<table>
<tr><td>Title of the Course Unit</td><td colspan="2">Practical Physics II</td></tr>
<tr><td>Course Code</td><td colspan="2">PHY 201 G2</td></tr>
<tr><td>Credit Value</td><td colspan="2">02 (90 hours of practical)</td></tr>
<tr><td>Objectives</td><td colspan="2">• Recall the basic laboratory skills
• Improve skills on experimental measurements in optics and electronics
• Design and present content-oriented attractive poster</td></tr>
<tr><td>Intended Learning Outcomes</td><td colspan="2">• Develop experimental skills to carry out laboratory practical in Optics and Electronics
• Explain experimental findings in relation to existing theories
• Conclude the experimental results
• Disseminate knowledge through content-oriented poster</td></tr>
<tr><td rowspan="2">Content/Description</td><td colspan="2">Students must attend weekly practical sessions each of three hours duration during whole academic year. Practicals will mostly be related to;

Optics: Biprism, Air Wedge, Newton’s Ring, Single Slit Diffraction, Prism Spectrometer, Transmission Grating, Polarization by pile of plates.

Electronics: Diode characteristics, Rectifiers, Solar cells characterization, Transistor (BJT & FET) characteristics and amplifiers, Feedback circuits, Oscillators, Operational amplifiers, Digital circuits

On completion of each weekly practical, students should submit lab report for marking. Marks will be allocated to the readings taken and their laboratory report.</td></tr>
<tr><td colspan="2">Poster Presentation: Students will be trained on preparing and presenting good posters. They will be allowed to select topic which could explain basic principle in any areas of Physics.

Posters will be evaluated under following categories: Typography, Layout & Structure and Content of the poster as well as Interaction of the poster presenter with audience.</td></tr>
<tr><td>Teaching and Learning Methods / Activities</td><td colspan="2">Laboratory demonstration
Weekly lab reports
Poster presentation</td></tr>
<tr><td rowspan="3">Evaluation</td><td>Continuous assessment on practical classes and lab reports</td><td>50 %</td></tr>
<tr><td>Poster presentation during the course</td><td>10 %</td></tr>
<tr><td>End of Practical Examinations in Electronics and Optics</td><td>40 %</td></tr>
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Recommended References	• A Practical Guide to Experimental Geometrical Optics, Yuriy A. Garbovskiy and Anatoliy V. Glushchenko, Cambridge University Press (2017), ISBN: 9781316758465. • An Introduction to Practical Laboratory Optics, J. F. James, Cambridge U. Press 196 pp (2014), ISBN 978-1-107-68793-6. • Practical Physics and Electronics, C.C. Ouseph and U.J. Rao, Viswanathan Printers & Publishers Pvt Ltd (2009), ISBN-10: 818715621X, ISBN-13: 978-8187156215. • Experiments and Demonstrations in Physics (second edition), Yaakov Kraftmakher, World Scientific (2014) 796 pages ISBN-10: 9789814434881.

Title of the Course Unit	**Solid State Physics**	
Course Code	PHY 202 G2	
Credit Value	02 (30 hours of lectures and tutorials)	
Objectives	• Distinguish various types of atomic/molecular bonds • Analyze different types of crystal structures • Explain thermal and electrical properties of matter • Classify insulators, semiconductors and conductors	
Intended Learning Outcomes	• Demonstrate different types of bonds • Categorize different types of crystal structures • Develop models for thermal and electrical properties of solids • Categorize different types of semiconductors • Demonstrate the formation of p-n junctions	
Content /Description	**Structure of matter:** Nature of matter, charge to mass ratio of electrons, mass spectrograph, determination of the electron charge, crystals, types of crystals, crystal structures, unit cells, FCC, BCC and HCP structures, crystal defects, X-ray diffraction.	
	Inter-atomic forces: Molecules and binding forces; Van der Waals, ionic, covalent and metallic bonds.	
	Thermal properties of solids: Monoatomic and diatomic lattice vibration, boundary conditions, phonon density of states, Classical theory of heat capacity of solids, Einstein model, Debye model, thermal expansion.	
	Electrical properties: Drude free electron theory of metals, failures of Drude model, Sommerfeld free electron theory, Density of states, Fermi-Dirac statistics, Fermi energy, the qualitative introduction to band theory of solids, classification of solids based on energy band diagram, introduction to semiconductors, intrinsic and extrinsic semiconductors, donors and acceptors, Fermi level in semiconductors, formation of p-n junctions.	
Teaching and Learning Methods / Activities	Lectures and tutorial discussions	
Evaluation	In-Course Assessment Examinations	30 %
	End of Course Examination	70 %
Recommended References	• Introduction to Solid State Physics, C. Kittel (8th Edition), Wiley (2004) • Solid State Physics: Structure and Properties of Materials, M.A. Wahab, (2nd Edition), Alpha Science International Ltd. (2005) • Elementary Solid State Physics: Principles and Applications, M.A. Omar, (4th edition), Addison-Wesley (1994)	

Title of the Course Unit	**Optics and Special Relativity**	
Course Code	PHY 203 G2	
Credit Value	02 (30 hours of lectures and tutorials)	
Objective/s	• Illustrate the basic principles of geometrical optics • Explain the interference, diffraction and polarization of light • Introduce the operating principle of lasers and its applications • Explain the concepts of special relativity	
Intended Learning Outcomes	• Apply lens maker equations for thick and thin lenses • Categorize the formation of various types of aberrations in lenses • Understand the interference, diffraction and polarization of light • Demonstrate Einstein postulates in special theory of relativity	
Contents	**Ray Optics:** Huygen's principle, spherical mirrors, thick and thin lenses, lens combinations, lens aberration, eye pieces, telescope, microscope.	
	Interference: Wave nature of light, two beam interference on non-reflecting films, Michelson interferometer, Rayleigh refractometer, multiple beam interference, Fabry–Perot interferometer and its chromatic resolving power, interference filters.	
	Diffraction: (**Fraunhöfer diffraction)** Single slit diffraction, chromatic resolving power of a prism, resolving power of telescopes and microscopes. Double slit diffraction, Michelson's stellar interferometer, multiple slit diffraction, diffraction and reflection gratings, chromatic resolving power of gratings (Fresnel diffraction), Diffraction at a straight edge, diffraction at circular apertures and obstacles, the zone plate.	
	Polarization: Polarization by absorption, polarization by reflection, scattering and double refraction, properties of ordinary and extra-ordinary rays, quarter wave and half wave plates, interference of polarized light.	
	Introduction to Lasers: The fundamental physical processes of lasers, variety of specific laser systems, optical laser gain, oscillation, resonators, application of laser	
	Special theory of relativity: Invariance of the velocity of light in vacuum and its experimental confirmation, Einstein's postulates, Lorentz transformation of space and time co-ordinates, time dilation, length contraction and their experimental confirmations, transformation of velocities, mass-velocity and mass-energy relationships, transformation of momentum and energy, simple applications of special relativity.	
Teaching and Learning Methods / Activities	Lectures and tutorial discussions	
Evaluation	In-Course Assessment Examinations	30 %
	End of Course Examination	70 %

Recommended References	• Fundamentals of Optics, F.A. Jenkins and H.E. White (4^{th} edition), McGraw-Hill (1976) • A Textbook of Optics, N. Subrahmanyam, B.V. Lal and M.N. Avadhanulu, S. Chand and Co. Ltd. (2006) • Special Relativity, A.P.French, The MIT Introductory Physics Series, W.W. Norton and Company (1968)

Title of the Course Unit	Electromagnetism
Course Code	PHY 204 G2
Credit Value	02 (30 hours of lectures and tutorials)
Objective/s	• Recall basic mathematics required to formulate electromagnetic theory • Apply Maxwell's equations in problems related to electro-statics and magneto-statics • Make use of electromagnetic theory to solve problems in changing electromagnetic fields
Intended Learning Outcomes	• Describe various laws of electromagnetism including Coulomb's law, Gauss's law • Utilize laws of electromagnetism to evaluate and predict the forces in an isolated multi-charge system • Explain electromagnetic induction and Faraday's law • Use Maxwell's equations to describe the time-varying electromagnetic fields
Contents	**Electrostatics:** Coulomb's law, electric field (**E**) and potential (V), Gauss's law in vacuum, Laplace's and Poisson's equation, electric dipoles, uniqueness theorems, conducting sphere in electric field, the method of images: point charge near conducting sphere and line charge near conducting cylinder as examples, capacitance of parallel cylinders, work and energy in electrostatics, force on a charged conductor. Isotropic dielectrics, polarization charges, Gauss's law in dielectric, permittivity and susceptibility, properties of electric displacement (**D**) and electric field **(E)**, boundary conditions at dielectric boundaries, relationship between electric field **(E)** and polarization (**P**), thin slab in electric field, dielectric sphere in an electric field, local fields inside dielectrics, Clausius-Mossotti equation.
	Magnetostatics: Forces between current carrying elements, Gauss's law, dipoles, magnetic scalar potential, Ampère's law, magnetic vector potential. Magnetic media, magnetization, permeability and magnetic susceptibility, properties of magnetic field (**B**) and magnetic field intensity (**H**), boundary conditions at surfaces, methods of calculating **B** and **H**, magnetisable sphere in a uniform magnetic field, electromagnets, magnetic circuits, diamagnetism, paramagnetism, ferromagnetism, Curie-Weiss law, domains, hysteresis, permanent magnets.
	Time varying EM fields: Electromagnetic induction, Faraday's law, magnetic energy, self-inductance, inductance of a long solenoid, coaxial cylinders, parallel cylinders, mutual inductance, transformers, displacement current, Maxwell's equations, electromagnetic waves.

Teaching and Learning Methods / Activities	Lectures and tutorial discussions	
Evaluation	In-Course Assessment Examinations	30 %
	End of Course Examination	70 %
Recommended References	• Introduction to Electrodynamics, D. J. Griffiths (4th edition), Addition-Wesley (2012) • The Feynman Lectures on Physics, R.P. Feynman, R. B. Leighton and M. Sands, Vol II, Addison-Wesley (1964) • Electricity and Magnetism, W.J. Duffin (4th Edition), McGraw-Hill (1973)	

Title of the Course Unit	**Computational Physics**	
Course Code	PHY 205 G2	
Credit Value	02 (20 hours of lectures and 30 hours of practical)	
Objective/s	• Outline the features of MATLAB • Apply numerical methods in solving physics problems • Design algorithms to simulate physics problems	
Intended Learning Outcomes	• Illustrate the capabilities and limitations of computational methods in solving homogeneous linear equations • Explain the characteristics of various numerical methods exploited in solving physics problems. • Analyze physical problems and their solutions on a computer. • Develop skills to write and develop simple simulation programs	
Contents	**Introduction:** Programming languages and algorithms, scientific software libraries	
	Numerical methods with programming exercises in MATLAB: Root finding, solving linear systems by direct and iterative methods, interpolation and extrapolation, differentiation and integration, curve fitting, matrices and eigenvalue problems, linear and nonlinear equations, eigen-systems, solution of ordinary differential equations, elementary statistics, Fourier transforms.	
	Computer simulation of the physics problems: The motion of falling objects, two body problems, mini solar system, two body scattering, harmonic oscillator, electric circuit oscillator, electric field due to a charge distribution.	
Teaching and Learning Methods / Activities	Lectures and tutorial discussions	
Evaluation	**Theory** In-Course Assessment Examinations End of course examination	 30% 70 %
	Practical Continuous assessment of practical reports End of course practical examinations	 40 % 60 %
	Weightage: Theory Practical	 75 % 25 %

Recommended References	• A Practical Introduction to Programming and Problem Solving, S. Attaway, MATLAB (3rd edition), Elsevier Inc. (2013) • A First Course in Computational Physics, P.L. Devries and J.E. Hasbun (2nd edition), Jones and Barlett Publishers (2011) • A Guide to MATLAB for Beginners and Experienced Users, B.R. Hunt, R.L. Lipsman and J.M. Rosenberg, (3rd edition), Cambridge University Press (2014)