DISCIPLINE SCIENTFIC ELECTIVE COURSE: **ALS ZOO DSE-07**

BASICS OF CHRONOBIOLOGY

Credits distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practicals / Practice		
Basics of chronobiology ALS ZOO DSE 07	**4**	**2**	**Nil**	**2**	**Appeared in Sem-VI**	NA

Learning Objectives

The learning objectives of this course are as follows:

- to understand the cyclic physiological phenomena.
- to learn about the unique phenomena of seasonal migration and hibernation.
- to expose the students to clock dysfunctions.
- to make the students aware of the various aspects of chronobiology and its application in therapeutics and medicine
- to enable the students to learn about their own rhythms of sleep and body temperature
- Summarize the importance of various biological rhythm in nature.

Learning Outcomes

By studying this course, students will be able to

- Understand the concepts of biological significance of biological rhythms
- Acquaint with the patterns of animal behaviour and importance of circadian rhythms.
- Observe the adaptations in various animals.
- Develop an overview of the principles of chronobiology.
- Molecular mechanisms underlying the generation of circadian time
- study about the applications of chronobiology in medicine, pharmacology and therapeutics.

- **Theory** **30h**

UNIT- 1: Introduction to Chronobiology **12 h**

Milestone and scope of chronobiology; Types and properties of Rhythms – Ultradian rhythms, Circadian rhythms, Infradian rhythms; Lunar rhythm; Circannual rhythm. Characteristics of circadian rhythms, Temperature compensation; Masking and synchronization; Zeitgebers- Photic and non-photic Zeitgebers.

UNIT- 2: Biological clock system **8 h**

Characteristics, Input, time generation and output components; Central and peripheral clocks; Suprachiasmatic nucleus; Molecular mechanisms underlying the generation of circadian time in Drosophila.

UNIT- 3: Circannual rhythm and Photoperiodism **10 h**

Circannual rhythms; Photoperiodism and regulation of seasonal breeding animals in vertebrates; Pineal as photoreceptive structure in non-mammalian vertebrates. Seasonal Migration in birds; Role of melatonin and serotonin.

UNIT- 4: Circadian rhythms and human health. **10 h**

Circadian clock and sleep-wake cycle; Jet Lag, Shift work ; Sleep and Chronotypes; Consequence of clock dysfunction- Sleep Disorders, Depression, Anxiety, Stress, Cancer; Obesity, Immune Disorders; Chronopharmacology, Chronomedicine and Chronotherapy.

Practicals **60 h**

(Laboratory periods: 15 classes of 4 hours each)

1. Study of characteristics of circadian rhythms from a given dataset.
2. Ambulatory blood pressure monitoring and biological rhythm analysis.
3. Using periodically assembled data study of body temperature rhythm.
4. Study of circadian functions in humans (daily eating, sleep and temperature patterns).
5. Human chronotypes-MCTQ questionnaire and analysis.
6. Project related to topics covered in theory/ project report based on visit to labs/institutions/industry etc.

Essential/recommended readings

1. Binkley, S. (2020). Biological clocks: Your owner's manual. CRC Press.

2. Jay. C. Dunlap, Jennifer. J. Loros, Patricia J. DeCoursey (ed). 2004, Chronobiology Biological Timekeeping: J, Sinauer Associates, Inc. Publishers, Sunderland, MA, USA.
3. Koukkari, W. L., & Sothern, R. B. (2007). Introducing biological rhythms: A primer on the temporal organization of life, with implications for health, society, reproduction, and the natural environment. Springer Science & Business Media.

SUGGESTED readings

1. Palmer, J. D. (2002). The living clock: The orchestrator of biological rhythms. OxfordUniversity Press.
2. Dunlap J. C, Loros J. J, DeCoursey P. J. (2004) Chronobiology Biological Time keeping. Sinauer Associates, Inc. Publishers, Sunderland, MA, USA.
3. Saunders D. S. (2002). Insect Clocks. III Edition, Barens and Noble Inc. New York, USA

NOTE: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time