

## MANONMANIAM SUNDARANAR UNIVERISTY, TIRUNELVELI-12 SYLLABUS UG - COURSES – AFFILIATED COLLEGES



Course Structure for B. Sc. Physics (Choice Based Credit System)

(with effect from the academic year 2021-2022 onwards )

Semester-VI								
Part	Subject Status	Subject Title	Subject Code	Credit				
III	Core	QUANTUM MECHANICS	CMPH61	4				
III	Core	DIGITAL ELECTRONICS	CMPH62	4				
III	Core	SOLID STATE PHYSICS	CMPH63	4				
III	Elective	ENERGY PHYSICS	CEPH61	4				
III	Practical	MAJOR PRACTICAL-VII	CMPHP7	3				
III	Practical	MAJOR PRACTICAL-VIII	CMPHP8	3				
III	Project	PROJECT	CMPH6P	4				



#### Total Marks: 100 Internal Exam: 25 marks + External Exam: 75 marks

#### A. Scheme for internal Assessment:

Maximum marks for written test: 20 marks3 internal tests, each of I hour duration shall be conducted every semester.To the average of the best two written examinations must be added the marks scored in. The assignment for 5 marks.

The break up for internal assessment shall be: Written test- 20 marks; Assignment -5 marks Total - 25 marks

#### **B.** Scheme of External Examination

**3 hrs.** examination at the end of the semester

- A Part : 1 mark question two from each unit
- B Part: 5 marks question one from each unit
- C Part: 8 marks question one from each unit

#### > Conversion of Marks into Grade Points and Letter Grades

S.No	Marks	Letter Grade	Grade point (GP)	Performance
1	90-100	0	10	Outstanding
2	80-89	A+	9	Excellent
3	70-79	А	8	Very Good
4	60-69	B+	7	Good
5	50-59	В	6	Above Average
6	40-49	С	5	Pass
7	0-39	RA	-	Reappear
8	0	AA	-	Absent

#### <u>Cumulative Grade Point Average (CGPA)</u>

$$\mathsf{CGPA} = \frac{\Sigma \left(\mathsf{GP} \times \mathsf{C}\right)}{\Sigma \mathsf{C}}$$

- **GP** = Grade point, **C** = Credit
- CGPA is calculated only for Part-III courses
- CGPA for a semester is awarded on cumulative basis

#### > Classification

a) F	irst Class with Distinction	:	$CGPA \ge 7.5*$
b) F	first Class	:	$CGPA \ge 6.0$
c) S	econd Class	:	$CGPA \ge 5.0 \text{ and } \le 6.0$

d) Third Class : CGPA< 5.0



# **QUANTUM MECHANICS**

#### **Preamble:**

• This course includes Quantum theory, Wave properties of matter, Heisenberg uncertainty principle, schrodinger's wave equation and applications of quantum mechanics

#### Unit –I: ORGIN OF QUANTUM THEORY

Black body radiation – Failure of classical Physics to explain energy distribution in the spectrum of a black body - Planck's Quantum theory–photo electric effect - Einstein's explanation for photo electric effect – The Ritz combination principle in spectra – Stability of an atom – Bohr's quantization of angular momentum and its application to the hydrogen atom.

### **Unit –II: WAVE PROPERTIES OF MATTER**

Wave particle duality - De Broglie Hypothesis for matter waves – Concept of group velocity - Phase and Group Velocity – velocity of De Broglie Waves – Diffraction of particles – Interference of electrons – Wave packet

#### **Unit-III: HEISENBERG UNCERTAINTY PRINCIPLE**

Uncertainty Principle - Elementary Proof of Heisenberg's Uncertainty Relation-Elementary Proof of the Heisenberg's Uncertainty Relation between energy and Time - Illustration of Heisenberg's uncertainty principle by Thought experiments -Consequences of the uncertainty relation

#### **Unit –IV: SCHRODINGER'S WAVE EQUATION**

Schrodinger's one dimensional time-dependent wave equation – One dimensional Time-independent Schrodinger's wave equation – Physical Interpretation of the Wave Function  $\psi$  – Operators in quantum Mechanics, Eigen Function, Eigen value and Eigen Value equation – Expectation values – Postulates of Quantum mechanics

#### **Unit –V: APPLICATIONS OF QUANTUM MECHANICS**

Particle in a one dimensional box – Particle in a rectangular three dimensional box – Simple harmonic oscillator – One dimensional simple harmonic oscillator in quantum mechanics – Reflection at a steep potential – Transmission across a potential barrier

#### **Book for Study**

- 1. Elements of Quantum Mechanics, Kamal Singh & S P Singh-Chand &Co
- 2. Mathews P.M. and Venkatesh K. Quantum Mechanics Tata McGraw Hill Publishing Ltd



### **Book for Reference**

- 1. Gipta, Kumar, Sharma Quantum Mechanics Jai Prakash Nath Company
- 2. Quantum Mechanics- G.Arul Das-PHI Private Learning Ltd.
- 3. Quantum Mechanics- V.Murugan Pearson publication
- 4. Quantum Mechanics- Mahesh C.Jain- PHI Private Learning Ltd

# **Digital Electronics**

## Preamble:

• This course includes number systems, binary arithmetic and codes, logic gates and Boolean algebra, Arithmetic circuits, Flip-flop and multi-vibrators and Shift Registers and Counters

## Unit I: Number systems, Binary arithmetic and Codes

Decimal, binary, Octal, decimal and hexadecimal number systems and their interconversions -Binary arithmetic - Binary addition - binary subtraction-1's and 2's complements -- BCD codes, ASCII code, Excess-3code, Gray code.

## Unit II: Boolean algebra and Logic gates

Boolean algebra-De Morgan's theorem –Positive logic and negative logic systems-Basic logic gates, OR, AND, NOT (symbol, Boolean equation, truth table, circuit diagram and working) -NAND, NOR, EX-OR (symbol, Boolean equation, truth table only) - NAND and NOR as universal building blocks.

## Unit III: Arithmatic circuits, Flip-flops and multi vibrators

Half and full adders – Half and full subtractors - RS Flip-flop-clocked RS Flip-flop, JK Flip-flop, JK master slave Flip-flop, D Flip-flop, T Flip-flop – 555 timer –Astable multivibrator, monostable multi vibrator -Frequency divider

## Unit IV: Karnaugh map and combinational circuit applications

Karnaugh map - 2, 3 and 4 variables –simplification - SOP and POS form of Boolean functions - -Don't care conditions-Multiplexer, Demultiplexer, Encoder, Decoder, parity generator and checker.

# Unit V: Shift Registers and Counters

Types of registers- Serial in –Serial out-Serial in-Parallel out- Parallel in- Serial out-Parallel in-Parallel out-Asynchronous counters and Synchronous counters- Ring counter- Binary counter- Up-Downcounter-Mod-5 counter-Mod-10 counter (decade counter) -A/D and D/A converters



#### **Book for study**

- 1. Digital principles and applications Albert Paul Malvino & Donald P. Leach
- Digital logic and computer design Morris Mano Prentice Hall of India, Pvt. Ltd

### **Book for reference**

- 1. Gothmann W.H., Digital Electronics Prentice Hall of India, Pvt. Ltd.
- 2. Metha V.K. Mehtha. R. Principles of electronics, S.Chand & Co.
- 3. Fundamentals of Digital Electronics and Microprocessors–Anokh Singh, A.K.Chhabra, S.Chand & Co

# **Solid State Physics**

## Preamble:

• Objective of this paper is to introduce crystals and nano particles and to provide an understanding about different types of materials. The paper needs a basic knowledge of elements of modern physics and the learners are expected to get some ideas on Materials Research.

## **UNIT-I: CRYSTAL LATTICES**

Introduction-seven classes of crystals - Bravais lattice in three dimensions -crystal structure -Simple cubic, Face centered cubic, Body centered cubic and Hexagonal close packed structure -Sodium Chloride, Zinc Blende and Diamond Structures. Miller Indices and crystal planes - procedure for finding Miller Indices -interplanar spacing - Diffraction of X-Rays - Bragg's Law

## **UNIT- II: BONDING IN SOLIDS**

Types of bonds in crystals-Ionic, covalent, Metallic, Vanderwaal's and Hydrogen Bonding-Bond energy of sodium chloride molecule-Comparison between ionic and covalent solids - variation of inter atomic force with inter atomic spacing-cohesive energy-cohesive energy of ionic solids-application to sodium chloride crystal evaluation of Madelung constant for sodium chloride.

## **UNIT - III: TYPES OF MAGNETIC MATERIALS**

Introduction -classical theory of Diamagnetism - Langevin's theory of Para magnetism - Weiss Theory of Para magnetism - Domain theory of ferromagnetism – Anti ferro magnetism-Fundamental Definitions of Dielectrics - Different types of Electric Polarization- electronic, ionic, orientation and space charge Polarization - Dielectric Loss - Internal Field - Clausius– Mossotti Relation



### **UNIT-IV: SUPER CONDUCTIVITY**

Introduction - General Properties of Superconductors - effect of magnetic field - Meissner effect - effect of current - thermal properties - entropy – specific heat-energy gap-isotope effect-London equations-AC&DC Joseph son effect - applications-Type–I and Type–II Super conductors-Explanation for the Occurrence of Super Conductivity-BCS theory- Application of Superconductors - High TC superconductors.

#### **UNIT-V: NANO TECHNOLOGY**

Nanomaterials-synthesis and classification—techniques used in synthesis of nanomaterials-chemical vapour deposition-sol-gel technique-electro deposition method-ball milling method- characterization - properties and applications of nanomaterials-fullerene, graphene and carbon nano tubes

#### **Books for Study**

- 1. Solid State Physics -P.K. Palanisamy –SCITECH Publications Pvt. Ltd. Chennai
- 2. Nano-essentials and understanding Pradeep.T.Mc-Graw-Hill Ltd.

#### **Books for reference**

- 1. Introduction to Solid State Physics Kittel-Wiley and Sons, New Delhi
- 2. Material Science and Engineering- V. Raghavan PHI
- 3. Introduction to Solids- Azaroff- TMH
- 4. Material Science-M. Arumugam Anuradha Publishers
- 5. Solid State Physics H.C.Gupta Vikas publishing house Pvt. Ltd.
- 6. Principles of Nanoscience and technology Shah M.A.Ahmed, Narosha Publishing House Pvt. Ltd.

# **ENERGY PHYSICS**

## Preamble:

• Objective of the course is to provide an understanding of the present energy crisis and various available energy sources. The paper does not need require any special prerequisite and the learners are expected to know the use of alternate energy sources

## **UNIT I: INTRODUCTION TO ENERGY SOURCES**

World's reserve of Commercial energy sources and their availability-Various forms of energy- renewable & non-renewable energy sources – Conventional & non-conventional energy sources– commercial & non-commercial energy sources, comparison –merits, demerits and applications of coal, oil and natural gas

#### UNIT II: SOLAR ENERGY

Solar energy – nature of solar radiation and its components -Basic Principles of Liquid



flat plate collector –Materials for flat plate collector -Construction and working- Solar water heater - Solar crop dryer – Solar space cooling – solar ponds - solar cookers (box type) - merits and demerits of solar energy

#### **UNIT III: PHOTOVOLTAIC SYSTEMS**

Introduction – Photovoltaic principle - Basic Silicon Solar cell- Power output and conversion efficiency-Limitation to photovoltaic efficiency-Basic photovoltaic system for power generation-Advantages and disadvantages-Types of solar cells-Application of solar photovoltaic systems - PV Powered fan – PV powered area lighting system– A Hybrid System.

#### **UNIT IV: BIOMASS ENERGY**

Introduction-Biomass classification- Biomass conversion technologies-Bio-gas generation-Factors affecting bio-digestion -Working of biogas plant- floating and fixed dome type plant -advantages and disadvantage of -Bio-gas from plant wastes-Methods for obtaining energy from biomass-Thermal gasification of biomass-Working of down draft gasifier- Advantages and disadvantages of biological conversion of solar energy.

#### **UNIT V: WIND ENERGY AND OTHER ENERGY SOURCES**

Wind Energy Conversion-Classification and description of wind machines, wind energy collectors-Energy storage-- Energy from Oceans and Chemical energy resources - Ocean thermal energy conversion-tidal power, advantages and limitations of tidal power generation-Energy and power from waves- wave energy conversion devices- Fuel cells- and application of fuel cells- batteries- advantages of battery for bulk energy storage- Hydrogen as alternative fuel for motor vehicles.

#### **Books for study**

- 1. Rai G. D, Non conventional Energy sources, 4th Edition, Khanna Publishers, 2010
- 2. Solar Energy- Principles of thermal collection and storage S.P.SUKHAME-Tata-McGraw-Hill Publishing Company Ltd.

#### **Books for References**

- 1. Chetan Singh Solanki, Solar Photvoltaics Fundamentals, Technologies and Applications, 2nd Edition, PHIL earning Private Limited, 2011.
- 2. Kothari D.P., K.C.Singal and Rakesh Ranjan, Renewable energy sources and emerging Technologies, Prentice Hall of India, 2008.
- 3. Jeffrey M. Gordon, Solar Energy: The State of the Art, Earthscan, 2013.
- 4. Kalogirou S.A., Solar Energy Engineering: Processes and Systems, 2nd

Edition, Academic Press, 2013.

5. Zobaa A.F. and Ramesh Bansal, Hand book of Renewable Energy Technology, World Scientific, 2011

# **MEDICAL PHYSICS**

#### **Preamble:**

• This course facilitates an understanding of the basic concepts in Biomedical instrumentation and awareness regarding radiation hazards and safety.

## **UNIT-I: X-RAYS**

Electromagnetic spectrum - production of x-rays - x-ray spectra –Brehms strahlung process - Characteristic x-ray - X-ray tubes - Coolidge tube - X-ray tube design - tube cooling - stationary mode - Rotating anode X-ray tubes -Tube rating - quality and intensity of X-ray. X-ray generator circuits - half wave and full wave rectification - filament circuit - kilo voltage circuit - high frequency generator- exposure timers- HT cables.

## UNIT-II: RADIATION SAFETY AND HEALTH PHYSICS

Introduction to Radio activity - Artificial and natural - radioactivity –Physical features of radiation-units of radiation- conventional sources of radiation, Interaction of different types of radiation with matter -penetration power in living cells-radiation damage to the cell-effect of radiation on cells-measurement of ionizing radiation-measurement of biological damage-Linear energy transfer (LET)-radiation risk-radiation dosimetry-security of radio-active material- radio-active waste management

## UNIT-III: BIOMEDICAL INSTRUMENTATION

Development of biomedical instrumentation-biometrics-introduction to the maninstrument system-components of man-instrument system-transducers for biomedical applications-biomedical computer applications-computer analysis of ECGcomputerized axial tomography (CAT) Scanners

# **UNIT-IV: MEDICAL IMAGING PHYSICS**

Radiological imaging - Radiography - Filters - grids - cassette - X-ray film –film processing – fluoroscopy - computed tomography scanner- principle function - display - generations –mammography - ultrasound imaging - magnetic resonance imaging thyroid uptake system - Gamma camera (Only Principle, function and display)



### **UNIT-V LASERSIN MEDICINE**

Introduction to laser-principle and production of laser- effects of laser radiation on tissues - photo thermal effects- photo chemical effects –photo dynamic therapy-Laser applications in therapy and diagnosis-opthalmology - Fibre optic endoscopy and dentistry-Laser as a beautician's tool-laser hazards-biological effects.

#### **Books for study and Reference**

- 1. Basic Radiological Physics Dr. K. Thayalan Jayapee Brothers Medical Publishing Pvt. Ltd. New Delhi (2003)
- 2. The essential physics of Medical Imaging: Bushberg, Seibert, Leidholdt and Boone Lippincot Williams and Wilkins, Second Edition (2002)
- 3. Biomedical instrumentation-Leslie Cromwell, Fred J. Weibel-Erich A. Pfeiffer-Pearson Publications
- 4. Lasersin Medicine- RW Wayanant, Plenum Publishing Co
- 5. Nuclear medicine physics: Chandra Lippincot Williams and Wilkins (1998)

# PROJECT

#### **GUIDE LINES:**

The objective of the course is to train the students to gain confidence to carry out independent work, group and get experience in handling of various equipments.

- It must be the Group Project
- Each group consists of maximum of five students
- Project must be related to the Physics subject
- Readymade projects not allowed
- Downloaded projects not allowed
- Both experimental and theoretical projects are allowed
- Field trip visit (maximum two days) related to project

# PRACTICAL-VII GENERAL PRACTICAL

(6 experiments compulsory)

- 1. Spectrometer Hartmann's interpolation formula
- 2. Spectrometer i1 i2 curve
- 3. Spectrometer -i d curve, critical angle of a prism
- 4. Self-inductance Rayleigh's Bridge
- 5. Spectrometer Dispersive Power of Grating oblique incidence
- 6. Impedance and power factor LR Circuit
- 7. Comparison of mutual inductance M1 / M2 Ballistic Galvanometer
- 8. Moment of Magnet Tan C position

## PRACTICAL – VIII ELECTRONICS

#### (6 Experiments compulsory)

- 1. Arithmetic and Logic Units (ALU)
  - a. Half Adder
  - b. Full Adder
- 2. Mono stable multi vibrator using 555 Timer
- 3. Combinational Logic To convert a Boolean Expressions (any two) into Logic Gate Circuit and assemble it using logic gate IC's
- 4. Universal building block NAND gate
- 5. Universal building block NOR gate
- 6. Verification of Boolean Algebra (any four)
- 7. Verification of De-Morgan's laws
- 8. Hartley Oscillator