



# SRI VIDYA MANDIR ARTS & SCIENCE COLLEGE

(Autonomous)

[An Autonomous College Affiliated to Periyar University, Salem, Tamil Nadu]

[Accredited by NAAC with 'A' Grade with CGPA of 3.27]

[Recognized 2(f) & 12(B) Status under UGC Act of 1956]

Katteri – 636 902, Uthangarai (Tk), Krishnagiri (Dt)

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## DEGREE OF MASTER OF SCIENCE IN PHYSICS CHOICE BASED CREDIT SYSTEM (CBCS)

### REGULATIONS AND SYLLABUS FOR

### M.Sc. PHYSICS PROGRAMME

### (SEMESTER PATTERN)

(For Students Admitted in the College from the  
Academic Year 2020-2021 Onwards)

### REGULATIONS AND SYLLABUS FOR M.Sc. PHYSICS PROGRAMME



### Programme Outcomes (POs)

|            |   |
|------------|---|
| <b>PO1</b> | A graduate with Master degree has in depth and detailed functional knowledge of the fundamental theoretical concepts and experimental methods in respective discipline.   |
| <b>PO2</b> | Engage in self direct continuous learning, aimed at global competency, which will promote professional and personal growth  |
| <b>PO3</b> | Students will show that they have learnt laboratory skills, enabling them to take measurements in laboratories and analyze the measurements to draw valid conclusions.  |
| <b>PO4</b> | Combining various academic disciplines and professional specializations to cross borders and redefine problems in order to explore solutions based on the new understanding of complex situation.   |
| <b>PO5</b> | Acquiring knowledge at a higher level that would help to develop the necessary skills and recognize the need for the preparation and ability to engage in independent life long learning in the broadest context of technological change. |

### Programme Specific Outcomes (PSOs)

|             |  |
|-------------|--|
| <b>PSO1</b> | Apply the fundamental knowledge of Physics to appreciate, develop and test physical concepts, for applications in materials, analytical tools in medicine, engineering, technological devices, digitalized space communication etc., |
| <b>PSO2</b> | Identify and access the diverse applications of Physics through the utilization of mathematical concepts to solve complex issues of environmental and safety requirements, enriching towards career advancement.                     |
| <b>PSO3</b> | Formulate the expertise in various domains of Physics acquired through the knowledge of experimental principles to demonstrate, innovate, design and develop the skills towards the futuristic needs of the industry/society.        |
| <b>PSO4</b> | Compile research based knowledge and methods including design of experiments, analysis, interpretation and evaluation of information, to provide valid critique to the society.  |
| <b>PSO5</b> | Communicate explicitly and exchange ideas with regard to theoretical and experimental aspects, the impacts of Physics on environment and society.  |
| <b>PSO6</b> | Apply reasoning, informed by the contextual knowledge to access societal, health, safety, legal, ethical and cultural issues and consequent responsibilities relevant to Physics.  |



## SRI VIDYA MANDIR ARTS & SCIENCE COLLEGE

(Autonomous)

Master of Science (M.Sc.) in Physics

Programme Pattern and Syllabus (CBCS)

(For Students Admitted in the College from the Academic Year 2020-2021 Onwards)

| Sl. No.             | Nature of the Course | Course Code | Name of the Course   | Hours/Week | Credits  | Marks      |            |            |
|---------------------|----------------------|-------------|--|------------|--|------------|------------|------------|
|                     |                      |             |  |            |  | CIA        | ESE        | Total      |
| <b>SEMESTER I</b>   |                      |             |  |            |  |            |            |            |
| 1                   | Core – I             | 20PPH1C01   | Mathematical Physics                                       | 6          | 4  | 25         | 75         | 100        |
| 2                   | Core – II            | 20PPH1C02   | Classical Mechanics  | 6          | 4  | 25         | 75         | 100        |
| 3                   | Core – III           | 20PPH1C03   | Linear and Non Linear Integrated Circuits and Applications | 5          | 4  | 25         | 75         | 100        |
| 4                   | Elective – I         | 20PPH1E01   | Energy Physics   | 5          | 4  | 25         | 75         | 100        |
| 5                   | Core Practical– I    | 20PPH2P01   | General and Advanced Physics Experiments                   | 4          | Credit and Marks are carried to Core Practical – I of Semester II  |            |            |            |
| 6                   | Core Practical– II   | 20PPH2P02   | Electronics Experiments                                    | 4          | Credit and Marks are carried to Core Practical – II of Semester II |            |            |            |
| <b>Total</b>        |                      |             |  | <b>30</b>  | <b>16</b>  | <b>100</b> | <b>300</b> | <b>400</b> |
| <b>SEMESTER II</b>  |                      |             |  |            |  |            |            |            |
| 7                   | Core – IV            | 20PPH2C04   | Quantum Mechanics - I                                      | 5          | 4  | 25         | 75         | 100        |
| 8                   | Core – V             | 20PPH2C05   | Thermodynamics and Statistical Physics                     | 5          | 4  | 25         | 75         | 100        |
| 9                   | Core – VI            | 20PPH2C06   | Microprocessor 8085 and Microcontroller 8051               | 5          | 4  | 25         | 75         | 100        |
| 10                  | Elective – II        | 20PPH2E02   | Optoelectronic Devices and its Applications                | 5          | 4  | 25         | 75         | 100        |
| 11                  | Core Practical– I    | 20PPH2P01   | General and Advanced Physics Experiments                   | 4          | 4  | 40         | 60         | 100        |
| 12                  | Core Practical– II   | 20PPH2P02   | Electronics Experiments                                    | 4          | 4  | 40         | 60         | 100        |
| 13                  | Common Course        | 20P2HR01    | Human Rights   | 2          | 2  | 25         | 75         | 100        |
| <b>Total</b>        |                      |             |  | <b>30</b>  | <b>26</b>  | <b>205</b> | <b>495</b> | <b>700</b> |
| <b>SEMESTER III</b> |                      |             |  |            |  |            |            |            |
| 14                  | Core – VII           | 20PPH3C07   | Quantum Mechanics - II                                     | 6          | 4  | 25         | 75         | 100        |
| 15                  | Core – VIII          | 20PPH3C08   | Electromagnetic Theory                                     | 6          | 4  | 25         | 75         | 100        |
| 16                  | Core – IX            | 20PPH3C09   | Spectroscopy   | 6          | 4  | 25         | 75         | 100        |
| 17                  | Elective – III       | 20PPH3E03   | Nanoscience and Nano Technology                            | 4          | 4  | 25         | 75         | 100        |



|                         |                     |             |  |            |           |            |             |             |
|-------------------------|---------------------|-------------|--|------------|-----------|------------|-------------|-------------|
|                         | (Any one)           | 20PPH3E04   | Synthesis of Materials and Characterizations                               |            |           |            |             |             |
| 18                      | Core Practical– III | 20PPH3P03   | Microprocessor 8085 and Microcontroller 8051 Experiments                   | 4          | 4         | 40         | 60          | 100         |
| 19                      | EDC                 | ----        | Extra Disciplinary Course (EDC) – I (Other than Physics Major Subject)     | 4          | 4         | 25         | 75          | 100         |
| <b>Total</b>            |                     |             |  | <b>30</b>  | <b>24</b> | <b>165</b> | <b>435</b>  | <b>600</b>  |
| <b>SEMESTER IV</b>      |                     |             |  |            |           |            |             |             |
| 20                      | Core – X            | 20PPH4C10   | Condensed Matter Physics   | 6          | 4         | 25         | 75          | 100         |
| 21                      | Core – XI           | 20PPH4C11   | Nuclear and Particle Physics   | 6          | 4         | 25         | 75          | 100         |
| 22                      | Core – XII          | 20PPH4C12   | Numerical and Computational Methods  | 6          | 4         | 25         | 75          | 100         |
| 23                      | Core Practical– IV  | 20PPH4P04   | Computational Methods  | 4          | 4         | 40         | 60          | 100         |
| 24                      | Project             | 20PPH4PR01  | Project  | 8          | 6         | -          | 100         | 100         |
| Internship              |                     |             |  | -          | 2         | -          | -           | -           |
| <b>Total</b>            |                     |             |  | <b>30</b>  | <b>25</b> | <b>115</b> | <b>385</b>  | <b>500</b>  |
| <b>Cumulative Total</b> |                     |             |  | <b>120</b> | <b>90</b> | <b>585</b> | <b>1635</b> | <b>2200</b> |
| <b>Sl. No.</b>          |                     |             | <b>Extra Disciplinary Course (EDC) (Other than Physics Major students)</b> |            |           |            |             |             |
| 1                       | EDC                 | 20PPH2EDC01 | Electronic Appliances  | 4          | 4         | 25         | 75          | 100         |

**Note**

CBCS – Choice Based Credit system

CIA – Continuous Internal Assessment

ESE – End Semester Examinations



# PROGRAMME SYLLABUS



| Program: M.Sc. Physics |            |                        |         |                                    |
|------------------------|------------|------------------------|---------|------------------------------------|
| Core – I               |            | Course Code: 20PPH1C01 |         | Course Title: Mathematical Physics |
| Semester               | Hours/Week | Total Hours            | Credits | Total Marks                        |
| I                      | 6          | 90                     | 4       | 100                                |

### Course Objectives

1. To enable the students to understand the basic principles and importance of tensor analysis, group theory and appreciate their applications in the field of Physics.
2. To provide an insight into complex analysis, special functions, transform techniques which form the back bone of all higher physics and to apply these techniques to solve Physics problems.

### **UNIT I : VECTOR ANALYSIS AND TENSORS**

Linear vector spaces, Gram - Schmidt Orthogonalization Process, Linear operators, Hilbert space, Orthogonal expansion of separable Hilbert spaces – Orthogonal curvilinear coordinates – Gradient, divergence, Curl and Laplacian – Evaluation of line, surface, volume integrals.

Introduction to tensors – Transformation of coordinates – Summation convention – Tensor transformation (contravariant, covariant tensors) – Rank of a tensor – Quotient law – Kronecker and Livi-Civita symbol – Symmetric and Anti-symmetric tensor

### **UNIT II : INTEGRAL TRANSFORM**

**Fourier transform:** Fourier sine, cosine and complex integrals – Fourier sine and cosine transform (finite and infinite) – Properties of Fourier transforms (Linear property, change of scale property, shifting property and modulation theorem) - Convolution theorem – Boundary value problems.

**Laplace Transform:** Laplace formulae – Properties of Laplace transforms (Linear property – Change of scale property, first and second shifting theorems) – Special functions of Laplace transforms (Gamma, Bessel, and Dirac delta)



### UNIT III : COMPLEX ANALYSIS

Complex function – Analytic function – Limit, Continuity – Differentiability – Cauchy-Riemann conditions-Cauchy's integral theorem (simply and multiply connected regions) – Cauchy's integral formulae -Taylor and Laurent expansion – Singularities of an analytic function – Residues – Cauchy's residue theorem –Evaluation of definite integrals – Contour integration.

### UNIT IV : SPECIAL FUNCTIONS

Legendre, Bessel, Hermite and Laguerre differential equations - Generating functions-orthogonality properties - Recurrence relations - Rodrigue's formula.

### UNIT V : GROUP THEORY

**Groups and their basic Properties:** Group – Basic properties – Abelian group – Isomorphic group – Similarity transformation and classes – Group multiplication tables

**Representation of Groups:** Symmetric elements – Transformation, Matrix representation – Point groups – Reducible and irreducible representations – Great orthogonality theorem – Construction of character tables for point groups  $C_{2v}$  ( $XY_2$  bent symmetrical type molecule) and  $C_{3v}$  ( $XY_3$  Pyrimidal type molecule) structure of character tables.

### BOOKS FOR STUDY:

1. Satya Prakash, Mathematical Physics, Sultan Chand & Sons, New Delhi (2004).  
[Unit Covered: 1 – 5: Pages: 2 - 117, 231 - 301, 514 – 606, 820 - 881, 998 - 1034].
2. B.D. Gupta, Mathematical Physics, Vikas publishing house, New Delhi (2010).  
[Unit Covered: 1 – 5: Sections: 1.1 – 1.188, 3.1 – 3.86, 4.1 – 4.86, 5.1 – 5.155, 9.1 – 9.64, 10.1 – 10.62].

### BOOKS FOR REFERENCE:

1. A.W. Joshi, Matrices and Tensors in Physics, New Age, New Delhi (2006).
2. G. Arfken and H.J. Weber, Mathematical methods for Physicists, Academic Press (1995).
3. K.F. Riley, M.P. Hobson and S.J. Bence, Mathematical Methods for Physics and Engineering, Cambridge University Press (1998).
4. R.V. Churchill, Complex variables and applications, McGraw Hill (1990).



5. W. Bell, Special functions for Scientists and Engineers, Dover Publications, Inc., Mineola, New York (2004).
6. A.W. Joshi Elements of Group Theory for Physicists, Wiley Eastern (1997).

### Course Outcomes (COs)

On successful completion of the course, the students will be able to

| CO Number | CO Statement  | Knowledge Level |
|-----------|---|-----------------|
| CO1       | Use the complex derivatives function, use and operate analytic functions, demonstrate knowledge of integration in the complex plane, use the Cauchy integral theorem and formula, understand residues and their use in integration.                           | K1 & K2         |
| CO2       | Gain a working knowledge of know elementary ideas in Gamma and Beta functions, series solutions and special functions, will be able to apply to solve problems in classical, statistical and quantum mechanics as well as electromagnetism                    | K2              |
| CO3       | Evaluate the Fourier transform of a continuous function, and be familiar with its basic properties and convolution theorem and also learn Laplace transform, properties and special functions will help the students to critically analyze physical problems. | K2 & K3         |
| CO4       | Understand Tensors and its importance in physics because they provide a concise mathematical framework for formulating and solving physics problems in areas such as elasticity, fluid mechanics, and general relativity.                                     | K4              |
| CO5       | The basic ideas of Group Theory and the closely related representation theory have many important applications in physics, chemistry, and materials science.  | K6              |

**K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6–Create**



**Mapping of COs with POs**

| <b>CO</b>  | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> |
|------------|------------|------------|------------|------------|------------|
| <b>CO1</b> | M          | S          | M          | S          | S          |
| <b>CO2</b> | M          | S          | S          | S          | S          |
| <b>CO3</b> | S          | S          | S          | M          | S          |
| <b>CO4</b> | S          | S          | S          | S          | S          |
| <b>CO5</b> | S          | S          | S          | S          | S          |

**S – Strong****M – Medium****L – Low**



| Program: M.Sc. Physics |            |                        |         |                                   |
|------------------------|------------|------------------------|---------|-----------------------------------|
| Core – II              |            | Course Code: 20PPH1C02 |         | Course Title: Classical Mechanics |
| Semester               | Hours/Week | Total Hours            | Credits | Total Marks                       |
| I                      | 6          | 90                     | 4       | 100                               |

### Course Objectives

1. To acquire basic concept and knowledge relevant to methods of Lagrangian and Hamiltonian Dynamics.
2. To apply the Lagrangian Dynamics method for the study of small oscillations and motion of rigid bodies.
3. To solve problems pertaining to physical bodies using Canonical transformation and Hamilton Jacobi method.

### **UNIT I: LAGRANGIAN FORMULATION, APPLICATIONS AND HAMILTON PRINCIPLE**

Mechanics of a system of particles: Constraints and its classifications – Generalized coordinates – Degrees of freedom – D'Alembert's principle – Cyclic coordinates and Lagrange's Equations – Applications of Lagrange's formulation – Compound pendulum – Spherical pendulum – Simple pendulum– Isotropic oscillator – Particle moving on the surface of the earth – Bead sliding on a uniformly rotating wire in a force free space – Calculus of variations: Hamilton's principle – Lagrange's equation from Hamilton's principle.

### **UNIT II: HAMILTONIAN FORMULATION-APPLICATIONS**

Hamiltonian of a system – Cyclic coordinates and conservation of theorems – Integrals of Hamilton's equations – Hamilton's canonical equations of motion, significance – Deduction of canonical equations from a variational principle – Simple pendulum – Compound pendulum – Particle moving near the surface of the earth – Particle in a central field of force – Hamiltonian for a charged particle in an electromagnetic field – Principle of least action.



### **UNIT III: CANONICAL TRANSFORMATION AND HAMILTON-JACOBI THEORY**

Canonical transformation – Advantage – Examples of Canonical transformations – Condition for a transformation to be Canonical – Infinitesimal Canonical transformation – Hamilton–Jacobi method – Hamilton–Jacobi partial differential equation – Hamilton–Jacobi equation for principal function, and characteristic function – Harmonic oscillator problem by Hamilton – Jacobi method – Particle falling freely in a uniform magnetic field – Kepler's problem solution by Hamilton–Jacobi method.

### **UNIT IV: ACTION ANGLE VARIABLE, POISSON BRACKET-LAGRANGE'S BRACKET**

Action angle variables – Harmonic oscillator in action-angle variables – Poisson brackets – Properties of Poisson bracket – Invariance of Poisson brackets to Canonical transformations – Equation of motion in Poisson bracket form – Infinitesimal contact transformations – Lagrange brackets – Invariant of Lagrange bracket under Canonical transformation – Relation between Lagrange and Poisson brackets.

### **UNIT V: MECHANICS OF SMALL OSCILLATIONS, RIGID BODY'S KINEMATICS**

Lagrangian equations of motion for small oscillations – Normal coordinates and normal frequencies of vibration – Vibrations of a linear triatomic molecule – Euler's angles rotating coordinate system – Coriolis force – Angular momentum – Kinetic energy of a rigid body – Moments and products of inertia – Euler equations of motion – Torque free motion of rigid body – Motion of symmetrical top under the action of gravity.

#### **BOOKS FOR STUDY:**

1. S. L. Gupta, V. Kumar, H.V. Sharma, Classical Mechanics, Pragati Prakashan Educational Publishers, Meerut (2007).  
[Unit Covered: 1–5: Pages : 6–16, 30–40, 50–65, 100–115, 340–343, 120–140, 150–185, 245–290, 325–348].
2. G. Aruldas, Classical Mechanics, Prentice - Hall of India Pvt. Ltd., New Delhi (2008).  
[Unit Covered: 1–5: Pages: 6–14, 39–50, 57–74, 78–96, 137–167, 173–189, 196–219, 231–251].



### BOOKS FOR REFERENCE

1. K.C. Gupta, Classical Mechanics of Particles and Rigid Bodies, New Age International, New Delhi (1997).
2. J.C. Upadhaya, Classical Mechanics, Himalaya Publishing House Pvt. Ltd., Bangalore Second Edition (2017).
3. H. Goldstein, C. Poole and J. Safko, Classical Mechanics, Pearson Education Asia, New Delhi (2002).
4. S.N. Biswas, Classical Mechanics, Books and Allied Ltd., Kolkata (1998).
5. N.C. Rana and P.S. Joag, Classical Mechanics, Tata McGraw Hill Publishing Company Ltd., New Delhi (1991).
6. R.G. Takwa, Introduction to Classical Mechanics, Himalaya Publishing House Pvt. Ltd., Bangalore (2010).

### Course Outcomes (COs)

On successful completion of the course, the students will be able to

| CO Number | CO Statement   | Knowledge Level |
|-----------|--|-----------------|
| CO 1      | Formulate and solve classical mechanics problems using Lagrangian and Hamiltonian methods.                               | K1 & K2         |
| CO 2      | Find constants of motion according to the Hamilton Jacobi theory using Canonical transformations.                        | K3 & K4         |
| CO 3      | Study periodic motion by action-angle variables and find derivatives in phase space using Poisson brackets.              | K3 & K4         |
| CO 4      | Apply methods of classical mechanics, including normal modes, to a continuum system such as a fluid.                     | K5 & K6         |
| CO 5      | Use symmetries of a system to identify conserved quantities and predict the nature of normal modes of its linearization. | K5 & K6         |

**K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create**



**Mapping of COs with POs**

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 |
|-----|-----|-----|-----|-----|-----|
| CO1 | M   | M   | M   | M   | S   |
| CO2 | M   | M   | M   | S   | S   |
| CO3 | S   | S   | S   | S   | S   |
| CO4 | S   | S   | S   | S   | S   |
| CO5 | S   | S   | S   | S   | S   |

**S – Strong**

**M – Medium**

**L – Low**



| Program: M.Sc. Physics |            |                        |         |  |
|------------------------|------------|------------------------|---------|--|
| Core – III             |            | Course Code: 20PPH1C03 |         | Course Title: Linear And Non-Linear Integrated Circuits And Applications |
| Semester               | Hours/Week | Total Hours            | Credits | Total Marks  |
| I                      | 5          | 75                     | 4       | 100  |

### Course Objectives

1. To acquire knowledge about operational amplifiers and waveform generators.
2. To understand the theories of combinational and sequential logic circuits.
3. To habituate the concepts of data converter and active filters.

#### **UNIT I: OPERATIONAL AMPLIFIER AND ANALOG COMPUTATION**

Operational Amplifier - Electrical Parameters – Offset and Null Connection – Offset Error and Correction - Inverting Single Input Summing Amplifier – Three Input Averaging Amplifier - Differential Amplifier - General Linear Applications - Simultaneous equations and differential equations- Instrumentation amplifier- Log and Antilog amplifiers- Analog multiplication and division

#### **UNIT II: LINEAR IC'S - WAVEFORM GENERATORS**

Sine wave Oscillator - Wien's Bridge Oscillator and Phase shift oscillator – Square wave generator – Triangular wave generator - Saw-tooth generator – Quadrature Oscillator - Pulse generator — 555 Timer IC - Internal Architecture and working – Astable multi vibrator - Voltage controlled oscillator - Monostable multi vibrator - Schmidt trigger – Squarer - Phase Locked Loop.(PLL) - Application of PLL in Television Transmission.

#### **UNIT III: COMBINATIONAL LOGIC CIRCUITS**

NAND/ NOR as Universal building blocks – Half and Full Adders - Half and Full Subtractors – 4 bit binary Adder and Subtractor - 4 bit BCD Adder and Subtractor - Encoder and Decoder- Multiplexer and Demultiplexer - Memory Devices – ROM – RAM – EPROM

**UNIT IV: SEQUENTIAL LOGIC CIRCUITS**

Flip Flops- RS Flip flop, Clocked RS Flip flop, D-type Flip flop, JK Flip flop, T Flip flop and M/S JK Flip flop, Counters- Synchronous, Asynchronous (Up and Down) and Modulus counters- BCD counters- Shift registers- Ring counter as divide by N counter- Johnson counter as divide by 2N counter.

**UNIT V: DATA CONVERTERS AND ACTIVE FILTERS**

Digital to analog converter - Binary weighted and R/2R ladder type- Accuracy and resolution- Dual slope digital to analog converter – analog to digital converter - Simultaneous conversion- Counter method- Successive approximation method.

Active filters – Low pass, High Pass, Band pass, Band stop - Second order Butter worth design – Multiple Feedback filter circuit

**BOOKS FOR STUDY:**

1. Ramakant A Gayakwad, Op-Amps and Linear Integrated Circuits, Fourth Edition, Pearson, Prentice Hall (2000).
2. Anil K Maini, Digital Electronics, Principles, Devices and Applications, John Wiley and Sons Limited (2007).
3. Donald P Leach & Albert Paul Malvino, Digital Principles and Applications, Seventh Edition, Tata McGraw Hill Education Private Limited, New Delhi (2011).

**BOOKS FOR REFERENCE:**

1. Jacob Millman, Christes C. Halkias, Integrated Electronics: Analog and Digital Circuits and Systems, Second Edition, Mc-Graw Hill, Kogakusha, Japan (2011).
2. Thomas L. Floyd, David Buchla, Basic Operational Amplifiers and Linear Integrated Circuits, Second Edition, Prentice Hall (1999).



### Course Outcomes (COs)

On successful completion of the course, the students will be able to

| CO Number | CO Statement  | Knowledge Level |
|-----------|---|-----------------|
| CO1       | Acquire elaborate knowledge about operational amplifier and its applications                        | K1 & K2         |
| CO2       | Understand the concepts of oscillators & multivibrators and its applications in electronic devices. | K2 & K3         |
| CO3       | Gain the knowledge of basic digital circuits and memory devices.                                    | K3 & K4         |
| CO4       | Develop the practical knowledge in the field of registers and counters.                             | K5 & K6         |
| CO5       | Understand the working principles of data converting circuits and active filters.                   | K5              |

**K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 – Create**

### Mapping of COs with POs

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 |
|-----|-----|-----|-----|-----|-----|
| CO1 | M   | M   | S   | S   | S   |
| CO2 | M   | S   | S   | M   | S   |
| CO3 | S   | S   | S   | S   | S   |
| CO4 | S   | S   | S   | S   | S   |
| CO5 | S   | S   | S   | S   | S   |

S – Strong

M – Medium

L – Low





| Program: M.Sc. Physics |            |                        |         |                                 |
|------------------------|------------|------------------------|---------|---------------------------------|
| Elective – I           |            | Course Code: 20PPH1E01 |         | Course Title: Energy<br>Physics |
| Semester               | Hours/Week | Total Hours            | Credits | Total Marks                     |
| I                      | 5          | 75                     | 4       | 100                             |

### Course Objectives

1. To gain knowledge relevant to Physics aspects of different energy sources.
2. To understand technological aspects of renewable energy devices and their application potentials.

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

Energy sources–Renewable energy sources and their types – Non-renewable energy sources and their types –Advantages and disadvantages–Solar radiation: Extra-terrestrial and terrestrial radiation – World energy futures.

#### **UNIT -II: SOLAR CELLS**

Solar photovoltaics – Principle of photovoltaic conversion of solar energy– Solar cell parameters, Solar cell electrical characteristics – Efficiency of solar cell – Types of solar cells and their fabrication: Silicon, Thin-film and Dye-sensitized solar cells – Applications of solar cells.

#### **UNIT -III: APPLICATIONS OF SOLAR ENERGY**

Solar water heating – Solar space heating–Solar space cooling– Solar dryer –Solar distillation – Solar pumping – Solar furnace – Solar cooker – Solar greenhouse– Solar photocatalysis.

#### **UNIT -IV: WIND ENERGY**

Base principles of wind energy conversion – Wind data and energy estimation – Basic components of wind energy conversion systems – Types: Vertical axis and horizontal axis



wind machines – Scheme for electric generation – Generator control – Load control – Applications of wind energy.

### **UNIT -V: ENERGY FROM BIOMASS**

Biomass conversion technologies – Wet and dry process – Photosynthesis –Biogas generation: Basic processes and energetics – Factors affecting biodigestion and generation of gas – Classification of biogas plants: Continuous and batch types, done and drum types – Properties of biogas –Applications of biogas.

### **BOOKS FOR STUDY:**

1. G.D. Rai, Non-Conventional Energy Sources, Khanna Publishers, New Delhi (2009).  
[Unit Covered: 1–5: Pages: 1–72, 146–223, 227–310, 311–384]

### **BOOKS FOR REFERENCE:**

1. F. Kreith and J.F. Kreider, Principles of Solar Engineering, Tata McGraw Hill (1978).
2. A.B. Meinel and A.P.Meinel, Applied Solar Energy, Addison Wesley Publishing Co. (1976).
3. M.P.Agarwal, Solar Energy, S. Chand and Co., New Delhi (1983).
4. S.P.Sukhatme, Solar Energy, Tata McGraw Hill (1997).



### Course Outcomes (COs)

On successful completion of the course, the students will be able to

| CO Number | CO Statement  | Knowledge Level |
|-----------|---|-----------------|
| CO1       | Gain knowledge about origin and types of diverse energy sources   | K1 & K2         |
| CO2       | Understand properties of energy sources and identify their application potentials                                       | K2 & K3         |
| CO3       | Gather research-based knowledge about principal, construction and operation of different energy conversion technologies | K3&K4           |
| CO4       | Acquire information pertaining to application potential of various energy sources through appropriate technologies      | K5              |
| CO5       | Develop skills to design portable energy conversion devices and their demonstration                                     | K6              |

**K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create**

### Mapping of COs with POs

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 |
|-----|-----|-----|-----|-----|-----|
| CO1 | M   | M   | S   | S   | S   |
| CO2 | M   | M   | S   | S   | S   |
| CO3 | S   | S   | S   | S   | S   |
| CO4 | M   | S   | S   | S   | S   |
| CO5 | S   | S   | S   | S   | S   |

**S – Strong**

**M – Medium**

**L – Low**



| Program: M.Sc. Physics |                 |                        |              |  |
|------------------------|-----------------|------------------------|--------------|--|
| Core Practical – I     |                 | Course Code: 20PPH2P01 |              | Course Title: General and Advanced Physics Experiments |
| Semester<br>I and II   | Hours/Week<br>4 | Total Hours<br>120     | Credits<br>4 | Total Marks<br>100                                     |

### Course Objectives

1. To understand the concept of mechanical behavior of materials and calculation of same using appropriate equations.
2. To calculate the thermodynamic quantities and physical properties of materials.
3. To analyze the optical and electrical properties of materials.

### SEMESTER – I

#### I(a). GENERAL PHYSICS EXPERIMENTS

(Any *twelve* Experiments)

1. Cornu's Method- Young's Modulus and Poisson's ratio by Elliptic fringes.
2. Cornu's Method – Young's modulus and Poisson's ratio by Hyperbolic fringes.
3. Viscosity of liquid – Meyer's disc.
4. Stefan's Constant
5. Coefficient of linear expansion- Air wedge Method
6. Permittivity of a liquid using an RFO
7. Susceptibility by Quincke's method.
8. B-H loop using Anchor ring.
9. B-H curve using CRO.
10. Susceptibility by Guoy's method.
11. Thickness of the enamel coating on a wire- By diffraction
12. Hydrogen Spectrum- Rydberg's Constant
13. FP Etalon
14. LG Plate.
15. Arc spectrum: Copper



16. Solar constant.
17. Solar spectrum – Hartmann’s formula. Edser and Butler fringes – Thickness of air film.
18. Band gap energy- Thermistor

## SEMESTER – II

### I (b). ADVANCED PHYSICS EXPERIMENTS

(Any *twelve* Experiments)

1. Specific charge of an electron – Thomson’s method.
2.  $e/m$  by Millikan’s method.
3. Ultrasonics – Compressibility of a liquid.
4. Miscibility measurements using ultrasonic diffraction method.
5. Michelson Interferometer – Wavelength, Separation of wavelengths.
6. Michelson Interferometer – Thickness of thin film.
7. GM counter – characteristics, inverse square law, absorption coefficient.
8. GM counter – Feather’s analysis: Range of Beta rays.
9. Conductivity measurement using four probe methods.
10. Arc spectrum – Iron.
11. Iodine absorption spectra.
12. Molecular spectra – AIO band.
13. Molecular spectra – CN bands.
14. Laser Experiments: Study of Laser beam parameters.
15. Laser Experiments : (i) Diffraction at straight edge, (ii) Interference of laser beams – Lloyds single mirror method, (iii) Interference using an optically plane glass plate, (iv) Diffraction at a straight wire and (v) Diffraction at a circular aperture.
16. Experiments on optical fibres.
17. Microwave test bench - Standing wave Measurements and standing wave coefficient, , Law of Inverse square – Receiver end transmitter behavior – Radiation Pattern
18. Dielectric measurements in Microwave test bench.
19. Hall Effect.



20. UV-Visible spectroscopy – Verification of Beer-Lambert's law and identification of wavelength maxima – Extinction coefficient

21. Interpretation of vibrational spectra of a given material

### Course Outcomes (COs)

On successful completion of the course, the students will be able to

| CO Number | CO Statement  | Knowledge Level |
|-----------|---|-----------------|
| CO1       | Understand the strength of material using Young's modulus.              | K1 & K2         |
| CO2       | Acquire knowledge of thermal behaviour of the materials.                | K2 & K3         |
| CO3       | Understand theoretical principles of magnetism through the experiments. | K4              |
| CO4       | Acquire knowledge about arc spectrum and applications of laser          | K5 & K6         |
| CO5       | Improve the analytical and observation ability in Physics Experiments   | K6              |

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

### Mapping of COs with POs

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 |
|-----|-----|-----|-----|-----|-----|
| CO1 | M   | M   | M   | S   | S   |
| CO2 | M   | M   | S   | S   | S   |
| CO3 | S   | S   | S   | S   | S   |
| CO4 | S   | M   | S   | S   | S   |
| CO5 | S   | S   | S   | S   | S   |

S – Strong

M – Medium

L – Low



| Program: M.Sc. Physics |            |                        |         |                                       |
|------------------------|------------|------------------------|---------|---------------------------------------|
| Core Practical – II    |            | Course Code: 20PPH2P02 |         | Course Title: Electronics Experiments |
| Semester               | Hours/Week | Total Hours            | Credits | Total Marks                           |
| I and II               | 4          | 120                    | 4       | 100                                   |

### Course Objectives

1. To observe the applications of FET and UJT.
2. To study the different applications of operational amplifier circuits.
3. To learn about Combinational Logic Circuits and Sequential Logic Circuits

### SEMESTER – I

#### II(a). ELECTRONICS EXPERIMENTS

##### (Any *twelve* Experiments)

1. Design of UJT relaxation oscillator for a given frequency – Generation of positive and negative triggering pulses.
2. FET CS amplifier- design, Frequency response, input impedance, output impedance
3. Study of important electrical characteristics of IC741.
4. Design of 3 input summing and average amplifier – Design of differential amplifier to solve  $2V_2 - 5V_1$ .
5. Study of attenuation characteristics of Wien's bridge network and design of Wien's bridge oscillator using Op-Amp.
6. Study of attenuation characteristics of Phase shift network and design of Phase shift oscillator using Op-Amp.
7. Designs of Schmidt trigger circuit using IC 741 for a given hysteresis- application as squarer.
8. Design of square wave oscillator using IC741- Triangular wave oscillator using IC 741- Triangular wave generator
9. Design of a quadrature wave using IC324
10. Construction of pulse generator using the IC 741 – application as frequency divider



11. Op-Amp- 4 bit Digital to Analog converter (Binary Weighted and R/2R ladder type)
12. Study of R-S, clocked R-S and D-Flip flop using NAND gates
13. Study of J-K, D and T flip flops using IC 7476/7473
14. Arithmetic operations using IC 7483- 4 bit binary addition and subtraction.
15. Design of Arithmetic logic unit using IC 74181

## SEMESTER – II

### II(b). ELECTRONICS EXPERIMENTS

#### (Any *twelve* Experiments)

1. IC 7490 as scalar and seven segment display using IC7447
2. Solving simultaneous equations – IC 741 / IC LM324.
3. Op-Amp –Active filters : Low pass, High pass and Band pass filters (Second Order) Butter worth filter
4. Design of second order butterworth multiple feedback narrow band pass filter
5. Realization of analog to digital converter (ADC) using 4-bit DAC and synchronous counter IC74193
6. Construction of square wave generator using IC 555 – Study of VCO.
7. Design of Schmidt trigger circuit using IC555 for a given hysteresis – Application as squarer.
8. Construction of pulse generator using the IC 555 – Application as frequency divider.
9. IC 7476 / IC7473 – Study of binary up / down counters
10. IC 7476 – Shift register, ring counter and Johnson counter (twisted ring counter).
11. Design of synchronous parallel 4-bit binary up/down counter using IC 74193
12. Design of asynchronous parallel 4-bit binary up/down counter using IC 7493
13. Construction of 4-1 multiplexer using basic gates AND, OR and NOT operations.
14. Study of 16-1 multiplexer using IC 74150
15. Construction of 1-4 demultiplexer using basic gates AND and NOT operations.
16. Study of 1-16 demultiplexer using IC 74154.



**Course Outcomes (COs)**

On successful completion of the course, the students will be able to

| <b>CO Number</b> | <b>CO Statement</b>  | <b>Knowledge Level</b> |
|------------------|--|------------------------|
| <b>CO1</b>       | Conduct experiments on applications of FET and UJT                                 | K1 & K2                |
| <b>CO2</b>       | Analyze various parameters related to operational amplifiers.                      | K2 & K3                |
| <b>CO3</b>       | Understand the concepts involved in arithmetic and logical circuits using IC's     | K4                     |
| <b>CO4</b>       | Acquire knowledge about Combinational Logic Circuits and Sequential Logic Circuits | K5                     |
| <b>CO5</b>       | Analyze the applications of counters and registers                                 | K6                     |

**K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create**

**Mapping of COs with Pos**

| <b>CO</b>  | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> |
|------------|------------|------------|------------|------------|------------|
| <b>CO1</b> | M          | M          | M          | S          | S          |
| <b>CO2</b> | M          | M          | S          | S          | S          |
| <b>CO3</b> | S          | S          | S          | S          | S          |
| <b>CO4</b> | S          | S          | S          | S          | S          |
| <b>CO5</b> | S          | S          | S          | S          | S          |

**S – Strong**

**M – Medium**

**L – Low**



| Program: M.Sc. Physics |                 |                        |              |                                     |
|------------------------|-----------------|------------------------|--------------|-------------------------------------|
| Core – IV              |                 | Course Code: 20PPH2C04 |              | Course Title: Quantum Mechanics - I |
| Semester<br>II         | Hours/Week<br>5 | Total Hours<br>75      | Credits<br>4 | Total Marks<br>100                  |

### Course Objectives

1. To familiarize basic concepts of Quantum Mechanics and its features.
2. To understand procedures involved in perturbation process and its applications.
3. To acquire knowledge about angular momentum and representation of matrix.

### **UNIT –I: FORMALISM OF QUANTUM MECHANICS**

Physical Interpretation of Wave Functions Expectation Values of Dynamical Quantities – Probability Current Density - Ehrenfest Theorem, Schrodinger Equation in Momentum Representation - Momentum Operator – Hamiltonian Operator – Hermitian Operator and its Properties, Dirac Delta Function – Completeness Property of Eigen Functions Superposition of Eigen States – Parity Operator, Commutator Algebra –Schwarz Inequality, Heisenberg's Uncertainty Relation Derived from Operators and its Applications.

### **UNIT –II: ANGULAR MOMENTUM**

Angular Momentum in Position Representation, Spin Angular Momentum – Total Angular Momentum, Commutation Relations for Angular Momentum Operators, Eigen Value Spectrum  $J^2$  and  $J_z$ ,  $J_x$  and  $J_y$ , Raising and Lowering Operators:  $J_+$  and  $J_-$ , Addition of Angular Momenta – Clebsch-Gordon Co-efficient –its Properties and its Evaluation.

### **UNIT -III: MATRIX REPRESENTATION**

Hilbert Space – Unitary Transformation and their Properties, Representation of State Vector and Equation of Motion: Schrodinger Picture – Heisenberg Picture – The Interaction Picture, Dirac's BRA and KET Vector Notation, Coordinate and Momentum Representation, Matrix Theory of Harmonic Oscillator.

**UNIT –IV: PERTURBATION THEORY FOR STATIONARY STATES**

First and Second Order Perturbation Theory in Non– Degenerate and Degenerate Cases, Application to Perturbed Harmonic Oscillator- The Perturbation Energy Term is Proportional to  $X$  and  $X^2$ , Stark Effect in Hydrogen Atom, Variation Method – Application to Ground State of Helium Atom, Application to Ground State of Hydrogen Atom, WKB Approximation – Probability of Penetration of Barrier.

**UNIT – V: TIME DEPENDENT APPROXIMATION METHODS**

Time Dependent Perturbation Theory, Fermi Golden Rule, Constant and Harmonic Perturbations, Adiabatic and Sudden Approximation, A Charged Particle in an Electromagnetic Field.

**BOOKS FOR STUDY:**

1. Satya Prakash, Quantum Mechanics, Kedar Nath Ram Nath, Meerut (2009).  
[Units Covered: 1– 5: Pages: 90-93, 95, 96, 113, 114, 240 – 249, 252, 253, 256, 257, 260 – 265, 270 – 274, 276, 277, 328 – 330, 334 – 338, 339 – 349, 351 – 355, 396, 397, 400 – 407, 415 – 419, 441- 456, 469 – 478, 489 – 493, 497 – 500, 518 – 532]
2. G. Aruldas, Quantum Mechanics, Prentice- Hall of India, New Delhi (2006).  
[Units Covered: 1– 5: Pages: 24, 33 – 38, 49 – 52, 54 – 56, 63 – 68, 148 – 150, 170 – 184, 195 – 204, 215, 216, 218 – 222, 229 -231, 242 – 246]

**BOOKS FOR REFERENCES:**

1. R.K. Srivastava, Quantum Mechanics, Prentice- Hall of India, New Delhi (2007)
2. P. M. Mathews and K. Venkatesan , A Text Book of Quantum Mechanics, Tata McGraw Hill, New Delhi (1987)
3. Pauling and E.B.Wilson, Quantum Mechanics, McGraw Hill, New York (1935).
4. Leonard I. Schiff, Quantum Mechanics, McGraw, Hill (1968).
5. E. Merzbacher, Quantum Mechanics, Third Edition, John Wiley and Sons (2004).
6. David J.Griffiths, Introduction to Quantum Mechanics, Second Edition, Addison Wesley (1999).

**Course Outcomes (COs)**

On successful completion of the course, the students will be able to

| CO Number | CO Statement   | Knowledge Level |
|-----------|--|-----------------|
| CO1       | Understand fundamental, principles of quantum mechanics                                  | K1 & K2         |
| CO2       | Understands about different perturbation and variation methods                           | K2 & K3         |
| CO3       | Gather knowledge about time dependent and independent theories.                          | K3&K4           |
| CO4       | Gain knowledge regarding methods of determining lower level of Hydrogen and Helium atom. | K5              |
| CO5       | Learn about the Angular momentum and its rules.  | K3, K4 &K6      |

**K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create**

**Mapping of COs with POs**

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 |
|-----|-----|-----|-----|-----|-----|
| CO1 | M   | M   | M   | S   | S   |
| CO2 | M   | M   | S   | S   | S   |
| CO3 | S   | S   | S   | S   | S   |
| CO4 | S   | S   | S   | S   | S   |
| CO5 | S   | S   | S   | S   | S   |

**S – Strong**

**M – Medium**

**L – Low**



| Program: M.Sc. Physics |                 |                        |              |  |
|------------------------|-----------------|------------------------|--------------|--|
| Core – V               |                 | Course Code: 20PPH2C05 |              | Course Title:<br>Thermodynamics and<br>Statistical Physics |
| Semester<br>II         | Hours/Week<br>5 | Total Hours<br>75      | Credits<br>4 | Total Marks<br>100   |

### Course Objectives

1. To understanding laws of thermodynamics and a systematic definition of thermodynamic potentials as the general formalism of thermodynamics.
2. To overview foundations of equilibrium statistical physics as the microscopic theory of matter and fields.

### **UNIT I: BASIC OF THERMODYNAMICS AND APPLICATIONS**

Concept of entropy: Entropy of a system – Entropy and probability – Change in entropy of a solid/Liquid – Thermodynamic potentials and the reciprocity relations – Gibb’s Helmholtz relation – Thermodynamic equilibria – Nernst’s heat theorem – Blackbody radiation and Planck's radiation distribution law.

### **UNIT II: SPECIFIC HEAT OF SOLIDS**

Specific heat of solids: Dulong and Petit’s law – Einstein’s theory of the specific heat of solid – Debye’s theory of specific heat capacity of solids – Criticism of Debye theory – Negative temperature – Specific heat anomaly of metals and its solution – Liquid helium – Bose-Einstein condensation.

### **UNIT III: ENSEMBLES AND PARTITION FUNCTION**

Ensembles: Microcanonical ensemble, Canonical ensemble and Grand canonical ensemble – Comparison of various ensembles – Partition function and its correlation with thermodynamic quantities – Thermodynamical quantities by partition function – Helmholtz free energy – Entropy of a system – Probability of one-dimensional random walk – Brownian movement.



#### UNIT IV: CLASSICAL STATISTICS

Phase space – Microstate and macrostate of a system – Liouville's Theorem – Entropy of a perfect gas: Gibbs' paradox – Removal of paradox – Perfect gas in Micro Canonical ensemble – Ideal gas in Canonical ensembles – Ideal gas in Grand Canonical ensembles.

#### UNIT V: QUANTUM STATISTICS

Stirling's approximation – Thermodynamical probability – Maxwell Boltzmann statistics – Bose-Einstein quantum statistics – Fermi Dirac statistics – Comparison of three distribution statistics – Thermionic emission – Van der Waals gas equation – Phase transition: Second order phase transition – Ising model in one dimension.

#### BOOKS FOR STUDY:

1. Gupta and Kumar, Elementary Statistical Mechanics, Pragati Prakashan, Meerut (2011).  
[Unit Covered: 1–5: Pages: 10–22, 33–40, 72–80, 100–156, 210–227, 235–241, 252–260, 307–310, 317–326].
2. Sathya Prakash, Statistical Mechanics, Pragati Prakashan, Meerut (2004).  
[Unit Covered: 1–5: Pages: 28–34, 65–80, 100–105, 118–120, 191–197, 225–238, 245–252, 272–275, 288–335, 370–415, 435–445, 536–540, 558–570]
3. B. K. Agarwal and M. Eisner, Statistical Mechanics, New Age International, New Delhi (1998).  
[Unit covered: 1–5: Pages: 2–13, 18–25, 45–55, 61–80, 119–125, 147–158, 204–210, 215–225, 259–263].

#### BOOKS FOR REFERENCE:

1. K. Huang, Statistical Mechanics, John Wiley and Sons, New Delhi (1975).
2. R.K. Pathria and Paul D Beale, Statistical Mechanics, Academic Press (2000).
3. F. Reif, Statistical and Thermal Physics, McGraw Hill, International Edition, Singapore (1975).
4. B.B. Laud, Fundamentals of Statistical Mechanics - New Age International Publishers, Second Edition (2012).
5. C. Kittel, Elementary Statistical Physics, John Wiley & Sons, (2004).
6. R.P. Feynman, Statistical Mechanics, Addison Wesley, First Edition, (1998).
7. R.K. Pathria, Statistical Physics, Pergamon, Oxford, Third Edition, (2011).



8. S.R.A. Salinas, Introductory Statistical Physics, Springer (2000).

**Course Outcomes (COs)**

On successful completion of the course, the students will be able to

| CO Number | CO Statement   | Knowledge Level |
|-----------|--|-----------------|
| CO 1      | Understand laws and concepts of thermodynamics   | K1 & K2         |
| CO2       | Apply statistical physics methods to solve problems in physical systems.   | K2 & K3         |
| CO 3      | Apply concepts and principles of black body radiations and thermodynamics to analyze radiation phenomena in thermodynamic systems. | K3 & K4         |
| CO 4      | Analyze phase equilibrium condition and identify types of phase transitions of physical systems.                                   | K3 & K4         |
| CO 5      | Understand phase space, micro and macro states; Quantum statistical mechanics and Distribution laws.                               | K5 & K6         |

**K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create**

**Mapping of COs with POs**

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 |
|-----|-----|-----|-----|-----|-----|
| CO1 | M   | M   | M   | S   | S   |
| CO2 | M   | M   | M   | S   | S   |
| CO3 | S   | S   | S   | S   | S   |
| CO4 | S   | S   | S   | S   | S   |
| CO5 | S   | S   | S   | S   | S   |

S – Strong

M – Medium

L – Low



| Program: M.Sc. Physics |                 |                        |              |  |
|------------------------|-----------------|------------------------|--------------|--|
| Core – VI              |                 | Course Code: 20PPH2C06 |              | Course Title:<br>Microprocessor 8085 and<br>Microcontroller 8051 |
| Semester<br>II         | Hours/Week<br>5 | Total Hours<br>75      | Credits<br>4 | Total Marks<br>100   |

### Course Objectives

1. To provide an understanding of the architecture and functioning of microprocessor 8085A and to the methods of interfacing I/O devices and memory to microprocessor.
2. To introduce 8085A programming and applications and the architecture and instruction sets of microcontroller 8051.

### **UNIT I: 8085 PROGRAMMING, PERIPHERAL DEVICES AND THEIR INTERFACING**

Instruction set - Addressing modes - Programming techniques - Memory mapped I/O scheme- I/O mapped I/O scheme - Memory and I/O interfacing- Data transfer schemes - Interrupts of 8085 - Programmable peripheral interface (PPI) - Control group and control word- Programmable DMA controller - Programmable interrupt controller – Programmable communication interface - Programmable counter /interval timer.

### **UNIT II: 8085 INTERFACING APPLICATIONS**

Seven segment display interface - Interfacing of Digital to Analog converter and Analog to Digital converter - Stepper motor interface - Measurement of electrical quantities –(Voltage and current) Measurement of physical quantities(Temperature and strain).

### **UNIT III: 8051 MICROCONTROLLER HARDWARE**

Introduction – Features of 8051 – 8051 Microcontroller Hardware : Pin-out 8051, Central Processing Unit (CPU), internal RAM, Internal ROM, Register set of 8051 – Memory organization of 8051 – Input/Output pins, Ports and Circuits – External data memory and program memory : External program memory, External data memory.





#### **UNIT IV: 8051 INSTRUCTION SET AND ASSEMBLY LANGUAGE PROGRAMMING**

Addressing modes – Data moving (Data transfer) instructions : Instructions to Access external data memory, external ROM / program memory, PUSH and POP instructions, Data exchange instructions – Logical instructions : byte and bit level logical operations, Rotate and swap operations – Arithmetic instructions : Flags, Incrementing and decrementing, Addition, Subtraction, Multiplication and division, Decimal arithmetic – Jump and CALL instructions : Jump and Call program range, Jump, Call and subroutines – Programming.

#### **UNIT V: INTERRUPT PROGRAMMING AND INTERFACING TO EXTERNAL WORLD**

8051 Interrupts – Interrupt vector table – Enabling and disabling an interrupt – Timer interrupts and programming – Programming external hardware interrupts – Serial communication interrupts and programming – Interrupt priority in the 8051 : Nested interrupts , Software triggering of interrupt.

LED Interface Seven segment display interface- Interfacing of Digital to Analog converter and Analog to Digital converter - Stepper motor interface - Measurement of electrical quantities –Voltage and current) Measurement of physical quantities(Temperature an strain).

#### **BOOKS FOR STUDY:**

1. A. Nagoor Kani, Microprocessors & Microcontrollers, RBA Publications (2009).  
[Unit Covered: 1 – 5: Pages: 1 - 42,53 - 87, 97 – 159, 299 - 328, 333 - 397].
2. A. P. Godse and D. A. Godse, Microprocessors, Technical Publications, Pune (2009).  
[Unit Covered: 1: Pages: 1 - 84].
3. Ramesh Gaonkar, Microprocessor Architecture, Programming and Applications with 8085, Penram International Publishing (2013).  
[Unit Covered: 1 - 5] [Pages: 1 - 25,54 - 85, 446 – 477, 497 - 501].

#### **BOOKS FOR REFERENCE:**

1. Douglas V. Hall, Microprocessors and Interfacing programming and Hardware, Tata Mc Graw Hill Publications (2008)



2. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. Mckinlay, The 8051 Microcontroller and Embedded Systems, Pearson Education (2008).

### Course Outcomes (COs)

On successful completion of the course, the students will be able to

| CO Number | CO Statement   | Knowledge Level |
|-----------|--|-----------------|
| CO1       | Gain knowledge of architecture and working of 8085 microprocessor.           | K1 & K2         |
| CO2       | Get knowledge of architecture and working of 8051 Microcontroller.           | K3              |
| CO3       | Be able to write simple assembly language programs for 8085A microprocessor. | K3 & K4         |
| CO4       | Able to write simple assembly language programs for 8051 Microcontroller.    | K5              |
| CO5       | Understand the different applications of microprocessor and microcontroller. | K6              |

**K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6–Create**

### Mapping of COs with POs

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 |
|-----|-----|-----|-----|-----|-----|
| CO1 | M   | S   | M   | S   | S   |
| CO2 | M   | S   | S   | S   | S   |
| CO3 | S   | S   | S   | S   | S   |
| CO4 | S   | S   | S   | S   | S   |
| CO5 | S   | S   | S   | S   | S   |

**S – Strong**

**M – Medium**

**L – Low**



| Program: M.Sc. Physics |            |                        |         |   |
|------------------------|------------|------------------------|---------|---|
| Elective – II          |            | Course Code: 20PPH2E02 |         | Course Title: Optoelectronic Devices and its Applications |
| Semester               | Hours/Week | Total Hours            | Credits | Total Marks   |
| II                     | 5          | 75                     | 4       | 100   |

### Course Objectives

1. To acquire basic principle and knowledge about optoelectronics and optical fiber communication systems.
2. To understand technological aspects of diverse optoelectronic devices and their applications.

#### **UNIT – I: INTRODUCTION**

Propagation of electromagnetic waves in dielectric wave guides–Boundary conditions– Phase velocity and group velocity–Fibers and dispersion in fibers– Cut off frequency– Electromagnetic field in core and cladding–Types of fibers: Single mode and multimode fibers – Step index and graded index fibers.

#### **UNIT – II: LASERS**

Lasers–Principles of lasers: Absorption of radiation, spontaneous and stimulated emission – Coherence– Gain equation–Three level and four level lasers– He-Ne laser– Ruby laser – Diode laser: Homojunction and heterojunction diode lasers.

#### **UNIT - III: FIBER OPTICS COMMUNICATION**

LED and lasers source– Transmitter modulator – Acousto and electro-optic modulators– Modulation types: Amplitude, frequency and pulse code modulation– Detection and demodulation– Detection and demodulation– PIN– Avalanche photodetector– Photomultiplier tube.



### UNIT - IV: FIBER OPTIC SENSORS

Fiber optic sensors: Introduction –Types: Intrinsic and extrinsic sensors– Intensity modulated sensors– Phase sensor –Fiber based sensors for displacement, temperature and pressure measurements– Fiber Bragg grating based sensors.

### UNIT – V: INTERFEROMETRIC FIBER OPTIC SENSORS

Basic principles– Interferometric configurations: Mach-Zehnder, Michelson and Fabry-Perot interferometers – Sagnac interferometer– Fiber-optic gyroscope– Applications of interferometric fiber optic sensors.

#### BOOKS FOR STUDY:

1. Dr. M. Arumugam, Optical Fiber Communication and Sensors, Anuradha Agencies Publishers, Kumbakonam (2002).

[Unit Covered: 1–5 : Sections: 2.1–2.32, 4.1–4.11, 5.1–5.6.2, 5.7–5.7.3, 5.8–5.8.2, 8.10–8.11.3, 5.7–5.7.3, 10.5–10.5.7]

#### BOOKS FOR REFERENCE:

1. H.G. Unger, Planar Optical Waveguides and Fibres, Oxford University Press, Oxford (1977).
2. A. Yariv, Principles of Optical Electronics, John Wiley, New York (1984).
3. H.A. Haus, Waves and Fields in Optoelectronics, Prentice Hall, New Jersey (1984).
4. Ajoy Ghatak, Optics, Second Edition, Tata McGraw Hill (2013).
5. B.P. Pal, Fundamentals of Fiber Optics in Telecommunications and Sensor Systems, New Age International, New Delhi (1992).
6. P. K. Rastogi, Optical Measurement Techniques and Applications, Artech House (1997).
7. Dave Birtalan, William Nunley, Optoelectronics: Infrared-Visible-Ultraviolet Devices and Applications, Second Edition, CRC Press (2009).
8. Michael A. Parker, Physics of Optoelectronics, CRC Press (2005).



### Course Outcomes (COs)

On successful completion of the course, the students will be able to

| CO Number | CO Statement  | Knowledge Level |
|-----------|---|-----------------|
| CO1       | Understand basic knowledge and concepts of optoelectronics  | K1 & K2         |
| CO2       | Gain knowledge and importance of fibers and their types   | K2 & K3         |
| CO3       | Know research-based knowledge about principal, construction and operation of different optoelectronic devices | K3 & K4         |
| CO4       | Develop skills pertaining to application potential of diverse optoelectronic devices                          | K5              |
| CO5       | Share ideas with respect to theoretical and experimental aspects of optoelectronic devices                    | K6              |

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

### Mapping of COs with POs

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 |
|-----|-----|-----|-----|-----|-----|
| CO1 | M   | M   | S   | S   | S   |
| CO2 | M   | M   | S   | S   | S   |
| CO3 | M   | S   | S   | S   | S   |
| CO4 | S   | S   | S   | S   | S   |
| CO5 | S   | S   | S   | S   | S   |

S – Strong

M – Medium

L – Low



| Program: M.Sc. Physics |                 |                             |              |  |
|------------------------|-----------------|-----------------------------|--------------|--|
| EDC                    |                 | Course Code:<br>20PPH2EDC01 |              | Course Title: Electronic<br>Appliances |
| Semester<br>II         | Hours/Week<br>4 | Total Hours<br>60           | Credits<br>4 | Total Marks<br>100                     |

### Course Objectives

1. To understand the basics about electronic devices.
2. To learn the working principles and operation of electronic appliances.

### **UNIT I: ELECTRONIC COMPONENTS**

Components – Resistors – Resistance Value – Types of Resistance – Capacitor – Capacitor Value – Types of Resistance – Construction and working of Diodes and Transistors – IC's.

### **UNIT II: ELECTRICAL APPLIANCES**

Basic of UPS – Stabilizers – Voltage regulators – Iron Box – Microwave Oven – Refrigerators – Air Conditioners – Washing Machines.

### **UNIT III: ELECTRONIC APPLIANCES**

Basics of Radio – TV – LCD Projectors – Digital Camera – Scanners – Video Conferencing.

### **UNIT IV: COMPUTERS**

Generation of computer – Block diagram of a Computer – Input Device – Memory Device – Control Unit – Arithmetic logic unit – Output device – RAM – ROM.

### **UNIT V: COMMUNICATION ELECTRONICS**

Basics of Mobile Phones – Wireless Phones – Antenna – Internet – Satellites.

### **BOOKS FOR STUDY AND REFERENCE:**

1. S. S. Kamble, Electronics & Mathematical Data Book, Allied Publishers Ltd., (1997).
2. William David Cooper, Electronic Instrumentation and Measurement Technique, Second Edition, Prentice Hall, New Delhi (2007).



### Course Outcomes (COs)

On successful completion of the course, the students will be able to

| CO Number | CO Statement   | Knowledge Level |
|-----------|--|-----------------|
| CO1       | Utilize the basic knowledge in electronics field               | K1 & K2         |
| CO2       | Examine the fundamental of electronic devices                  | K2              |
| CO3       | Gain knowledge on electrical and electronic appliances         | K2 & K3         |
| CO4       | Demonstrate the working function of home appliances            | K4              |
| CO5       | Apply research based knowledge to design electronic appliances | K6              |

**K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6–Create**

### Mapping of COs with POs

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 |
|-----|-----|-----|-----|-----|-----|
| CO1 | M   | M   | M   | S   | S   |
| CO2 | M   | S   | S   | S   | S   |
| CO3 | S   | S   | S   | S   | S   |
| CO4 | S   | S   | S   | S   | S   |
| CO5 | S   | S   | S   | S   | S   |

**S – Strong**

**M – Medium**

**L – Low**