



**List of Courses which focuses on Professional Ethics, Gender, Human Values, Environment & Sustainability and other value framework**

**Department : *Pure and Applied Physics***

**Programme Name : *B.Sc. Electronics***

***Academic Year : 2023-24***

**Courses which focuses on Professional Ethics, Gender, Human Values, Environment & Sustainability and other value framework:**

Sr. No.	Course Code	Name of the Course
01.	PLUBTS2	Simulation and Design of Digital Circuit Components



**DEPARTMENT OF PURE AND APPLIED PHYSICS**  
**B. Sc. (Electronics) Course structure under NEP-2020**  
**Academic year 2023 – 2024**

Sem.	Courses	Course Code	Number of courses	Level	Credits	Credits (L+T+P)	Int. Marks	Ext. Marks	Total
1	Major-I	PLUATT1	Basic Circuit Theory & Network Analysis	2	3	(3+0+0)	30	70	100
		PLUATL1	Basic Circuit Theory & Network Analysis Lab		1	(0+0+1)	30	70	100
	Minor-I		Opted from the Pool Course offered by University	2	4		30	70	100
	Multidisciplinary		Opted from the Pool Course offered by University	1	3		30	70	100
	AEC		Opted from the Pool Course offered by University	1	2		30	70	100
	SEC		Opted from the Pool Course offered by University	1	3		30	70	100
	VAC-1		Opted from the Pool Course offered by University	1	2		30	70	100
	VAC-2		Opted from the Pool Course offered by University	1	2		30	70	100
			<b>Total</b>		<b>20</b>				<b>800</b>
2	Major-II	PLUBTT1	Semiconductor Physics & Devices	2	3	(3+0+0)	30	70	100
		PLUBTL1	Semiconductor Physics & Devices Lab		1	(0+0+1)	30	70	100
	Minor-II		Opted from the Pool Course offered by University	2	4		30	70	100
	Multidisciplinary		Opted from the Pool Course offered by University	1	3		30	70	100
	AEC		Opted from the Pool Course offered by University	1	2		30	70	100
	SEC		Opted from the Pool Course offered by University	1	3		30	70	100
	VAC-1		Opted from the Pool Course offered by University	1	2		30	70	100
	VAC-2		Opted from the Pool Course offered by University	1	2		30	70	100
			<b>Total</b>		<b>20</b>				<b>800</b>
3	Major-III	PLUCTT1	Digital Electronics	3	3	(3+0+0)	30	70	100
		PLUCTL1	Digital Electronics Lab		1	(0+0+1)	30	70	100
	Major-IV	PLUCTT2	C Programming and Data Structures	3	3	(3+0+0)	30	70	100
		PLUCTL2	C Programming and Data Structures Lab		1	(0+0+1)	30	70	100
	Minor-III		Opted from the Pool	3	4		30	70	100



	Multidisciplinary Offered by the School of Physical Sciences and Natural Sciences	PPUATM1	Conceptual Understanding of Physical Science – I	1	3	(2+1+0)	30	70	100
	SEC Offered by the Department	PLUATS1	Network Circuit Analysis	1	3	(2+0+1)	30	70	100
II	Minor-II Offered by the Department	PLUBTG2	Semiconductor Devices	2	3	(3+0+0)	30	70	100
		PLUBLG2	Semiconductor Devices Lab		1	(0+0+1)	30	70	100
	Multidisciplinary Offered by the School of Physical Sciences and Natural Sciences			1	3	(2+1+0)	30	70	100
	SEC Offered by the Department	PLUBTS2	Simulation and Design of Digital Circuits Components	1	3	(2+0+1)	30	70	100

PHY- Physics, L-Lecture, T- Tutorial, P-Practical

### SEC - 1: Simulation and Design of Digital Circuit Components

**Course Code: PLUBTS2**

**Credits = 1 (1+0+0)**

#### Course Objectives

- ☐ To acquaint students with various basic digital gates used in digital system and develop logical circuits using Boolean gates, construction of various logic circuits using basic gates.
- ☐ To impart practical working knowledge of Simulation and Analysis of digital circuits using MATLAB and/or SCILAB.

#### Learning Outcomes:

On successful Completion of the course, students will be able to:

- ☐ Understand the main features and importance of the MATLAB/SCI LAB mathematical programming environment.
- ☐ Apply working knowledge of MATLAB/SCI LAB package to simulate and solve Digital Electronics circuits and Applications.

#### Basics of the circuit components



Basics of Voltage, Current, Resistance and Power, Ohm's law, Series and parallel combinations of electrical components. Basics of electrical instruments such as multimeter, voltmeter and ammeter.

### **Basics and Applications of the MATLAB**

Fundamentals of the MATLAB software. Logic Circuits, Equivalent circuits of an NOT Gate, Exclusive OR Gate, , NOR Gate as Universal Gate, NAND Gate, NAND Gate as Universal Gate, NOR Gate, Half Adder, Full Adder, Half Adder using NAND Gate, Full Adder using NAND Gate, Comparator.

### **Reference Books:**

1. Electrical Circuits, K.A. Smith and R.E. Alley
2. Modern Digital Electronics by R.P. Jain
3. Digital Electronics by Malvino and Leech
4. Digital Signal Processing with Examples in MATLAB by Samuel D. Stearns and Don R. Hush



**List of Courses which focuses on Professional Ethics, Gender, Human Values, Environment & Sustainability and other value framework**

**Department : *Pure and Applied Physics***

**Programme Name : *B.Sc. Physics***

***Academic Year : 2023-24***

**Courses which focuses on Professional Ethics, Gender, Human Values, Environment & Sustainability and other value framework:**

Sr. No.	Course Code	Name of the Course
01.	PPUATM1	Conceptual Understanding of Physical Science – I
02.	PPUATS1	Experimental Techniques in Physics
04.	PPUBTS1	Renewable Energy and Energy Harvesting



## Scheme and Syllabus

### DEPARTMENT OF PURE AND APPLIED PHYSICS B. Sc. (Physics) Course structure under NEP-2020 Academic year 2023 – 2024

#### Courses Offered by the Department of Pure & Applied Physics/School

Sem.	Courses	Course Code	Number of courses	Level	Credits	Credits (L+T+P)	Int. Marks	Ext. Marks	Total
I	Minor-I Offered by the Department	PPUATG2	Mathematical methods in Physical Sciences	2	4	(3+1+0)	30	70	100
	Multidisciplinary Offered by the School of Physical Sciences and Natural Sciences	PPUATM1	Conceptual Understanding of Physical Science – I	1	3	(2+1+0)	30	70	100
	SEC Offered by the Department	PPUATS1	Experimental Techniques in Physics	1	3	(2+0+1)	30	70	100
II	Minor-II Offered by the Department	PPUBTG1	Mechanics	2	3	(3+0+0)	30	70	100
		PPUBLG1	Mechanics Lab		1	(0+0+1)	30	70	100
	Multidisciplinary			1	3	3(2+1+0)	30	70	100

	Offered by the School of Physical Sciences and Natural Sciences								
	SEC Offered by the Department	PPUBTS1	Renewable Energy Resources	1	3	(2+0+1)	30	70	100

PHY- Physics, L-Lecture, T- Tutorial, P-Practical



Credits = 3(2+1+0)

**Multidisciplinary -I : Conceptual Understanding of Physical Science – I Course**

**Code: PPUATM1**

**Course Objectives**

- To let the students attain a comprehensive knowledge and coherent understanding of phenomena involved in physical sciences
- To let the students acquire practical and procedural knowledge required for carrying out skilled work/tasks related to physical sciences
- To build capacity to understand from what has been learned, translate concepts to real-life situations
- To build capacity to find solutions to specific problems

**Learning Outcomes:**

Upon successful completion of this course the students will be able to • Understand physical phenomena and different processes in physical sciences • Understand the basics of mechanical world around us

- Develop a thorough understanding of various aspects of daily life chemistry

**Unit-I: Chemistry in daily life:**

Organic molecules in daily life: Chemistry of carbohydrates, amino acids, lipids, fats, soaps, detergents: General structure, source, and applications. General introduction to pesticides (natural and synthetic), benefits and adverse effects, synthesis and technical manufacture and uses of representative pesticides in the following classes: Organochlorines (DDT); Quinones (Chloranil). Chemical constitution and physiological functions of vitamins A, vitamin C (Ascorbic acid).

**Unit-II: Measurement:**

Physical quantities and dimensions of physical quantities, dimensional analysis and its applications.

**Kinematics:** Motion in a straight line: Position-time graph, speed and velocity. Uniform and non-uniform motion, average speed and instantaneous velocity. Uniformly accelerated motion, velocity time and position-time graphs, and relations for uniformly accelerated motion (graphical treatment), Scalar and Vector products of Vectors.

**Unit-III: Laws of Motion:**

Intuitive concept of force. Inertia, Newton's first law of motion; momentum and Newton's second law of motion; impulse; Newton's third law of motion. Law of conservation of linear momentum and its applications.

**Work, Energy and Power:**

Work done by a constant force and a variable force; kinetic energy, work-energy theorem, power. Notion of potential energy, potential energy of a spring, conservative forces; conservation of mechanical energy (kinetic and potential energies); nonconservative forces.

**Unit-IV: Gravitation:** Kepler's laws of planetary motion. The universal law of gravitation. Acceleration due to gravity and its variation with altitude and depth. Gravitational potential energy; gravitational potential. Escape velocity.

**References:**





1. "Organic Chemistry", I. L. Finar, Vol. I & II, 5th Edition (1975), Reprinted in 1996, ELBS and Longman Ltd., New Delhi.
2. "Biochemistry" L. Stryer, 5th edition (2002) Freeman & Co New York.
3. "Principles of Biochemistry" D. L. Nelson M.M. Cox, Lehninger, 3rd edition (2002) McMillan North Publication.
- BSc (Physics)
4. R. Cremlyn: *Pesticides*, John Wiley
5. Mechanics, J.C. Upadhyaya, 2017, Ram Prasad Publications, Agra.
6. Classical Mechanics, 2014 J.C. Upadhyaya, Himalaya Publishing House.
7. NCERT, Physics Part-1

### SEC-I: Experimental Techniques in Physics Course Code: PPUATS1

**Credits = 3(2+0+1)**

#### Course Objectives:

The course aims to develop an understanding of • Knowledge about basic apparatus use in physics.

- Develop conceptual competence in the learners and make them realize and appreciate the interface of Physics with other disciplines.
- Expose the learners to different processes used in Physics-related industrial and technological applications

#### Learning Outcomes:

Upon successful completion of this course, students will be able to address following points:

- Learn the various apparatus for measurements
- Students will be able to learn how to measure various physical quantities by the instruments.
- Knowledge of digital multimeter.

**Unit I:** Need for measurement: Units of measurement; systems of units; SI units, fundamental and derived units, significant figures, Instruments accuracy, precision, sensitivity, resolution, range, least count of different instruments etc. Errors in measurements.

**Unit-II** Basic Apparatus: Length and Time Measurements - Vernier calipers, Screw gauge, spherometer, Stop watch, Stop clock and Digital timer; Measurement of Temperature, Relation among various units of temperature, Mercury thermometer, sensitive thermometer.

**Unit III:** Basic of resistance and its measurements, color coding for the resistance value, Series and parallel combination of resistances and its value determination.

**Unit IV:** Use of analog millimeter: basic concept of voltage, current, ac and dc voltage and current, principles of measurement of dc voltage and dc current, ac voltage and ac current, specifications of a multimeters and their significance, Power and its units.

#### References

1. B L Theraja : A text book in Electrical Technology
2. M G Say : Performance and design of AC machines
3. Venugopal : Digital Circuits and Systems





**SEC-II: Renewable Energy Resources Course Code: PPUBTS1**

**Credits = 3(2+0+1)**

**Course Outcomes:**

- To understand the Energy policies and to know some of the renewable energy sources such as solar energy, off-shore wind energy, tidal energy, biogas energy and hydroelectricity.
- Illustrate Photovoltaic conversion mechanism.
- Appraise wind energy conversion and ocean energy
- Conversion of vibration into voltage using piezoelectric materials,
- Conversion of thermal energy into voltage using thermoelectric modules.
- The students are expected to learn not only the theories of the renewable sources of energy, but also to have hands-on experiences on them wherever possible.

**Unit – I: Renewable Energy Sources:** Solar, wind, small hydro, biomass, geothermal and ocean energy, energy flow in ecosystem, Solar Energy Resources, Solar radiation: Spectrum of EM radiation, sun structure and characteristics.

**Unit – II: Photovoltaic Materials and Devices:**

Photovoltaic phenomena, Bulk and thin solar cell materials, p-n junction: homo and hetero junctions; Electrical and optical properties of photovoltaic / semiconductor materials, power conversion efficiency, factors affecting the PCE, solar cell design, various parameters of solar cell.

**Unit – III: Solar Thermal Conversion:**

Solar thermal collectors- flat plate collectors, concentrating collectors; solar heating of buildings; solar still; solar water heaters; solar driers; conversion of heat energy in to mechanical energy, solar thermal power generation systems.

**Reference Books:**

1. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
2. Solar energy - M P Agarwal - S Chand and Co. Ltd.
3. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.
4. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford
5. University Press, in association with The Open University. Dr. P Jayakumar, Solar Energy: Resource Assessment Handbook, 2009
6. J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
7. on- conventional energy resources, B H Khan, Tata McGraw-Hill Publication 2006, ISBN 0-07-060654-42
8. Renewable Energy Resources Paperback John Twidell and Tony Weir ,Routledge, Taylor& Francis, 2015
9. Solar Photovoltaic's: Fundamentals, Technologies And Applications, CHETAN SINGH SOLANKI, PHI Learning Pvt. Ltd., Third Edition 2015
10. Non – Conventional Energy Resources: G. D. Rai, KhannaPublishers,2008.
11. Solar Energy Fundamentals, Technology, and Systems, Klaus JägerOlindolsabella Arno H.M. SmetsRenéA.C.M.M. van SwaaijMiroZeman Delft University of Technology, 2014 BSc (Physics)



**List of Courses which focuses on Professional Ethics, Gender, Human Values, Environment & Sustainability and other value framework**

**Department : *Pure and Applied Physics***

**Programme Name : *M.Sc. Electronics***

***Academic Year : 2023-24***

**Courses which focuses on Professional Ethics, Gender, Human Values, Environment & Sustainability and other value framework:**

Sr. No.	Course Code	Name of the Course
01.	OPNPET1	Applications of Nanotechnology in Electronics



## Scheme and Syllabus

Sem	Course Opted	Course Code	Name of the course	Credit	L:T:P	Internal	External	Total
I	Core-1	PEPATT1	Mathematical Techniques for Electronics	5	4+1+0	30	70	100
	Core -2	PEPATT2	Semiconductors Materials & Devices	3	3+0+0	30	70	100
		PEPALT2	Semiconductors Materials & Devices Lab	2	0+0+2	30	70	100
	Core -3	PEPATT3	Analog and Digital Electronics	3	3+0+0	30	70	100
		PPPALT3	Analog and Digital Electronics Lab	2	0+0+2	30	70	100
	Open Elective		Opted from the pool and offered by other departments	5	5+0+0	30	70	100
	Other if any*							
			<b>TOTAL</b>	<b>20</b>				<b>600</b>
			<b>Open Elective offered by the Department</b>					
	Open Elective	OPNPET1	Applications of Nanotechnology in Electronics	3	3+0+0	30	70	100
		OPNPET1	Applications of Nanotechnology in Electronics Lab	2	0+0+2	30	70	100
II	Core-4	PEPBTT1	Electromagnetic theory and Wave Propagation	5	4+1+0	30	70	100
	Core -5	PEPBTT2	IC Fabrication and VLSI Technology	5	4+1+0	30	70	100
	Core -6	PEPBTT3	Microprocessors and Microcontrollers	3	3+0+0	30	70	100
		PEPBLT3	Microprocessors and Microcontrollers Lab	2	0+0+2	30	70	100
	Discipline Specific Elective 1	PEPBTD1	Advanced Communication System-1	3	3+0+0	30	70	100
		PEPBLD1	Analog and Digital Communication System Lab	2	0+0+2	30	70	100
	Other if any*							
			<b>TOTAL</b>	<b>20</b>				<b>900</b>

**Open Elective: Applications of Nanotechnology in Electronics**

**Course Code: OPNPET1**

**Credits = 3 (3+0+0)**

**Course Objectives**

- ☐ Foundation knowledge of the nanoscience field
- ☐ To bring out the distinct properties such as electronic, optical properties of nanostructures
- ☐ To make the students acquire an understanding the nanomaterials and their applications

**Learning Outcomes**

Upon successful completion of this course, students will be able to address following points:

- ☐ Learn about the distinct properties of nanomaterials
- ☐ Understand the principles of nanomaterial characterization techniques
- ☐ Describe the principle and operation of nanomaterial-based devices

**Unit – I:** Definition of Nano-science and nano technology, History of nanoscience, Energy band-gap in semiconductors, Fermi level, Donors, acceptors and deep traps, Excitons, Mobility, Conduction electrons, density of states, Zero dimensional (0D), one dimensional (1D) , two dimensional (2D) , three dimensional (3D), Nano-structured materials, Influence of nano over micro/macro.

**Unit – II:** Properties of Nanomaterials: Size dependence of properties, Optical: Absorption, transmission, Photoluminescence, Fluorescence, Phosphorescence, Surface Plasmon Resonance, effect of size of nano particles. Electrical: Conduction mechanisms in 3D (Bulk), 2D (Thin film) and Low dimensional systems.

**Unit – III:** Type of Nanomaterials: different type of nano materials, Carbon nanotube, Fullerene, Type of CNT: SWNT (Single wall nano tube), Multi wall nano tubes, Graphite and Graphene, metal nano particle silver and gold, ZnO and TiO<sub>2</sub> metal oxides, Semiconductors, Nano-composites, Creating nanoparticles by using software.

**Unit – IV:** Synthesis of nanomaterials: Combustion method, Sol-gel method, Co-precipitation method. Characterization tools for nanomaterials: X-Ray Diffraction, UV-VIS Spectrophotometer, Spectrofluorophotometer, Scanning Electron Microscopy, Transmission Electron Microscopy.

**Reference Books:**

1. Introduction to Nanotechnology, Charles P. Poole, Jr., Frank J. Owens, Wiley India (P)Limited New Delhi.
2. Nanoscience and Nanotechnology, K.K. Chattopadhyay, A.N. Banerjee, PHI Learning Private Limited, New Delhi.
3. Understanding of Nano Science and Technology, PoorviDutta, Sushmita Gupta, Global Vision Publishing House, New Delhi.

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**Department : *Pure and Applied Physics***

**Programme Name : *B.Sc. Physics***

***Academic Year : 2023-24***

**Courses which focuses on Professional Ethics, Gender, Human Values, Environment & Sustainability and other value framework:**

Sr. No.	Course Code	Name of the Course
01.	OPNPPT1	Nanomaterials and its Applications



## Scheme and Syllabus

Sem	Course Opted	Course Code	Name of the course	Credit	L:T:P	Internal	External	Total
I	Core-1	PPPATT1	Classical Mechanics	5	4+1+0	30	70	100
	Core -2	PPPATT2	Quantum Mechanics	4	3+1+0	30	70	100
		PPPALT2	Quantum Mechanics Lab	1	0+0+1	30	70	100
	Core -3	PPPATT3	Electronic and Experimental Methods	3	3+0+0	30	70	100
		PPPALT3	Electronic and Experimental Methods Lab	2	0+0+2	30	70	100
	Open Elective		Opted from the pool and offered by other departments	5		30	70	100
	Other if any							
			TOTAL	20				500
		Open Elective offered by department						
	Open Elective	OPNPPT1	Nanomaterials and its Applications	3	3+0+0	30	70	100
OPNPPL1		Nanomaterials and its Applications Lab	2	0+0+2	30	70	100	
Open Elective	OPNPPT2	Advanced characterization and computational techniques in Physics	3	3+0+0	30	70	100	
	OPNPPL2	Advanced Characterization and Computational Techniques in Physics Lab	2	0+0+2	30	70	100	
II	Core-4	PPPBTT1	Concepts of Mathematical Physics	5	4+1+0	30	70	100
	Core -5	PPPBTT2	Advanced Quantum Mechanics	4	3+1+0	30	70	100
		PPPBLT2	Advanced Quantum Mechanics Lab	1	0+0+1	30	70	100
	Core -6	PPPBTT3	Statistical Mechanics	5	4+1+0	30	70	100
	Discipline Specific elective 1	PPPBTD1	Computational Physics and Programming	3	3+0+0	30	70	100
		PPPBLD1	Computational Physics and Programming Lab	2	0+0+2	30	70	100
	Other if any							
			TOTAL	20				1000



**Open Elective: Nanomaterials and Its Applications**

**Course Code: OPNPPT1**

**Credits = 3(3+0+0)**

**Course Objectives:**

The objective of the subject is that the student acquires knowledge

- ☐ To foundational knowledge of the Nanomaterials and related fields.
- ☐ To understand the influence of dimensionality of the object at nanoscale on their properties
- ☐ To make the students acquire an understanding the basic Nanoscience/Nanotechnology and their Applications .
- ☐ Students gain knowledge about the principles of various synthesis techniques.

**Learning Outcomes:**

After completing this course students will be able to:

- ☐ Learn about the background on Nanoscience
- ☐ Understand the various synthesis methods of Nanomaterials and their application and the impact of Nanomaterials on environment
- ☐ Apply their learned knowledge to develop new Nanomaterial's.

**Unit – I:** History of nano- materials, Ancient Indian Culture and Nanotechnology, Role of Feynman in development of Present Nano-sciences, what are Nanoscience and Nanotechnology? Atomic structure and atom size and their effects, Types of 1D, 2D, 3D Nano-structured materials, Influence of nano over micro/macro.

**Unit – II:** Properties of Nano materials: Physical, Magnetic, Optical, Thermal, Mechanical, Electrical for nano materials and Chemical Properties, Size effects, Surface Effects and Surface to Volume ratio.

**Unit – III :** Type of Nanomaterials: different type of nano materials, Carbon nanotube, Fullerene, Type of CNT: SWNT (Single wall nano tube), Multi wall nano tubes. 2D nano material, Graphite and Graphene, metal nano particle silver and gold, ZnO and TiO<sub>2</sub> metal oxides, Semiconductors, Nanocomposites, Creating nanoparticles by using software.

**Unit – IV:** Synthesis of nano materials: Top- down or bottom up approach, Physical Methods, PLD, Sputtering, Thermal evaporation, Chemical Methods – CVD, Sol-gel, Hydrothermal, Biological Methods – Green Synthesis, mechanical milling, sputtering and microwave plasma, chemical reduction and oxidation, hydrothermal, micelles, sol-gel processes, photolysis, and metal organic chemical vapor deposition

**Reference Books:**

1. Introduction to Nano Science and Nano Technology – K.K. Chattopadhyay & AN Banerjee PHI Pvt. Ltd., 2009.
2. Nano technology: Principles and practices - Sulabha K. Kulkarni, Capital Publisher Co. ,2015.
3. Introduction to nano technology: Charles P. Poole, Jr. Frank J. Owen, Wiley, Interscience Pub., May, 2003.

4. Nanostructures & Nanomaterials Synthesis Properties & Applications. Guozhong Cao, Imperial College Press, 2003.



गुरु घासीदास विश्वविद्यालय  
(केन्द्रीय विश्वविद्यालय अधिनियम 2009 क्र. 25 के अंतर्गत स्थापित केन्द्रीय विश्वविद्यालय)  
कोनी, बिलासपुर - 495009 (छ.ग.)



Guru Ghasidas Vishwavidyalaya  
(A Central University Established by the Central Universities Act 2009 No. 25 of 2009)  
Koni, Bilaspur - 495009 (C.G.)

**List of Courses which focuses on Professional Ethics, Gender, Human Values, Environment & Sustainability and other value framework**

**Department : *Pure and Applied Physics***

**Programme Name : *Pre-PhD. Physics/Electronics***

***Academic Year : 2022-23***

**Courses which focuses on Professional Ethics, Gender, Human Values, Environment & Sustainability and other value framework:**

Sr. No.	Course Code	Name of the Course
01.	Paper-I	Research Methodology & Computer applications



### **Scheme and Syllabus**

level	Course name	Credit	Remarks
School level	<b>Research Methodology &amp; Computer Applications</b>	04	Common to all
Department level	Experimental, Theoretical techniques & Instrumentation in Physics Research	04	Common to Physics Candidates
Paper –III (Optional) Any one of the followings	III A: Advanced Materials III D: Advance Nuclear Physics III E: Advanced Astronomy and Astrophysics	04	Any course



## Paper I Research Methodology & Computer applications

Mode of study includes: Assigning the topic to students based on their basic background and presentation in the form of seminar which will be followed by discussion and submission of the write-up. This will be evaluated by group of teachers.

### Unit 1: Research methodology

Definition of Research, Components of Research Problem, Various Steps in Scientific Research : Hypotheses, Research Purposes, Research Design, Literature searching Literature Survey, defining the question and formulating hypothesis/ hypothesizes, Collection of research data, tabulating and cataloging. Sampling and methods of data analysis.

### Unit 2: Errors in measurements and statistical methods:

Types of errors; mean deviation, standard deviation and probable errors; propagation of errors with summation, difference, product and quotient Probability Theories - Conditional Probability, Poisson Distribution, Binomial Distribution and Properties of Normal Distributions, Estimates of Means and Proportions; Chi-Square Test, Association of Attributes - t-Test - Standard deviation - Co-efficient of variations. Correlation and Regression Analysis, plotting of graphs.

### Unit3: Laboratory practices and safety guidelines:

Safe working procedure and protective environment, Laboratory safety measures, Handling radiation, Chemical hazards and their types, Safe chemical use, Proper storage and disposal of hazardous materials, Bio-hazardous and other toxic experimental materials, Maintenance of equipments.

### Unit 4: Computer applications in scientific writing skills

Applications of Microsoft Excel, power point and origin for data processing and data analysis, research paper – presentation using power point (which include texts, graphs, pictures, tables, references etc.) (oral in power point/poster);

Curve fitting, Method of least square fit, least square fit (straight line) to linear equations and equation reducible to linear equations. Non-linear curve fitting, back ground correction and mathematical manipulation in data using origin.

Structure and Components of Research Report, Types of Report: research papers, thesis, Research Project Reports, Pictures and Graphs, citation styles, writing manuscript in Latex,

Steps to better writing,

### Unit 5: Ethics in Science:

The source of ethical issues in science: examples from different disciplines. Ethical issues in science research and reporting: objectivity and integrity, the problem of plagiarism and related issues, international norms and standards. Scientific temper and virtues, expectations from scientific community.



IPR and Patent regime: Recording and storage/retention of recorded materials. Management and use responsibilities in proper utilization of the facilities. Socio-legal issues, originality

### **References:**

1. “How to write and Publish” by Robert A. Day and Barbara Gastel, (Cambridge University Press).
2. “Survival skills for Scientists” by Federico Rosei and Tudor Johnson, (Imperial College Press).
3. “How to Research” by Loraine Blaxter, Christina Hughes and Malcolm Tight, (Viva Books).
4. “Probability and Statistics for Engineers and Scientists” by Sheldon Ross, (Elsevier Academic Press).
5. “The Craft of Scientific Writing” by Michael Alley, (Springer).
6. “A Students's Guide to Methodology” by Peter Clough and Cathy Nutbrown, (Sage Publications).