PHYSICS-18: CLASSICAL DYNAMICS

The emphasis of the course is on applications in solving problems of interest to physicists. The students are to be examined entirely on the basis of problems, seen and unseen.

Classical Mechanics of Point Particles: Generalised coordinates and velocities. Hamilton's Principle, Lagrangian and the Euler-Lagrange equations. Applications to simple systems such as coupled oscillators. Canonical momenta & Hamiltonian. Hamilton's equations of motion. Applications: Hamiltonian for a harmonic oscillator, particle in a central force field. Poisson brackets. Canonical transformations. (15 Lectures)

Special Theory of Relativity: Postulates of Special Theory of Relativity. Lorentz Transformations. Minkowski space. The invariant interval, light cone and world lines. Spacetime diagrams. Time-dilation, length contraction and the twin paradox. Four-vectors: spacelike, timelike and lightlike. Four-velocity and acceleration. The metric and alternating tensors. Four-momentum and energy-momentum relation. Doppler effect from a four-vector perspective. Concept of four-force. Conservation of four-momentum. Relativistic kinematics. Application to two-body decay of an unstable particle. The Electromagnetic field tensor and its transformation under Lorentz transformations: relation to known transformation properties of **E** and **B**. Electric and magnetic fields due to a uniformly moving charge. Equation of motion of a charged particle and Maxwell's equations in tensor form. Motion of charged particles in external electric and magnetic fields. (23 Lectures)

Electromagnetic radiation: Review of retarded potentials. Potentials due to a moving charge: Lienard Wiechert potentials. Electric and Magnetic fields due to a moving charge: Power radiated, Larmor's formula and its relativistic generalisation. (10 Lectures)

Suggested Study: Principle of Virtual Work and d'Alebert's Principle; Canonical transfromations; Aberration of Starlight; Synchrotron Radiation.

Reference Books:

- Classical Mechanics, H. Goldstein, C. P. Poole, J. L. Safko, 3rd Edn., 2002, Pearson Education.
- Mechanics, L. D. Landau and E. M. Lifshitz, 1976, Pergamon.
- Classical Electrodynamics, J.D. Jackson, 3rd Edn., 1998, Wiley.
- The Classical Theory of Fields, L.D Landau, E.M Lifshitz, 4th Edn., 2003, Elsevier.
- Introduction to Electrodynamics, D.J. Griffiths (International Edition), 2012, Pearson Education.
- Classical Mechanics: An introduction, Dieter Strauch, 2009, Springer.
- Solved Problems in classical Mechanics, O.L. Delange and J. Pierrus, 2010, Oxford Press.

PHYSICS PRACTICAL-VIII

(Students have to perform at least 5 experiments from the section VIIIB. Additional experiments may be included with the approval of the committee of courses)

PHYSICS LAB.-VIIIB

1. To study the output characteristics of a MOSFET.
2. To study the characteristics of a UJT and design a simple Relaxation Oscillator.
3. To design an Amplitude Modulator using Transistor.
4. To design PWM, PPM, PAM and Pulse code modulation using ICs.
5. To design an Astable multivibrator of given specifications using transistor
6. To study a PLL IC (Lock and capture range)
7. Generation of DSB-SC AM signal and SSB AM signal
8. To study envelope detector for demodulation of AM signal
9. Study of ASK and FSK modulator
10. Study of PSK modulator and demodulator.
11. To study ASK encoded data and detection of unique code in RFID technology.

Reference Books:

- Basic Electronics:A text lab manual, P.B.Zbar, A.P.Malvino, M.A.Miller,1994, Mc-Graw Hill
- Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill
- Electronics : Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall
- OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall
- Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill

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