Course Modules:

Module I: Different Mathematical concepts from Sanskrit texts

Development of place value system in India. Different system of numeration: Āryabhaṭan, Bhūtasaṅkhyā and Kaṭapayādi. Mathematical ideas developed in India: Kuṭṭaka, the method for solving the linear indeterminate equations. Different methods for the computation of tabular sines. Obtaining desired Rsine and Rcosine. Series expansion of trigonometric functions. Mādhava series to find the value of π and its fast convergent approximations.

Module II: Basics of Spherical Astronomy

Introduction spherical trigonometry. The spherical triangle. The fundamental formulae: sine formula, cosine formula and four parts formula and their proofs. Three different co-ordinate systems: horizontal, equatorial and ecliptic. Rising and setting of stars. Rate of change of azimuth and zenith distance. Numerical examples.

Module III: Indian Calendrical systems

Concept of time. Solar and lunar reckoning of time: year, months, days etc. *Adhimāsa* or inter-calary month. Elements of Indian calendar known a s *Pancāṅga*. Large units of time like *Mahāyuga, Manvantara* etc. Revolution of planets in a *Mahāyuga*. Computation of *Ahargaṇa. Kuṭṭaka* and *Ahargaṇa*.

Module IV: Computation of Planetary longitudes

Algorithm to find the geocentric longitude of the planets: Mean longitude. Corrections to the mean longitude: *Mandasaṃskāra, and Śīghrasaṃskāra*. Solar and Lunar eclipses. Shadow experiments.

Text Books and References:

- W. M. Smart, A text book on Spherical Astronomy, Cambridge at the Unoversity press 1949.
- Tantrasaṅgraha of Nīlakaṇṭha Somayājī, tr. with mathematical notes by K. Ramasubramanian, M. S. Sriram, jointly published by Hindustan Book Agency, Delhi and Springer, London 2011.
- Karaṇpaddhati of Putumana Somayājī, tr. with mathematical notes by Venketeswara Pai R., K. Ramasubramanian, M. S. Sriram and M. D. Srinivas jointly published by Hindustan Book Agency, Delhi and Springer, Singapore 2018.
- Bag A.K., Mathematics in Ancient and Medieval India, Chaukhambha Orientalia, Delhi 1979.
- Subbarayappa B.V. and Sarma K.V., Indian Astronomy - a source book, Nehru Centre, Bombay 1985.
- Sen S.N. and Shukla K.S., History of Astronomy in India, INSA, New Delhi 1985.

- Balachandra Rao S., Indian Astronomy - an Introduction, University Press (India) Limited, Hyderabad 2000.