ST.JOSEPH’S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

I SEMESTER **PHYSICS**  TIME:4 HRS/WEEK

PH 1402 (3) **MECHANICS, WAVES AND OSCILLATIONS** MAX.MARKS:100

w.e.f. 2020 – 2021 (“20AH”) **SYLLABUS**

**COURSE OUTCOMES:** **On successful completion of this course, the students will be able to:**

* Understand Newton’s laws of motion and motion of variable mass system and its application to rocket motion and the concepts of impact parameter, scattering cross section.
* Apply the rotational kinematic relations, the principle and working of gyroscope and its applications and the precessional motion of a freely rotating symmetric top.
* Comprehend the general characteristics of central forces and the application of Kepler’s laws to describe the motion of planets and satellite in circular orbit through the study of law of Gravitation.
* Understand postulates of Special theory of relativity and its consequences such as length contraction, time dilation, relativistic mass and mass-energy equivalence.
* Examine phenomena of simple harmonic motion and the distinction between undamped, damped and forced oscillations and the concepts of resonance and quality factor with reference to damped harmonic oscillator.
* Appreciate the formulation of the problem of coupled oscillations and solve them to obtain normal modes of oscillation and their frequencies
* Appreciate the formulation of the problem of coupled oscillations and solve them to obtain normal modes of oscillation and their frequencies in simple mechanical systems.
* Figure out the formation of harmonics and overtones in a stretched string and acquire the knowledge on Ultrasonic waves, their production and detection and their applications in different fields.

**UNIT – I:**

**1. MECHANICS OF PARTICLES:**

Review of Newton’s Laws of Motion, Motion of variable mass system, Motion of a rocket, Multistage rocket, Concept of impact parameter, scattering cross-section, Rutherford scattering-Derivation.

**2. MECHANICS OF RIGID BODIES:**

Rigid body, rotational kinematic relations, Equation of motion for a rotating body, Angular momentum and Moment of inertia tensor, Euler equations, Precession of a spinning top, Gyroscope, Precession of atom and nucleus in magnetic field, Precession of the equinoxes

**UNIT – II:**

**3. MOTION IN A CENTRAL FORCE FIELD:**

Central forces, definition and examples, characteristics of central forces, conservative nature of central forces, Equation of motion under a central force, Kepler’s laws of planetary motion- Proofs, Motion of satellites, Basic idea of Global Positioning System (GPS), weightlessness, Physiological effects of astronauts

**UNIT – III:**

**4. RELATIVISTIC MECHANICS:**

Introduction to relativity, Frames of reference, Galilean transformations, absolute frames, Michelson-Morley experiment, negative result, Postulates of Special theory of relativity, Lorentz transformation, time dilation, length contraction, variation of mass with velocity, Einstein’s mass-energy relation.

**UNIT – IV:**

**5. UNDAMPED, DAMPED AND FORCED OSCILLATIONS:**

Simple harmonic oscillator and solution of the differential equation, Damped harmonic oscillator, Forced harmonic oscillator – Their differential equations and solutions, Resonance, Logarithmic decrement, Relaxation time and Quality factor.

**6. COUPLED OSCILLATIONS:**

Coupled oscillators-Introduction, Two coupled oscillators, Normal coordinates and Normal modes- N-coupled oscillators and wave equation

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**UNIT – V:**

**7. VIBRATING STRINGS:**

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,Melde’s strings.

**8. ULTRASONICS:**

Ultrasonics, General Properties of ultrasonic waves, Production of ultrasonics by piezoelectric and magnetostriction methods, Detection of ultrasonics, Applications of ultrasonic waves, SONAR

**REFERENCE BOOKS:**

1. B. Sc. Physics, Vol.1, Telugu Academy, Hyderabadϖ
2. Fundamentals of Physics Vol. I – Resnick, Halliday, Krane ,Wiley India 2007ϖ
3. College Physics-I. T. Bhimasankaram and G. Prasad. Himalaya Publishing House.ϖ
4. University Physics-FW Sears, MW Zemanskyϖ& HD Young,Narosa Publications, Delhi
5. Mechanics, S.G.Venkatachalapathy, Margham Publication, 2003.ϖ
6. Waves and Oscillations. N. Subramanyam and Brijlal, VikasPulications.ϖ
7. Unified Physics – Waves and Oscillations, Jai PrakashNathϖ&Co.Ltd.
8. Wavesϖ& Oscillations. S.Badami, V. Balasubramanian and K.R. Reddy, Orient Longman.
9. The Physics of Waves and Oscillations, N.K.Bajaj, Tata McGraw Hillϖ
10. Science and Technology of Ultrasonics- Baldevraj, Narosa, New Delhi,2004.

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ST.JOSEPH’S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

I SEMESTER **PHYSICS**  TIME:2HRS/WEEK

PH 1452 (2) **MECHANICS, WAVES AND OSCILLATIONS** MAX.MARKS:50

w.e.f. 2020-2021 Admitted Batch (21AH) **PRACTICAL** **SYLLABUS – I A**

**COMPULSORY EXPERIMENTS:**

1.Uniform bending----Determination of Y

2.Viscosity of a liquid-----Poiseuille's method

3.Bifiliar Pendulum-----Determination of I

4.Torsional Pendulum------Determination of n

5.Volume resonator-----Determination of frequency

6. Compound pendulum-----Determination of g

7. Spiral spring---Determination of Y and n

8. Verification of laws of vibration of strings------Sonometer

**DEMONSTRATION EXPERIMENTS:**

1.Melde's experiment----Determination of frequency

2.Fly wheel------Determination of I

3.Two coupled oscillators---Determination of coupling constant

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