
16	क्षत्रिय	60	वर्णसङ्करता
17	गणितीय विज्ञान	61	वाक्पारुष्य
18	गृहस्थाश्रम	62	वानप्रस्थ
19	चिकित्सा एवं स्वास्थ्य प्रबन्धन	63	विवाह
20	चोरी	64	वेतन आदान
21	जगदुत्पत्ति	65	वेदविशेषताएं
22	त्रिगुण	66	वैश्य
23	दण्ड तथा साहस	67	व्यवहार

24	दण्डपारुष्य	68	व्यसन निरूपण
25	दत्ताऽनपकर्म	69	व्यापार
26	दान एवं दानवर्जन	70	व्रात्यविचार
27	दायभाग	71	शपथ
28	द्यूतधर्म	72	शास्त्रवर्ण्यविषय
29	धर्म	73	शुद्धिकरण
30	निक्षेप	74	शूद्र
31	नियोग	75	श्राद्ध विधि
32	नैमित्तिक कर्म	76	षड्गुण
33	पञ्चमहाभूत	77	संन्यास
34	पञ्चमहायज्ञ	78	संविद व्यतिक्रम
35	परस्त्रीसंग्रहण	79	संस्कार
36	पर्यावरण एवं संरक्षण	80	सम्भूयसमुत्थान
37	पातक	81	साक्षी
38	पितरों की उत्पत्ति	82	सीमाविवाद व्यवस्था
39	पुत्र निरूपण	83	सृष्टिक्रम
40	पुत्र प्रकार	84	स्त्रीधन
41	पुरुषार्थ	85	स्त्रीपुरुष धर्म
42	प्रणव एव सावित्री ऋक्	86	स्त्रीपूजा-धर्म-कर्म
43	प्रबन्धन विज्ञान	87	स्वच्छता
44	प्रलय	88	स्वामीपाल विवाद

Appendix-II

Sample of the Concept tag Database of MS

ID	Verses	Chapter	Num	Con_ID
1	मनुं एकाग्रं आसीनं अभिगम्य महर्षयः । प्रतिपूज्य यथान्यायं इदं वचनं अब्रुवन् ॥	1	1	
2	भगवन् सर्ववर्णानां यथावदनुपूर्वशः । अन्तरप्रभवाणां च धर्मान् नो वक्तुं अर्हसि ॥	1	2	1,20
3	त्वं एको ह्यस्य सर्वस्य विधानस्य स्वयंभुवः । अचिन्त्यस्याप्रमेयस्य कार्यतत्त्वार्थवित् प्रभो ॥	1	3	
4	स तैः पृष्टस् तथा सम्यगमितौजा महात्मभिः । प्रत्युवाचाऽऽर्च्य तान् सर्वान् महर्षीञ् श्रूयतां इति ॥	1	4	
5	आसीदिदं तमोभूतं अप्रज्ञातं अलक्षणम् । अप्रतर्क्यं अविज्ञेयं प्रसुप्तं इव सर्वतः ॥	1	5	32, 33
6	ततः स्वयंभूर्भगवानव्यक्तो व्यञ्जयन्निदम् । महाभूतादि वृत्तौजाः प्रादुरासीत् तमोनुदः ॥	1	6	32, 33, 44
7	योऽसावतीन्द्रियग्राह्यः सूक्ष्मोऽव्यक्तः सनातनः । सर्वभूतमयोऽचिन्त्यः स एव स्वयं उद्वभौ ॥	1	7	32, 33
8	सोऽभिध्याय शरीरात् स्वात् सिसृक्षुर् विविधाः प्रजाः । अप एव ससर्जाऽऽदौ तासु बीजमवाऽसृजत् ॥	1	8	32, 33
9	तदण्डं अभवद् धैमं सहस्रांशुसमप्रभम् । तस्मिञ् जज्ञे स्वयं ब्रह्मा सर्वलोकपितामहः ॥	1	9	32, 33

10	आपो नारा इति प्रोक्ता आपो वै नरसूनवः । ता यदस्याऽयनं पूर्वं तेन नारायणः स्मृतः ॥	1	10	32, 33
11	यत् तत् कारणं अव्यक्तं नित्यं सदसदात्मकम् । तद्विसृष्टः स पुरुषो लोके ब्रह्मेति कीर्त्यते ॥	1	11	32, 33, 44
12	तस्मिन्नण्डे स भगवानुषित्वा परिवत्सरम् । स्वयं एवाऽऽत्मनो ध्यानात् तदण्डं अकरोद् द्विधा ॥	1	12	32, 33
13	ताभ्यां स शकलाभ्यां च दिवं भूमिं च निर्ममे । मध्ये व्योम दिशश् चाऽष्टावपां स्थानं च शाश्वतम् ॥	1	13	32, 33
14	उद्वबर्हाऽऽत्मनश् चैव मनः सदसदात्मकम् । मनसश् चाऽप्यहंकारं अभिमन्तारं ईश्वरम् ॥	1	14	32, 33
15	महान्तं एव चाऽऽत्मानं सर्वाणि त्रिगुणानि च । विषयाणां ग्रहीतृणि शनैः पञ्चेन्द्रियाणि च ॥	1	15	32, 33, 43
16	तेषां त्ववयवान् सूक्ष्मान्घण्णां अप्यमितौजसाम् । सन्निवेश्याऽऽत्ममात्रासु सर्वभूतानि निर्ममे ॥	1	16	32, 33
17	यन मूर्त्यवयवाः सूक्ष्मास् तस्येमान्याश्रयन्ति षट् । तस्माच्छरीरं इत्याहुस् तस्य मूर्तिं मनीषिणः ॥	1	17	32, 33, 44
18	तदाविशन्ति भूतानि महान्ति सह कर्मभिः । मनश्चावयवैः सूक्ष्मैः सर्वभूतकृदव्ययम् ॥	1	18	32, 33, 44
19	तेषां इदं तु सप्तानां पुरुषाणां महौजसाम् । सूक्ष्माभ्यो मूर्तिमात्राभ्यः संभवत्यव्ययाद् व्ययम् ॥	1	19	32, 33, 44

20	आद्याऽऽद्यस्य गुणं त्वेषां अवाप्नोति परः परः । यो यो यावत्तिथश चैषां सस तावद्गुणः स्मृतः ॥	1	20	32, 33, 44
21	सर्वेषां तु स नामानि कर्माणि च पृथक्पृथक् । वेदशब्देभ्य एवाऽऽदौ पृथक् संस्थाश्च निर्ममे ॥	1	21	32, 33
22	कर्मात्मनां च देवानां सोऽसृजत्प्राणिनां प्रभुः । साध्यानां च गणं सूक्ष्मं यज्ञं चैव सनातनम् ॥	1	22	32, 33
23	अग्निवायुरविभ्यस्तु त्रयं ब्रह्म सनातनम् । दुदोह यज्ञसिद्ध्यर्थं ऋग्यजुःसामलक्षणम् ॥	1	23	32, 33, 36
24	कालं कालविभक्तीश् च नक्षत्राणि ग्रहांस् तथा । सरितः सागराञ् छैलान् समानि विषमाणि च ॥	1	24	32, 33, 40
25	तपो वाचं रतिं चैव कामं च क्रोधमेव च । सृष्टिं ससर्ज चैवेमां स्रष्टुमिच्छन्निमाः प्रजाः ॥	1	25	32, 33
26	कर्मणां च विवेकार्थं धर्माधर्मौ व्यवेचयत् । द्वन्द्वैरयोजयच्च चेमाः सुखदुःखादिभिः प्रजाः ॥	1	26	32, 33, 19
27	अण्व्यो मात्रा विनाशिन्यो दशार्धानां तु याः स्मृताः । ताभिः सार्धं इदं सर्वं संभवत्यनुपूर्वशः ॥	1	27	33, 44
28	यं तु कर्मणि यस्मिन् स न्ययुङ्क्त प्रथमं प्रभुः । स तदेव स्वयं भेजे सृज्यमानः पुनः पुनः ॥	1	28	33
29	हिंसाऽहिंसे मृदुकूरे धर्माऽधर्मावृताऽनृते । यद्यस्य सोऽदधात् सर्गे तत् तस्य स्वयमाविशत् ॥	1	29	33

30	यथर्तुलिङ्गान्यृतवः स्वयं एव तृपर्यये । स्वानि स्वान्यभिपद्यन्ते तथा कर्माणि देहिनः ॥	1	30	33
31	लोकानां तु विवृद्ध्यर्थं मुखबाहूरुपादतः । ब्राह्मणं क्षत्रियं वैश्यं शूद्रं च निरवर्तयत् ॥	1	31	1, 27, 28, 29, 30, 33
32	द्विधा कृत्वाऽऽत्मनो देहं अर्धेन पुरुषोऽभवत् । अर्धेन नारी तस्यां स विराजं असृजत् प्रभुः ॥	1	32	33
33	तपस् तत्त्वाऽसृजद् यं तु स स्वयं पुरुषो विराट् । तं मां वित्ताऽस्य सर्वस्य स्रष्टारं द्विजसत्तमाः ॥	1	33	33
34	अहं प्रजाः सिसृक्षुस्तु तपस् तत्त्वा सुदुश्चरम् । पतीन् प्रजानां असृजं महर्षीनादितो दश ॥	1	34	33
35	मरीचिं अत्र्यङ्गिरसौ पुलस्त्यं पुलहं क्रतुम् । प्रचेतसं वसिष्ठं च भृगुं नारदं एव च ॥	1	35	33
36	एते मनूस्तु सप्ताऽन्यानसृजन् भूरितेजसः । देवान् देवनिकायांश्च महर्षींश्च चाऽमितौजसः ॥	1	36	33
37	यक्षरक्षःपिशाचांश्च गन्धर्वाप्सरसोऽसुरान् । नागान् सर्पान् सुपर्णांश्च पितृणां च पृथग् गणान् ॥	1	37	33
38	विद्युतोऽशनिमेघांश्च रोहितेन्द्रधनूंषि च । उल्कानिर्घातकेतूँश्च ज्योतींष्युच्चावचानि च ॥	1	38	33
39	किन्नरान् वानरान् मत्स्यान् विविधांश्च विहङ्गमान् । पशून् मृगान् मनुष्यांश्च व्यालांश्चोभयतोदतः ॥	1	39	33

40	कृमिकीटपतङ्गांश्च यूकामक्षिकमत्कुणम् । सर्वं च दंशमशकं स्थावरं च पृथग्विधम् ॥	1	40	33
41	एवं एतैरिदं सर्वं मन्त्रियोगान् महात्मभिः । यथाकर्म तपोयोगात्सृष्टं स्थावरजङ्गमम् ॥	1	41	33
42	येषां तु यादृशं कर्म भूतानां इह कीर्तितम् । तत् तथा वोऽभिधास्यामि क्रमयोगं च जन्मनि ॥	1	42	
43	पशवश्च मृगाश्चैव व्यालाश् चोभयतोदतः । रक्षांसि च पिशाचाश्च मनुष्याश्च जरायुजाः ॥	1	43	34
44	अण्डजाः पक्षिणः सर्पा नक्रा मत्स्याश्च कच्छपाः । यानि चैवंः प्रकाराणि स्थलजान्यौदकानि च ॥	1	44	34
45	स्वेदजं दंशमशकं यूकामक्षिकमत्कुणम् । ऊष्मणश् चोपजायन्ते यच्चाऽऽन्यत् किञ्चिदीदृशम् ॥	1	45	34
46	उद्भिज्जाः स्थावराः सर्वे बीजकाण्डप्ररोहिणः । ओषध्यः फलपाकान्ता बहुपुष्पफलोपगाः ॥	1	46	34
47	अपुष्पाः फलवन्तो ये ते वनस्पतयः स्मृताः । पुष्पिणः फलिनश्चैव वृक्षास्तूभयतः स्मृताः ॥	1	47	34
48	गुच्छगुलमं तु विविधं तथैव तृणजातयः । बीजकाण्डरुहाण्येव प्रताना वल्ल्य एव च ॥	1	48	34
49	तमसा बहुरूपेण वेष्टिताः कर्महेतुना । अन्तःसञ्ज्ञा भवन्त्येते सुखदुःखसमन्विताः ॥	1	49	34

50	एतदन्तास्तु गतयो ब्रह्माद्याः समुदाहृताः । घोरेऽस्मिन् भूतसंसारे नित्यं सततयायिनि ॥	1	50	34
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List of Publications

धर्मशास्त्रीय ज्ञान परम्परा का डिजिटलीकरण एवं ऑनलाइन खोज तन्त्र का विकास

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Abstract

भारतीय शास्त्र परम्परा में धर्मशास्त्र सामाजिक, राजनैतिक, आर्थिक, दार्शनिक, धार्मिक, सांस्कृतिक, न्यायिक आदि परम्पराओं के प्रबन्धन का एक शास्त्र माना जाता है। धर्मशास्त्रीय ग्रन्थों में विषयों की एक विस्तृत श्रृंखला को समाहित किया गया है और यह विशेष रूप से तीन प्रमुख क्षेत्रों में विभाजित किया जाता है; आचार, व्यवहार और प्रायश्चित्त। धर्मशास्त्रीय ग्रन्थ मूल रूप से संस्कृत भाषा में लिखे गए हैं तदनन्तर यह विभिन्न भाषाओं में अनुवादित किए गए हैं। सूचना प्रौद्योगिकी के इस युग में एवं स्मार्ट फोन तथा कम्प्यूटर डिवाइसेज के बढ़ते प्रयोग से ज्ञान परम्परा के आदान प्रदान के माध्यमों में परिवर्तन आया है। भारी भरकम ग्रन्थ का स्थान ई-पुस्तक ने ले लिया है। तकनीकी क्षेत्र में प्रचुर प्रगति होने के बाद भी संस्कृत के ग्रन्थों का डिजिटलीकरण बहुत ही कम हुआ है। धर्मशास्त्रीयग्रन्थों जैसे मनुस्मृति आदि के ज्ञानाभाव के कारण अनेक लोग इसकी निन्दा करते हैं। इसलिए प्रस्तुत शोध पत्र का उद्देश्य मनुस्मृति के पाठ को डिजिटलाइज करके इसके लिए तत्काल सन्दर्भ प्रणाली विकसित करना है। इसके लिए मनुस्मृति का सम्पूर्ण डाटा यूनीकोड में देवनागरी लिपि में संकलित एवं डिजिटलाइज किया गया है। धर्मशास्त्रीय अवधारणाओं को टैग करके एक वेब आधारित सूचना निष्कर्षण प्रणाली विकसित की गई है। जिसके माध्यम से विभिन्न लिपियों में इन्पुट लेकर मनुस्मृति में प्राप्त अवधारणाओं या इन्पुट से सम्बन्धित श्लोकों के हिन्दी एवं अंग्रेजी अनुवाद के साथ तत्काल सन्दर्भ प्राप्त किया जा सकता है। इस सिस्टम से सूचना प्राप्त करने के लिए दो माध्यम उपलब्ध हैं; पहला, मैनुअल 'शब्द' टाइप करके एवं दूसरा धर्मशास्त्रीय अवधारणा मेनू में सूचीबद्ध विकल्पों में से किसी भी विकल्प का चयन करके। परिणामतः, खोजे गए शब्दों/ अवधारणाओं का पूरा सन्दर्भ तथा उसके द्विभाषी अनुवाद और लिप्यंतरण सहित उपयोगकर्ता के लिए सहजता से तुरन्त ही सुलभ होता है। यह सिस्टम दिल्ली विश्वविद्यालय के संस्कृत विभाग की वेबसाइट <http://cl.sanskrit.du.ac.in> पर उपलब्ध है। मौजूदा सिस्टम प्रभावी ऑनलाइन टूल्स की कमी के कारण शिक्षण और शोध के क्षेत्र में अत्यधिक महत्वपूर्ण भूमिका निभा सकती है।

Keywords: धर्मशास्त्र, धर्मशास्त्रीय खोज, संस्कृत का डिजिटलीकरण, धर्मशास्त्रों में खोज सूचना निष्कर्षण, मनुस्मृति का संगणकीय विश्लेषण, Information Extraction in Manusmriti, Sanskrit Text Search

Article Publication

Published Online: 17-Aug-2021

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doi [10.31305/rrjm.2021.v06.i08.010](https://doi.org/10.31305/rrjm.2021.v06.i08.010)

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पृष्ठभूमि (Introduction)

हिन्दू धर्म की सांस्कृतिक परम्पराएं सबसे प्राचीन एवं समृद्ध मानी जाती हैं। प्राचीन काल में समाज का प्रबन्धन परिवार से ही प्रारम्भ हो जाता है। किसी भी समाज में परिवार को सबसे छोटी ईकाई माना जाता है (Bose, 1998 & विद्यालंकार, 2013)। समाज का समुचित विकास नियम एवं विनियम के बिना सम्भव नहीं है। यद्यपि वैदिक काल के साहित्य में कुछ हद तक इस प्रकार के सामाजिक नियमों का उल्लेख प्राप्त होता है (Srivastava, 2015) परन्तु इनका प्रलेखन धर्मशास्त्र काल में हुआ। धर्मशास्त्रीय पाठ हिन्दू समाज के सामाजिक, राजनैतिक, आर्थिक एवं धार्मिक जीवन से सम्बन्धित प्राचीनतम प्रलेख हैं। इसमें प्रायः हिन्दू धर्म के कर्तव्यों (धर्मों), सामाजिक प्रबन्धन, मनुष्य की दिनचर्या, रहन-सहन, भक्ष्य-अभक्ष्य, पर्यावरण, आयुर्वेद आदि से सम्बन्धित नियम शामिल हैं (Narayanaswamy, 1981 and Sudheendra & Reena, 2017)। इनके अतिरिक्त भारतीय दर्शन, धर्म, सामाजिक मुद्दों और सामुदायिक कानूनों में भी धर्म का प्राथमिक महत्व प्रतिपादित किया गया है (Srivastava, 2015)। यह एक सुदीर्घ परम्परा है जो अत्यन्त व्यापक इतिहास रखती है। इन ग्रन्थों की एक

प्रमुख अवधारणा है “धर्म” जो उस व्यवहार को दर्शाता है जिसे ‘जीने के समुचित तरीके’ और ‘धार्मिकता के मार्ग’ (Chambers, 2002) के अनुरूप माना जाता है। प्राचीन भारतीय सामाजिक संस्थाएँ सभ्यता निर्माण, सामाजिक विकास और सामुदायिक जीवन की एक विशिष्ट परम्परा का प्रतिनिधित्व करती हैं। धर्मशास्त्रीय ग्रन्थों में धर्म का मूल अर्थ विविध रूपों में प्राप्त होता है एवं इसके अन्तर्गत व्यवहार के स्वीकृत मानदण्ड, एक अनुष्ठान के भीतर प्रक्रियाएँ, धार्मिकता और नैतिक दृष्टिकोण, नागरिक व आपराधिक कानून, कानूनी प्रक्रियाएँ अथवा तपस्या या दण्ड विधान, एवं उचित और उत्पादक जीवन के लिए दिशानिर्देश शामिल हैं (Kane, 1962; काणे, 1992)। धर्म की अवधारणा का वर्णन करते हुए ओलिवल (2004) कहते हैं कि इसके अन्तर्गत विभिन्न सामाजिक संस्थाएँ यथा विवाह प्रणाली, विरासत सम्पत्ति, गोद लेने के नियम और विनियम, कार्य अनुबन्ध नियम, न्यायपालिका प्रणाली, समुदाय और समाज में विवादों के मामले में प्रक्रिया, साथ ही व्यक्तिगत विकल्प जैसे- भोजन की प्राथमिकताएँ, अध्ययन का निलंबन, यौन व्यवहार आदि सम्मिलित हैं जिनका यथार्थ चिन्तन हमें धर्मशास्त्रीय ग्रन्थों में सुलभ होता है।

धर्म शब्द संस्कृत के “धृ” धातु से बना है जिसका अर्थ है धारण करना या सहारा देना (Kane, 1962 and काणे, 1992)। इसमें उचित व्यवहार के लिए व्यापक विचार जैसे अधिकार, कर्तव्य, चरित्र, रीति-रिवाज, आचरण, गुण, कानून और उचित व्यवहार भी शामिल हैं जो सफल जीवन की ओर ले जाते हैं। स्मृतियाँ मानवीय रूप से लिखित ग्रन्थ हैं जिनमें दीर्घ कालीन परम्पराएँ एकत्रित हैं। स्मृतिशास्त्र में धर्म सूत्र (गद्य) और धर्मशास्त्र (पद्य) दोनों का समन्वय है। स्मृतियों को सामाजिक-सांस्कृतिक कानून का एक प्राचीन ढाँचा माना जा सकता है। मनु की संहिता, याज्ञवल्क्य संहिता और नारद संहिता (पाण्डेय, हिन्दू धर्मकोश, 1988), स्मृतिशास्त्र के प्रमुख ग्रन्थ माने जाते हैं। इन ग्रन्थों में सामाजिक कानूनों, उपभोक्ता कानूनों, कर अदायगी (Sharma, 2016), आदिवासी समुदाय कानूनों और संबंधित कानूनी प्रक्रियाओं पर विशेष खण्ड शामिल हैं।

इन स्मृतियों को समझने के लिए अनेकों टीकाएँ, भाष्य एवं व्याख्याएँ भी लिखी गई हैं। इनका प्रमुख केन्द्र बिन्दु स्मृतियों में निर्धारित कानून व्यवस्था की व्याख्या करना है। टीकाएँ एवं भाष्य मूल स्रोतों को अधिक विस्तारपूर्वक एवं सुगम तरीके से समझने में सहायता करते हैं। प्राचीन धर्मशास्त्रीय ग्रन्थों में इस अवधारणा को आचार एवं व्यवहार के रूप में कहा गया है (पाण्डेय, हिन्दू धर्मकोश, 1988)।

मनुस्मृति का संक्षिप्त परिचय (Brief Introduction of Manusmriti)

यद्यपि धर्मशास्त्रीय ग्रन्थों की संख्या अधिक है फिर भी इनमें मनुस्मृति सर्वप्रमुख माना जाती है। यह 12 अध्यायों में विभाजित है। पाठ की रचना श्लोकों में की गई है। यह एक शिक्षक एवं धर्म के विभिन्न पहलुओं के विषय में जानने के लिए उत्सुक उसके शिष्यों के बीच एक संवाद के रूप में वर्णित है। कुछ पाश्चात्य विद्वानों ने पहले 58 श्लोकों का श्रेय आचार्य मनु को दिया गया है जबकि शेष दो हजार से अधिक पद्यों को उनके छात्र भृगु द्वारा प्रोक्त माना है (Olivelle, 2004; Kane, 1962 and कौण्डिन्यायन, 2014)। इसके प्रथम अध्याय में ब्रह्माण्डोत्पत्ति, दस मनुओं की उत्पत्ति, चतुर्वर्णाश्रम की प्रणाली, चार प्रकार के युग, समय और सदियों के विभाजन के बारे में चर्चा की गई है। द्वितीय अध्याय में धर्म के लक्षण और स्रोत, सोलह संस्कार, व्रत और अनुष्ठान करने की प्रक्रिया और तरीके, छात्र-गुरु सम्बन्ध, यज्ञ के परिणाम, आचार्य-उपाध्याय-गुरु का महत्व, सात्विक आचरण, व्रत की अवधारणा, ब्रह्मचर्य विधि आदि के बारे में बताया गया है। तृतीय, चतुर्थ और पञ्चम अध्याय गृहस्थ आश्रम और उससे जुड़े विभिन्न कर्तव्यों और जिम्मेदारियों, गृहस्थों के उद्देश्यों, कबीले का चयन, समाज में स्त्रियों की पूजा, आगन्तुकों के प्रति आतिथ्य भाव, विवाह के प्रकार, मृतक की शान्ति, आजीविका, सत् असत् आचरण, खाद्य और अखाद्य की अवधारणा के विषय में चर्चा करते हैं। छठा अध्याय वानप्रस्थ विधि परिव्राजक-धर्म, संन्यास और मोक्ष से सम्बन्धित है। सातवां अध्याय शासक, राज्य, राजा के कर्तव्यों और उसकी प्रजा के बारे में बात करता है। आठवें अध्याय में व्यवहार दर्शन अर्थात् मुद्रा, वित्तीय और वित्तीय विभाग, राजस्व और व्यय, वाणिज्यिक गतिविधियों, गवाहों के कर्तव्यों आदि से संबंधित है। नौवें अध्याय में पुरुषों और महिलाओं के कर्तव्यों (Patwari, 2011), संपत्ति के विभाजन, बारह प्रकार के पुत्रों, अपराधियों के उन्मूलन और वैश्यों और शूद्रों के उपचार पर चर्चा की गई है। दसवें अध्याय में अन्तर्जातीय विवाहों और आपात काल में व्यक्ति के कर्तव्यों (आपद्धर्म) के बारे में विस्तारपूर्वक चर्चा की गई है। ग्यारहवें और बारहवें अध्याय में उस तपस्या का वर्णन किया गया है जिसे एक व्यक्ति को अपने पापों का पश्चात्ताप करने के लिए करना चाहिए जो उसने जाने- अनजाने में किए थे। यह प्रत्यक्ष और अप्रत्यक्ष तपस्या, मोक्ष के साधन, पापों, कर्मों और कुकर्मों की अवधारणा, दान और परम ब्रह्म के साथ एकीकरण के बारे में बात करता है (Olivelle, 2004; Kane, 1962 and कौण्डिन्यायन, 2014)। इस प्रकार मनुस्मृति की प्रमुख अवधारणाएँ हैं: सृष्टि कि उत्पत्ति, धर्म के स्रोत, चार सामाजिक वर्गों का धर्म, वर्णाश्रम का चातुर्थ्य, कर्म का नियम, पुनर्जन्म और अंतिम मुक्ति, गुण और बहिष्कार, व्यवहार, नैतिक संहिता और आचरण, कानून के स्रोत, महिलाओं के अधिकार, पुरुषार्थ, संस्कार (पाण्डेय, 2014), प्रत्येक नागरिक के अधिकार और कर्तव्य, राज्य शिल्प, युद्ध के नियम, शासक, राजत्व (कुमार, 1996) इत्यादि। मनुस्मृति में कुल श्लोकों की संख्या लगभग 2703 मानी जाती है। जिनका विवरण तालिका

Digitization and Instant Reference System for Dharmaśāstric Knowledge Tradition

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Abstract

The tradition of *Dharmaśāstra* (DS) carries extensive history and contains the treatises of Ancient Indian Social institutions. Dharma is a key concept of the text and it signifies the behavior that is considered to be in accordance with the 'right way of living' and 'path of righteousness'. DS covers a wide range of topics and is particularly divided into three major areas as *ācāra* (Customs), *vyavahāra* (stated legal procedures) and *prāyaścita* (penance/atonement). The texts of the DS are primarily written in the Sanskrit language and later translated into various languages. In the era of Information technology, everyone wants to obtain and share information online only. DS texts are not only studied by Sanskrit scholars but also referred by historians, sociologists, political scientists, economists, law enthusiasts and linguists worldwide. As of yet, there is quite a lack of development done in this area where a person can search the information regarding the DS texts online for further research or in-depth studies. Therefore, the major objective of the paper is to digitize and develop an instant referencing system for DS texts. Therefore, for the above-stated purpose, the complete data of the *Manusmṛiti* (MS) has been collected and digitalized in the Devanagari script in Unicode. Therefore, a web-based Information Extraction system is being developed. The proposed system will be able to take input in various scripts and generate the desired output in a similar way. The information can be searched by typing a 'word' or selecting the options from the listed DS concept menu. As a result, the complete reference of the searched words/ concepts inclusive of its bilingual (Hindi and English) translation and transliteration will be easily accessible to the user. The proposed system will be available online for public use at no cost. This system may play a very important role in teaching, learning and research because of the lack of existing effective online tools.

Keywords: Dharmaśāstra (DS), Indian Knowledge Tradition, Information Extraction, Data Mining, Online Indexing, Manusmṛiti (MS)

1. Introduction

DS is a collection of many theological texts and it contains the treatises of Hinduism on *Dharma* (duties). *Dharma* is of primary importance in Indian philosophy, religion, social issues and community laws. Ancient Indian Social institutions represent a distinct tradition of civilization formation, society

development and community living. The fundamental meaning of *Dharma* in DS is diverse and it includes accepted norms of behavior, procedures within a ritual, moral actions, righteousness and ethical attitudes, civil and criminal law, legal procedures and penance or punishment, and guidelines for proper and productive living. Olivelle (2004) has described the concept of *Dharma* which includes various social institutions discussed in DS literature such as marriage system, inheritance property, adoption rules and regulations, work contracts rules, judiciary system and process in case of disputes within the community and society, as well as personal choices such as food preferences, suspension of study and sexual demeanors etc.

The word *dharma* is derived from the Sanskrit verb root “*dhr*” which means to hold or support. It can be considered analogous with the “right way of living” or “the path of righteousness” (Chambers, 1999). It also contains the widespread ideas for proper behavior leading to productive living, rights, duties, character, customs, conduct, virtues, laws and behavior considered appropriate, correct or morally upright. *Smṛti* has humanly authored written scriptures that contain the collected traditions. The *smṛtis* is an amalgamation of sutras (prose) and DS (poetry). *Smṛtis* can be considered as an ancient framework of socio-cultural law. The code of Manu, the code of *yājñavalkya* and the code of *Nārada* are the principle *smṛtis*. All these *smṛtis* contain special sections on the social laws, consumer laws, tribal community laws and related legal procedures. There are huge *tīkāś* (commentaries) and *nibandhas* (digests) which are written on the basis of this *smṛtis*. The major focus of these is to interpret the law as laid down in the *smṛtis*. The commentaries and digests have systemized, consolidated and analyzed the *smṛtis*, thereby giving an entire body of law. These are of particular importance and are essential as they help in understanding the original sources in a more refined manner. Famous *tīkāś* are *smṛticandrikā*, *ratnākara* and *caturvargacintāmaṇi* etc. When humans began to live in groups, it led to the development of the concept of civilization and community living. It was then but natural that they should conform to certain patterns of human behavior for peace and harmony. This gave birth to the norms or ways of living a more structured life. This concept in the ancient DS texts was coined as *ācāra* (Kaundinnyayayn, 2014).

MS is a primary text of the DS, it is an ancient legal text divided into 12 chapters (*adhyaya*). The text is composed in metric verses, in the form of a dialogue between an exalted teacher and disciples who are eager to learn about the various aspects of *dharma*. The first 58 verses are attributed to Manu, while the remaining more than two thousand verses are attributed to his student Bhrigu (Olivelle, 2005). It contains special sections on the social laws, consumer laws, tribal community laws and related legal procedures. The first chapter discusses the genesis of the universe, the origination of ten Manus, the fourfold system of *varṇa* and *āśrama*, four types of *yugas*, division of time and centuries. The second chapter explains about features and sources of *dharma*, sixteen *saṃskāra*, procedure and methods of observing vows and performing ceremonies, student- guru bond, results of *yajña*, the importance of *ācārya*, *upādhyāya*, *guru*, *ṛtvika*, the concept of *vrātya*, *brahmacharya vidhi* and so on. Third, the fourth and fifth chapter talks about the *gṛhastha āśrama* and various duties/responsibilities attached to it, householder-ship and its objectives, selection of the clan, worshipping of women in the society, hospitality towards guests, types of marriages, pacification of the deceased, livelihood aspect of life, good and bad conduct, the concept of edible and inedible. Sixth chapter deals with the *vānaprastha vidhi parivrājaka-dharma*, *saṃnyāsa* and *mokṣa*. The seventh chapter talks about the ruler, state-ship and kingdom, duties of the king and its subjects. The eighth chapter deals with

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Language in India www.languageinindia.com ISSN 1930-2940 22:03 February 2022

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मनुस्मृति में मानवीय स्वास्थ्य चिन्तन एवं प्रबन्धन

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शोधसारांश

चिकित्सा क्षेत्र में प्राचीन भारत बहुत ही उन्नत था। वेदों में चिकित्साशास्त्र के विभिन्न पहलुओं पर विस्तृत चर्चा प्राप्त होती है। अथर्ववेद को चिकित्सा का विश्वकोश माना जाता है एवं आयुर्वेद को अथर्ववेद का उपवेद अथवा पूरक विषय माना गया है। इसी प्रकार धर्मशास्त्र को स्वच्छता, परिशुद्धता एवं सामाजिक प्रबन्धन आदि पर परिचर्चा प्रदान करने के कारण आरोग्यशास्त्र कहा जाता है। स्वास्थ्य एवं उपचार का सामाजिक सन्दर्भ भारत की स्वदेशी चिकित्सा प्रणालियों में गहराई से अंतर्निहित है। धर्मशास्त्रों में संस्कार तथा आश्रम व्यवस्था को अत्यन्त महत्त्वपूर्ण स्थान प्रदान किया गया है। धर्मशास्त्रों में विभिन्न संस्कारों का भरपूर उल्लेख मिलता है। आयुर्वेद में, संस्कार शब्द को "संस्कारोही गुणन्व्रध्यानम्" के रूप में प्रस्तुत किया गया है, जिसका अर्थ है विशिष्ट गुणों को शामिल करके किया गया गुणात्मक सुधार। संस्कारों का मुख्य उद्देश्य शिशु के गर्भावस्था एवं जन्म के पश्चात समुचित विकास, जीवन के लिए सफलतापूर्वक तैयार करना, उचित भोजन की आदतें विकसित करना, पर्याप्त पोषण सुनिश्चित करना, उसके शरीर व बौद्धिक विकास तथा सुदृढ चरित्र बनाना है। संक्षेप में, संस्कार का अर्थ उन धार्मिक संस्कारों और प्रक्रियाओं से है जिससे शरीर, मन और बुद्धि को पवित्र करते हैं। धर्मशास्त्रों में वर्णित सभी संस्कार जीवन के प्रत्येक चरण में बाल स्वास्थ्य और समग्र विकास में मुख्य भूमिका निभाते हैं। प्राचीन भारत में प्रचलित चिकित्सा विज्ञान एवं स्वास्थ्य प्रबन्धन की कुछ झलकियां इस लेख में प्रस्तुत की गई हैं। यह शोधपत्र प्राचीन भारत में बाल विकास, वृद्ध स्वास्थ्य, औषधीय विचारों, पर्यावरण शौच एवं स्वच्छता का भी संक्षेप में पता लगाता है।

संकेत शब्द: मनुस्मृति, स्वच्छता, चिकित्सा विज्ञान, स्वास्थ्य प्रबन्धन, संस्कार, आश्रम व्यवस्था

पृष्ठभूमि

प्राचीन भारत कई उन्नत विज्ञानों का जन्म स्थान माना जाता है। भारत की पवित्र भूमि से जहां एक ओर धर्म, संस्कृति, परम्पराएं एवं प्रथाएं उपजी हैं, वहीं दूसरी ओर अर्थ एवं वित्तीय विज्ञान, प्रबन्धनशास्त्र, मनोवैज्ञानिक अध्ययन, आयुर्वेद, चिकित्सा विज्ञान, पर्यावरण, धातु विज्ञान, स्वच्छता प्रबन्धन जैसी उत्कृष्ट वैज्ञानिक धाराओं का भी निस्सरण हुआ है। विश्व की सभी प्राचीन सभ्यताओं ने अपनी-अपनी विशिष्ट औषधीय प्रणाली विकसित की है, परन्तु प्राचीन भारतीय चिकित्सा पद्धति को अपने विचारों और उपचारात्मक उपायों दोनों में सबसे अधिक व्यवस्थित तथा सबसे समग्र प्रणाली माना जाता है। भारतीय चिकित्सा ने विकास के उसी मार्ग का अनुसरण किया जिसका चिकित्सा विज्ञान ने सभी प्राचीन संस्कृतियों में किया था। इसकी शुरुआत प्रेत विद्या और जादुई चिकित्सा से हुई। तत्पश्चात चिकित्सा दर्शन के विकास के साथ साथ तर्कसंगत दृष्टिकोण का पालन किया गया जिसके माध्यम से बीमारियों के कारण और रोगों के उपचार के लिए एक सैद्धान्तिक आधार प्रदान किया गया। अथर्ववेद को चिकित्सा विज्ञान का पहला चरण माना जाता है। अथर्ववेद में पौधों तथा विशिष्ट जडीबूटियों से किए जाने वाले उपचार वर्णित हैं। पहला तर्कसंगत दृष्टिकोण चरकसंहिता और सुश्रुतसंहिता की रचना में देखा जाता है। चरक और सुश्रुत का चिकित्सा दर्शन के प्रति अत्यन्त व्यावहारिक दृष्टिकोण है। वे ब्रह्माण्ड विज्ञान, मौलिक सिद्धांत तथा मानव शरीर और स्वास्थ्य के सम्बन्ध में तत्कालीन वर्तमान विचारों को दर्शाते हैं। भारतीय दर्शन और चिकित्सा के हमारे ज्ञान के प्रारम्भिक स्रोत चार वेद माने जाते हैं। रुद्र, अग्नि, वरुण, इंद्र एवं मारुति जैसे देवताओं को वैदिक काल में दिव्य चिकित्सकों के रूप में अभिहित किया गया था। अथर्ववेद में सात सौ इकतीस मंत्रों में चिकित्सा विद्या निहित है। दीर्घायु प्रदान करने वाले मन्त्र भी प्राप्त होते हैं। अथर्ववेद में मूलतः उन सभी रोगों का संक्षेप में उल्लेख प्राप्य है

जिनका वर्णन पश्चिमी देश अर्वाचीन चिकित्सा के नाम से करता है जैसे बालासा (कफ), उन्मद (उन्माद अथवा मनोरोग), शल्य (सर्जरी), प्रसूति-विज्ञान एवं वाजीकरण आदि। अथर्ववेद ने अजशृंगी, पृष्णी परणी, अपामार्ग आदि जैसे हर्बल उपचारों को जीवाणुरोधी बताया है। शंख, प्रतिसार, मणिधराना आदि को बैक्टीरिया निवारक के रूप में कहा है। पवित्र, अरोग्य तथा स्वस्थ जीवन जीने के लिए वेदों एवं धर्मशास्त्रों में शौच को महत्वपूर्ण तत्व माना जाता है। हिन्दू धर्मग्रन्थ बारम्बार स्वच्छता के महत्व पर जोर देते हैं। दक्ष स्मृति में स्पष्ट कहा गया है कि व्यक्ति को प्रत्येक कार्य में शुचिता बनाए रखने का प्रयास करना चाहिए व पवित्रता का पालन न होने पर, सभी कार्य निष्फल हो जाते हैं (श्रीधर, 2020)। मनुस्मृति के अनुसार शौच का शाब्दिक अर्थ है स्वच्छता और पवित्रता दोनों मान्य है। शौच का तात्पर्य न केवल अपने आस-पास की स्वच्छता से है बल्कि मन की पवित्रता से एवं शरीर के स्वस्थ सक्रियता से भी है। हड़प्पा और मोहनजोदड़ो की खुदाई में पर्याप्त प्रमाण मिलते हैं जो इस तथ्य की पुष्टि करते हैं कि सिन्धु घाटी सभ्यता के लोग स्वच्छता, शौच व परिशुद्धता के विषय में दक्षता हासिल कर चुके थे। हड़प्पा और मोहनजोदड़ो दोनों का निर्माण सावधानीपूर्वक योजना के अनुसार किया गया है। नगर नियोजन की पूरी अवधारणा स्वच्छता और सार्वजनिक स्वास्थ्य के लिए एक उल्लेखनीय चिन्ता को स्पष्ट दर्शाती है। इन स्थलों की खुदाई से कई चिकित्सीय पदार्थ जैसे शिलाजीत, मधुमेह व गठिया के उपचार आदि सामने आए हैं। इसके अतिरिक्त इन स्थलों की खुदाई में ऐसे कपाल प्राप्त हुए जिस पर सर्जरी के निशान विद्यमान थे। ये दृष्टान्त प्राचीन भारत में प्रचलित चिकित्सा विज्ञान की उच्च गुणवत्ता को समाहित करते हैं। वैदिक काल में चिकित्सा अवलोकन और सिद्धान्त ने भारतीय चिकित्सा की एक अधिक तर्कसंगत और पद्धतिगत प्रणाली की नींव रखी, जिसे आयुर्वेद (जीवन का विज्ञान) के रूप में जाना जाता है, इसकी शुरुआत 600 ईसा पूर्व से मानी जाती है। अथर्ववेद को आयुर्वेद का आधार माना जाता है क्योंकि अथर्ववेद में विभिन्न पौधों, जडीबूटियों व अन्य पदार्थों के औषधीय मूल्य निहित हैं। परन्तु समय के साथ, आयुर्वेद का स्वास्थ्य और रोग के एक पूर्ण विकसित तर्कसंगत सिद्धान्त के रूप में आविर्भाव हुआ। 600-200 ईसा पूर्व की अवधि में भारत के औषधीय विचारों और प्रथाओं के साक्ष्य भारत के समकालीन ग्रीक आगन्तुकों, बौद्ध ग्रन्थों और चाणक्य के अर्थशास्त्र के विवरणों से प्राप्त हुए हैं। आयुर्वेदिक सिद्धान्त के लिए, अधिकांश इतिहासकार के दो प्रमुख संस्कृत चिकित्सा ग्रन्थों, चरक संहिता व सुश्रुत संहिता का उल्लेख करते हैं। इन ग्रन्थों के अतिरिक्त वाग्भट्ट का अष्टांगहृदय भी आयुर्वेद का एक और महत्वपूर्ण ग्रन्थ है। चरक संहिता मुख्य रूप से चिकित्सा विज्ञान पर चर्चा करती है व सुश्रुत संहिता में विभिन्न शल्य चिकित्सिक प्रक्रियाओं का विस्तार से वर्णन किया गया है। भारत की प्राचीन चिकित्सा प्रणाली के इतिहास में अगला चरण धर्मशास्त्र आता है। पारम्परिक ज्ञान समुदायों की विशिष्ट संस्कृतियों को दर्शाता है। भारत विभिन्न संस्कृतियों, भाषाओं, पहनावे, खाद्य पदार्थों के रूप में स्वदेशी यानी पारम्परिक ज्ञान की महत्वपूर्ण भूमिका को निभाता है। भारत आयुर्वेद, प्राकृतिक चिकित्सा, योग और पोषण जैसे पारम्परिक उपचारों की मातृभूमि है। प्राकृतिक उपचार विधियों के अतिरिक्त कला, संगीत, साहित्य, मूर्तिकला, नाटक, उपन्यासों का महत्वपूर्ण ज्ञान प्राप्त करने और साझा करने के लिए भारत हमेशा स्वदेशी संस्कृतियों के अनुसन्धान के सर्वोत्तम स्थानों में से एक रहा है। धर्मशास्त्र स्थानीय समुदायों के बीच पारम्परिक संस्कृतियों की प्रथाओं, स्वदेशी ज्ञान और विश्वासों का प्रतिनिधित्व करते हैं। धर्मशास्त्रों का अनवरत अध्ययन किया जा रहा है जिससे लोगों की जीवन शैली, भोजन की आदतों, समग्र दृष्टिकोण, प्राकृतिक संसाधनों के उपयोग, शौच, परिशुद्धता और पर्यावरण के समायोजन के माध्यम से लगातार अनुप्रयोगों का विकास कर रहे हैं। प्रतिदिन स्नान करना, मदिरा, मांस, मैथुन आदि का त्याग करना, विचार, वाणी एवं कर्म में पवित्रता रखना तथा स्वच्छता के सिद्धान्तों का अभ्यास करने से व्यक्ति अपने मन को शुद्ध कर सकता है। निर्मल हृदय एवं शुद्ध विचार एक स्वस्थ जीवन तथा सकारात्मक मानसिक स्वास्थ्य की ओर अग्रसर करता है। यही कारण है कि योगसूत्र शौच को चार नियमों अथवा कर्तव्यों में से एक के रूप में निर्धारित करता है (श्रीधर, 2020)। मनुस्मृति में भी यही भाव व्यक्त किया गया है; *अहिंसा सत्यम् अस्तेयं शौचम् इन्द्रियनिग्रहः* | (10.63)

शोधपत्र का उद्देश्य

मनुष्य को स्वस्थ रखने के लिए मनुस्मृति में उनके सामाजिक जीवन सम्बन्धी अनेक प्रकार के नियमों एवं संस्थाओं के माध्यम से एक निश्चित दिनचर्या का वर्णन प्राप्त होता है। जिससे मनुष्य इनका पालन करके इन्हें अपने जीवन का अभिन्न अङ्ग बना लेता है

Environmental Awareness and Protection in Ancient Bharat based on Dharmaśāstric Literature

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Abstract: *The lifestyles and conventions of the practice for the environment by individuals were the supreme motive of the Ancient Indian society administrators, thinkers, intellectuals and rulers for the sustainable development of the society. The people of Dharmaśāstric period were duly aware of the environmental concepts, natural resources and measures to conserve them. Environment has been given utmost importance in ancient Indian culture. Indian society has always protected the natural resources through its unique religious practices and appropriate behaviors as a way of environmental management. Traditional Indian society has always been spiritualistic about the environment, thus, environment friendly. Many references are found in the Dharmaśāstra (DS) and other eminent texts of ancient Bharata on environmental protection, ecological balance, weather cycle, occurrence of rainfall, hydrological cycle and all the subjects related to them. The concern for the protection of environmental health, preservation of natural resources, proper public sanitation and the concept of cleanliness is deeply rooted in the Dharmaśāstric literature. DS was conceived as the text of society management through viable social institutions and focussing majorly on the society development through the medium of prescribed Achara. The style of environmental protection depicted in the DS is immutable today as well as plays an important role to provide the best solution for the management of global environmental problems and its preservation. The major objective of the paper is to explore the management methods of the awareness of our seers about the environment of ancient Bharata through authentic references from the DS.*

Keywords: Environment Protection, Environmental Awareness, Ancient Indian Literature, Dharmaśāstra (DS)

1. INTRODUCTION

Ancient Bharat has a very rich knowledge tradition of various sciences and technology. The opulent knowledge system was documented in Sanskrit language in the form of compendiums known as Śāstras. These works are related to poetics, dramaturgy, technical treatises on grammar, philosophy, world literature, sciences, arts, legal studies rituals and many more. From time to time, the influence of Sanskrit studies and scriptures, strongly embedded in our academics is clearly visible in Indian literature, philosophy, politics, economics and cultural development. The inclusion of traditional knowledge elements like *ṛta*, *satya*, *ahimsā* etc. in Indian social, educational and political framework proves that the Vedic, philosophical and theological aspect of Sanskrit studies is constantly flourishing. Historians and philologists have proven the certainty of the Sanskrit as a spoken language in the past. Pollock (2001) proclaimed that Sanskrit language was indigenous to Bharat, but now we are witnessing the impact of Sanskritization globally. Sanskrit not only revives the ancient indigenous literature of Bharat, but it is also being used to know the history of various modern sciences. There are many advance texts of sciences which are written in Sanskrit such as Caraka and Suśruta's compendiums on medicine, Āryabhaṭṭa's work on mathematics, Bhāskara's astronomy, Kauṭilya's politics and administration and Pāṇinī's grammar are landmarks for the modern development of science and logic (Biswas & Banerjee, 2016). Ancient Bharata is considered to be the origin of many advanced sciences in modern world. While religion, culture, traditions and

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practices have arisen from the holy land of Bharat, on the other hand expansive scientific streams like financial management and economics, management sciences, psychological studies, Āyurveda, medical science, environmental sciences such as metallurgy, mineralogy, geological sciences, oceanography and marine sciences, climatology, sanitation management, forestry and agriculture sciences, tropical and hydrological studies also emanate. Traditional knowledge refers to the specific cultures of the communities. Ancient Bharat plays an important role in indigenous traditional knowledge in the form of lifestyle conventions such as different cultures, various languages and dialects spoken, apparels and outfits, prescribed food and beverages, culinary tradition, medicinal tradition, concept of cleanliness, preservation of natural resources such as water, air, land, mineral ores etc. Environment and human health are interrelated and mutually dependent on each other. Bharat is the homeland of traditional treatments like Āyurveda, Naturopathy, Yoga and seasonal nutrition. From the beginning of times, Bharat has always been one of the most optimum places to research indigenous cultures to gain and share valuable knowledge of art, music, literature, sculpture, pottery, drama, literature, poetry, natural healing methods, environmental conservation strategies, afforestation etc. Theology represents the customs, indigenous knowledge and beliefs of traditional cultures among local communities. The scriptures are constantly being studied thereby developing applications continuously through adjustment of people's lifestyle, food habits, holistic approach, use of natural resources, defecation, precision and environment. According to DS texts one can purify one's mind by bathing daily, giving up alcohol, meat, sexual intercourse, etc., keeping purity in thought, speech and deed and practicing the principles of cleanliness. A pure heart and pure thoughts lead to a healthy life and positive mental health. This is the reason why the Yoga Sutras prescribe sanitation as one of the four rules or duties (Sridhar, 2020). The similar sentiment is expressed in Yājñavalkyaśmṛti (YS) as wellⁱ.

DSs are an extraordinary amalgamation of arts and science and consists of traditional as well as scientific knowledge of all major fields, hence, the importance of DSs is well renowned. It is a collection of theological texts and contains the treatises of Hinduism on Dharma (duties). Olivelle (2004) define "Dharma holds a cardinal importance in Indian Philosophy, religion, social issues and community laws. It includes the various social institutions such as marriage system, property inheritance, adoption rules and regulations, work contracts rules, judiciary system as well as personal choices e.g. food preferences, suspension of study and sexual demeanors etc." The DS texts are the oldest source of the social, political, economic and religious life of the primitive Indian society. It often includes decisions related to the duties (sects) of the citizens, public management, rules related to the daily routine of man, responsibility towards environment, Āyurveda (Narayanaswamy 1981) etc. The concept of dharma in management of society is the greatest and the most valuable contribution of DS to the world (Bobade 2019). The topics of the DS literatures are divided into three major categories known as; *ācāra*, *vyavahāra* and *prāyaścita* (Dhole, 2017). It is enriched with literature and moral code of conduct which has been prescribed for the betterment of the humanity, establishment of peace and harmony within the civic society and healthy environmental conditions.

DS embraces both traditional moral values as well as modern scientific aspects. The social scientists of this ancient period were aware of the importance of environment. Cleanliness, sanitation, purification of mind, body and soul and the various social rules and methodologies related to it are discussed in DS key texts. Cleanliness of the surroundings and the hygiene of the body has always been the priority, associated with *dharma* and kept as a major part of the *brahmacarya āśrama* to train and learn through tough acclimate. It is included in the ten-fold characteristics of *dharma*ⁱⁱ (Kumar, Mohapatra, & Singh, 2019). Protection of natural resources such as water, land and forests as well as, preservation of water sources was depicted as an eminent significance in the DS. Throwing of waste and filth in these natural water resources were declared as

Digital Accessibility and Information Mining of Dharmaśāstric Knowledge Traditions

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Abstract

The heritage of Dharmaśāstra (DS) carries extensive cultural history and encapsulates the treatises of Ancient Indian Social Institutions (SI). DS is reckoned as an epitome of the primitive Indian knowledge tradition as it incorporates a variety of genres for sciences and arts such as family law and legislation, civilization, ritualistic procedures, environment, economics, commerce and finance studies, management, mathematical and medical sciences etc. SI represents a distinct tradition of civilization formation, society development and community living. The texts of the DS are primarily written in the Sanskrit language and due to its expansive subject stream, it is later translated into various other languages globally. With the ingress of internet, development of advanced digital technologies and IT boom, information is accessed and exchanged via digital platforms. DS texts are studied not only by Sanskrit scholars but also referred by historians, sociologists, political scientists, economists, law enthusiasts and linguists worldwide. Despite its eminence, there is a major setback in digitizing and online information mining for DS texts. The major objective of the paper is to digitize and develop an instant referencing system to amplify the digital accessibility of DS texts. This will act as an effective and immediate learning tool for researchers who are keen on intensive studying of DS concepts.

Keywords: Information Extraction (IE), Online Indexing, Information Technology (IT), Heritage Computing, Cultural Tradition, Dharmaśāstra (DS), Manusmṛti (MS), Social Institutions (SI)

1. Background and Introduction

Ancient Bharata, a pseudonym for India, was a storehouse of indigenous knowledge tradition of various sciences and technology. The opulent knowledge system was documented in the Sanskrit language in the form of compendiums known as *śāstras*. Sanskrit is the classical language of Bharata. It is a language of learned treatises and an exquisite amalgamation of both arts and sciences. Indeed, Sanskrit as a language or a subject field is primitive in nature but scholars from all around the globe reckon Sanskrit as a lingua franca. As a language, it is used in an extremely limited and very specific context, yet, the socio-cultural value of the language retains its significance in the modern Indian milieu. Since the beginning, Bharata has achieved advancement in every aspect of intellectual traditions. The knowledge traditions of ancient Bharat have been cumulative and continuously expanding. It is intensively cohesive of many different fields of studies in ancient Indian texts ranging from the *Vedas*, *Brāhmaṇa*, *Upaniṣada*, *Dharmaśāstra* (DS), the six-fold Indian Philosophical tradition and so forth. Biswas and Banerjee (2016) highlighted the significance of Sanskrit texts such as *Caraka* and *Suśruta's* compendiums on medicine, *Āryabhaṭṭa's* work on mathematics, *Bhāskara's* astronomy, *Kauṭilya's* politics and administration and *Pāṇini's* grammar by depicting the advanced scientific perspectives dexterously elucidated in them. They proclaimed these primitive texts as landmarks for the modern development of science and logic.

DS is a genre of Sanskrit compendium exclusively privé to dharma and an idiosyncratic writing style of Sanskrit texts depicting the Indian knowledge tradition. The term DS is composed using two words “*dharma*” and “*śāstra*”. The word *dharma* originated from the “*dhṛ*” verb root in Sanskrit, which means to uphold, support or sustain, or to nourish, whereas, the word “*Śāstra*” derives from the root “*śas anuśiṣṭau*” with “*ṣṭrana*” suffix added to it. It literally means “which has been instructed and rescripted”. It is one

of the genres of Sanskrit texts devoted entirely to the ancient Indian tradition of social management through prescribed duties for every individual (Banerjee, 1999). It represents dharma as a right way of living (Dubey, 2012). They are part of Vedic literature. Vedas are considered to be the ancient text and the most credible source of DS. The four Vedas namely; *ṛgveda*, *Yajurveda*, *Sāmaveda*, and *Atharvaveda*, are considered the root of our ancient Indian religious and cultural prescriptions. In India, there is an exciting blend of scientific perspectives, artistic traditions, and philosophical perceptions. There is a multiplicity of ideas, manifold thoughts, disparate languages, substantial cultural heritage, exceedingly rich literature, sociological milieu, economic and political conditions, internal and external Epistemology (Phillips, 2014). Sociologist Bogardus (1924) defines Social Institutions (SI) as a structure of society that is organized to meet the needs of people through well-established procedures. It ensures the smooth functioning of the social structure, provides an established mechanism for positive growth and foundation for an organized society. SI organizes, directs and executes the multifarious activities required to fulfill the basic human needs which are essential for the proper working of society. India has been paramount in the field of primitive arts, ancient traditions, prescribed rituals and primordial scientific technologies. The DS texts are the oldest sources of the social phenomena, political scenarios, economic conditions, ethical norms and religious living of the primitive Indian society. The following section will briefly introduce various knowledge traditions and scientific perspectives conglomerated as Sanskrit literary heritage. These dimensions are as follows:

2. Research Problem and Objective

DS texts have been studied and continuously iterated by scholars globally. The traditional concepts and literary heritage of DS have often seen a literary revival and now the world is striving forward in the direction of exploring scientific nuances and technological perspectives in the primitive DS. The major key texts of DS encapsulate a wide

range of subjects. To intensify our knowledge of traditions, culture, history and heritage, as well as to rehabilitate the prior wisdom on ancient scientific aspects, DS texts need to be read and studied thoroughly by the sanskritists, sociologists, experts of management sciences, political scientists, economists, legal experts, *āyurveda ācāryas* and various science experts. The opulent knowledge base in Sanskrit has been a source of attraction for both Indians as well as western intellectuals. In recent years, there has been a tremendous body of work which is being conducted on various scientific fields in lieu of DS such as computational linguistics (CL) and spatial data mining, medical sciences, military and mathematical sciences, environmental sciences, management studies, economics and commerce, legal prescriptions etc. The philosophical influence of Sanskrit is evidently visible in the field of psychological studies health and physiological sciences. The ancient asceticism and healing traditions of Sanskrit scriptures have found their way into modern health and clinical sciences. This paper focuses on the various different dimensions and scientific perspectives from Sanskrit literature, specifically DS. It further elucidates the impact of Sanskrit studies on the global platform in the field of world science.

Therefore, the accessibility of Sanskrit resources is of utmost importance in India and also in the world for the extensive knowledge discourse of Sanskrit. In the contemporary era of globalization, with the worldwide influx of internet and digital innovations, the entire universe has witnessed a major IT-boom. The entire world is connected by a click of a button, people of one city are associated with the citizens of another continent, every individual today, is a world citizen, the world news is generated, accessible and received through web consortiums, traditional classroom teaching methodologies and lecture-based pedagogies have pivoted to digital learning and electronic tools, primitive physical athenaeums have transformed into digital libraries, yet its cataclysmic that hitherto we do not have any instant information retrieval system or online indexing apparatus based on DS texts, where desired information appertained to this specific knowledge field can be attained. In today's era of IT and Globalization, when there is a continuous surge in demand for educational materials to be made available online the availability of Sanskrit texts in the form of e-content is extremely scarce. The major objective of the system is to develop a Web-based Search Mechanism and an IE Mechanism for DS texts.

3. Dharmaśāstric Knowledge Tradition

In this section, the focus is devoted on the brief discussion on all the major fields of DS knowledge tradition. DS are the prominent sources of dharma. Dharma is the most fundamental tool in shaping various streams of Indian Knowledge System. It is essential for better understanding of Indian spirituality and scriptures as well as the most important uniting force of ancient Bharata. India developed its own distinct systems of ethics and values. The exercise of reasoning and the practice of argument was recorded in the early texts of India. It became the basis of a very well-known tradition of *śāstrārtha*; an open enquiry and debate to investigate the truth. This tradition in DS was connected with the subject of ontology, epistemology and dialectics.

The classical systems of Indian philosophy such as; *vedāntā*, *nyāya* and *sāṃkhya* in continuation with *mīmāṃsā*, *vaiśeṣika* and Yoga, including Buddhism, Jainism and atheistic schools, is the major constituent of DS knowledge tradition. Other knowledge traditions such as, arts and aesthetics, theory of emotion, drama, poetry, music, folk culture, paintings, language, grammar and literature are the primitive knowledge traditions propounded in the DS. Though the elementary focus of DS is on traditional contents yet it is considered constructive in the following areas of discussion.

3.1 Society Management through Varṇāśrama System

Varṇa is considered as the classifications of the major responsibilities held by the individuals of the society in Ancient India. It basically manages the society through appropriate distributions of the duties to everyone ensuring their rights and safeguarding the interests of every individual in the society (Chaubey, 2005). In ancient Indian civilization, to make human life civilized, cultured and well-planned, *varṇaśrama* system was introduced. The society was divided into four major *varṇas*: *brāhmaṇa*, *ṣatriya*, *vaiśya* and *śūdra* on the basis of the citizens bearing the corresponding social responsibilities. *Āśrama* is an important institution of Hindu social organization which is intimately associated with *varṇa*. The life of every human being is believed to be of training and self-governance. During this phase of training, humans supposedly pass through four stages. Just like the ancient Indian society was distributed into four *varṇas*. Similarly, an individual's life was divided in four stages known as *āśrama* system. According to the DS, an ideal life span of a human is a minimum of a 100 years. This period of 100 years is divided in equal parts of four. These were given the name of *āśrama*. It includes *brahmacaryā* (training and education period), *gṛhastha* (household), *vānaprastha* (retirement) and *saṃnyāsa* (life of renunciation). The concept of *āśrama* system in accordance with dharma is also very popular in ancient scriptures (Jayapalan, 2001). According to the AS, the strict observance of the duties of the four *varṇa* and *āśrama* system 'leads us to heaven' and bestows eternal bliss (Chander, 2015). The principle of *puruśārtha* is introduced to fulfil the human needs through dharma in ancient Indian society. The psychological-moral basis of the *āśramas* system is *puruśārthas* namely the dharma-*artha-kāma-mokṣa* which helps in organizing and operating the individual's life through *āśramas*. *Āśramas* are considered to have a close relationship with *puruśārthas*. The various efforts that a human undertakes to achieve his desires, is known as a *puruśārtha*. It makes a person aware of his ultimate goals and inspires him to perform their fundamental duties. Thus, *āśramas* and *puruśārthas* are intimately associated with each other.

3.2 Society Management through Politics and Ruling

The concept of good governance in the ancient Hindu system is based on brahmanical notion of '*yogakṣema*' which means the wellbeing of people. The administrative system of ancient India can be traced back to Hindu jurisprudence texts, which describes the characteristics of a global society and the legal system. Distinct concepts and system of polity and governance developed in India over time and democratic mechanisms were put in place to

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