Learning Outcomes based Curriculum Framework (LOCF)

For

B.Sc. Physics

(Four Year Degree Programme)

w.e.f. Session 2021-22

University School for Graduate Studies

Chaudhary Devi Lal University

Sirsa-125055, Haryana

2021

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1. About University School for Graduate Studies (USGS)

National Education Policy (NEP) -2020 has provided an impetus to the changing horizons of Higher Education. Chaudhary Devi Lal University Sirsa has recently established University School for Graduate Studies (USGS) in Teaching Block-IV (Dr. APJ Abdul Kalam Bhawan) of the university in order to start new programmes and courses for tuning ourselves to the latest state-of-the-art in Higher Education. The University School for Graduate Studies (USGS) will focus on strengthening graduate studies especially in the wake of NEP-2020 and will focus on designing, developing and execution of market/industry demand-oriented Four Year Degree Programmes (FYDP). To benefit students, society and faculty, the USGS is destined to start graduate programmes based on Learning Outcomes Curriculum Framework and as per NEP-2020 such as: (i) B.Com. Banking & Insurance, (ii) B.Com. Fintech & Financial Markets, (iii) B.Com. Derivatives & Risk Management, (iv) B.Sc. Data Science, (v) B.Sc. Mathematics, (vi) B.Sc. Physics, (vii) B.A. Economics & Finance. In addition, there is a 1-year programme namely (viii) Bachelor of Library & Information Science

The holistic development of the students to compete the changing scenario of the world in the 21st century is of prime importance. The University School for Graduate Studies is committed to impart quality education comprising academic knowledge and technical skills to the students.

2. Learning Outcomes based Curriculum Framework

The Choice Based Credit Scheme (CBCS) evolved into learning outcome-based curriculum framework and provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill-based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Grading system provides uniformity in the evaluation and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations which enables the student to move across institutions of higher learning. The uniformity in evaluation system also enables the potential employers in assessing the performance of the candidates.

2.1 Objectives of the Programme

B.Sc. Physics – Four year undergraduate programme in Physics is structured:

1. to motivate/inspire the students to inculcate deep knowledge and understanding of physical concepts, principles and theories of Physics.
2. to learn, design and perform experiments in the labs to demonstrate the concepts, principles and theories of Physics.
3. to develop the ability to apply the knowledge and critical thinking to specific problems in theoretical and experimental Physics.
4. to make strong foundation in basic and applied aspects of Physics, in order to develop skills to solve problems of Physics having applications in other disciplines and/or in the real world; and hence undergo research in interdisciplinary areas, jobs in scientific and industrial sectors and/or teaching career in Physics.

2.2 Programme Outcomes (POs)

After completing the programme, the students have:

PO1	Knowledge	capability of demonstrating comprehensive knowledge acquired during the course of study.
PO2	Communication	ability to communicate effectively on different aspects of Physics through examples with the scientific community as well as society at large.
PO3	Problem Solving	capability of applying knowledge to solve scientific and other problems using theoretical and experimental techniques/tools; and ability to use and learn scientific techniques, skill and tools for practices in Physics and the real world.
PO4	Investigation of Problems	ability of critical thinking, analytical reasoning and research based knowledge including design/performance of experiments, analysis and interpretation of data to provide conclusions.
PO5	Science and Society	ability to apply reasoning to assess the different issues related to society and the consequent responsibilities relevant to the professional scientific practices.
PO6	Life-Long Learning	aptitude to apply knowledge and skills that are necessary for participating in learning activities throughout life.
PO7	Ethics	Apply ethical principles and professional responsibilities in scientific practices.
PO8	Project Management	ability to demonstrate knowledge and understanding of the scientific principles and apply them to manage projects

2.3 Programme Specific Outcomes (PSOs)

After completing the programme, the students:

PSO1	acquire basic knowledge and understanding in different core areas of Physics such as mechanics, electricity and magnetism, thermal physics, waves and optics, statistical mechanics, modern physics quantum mechanics, electronics, electromagnetic theory, semiconductor physics, communication systems, mathematical physics, computational physics, digital and analog systems, nuclear and particle physics, solid state physics, nanomaterials and applications, and some other elective areas.
PSO2	learn how to design and perform experiments demonstrating their understanding of scientific concepts/phenomena/methods/techniques; and develop skills and aptitude to pursue higher studies and research in Physics.
PSO3	develop written and oral communications skills to communicate physics-related topics effectively through verbal, written, computational and graphical presentations.
PSO4	apply knowledge, understanding, critical thinking and skills of Physics to analyze interdisciplinary problems and solve them using theoretical and experimental techniques/tools and skills.

3. Programme Structure

B.Sc. Physics- Four year (Eight semesters) undergraduate programme is of 200 credits weightage consisting of Core Courses (CC), Discipline Specific Elective Courses (DSC), Skill Enhancement Courses (SEC), Generic Elective Courses (GEC) and Ability Enhancement Compulsory Courses (AECC).

Table 1: Courses and Credit Scheme

Semester	Core Courses (CC)		Discipline Specific Elective Courses (DSC)		Skill Enhancement Courses (SEC)		Ability Enhancement Compulsory Courses (AECC)		Generic Elective Courses (GEC)		Grand Total Credits
	1	2	3	4	5	6	7	8	9	10	(2+4+6+8+10)
	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	
I	4	**12**	-	**-**	1	**2**	2	**8**	1	**6**	**28**
II	5	**13**	-	**-**	2	**4**	1	**4**	1	**6**	**27**
III	4	**12**	1	**4**	-	**-**	**-**	**-**	1	**6**	**22**
IV	5	**13**	1	**4**	-	**-**	**-**	**-**	1	**6**	**23**

Table 2: Detailed break-up of Credit Courses

Semester	Core Courses (CC)	Discipline Specific Elective Courses (DSC)	Skill Enhancement Courses (SEC)	Ability Enhancement Compulsory Courses (AECC)	Generic Elective Courses (GEC)	Total Courses(CC+ DSC+ SEC+AECC+ GEC)
I	CC1 CC2 CC3 CC4	-	SEC1	AECC1 AECC2	GEC1	**08**
II	CC5 CC6 CC7 CC8 CC9	-	SEC2 SEC3	AECC3	GEC2	**09**
III	CC10 CC11 CC12 CC13	DSC1	-	-	GEC3	**08**
IV	CC14 CC15 CC16 CC17 CC18	DSC2	-	-	GEC4	**09**

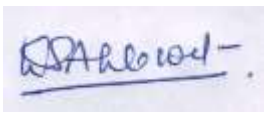


Table 3: Course code and Title along with credits details

Sr. No.	Course Code	Course Title	Credits		
			Lecture + Tutorial	Practical	Total
Semester I					
1.	ENG/1/AECC1	Functional English	4	-	4
2.	EVS/1/AECC2	Environmental Studies	4	-	4
3.	BSc/Phy/1/CC1	Mechanics	4	-	4
4.	BSc /Phy/1/CC2	Electricity & Magnetism	4	-	4
5.	BSc /Phy/1/CC3	Physics Lab.-I	-	2	2
6.	BSc /Phy/1/CC4	Physics Lab.-II	-	2	2
7.	BSc /Phy/1/SEC1	(i) Basic Instrumentation Skills **OR** (ii) Electrical Circuits & Networks	2	-	2
8.	……/1/GEC1	To be opted by student from Pool of Generic Elective Courses	-	-	6
				Total	**28**
Semester II					
1.	HIN/2/AECC3	Prayojanmoolak Hindi	4	-	4
2.	BSc/Phy/2/CC5	Thermal Physics	4	-	4
3.	BSc/Phy/2/CC6	Waves & Optics	4	-	4
4.	BSc/Phy/2/CC7	Physics Lab.-III	-	2	2
5.	BSc/Phy/2/CC8	Physics Lab.-IV	-	2	2
6.	BSc/Phy/2/CC9	Seminar	-	-	1
7.	BSc/Phy/2/SEC2	(i) Basic Instrumentation Lab. **OR** (ii) Electrical Circuits & Networks Lab.	-	2	2
8.	COMP/2/SEC3	Computer Skills	-	2	2
9.	……/2/GEC2	To be opted by student from Pool of Generic Elective Courses	-	-	6
				Total	**27**
Semester III					
1.	BSc/Phy/3/CC10	Mathematical Physics-I	4	-	4
2.	BSc/Phy/3/CC11	Elements of Modern Physics	4	-	4
3.	BSc/Phy/3/DSC1	Physics of Semiconductor Devices	4	-	4
4.	BSc/Phy/3/CC12	Physics Lab.-V	-	2	2
5.	BSc/Phy/3/CC13	Physics Lab.-VI	-	2	2
6	……../3/GEC3	To be opted by student from Pool of Generic Elective Courses	-	-	6
				Total	**22**
Semester IV					
1.	BSc/Phy/4/CC14	Electromagnetic Theory	4	-	4
2.	BSc/Phy/4/CC15	Classical and Statistical Physics	4	-	4
3.	BSc/Phy/4/DSC2	Solid State Physics	4	-	4
4.	BSc/Phy/4/CC16	Physics Lab.-VII	-	2	2
5.	BSc/Phy/4/CC17	Physics Lab.-VIII	-	2	2
6.	BSc/Phy/4/CC18	Seminar	-	-	1
7.	……./4/GEC4	To be opted by student from Pool of Generic Elective Courses	-	-	6
				Total	**23**

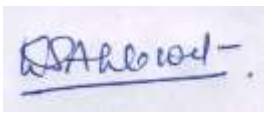
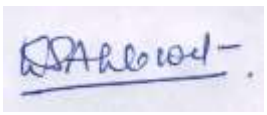
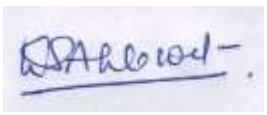



Table 4: Generic Elective Courses offered by Department of Physics for the Students of other departments

Course Code	**Course Title**	**Credits**
	Semester -I	
BSc/Phy/1/GEC1	Mechanics (Theory)	4
BSc/Phy/1/GEC2	Mechanics (Lab.)	2
	Semester -II	
BSc/Phy/2/GEC3	Waves and Optics (Theory)	4
BSc/Phy/2/GEC4	Waves and Optics (Lab.)	2
	Semester -III	
BSc/Phy/3/GEC5	Electricity & Magnetism (Theory)	4
BSc/Phy/3/GEC6	Electricity & Magnetism(Lab.)	2
	Semester -IV	
BSc/Phy/4/GEC7	Electromagnetic Theory	4
BSc/Phy/4/GEC8	Electromagnetic Lab.	2



Semester-I



ENG/1/AECC1 -Functional English

Credits: 4(Theory) **Max. Marks: 100**
Lectures: 60 **Final Term Exam.: 70**
Duration of Exam.: 3 Hrs. **Internal Assessment: 30**

Objective: The course aims to introduce students to the theory, fundamentals and tools of communication and to develop in them effective communication skills which should be integral to personal, social and professional interactions. In addition, to develop in them the understanding of the English language.

Learning Outcomes: After completion of the course, learners will:

CO1: have the knowledge of communication.
CO2: have speaking skills in social interactions and communication in professional situations such as interviews, group discussions and office environments.
CO3: have the knowledge and understanding of the language of communication.
CO4: have reading, listening and writing skills.

Note for the Paper Setter: *The question paper will consists of nine questions in all. The first question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit.*

Unit-I

Introduction: Definition andTheory of Communication, Types and modes of Communication. Language of Communication: Verbal and Non-verbal (Spoken and Written); Personal, Social and Business Barriers and Strategies; Intra-personal, Inter-personal and Group communication. Impact of communication on performance.

Unit-II

Speaking Skills: Monologue, Dialogue, Group Discussion, Effective Oral Communication, Miscommunication, Oral Presentation, Interview, Public Speech.

Unit-III

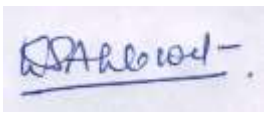
Remedial English: Parts of Speech, Sentences, Subject- Verb Agreement, Active and Passive Voice, Degrees of comparison, Direct and Indirect Speech, Question Tags.

Reading and Understanding: Close Reading, Comprehension, Summary, Paraphrasing, Analysis and Interpretation, Translation (from Indian language to English and vice-versa), Literary/Knowledge Texts.

Unit-IV

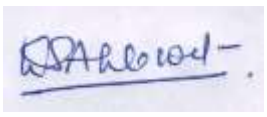
Writing Skills: Elements of writing, Documenting, Report Writing, Making notes, Letter writing, Business communications

Listening Skills: Listening and its types, Barriers of effective Listening, Barriers and Strategies for effective listening, Listening to complaints.



Suggested Readings:

1. B.K. Das and A. David, A Remedial Course in English, Book 2, C.I.E.F.L. (O.U.P.) 1980.
2. A.S. Hornby, Oxford Advanced Learner's Dictionary of Current English (O.U.P.) 3, A Textbook of English Phonetics for Indian Students by T. Balasubramanian.
3. Fluency in English - Part II, Oxford University Press, 2006.
4. Business English, Pearson, 2008.
5. Language, Literature and Creativity, Orient Blackswan, 2013.



EVS/1/AECC2 -Environmental Studies

Credits: 4 (Theory) **Max. Marks: 100**
Lectures: 60 **Final Term Exam.: 70**
Duration of Exam.: 3 Hrs. **Internal Assessment: 30**

Course Objective: Students will understand how science and the scientific methods work to address environmental problems. The students will become familiar with the Earth's major systems, how they function and how they are affected by human?

Course Outcomes: After completing the course in Environmental Studies, students will be able to: Demonstrate an integrated approach to environmental issues with a focus on sustainability; Use critical thinking, and methodological approaches of the social sciences, natural sciences, and humanities in environmental problem solving.

Note for the Paper Setter: *The question paper will consists of nine questions in all. The first question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit.*

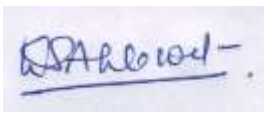
UNIT I

The multidisciplinary nature of environmental studies: Definition, Scope and importance need for public awareness. Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems. Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modem agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources; Growing energy needs, renewable and non-renewable energy sources, case studies. Land resources: Land as a resource, land degradation man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT II

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem. Producers, Consumers and decomposers. Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, Characteristic features, structure and function of the following of the ecosystem: Forest ecosystem, Grass land ecosystem, desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Biodiversity and its conservation: Introduction-Definition: genetic, species and ecosystem diversity. Bio-geographical classification of India. Value of diversity: consumptive use, productive use, social, ethical; aesthetic and option calls. Biodiversity at global, National and local levels. India as a mega- diversity nation. Hot-sports of biodiversity. Threats to biodiversity: habitat loos, poaching of wildlife, man-wildlife conflicts. Endangered and endemics. Conservation of biodiversity: In-situ and Ex-situ, Conservation of biodiversity.




UNIT III

Environmental Pollution: Definition-Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster Management: floods, earthquake, cyclone and landslides.

Social Issues and the environment: From Unsustainable to Sustainable development. Ur ban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Case studies. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation. Consumerism and waste products. Air (prevention and Control of Pollution) Act. Water (prevention and control of pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness.

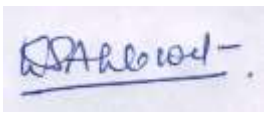
UNIT IV

Human Population and the Environment: Population growth, variation among nations. Population explosion- family Welfare Programme. Environment and human hea1th.Human Rights. Value Education. HIV/AIDS. Women and child welfare, role of information technology in environment and human health, Case Studies.

Field work: Visit to a local area to document environmental assets: river/forest grass land/ hill/mountain, Visit to a local polluted site-Urban/Rural/Industrial/ Agricultural, Study of common plants, insects, birds. Study of simple ecosystems pond, river, hill slopes, etc.

Suggested Readings:

1. Agarwal, K.C. 2001 *Environmental Biology,* Nidhi Publ. Ltd. Bikaner.
2. BharuchaErach, *The Biodiversity of India,* Mapin Publishing Pvt. Ltd., Ahmedabad- 380013, India.
3. Clerk RS., *Marine Pollution;* Clanderson Press Oxford.
4. *Down to Earth,* Centre for Science and Environment.
5. Hawkins R.E., *Encyclopedia of Indian Natural History,* Bombay Natural History Society, Bombay.
6. Mhaskar A.K, *Matter Hazardous,* Techno-Science Publications.
7. Townsend C., Harper J, and Michael Begon, *Essentials of ecology,* Blackwell Science.
8. Trivedi R.K and P.K Goel, *Introduction to air pollution,* Techno-Science Publications.
9. Trivedi R.K, *Handbook of Environmental Laws, Ru1es, Guidelines Compliances and Standards, Vol I and II,* Envirol Media.
10. Wagner KD., 1998. *Environmental Management.* W.B. Saunders Co. Philadelphia, USA.



BSc/Phy/1/CC1–Mechanics

Credits: 4 **Max. Marks: 100**
Lectures: 60 **Final Term Exam.: 70**
Duration of Exam.: 3 Hrs. **Internal Assessment: 30**

Objective: The objective of this course is to teach the students fundamentals of Newtonian Mechanics, rigid body dynamic, concept of inverse square force and the special theory of relativity**.**

Course Outcomes: After successfully completing the course, student will be able to:
CO1: Learn the concept of conservation of energy, momentum, angular momentum and apply them to understand the basic problems in physics.
CO2: Understand the application of rotational dynamics motions in analyzing rolling with slipping. Write the expression for the moment of inertia about the given axis of symmetry for different uniform mass distributions.
CO3: Understand the concept of central force problem, gravitational energy and GPS. Applications of inverse square law.

CO4: Describe special relativistic effects and their effects on the mass and energy of a moving object and appreciate the nuances and important outcomes of Special Theory of Relativity.

Note for the Paper Setter: *The question paper will consists of nine questions in all. The first question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit.*

Unit-I

Fundamentals of Dynamics: Reference frames, Inertial and non-inertial frames of references, Conservative and non-conservative forces, Fictitious forces, Concept of potential energy, Energy diagram. Stable and unstable equilibrium, Elastic potential energy, Force as gradient of potential energy, Work &Potential energy, Impulse, Centre of Mass for a system of particles, Motion of centre of mass (discrete and continuous), Expression for kinetic energy, Linear momentum and angular momentum for a system of particles in terms of centre of mass values.

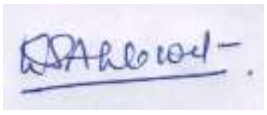
Collisions: Elastic and inelastic collisions between particles, Centre of Mass and Laboratory frames.

Unit-II

Rotational Dynamics: Equation of motion of a rigid body, Rotational motion of a rigid body in general and that of plane lamina, Rotation of angular momentum vector about a fixed axis, Angular momentum and kinetic energy of a rigid body about principal axis, Torque, Principle of conservation of angular momentum, Moment of Inertia (discrete and continuous), Calculation of moment of inertia for rectangular, cylindrical and spherical bodies, Kinetic energy of rotation, Motion involving both translation and rotation, elementary Gyroscope.

Unit-III

Inverse Square Law Force: Forces in nature (qualitative), Central forces, Law of gravitation, Gravitational potential energy, Inertial and gravitational mass, Potential energy and force between a point mass and spherical shell, a point mass and solid sphere, gravitational and electrostatic self-



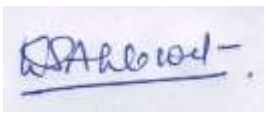

energy, two body problem and concept of reduced mass, Motion of a body under central force, Equation of orbit in inverse-square force field, satellite in Circular orbit &Geosynchronous orbits, Basic ideaof GPS (Global Positioning System).

Unit-IV

Special Theory of Relativity: Michelson-Morley Experiment and its outcome, Galilean transformation (velocity, acceleration)and its inadequacy, Postulates of Special Theory of Relativity, Lorentz Transformations, simultaneity, Lorentz contraction, Time dilation, Relativistic transformation of velocity, frequency and wave number, Relativistic addition of velocities, Variation of mass with velocity, Mass less Particles, Mass-energy Equivalence, Relativistic Doppler effect, Relativistic Kinematics (decay, inelastic collision, Compton effect), Transformation of Energy, Momentum and force, Four Vectors.

Text/Reference Books:

1. Classical Mechanics by H. Goldstein (2^{nd}Edition)
2. Berkeley Physics Course. Vol. 1.Mechanics, E.M. Purcell
3. Concepts of Modern Physics, Arthur Beiser
4. An introduction to Mechanics, D. Kleppner, R.J. Kolenkow, 2007, McGraw-Hill.
5. Mechanics, D.S. Mathur, S. Chand and Company Limited,2012.
6. Introduction to Special Relativity, R. Resnick, 2005, John Wiley andSons.
7. University Physics, F.W. Seers, M. W. Zemansky, H. D. Young, Addison-Wesley Pub. Co.
8. Fundamentals of Physics, Halliday, &Walker, Resnick John Wiley &Sons,Inc.



BSc/Phy/1/CC2– Electricity and Magnetism

Credits: 4 **Max. Marks: 100**
Lectures: 60 **Final Term Exam.: 70**
Duration of Exam.: 3 Hrs. **Internal Assessment: 30**

Objective: The course on Electricity and Magnetism deals with Coulomb's law, Electric field, potential formulation of electrostatic, Capacitors, Magnetism and magnetic materials along with the applications of these concepts.

Course Outcomes: After successfully completing the course, student will be able to:

CO1: explain and differentiate the vector and scalar formalisms of electrostatics. Also be able to Apply Gauss's law of electrostatics to solve a variety of problems.
CO2: describe the important properties of magnetic field. Understand the properties and theories of dia-, para- & ferromagnetic materials.
CO3: to understand the concept of dielectric behaviour of materials, Biot-Savart's law &its applications.

CO4: analyze AC circuits consisting of parallel and/or series combinations of voltage sources and resistors and to describe the graphical relationship of resistance, capacitor and inductor. Concept of network theorems.

Note for the Paper Setter: *The question paper will consists of nine questions in all. The first question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit.*

Unit-I

Electrostatics: Electric field, Electric field lines, Electric flux, Divergence of electrostatic field, Gauss' Law with applications, Conservative nature of Electrostatic Field, Electrostatic Potential, Potential and Electric Field of a dipole, Force and Torque on a dipole, Electrostatic energy of system of charges, Energy per unit volume in electrostatic field, Electrostatic energy of a charged sphere, Conductors in an electrostatic Field, Surface charge and force on a conductor, Laplace's and Poisson equations, Laplace equation in three dimension, The Uniqueness Theorems.

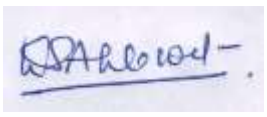
Unit-II

The method of images : Point charge in the presence of grounded conducting sphere, Solution of Laplace equation by separation of variables for Cartesian and spherical coordinates, Multipole expansion of potential due to arbitrary charge distribution.

Dielectric Properties : Dielectric medium, Polarization, Bound charges in a polarized dielectric and their physical interpretation, Electric displacement, Gauss's theorem in dielectrics, Parallel plate capacitor completely filled with dielectric, dielectric constant.

Unit-III

Magnetism: Lorentz force law, Magnetic forces, Magnetostatics: Biot-Savart's law &its applications (i) circular coil (ii) solenoid carrying current, Divergence and curl of magnetic field, Ampere's circuital law and it's applications for simple current configurations, Magnetic vector potential.




Magnetic Properties of Matter: Magnetization vector (M), Magnetic Intensity (H), Magnetic Susceptibility and permeability, Relation between B, H, M, Para-, Dia- and Ferromagnet ism, B-H curve and hysteresis.

Unit-IV

Electrical Circuits: AC Circuits: Kirchhoff's laws for AC circuits, Complex Reactance and Impedance, Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and (4) Band Width, Parallel LCR Circuit.

Network theorems: Ideal Constant-voltage and Constant-current Sources, Network theorems; Thevenin theorem, Norton theorem, Superposition theorem, Reciprocity theorem, Maximum power transfer theorem, Application to dc circuits.

Text/Reference Books:

1. D.J. Griffith, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.
2. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-HillEducation.
3. Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
4. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
5. Electricity and Magnetism, Reitzand Milford (Prentice Hall ofIndia)
6. Electricity and Magnetism, A.S. Mahajanand A.A. Rangwala(Tata McGraw Hill)
7. Electricity and Magnetism, Edward M Purcell, 1986, McGraw-Hill Education
8. Electricity and Magnetism, J.H. Fewkes & J. Yarwood, Vol. I, 1991, Oxford University Press.
9. Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn 1998 Benjamin Cummings.
10. Electricity and Magnetism, R. Murugeshan, S.Chand & Com. Pt. Ltd., New Delhi
11. Electromagnetic Fields and waves, K.D. Prasad, Satya Prakashan, New Delhi

BSc/Phy/1/CC3–Physics Lab-I

Credits: 2 (Practical) **Max. Marks: 50**
Teaching per week: 4 Hrs. **Duration of Exam: 3 Hrs.**

Objective: The objective of this course is to impart practical knowledge through design and performance of experiments.

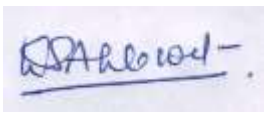
Course outcomes: After successfully completing the course, student will be able to:
CO1: Hands on experience with different instruments and measurements of different physical quantities and related concepts in Physics.
CO2: Verify some fundamental principles, effects and concepts of physics through experimentation.
CO3: Perform experiments related to mechanics (compound pendulum), rotational dynamics (Flywheel), elastic properties (Young Modulus and Modulus of Rigidity) and fluid dynamics (verification of Stokes law, Searle method) etc.
CO4: Learn to present observations, results and analysis in suitable and presentable form.

List of Experiments:

1. Measurement of Length (or diameter) using Travelling Microscope.
2. Moment of Inertia of a Fly Wheel
3. Moment of Inertia of irregular body using a Torsion Pendulum.
4. Surface Tension by Jaeger's Method.
5. Young Modulus by Bending of Beam.
6. Modulus of rigidity of material of wire by Maxwell's Needle.
7. Elastic constant by Searle's method.
8. Viscosity of water by its flow through a uniform capillary tube.
9. Acceleration due to Gravity 'g' by Bar pendulum.
10. To study the Motion of spring and calculate Spring constant & value of Acceleration due to Gravity.
11. To compare Moment of Inertia of a solid Sphere, Hollow Sphere and solid Disc of same mass with the help of Torsion Pendulum.

References:

1. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, New Delhi
2. Advanced Level Practical Physics, M. Nelkon and Ogborn, Henemann Education Books Ltd., New Delhi
3. Practical Physics, S.S. Srivastava and M.K. Gupta, Atma Ram & Sons, Delhi
4. Practical Physics, S.L. Gupta and V. Kumar, Pragati Prakashan Meerut
5. Modern Approach to Practical Physics, R.K. Singla, Modern Publishers, Jalandhar
6. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House




BSc/Phy/1/CC4–Physics Lab-II

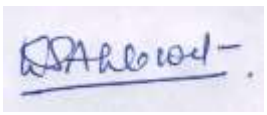
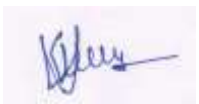
Credits: 2 (Practical) **Max. Marks: 50**
Teaching per week: 4 Hrs. **Duration of Exam: 3 Hrs.**

Objective: The objective of this course is to impart practical knowledge through design and performance of experiments.

Course outcomes: After successfully completing the course, student will be able to:
CO1: Hands on experience with different instruments and appreciate the beauty of different concepts and related experiments in Physics.
CO2: Verify some fundamental principles, effects and concepts of physics through experiments. Gaining knowledge related to LCR circuits, Ballistic galvanometer, magnetic field and inductance of two coils.
CO3: Perform experiments related to A.C. mains, D.C. voltage and current. Learn experimentation with Thevenin, Norton and Superposition theorems.
CO4: Learn to present observations, results and analysis in suitable and presentable form.

List of Experiments

1. To use Multimeter for measuring Resistance, A.C. and D.C. Voltage and Current, checking of electrical fuses.
2. Low resistance by Carey Foster's bridge with calibration.
3. Determination of Impedance of an A.C. circuit and its verification.
4. Frequency of A.C. mains using an electromagnet.
5. Frequency of A.C. mains Electrical vibrator.
6. High resistance by substitution method.
7. To study the characteristics of a series RC Circuit.
8. To determine an unknown Low Resistance using Potentiometer.
9. To determine an unknown Low Resistance using Carey Foster's Bridge
10. To compare capacitances using De'Sauty's bridge.
11. Measurement of field strength B and its variation in a solenoid (determine dB/dx).
12. To verify the Thevenin and Norton theorems.
13. To verify the Superposition, and Maximum power transfer theorems.
14. To determine self-inductance of a coil by Anderson's bridge.
15. To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impendence at resonance, (c) Quality factor Q, and (d) Band width.
16. To study the response curve of a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor Q.
17. Measurement of charge and current sensitivity and CDR of Ballistic Galvanometer.
18. Determine a high resistance by leakage method using Ballistic Galvanometer.
19. To determine self-inductance of a coil by Rayleigh's method.
20. To determine the mutual inductance of two coils by Absolute method.

References:

1. B.Sc. Practical Physics, C.L. Arora, 2005-2006, S. Chand Publisher, New Delhi
2. Advanced Level Practical Physics, M. Nelkon and Ogborn, Henemann Education Books Ltd., New Delhi
3. Practical Physics, S.S. Srivastava and M.K. Gupta, Atma Ram & Sons, Delhi
4. Practical Physics, S.L. Gupta and V. Kumar, Pragati Prakashan Meerut
5. Modern Approach to Practical Physics, R.K. Singla, Modern Publishers, Jalandhar
6. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House.

BSc/Phy/1/SEC1 (i) Basic Instrumentation Skills

Credits: 02 (Theory) **Max. Marks: 50**
Lectures: 30 **Final Term Exam: 30**
Duration of Exam.: 2 Hrs. **Internal Assessment: 20**

Objective: The objective of this course is to impart knowledge of basic instruments.

Course outcomes: Aftersuccessfully completing the course, student will be able to:

CO1: Exposure with various aspects of instruments and their usage through hands-on mode.
CO2: Experience of various Instrumentation Skills in the profession.
CO3: Basic understanding on instruments data observation, measurements, errors and analysis.
CO4: Training to use and learn techniques, skills and tools for professional practices.

Note for the Paper Setter: *The question paper will consists of five questions in all. The first question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, four more questions will be set unit-wise comprising of two questions from each of the two units. The candidates are required to attempt two more questions selecting at least one question from each unit.*

Unit-I

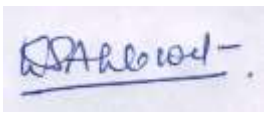
Basic of Measurement: Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects. Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance. Electronic Voltmeter: Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity. Principles of voltage, measurement (block diagram only). Specifications of an electronic Voltmeter/ Multimeter and their significance. AC millivoltmeter: Type of AC millivoltmeters: Amplifier- rectifier, and rectifier- amplifier. Block diagram ac millivoltmeter, specifications and their significance.

Unit-II

Cathode Ray Oscilloscope: Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only– no mathematical treatment), brief discussion on screen phosphor, visual persistence & chemical composition. Time base operation, synchronization. Front panel controls. Specifications of a CRO and their significance. Use of CRO for the measurement of voltage (dc and ac frequency, time period, Special features of dual trace, introduction to digital oscilloscope, probes. Digital storage Oscilloscope: Block diagram and principle of working.

Unit-III

Signal Generators and Analysis Instruments: Block diagram, explanation and specifications of low frequency signal generators. pulse generator, and function generator. Brief idea for testing, specifications. Distortion factor meter, wave analysis. Impedance Bridges & Q-Meters: Block diagram of bridge. working principles of basic (balancing type) RLC bridge. Specifications of RLC bridge. Block diagram & working principles of a Q- Meter. Digital LCR bridges.

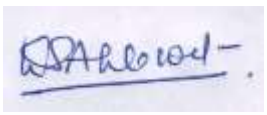



Unit-IV

Digital Instruments: Principle and working of digital meters. Comparison of analog & digital instruments. Characteristics of a digital meter. Working principles of digital voltmeter. Digital **Multimeter:** Block diagram and working of a digital multimeter. Working principle of time interval, frequency and period measurement using universal counter/frequency counter, time- base stability, accuracy and resolution.

Reference Books:

1. A text book in Electrical Technology - B L Theraja - S Chand and Co.
2. Performance and design of AC machines - M G Say ELBS Edn.
3. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
4. Logic circuit design, Shimon P. Vingron, 2012, Springer.
5. Digital Electronics, SubrataGhoshal, 2012, Cengage Learning.
6. Electronic Devices and circuits, S. Salivahanan& N. S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill.
7. Electronic circuits: Handbook of design and applications, U.Tietze, Ch.Schenk, 2008, Springer.
8. Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India.



BSc/Phy/1/SEC1 (ii) Electrical Circuits & Networks

Credits: 02 (Theory) **Max. Marks: 50**
Lectures: 30 **Final Term Exam: 30**
Duration of Exam.: 2 Hrs. **Internal Assessment: 20**

Objective: The objective of this course is to impart knowledge of electrical circuits and networks.

Course outcomes: After successfully completing the course, student will be able to:

CO1: Enable the students to design and trouble shoots the electrical circuits, networks and appliances through hands-on mode. Understanding electrical circuits.
CO2: Enhancing knowledge of electrical drawing, symbols, generators and transformers.

CO3: Learning technical skills of electric motors, rectifiers, capacitors, phase reversal electrical protection, and overload devices.

CO4: Learning basics for professional skills of electrical wiring, splices, shunting, inductors, Inductance and impedance.

Note for the Paper Setter: *The question paper will consists of five questions in all. The first question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, four more questions will be set unit-wise comprising of two questions from each of the two units. The candidates are required to attempt two more questions selecting at least one question from each unit.*

Unit-I

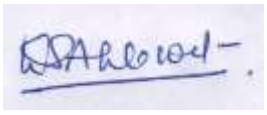
Basic Electricity Principles: Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel combinations.AC Electricity and DC Electricity. Familiarization with multimeter, voltmeter and ammeter. Understanding Electrical Circuits: Main electric circuit elements and their combination. Rules to analyze DC sourced electrical circuits. Current and voltage drop across the DC circuit elements. Single-phase and three-phase alternating current sources. Rules to analyze AC sourced electrical circuits. Real, imaginary and complex power components of AC source. Power factor. Saving energy and money.

Unit-II

Electrical Drawing and Symbols: Drawing symbols. Blueprints. Reading Schematics. Ladder diagrams. Electrical Schematics. Power circuits. Control circuits. Reading of circuit schematics. Tracking the connections of elements and identify current flow and voltage drop. Generators and Transformers: DC Power sources. AC/DC generators. Inductance, capacitance, and impedance. Operation of transformers.

Unit-III

Electric Motors: Single-phase, three-phase & DC motors. Basic design. Interfacing DC or AC sources to control heaters & motors. Speed & power of ac motor. Solid-State Devices: Resistors, inductors and capacitors. Diode and rectifiers. Components in Series or in shunt. Response of inductors and capacitors with DC or AC sources. Electrical Protection: Relays. Fuses and disconnect switches. Circuit breakers.




Unit-IV

Overload devices: Ground-fault protection. Grounding and isolating. Phase reversal. Surge protection. Interfacing DC or AC sources to control elements (relay protection device).Electrical Wiring: Different types of conductors and cables. Basics of wiring-Star and delta connection. Voltage drop and losses across cables and conductors. Instruments to measure current, voltage, power in DC and AC circuits. Insulation. Solid and stranded cable. Conduit. Cable trays. Splices: wirenuts, crimps, terminal blocks, split bolts, and solder. Preparation of extension board.

Reference Books:

1. A text book in Electrical Technology - B L Theraja - S Chand & Co.
2. A text book of Electrical Technology - A K Theraja.
3. Performance and design of AC machines - M G Say ELBS Edn.

Semester-II

HIN/2/AECC3- i;kstueyd fgUnh

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uksV% प्र" न पत्र में कुल 9 प्र" न हैं। प्रथम प्र" न अनिवार्य है, जिसमें समस्त पाठ्यक्रम से 2 अंक वाले 5 सक्षिप्त प्र" न हैा प्र" न पत्र में 4 ईकाई है, जिसमें प्रत्येक ईकाई में 15 अंको वाले 2 प्र" न हैा विद्धार्थी को प्रत्येक ईकाई में से 1 प्र" न करना अनिवार्य हैा

bdkbZ&I

पत्र–लेखन–सहकारी पत्र, परिपत्र, कार्यालय आदे" ा, f" ाकायत पत्र, आवेदन पत्र, मूलपत्र, पत्रोतर, पावती, अनुस्मारक, सरकारी पत्र, ईमेल–लेखन, भ्ाासकीय आदे" ा, अधिसूचना, पृश्ठाकन, प्रेस विज्ञप्ति, संक्षेपण लेखन– अर्थ परिभाशा प्रक्रिया, नियम (लेखन विधि)

bdkbZ& II

अभिनव काव्य गरिमा (काव्य पुस्तक) संप्रसंग व्याख्या व प्र" नोत्तर

bdkbZ& III

कम्प्यूटर– परिभाशा स्वरूप, महत्व

पारिभाशिक भाब्दावली – बैकिंग , वाणिज्य, मंत्रालय, उपक्रमो, निगमों, ओद्योगिक क्षेत्रों व मीडिया क्षैत्र

अनुवाद लेखन – अर्थ परिभाशा, स्वरूप, महत्व, प्रक्रिया, प्रकार

टिप्पण लेखन – अर्थ परिभाशा, नियम, लेखन विधि, उदाहरण

bdkbZ& IV

प्रयोजनमूलक हिन्दी – अर्थ, सरंचनात्मक स्वरूप महत्व, हिन्दी भाशा की प्रयोजनीयता

प्रयोजननमूलक हिन्दी के विविध रूप

भाब्द को" ा का अर्थ, परिभाशा, उद्दे" य प्रकार क्षैत्र व उपयोगिता

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1 प्रयोजनमूलक हिन्दीः डॉ नरे" ा मिश्रा (2017) राजपाल एण्ड सन्ज, क" मीरी गेट, दिल्ली

2 हिंदी साहित्य का इतिहासःडॉ रामसजन पाण्डेय (2012) संजय प्रका" ान, दिल्ली

3 अभिनव काव्य गरिमाःडॉ नरे" ा मिश्रा (2012) राजकमल प्रका" ान, दिल्ली

4 प्रयोजनमूलक हिन्दीः सिद्धांत और प्रयोग दंगल झाल्टे, वाणी प्रका" ान,दिल्ली

5 राजभाशा हिंदीः विवेचना और प्रयुक्तिः डा कि" ोर वासवानी,वाणी प्रका" ान,दिल्ली

6 राजभाशा हिंदी और उसका विकासः हीरालाल बाछोतिया, किताब घर प्रका" ान,दिल्ली

7 अनुवाद विज्ञानः सिद्धांत एंव प्रविधि, भोलानाथ तिवारी,किताब घर प्रका" ान,दिल्ली

BSc/Phy/2/CC5– Thermal Physics

Credits: 4 **Max. Marks: 100**
Lectures: 60 **Final Term Exam.: 70**
Duration of Exam.: 3 Hrs. **Internal Assessment: 30**

Objective: The course on thermal physics is framed with the objective that students are able to understand basic concepts of thermos-dynamical systems. Students will be able to understand heart, work, temperature, entropy and the laws of thermodynamics. Behaviour of real gases as thermos-dynamical systems has also been included.

Course Outcomes: After successfully completing the course, student will be able to:
CO1: Learn about Kinetic interpretation of Temperature, the real gas equations, Van der Waal equation of state and Brownian motion.
CO2: Learn the basic aspects of kinetic theory of gases, Maxwell-Boltzman distribution law, equitation of energies, mean free path of molecular collisions, viscosity, thermal conductivity, diffusion.
CO3: Understand the basic concepts of thermodynamics, the first and the second law of thermodynamics, Joule Thomson effect, Joule-Thomson(Porous plug)experiment, the concept of entropy and the associated theorems, calculations of entropy freversible & irreversible process,s T-Sdiagram and Nernstheat law (third law of thermodynamics).
CO4: Derive the Clausius-Clapeyron and Clausius latent heat equations and understand their significance. The students will also be able to learn about Maxwell's thermodynamic relations their physical interpretations.

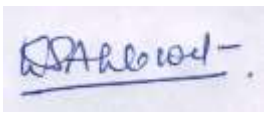
Note for the Paper Setter: *The question paper will consists of nine questions in all. The first question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit.*

Unit-I

Zeroth and First Law of Thermodynamics: Extensive and intensive thermodynamic variables, Thermodynamic equilibrium, zeroth law and Concept of Temperature, Work and heat, State functions, First law of thermodynamics, Internal energy, Applications of first law, General relation between Cp and Cv, Work done during isothermal and adiabatic processes.

Unit-II

Entropy and Third law of Thermodynamics: Concept of entropy, Clausius theorem, Clausius Inequality, Second Law of Thermodynamics in terms of Entropy, Entropy of a Perfect Gas and Universe, Entropy Changes in Reversible and Irreversible Processes, Principle of Increase of Entropy, Third Law of The rmodynamics, Unattainability of absolute zero, T-S Diagrams, Phase Change, Classification of Phase Changes.




Unit-III

Thermodynamic Potentials: Extensive and Intensive Thermodynamic Variables; Internal Energy; Definition, importance, properties and applications of Chemical Potential, Enthalpy, Gibbs function and Helmholtz function. **Maxwell's Thermodynamic Relations:** Derivations of Maxwell's Relations and their applications: (1) Clausius- Clapeyron equation (2) Cp- Cvvalue, (3) Energy equations (4) Change of temperature during adiabatic process.

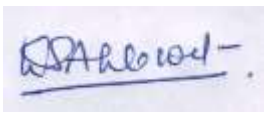
Unit-IV

Real gases: Behavior of Real Gases, Deviations from the Ideal Gas Equation. The Virial Equation, Critical Constants. Continuity of Liquid and Gaseous State. Vapour and Gas, Boyle Temperature, Van -der Waal's Equation of State for Real Gases. Values of Critical Constants. Law of Corresponding States. Comparison with Experimental Curves, P-V Diagrams, Joule's Experiment, Free Adiabatic Expansion of a Perfect Gas.

Thermo-electricity: See back effect, Paltier effect, Thomson effect and their explanations.

Text/Reference Books:

1. A Treatise on Heat: Meghnad Saha and B.N. Srivastava, Indian Press
2. Thermal Physics: S. Garg, R. Bansal and Ghosh, Tata McGraw-Hill
3. Concepts in Thermal Physics: S.J. Blundell and K.M. Blundell, Oxford University Press
4. Heat and Thermodynamics: An Intermediate Textbook by M. W. Zemansky and R. Dittman, McGraw-Hill.
5. Thermal Physics and Statistical Mechanics, S.K. Roy, New Age International Publishers, New Delhi
6. Thermodynamics and Statistical Physics, J.K. Sharma and K.K. Sarkar, Himalaya Publishing House, Bombay
7. Introduction to Thermodynamics and itsApplications, Stowe Keith, University Press (India) Pvt. Ltd, Hyderabad
8. Introductory Thermodynamics, PierreInfelta, Brown Walker Press, Boca Ratan, Florida
9. Fundamentals of Thermodynamics, J. K. Johnson, University of Pittsburgh2009
10. Thermodynamics and Its Applications, Jefferson Tester, Michael Modell, 3rd Edition
11. Thermodynamics, Statistical Thermodynamics & Kinetics, Thomas Engel, PhilipReid, 2nd Edition



BSc/Phy/2/CC6– Waves & Optics

Credits: 4 **Max. Marks: 100**
Lectures: 60 **Final Term Exam.: 70**
Duration of Exam.: 3 Hrs. **Internal Assessment: 30**

Objective: The objective of this course is to introduce the basics of Waves & Optics and their applications.

Course Outcomes: After successfully completing the course, student will be able to:
CO1: Have understanding of Interference - by Division of Wave front, by Division of Amplitude and Interference due to transmitted light & reflected light.
CO2: Learn about Huygens-Fresnel's theory, diffraction at a straight edge and at a circular aperture, diffraction due to a narrow slit and due to a narrow wire.
CO3: Understand and explain the Fraunhoffer diffraction, dispersive power of grating, Rayleigh's criterion and resolving power of telescope & a grating.
CO4: Understand the theories and laws of polarization along with understanding of the production and detection of (i) Plane polarized light (ii) Circularly polarized light and (iii) Elliptically polarized light.

Note for the Paper Setter: *The question paper will consists of nine questions in all. The first question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit.*

UNIT-I

Interference: Interference by Divisionof Wave front: Young's double slit experiment, Coherence, Conditions of interference, Fresnel's biprismand itsapplications to determine the wavelength of sodium light and thickness of amicasheet, phasechangeon reflection. Interference byDivisionof Amplitude: Plane parallel thin film, production of colors in thin films, classification of fringes infilms, Interference due to transmitted light and reflected light, wedgeshaped film, Newton's rings.

UNIT-II

Diffraction-I : Huygens-Fresnel's theory, Fresnel's assumptions, rectilinear propagation of light, Fresnel's half period zones, zone plate, diffraction at a straight edge, rectangular slit and diffraction at a circular aperature. Diffraction due to a narrow slit, diffraction due to a narrow wire.

UNIT-III

Diffraction- II: Fraunh offer diffraction: one slit diffraction, two slit diffraction, N-slit diffraction, plane transmission grating spectrum, dispersive power of grating, limit of resolution, Rayleigh's criterion, resolving power of telescope and a grating.

UNIT-IV

Polarization: Polarization:Polarisationbyreflection,refractionandscattering,MalusLaw, Phenomenon of double refraction, Huygens's wave theory of double refraction(Normal andobliqueincidence),AnalysisofpolarizedLight.Nicolprism,Quarterwaveplateand halfwaveplate,productionanddetectionof(i)Planepolarizedlight(ii)Circularly polarizedlightand(iii)Ellipticallypolarizedlight.Opticalactivity,Fresnel'stheoryof optical rotation, Specificrotation, Polarimeters (half shade and Biquartz).

Text/Reference Books:

1. Principles of Optics, M. Born and E. Wolf, Pergamaman Press.
2. Fundamentals of Optics, Jenkinsand White, McGraw Hill Book Co.Ltd., New Delhi.
3. Optics, K.D. Muller, University Science Books, Millally California.
4. An Introduction to Interferometery,Tolansky, John Wiley & Sons, New Delhi.
5. Polarized Light Production and Use, Shurcliff, Harward University Press, Cambridge, M A (USA)
6. Refresher Course in Physics Vol. II, C.L. Arora, 2005-2006, S Chand and Co, New Delhi.

BSc/Phy/2/CC7–Physics Lab-III

Credits: 2 (Practical) **Max. Marks: 50**
Teaching per week: 4 Hrs. **Duration of Exam: 3 Hrs.**

Objective: The objective of this course is to impart practical knowledge through design and performance of experiments.

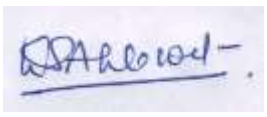
Course outcomes: After successfully completing the course, student will be able to:
CO1: Hands on experience with different instruments and measurements of related physical quantities.
CO2: Verify some fundamental principles, effects and concepts of physics through experimentation.
CO3: Perform basic experiments in thermal Physics, viz., determinations of Stefan's constant, coefficient of thermal conductivity, temperature coefficient of resistant, variation of thermo-emf of a thermocouple with temperature difference at its two junctions and calibration of a thermocouple.
CO4: Learn to present observations, results and analysis in suitable and presentable form.

List of Experiments

1. Measurement of Planck constant using black body radiation.
2. To determine Stefan's Constant.
3. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
4. To determine the thermal conductivity of bad conductor by Lee and Charlton's disc method.
5. To determine the temperature co-efficient of resistance by platinum resistance thermometer.
6. To study the variation of thermo e.m.f. across two junctions of a thermocouple with temperature.
7. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge.
8. To determine Mechanical Equivalent of Heat by Callender and Barne's contant flow method.
9. To draw a calibration curve for a thermocouple.
10. To find the specific heat of a solid by a method of mixture
11. To find the specific heat of a liquid (Turpentine oil) by law of cooling.
12. To find coefficient of apparent expansion of glycerine

References:

1. B.Sc. Practical Physics, C.L. Arora, 2005-2006, S. Chand Publisher, New Delhi
2. Advanced Level Practical Physics, M.Nelkon and Ogborn, Henemann Education Books Ltd., New Delhi
3. Practical Physics, S.S. Srivastava and M.K. Gupta, Atma Ram & Sons, Delhi.
4. Practical Physics, S.L. Gupta and V. Kumar, Pragati Prakashan Meerut.
5. Modern Approach to Practical Physics, R.K. Singla, Modern Publishers, Jalandhar.
6. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House.




BSc/Phy/2/CC8–Physics Lab-IV

Credits: 2 (Practical) **Max. Marks: 50**
Teaching per week: 4 Hrs. **Duration of Exam: 3 Hrs.**

Objective: The objective of this course is to impart practical knowledge through design and performance of experiments.

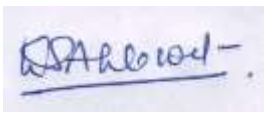
Course outcomes: After successfully completing the course, student will be able to:
CO1: Hands-on experience of using various optical instruments and making finer measurements of wavelength of light using Newton Rings experiment, Fresnel Biprism etc. and resolving power of optical equipment.
CO2: Understand various optical phenomena, principles, workings and applications of optical instruments through experiments.
CO3: Learn to present observations, results and analysis in suitable and presentable form.

List of Experiments

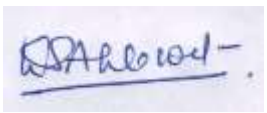
1 To measure the (a)area of a window (b) height of an inaccessible object using a sextant.
2 To determine Refractive index of the material of a prism using sodium source.
3 To determine the dispersive power and Cauchy constants of the material of a prism using Mercury discharge source.
4 To draw agraph between wavelength and minimum deviation for various lines froma Mercury discharge source.
5 Determination of wave length of sodium light and the number of lines per centimetre using a diffraction grating.
6 Determination of wave length of sodium light using Newton's Rings.
7 Resolving power of a telescope.
8 Comparison of Illuminating Powers by a Photometer.
9 Measurement of (a) Specific rotation (b) concentration of sugar solution using polarimeter.
10 Ordinary and extra ordinary refractive indices for calcite or quartz.
11 To find the equivalent focal length of a lens system by nodal slide assembly.

References:

1. B.Sc. Practical Physics, C.L. Arora, 2005-2006, S. Chand Publisher, New Delhi
2. Advanced Level Practical Physics, M. Nelkon and Ogborn, Henemann Education Books Ltd., New Delhi
3. Practical Physics, S.S. Srivastava and M.K. Gupta, Atma Ram & Sons, Delhi
4. Practical Physics, S.L. Gupta and V. Kumar, Pragati Prakashan Meerut
5. Modern Approach to Practical Physics, R.K. Singla, Modern Publishers, Jalandhar
6. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House




BSc/Phy/2/CC9- Seminar



BSc/Phy/2/SEC2 –(i) Basic Instrumentation Lab

Credits: 2 (Practical) **Max. Marks: 50**
Teaching per week: 4 Hrs. **Duration of Exam: 3 Hrs.**

Objective: The objective of this course is to impart practical knowledge through hands on training of basic instruments.

Course outcomes: After successfully completing the course, student will be able to:

CO1: exposure with various aspects of instruments and their usage through hands-on mode.

CO2: real work experience of various lab skills on related instruments in the profession.

CO3: basic understanding on instruments data observation, measurements, errors and analysis.

CO4: practical's training to use and learn techniques, skills and tools for professional practices.

The test of lab skills will be of the following test items:

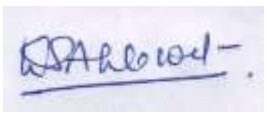
1.Use of an oscilloscope. 2. CRO as a versatile measuring device. 3. Circuit tracing of Laboratory electronic equipment, 4. Use of Digital multimeter/VTVM for measuring voltages 5.Circuit tracing of Laboratory electronic equipment, 6.Winding a coil/transformer. 7. Study the layout of receiver circuit. 8. Trouble shooting a circuit 9. Balancing of bridges.

Laboratory Exercises: 1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance. 2. To observe the limitations of a multimeter for measuring high frequency voltage and currents. 3. To measure Q of a coil and its dependence on frequency, using a Q- meter. 4. Measurement of voltage, frequency, time period and phase angle using CRO. 5. Measurement of time period, frequency, average period using universal counter/ frequency counter. 6. Measurement of rise, fall and delay times using a CRO. 7. Measurement of distortion of a RF signal generator using distortion factor meter. 8. Measurement of R, L and C using a LCR bridge/ universal bridge.

Open Ended Experiments: (i). Using a Dual Trace Oscilloscope, (ii). Converting the range of a given measuring instrument (voltmeter, ammeter).

Reference Books:

1. A text book in Electrical Technology - B L Theraja - S Chand and Co.
2. Performance and design of AC machines - M G Say ELBS Edn.
3. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
4. Logic circuit design, Shimon P. Vingron, 2012, Springer.
5. Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
6. Electronic Devices and circuits, S. Salivahanan & N. S. Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill.
7. Electronic circuits: Handbook of design and applications, U. Tietze, Ch. Schenk, 2008, Springer.
8. Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India.



BSc/Phy/2/SEC2 –(ii) Electrical Circuits & Networks Lab

Credits: 2 (Practical) **Max. Marks: 50**
Teaching per week: 4 Hrs. **Duration of Exam: 3 Hrs.**

Objective: The objective of this course is to impart practical knowledge through hands on training of electrical circuits and networks.

Course outcomes: After successfully completing the course, student will be able to:
CO1: enable the students to design and trouble shoots the electrical circuits, networks and appliances through hands-on mode. Understanding electrical circuits.
CO2: enhancing knowledge of electrical drawing, symbols, generators and transformers.
CO3: learning technical skills of electric motors, rectifiers, capacitors, phase reversal electrical protection, and overload devices.
CO4: learning basics for professional skills of electrical wiring, splices, shunting, inductors, Inductance and impedance.

Laboratory Exercises:
Performance and design of Electrical Circuits & Networks in the Lab. as per syllabi of theory course namely Electrical Circuits & Networks.

Reference Books:

1. A text book in Electrical Technology - B L Theraja - S Chand and Co.
2. Performance and design of AC machines - M G Say ELBS Edn.
3. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
4. Logic circuit design, Shimon P. Vingron, 2012, Springer.
5. Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
6. Electronic Devices and circuits, S. Salivahanan& N. S. Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill.
7. Electronic circuits: Handbook of design and applications, U. Tietze, Ch. Schenk, 2008, Springer.
8. Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India.

COMP/2/SEC3-COMPUTER SKILLS

Credits: 2 (Practical) **Max. Marks: 50**
Duration of Exam.: 3 Hrs. **Final Term Exam.: 50**

Objective: The course aims to provide practical computer knowledge and skillsto students and to enhance the usefulness of information technology tools in various activities.

Learning Outcomes: After completion of the course, learners will be able to:

CO1: Know about Operating System, Overview of various Computer & Mobile Operating systems and Applications.
CO2: Perform various features of Word processing such that Table, Mail merge, Hyperlink, etc.
CO3: Prepare a business presentation on MS PowerPoint.
CO4: Perform various mathematical, logical, and other functions on a large set of data using MS Excel.

Unit-I

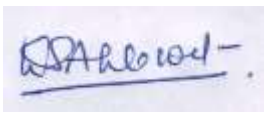
Windows: Installation of Windows, Windows Desktop, My computer, My documents, Network neighbourhood, Recycle Bin, Quick launch tool bar, System tray, Start menu, Task bar - System Tray - Quick launch tool bar - Start button - Parts of Windows, Keyboard Accelerators: Key board short keys or hotkeys, Working with Notepad & WordPad, Creating & Editing Images with Microsoft paint, using the Calculator, Personalising Windows.

MS-Word: Working with Documents, Formatting page & setting Margins, Converting files to different formats, Importing & Exporting documents, Formatting Documents - Setting Font styles, Font selection- style, Setting Paragraph style, Alignments, Indents, Line Space, Margins, Bullets& Numbering. Setting Page style - Formatting Page, Page tab, Margins, Layout settings, Border & Shading, Columns, Header & footer, Setting Footnotes & end notes, page break, Setting Document styles, Table of Contents, Index, Page Numbering, date & Time, Creating Tables- Table settings, Borders, Alignments, Insertion, deletion, Merging, Splitting, Sorting, Drawing - Inserting Clip Arts, Pictures/Files, Tools –Spell Checks, Mail merge, Templates, Printing Documents.

Unit-II

MS-Excel: Spread Sheet & its Applications, Opening Spreadsheet, Menus , Working with Spreadsheets- opening, Saving files, setting Margins, Spread sheet addressing - Rows, Columns & Cells, Referring Cells & Selecting Cells – Shortcut Keys. Entering & Deleting Data, Inserting Data, Insert Cells, Column, rows & sheets, Inserting Functions, Formula - finding total in a column or row, Mathematical operations (Addition, Subtraction, Multiplication, Division, Exponentiation), Formatting Spreadsheets- Labelling columns & rows, Formatting- Cell, row, column & Sheet, Category - Alignment, Font, Border & Shading, Hiding/ Locking Cells, Working with sheets – Sorting, Filtering, Creating Charts , Tools – Error checking, Spell Checks.

MS-Power-Point: Introduction to presentation – Opening new presentation, Different presentation templates, setting backgrounds, selecting presentation layouts. Creating a presentation-Setting Presentation style, Adding text to the Presentation.Formatting a Presentation-Adding style, Colour, Arranging objects, Adding Header & Footer, Slide Background, Slide layout. Adding Graphics to the Presentation- Inserting pictures, tables into presentation, Adding Effects to the Presentation-Setting Animation & transition effect. Practical Exercises:

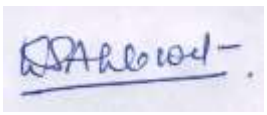



Suggested Readings:

1. Bharihoka, D. (2012). Fundamentals of Information Technology. New Delhi: Excel Book.
2. Boockholdt, J. L. (1999). Accounting Information System: Transaction Processing and Control. Boston: Irwin McGraw Hill.
3. Gelinas, U. J., & Steve, G. S. (2002). Sutton, Accounting Information System. Mason: South Western Thomson Learning.
4. Hall, J. A. (2006). Accounting Information System. Nashville: South Western College Publishing. Rajaraman, V. (2018). Introduction to Information Technology. New Delhi: PHI Learning Pvt. Ltd.

Note: Open-Source Software or MS Excel, MS Access, and Tally may be used at appropriate places.

Generic Elective Courses



BSc/Phy/1/GEC1–Mechanics (Theory)

Credits: 4 **Max. Marks: 100**
Lectures: 60 **Final Term Exam.: 70**
Duration of Exam.: 3 Hrs. **Internal Assessment: 30**

Objective: The objective of this course is to teach the students fundamentals of Newtonian Mechanics, rigid body dynamic, concept of inverse square force and the special theory of relativity**.**

Course Outcomes: After successfully completing the course, student will be able to:
CO1: Learn the concept of conservation of energy, momentum, angular momentum and apply them to understand the basic problems in physics.
CO2: Understand the application of rotational dynamics motions in analyzing rolling with slipping. Write the expression for the moment of inertia about the given axis of symmetry for different uniform mass distributions.
CO3: Understand the concept of central force problem, gravitational energy and GPS. Applications of inverse square law.

CO4: Describe special relativistic effects and their effects on the mass and energy of a moving object and appreciate the nuances and important outcomes of Special Theory of Relativity.

Note for the Paper Setter: *The question paper will consists of nine questions in all. The first question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit.*

Unit-I

Fundamentals of Dynamics: Reference frames, Inertial and non-inertial frames of references, Conservative and non-conservative forces, Fictitious forces, Concept of potential energy, Energy diagram. Stable and unstable equilibrium, Elastic potential energy, Force as gradient of potential energy, Work &Potential energy, Impulse, Centre of Mass for a system of particles, Motion of centre of mass (discrete and continuous), Expression for kinetic energy, Linear momentum and angular momentum for a system of particles in terms of centre of mass values.

Collisions: Elastic and inelastic collisions between particles, Centre of Mass and Laboratory frames.

Unit-II

Rotational Dynamics: Equation of motion of a rigid body, Rotational motion of a rigid body in general and that of plane lamina, Rotation of angular momentum vector about a fixed axis, Angular momentum and kinetic energy of a rigid body about principal axis, Torque, Principle of conservation of angular momentum, Moment of Inertia (discrete and continuous), Calculation of moment of inertia for rectangular, cylindrical and spherical bodies, Kinetic energy of rotation, Motion involving both translation and rotation, elementary Gyroscope.

Unit-III

Inverse Square Law Force: Forces in nature (qualitative), Central forces, Law of gravitation, Gravitational potential energy, Inertial and gravitational mass, Potential energy and force between a point mass and spherical shell, a point mass and solid sphere, gravitational and electrostatic self-

energy, two body problem and concept of reduced mass, Motion of a body under central force, Equation of orbit in inverse-square force field, satellite in Circular orbit &Geosynchronous orbits, Basic ideaof GPS (Global Positioning System).

Unit-IV

Special Theory of Relativity: Michelson-Morley Experiment and its outcome, Galilean transformation (velocity, acceleration)and its inadequacy, Postulates of Special Theory of Relativity, Lorentz Transformations, simultaneity, Lorentz contraction, Time dilation, Relativistic transformation of velocity, frequency and wave number, Relativistic addition of velocities, Variation of mass with velocity, Mass less Particles, Mass-energy Equivalence, Relativistic Doppler effect, Relativistic Kinematics (decay, inelastic collision, Compton effect), Transformation of Energy, Momentum and force, Four Vectors.

Text/Reference Books:

1. Classical Mechanics by H. Goldstein (2^{nd}Edition)
2. Berkeley Physics Course.Vol. 1.Mechanics, E.M. Purcell
3. Concepts of Modern Physics,Arthur Beiser
4. An introduction to Mechanics, D. Kleppner, R.J. Kolenkow, 2007, McGraw-Hill.
5. Mechanics, D.S. Mathur, S. Chand and Company Limited, 2012.
6. Introduction to Special Relativity, R. Resnick, 2005, John Wiley andSons.
7. University Physics, F.W. Seers, M. W. Zemansky, H. D. Young, Addison-Wesley Pub. Co.
8. Fundamentals of Physics, Halliday, &Walker, Resnick John Wiley &Sons,Inc.

BSc/Phy/1/GEC2– Mechanics (Lab.)

Credits: 2 (Practical) **Max. Marks: 50**
Teaching per week: 4 Hrs. **Duration of Exam: 3 Hrs.**

Objective: The objective of this course is to impart practical knowledge through design and performance of experiments.

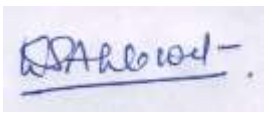
Course outcomes: Aftersuccessfully completing the course, student will be able to:
CO1: hands on experience with different instruments and measurements of different physical quantities and related concepts in Physics.
CO2: verify some fundamental principles, effects and concepts of physics through experimentation.
CO3: perform experiments related to mechanics (compound pendulum), rotational dynamics (Flywheel), elastic properties (Young Modulus and Modulus of Rigidity) and fluid dynamics (verification of Stokes law, Searle method) etc.
CO4: learn to present observations, results and analysis in suitable and presentable form.

List of Experiments:

1. Measurement of Length (or diameter) using Travelling Microscope.
2. Moment of Inertia of a Fly Wheel
3. Moment of Inertia of irregular body using a Torsion Pendulum.
4. Surface Tension by Jaeger's Method.
5. Young Modulus by Bending of Beam.
6. Modulus of rigidity of material of wire by Maxwell's Needle.
7. Elastic constant by Searle's method.
8. Viscosity of water by its flow through a uniform capillary tube.
9. Acceleration due to Gravity 'g' by Bar pendulum.
10. To study the Motion of spring and calculate Spring constant & value of Acceleration due to Gravity.
11. To compare Moment of Inertia of a solid Sphere, Hollow Sphere and solid Disc of same mass with the help of Torsion Pendulum.

References:

1. B.Sc. Practical Physics, C.L. Arora, 2005-2006, S. Chand Publisher, New Delhi
2. Advanced Level Practical Physics, M. Nelkon and Ogborn, Henemann Education Books Ltd., New Delhi
3. Practical Physics, S.S. Srivastava and M.K. Gupta, Atma Ram & Sons, Delhi
4. Practical Physics, S.L. Gupta and V. Kumar, Pragati Prakashan Meerut
5. Modern Approach to Practical Physics, R.K. Singla, Modern Publishers, Jalandhar
6. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House




BSc/Phy/2/GEC3– Waves & Optics (Theory)

Credits: 4 **Max. Marks: 100**
Lectures: 60 **Final Term Exam.: 70**
Duration of Exam.: 3 Hrs. **Internal Assessment: 30**

Objective: The objective of this course is to introduce the basics of Waves & Optics and their applications.

Course Outcomes: After successfully completing the course, student will be able to:
CO1: Have understanding of Interference - by Division of Wave front, by Division of Amplitude and Interference due to transmitted light & reflected light.
CO2: learn about Huygens-Fresnel's theory, diffraction at a straight edge and at a circular aperture, diffraction due to a narrow slit and due to a narrow wire.
CO3: understand and explain the Fraunh offer diffraction, dispersive power of grating, Rayleigh's criterion and resolving power of telescope& agrating.
CO4: understand the theories and laws of polarization along with understanding of the production and detection of (i) Plane polarized light (ii)Circularly polarized light and (iii) Elliptically polarized light.

Note for the Paper Setter: *The question paper will consists of nine questions in all. The first question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit.*

UNIT-I

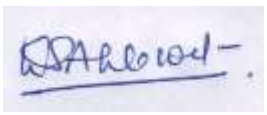
Interference: Interference by Division of Wave front: Young's double slit experiment, Coherence, Conditions of interference, Fresnel's biprism and its applications to determine the wavelength of sodium light and thickness of amicasheet, phase change on reflection. Interference by Division of Amplitude: Plane parallel thin film, production of colors in thin films, classification of fringes infilms, Interference due to transmitted light and reflected light, wedge shaped film, Newton's rings.

UNIT-II

Diffraction-I : Huygens-Fresnel's theory, Fresnel's assumptions, rectilinear propagation of light,Fresnel's half period zones, zone plate, diffraction at a straight edge, rectangular slit and diffraction at a circular aperature. Diffraction due to a narrow slit, diffraction due to a narrow wire.

UNIT-III

Diffraction- II: Fraunh offer diffraction: one slit diffraction, two slit diffraction, N-slit diffraction, plane transmission grating spectrum, dispersive power of grating, limit of resolution, Rayleigh's criterion, resolving power of telescope and agrating.




UNIT-IV

Polarization: Polarization: Polarisation by reflection, refraction and scattering, Malus Law, Phenomenonofdoublerefraction,Huygens'swavetheoryofdoublerefraction(Normal andobliqueincidence),AnalysisofpolarizedLight.Nicolprism,Quarterwaveplateand halfwaveplate,productionanddetectionof(i)Planepolarizedlight(ii)Circularly polarizedlightand(iii)Ellipticallypolarizedlight.Opticalactivity,Fresnel'stheoryof optical rotation, Specificrotation, Polarimeters (half shade and Biquartz).

Text/Reference Books:

1. Principles of Optics, M. Born and E. Wolf, Pergamaman Press.
2. Fundamentals of Optics, Jenkins and White, McGraw Hill Book Co. Ltd., New Delhi.
3. Optics, K.D. Muller, University Science Books, Millally California.
4. An Introduction to Interferometery, Tolansky, John Wiley & Sons, New Delhi.
5. Polarized Light Production and Use, Shurcliff, Harward University Press, Cambridge, M A (USA)
6. Refresher Course in Physics Vol.II, C.L. Arora, 2005-2006, S Chand and Co, New Delhi.

BSc/Phy/2/GEC4–Waves & Optics (Lab.)

Credits: 2 (Practical) **Max. Marks: 50**
Teaching per week: 4 Hrs. **Duration of Exam: 3 Hrs.**

Objective: The objective of this course is to impart practical knowledge through design and performance of experiments.

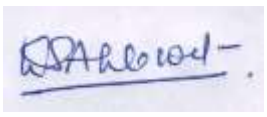
Course outcomes: After successfully completing the course, student will be able to:
CO1: hands-on experience of using various optical instruments and making finer measurements of wavelength of light using Newton Rings experiment, Fresnel Biprism etc. and resolving power of optical equipment.
CO2: Understand various optical phenomena, principles, workings and applications of optical instruments through experiments.
CO3: Learn to present observations, results and analysis in suitable and presentable form.

List of Experiments

1. To measure the (a)area of a window (b) height of an inaccessible object using a sextant.
2. To determine Refractive index of the material of a prism using sodium source.
3. To determine the dispersive power and Cauchy constants of the material of a prism using Mercury discharge source.
4. To draw agraph between wavelength and minimum deviation for various lines from a Mercury discharge source.
5. Determination of wave length of sodium light and the number of lines per centimetre using a diffraction grating.
6. Determination of wave length of sodium light using Newton's Rings.
7. Resolving power of a telescope.
8. Comparison of Illuminating Powers by a Photometer.
9. Measurement of (a) Specific rotation (b) concentration of sugar solution using polarimeter.
10. Ordinary and extra ordinary refractive indices for calcite or quartz.
11. To find the equivalent focal length of a lens system by nodal slide assembly.

References:

1. B.Sc. Practical Physics, C.L. Arora, 2005-2006, S. Chand Publisher, New Delhi
2. Advanced Level Practical Physics, M. Nelkon and Ogborn, Henemann Education Books Ltd., New Delhi
3. Practical Physics, S.S. Srivastava and M.K. Gupta, Atma Ram & Sons, Delhi
4. Practical Physics, S.L. Gupta and V. Kumar, Pragati Prakashan Meerut
5. Modern Approach to Practical Physics, R.K. Singla, Modern Publishers, Jalandhar
6. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House




Semester-III

BSc/Phy/3/CC10: Mathematical Physics – I

Credits: 4 **Max. Marks: 100**
Lectures: 60 **Final Term Exam.: 70**
Duration of Exam.: 3 Hrs. **Internal Assessment: 30**

Objective: The course covers basics of differential equation, vector calculus, vector algebra, vector differentiation, vector integration, probability and errors. These topics are useful for the mathematical basis of electromagnetism, quantum mechanics and other courses.

Course Outcomes: After completing this course, students would be able to deal with mathematics that appears in other papers such as Classical Mechanics, Quantum Mechanics, Nuclear Physics, Condensed Matter Physics, etc.
CO1: Understanding of vector calculus and differentiation of physical quantities.
CO2: Understanding of vector integration and calculus of functions of more than one variable.
CO3: Understanding 1st and 2nd order differential equations as well as plotting of curves, Taylor and Binomial series.
CO4: Understanding theory of probability and errors.

Note for the Paper Setter: *The question paper will consists of nine questions in all. The first question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit.*

UNIT-I

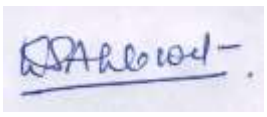
Vector Calculus: Recapitulation of vectors: Properties of vectors under rotations, Scalar product and its invariance under rotations, Vector product, Scalar triple product and their interpretation in terms of area and volume respectively, Scalar and Vector fields.
Vector Differentiation: Directional derivatives and normal derivative, Gradient of a scalar field and its geometrical interpretation, Divergence and curl of a vector field, De and Laplacian operators, Vector identities.

UNIT-II

Vector Integration: Ordinary Integrals of Vectors, Multiple integrals, Jacobian, Notion of infinitesimal line, Surface and volume elements, Line, surface and volume integrals of Vector fields, Flux of a vector field, Gauss's divergence theorem, Green's and Stokes Theorems and their applications (no rigorous proofs)
Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials, Constrained Maximization using Lagrange Multipliers.

UNIT-III

Calculus: Recapitulation: average and instantaneous quantities Intuitive ideas of continuous, differentiable, functions and plotting of curves, Approximation: Taylor and binomial series (statements only).
First Order and Second Order Differential equations: First Order Differential Equations and Integrating Factor, Homogeneous Equations with constant coefficients, Wronskian and general solution, Statement of existence and Uniqueness Theorem for Initial Value Problems, Particular Integral.



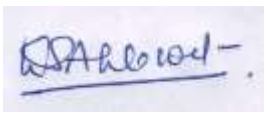

UNIT-IV

Introduction to probability: Independent random variables, Probability distribution functions; Binomial, Gaussian, and Poisson distributions (with examples), Mean and variance, Dependent events: Conditional Probability, Bayes' Theorem and the idea of hypothesis testing.

Theory of Errors: Systematic and Random Errors, Propagation of Errors, Normal Law of Errors, Standard and Probable Error, Least-squares fit, Error on the slope and intercept of a fitted line.

Reference Books:

1. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7th Edn., Elsevier.
2. Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India.
3. Mathematical Physics, H K Das, 2008, S Chand.
4. Mathematical Physics, B.S. Rajput, 2017, Pragati Parkashan, Meerut.
5. Mathematical Methods in Physical Sciences, M.L. Boas, 2005, Wiley, New York.
6. Mathematical Methods for Physicists, G.B. Arfken, 2012, Elsevier, Netherlands.
7. Mathematical Physics, P.K. Chatopadhyay, 2004, New Age, New Delhi.



BSc/Phy/3/CC11: Elements of Modern Physics

Credits: 4 **Max. Marks: 100**
Lectures: 60 **Final Term Exam.: 70**
Duration of Exam.: 3 Hrs. **Internal Assessment: 30**

Objective: The aim of this course is to aware the students about the developments in physics in the last century by introducing the concepts of quantization, dual nature of matter, basic quantum mechanics and cosmology.
Course Outcomes: Students will be awared on foundations of modern physics, experiments forming basis of quantum mechanics, atomic structure, wave concepts, uncertainty principle and basic idea of cosmology.

CO1: Understanding the topics of old quantum mechanics.
CO2: Understanding of atomic structure and Heisenberg's uncertainty principle.
CO3: Understanding wave nature of matter and atomic structure by quantum wave mechanics.
CO4: Theoretical and experimental understanding of cosmology.

Note for the Paper Setter: *The question paper will consists of nine questions in all. The first question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit.*

UNIT – I

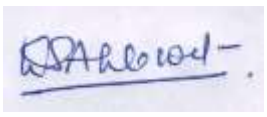
Introduction to electromagnetic spectra, Properties of Thermal Radiation, Spectral Distribution of Blackbody Radiation, Kirchhoff's Law, Stefan-Boltzmann Law and Wien's Distribution and Displacement law, Rayleigh-Jean's Law, Ultraviolet Catastrophe, Planck's postulates of black body radiation, Planck's Law of Blackbody Radiation and its experimental verification. Photoelectric effect, Einstein's explanation and its experimental verification (R. Millikan). Compton scattering, Pair production and annihilation, Bremsstrahlung effect, Cherenkov radiation. X-ray Spectra of atoms and its production.

UNIT – II

Atomic structure: Rutherford scattering, Rutherford's model and its drawbacks, Bohr atomic model; quantization rule, atomic stability, calculation of energy levels for hydrogen like atoms and their spectra, effect of nuclear mass on spectra, Correspondence principle, Franck-Hertz experiment.
Wave properties of matter: De-Broglie wavelength and matter waves; Wave-particle duality, Davison and Germer experiment, wave packets, phase velocity, group velocity and their relations. Electron microscope.
Uncertainty principle: Heisenberg's uncertainty principle; Estimating minimum energy of a confined particle using uncertainty principle, Energy-time uncertainty principle. Applications.

UNIT – III

Two slit interference experiment with photons, atoms and particles; linear superposition principle as a consequence; Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of a wave function, probabilities and normalization; Probability and probability current densities in one dimension.




Concept of wave function: Origin and probability interpretation of wave function, properties of wave-function. One dimensional infinitely rigid box- energy eigenvalues and eigenfunctions, normalization; Quantum dot as example.

UNIT – IV

Cosmology: The Expansion of the Universe, The Cosmic Microwave Background Radiation, Dark Matter, The General Theory of Relativity, Tests of General Relativity, Stellar Evolution and Black Holes, Cosmology and General Relativity, The Big Bang Cosmology, The Formation of Nuclei and Atoms, Experimental Cosmology.

Reference Books:

1. Concepts of Modern Physics, Arthur Beiser, 2002, McGraw-Hill.
2. Introduction to Modern Physics, Rich Meyer, Kennard, Coop, 2002, Tata McGraw Hill
3. Modern Physics, Knneth S.Krane, John Wiley & Sons, Inc.
4. Modern Physics, Raymond A. Serway, Clement J. Moses, Curt A. Moyer, 2005, CENGAGE Learning.
5. Principles of Modern Physics, A.K. Saxena, 2007, Narosa Publication.

BSc/Phy/3/DSC1: Physics of Semiconductor Devices

Credits: 4 **Max. Marks: 100**
Lectures: 60 **Final Term Exam.: 70**
Duration of Exam.: 3 Hrs. **Internal Assessment: 30**

Objective: The course enables students to develop an in-depth understanding about the physics of semiconductors through an exposure of various types of semiconductor diodes, transistors, binary number systems and logic gates.

Course Outcomes: After completion of this course, students will be able to understand:
CO1: the physics and basics of semiconductors.
CO2: the basics of semiconductor diodes.
CO3: the basics of bipolar junction transistors (BJT**)** and their characteristics along with applications.
CO4: the basics of binary number systems, logic gates and Boolean algebra.

Note for the Paper Setter: *The question paper will consists of nine questions in all. The first question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit.*

UNIT – I

Physics of Semiconductors: The Energy-Band theory of Crystals, Classification of materials, Direct and indirect band gap semiconductors, Intrinsic and extrinsic semiconductors, concept of effective mass, Donor and Acceptor impurities, mass action law, Carrier Concentrations; The Fermi Level, Charge densities in semiconductors, Electrical properties of Ge and Si, Generation and recombination of charges, Carrier diffusion, Continuity equation, Injected minority-carrier charge, The Potential variation within a graded semiconductor.

UNIT – II

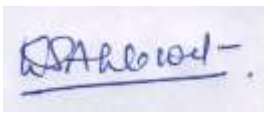
Semiconductor Diodes: Open circuit p-n junction, V-I characteristics and their dependence, Ideal Diode, The Diffusion capacitance, Breakdown Diodes, Tunnel Diode, Semiconductor Photodiode, LED, Diode as circuit element, Load line, Piecewise linear diode model, p-n junction as rectifier (half, full and bridge rectifier), Ripples, Filters (capacitor, inductor and π-filters), Clipping and clamping circuits.

UNIT – III

Bipolar Junction Transistors (BJT): The junction transistor and its current components, I-V characteristics, Transistor as an amplifier, Type of transistors, Common-Base (CB), Common-Emitter (CE), Common-Collector (CC) configuration, characteristics of CE, CB and CC configurations, Ebers-Moll BJT Model, Phototransistor, Switching Transistor, Biasing for transistor, load line and Q point. Types of biasing, Fixed Bias circuits, Collector to base bias circuits, Bias circuit with emitter resistance, Voltage divider bias circuits.

UNIT – IV

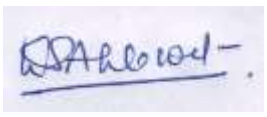
Number System and Codes: Decimal, Binary, Hexadecimal and Octal number systems, base conversions, Binary, octal and hexadecimal arithmetic (addition, subtraction by complement method, multiplication), representation of signed and unsigned numbers, Binary Coded Decimal code.




Logic Gates and Boolean algebra: Introduction to Boolean Algebra and Boolean operators: De Morgan's Theorems, Boolean Laws, simplifications of Logic Circuits using Boolean Algebra, Positive and negative logic, Truth Tables of OR, AND, NOT, construction and symbolic representation of XOR, XNOR, Universal NOR and NAND gates (DTL, TTL gates).

Reference Books:

1. Semiconductor Physics and Devices: Donald A Neaman and Dhrubes Biswas, 4thEdition, McGraw Hill, India
2. Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
3. Basic Electronics and Linear Circuits, N. N. Bhargava et. al., 2ndEdition, McGraw Hill, India
4. Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
5. Solid State Electronic Devices, B. G. Streetman & S. K. Banerjee, 6thEdn.,2009, PHI Learning



BSc/Phy/3/CC12–Physics Lab-V

Credits: 2 (Practical) **Max. Marks: 50**
Teaching per week: 4 Hrs. **Duration of Exam: 3 Hrs.**

Objective: The objective of this course is to impart practical knowledge through design and performance of experiments.

Course outcomes: After successfully completing the course, student will be able to:

CO1: get hands on experience with different instruments by measuring related physical quantities.

CO2: verify some fundamental principles, effects and concepts of physics through experimentation.

CO3: basic understanding on instruments, data observation, errors, along with practical's training to use and learn techniques, skills and tools for professional practices.

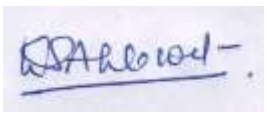
CO4: learn to present observations, results and analysis in suitable and presentable form.

List of Experiments

1. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light.
2. To determine the Planck's constant using LEDs of at least 4 different colours.
3. To determine the wavelength of laser source using diffraction of single slit.
4. To determine the wavelength of laser source using diffraction of double slits.
5. Comparing intensity of light sources and verify inverse square law.
6. Study the characteristics of photodiodes.
7. To determine the particle size of lycopodium powder.
8. To find the horizontal distance between two points using a sextant.
9. To compare the capacitances of two capacitors by deflection method.
10. To find the capacitance of a capacitor by discharging it through a voltmeter.
11. To compare the luminous intensities of two light sources using a photo-voltaic cell.
12. To determine the thermionic work function of tungsten using a directly heated diode.

Reference Books:

1. B.Sc. Practical Physics, C.L. Arora, 2005-2006, S. Chand Publisher, New Delhi
2. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition reprinted 1985, Heinemann Educational Publishers
4. A Text Book of Practical Physics, I.Prakash& Ramakrishna, 11th Ed., 2011,Kitab Mahal
5. A Course of Experiments with He-Ne laser, R.S. Sirohi, 2001, New Age International Publicaiton.
6. Experimental Physics, Gyan Prakash, 2012, Studium Press (India) Pvt. Ltd.



BSc/Phy/3/CC13–Physics Lab-VI

Credits: 2 (Practical) **Max. Marks: 50**
Teaching per week: 4 Hrs. **Duration of Exam: 3 Hrs.**

Objective: The objective of this course is to impart practical knowledge through design and performance of experiments.

Course outcomes: After successfully completing the course, student will be able to:
CO1: get hands on experience with different instruments and measurements related physical quantities.
CO2: verify some fundamental principles, effects and concepts of physics through experimentation.
CO3: get basic understanding on instruments, data observation, errors, along with practical's training to use and learn techniques, skills and tools for professional practices.

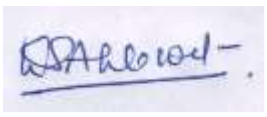
CO4: learn to present observations, results and analysis in suitable and presentable form.

List of Experiments

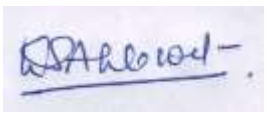
1. Study of Franck-Hertz experiment.
2. To study the characteristics of solar cell.
3. Study of Zeeman Effect.
4. Determine wavelength of laser light by using vernier calipers/ engraved metal scale.
5. Distance measurement by triangularization method using laser.
6. To measure the divergence of laser beam.
7. To determine Boltzmann constant.
8. To determine the angular diameter of the Sun with the help of a sextant.
9. To determine the amplitude or the angular elevation of the Sun using a sextant.
10. To find the capacitance of a capacitor using flashing and quenching of a neon lamp.
11. To find the band gap of a semiconductor material.

Reference Books:

1. B.Sc. Practical Physics, C.L. Arora, 2005-2006, S. Chand Publisher, New Delhi
2. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition reprinted 1985, Heinemann Educational Publishers
4. A Text Book of Practical Physics, I.Prakash& Ramakrishna, 11th Ed., 2011, Kitab Mahal.
5. A Course of Experiments with He-Ne laser, R.S. Sirohi, 2001, New Age International Publication.
6. Experimental Physics, Gyan Prakash, 2012, Studium Press (India) Pvt. Ltd.




Semester-IV



BSc/Phy/4/CC14: Electromagnetic Theory

Credits: 4 **Max. Marks: 100**
Lectures: 60 **Final Term Exam.: 70**
Duration of Exam.: 3 Hrs. **Internal Assessment: 30**

Objectives: The course enables student to develop in depth understanding about the electromagnetic induction, Maxwell's equations, electromagnetic wave propagation, Poynting's vector, electromagnetic field transformation.

Course Outcomes: The student will be able to understand;
CO1: electromagnetic induction and it's applications.
CO2: Maxwell's equations and generation of electromagnetic fields.
CO3: wave propagation through vacuum and isotropic dielectric medium as well as wave guide.
CO4: electromagnetic potential and dipole radiation.

Note for the Paper Setter: *The question paper will consists of nine questions in all. The first question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit.*

UNIT-I

Motional EMF, Faraday's Law of induction, Induced electric field, Lenz's law, Inductance, Self induction of a single coil, Mutual induction of two coils, Transformers, Energy stored in magnetic field,
Maxwell`s equations: Maxwell's fixing of Ampere's law, Displacement current, Maxwell's equations in vacuum.

UNIT-II

Maxwell's equations in matter, Boundary Conditions, Continuity equation, Poynting Theorem and Poynting vector, Maxwell Stress tensor, Conservation of Momentum and angular momentum in electromagnetic field, Energy density in electromagnetic field.

UNIT-III

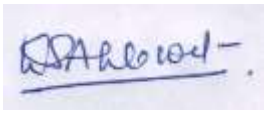
The wave equation, Sinusoidal waves, Wave equations for **E** and **B** fields, Electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, Energy and momentum in EM waves, Propagation in linear media, Reflection and transmission at Normal and Oblique incidence, Brewster's angle, Wave guides, TEM waves.

UNIT-IV

Scalar and vector potential for electromagnetic fields, Gauge Transformation, Coulomb Gauge, Lorentz Gauge, Electric and magnetic dipole radiation (no derivation needed, discussion of results only), Magnetism as relativistic phenomenon, Transformation of electric and magnetic fields between two inertial frames.

Reference Books:

1. Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn, 1998, Benjamin Cummings.
2. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
3. Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
4. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
5. Electromagnetics, S.L. Kakani & C. Hemrajani, 2016, CBS Publication.




BSc/Phy/4/CC15: Classical and Statistical Mechanics

Credits: 4 | **Max. Marks: 100**
Lectures: 60 | **Final Term Exam.: 70**
Duration of Exam.: 3 Hrs. | **Internal Assessment: 30**

Objective: The objective of the course is to provide a basic knowledge of constraints, planetary motion, Langrange's formulation of classical system of particles. The course also includes the basics of classical and quantum statistics.

Course Outcomes: After completion of this course, students will be able to understand the basics of classical and statistical mechanics. They will be having basic knowledge of.

CO1: two-body central force problem and Lagrangian dynamics.
CO2: rigid bodies- kinematics and dynamics.
CO3: introductory topics in statistical physics.
CO4: topics in classical and quantum statistics.

Note for the Paper Setter: *The question paper will consists of nine questions in all. The first question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit.*

UNIT – I

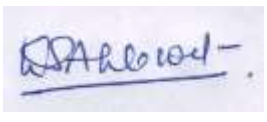
Two-body central force problem and Lagrangian Dynamics: Constraints & their classification, Generalized coordinates, D'Alembert's principle and Lagrange's equations, Simple applications of the Lagrangian formulation, Velocity-dependent potentials and the dissipation function, Hamilton's principle, Derivation of Lagrange's equations from Hamilton's principle, Cyclic coordinates, Conservation theorems and symmetry properties. Two –body central force problem: Reduction to the equivalent one-body problem, Equations of motion and first integrals, Equivalent 1-D problem and classification of orbits.

UNIT –II

Rigid Bodies- Kinematics and Dynamics: Independent coordinates of the rigid bodies, orthogonal transformations, Euler angles and Euler's theorem, Infinitesimal rotation, rate of change of a vector, Coriolis force, angular theorem, infinitesimal rotation, angular momentum and kinetic energy of a rigid body, the inertia tensor, principal axis transformation, Euler equations of motion, Torque free motion of rigid body, motion of asymmetrical top.

UNIT- III

Introduction to Statistical Physics: Laws of Thermodynamics, Entropy and Disorder, Statistical Definition of Entropy, Macroscopic and Microscopic Systems, Events (dependent, independent and mutually exclusive), statistical Probability, a-priori probability, probability theorems, Tossing of Coins, Permutations and Combinations, Distribution of N distinguishable and indistinguishable particles in boxes, Macro and Micro states, Thermodynamic potentials and Thermodynamic equilibriums, phase space, Liouville's Theorem, Density Matrix, Fluctuations, Three kinds of Statistics 75.




UNIT-IV

Classical and Quantum Statistics: Maxwell- Boltzmann Statistics applied to an ideal gas, M.B. velocity distribution law, Thermodynamical quantities, ideal Boltzmann gas, Monoatomic and Diatomic ideal gases, ideal paramagnetism, Bose- Einstein energy distribution law, Planck's Radiation Law, B-E Gas, Degeneracy and B.E. Condensation, Fermi- Dirac energy distribution Law, F.D. Gas and Degeneracy, Fermi Energy and Fermi Temperature, Zero point Energy, Zero point Pressure and average speed (at 0K) of electron gas, Specific heat Anomaly of metals and its solution, M.B. distribution as a limiting case of B.E. and F.D. distributions, Comparison of three Statistics.

Reference Books:

1. Classical Mechanics, 3rded.,2002 by H. Goldstein, C. Poole and J. Safko, Pearson Edition
2. Classical Mechanics of Particles and Rigid Bodies by K. C. Gupta, 2008, New Age International.
3. Classical Mechanics, N.C. Rana & P.S. Jaog, 2017, Tata MC Graw Hill, New Delhi.
4. Statistical Mechanics, R.K. Pathria & D. Beale, 2021, Elsevier Publication.
5. Statistical Mechanics, B.K. Agarwal & M. Eisner, 2020, New Age International Publication.
6. Introduction to Statistical Mechanics, S.K. Sinha, 2005, Narosa Publication.

BSc/Phy/4/DSC2: Solid State Physics

Credits: 4 **Max. Marks: 100**
Lectures: 60 **Final Term Exam.: 70**
Duration of Exam.: 3 Hrs. **Internal Assessment: 30**

Objective: The aim of the course is to familiarize the students with the concepts of crystal structure, reciprocal lattice, bonding in solids, elastic constants and magnetic properties of solids.

Course Outcomes: After completion of this course, students will be able to understand the basics of crystal structure, reciprocal lattice, bonding in solids, elastic constants and magnetic properties of solids. Students get knowledge on

CO1: elements of crystal structure.
CO2: reciprocal lattice and X-ray diffraction methods.
CO3: bonding in solids and elastic constants.
CO4: theory of magnetism, magnetic properties and superconductivity of materials.

Note for the Paper Setter: *The question paper will consists of nine questions in all. The first question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit.*

UNIT – I

Crystal Structure: Introduction to crystalline & amorphous solids**,** Crystal lattice and Translation Vectors, Unit cell and basis, Primitive and non-primitive lattices, Symmetry operations, Point groups and space groups, Bravais lattices in 2D and 3D, Lattice planes, Miller Indices, Interplanner spacing, Crystal structures: sc, bcc, fcc and hcp, Examples: NaCl, CsCl, Diamond and ZnS structure.

UNIT – II

Reciprocal lattice: Bragg's law, Fourier analysis of electron density, reciprocal lattice, Diffraction condition in reciprocal space, Laue's equations, Ewald construction, Brillioun zones and Weigner Seitz cell concepts, Brillioun zones construction, Reciprocal lattice (sc, bcc, fcc), Fourier analysis of basis, Atomic scattering factors, Geometrical structure factor, X-ray diffraction method: Laue, Rotating and powder crystal methods.

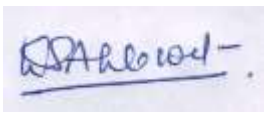
UNIT – III

Bonding in solids: Force between atoms, Cohesion of atoms and cohesive energy, Crystal of inert gases, Van der Waal interaction, Repulsive interaction, Equilibrium lattice constants, Ionic crystals, Lattice energy of ionic crystal, Madelung constant of ionic crystal, Covalent crystals, Metals, Hydrogen Bonds, Atomic radii.

Elastic constants: Elastic strains, Stress components, Stiffness constants for cubic crystals, Elastic energy density, Bulk Modulus and Compressibility, Elastic waves.

UNIT – IV

Magnetic Properties: Origin of magnetism, Types of magnetism,Dia-, Para-, Ferri-, Ferro and anti-ferromagnetic materials, Langevin's Classical and quantum Theory of Dia– and Paramagnetic, Curie's law, Weiss's Theory of Ferromagnetism, Exchange interactions, Spin Hamiltonian and the Heisenberg model; Spin waves- magnons, Ferromagnetic domains: Magnetization curve, Bloch wall, Origin of domains.




Superconductivity: Critical temperature, Critical magnetic field, Meissner effect, Type I and type II Superconductors, London's equation and Penetration depth, energy gap, BCS theory, Josephson effect.

Reference Books:

1. Introduction to Solid State Physics, Charles Kittel, 8th Edition, 2004, Wiley India Pvt. Ltd.
2. K.V. Keer, Principles of solid state physics, Wiley - Eastern, 1993.
3. Solid State Physics, N.W. Ashcroft and N.D. Mermin, 1976, Cengage Learning.
4. Solid State Physics, M.A. Wahab, 2011, Narosa Publications.
5. Introduction to Solid State Physics, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill.
6. Solid State Physics: An Introduction to Theory and Experiment by H. Ibach and H. Luth
7. Neil W Ashcroft and N David Mermin, Solid State Physics, Holt Saunders International Edn, 1976.
8. BD Cullity, Introduction to Magnetic Materials, Addison-Wesley, 1972.

BSc/Phy/4/CC16–Physics Lab-VII

Credits: 2 (Practical) **Max. Marks: 50**
Teaching per week: 4 Hrs. **Duration of Exam: 3 Hrs.**

Objective: The objective of this course is to impart practical knowledge through hands on training of basic instruments.

Course outcomes: After successfully completing the course, student will be able to get:

CO1: exposure with various aspects of instruments and their usage through hands-on mode.

CO2: real work experience of various lab skills on related instruments in the profession.

CO3: basic understanding on instruments data observation, measurements, errors and analysis.

CO4: practical's training to use and learn techniques, skills and tools for professional practices.

List of Experiments:

1. To study the growth and decay of current in a L, R circuit using magnetic core inductor.
2. To determine the magnetic induction field between the pole pieces of an electromagnet with the help of a search coil and a ballistic galvanometer using a mutual inductance for calibration of ballistic galvanometer.
3. To determine the value of e/m for electron by long solenoid (Helical) method.
4. To determine e/m by magnetron method or small solenoid method.
5. To determine the electronic charge by Millikan's Method.
6. To determine the frequency of AC mains using a Sonometer and an electromagnet.
7. To find the value of B_H the Horizontal component of earth's magnetic field in the laboratory using a deflection and vibration magnetometer.
8. To find the value of M in the laboratory using deflection and vibration magnetometer.
9. To study the variation of magnetic field with distance along the axis of a circular coil carrying current by plotting a graph.
10. To study the induced emf as a junction of velocity of the magnet (simple method).
11. To study the induced emf as a junction of velocity of magnet.
12. To obtain the wave form of AC mains supply using a cathode ray oscilloscope.
13. To measure the AC voltage using a CRO and to calculate the deflection sensitivity in mm per rms volt.
14. To measure a dc voltage with the help of a CRO.
15. To demonstrate the phase difference in the case of resistance, inductance and capacitance and to measure their values using a CRO.
16. To measure the phase difference between current & voltage for CR and LR of AC circuit using a CRO.
17. Magnetic field measurement by using Helmholtz coil.

Reference Books:

1. B.Sc. Practical Physics: C.L. Arora, 2005-2006, S.Chand & Co. Ltd.
2. A text book in Electrical Technology - B L Theraja, 2006, S Chand and Co.
3. Performance and design of AC machines - M G Say, 2002, ELBS Edn.
4. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
5. Logic circuit design, Shimon P. Vingron, 2012, Springer.
6. Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
7. Electronic Devices and circuits, S. Salivahanan & N. S. Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill.
8. Electronic circuits: Handbook of design and applications, U. Tietze, Ch. Schenk, 2008, Springer.
9. Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India.
10. Experimental Physics, Gyan Prakash, 2012, Studium Press (India) Pvt. Ltd.

BSc/Phy/4/CC17–Physics Lab-VIII

Credits: 2 (Practical) **Max. Marks: 50**
Teaching per week: 4 Hrs. **Duration of Exam: 3 Hrs.**

Objective: The objective of this course is to impart practical knowledge through design and performance of experiments.

Course outcomes: After successfully completing the course, student will be able to get
CO1: hands on experience with different instruments and measurements of related physical quantities.
CO2: verify some fundamental principles, effects and concepts of physics through experimentation.
CO3: basic understanding on instruments data observation, measurements, errors and analysis.

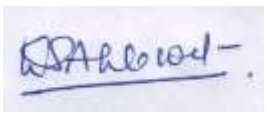
CO4: practical's training to use and learn techniques, skills and tools for professional practices.

List of Experiments:

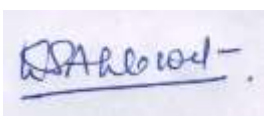
1. To determine the frequency of an electric tuning fork by Melde's experiment.
2. To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped film.
3. To verify inverse square law of radiation using a photoelectric cell.
4. To determine wavelength of spectral lines of Hg source using plane diffraction grating.
5. To determine dispersive power and resolving power of a plane diffraction grating.
6. To find the polarization angle of laser light using polarizer and analyzer.
7. To verify Malus law of polarization.
8. Measurement of focal length of mirrors and lenses.
9. To find Brewster's angle.
10. Study Faraday law of induction.
11. To study the characteristics of a photo-voltaic cell (solar cell).
12. Study of optical fiber as a waveguide.
13. To determine the coefficient of increase of pressure of air at constant volume.
14. To find the melting point of wax using Joly's constant volume air thermometer.

Reference Books:

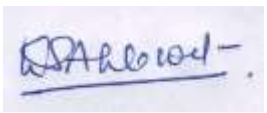
1. B.Sc. Practical Physics, C.L. Arora, 2005-2006, S. Chand Publisher, New Delhi
2. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
3. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
4. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
5. A Laboratory Manual of Physics for undergraduate classes, D.P. Khandelwal, 1985, Vani Pub.
6. Experimental Physics, Gyan Prakash, 2012, Studium Press (India) Pvt. Ltd.




BSc/Phy/4/CC18- Seminar



Generic Elective Courses



BSc/Phy/3/GEC5– Electricity and Magnetism

Credits: 4 **Max. Marks: 100**
Lectures: 60 **Final Term Exam.: 70**
Duration of Exam.: 3 Hrs. **Internal Assessment: 30**

Objective: This course deals with Coulomb's law, electric field, potential formulation of electrostatic, capacitors, magnetism and magnetic materials along with their applications.
Course Outcomes: After successfully completing the course, student will be able to:

CO1: explain and differentiate the vector & scalar formalisms of electrostatics. Also be able to apply Gauss's law of electrostatics to solve a variety of problems.
CO2: describe the important properties of magnetic field. Understand the properties and theories of dia-, para- & ferromagnetic materials.
CO3: understand the concept of dielectric behaviour of materials, Biot-Savart's law &its applications.

CO4: Analyze AC circuits consisting of parallel and/or series combinations of voltage sources and resistors and to describe the graphical relationship of resistance, capacitor and inductor. Concept of network theorems.

Note for the Paper Setter: *The question paper will consists of nine questions in all. The first question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit.*

Unit-I

Electrostatics: Electric field, Electric field lines, Electric flux, Divergence of electrostatic field, Gauss' Law with applications, Conservative nature of Electrostatic Field, Electrostatic Potential, Potential and Electric Field of a dipole, Force and Torque on a dipole, Electrostatic energy of system of charges, Energy per unit volume in electrostatic field, Electrostatic energy of a charged sphere, Conductors in an electrostatic Field, Surface charge and force on a conductor, Laplace's and Poisson equations, Laplace equation in three dimension, The Uniqueness Theorems.

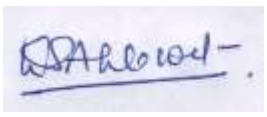
Unit-II

The method of images: Point charge in the presence of grounded conducting sphere, Solution of Laplace equation by separation of variables for Cartesian and spherical coordinates, Multipole expansion of potential due to arbitrary charge distribution.

Dielectric Properties : Dielectric medium, Polarization, Bound charges in a polarized dielectric and their physical interpretation, Electric displacement, Gauss's theorem in dielectrics, Parallel plate capacitor completely filled with dielectric, dielectric constant.

Unit-III

Magnetism: Lorentz force law, Magnetic forces, Magnetostatics: Biot-Savart's law &its applications (i) circular coil (ii) solenoid carrying current, Divergence and curl of magnetic field, Ampere's circuital law and it's applications for simple current configurations, Magnetic vector potential.




Magnetic Properties of Matter: Magnetization vector (M), Magnetic Intensity (H), Magnetic Susceptibility and permeability, Relation between B, H, M, Para-, Dia- and Ferromagnet ism, B-H curve and hysteresis.

Unit-IV

Electrical Circuits: AC Circuits: Kirchhoff's laws for AC circuits, Complex Reactance and Impedance, Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and (4) Band Width, Parallel LCR Circuit.

Network theorems: Ideal Constant-voltage and Constant-current Sources, Network theorems; Thevenin theorem, Norton theorem, Superposition theorem, Reciprocity theorem, Maximum power transfer theorem, Application to dc circuits.

Text/Reference Books:

1. B.Sc. Practical Physics, C.L. Arora, 2005-2006, S. Chand Publisher, New Delhi.
2. D.J. Griffith, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.
3. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-HillEducation.
4. Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
5. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
6. Electricity and Magnetism, Reitzand Milford (Prentice Hall of India)
7. Electricity and Magnetism, A.S. Mahajan and A.A. Rangwala (Tata McGraw Hill)
8. Electricity and Magnetism, Edward M Purcell, 1986, McGraw-Hill Education
9. Electricity and Magnetism, J.H. Fewkes & J. Yarwood, Vol. I, 1991, Oxford Univ. Press.
10. Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn 1998 Benjamin Cummings.
11. Electricity and Magnetism, R. Murugeshan, S.Chand & Com. Pt. Ltd., New Delhi
12. Electromagnetic Fields and waves, K.D. Prasad, Satya Prakashan, New Delhi

BSc/Phy/3/GEC6- Electricity & Magnetism (Lab.)

Credits: 2 (Practical) **Max. Marks: 50**
Teaching per week: 4 Hrs. **Duration of Exam: 3 Hrs.**

Objective: The objective of this course is to impart practical knowledge through design and performance of experiments.

Course outcomes: After successfully completing the course, student will be able to:
CO1: Hands on experience with different instruments and appreciate the beauty of different concepts and related experiments in Physics.
CO2: Verify some fundamental principles, effects and concepts of physics through experiments. Gaining knowledge related to LCR circuits, Ballistic galvanometer, magnetic field and inductance of two coils.
CO3: Perform experiments related to A.C. mains, D.C. voltage and current. Learn experimentation with Thevenin, Norton and Superposition theorems.
CO4: Learn to present observations, results and analysis in suitable and presentable form.

List of Experiments

1. To use Multimeter for measuring Resistance, A.C. and D.C. Voltage and Current, checking of electrical fuses.
2. Low resistance by Carey Foster's bridge with calibration.
3. Determination of Impedance of an A.C. circuit and its verification.
4. Frequency of A.C. mains using an electromagnet.
5. Frequency of A.C. mains Electrical vibrator.
6. High resistance by substitution method.
7. To study the characteristics of a series RC Circuit.
8. To determine an unknown Low Resistance using Potentiometer.
9. To determine an unknown Low Resistance using Carey Foster's Bridge
10. To compare capacitances using De'Sauty's bridge.
11. Measurement of field strength B and its variation in a solenoid (determine dB/dx).
12. To verify the Thevenin and Norton theorems.
13. To verify the Superposition, and Maximum power transfer theorems.
14. To determine self inductance of a coil by Anderson's bridge.
15. To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impendence at resonance, (c) Quality factor Q, and (d) Band width.
16. To study the response curve of a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor Q.
17. Measurement of charge and current sensitivity and CDR of Ballistic Galvanometer.
18. Determine a high resistance by leakage method using Ballistic Galvanometer.
19. To determine self-inductance of a coil by Rayleigh's method.
20. To determine the mutual inductance of two coils by Absolute method.

References:

1. B.Sc. Practical Physics, C.L. Arora, 2005-2006, S. Chand Publisher, New Delhi
2. Advanced Level Practical Physics, M. Nelkon and Ogborn, Henemann Education Books Ltd., New Delhi
3. Practical Physics, S.S. Srivastava and M.K. Gupta, 2018, Atma Ram & Sons, Delhi
4. Practical Physics, S.L. Gupta and V. Kumar, 2017, Pragati Prakashan Meerut
5. Modern Approach to Practical Physics, R.K. Singla, 2017, Modern Publishers, Jalandhar
6. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House.

BSc/Phy/4/GEC7 : Electromagnetic Theory

Credits: 4 **Max. Marks: 100**
Lectures: 60 **Final Term Exam.: 70**
Duration of Exam.: 3 Hrs. **Internal Assessment: 30**

Objectives: The course on Electricity and Magnetism deals with the Electromagnetic induction, Maxwell's Equations, Electromagnetic wave propagation, Poynting's Vector and electromagnetic field transformation

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Course Outcomes: The student will be able to understand electromagnetic induction and it's applications, Maxwell's equations and generation of electromagnetic fields, wave propagation through vacuum and isotropic dielectric medium.
The student will be able to understand;

CO1: electromagnetic induction and it's applications.
CO2: Maxwell's equations and generation of electromagnetic fields.
CO3: wave propagation through vacuum and isotropic dielectric medium as well as wave guide.
CO4: electromagnetic potential and dipole radiation.

Note for the Paper Setter: *The question paper will consists of nine questions in all. The first question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit.*

UNIT-I

Motional EMF, Faraday's Law of induction, Induced electric field, Lenz's law, Inductance, Self induction of a single coil, Mutual induction of two coils, Transformers, Energy stored in magnetic field,
Maxwell`s equations: Maxwell's fixing of Ampere's law, Displacement current, Maxwell's equations in vacuum.

UNIT-II

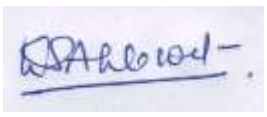
Maxwell's equations in matter, Boundary Conditions, Continuity equation, Poynting Theorem and Poynting vector, Maxwell Stress tensor, Conservation of Momentum and angular momentum in electromagnetic field, Energy density in electromagnetic field.

UNIT-III

The wave equation, Sinusoidal waves, Wave equations for **E** and **B** fields, Electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, Energy and momentum in EM waves, Propagation in linear media, Reflection and transmission at Normal and Oblique incidence, Brewster's angle, Wave guides, TEM waves

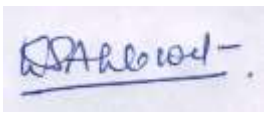
UNIT-IV

Scalar and vector potential for electromagnetic fields, Gauge Transformation, Coulomb Gauge, Lorentz Gauge, Electric and magnetic dipole radiation (no derivation needed, discussion of results only), Magnetism as relativistic phenomenon, Transformation of electric and magnetic fields between two inertial frames.




Reference Books:

1. D.J. Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.
2. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
3. Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
4. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.



BSc/Phy/4/GEC8: Electromagnetic Lab

Credits: 2 (Practical) **Max. Marks: 50**
Teaching per week: 4 Hrs. **Duration of Exam: 3 Hrs.**

Objective: The objective of this course is to impart practical knowledge through hands on training of basic instruments.

Course outcomes: After successfully completing the course, student will be able to get:

CO1: exposure with various aspects of instruments and their usage through hands-on mode.

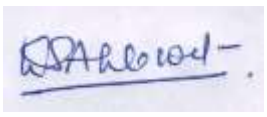
CO2: real work experience of various lab skills on related instruments in the profession.

CO3: basic understanding on instruments data observation, measurements, errors and analysis.

CO4: practical's training to use and learn techniques, skills and tools for professional practices.

List of Experiments:

1. To study the growth and decay of current in a L, R circuit using magnetic core inductor.
2. To determine the magnetic induction field between the pole pieces of an electromagnet with the help of a search coil and a ballistic galvanometer using a mutual inductance for calibration of ballistic galvanometer.
3. To determine the value of e/m for electron by long solenoid (Helical) method.
4. To determine e/m by magnetron method or small solenoid method.
5. To determine the electronic charge by Millikan's Method.
6. To determine the frequency of AC mains using a Sonometer and an electromagnet.
7. To find the value of B_H the Horizontal component of earth's magnetic field in the laboratory using a deflection and vibration magnetometer.
8. To find the value of M in the laboratory using deflection and vibration magnetometer.
9. To study the variation of magnetic field with distance along the axis of a circular coil carrying current by plotting a graph.
10. To study the induced emf as a junction of velocity of the magnet (simple method)
11. To study the induced emf as a junction of velocity of magnet.
12. To obtain the wave form of AC mains supply using a cathode ray oscilloscope.
13. To measure the AC voltage using a CRO and to calculate the deflection sensitivity in mm per rms volt.
14. To measure a dc voltage with the help of a CRO.
15. To demonstrate the phase difference in the case of resistance, inductance and capacitance and to measure their values using a CRO.
16. To measure the phase difference between current & voltage for CR and LR of AC circuit using a CRO.
17. Magnetic field measurement by using Helmholtz coil.




Reference Books:

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3. Performance and design of AC machines - M G Say, 2006, ELBS Edn.
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5. Logic circuit design, Shimon P. Vingron, 2012, Springer.
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7. Electronic Devices and circuits, S. Salivahanan & N. S. Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill.
8. Electronic circuits: Handbook of design and applications, U. Tietze, Ch. Schenk, 2008, Springer.
9. Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India.
10. Experimental Physics, Gyan Prakash, 2012, Studium Press (India) Pvt. Ltd.