

**Sri Venkateswara University, TIRUPATI**  
**B.Sc. PHYSICS II SEMESTER SYLLUBUS UNDER CBCS**  
w.e.f. 2015-16

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**Paper II: Waves & Oscillations**  
**(For Maths Combinations)**

**Work load: 60 hrs**

**4hrs/week**

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**UNIT-I (12 hrs)**

**1. Simple Harmonic oscillations**

Simple harmonic oscillator and solution of the differential equation - Physical characteristics of SHM, torsion pendulum-measurements of rigidity modulus, compound pendulum-measurement of 'g', Principle of superposition, beats, combination of two mutually perpendicular simple harmonic vibrations of same frequency and different frequencies. Lissajous figures.

**UNIT-II (12 hrs)**

**2. Damped and forced oscillations**

Damped harmonic oscillator, solution of the differential equation of damped oscillator. Energy considerations, comparison with un-damped harmonic oscillator, logarithmic decrement, relaxation time, quality factor, differential equation of forced oscillator and its solution, amplitude resonance and velocity resonance.

**UNIT-III (10 hrs)**

**3. Complex vibrations**

Fourier theorem and evaluation of the Fourier coefficients, analysis of periodic wave functions-square wave, triangular wave, saw tooth wave, simple problems on evolution of Fourier coefficients.

**UNIT-IV (17 hrs)**

**4. Vibrating strings: 8 hrs**

Transverse wave propagation along a stretched string, general solution of wave equation and its significance, modes of vibration of stretched string clamped at ends, overtones and harmonics. Energy transport and transverse impedance.

**5. Vibrations of bars: 9 hrs**

Longitudinal vibrations in bars-wave equation and its general solution. Special cases (i) bar fixed at both ends (ii) bar fixed at the midpoint (iii) bar fixed at one end. Tuning fork.

**UNIT-V (9 hrs)**

**6. Ultrasonics**

Ultrasonics, properties of ultrasonic waves, production of ultrasonics by piezoelectric and magnetostriction methods, detection of ultrasonics, determination of wavelength of ultrasonic waves. Applications of ultrasonic waves.

## REFERENCE BOOKS:

1. B.Sc. Physics Vol.1, Telugu Academy, Hyderabad.
2. Waves and Oscillations. N. Subramanyam and Brijlal, Vikas Publications.
3. Unified Physics Vol., Mechanics, Waves and Oscillations, Jai Prakash Nath & Co.Ltd.
4. Fundamentals of Physics. Halliday/Resnick/Walker, Wiley India Edition 2007.
5. Waves & Oscillations. S. Badami, V. Balasubramanian and K.R. Reddy, Orient Longman.
6. College Physics-I. T. Bhimasankaram and G. Prasad. Himalaya Publishing House.
7. Science and Technology of Ultrasonics- Baldevraj, Narosa, New Delhi, 2004
8. Introduction to Physics for Scientists and Engineers. F.J. Buche. McGraw Hill.

## Practical Paper II: Waves & Oscillations

Work load: 30 hrs per semester

2hrs/week

### Minimum of 6 experiments to be done and recorded

1. Volume resonator experiment
2. Determination of 'g' by compound/bar pendulum
3. Simple pendulum normal distribution of errors-estimation of time period and the error of the mean by statistical analysis
4. Determination of the force constant of a spring by static and dynamic method.
5. Determination of the elastic constants of the material of a flat spiral spring.
6. Coupled oscillators
7. Verification of laws of vibrations of stretched string-sonometer
8. Determination of frequency of a bar -Melde's experiment.
9. Study of a damped oscillation using the torsional pendulum immersed in liquid-decay constant and damping correction of the amplitude.
10. Formation of Lissajous figures using CRO.

### Suggested student activities

Student seminars, group discussions, assignments, field trips, study project and experimentation using virtual lab

### Examples

- Seminars - A topic from any of the Units is given to the student and asked to give a brief seminar presentation.
- Group discussion - A topic from one of the units is given to a group of students and asked to discuss and debate on it.
- Assignment - Few problems may be given to the students from the different units and asked them to solve.
- Field trip - Visit to Satish Dhawan Space Centre, Sriharikota / Thermal and hydroelectric power stations / Science Centres, any other such visit etc.
- Study project - Web based study of different satellites and applications.

### Domain skills:

Logical derivation, experimentation, problem solving, data collection and analysis, measurement skills

\*\*\* Documental evidence is to be maintained for the above activities.