UG Physics (SEC Course Structure, Tripura University
(As per NEP-2020 guideline)

Interdisciplinary courses

Offered by Physics

Course Code	**Paper Title**	**Credits**
Interdisciplinary course-I	Basic Measurements in Physics	3 (TH)
Interdisciplinary course: II	Physics of Renewable Energy Systems	3 (TH)
Interdisciplinary course: III	Nano Science and Thin Film	3 (TH)

Interdisciplinary course: I Offered by Physics

Basic Measurement in Physics

Credit=3 Full Marks = 100

(Distribution of marks: 60 (for final examination) + 40 (Internal Evaluation)

No. of Lectures required (NLP) = 45 hours

Unit-1 (NLP: 15 hours)

Basics of Measurement: Instruments accuracy, precision, sensitivity, resolution, range

Errors in measurements– Estimation of errors- Proportional error, systematic error, standard deviation from given set of sample data.

Mechanical devices: slide calliper, screw gauge's, spherometer. Calculation of least count/vernier constant and use of instruments for measuring lengths, diameter, height.

Unit-2 (NLP: 15 hours)

Electrical Components: Idea about Resistor, colour coding of resistor, capacitor, inductor, and their field of applications, series and parallel combination of resistor, capacitor, Ohm law, Resistor as a heating element in heaters and as a fuse element, inductor in choke coil, capacitor in motors

Electrical Power sources: Characteristics of AC and DC signals, Constant Voltage source and Constant Current Source-Applications of Current sources & Voltage sources, different kind of AC & DC power sources. Battery eliminator, Different types of batteries, Rechargeable batteries – Lead acid batteries, Li-ion batteries, Series & Parallel & combination of batteries.

Unit-3 (NLP: 15 hours)

Electrical measurements: voltmeter, ammeter, pointer galvanometer, suspended coil galvanometer and their uses.

Multimeter- Introduction to different kinds of multimeter and their uses.
Transformer: Basic idea of Transformer, step-up and step-down transformer, uses.
Optics: Electromagnetic Spectrum-Concept of wavelength, frequency and energy, UV, visible and IR spectra, Basic idea about optical microscope –(simple and compound type) and telescope, LASER- Laser properties and their applications, Basic concepts of Optical Fiber and its applications, Display– basic idea about type of display like LED, OLED, LCD etc.

Suggested Books

1. Electrical and Electronics Measurements and Instrumentation – Purkait (Mcgraw Hill)
3. Basic Electrical Engineering – V. K. Mehta (S. Chand)
3. Modern Optics – A B Gupta (Books & Allied)
4. Electronic measurements and instrumentation - R Sedha (S Chand)
5. Fundamentals of Electric Circuits – Alexander, Sadiku (McGraw Hill)

Interdisciplinary course: II Offered by Physics
Physics of Renewable Energy Systems

Credit=3 Full Marks = 100

(Distribution of marks: 60 (for final examination) + 40 (Internal Evaluation)

No. of Lectures required (NLP) = 45 hours

Unit-I: Hydro, Tidal and Geothermal System **(NLP: 15 hours)**

i) Renewable and non-renewable energy sources, Classification of renewable energy sources,

ii) Introduction to Wind Energy, Continuity Equation and its applications, Betz Criteria for extracting wind power, Wind turbines and their operation, Materials Aspects and future direction

iii) Introduction to Hydroelectric Power, Hydroelectric Power Station and Turbines, Wave power and converters

v) Introduction to Tidal Power and Geothermal Energy

Unit-II: Solar Power **(NLP: 15 hours)**

Solar energy: Solar Energy-Key features, its importance, Merits & demerits of solar energy, Applications of solar energy. Solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell -brief discussion of each. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.

Basic idea of Dye sensitized solar cell, Basicidea of perovskite solar cell

Unit-III: Energy storage **(NLP: 15 hours)**

i) Introduction to Energy Storage Systems, Types of energy storage,

ii) Chemical energy storage: Biological energy storage, Hydrogen energy storage

iii) Thermal energy storage,

iv) Mechanical energy storage: Pumped hydroelectric energy storage, Compressed air energy storage, Flywheel energy storage

v) Electrical energy storage: From battery to super capacitors, Capacitors and super-capacitors, Construction, development and classification of Super capacitors, Superconducting magnetic storage, Electric double layer capacitors (EDLCs), Pseudo capacitors, Rechargeable batteries,

vi) Fuel cells: Principles, classifications and operations

vii) Distribution of electrical power

Text and Reference Books

1. Physics of Energy Sources, GEORGE C. KING, School of Physics and Astronomy Manchester
2. Physics and Technology of Sustainable Energy; E L Wolf
3. Advanced renewable Energy Systems, S C Bhatia
4. Renewable Energy: Power for a Sustainable Future, Godfrey Boyle
5. Electrochemical Supercapacitors, B. E. Conway
6. Renewable Energy Resources, John Twidell and Tony Weir
7. Sustainable Energy – without the hot air, David J. C. MacKay
8. Solar Photovoltaics: Fundamentals, Technologies and Applications, Chetan Singh Solanki
9. Handbook of Materials Characterization, Surender Kumar Sharma

Interdisciplinary course: III Offered by Physics
Nano Science and Thin Film
Credit=3 Full Marks = 100

(Distribution of marks: 60 (for final examination) + 40 (Internal Evaluation)

No. of Lectures required (NLP) = 45 hours

UNIT: I (NLP: 15 hours)

Definition of Nano dimension, Nano particles and Nano materials, importance of Nano particles, Idea about Nano scale, example of naturally occurring Nano materials, Interest in Nano materials: i)Large surface to volume ratio or high aspect ratio, ii) Quantum confinement effect and restriction of electron delocalization effect, application of high aspect ratio, Optical effect.

(NLP-8 hours)

One dimensional, Two dimensional and Three dimensional nanostructured materials, Quantum Dots. Metal oxide Nano particles, semiconductor Nano particles, composites Nano particles, mechanical-physical-chemical properties. (NLP-7 hours)

UNIT: II (NLP: 15 hours)

Graphene, Fullerene, Carbon Nano tube, their characteristics and applications (NLP-9 hours)
Application of Nano particles: In electronics and opto electronics devices, in coating and paint technology, biological and environmental technology and drug delivery system, polymer based application. (NLP-6 hours)

UNIT: III (NLP: 15 hours)

What is Thin Film and why it is important, Two dimension Nano structure. Different Thin Film preparation techniques, Brief discussion on Langmuir Blodgett technique, layer-by-layer self assembled technique, Spin coating technique, vacuum deposition technique. Different characterization techniques (NLP-8 hours)

Brief discussions on the application of Thin Film in different technological fields- in preparation of Light emitting diodes, in MOSFET, in Transistor and diodes, in various sensors, in gas sensor, in biological sensors and others. (NLP-7 hours)

Text and Reference Books

i) Nanoscience and Nanotechnology: Fundamentals of Frontiers by Shubra Singh, M.S. Ramachandra Rao

ii) Introduction to Nanoscience and Nanotechnology by Chattopadhyay K.K