

UNDERGRADUATE PROGRAMME IN SANSKRIT

Paper 15 - Indian Scientific Heritage

[A] Prescribed Course

Section 'A'	Indian Calendar Systems	08 hrs.
Section 'B'	Vedic Mathematics	16 hrs.
Section 'C'	Climatology and Hydrology	12 hrs.
Section 'D'	Āyurveda	12 hrs.
Projects / Presentations		12 hrs.

[B] Course Objectives

The ancient Sanskrit literature contains various marvellous concepts of Science and Technology. India's scientific heritage is an area of growing interest and opportunities. This course aims at acquainting scholars with some of its aspects and developing an appreciative mind towards our scientific heritage.

[C] Unit-wise Division

Section 'A'

(Indian Calendar Systems)

Unit 1 Divisions of time in Vedic Literature – Day, month, season, year etc. in *Samhitā* texts (*R̥gveda*; 1.25.8, 1.164.11; *Taittirīya Samhitā*, 1.4.14 ; 4.4.11), Concept of *ṛtu* and *samvatsara* in *Brāhmaṇa* texts (*Taittirīya Brāhmaṇa* 3.10.4.1, *Śatapatha Brāhmaṇa* 1.6.3), Calculation of five years, *yuga*, *ayana*, *tithi* and *nakṣatra* in *Vedāṅga Jyotiṣa* (*Yājñuṣa Jyotiṣa*, verses 5,9,19-20)

1 week/4hrs.

Unit 2 Ontological Measurement of time in India and the National Calendar – Nine-fold time-measurement according to the *Sūryasiddhānta* (*mānādhyāya*, 14.1), four types of practical measurements (14.2), solar units (14.3), lunar units and their practical applications (14.12-13) *nākṣatra māsa* and *māsa* planning (14.15-16), *sāwana māsa* and its use (14.18-19), revised rules of time calculation in the national Calendar accepted by Indian government since 1957.

1 week/4hrs.

Section 'B'

(Vedic Mathematics)

Unit 1 Mathematics in Vedic Literature - Concept and praise of Mathematics in Vedic literature (*Chāndogyaopaniṣad*; 7.1.2, 7.1.4; *Vedāṅga Jyotiṣa* (*Yājñuṣa Jyotiṣa*, 4), Numerical words in *Samhitā* texts (*R̥gveda*; 1.164.2, 1.164.10-15), Concept of zero (*R̥gveda*;

4.11.2,5.32.1,8.91.7, *Bṛhdāraṇyakopniṣad*, 5.1.1, *Chāndogyopaniṣad*; 4.10.5), decimal system (*Rgveda*; 10.94.7), Numbers from one to *parārdha* in Vedas (*Yajurveda*, 17.2), Development of geometry in Śulba period specially Pythagoras theorem (*Śulbasūtras* – 1.37 ; *dīrgha caturaśrasyātadubhayam karoti*)

8hrs.

Unit 2

Applied Principles of Vedic Mathematics – Definitions of mathematical functions according to Bhāskaracārya's *Līlāvātī* – Place of number, Addition, Subtraction, Multiplication, Division (*Līlāvātī - Abhinna-parikarmāṣṭaka*, 1-7 verses, i.e. from 'līlāgala---' to 'bhjedvā sati sambhave tu'); Application of first three formulae from Vedic Mathematics by Bhārtikrishna Tirtha – 'ekādhikena purvena'; 'nikhilam navataścaramam daśataḥ'; 'ūrdhva-tiryagbhyām'.

8hrs.

Section 'C'

(Indian Climatology and Hydrology)

Unit 1

Climatology in Ancient Sanskrit Literature and history of climatology in Ancient India, Meteorology in Vedic period (*Rgveda*; 1.19.7, 1.37.11, 1.164.47, 1.164.5, 5.62.1, 5.63. 1-7), Concept of *vṛṣṭi-garbha* in *Bṛhatsamhitā* (*vṛṣṭi-garbhakṣaṇa* chapter 21.1-12), Examination of wind in Bhadrabāhu Samhitā (*Bhadrabāhu Samhitā*, 9.115) Drought and good rainfall in Madhusudana Ojhā's *Kādambini*, (Simhāvaloka – verses 592-600)

6 hrs.

Unit 2

Water Management and Harvesting System in Ancient India – Water management in Indus valley civilization, Water-management in *Vedic Samhitās*, Eleven types of water in *Yajurveda* (*Yajurveda*; 22.25) Methods of detecting underground water and hydrology in *Bṛhatsamhitā*, Role of flora and fauna in recharging of underground water, Methods of water purification (*Bṛhatsamhitā*; 54.121-122, *Vṛkṣāyurveda*; 2.36-38)

6 hrs.

Section 'D'

(Āyurveda)

Unit 1

Subject matter and importance of Āyurveda ; History of Āyurvedic speculations in the Vedas, Atharvaveda as an early source for medicinal speculations

2 hrs.

Unit 2

Major texts and authors – Caraka, Suśruta, Aṣṭāṅga Hṛdayam, *Aṣṭāṅga Saṅgraha* of Vāgbhaṭa

3 hrs.

Unit 3 Selections from Vāgbhaṭa's *Aṣṭāṅg- saṅgraha*; (Ed. Ravi Datta Tripathi : Chowkhamba Sanskrit Pratishtanam, Delhi., Reprinted 2011)

(a) Eight parts of Āyurveda, (pp 6-7); Three *doṣas*, (I.23-24); causes of diseases (I.42); types of diseases (II. 26-33, 35)

3 hrs.

(b) Healthy foods – Water (VI.30-31, 43, 46-51), Milk products – (verses from Ch VI : *dugdha* 54-56 ; *dadhi* – 65-68 ; *takra*, 69-70; *navanīta* 72-73 ; *ghṛta* 73-76 ; fruits – *drākṣā* 168-169 ; *dāḍima* 169-171; condiments - Ch. XIII verses 39-43; *āmalakam* – 44- 45; *vibhītaka* 46; *triphalā* – 47 ; *hingu* 66-67, *nāgara* and *trikaṭu* 54

3 hrs.

[D] Suggested Projects

1. Conversion from Christian calendar to Śaka calendar.
2. Calculations based on Bharati Krishna Tirtha's formulae.
3. Case studies of rain water harvesting in various buildings.
4. Study of pollution of the Yamuna.
5. Dying or dead water bodies in Delhi.
6. Reports with pictures on visit to *Ugrasena ki Bāvli* and /or other water bodies.
7. Collection of samples of medicinal plants with write ups.
8. Visit to an Āyurvedic clinic/ hospital and case studies.
9. Reports on interview with doctors and patients.

[E] Recommended Books

Section 'A' : Indian Calendar Systems

Unit 1 Divisions of time in Vedic Literature

- मुले, गुणाकर : "भारतीय कैलेंडर की विकास यात्रा", अभिव्यक्ति, (वेबसाइट लेख)
www. abhivyakti-hindi.org/smibandh/2008
- त्रिपाठी, देवी प्रसाद : भारतीय काल गणना में नूतन संवत्सरारम्भ, भारतीय पक्ष (वेबसाइट लेख)
- Chakravarthy, A.K. : *Origin and Development of Indian Calendrical Science*, Indian Studies Past and Present, Calcutta, 1975, pp. 1-18.
- Shastri, T.S. Kuppana : *Vedāṅga Jyotiṣa of Lagadha*, ed. K.V. Sarma, Indian National Science Academy, New Delhi, 1985, pp.11-16

Unit 2 Measurement of time in India and the National Calendar

पाण्डे, रामचन्द्र : सूर्य सिद्धान्त, मानाध्याय-14, पृ. 345-355

Section 'B' : Vedic Mathematics

Unit 1 Mathematics in Vedic Literature

दत्त, विभूतिभूषण एवं अवधेश नारायण सिंह: हिन्दू गणितशास्त्र का इतिहास, भाग-1, प्रकाशन ब्यूरो, उत्तर प्रदेश सरकार, लखनऊ, पृ.1-13.

आचार्य, सुद्युम्न : गणितशास्त्र के विकास की भारतीय परम्परा, मोतीलाल बनारसीदास, दिल्ली, 2006, पृ.1-55.

उपाध्याय, बलदेव : प्राचीन भारतीय गणित, विज्ञान भारती, नई दिल्ली, पृ. 19-25, 103-112.

Davi, S.G. : "Ancient Indian Mathematics -A Conspectus", website article), Resonance, March, 2012, pp. 236-246, www. ias. ac.in

Krishna Swami : "Peeps into India's Mathematical Past" (website article) Ayyangar, A.A. www.ms.uky.edu.

Unit 2 Applied Principles of Vedic Mathematics

झा, राम लषण लाल भास्कराचार्य विरचित लीलावती, (हिन्दी अनुवाद एवं व्याख्या सहित) चाखम्बा विद्याभवन, वाराणसी, 1994, पृ. 9-19.

भारती कृष्णतीर्थ वैदिक गणित, सम्पा. वी. एस. अग्रवाल (हिन्दी अनु. - विश्वमोहन तिवारी) मोतीलाल बनारसीदास, दिल्ली, 2009. पृ. 1-50.

सिंह, जे.डी. एवं अन्य वैदिक गणित (व्यावहारिक उपागम), साहित्यागार, जयपुर, 2009. पृ. 1-80.

Sri Sathya Sai Veda "Vedic Mathematics-Methods" (website article) Pratisthan www.Vedanu.org/Veda/1795-vedic

Williams, Kenneth R "The System of Vedic Mathematics - A comparison" (website article) www. vedic maths. org. system of vedic

Section 'C' : Climatology and Hydrology

Unit 1 Climatology in Ancient Sanskrit Literature

त्रिपाठी, धुनीराम प्राच्यभारतीय ऋतुविज्ञानम्, सरस्वती भवन अध्ययन माला-19, वाराणसेय संस्कृत विश्वविद्यालय वाराणसी, 1971, पृ. 1-28.

- मिश्र, शिव गोपाल “ भारतीय कृषि का विकास”, अध्याय-7-जलवायु विज्ञान, मानव संसाधन विकास मंत्रालय, भारत सरकार, 2002, पृ. 27-33.
- ज्ञा, सुरकान्त (सम्पा.) बृहत्संहिता, हिन्दी अनुवाद एवं व्याख्या, चौखम्बा संस्कृत सीरीज ऑफिस, वाराणसी, भाग-1, पृ. 418-424.
- शास्त्री, नेमिचन्द्र (सम्पा.) भद्रबाहुसंहिता, हिन्दी अनुवाद, भारतीय ज्ञानपीठ प्रकाशन, दिल्ली, 1991., पृ. 104-107.
- ओझा, मधुसूदन कादम्बिनी, हिन्दी अनुवाद, संपा. प्रद्युम्न ओझा, जयपुर, 1944, पूर्वोक्त, पृ. 127-131.
- Ramanathan, A.S. *Weather Science in Ancient India*, Rajasthan Patrika, Jaipur, 1993, pp.1-43
- Srinivasan, T.M. "The Theories of Cloud Formation and Rain in Ancient India", (Article), *Recent Researchs in Indology*, Hermen Publishing House, New Delhi, 1966 pp. 377-388

Unit 2 Water Management and Harvesting System in Ancient India

- पाण्डे, अनिल कुमार एवं अन्य प्राचीन भारत में कृषिविज्ञान, अध्याय-8, सिंचाई और जल प्रबन्धन, पृ. 131-149
- त्रिपाठी, राधावल्लभ पानी की कहानी (संस्कृत साहित्य के झरोखे से), सप्रे संग्रहालय, भोपाल, 2012, पृ. 17-80
- Tripathi, T.M. and others *Hydrology in Ancient India*, Document of National Institute of Hydrology, Roorkee September, 1990, pp 1-15
- Murty, K.S. "Varahamihira, the earliest Hydrologist", Proceedings of the Rom Symposium, April, 1987, IAHS, Publication No 164, 1987, pp.11-15.
- Pandey, D.N.Gupta, A.K. "Rainwater Harvesting as an adaptation to climate change", Anderson, David M. *Current Science*, vol. 85, No. 1, July, 2003, pp. 46-52.

Unit 3 Classical References to Aspects of Hydrology in Sanskrit Literature

Note: Primary readings are the same as given in the reference books for Unit 3 of Section ‘C’.

Section ‘D’ : Āyurveda

- *Aṣṭāṅga- Saṅgraha* of Vāgbhaṭa, (Ed.) Ravidatta Tripathi, Chowkhamba Sanskrit Pratishthana, Delhi, Reprinted 2011.
- *Āyurveda Kā Saṅkṣipta Itihāsa*, Hindi Sahitya Sammelan, Allahabad.