

**SARDAR PATEL UNIVERSITY
VALLABH VIDYANAGAR**



**DEPARTMENT OF PHYSICS
Programme M.Phil**

(Under the Choice based Credit Scheme)
Effective from: June-2017-18

Semester II

Course No.	Title	Theory/ Practical	Credit
MS02CPHY21	Research Methodology and Data Analysis in Physics - II	Theory	2
MS02CPHY22	Advanced Devices and High Pressure Physics	Theory	3
MS02CPHY23	Introductory Biophysics and Medical Physics	Theory	3

MS02CPHY21 (2 Credit)

Research Methodology and Data Analysis in Physics - II

Unit-I

Defining the Research Problem: Selection of a research Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem : An Illustration.

Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs

Unit-II

Measurement in Research: Measurement Scales, Sources of Error in Measurement, Tests of Sound Measurement, Technique of Developing Measurement Tools.

Scaling :Meaning of Scaling, Scale Classification Bases, Important Scaling Techniques, Scale Construction Techniques.

Methods of Data Collection :Collection of Primary Data, Observation Method, Collection of Data through Schedules, Some Other Methods of Data Collection

Unit-III

Processing and Analysis of Data :Processing Operations, Some Problems in Processing. Elements/Types of Analysis: Statistics in Research, Measures of Central Tendency, Measures of Dispersion, Measures of Asymmetry (Skewness), Measures of Relationship, Simple Regression Analysis, Multiple Correlation and Regression, Partial Correlation, Association in Case of Attributes.

Unit-IV

Testing of Hypotheses-I (Parametric or Standard Tests of Hypotheses): Basic Concepts Concerning Hypothesis and Testing of Hypotheses ,Procedure for Hypothesis Testing , Flow Diagram for Hypothesis Testing, Measuring the Power of a Hypothesis Test, Tests of Hypotheses

Important Parametric Tests, Hypothesis Testing of Means, Hypothesis Testing for Differences between Means, Hypothesis Testing for Comparing Two Related Samples.

Hypothesis Testing of Correlation Coefficients, Limitations of the Tests of Hypotheses.

Interpretation and Report Writing :Technique of Interpretation,Precaution in Interpretation.

Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report

Types of Reports ,Mechanics of Writing a Research Report , Precautions for Writing Research Reports

Book: C R Kothari, Research Methodology-Methods and Techniques, New Age International (P) Ltd., Publishers (2004)

MS02CPHY22 (03 Credit)
Advanced Devices and High Pressure Physics

UNIT I

Photovoltaic Devices-I: Principle of solar cells, Classification of Solar Cells, p-n junction solar cells, Dark and Illuminated characteristics, solar cell output parameters- efficiency, fill factor, series resistance, shunt resistance, absorption coefficient, efficiency limits, efficiency losses, efficiency measurement, Dependence of Solar Cell Parameters on Incident Intensity, Material selection for solar cells

Photovoltaic Devices II; Hetero-junction solar cells, MIS solar cells, Metal-semiconductor heterojunction- Schottky Junction Solar Cells, Liquid junction solar cells(PEC), Corrosion aspects in PEC, Comparison of p-n junction and PEC solar cells, Dye Sensitized Solar Cells(DSSC)- Principle of operation, Materials for DSSC, Photovoltaic Characteristics of DSSC, Advantages and limitations of DSSC.

UNIT II

Nano MEMS- Circuits, Systems and Applications: Introduction to MEMS, Nano MEMS Systems on Chip(SoC), SoC Architecture, Soc Building Blocks, Charge Detector, Which-Path Electron Interferometer, Parametric Amplification in Torsional MEM Resonator, Casimir Effect Oscillator, Nano-mechanical Laser.

Nano MEMS Photonic Applications: Introduction, Surface Plasmons (SP), SP Propagation in Narrow Metal Strips, SP Propagation in Nano-wires, SP Resonances in Single Metallic Nanoparticles, SP coupling of Metallic Nano-particles, Plasmonic Waveguides, Nano-photonic SP based Devices, Semi-conducting Nano-wire Based Nano-photonics,

UNIT III

Production and measurement of high pressure: Introduction, properties of materials for high pressure systems, The transmission of pressure, basic considerations in pressure measurement, Practical methods of pressure generation: Gravitational methods, Thermodynamic methods, shock – wave methods, Piston methods- Single and multi stage, Pressure measurements and pressure scale: Primary pressure measurement, secondary measuring instruments-Phase change methods, Bourdon gauges, resistance gauges, pressure calibration points. Bridgman Anvil Cell and Diamond Anvil Cell

UNIT-IV

Theory of High and Ultra-High Pressure: Equation of state of solids at moderately high pressures: Isothermal theories: Theory of finite strain, equation of state derived from inter-atomic forces,

Elevated temperature: The Gruneisen relations, The Debye theory for the equation of state, The Simon equation of melting, Gruneisen's ratio and the elastic parameters.

Equation of state of matter at ultra – high pressures: Thomas-Fermi model at absolute zero of temperature, temperature perturbation of the T-F model, the TFD model, the Wigner-Seitz model.

Books

1. Solar cells- By Chenming Hu and Richard M. White, MGH Company.
2. Photoelectrochemical solar cells-Suresh Chandra, Gerdon and Breach Publications, New York.
3. Principles and Applications of Nano MEMS Physics
H. J. De Los Santos, Springer Publications Netherlands
4. High pressure Physics and Chemistry Volume-1
Editor: R.S.Bradley
Academic Press- London and New York-1963

MS02CPHY23 (03 Credit)
Introductory Biophysics and Medical Physics

Unit:I

Macromolecular structure: Introduction, Nucleic acid structure: DNA & RNA. Protein structure: Primary structure, Secondary structure, Tertiary structure, Quaternary structure and Virus structure, Structure of fibrous and globular protein structure: α - helix, β - strand and β sheet, collagen helix. Genetic code and Protein folding.

Unit:II

Biophysics Laws and processes; Osmosis, Diffusion, viscosity and surface tension, Dynamics of blood flow

Biophysical phenomena in biochemical studies' pH meter, Importance of Buffers in Biological systems, Centrifuges, Chromatography; Principle of Chromatography, Thin layer Chromatography (TLC), Column Chromatography, High Performance Liquid Chromatography. Electrophoresis: Gel Electrophoresis, SDS- polyacrylamide Electrophoresis.

Unit:III

Principles of optics and spectroscopy in biological system: Light microscopy, Spectroscopy: Ultraviolet and Visible Spectroscopy, Optical Rotatory Dispersion (ORD) and Circular Dichroism

Bioenergetics: Energy pathway in biology, Thermodynamic principles, Concept of free energy, entropy, Chemical potential, Photosynthesis - I & II, Energy conversion pathway: Oxidation, Glycolynin, The kerbs cycle, The respiratory chain.

Unit:IV

Bioelectricity and Nerve impulse Conduction: Membrane Potential, Resting Membrane Potential, Action Potential and Nerve Impulse Conduction, Rate of Nerve Impulse Conduction. Sensory mechanisms- The eye: The visual receptor, Electrical activity and visual generator potentials, Optical defects in eye, neural aspects of vision, Visual communications, bioluminescence.

Books:

1. Biophysics by Vasantha Pattabhi, N. Gautham, Narosa Publishing House PVT. Ltd.
2. Biophysics Principles and Techniques, by M A Subramanian, MJP Publishers, Chennai
3. Biophysics, P.S. Mishra, VK Publication, New Delhi