

**SYLLABUS**

MANONMANIAM SUNDARANAR UNIVERISTY, TIRUNELVELI-12

**UG - COURSES – AFFILIATED COLLEGES**Course Structure for **B.Sc Physics**

(Choice Based Credit System)

(with effect from the academic year 2017- 2018 onwards )

Semester-VI				
Part	Subject Status	Subject Title	Subject Code	Credit
III	Core	DIGITAL ELECTRONICS	SMPH61	5
	Core	QUANTUM MECHANICS	SMPH62	5
	Core	NUCLEAR PHYSICS	SMPH63	4
	Core	SOLID STATE PHYSICS	SMPH64	4
	Elective	ENERGY PHYSICS	SEPH6B	4
IV	Practical	MAJOR PRACTICAL-VII	SMPHP7	4
III	Practical	MAJOR PRACTICAL-VIII	SMPHP8	4



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

**A. Scheme for internal Assessment:**

Maximum marks for written test: **20 marks**

**3 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	O	10	Outstanding
2	80-89	A+	9	Excellent
3	70-79	A	8	Very Good
4	60-69	B+	7	Good
5	50-59	B	6	Above Average
6	40-49	C	5	Pass
7	0-39	RA	-	Reappear
8	0	AA	-	Absent

➤ **Cumulative Grade Point Average (CGPA)**

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

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

➤ **Classification**

- First Class with Distinction : CGPA  $\geq$  7.5\*
- First Class : CGPA  $\geq$  6.0
- Second Class : CGPA  $\geq$  5.0 and  $<$  6.0
- Third Class : CGPA  $<$  5.0



## **DIGITAL ELECTRONICS**

**Preamble:** This course provides an understanding of Boolean algebra and digital circuits. The paper need a basic knowledge in solid state electronics and the learners are expected to gain knowledge to design electronic circuits

### **UNIT I: NUMBER SYSTEMS, BINARY ARITHMETIC AND CODES**

Decimal, binary, octal and hexadecimal number systems and their inter-conversions -binary arithmetic-binary addition-subtraction-1's and 2's complements-BCD codes, ASCII code, Excess-3code, Gray code. (7L+5T)

### **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. (8L+6T)

### **UNIT III: ARITHMETIC CIRCUITS, FLIP-FLOPS AND MULTIVIBRATORS**

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 multivibrator-Frequency divider(11L+7T)

### **UNIT IV: KARNAUGH MAP AND COMBINATIONAL CIRCUIT APPLICATIONS**

Karnaugh map - 2,3and 4 variables –simplification-SOP and POS form of Boolean functions - Don't care conditions-Multiplexer, Demultiplexer, Encoder, Decoder, parity generator and checker. (10L+6T)

### **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 and Synchronous counters- Ring counter-Binary counter- Up- Down counter- Mod-5 counter- Mod-10 counter (decade counter)-A/D and D/A converters(9L+6T)

#### **Books for study**

1.Digital principles and applications - Albert Paul Malvino & Donald P.Leach

#### **Books for reference**

- 1.Digital logic and computer design-Morris Mano-Prentice Hall of India,Pvt.Ltd.
- 2.Gothmann W.H.,Digital Electronics- Prentice Hall of India,Pvt.Ltd.
- 3.Metha V.K.Mehtha.R.Principles of electronics,S.Chand &Co.
- 4.Fundamentals of Digital Electronics and Microprocessors - Anokh singh, A.K.Chhabra, S.Chand &Co.



# QUANTUM MECHANICS

**Preamble:** Objective of this course is to introduce wave- particle duality of matter and the formation of Quantum mechanics. The paper need a basic knowledge in Mathematics and Modern physics and the learners are expected to know the application of basic equations in quantum mechanics to various states

## UNIT I: DEVELOPMENT OF QUANTUM MECHANICS

Inadequacy of classical mechanics-Black body radiation – Theoretical laws of Black body radiation (Wein's displacement law –Wein's Radiation formula – Rayleigh Jeans law) – Planck's Quantum hypothesis – photoelectric effect-Einstein's explanation for photoelectric effect-Compton effect – Einstein's quantum theory of specific heat-Quantum states of energy. (8L+5T)

## UNIT II : WAVE PROPERTIES OF MATTER

Wave particle duality-Phase and Group Velocity – Analytical expression for a Group of waves – Wave packets formed by Superposition of Number of Plane waves – De Broglie Hypothesis – Derivation of De Broglie relation – Phase velocity of De Broglie Waves – Relation between De Broglie wave and Phase velocity – Davison and Germer's experiment on electron diffraction-Diffraction of Atoms and Molecules (9L+6T)

## UNIT III : HEISENBERG UNCERTAINTY PRINCIPLE

Uncertainty Principle - Elementary Proof of Heisenberg's Uncertainty Relation and its Physical significance –Illustration by Thought experiments-consequences .(8L+5T)

## UNIT IV: SCHRODINGER'S WAVE EQUATION:

Basic postulates of Quantum mechanics –Schrodinger's equation – 1D and 3D wave equation into the Time-dependent and Time-independent part – Physical Interpretation of the Wave Function  $\psi$  – Operators in quantum Mechanics, Eigen Function, Eigen value and Eigen Value equation – Expectation values – Orthogonality of Energy Eigen function - Schrodinger's Wave equation for the Complex Conjugate Wave function  $\psi^*(x, y, z, t)$  – Probability current Density – Ehrenfest's Theorem – Momentum wave function for free particle – Momentum Eigen function – Exact statement and proof of Uncertainty principle for one dimensional wave packet (11L+8T)

## UNIT V: APPLICATIONS OF QUANTUM MECHANICS

Free particle – Potential step – Rectangular Potential barrier- Tunnel effect –



emission of  $\alpha$  particles from Radioactive element - Square well potential- free states- Particle in 1D box – Particle in 3D box – Simple harmonic oscillator – 1D simple harmonic oscillator in quantum mechanics – Particle in 1 D square well potential of finite Depth. (9L+6T)

### Books for Study

1. Elements of Quantum Mechanics, **Kamal Singh & S P Singh**-Chand &Co;

### Books for Reference

1. Mathews P.M. and Venkatesh k. Quantum Mechanics Tata McGraw Hill Publishing Ltd.
2. Gupta, Kumar, Sharma -Quantum Mechanics-JaiPrakash Nath Company
3. Quantum Mechanics-G.Arul Das-PHI Private Learning Ltd.
4. Quantum Mechanics-V.Murugan-Pearson publication
5. Quantum Mechanics-Mahesh C.Jain- PHI Private Learning Ltd

## NUCLEAR PHYSICS

**Preamble:** Objective of this course is to provide the basics of atomic nucleus and nuclear reactions. The paper needs a basic knowledge in modern physics and the learners are expected to know the impact of nuclear reactions to the environment.

### UNIT I: ATOMIC NUCLEUS

General properties of the nucleus- binding energy –mass defect -packing fraction— BE/A curve and its significance -proton electron hypothesis- proton neutron hypothesis -Nuclear forces –characteristics –Meson theory of nuclear forces – Nuclear models – Liquid drop model –Binding Energy formulae– Shell Model –magic numbers(12L)

### UNIT II RADIO ACTIVITY

Natural radio activity –alpha,beta and gamma rays-properties- radioactive series-laws of radioactive disintegration-half life period –mean life period –Radio carbon dating-law of successive disintegration– range of  $\alpha$  particle – Geiger Nuttal law-  $\alpha$  decay- theory- $\beta$ - decay –neutrino theory of  $\beta$  decay-neutrino and its properties-electron capture.  $\gamma$  decay- nuclear isomers- Mossbauer effect - applications-radio isotopes - uses. (14L)

### UNIT III: NUCLEAR REACTIONS

Kinematics of nuclear reaction-conservation of momentum - Q value of nuclear reaction-compound nucleus - nuclear energy level-Nuclear fission –energy released in fission-. Nuclear reactor-uses - Nuclear fusion –Thermo nuclear reactions-controlled



thermo nuclear reaction-Principle and action of atom bomb - hydrogen bomb-fusion reactor –plasma confinement (11L)

#### **UNIT IV: NUCLEAR DETECTORS AND PARTICLE ACCELERATORS**

Detectors-G.M.Counter-scintillation counter-bubble chamber-wilson cloud chamber-Accelerators-cyclotron-synchrocyclotron-betatron-synchrotrons (10L)

#### **UNIT V: COSMIC RAYS AND ELEMENTARY PARTICLES**

Cosmic rays-introduction-discovery-latitude, altitude and azimuth effects-longitudinal effect-north –south effect-seasonal and diurnal changes-primary and secondary cosmic rays-nature of cosmic rays- cosmic ray showers-Van Allen belt-origin of cosmic radiation. Elementary particles-introduction-particles and antiparticles-antimatter-the fundamental interaction-elementary particle quantum numbers-conservation laws and symmetry-the quark model (13L)

**Book for study** 1. Modern Physics- R.Murugesan, S. Chand & Co

#### **Reference Books**

1. Modern Physics- Seghal Chopra & Seghal, Sultan Chand 1998
2. Perspective of Modern Physics-Arther Beiser –Tata-Mc Graw Hill Publishing Company
3. Atomic and Nuclear Physics-Shatendra Sharma-Pearson Publications
4. Atomic Physics-Gupta and Kumar
5. Fundamental Physics-Halliday and Resnick

## **SOLID STATE PHYSICS**

**Preamble:** Objective of this paper is to introduce crystals and nanoparticles 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 - reciprocal lattices - reciprocal lattice to SCC, BCC and FCC lattices. (13L)

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

Introduction -classical theory of Diamagnetism - Langevin's theory of Paramagnetism - Weiss Theory of Paramagnetism - Ferromagnetism - Explanation of Heisenberg's internal field and quantum theory of ferromagnetism - Domain theory of ferromagnetism - Anti ferromagnetism - ferrites - Fundamental Definitions of



Dielectrics - Different types of Electric Polarizations- electronic, ionic, orientation and space charge Polarizations - Dielectric Loss - Internal Field - Clausius – Mosotti Relation(12L)

### UNIT-III: BONDING IN SOLIDS

Types of bonds in crystals - Ionic, covalent, Metallic, Vander waal'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. (11L)

### 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 Josephson effects - applications - Type-I and Type-II Superconductors - Explanation for the Occurrence of Super Conductivity - BCS theory - Application of Superconductors - High TC superconductors. (14L)

### UNIT-V: NANOTECHNOLOGY

Nanomaterials-synthesis and classification --techniques used in synthesis of nanomaterials-chemical vapour deposition-sol-gel technique-electro deposition method-ball milling method- charecterisation - properties and applications of nanomaterials- fullarence, graphine and carbon nanotubes (10L)

#### **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-India's production and reserves-Conventional and non-conventional sources of energy, comparison – Coal- Oil and natural gas –applications - merits and demerits (10L)

### **UNIT II : SOLAR THERMAL ENERGY**

Solar constant -Solar spectrum-Solar radiations outside earth's atmosphere –at the earth surface- on tilted surfaces -Solar Radiation geometry-Basic Principles of Liquid flat plate collector –Materials for flat plate collector -Construction and working- Solar distillation–Solar disinfection - Solar drying-Solar cooker(box type)- Solar water heating systems – Swimming pool heating. (12L)

### **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. (13L)

### **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 downdraft gasifier- Advantages and disadvantages of biological conversion of solar energy. (11L)

### **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. (14L)

#### **Books for study**

1. Kothari D.P., K.C. Singal and Rakesh Ranjan, Renewable energy sources and emerging Technologies, Prentice Hall of India, 2008.
- 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 Photovoltaics Fundamentals, Technologies and Applications, 2ndEdition, PHI Learning Private Limited, 2011.



2. Rai G. D, Non conventional Energy sources, 4th Edition, Khanna Publishers, 2010.
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. Zobia A.F.and Ramesh Bansal, Handbook of Renewable Energy Technology, World Scientific, 2011.

### **PRACTICAL- VII**

1. Spectrometre-Hartmann's interpolation formula
2. Spectrometre- i 1-i 2 curve
3. Mirror Galvanometer -Thermo EMF
4. Anderson's bridge-self inductance
5. Hyperbolic fringes
6. Arithmetic and Logic Units (ALU)
  - i. Half Adder
  - ii. Full Adder
  - iii. 4-bit Binary Adder.
7. Astable and Monostable multivibrator using 555 Timer
8. Combinational Logic
  - a) To design a combinational logic system for a specified Truth Table.
  - b) To convert a Boolean Expression into Logic Gate Circuit and assemble it using logic gate IC's
9. Analog/Digital Conversion
  - a) To design an analog to digital converter of given specifications.
  - b) To design a digital to analog converter of given specification
10. To build Flip-Flop Circuits using elementary gates (RS, Clocked RS, D-type, and JK Flip-Flop).

### **PRACTICAL – VIII**

## **COMPUTER PROGRAMMING WITH C++**

1. a. Arithmetic operations--use do while loop b. To test the validity of any entered character whether it belongs to the alphabetical set or a number or a special character.
2. To find the sum of series using for loop.
  - a.  $\text{Sum} = 1+3+5+\dots+n.$
  - b.  $\text{Sum} = x - + - + \dots$
  - c.  $\text{Sum} = 12+ + +\dots+$



3. To find the factorial of a number by using function declaration with/without using the return statement.
4. To read a set of numbers from a standard input device and to find out the largest number in the given array using function declaration. Also sort them in the ascending or the descending order.
5. To read the elements of the given two matrices of order  $m \times n$  and to perform the matrix addition and display the transpose of the result.
- 6.a. To display the name of the day in a week depending upon the number entered through key board using Switch-Case statement b) To read the data variables (such as Day, Month and Year) of the class by the member function and display the contents of class objects on the screen in the format DD/MM/YYYY.
7. To generate a series of Fibonacci numbers using constructor
8. To read the following information from the keyboard in which basic class consists of Name, Roll No. and Sex. The derived class contains the data members Height and weight. Display the contents of the class. Use inheritance concept.
9. a. An OOP to find the period of a pendulum of given length  $L$ , in a gravitational field. Accept the required values using the keyboard. Also display the results. b. Develop a program in C++ to calculate the Young's modulus of a material from the data obtained from uniform bending method.
10. Solve Quadratic equation.
11. Matrix multiplication
12. Define a class to represent a bank account details

#### Data members

1. Name of the depositor
2. Account name
3. Type of account
4. Balance amount in the account

#### Member function



1. To assign initial values
3. To withdraw an amount
4. To display name and balance

