St. Xavier's College – Autonomous
Mumbai

Syllabus
For 3rd Semester Courses in PHYSICS
(June 2018 onwards)

Contents:

Course: SPHY0301

Title: Waves and Quantum Optics
Learning Objectives: To understand the interaction of light with matter.
Number of Lectures: 45

Unit 1
Interference and Diffraction (15 lectures)
Michelson Interferometer : circular fringes, localized fringes, white light fringes.
The Fabry-Perot Interferometer, Febry-Perot Spectroscopy.
Fresnel Diffraction : Introduction, Fresnel's half period zones, diffraction by a circular aperture and obstacle, zone plate, apertures and obstacles with straight edges, vibration curve for strip division: Cornu's Spiral, diffraction by a single slit and narrow obstacle.

Unit 2
Polarization (15 lectures)
The nature of polarized light: linear, circular, elliptical polarization, Polarizers, Dichroism, Birefringence: crystals and polarizers, Scattering and Polarization, Polarization by reflection, Retarders: Wave plates and Rhombs, Half wave plate, Quarter wave plate, compensator and variable retarders. Circular Polarizers, Polarization of Polychromatic light, Optical activity, Induced optical effects: photoelasticity, The Faraday effect, Kerr and Pockets Effects. Liquid crystals.

Unit 3
Quantum Optics (15 lectures)
Basics of coherence theory: introduction, visibility, Coherence length, temporal and spatial coherence.
Lasers: introduction, Stimulated Emission: population of energy levels, The Einstein A and B coefficients, Metastable states, pumping, optical resonator cavities, Guassian laser beams, Ruby Laser, He-Ne Laser, semiconductor laser, speckle effect, applications of LASERS.
Holography: Basic principles of Holography, viewing a Hologram, Developments and applications, Holographic Interferometry.

REFERENCE BOOKS:

1. Optics -by Eugene Hecht, 4th ed., Pearson Education Asia, 2002.
2. Optics -by Ajoy Ghatak, McGraw-Hill Education, 2009.
3. Fundamentals of Optics –by Jenkins and White, 4th ed., McGraw Hill Education, 2001
4. LASERS- by Ajoy Ghatak and Thyagarajan, Springer, 2010

Course: SPHY0302

Title: Mathematical Physics
Learning Objectives: To understand the mathematical concepts related to physics
Number of lectures: 45

Unit 1 **(15 lectures)**

Conics 10+2 level (parabola, hyperbola, ellipse)
Vector analysis
Coordinate systems (orthogonal curvilinear)

Unit 2 **(15 lectures)**

Matrices and applications
Probability theory and applications.
Differential equations-1

Unit 3 **(15 lectures)**

Differential equations-2
Fourier series
Fourier and Laplace Transforms

References:-

1. Thomas, George B. Jr.; Weir, Maurice D. & Hass, Joel: Calculus. (12th ed.) Chennai. Pearson India Education Services Pvt. Ltd, 2016. 978-93-325-4242-6--(515Tho)

2. Dass, H.K. & Verma, Rama: Mathematical physics. (6th ed. reprint) New Delhi. S. Chand & Company Ltd., 2011(2012). 81-219-1469-8--(530.15Das)

3. Gupta, B.D.: Mathematical physics. (4th ed.) New Delhi. Vikas Publishing House Pvt. Ltd., 2010(2011). 978-81-259-3096-9--(530.15Gup)

4. Arfken, George B. & Weber, Hans J.: Mathematical methods for physicists. (4th ed. Indian reprint) Bangalore. Prism Books Pvt. Ltd., 1995. 81-7286-036-6--(530.15ARF/WEB)

5. Riley, K.F.; Hobson, M.P. & Bence, S.J.: Mathematical methods for physics and engineering. (3rd ed.) Cambridge. Cambridge University press, 2010. 978-0-521-13987-8--(515.1Ril)

C.I.A.: Problem Solving / Multiple Choice Questions /Assignments/Presentations

Course: SPHY0303

Title: Electronics
Learning Objectives: Understanding working of basic electronic gadgets.
Number of Lectures: 45

UNIT I P-N junctions, BJT (15 Lectures)
Review of Semiconductor Diodes, Diode Applications (Revision), Passive filters
Bipolar Junction Transistor, DC Biasing of BJTs, BJT Frequency Analysis
Self study:
Common base configuration, Current-mirrors, current source circuits, practical Applications

Unit II OPAMPs and Thyristors (15 Lectures)
Differential amplifiers, Operational amplifiers
Op Amp applications
SCR &Applications of SCR
Self Study:
Light activated SCR, Photo-transistors, Opto-isolators

Unit III Digital Electronics (15 lectures)
Digital logic (Revision),
Combinational logic circuits Number Systems and Codes
Arithmetic circuits
Flip flops: RS FF, Clocked RS FF, JK FF, M/S JK FF, T- FF, Clear & Preset functions
Counters: Ripple counter upto 4 bit, Up-Down counter, modified counters
Self Study: digital clock, digital frequency meter

REFERENCE BOOKS:

Main References :-

1. Boylestad, Robert L. & Nashelsky, Louis: Electronic devices and circuit theory. (11th ed.) Noida. Pearson India Education Services Pvt. Ltd, 2016. 978-93-325-4260-0--(621.3815Boy/Nas)

2. Leach, Donald P.; Malvino, Albert Paul & Saha, Goutam: Digital principles and applications. (8th ed.) New Delhi. McGraw Hill Education (India) Private Ltd, 2015. 978-93-392-0340-5--(621.381Mal/Lea)

3. Malvino, Albert Paul & Bates, David J.: Electronic principles. (7th ed.) New Delhi. Tata McGraw Hill Education Private Limited, 2007(2010). 0-07-063424-4--(621.381Mal/Bat)

4. Mottershead, Allen: Electronic devices and circuits: An introduction. (Indian reprint) New Delhi. Prentice-Hall Of India Private Limited, 1973. 0-87692-124-1--(621.3815MOT)

C.I.A.:

Problem Solving / Multiple Choice Questions /Assignments/ /Seminar Presentations / Field trips

COURSE : SPHY03PR

REGULAR EXPERIEMENTS + PROJECT WORK (IN THEORY RELATED TOPICS)

Experimental Project work:	**30×3 marks**
Presentation:	**20 marks**
Exam on regular experiments	**25 marks**
Journal	**15 marks**

Minimum Three experiments from each paper

Wave and Quantum Optics:

1. Schuster Method.
2. Cauchy's constant.
3. Cylindrical obstacle.
4. R. P. of telescope.
5. Fresnel diffraction of straight edge or circular aperture
6. Diffraction grating –wavelength of Hg lines

Mathematical Physics:

1. Numerical analysis of Mathematical methods(e.g. Differential equation, matrices, Fourier analysis, different random walks) using softwares like Octave, MS Excel.
2. Finding solutions of different physical systems (Coupled harmonic motion, LCR Circuits
   etc.) using numerical analysis (using above mentioned softwares)
3. Demonstration of Fourier series using OPAMP circuits.

Electronics:

1. Bridge rectifier, Zener Diode.
2. Study of Clipper and clamper circuits
3. Transistor o/p characteristics, different biasing, load line and stability.
4. CE amplifier, frequency response, input and output impedance
5. Logic gates + half adder, Full adder
6. Sum of product and product of sum method.
7. Opamp- inverting, non inverting ammplifiers and voltage folloer

REFERENCES:

1.Advanced Practical Physics –Worsnop & Flint .
2.Advanced course in Practical Physics D.Chattopadhye , P.C. Rakshit & B,Saha .
3. B.Sc. Practical Physics –C.L. Arora