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KUNTHAVAI NAACCHIYAAR GOVERNMENT ARTS COLLEGE FOR WOMEN

Autonomous College Affiliated to Bharathidasan University

Re-Accredited by NAAC with 'B' Grade

Thanjavur - 613 007, Tamil Nadu, India.

**CBCS & OBE**

Scheme of Instruction and Syllabus for

**M.Sc., PHYSICS**

**(I to IV Semester)**

**(2022-2023 onwards)**

**PG and RESEARCH DEPARTMENT OF PHYSICS**

KUNTHAVAI NAACCHIYAAR GOVT. ARTS COLLEGE FOR WOMEN (AUTONOMOUS), THANJAVUR-613007.

## DEPARTMENT OF PHYSICS

### VISION

The Vision of the Department of Physics is to provide in depth understanding of, the principles and concept of Physics and to acquire proficiency, both in theoretical and experimental Physics. The Department aims to enhance the student's knowledge in basics as well as in Applied Physics. To inculcate aptitude for a research career in academic or in industry, by introducing advanced ideas and techniques that are applicable.

### MISSION

To import quality education in Physics such that, they aim to attain better position in the best Organizations. To make the students effectively disseminate their knowledge to the next coming generation. To develop the capacity and know-how to apply the principles and laws of Physics to solve problems. Enhance their ability to do and interpret the data obtained in experiments. To extend research facilities and thereby approaching towards the centre for excellence. To apply the knowledge of Physics for sustainable development of the society. Assume responsibility and always practice ethical principles, to function effectively, as individual as well as in a team.

## M.Sc., PHYSICS PROGRAMME OUTCOME

After the completion of M.Sc., Physics CBCS Programme, the students will be able to:

| S. No | Focus of PO | Programme outcomes |
|---|---|---|
| 1 | Designing | Analyze and interpret data to create and Design a new Knowledge |
| 2 | Creativity | Mould to adopt, absorb and develop innovative ideas. |
| 3 | Experimental Skill | Acquire the skills in planning and handling the scientific instruments and performing laboratory experiments |
| 4 | Interdisciplinary learning | Articulate in-depth to understand the core knowledge on various advanced fields of Physics |
| 5 | Research Development | Motivate and identify their areas of interest in research after doing their projects |
| 6 | Problem Analysis | Gain the ability to identify and analyze complex Physics Problems. |
| 7 | Engulfing | Elevate themselves as consultants to provide solutions for the industrial problems |
| 8 | Modern tool usage | Create, select and apply appropriate techniques to design an experiment. |
| 9 | Critical analysis | Examine Physics Patterns, trends, factors and impacts with unique ideas |
| 10 | Programming Skill | Pursue higher education in the field of technology. |

**K. N. Govt. Arts College (W) Autonomous, Thanjavur - 7.**

**M.Sc., Physics Course Structure under CBCS**

**(For the candidates admitted from the academic year 2022 - 2023 onwards)**

| Semester | Course | Subject Code | Title of the Paper | Inst. | Credit | Exam. | Marks | | Total |
|---|---|---|---|---|---|---|---|---|---|
| I | CC 1 | 22KP1P01 | Mathematical Physics | 6 | 5 | 3 | 25 | 75 | 100 |
| | CC 2 | 22KP1P02 | Classical & Statistical Mechanics | 6 | 5 | 3 | 25 | 75 | 100 |
| | CC 3 | 22KP1P03 | Microprocessor and Micro Controller | 6 | 5 | 3 | 25 | 75 | 100 |
| | CC 4 (P) | 22KP1P04P | Practical - I | 6 | 4 | 4 | 40 | 60 | 100 |
| | MBE 1 | 22KP1PELP1:1 | Analog and Digital Electronics | 6 | 4 | 3 | 25 | 75 | 100 |
| | | 22KP1PELP1:2 | Programming in C++ | | | | | | |
| | | | | **30** | **23** | - | **140** | **360** | **500** |
| II | CC 5 | 22KP2P05 | Electro Magnetic theory | 7 | 5 | 3 | 25 | 75 | 100 |
| | CC 6 | 22KP2P06 | Quantum Mechanics | 7 | 6 | 3 | 25 | 75 | 100 |
| | CC 7 | 22KP2P07 | Condensed Matter Physics | 6 | 5 | 3 | 25 | 75 | 100 |
| | CC 8 (P) | 22KP2P08P | Practical - II | 6 | 4 | 4 | 40 | 60 | 100 |
| | NME 1 | 22KP2PELO1 | Astro Physics | 4 | 3 | 3 | 25 | 75 | 100 |
| | ECC1 | 22KP2SSP1 | Laser Physics | | 3 | 3 | - | 100 | 100 |
| | | | MOOC ( Value Added) | | | | | | |
| | ECC2 | | Add on Course | - | 4 | - | - | - | - |
| | | | | **30** | **23** | - | **140** | **360** | **500** |
| III | CC 9 | 22KP3P09 | Spectroscopy | 7 | 6 | 3 | 25 | 75 | 100 |
| | CC 10 | 22KP3P10 | Nuclear and Particle Physics | 7 | 5 | 3 | 25 | 75 | 100 |
| | CC 11 (P) | 22KP3P11P | Practical - III | 6 | 4 | 4 | 40 | 60 | 100 |
| | MBE 2 | 22KP3PELP2:1 | Communication Electronics | 6 | 4 | 3 | 25 | 75 | 100 |
| | | 22KP3PELP2:2 | Physics for Competitive Examinations | | | | | | |
| | NME 2 | 22KP3PELO2 | Ultrasonics | 4 | 3 | 3 | 25 | 75 | 100 |
| | ECC3 | 22KP3SSP2 | Solar Energy | | 3 | 3 | - | 100 | 100 |
| | | | MOOC ( Value Added) | | | | | | |
| | | | | **30** | **22** | - | **140** | **360** | **500** |
| IV | CC 12 | 22KP4P12 | Nano Physics | 6 | 4 | 3 | 25 | 75 | 100 |
| | CC 13 | 22KP4P13 | Crystal Growth and Thin film Physics | 6 | 4 | 3 | 25 | 75 | 100 |
| | CC 14 (P) | 22KP4P14P | Practical - IV | 6 | 4 | 4 | 40 | 60 | 100 |
| | MBE 3 | 22KP4PELP3:1 | Numerical and Computational Physics | 6 | 4 | 3 | 25 | 75 | 100 |
| | | 22KP4PELP3:2 | Medical Physics | | | | | | |
| | Project Work | 22KP4P15PW | Project Work | 6 | 6 | - | - | 100 | 100 |
| | | | | **30** | **22** | - | **115** | **385** | **500** |
| | | | | **120** | **90** | - | **560** | **1440** | **2000** |

I. Major Based Electives

M.Sc., Physics-List of Major Based Elective Courses 2022-2023

| Semester I | Code | Major Based Elective I |
|---|---|---|
| MBE 1 | 22KP1PELP1:1 | Analog and Digital Electronics |
| | 22KP1PELP1:2 | Programming in C++ |
| **Semester II** | **Code** | **Major Based Elective II** |
| NME 1 | 22KP2PELO1 | Astrophysics |
| **Semester III** | **Code** | **Major Based Elective III** |
| MBE 2 | 22KP3PELP2:1 | Communication Electronics |
| | 22KP3PELP2:2 | Physics for Competitive Examinations |
| NME 2 | 22KP2PELO2 | Ultrasonics |
| **Semester IV** | **Code** | **Major Based Elective IV** |
| MBE 3 | 22KP4PELP3:1 | Numerical and Computational Physics |
| | 22KP4PELP3:2 | Medical Physics |

II. Add-on-Course: Semester II:

## V. Continuous Internal Assessment System

| | Maximum | Components | | | Passing Minimum |
|---|---|---|---|---|---|
| | | Attendance | CIA | Seminar / Assignment | |
| Theory | 25 | 05 | 15 | 05 | 12 |
| Practical* | 40 | 05 | 25 | 10 (Record) | 20 |

## VI. Question Pattern

| | Part A | Part B | Part C |
|---|---|---|---|
| Semester Exam: Theory (75) | 20 X 1=20 (Answer All) | 5 X 5= 25 (Internal choice) | 3 X10 =30(Open choice) |
| Semester Exam: Practical (60) | 5X10 = 50* | - | - |
| | | | |
| CIA Exam: Theory (50) | 10 X 1=10 (Answer All) | 4 X 5= 20 (Internal choice) | 2 X10 =20(Open choice) |
| Model Exam Theory (75) | 20 X 1=20 (Answer All) | 5 X 5= 25 (Internal choice) | 3 X10 =30(Open choice) |
| Model Exam: Practical (50) * | 5X10 = 50 | - | - |

## VII. Question Allocation and Blooms Taxonomy for (Direct) Assessment

| Unit | Section & Marks | Question Number | Blooms Level | Action Verbs |
|---|---|---|---|---|
| I | A (1 mark) | 1-4 | I / II | **Level I:** Choose, Define, Find, How, Label, List, Match, Name, Select, Show, Tell, What, When, Where, Which, Who, Why<br><br>**Level II:** Classify, Compare, Contrast, Demonstrate, Explain, Extend, Illustrate, Infer, Interpret, Outline, Relate, Show, Summarize, Translate<br><br>**Level III:** Apply, Build, Choose, Construct, Develop, Experiment with, Identify, Interview, Make use of, Model, Organize, Plan, Select, Solve, Utilize<br><br>**Level IV:** Analyze, Assume, Categorize, Discover, Dissect, Distinguish, Divide, Examine, Function, Inference, Inspect, Motive, Relationships, Simplify, Survey, Take part in, Test for, Theme<br><br>**Level V:** Agree, Appraise, Assess, Award, Conclude, Criteria, Criticize, Decide, Deduct, Defend, Determine, Disprove, Estimate, Evaluate, Importance, Influence, Interpret, Judge, Justify, Mark, Measure, Opinion, Perceive, Prioritize, Prove, Rate, Recommend, Rule on, Select, Support, Value<br><br>**Level VI:** Adapt, Combine, Compile, Compose, Construct, Create, Delete, Design, Develop, Discuss, Elaborate, Estimate, Formulate, Happen, Imagine, Improve, Invent, Make up, Maximize, Minimize, Modify, Original, Originate, Plan, Predict, Propose, Solution, Solve, Suppose, Test, Theory |
| | B (5 mark) | 21 (a) and (b) | I / II | |
| | C (10 mark) | 26 | I / II | |
| II | A (1 mark) | 5-8 | I / II | |
| | B (5 mark) | 22 (a) and (b) | I / II | |
| | C (10 mark) | 27 | I / II | |
| III | A (1 mark) | 9-12 | I / II | |
| | B (5 mark) | 23 (a) and (b) | III / IV | |
| | C (10 mark) | 28 | III / IV | |
| IV | A (1 mark) | 13-16 | I / II | |
| | B (5 mark) | 24 (a) and (b) | III / IV | |
| | C (10 mark) | 29 | V / VI | |
| V | A (1 mark) | 17-20 | I / II | |
| | B (5 mark) | 25 (a) and (b) | V / VI | |
| | C (10 mark) | 30 | V / VI | |

| BL | No. Of Questions (Sections) | | | Total Marks | % of Marks |
|---|---|---|---|---|---|
| | A | B | C | | |
| I. Remembering | 12 | 4 | 2 | 12 | 50 |
| II. Understanding | 08 | | | 48 | |
| III. Applying | - | 4 | 2 | 20 | 33 |
| IV. Analyzing | - | | | 20 | |
| V. Evaluating | - | 2 | 1 | 10 | 17 |
| VI. Creating | - | | | 10 | |
| Total Questions | 20 | 10 | 5 | 120 | 100 |

III. Details on the number of Courses, Instruction Hours and Credits

| Course | Course Title | No. of Courses | Instruction Hours | Credits |
|---|---|---|---|---|
| Part I | Core Course (Theory 10- + & Practical 4) | 14 | 88 | 66 |
| Part II | Major Based Elective | 3 | 18 | 12 |
| | Non-Major Elective | 2 | 8 | 6 |
| Part III | Project Work | 1 | 6 | 6 |
| | **Total** | 20 | 120 | 90 |

## IV. SEMESTER – WISE COURSE STRUCTURE

| Semester | Course | Total Courses | Ins. Hr/week | Credit |
|---|---|---|---|---|
| **I** | CC1,CC2,CC3, CC4(P),MBE1 | 5 | 30 | 23 |
| **II** | CC5,CC6,CC7, CC8(P),NME1 | 5 | 30 | 23 |
| **III** | CC9,CC10, CC11(P),MBE2,NME 2 | 5 | 30 | 22 |
| **IV** | CC12,CC13, CC14(P),MBE3, Project | 5 | 30 | 22 |
| **TOTAL** | | 20 | 120 | 90 |

**VIII.Teaching Methodology Adopted:** Department may adopted at least a 20 % of ICT enabled classes out of total hours of each course work and proper documents (Date, Hour, Course and unit, name of the faculty and sign of the representative student) to be maintained for the same

## IX.Outline of Learning Outcomes- based Curriculum Frame work (LOCF)

(All the following categories of courses will be given with definition, procedure and system of implementation)

1. **CC** : Core Course
2. **MBE**: Major Based Elective
3. Project Work
4. **ECC** - Extra Credit Course
   A. SS-Self Study
   B. **Add on Course**

* add-on Certificate Courses with 10-30 contact hrs conducting by Course Coordinator of the department /College
\# List of MOOC Courses will be given by the Course Coordinator

# SEMESTER-I

| SEM 1 | CC1 | MATHEMATICAL PHYSICS | 22KP1P01 | Ins.Hrs.6 | Credit : 5 |
|---|---|---|---|---|---|

**Course Objectives:** Equip the Students with Mathematical techniques that needs for the understanding of the theoretical concepts in different course, taught in the M.Sc. programme. It also enhances the problem solving skills and gives the ability to formulate, interpret and draw inferences from the mathematical solutions.

| CO | Statement |
|---|---|
| 1 | Development of essential mathematical skills to solve problems arising in various branches of Physics. |
| 2 | Interpret the vector integration theorems and relation in electromagnetic theory to calculate the physical problems. |
| 3 | Illustrating the properties of beta and gamma functions and their applications. |
| 4 | Explain the usefulness of matrices and matrix operations in different physical context. |
| 5 | Evaluate real integrals appearing in Science and Engineering problems. |

**Unit 1: Vector analysis**

Concept of vector fields - Addition of Vectors – Product of two Vectors – Characteristics of Vector product of two Vectors - Concept of scalar fields – Multiplication of a Vector by a Scalar – Gradient of a Scalar field – Gradient or sum of two scalar point functions – Gradient of product of two scalar point functions – Divergence of a Vector point function – Divergence of sum of two vector functions – Divergence of product - curl or rotation of a Vector point function – Curl of sum of two vector point functions – Curl of Product of two Vector point functions - Laplacian function - Vector identities.

Line integral, surface integral and volume integral – Gauss theorem - Green's Theorem - Stoke's theorem.

**Unit II: Differential Equations**

order and Degree of a Differential Equation – Formation of Differential Equations – Soiution of a Differential Equation – Differential Equation of the First order and First Degree – Homogeneous Differential Equations – Linear Differential Equations

**Unit III: Complex Analysis**

Functions of complex variables – Differentiability - Cauchy-Riemann Conditions - Complex Integration - Cauchy's integral theorem - Cauchy integral formula - Taylor's series. Laurent's series - Residues - Singularities - Cauchy's residue theorem.

**Unit 1V: Special Functions**

Gamma functions - Beta functions – Transformation of Gamma functions – Different forms of Beta functions – Proofs of Beta function - Relation between Beta and Gamma Function – Properties of Beta Function - Properties of Gamma Function.

**Unit V: Matrix and Group theory**

Characteristic equation of a matrix - Eigen values and Eigenvectors - Cayley - Hamilton Theorem- Reduction of a matrix to diagonal form - Jacobi method

Basic definitions - Group -Subgroup - Coset - Class - Multiplication table - -Point groups - Space groups – Representation theory - Homomorphism – - Character table : $C_2V$ and $C_3V$.

**Unit VI: Practicum (Only for CIA)**

**Skill development exercise**

(i) Partial differential equations in physics - Laplace, Poisson, Helmholtz and diffusion equation

(ii) Method of finding solutions in Cartesian and polar co-ordinates.

**Text Books**


1. H.K. Dass; (2008): Mathematical Physics, S. Chand, New Delhi.
2. Joshi AW ; (1995): Matrices and Tensors in Physics , Wiley Eastern Ltd, New Delhi
3. A. Singaravelu; (2009) :Engineering Mathematics I , Meenakshi Agency, Chennai


**References**


1. L.A. Pipes and L.R. Harvilli; (2009): Applied Mathematics for Engineering and Physicists, Fiber Khanna publishers, New Delhi.
2. J. Millikan & Chalcis Tata; (2001): Mathematical physics Electronic devices and circuits, McGraw Hill- New Delhi.
3. A.K. Ghatak, T.C. Goyal; (2005): Mathematical Physics, Prentice, Hall


CO-PO Mapping with Programme Outcomes: **Mathematical Physics** **Code: 22KP1P01**

| CO/PO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| *1* | 2 | 2 | - | 3 | - | 3 | - | - | 1 | 2 |
| *2* | 1 | - | - | 2 | - | 1 | - | - | - | - |
| *3* | 3 | 3 | - | 3 | - | - | - | - | - | - |
| *4* | 3 | 3 | - | 3 | - | - | - | - | 2 | 2 |
| *5* | - | - | - | - | - | 3 | - | - | - | 2 |

1 – Low, 2 – Moderate, 3 – High Correlation

Staff In-charge

HOD

| SEM 1 | CC2 | CLASSICAL AND STATISTICAL MECHANICS | 22KP1P02 | Ins. Hrs. 6 | Credit: 5 |
|---|---|---|---|---|---|

**Course Objectives:** To acquire knowledge about conservation laws and constrains. To gain knowledge on Newtonian Mechanics, Lagrangian Mechanics, Hamiltonian Mechanics and Statistical Mechanics.

| CO | Statement |
|---|---|
| 1 | Comprehend base formalism of Newtonian and Lagrangian dynamics. |
| 2 | Understand dynamics of rigid body and theory of small oscillations. |
| 3 | Familiarize with Lagrangian and Hamiltonian approaches in Classical Mechanics. |
| 4 | Describe the importance of ensembles and interpret the fundamentals of Classical and Statistical Mechanics. |
| 5 | Differentiate Classical Statistics and Quantum Statistics. |

**Unit I: Fundamental Principles and Lagrangian Formulation**

Mechanics of a particle – Conservation laws - Mechanics of a system of particles – Conservation laws – Constraints – Holonomic and Non-holonomic – Generalized coordinates – D'Alembert's Principle – Lagrange's equation from D'Alembert's Principle – Application of Lagrange's formulation – Simple pendulum, Compound pendulum and Atwood's machine.

**Unit II: Rigid Body Dynamics and Small Oscillations**

Euler's angles – derivation of transformation matrix – Principal Moments of Inertia - Moments and products of inertia – Euler's equation of motion for a rigid body – Theory of small oscillations – Normal modes and frequencies – Linear Triatomic molecule.

**Unit III: Hamilton's Formulation**

Hamilton's canonical equations of motion – Deduction of Hamilton's equation from variational principle – Application of Hamilton's equations of motion to linear harmonic oscillator, simple pendulum and compound pendulum – Principle of least action – Canonical transformations – Legendre transformation – Poisson bracket – Hamilton Jacobi equation.

**Unit IV:Classical Statistical Mechanics**

Phase space – Micro and macro states – Ensemble - Microcanonical, Canonical and Grand canonical ensembles – Statistical equilibrium - Postulates of Statistical mechanics - Maxwell-Boltzmann distribution law – Application of MB Statistics to an Ideal gas – Partition function - Relation between entropy and partition function.

**Unit V:Quantum Statistical Mechanics**

Basic concepts and postulates of quantum statistics – Indistinguishability and quantum statistics - Bosons and Fermions – Distinction between classical and quantum particles – Bose-Einstein statistics – Application of BE statistics: photon gas - Fermi-Dirac statistics – Comparison of MB, BE and FD statistics.

**Unit VI: Competitive exam preparation (Not for Semester exam)**

CSIR / NET exam related questions related to the course will be discussed.

**Textbooks**


1. H. Goldstein, C.P poole and J.L Safko, 2007, Classical Mechanics, Pearson Education and Dorling Kindersley, New Delhi.
2. J.C. Upadhyaya, 2005, Classical Mechanics, Himalaya Publishing House.
3. S.L. Gupta, V. Kumar and H.V Sharma, 2001Classical Mechanics,PragatiPrakashan, Meerut.
4. Gupta Kumar & Sharma, (1998), *Statistical Mechanics*, Vikas Publishing. House Private Limited, New Delhi
5. SathyaPrakash&Agarwal, (1999), *Statistical Mechanics*, Sultan Chand and Sons, New Delhi.
6. D. Jayaraman& K. Ilangovan, S. (2016) *Thermal Physics &Statistical Mechanics*, Vishwanathan Printers and Publishers Pvt. Ltd.


**References**


1. V.B. Bhatia, 1997, Classical Mechanics, Narosa Publication, New Delhi.
2. N.C. Rana and P.S. Joag, 1991, Classical Mechanics, Tata McGraw Hill, New Delhi.
3. Laud, *Fundamentals of Statistical Mechanics*, (2009) New Age International (p) Limited, NewDelhi.
4. Sinha, (2011). *Introduction to Statistical Mechanics*, Narosa Publishing House New Delhi,


CO-PO Mapping with Programme Outcomes: **Classical and Statistical Mechanics**

**Code: 22KP1P02**

| CO/PO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | - | - | 2 | - | - | - | - | - | 3 |
| 2 | 3 | - | - | - | - | - | - | 3 | - | 2 |
| 3 | 3 | 3 | 2 | - | - | - | - | - | - | - |
| 4 | 2 | 2 | | 2 | - | - | - | - | - | - |
| 5 | 2 | 1 | - | - | - | - | - | - | 1 | - |

1 – Low, 2 – Moderate, 3 – High Correlation

Staff In-charge

HOD

| SEM 1 | CC3 | MICROPROCESSOR AND MICROCONTROLLER | 22KP1P03 | Ins. Hrs. 6 | Credit:5 |
|---|---|---|---|---|---|

**Course Objectives:** To describe the architecture of 8085 microprocessors and 8051 microcontroller and to familiarize programming.To provide foundation for designing real world applications using Microprocessors and microcontrollers.

| CO | Statement |
|---|---|
| 1 | Describe the internal architecture of microprocessor and learn various addressing modes. |
| 2 | Apply knowledge and demonstrate programming proficiency using the various data transfer instructions of the Microprocessor. |
| 3 | Distinguish and analyze the properties of Microprocessors & Microcontrollers and explain the microcontroller's architecture and its operation |
| 4 | Understand the different types of instructions of Microcontroller and its programming. |
| 5 | Design an electrical circuitry and an assembly language programs that will provide solutions to real world problems. |

**Unit I: Microprocessor architecture**

Intel 8085 Microprocessor architecture – Registers - Status flags – Address and data bus - Pin configuration - Instruction cycle – Fetch operation – Execute operation – Machine cycle and state - Timing diagram - Timing diagram for opcode fetch cycle - Addressing modes: Direct, Register, Register-indirect, immediate and implicit addressing mode - Address Space partitioning: Memory mapped I/O and I/O mapped I/O - Memory and I/O Interfacing.

**Unit II: Instruction set and programming**

Intel 8085 instruction – Opcode and operands – Instruction word size - Data transfer group – Arithmetic group – Logical group – Branch group – Stack, I/O and machine control group - Assembly language Programming – Addition of two 8 bit numbers; Sum 16 bit - Subtraction of two 8 bit numbers – Multiplication of two 8 bit numbers; sum 16 bit – Division of two 8 bit numbers - Largest and Smallest number from an array.

**Unit III: Microcontroller**

Microcontroller – Comparison of Microcontroller and Microprocessor – Architecture of 8051 - Pin description of 8051 – General purpose registers - Special function registers – Counters/Timers – Interrupts of 8051 - Interrupt Enable Register - Interrupt Priority Register - Memory organization - ROM & RAM space.

**Unit IV: 8051 Instruction Set and Programming**

Instruction set – Data transfer instructions – Arithmetic instructions – Logical instructions – Program branching instruction– Assembly Language Programming – Addition of two 8 bit numbers – Subtraction of two eight bit numbers – Sum of a set of numbers.

**Unit V: Interfacing**

Programmable Peripheral Interface (PPI) – Intel 8255 – Architecture – Operating modes – Control groups – Control word - **Microprocessor interfacing:** Interfacing of 7 segment LED display – Traffic control interfacing – **Microcontroller interfacing:** Stepper motor: Step angle, Steps per revolution, Steps per second, Revolution Per Minute (RPM) (Definition only) - Interfacing of Stepper motor with microcontroller 8051 - Program for moving a stepper motor in forward direction – ADC interfacing – ADC 0808.

**Unit VI: Pentium processors (Only for CIA)**

Basics of Pentium processors – comparison of Pentium processors (Pentium 2, Pentium 3 and Pentium 4)

**Textbooks**

1. B. Ram, (2005), Fundamentals of Microprocessors and Microcomputers, Dhanpat Rai Publications (P) Ltd., New Delhi.

2. Muhammad Ali Mazidi, Janice Gillispie Mazidi (2005) The 8051 Microcontroller and Embedded Systems, Pearson Education, Delhi, Seventh Indian Reprint .

**References**

1. A.NagoorKani, (2006), Microprocessors& Microcontrollers, 1st edition, RBA Publications, Chennai.

2. M. Parasuram, Microcontroller, N. V. Publications, Pollachi.

CO - PO Mapping with Programme outcomes: **Microprocessor and Microcontroller**
**Code: 22KP1P03**

| CO/PO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| *1* | 3 | | | 1 | | | | | | |
| *2* | 3 | 2 | | | | 2 | | | | |
| *3* | 2 | 2 | | 1 | | | | | | |
| *4* | 2 | 1 | | | | 2 | | | | |
| *5* | 3 | 1 | | | | 2 | | 2 | 1 | |

1 – Low, 2 – Moderate, 3 – High Correlation

Staff In-charge

HOD

| SEM I | CC4(P) | PRACTICAL - I | 22KP1P04P | Ins.Hrs. 6 | Credit : 4 |
|---|---|---|---|---|---|

**Course Objectives:** To train the students to learn the techniques in Physics so that they can investigate various relevant aspects and be confident to handle sophisticated instruments.

| CO | Statement |
|---|---|
| 1 | Create knowledge in Experimental analysis and in design techniques. |
| 2 | Analyze the data to arrive at a valid conclusion and apply the computational thinking. |
| 3 | Express their skills with design consideration of Electronic circuits. |
| 4 | Integrate the strengths of the liberal arts tradition with the theoretical foundation to enter in to the research. |
| 5 | Determine the different laser parameters using the methods involved in Laser beam technique |

**Practical I**
**Select any Twelve experiments**
**General Experiments**

1. Determination of Young's Modulus, Rigidity Modulus and Poisson's ratio by Elliptical fringes method.
2. Determination of Stefan's constant.
3. Four probe method – Determination of resistivity
4. Determination of carrier concentration and Hall coefficients in semiconductors.
5. Spectrometer using Narrow angle prism.
6. Determination of magnetic susceptibility of liquid by Guoy method.
7. Determination of compressibility of a liquid by Ultrasonic Interferometer.
8. Determination of the wavelength using Laser grating.
9. Charge of an electron – Spectrometer

## Electronics Experiments

1. Emitter follower
2. Dual power supply – Construction
3. Construction of transistorized power supply using bridge rectifier
4. Constuct and study of Monostable Multivibrator.
5. Constuct and study of bistable Multivibrator.
6. Constuct and study of Weign bridge oscillator using Transistor.
7. Constuct and study of Phase shift oscillator using Transistor.
8. FET oscillator.
9. Design of Asynchronus Counter
10. Op – amp : Addition and Subtraction
11. Analog and Digital Convertor
12. BCD Adder and Subtractor
13. Shift Registers using Flip-Flop &ICs
14. Design and study of Weign bridge oscillator using Transistor.

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| SEM 1 | MBE 1 | ANALOG AND DIGITAL ELECTRONICS | 22KP1PELP1 :1 | Hours :6 | Credit:4 |
|---|---|---|---|---|---|

**Course Objectives:** To provide an extended knowledge of the Electronics. To acquaint the students with the theory, construction and operation of electronic devices and their applications.

| CO | Statement |
|---|---|
| 1 | Discuss the fundamental blocks of semiconductor devices, and their applications. |
| 2 | Gain the knowledge of Op-amp and use the methods to analyze the mathematical operations . |
| 3 | Interpret the data and understand the serial transfer between the shift registers. |
| 4 | Acquire the knowledge of semiconductor lasers, threshold condition for lasing and applications of opto Electronic devices.. |
| 5 | Articulate the knowledge of Integrated Circuit, to learn the design and construction of IC components and timer |

**Unit I : Semiconductor devices**

Varactor Diode – Tunnel diode - PIN diode -Enhancement MOSFET – Characteristics - Depletion MOSFET – Characteristics - Uni Junction Transistor – characteristics- Silicon controlled rectifier – characteristics – Power control System - DIAC and TRIAC - characteristics

**Unit II : Applications of Operational Amplifier**

Analog computation - Integrator, Differentiator, logarithmic Amplifier, Anti logarithmic amplifier - Voltage to Current and current to voltage converter - Voltage Comparator – Sample and hold Circuits - Schmitt Trigger – Bootstrap sweep generator – RC –Active filters – High and low pass filter

**Unit III : Digital Electronics**

SET- RESET (SR) Flip Flop – Race Condition - D type Flip Flop -JK Flipflop – Master slave flip flop - Serial in - Serial out shift Register – Serial transfer between shift registers - Logic Families – Resistor Transistor Logic (RTL) – Diode Transistor Logic (DTL) – Transistor Transistor Logic (TTL) – Characteristics of TTL.

**Unit IV: Opto Electronic Devices**

P-N Junction lasers – Gain in a Two – level lasing medium - Threshold condition for Lasing – Threshold current –Photo diode - Photo transistor – Photo voltaic cells –Photo dependent resistor (LDR) – Applications of LDR

**Unit V: Integrated Circuits and IC Timer**

Monolithic Integrated Circuit Fabrication – Epitaxial Growth - Masking and Etching - Fabrication of IC Components – Transistors – Resistors – diodes – 555 IC Timer, Functional diagram and Operation – Timer as Monostable multivibrator – Timer used as Astable multivibrator

**Unit VI: PRACTICUM (Only for CIA)**

1. Solving 2nd order linear and nonlinear differential (Duffing oscillator) equations.
2. Piecewise linear (PWL) circuit elements – Negative Impedance Converter (NIC)

**Text Books**

1.Gupta and Kumar, Hand book of Electronics, Pragati Edition.
2.D.P.Leach and A.P. Malvino, 2006, Digital Principals and Applications(Tata McGraw-Hill, New Delhi.
3. D. Choudhury Roy, Jain, Shail B, 2018Linear Integrated Circuits, (New Age International LTD).

**References**

1. Horowitz and Hill, 3rd Edition (2015) The Art of Electronics, (Cambridge University Press).
2. George Kennedy, Electronic Communications", 4th edition (1999) (Prentice-Hall of India Private Limited, New Delhi).
3.D.Chattopadhyay and P.C. Rakshit (2010) Electronics Fundamentals and Applications,New Age International Publications, NewDelhi,.
4. H. S. Kalsi (2000) Electronic Instrumentation, Tata McGraw- Hill, New Delhi.

CO-PO Mapping with Programme Outcomes: **Analog and Digital Electronics**

**Code: 22KP1PELP1:1**

| CO/PO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | - | 3 | - | - | 3 | - | 3 | - | - |
| 2 | 3 | - | - | - | - | 3 | - | - | 3 | 3 |
| 3 | - | 2 | - | 3 | - | 2 | - | 3 | - | - |
| 4 | 3 | 2 | 2 | - | - | - | - | - | 3 | - |
| 5 | 3 | - | - | 2 | - | 3 | - | 3 | - | - |

1 – Low, 2 – Moderate, 3 – High Correlation

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| SEM 1 | MBE 1 | PROGRAMMING IN C++ | 22KP1PELP1:2 | Ins. Hrs. 6 | Credit: 4 |
|---|---|---|---|---|---|

**Course Objectives:** To develop a greater understanding of the issues involved in programming language design and object oriented patterns and its implementation. To enhance problem solving and programming skills in c++ by implementing the object oriented concepts.

| CO | Statement |
|---|---|
| 1 | Describe the concept of constants, variables and Data types. |
| 2 | Determine the concept of Object-oriented programming. |
| 3 | Classify the concepts of functions. |
| 4 | Categorize the class hierarchies using the Object-oriented design process. |
| 5 | Express the use of Exception handling mechanism in C++. |

**Unit I: Overview of C:** History of C – Importance of C – Basic structure of C program – Constants, Variables and Data Types – Operators and expressions: Arithmetic, Relational, Logical, Assignment, Increment, Decrement, Conditional, Bitwise, Special operators - Arithmetic expressions – Type conversion – Operator precedence and Associativity.

**Unit I: Basics of C++:** Applications of C++ - C++ Statements – Structure of C++ Program – Tokens, Expressions and Control structure - Tokens - Keywords - Identifiers and Constants - Basic Data Types - Declaration and Initialization of variables - Operators in C++ - Expressions and their types - Operator precedence - Control structures.

**Unit - III: Functions in C++:** Introduction –The Main Function – Function Prototyping – Call by Reference – Return by Reference - Inline Functions – Default Arguments – Const Arguments - Function Overloading - Friend and Virtual Functions - Math Library Functions.

**Unit - IV: Classes and Objects:** Introduction - Specifying a class - Defining Member Functions - Nesting of Member Functions - Private Member Functions - Arrays within a class - Memory Allocation for objects - Arrays of objects- Objects as Function Arguments - Friendly Functions – Returning Objects - Local Classes.

**Unit - V: Constructors and Destructors:** Constructors – Parameterized Constructors – Multiple Constructors – Dynamic Initialization of Objects – Copy Constructors – Destructors. Exception Handling: Introduction – Basics of Exception Handling - Exception Handling Mechanism – Throwing Mechanism - Catching mechanism - Rethrowing an Exception - Specifying Exceptions.

**Unit – VI: New Features of ANSI C++ Standard (Only for CIA)**

Introduction – New data types - New Operators – Class implementation - Namespace Scope – Operator Keywords – New Keywords – New Headers.

**Textbooks**

1. E. Balagursamy (2017) Programming in ANSI C, Mc Graw Hill Education(India) Pvt. Ltd., Seventh Edition, Fourth Reprint.

Chapters: 1, 2, 3.

2. E. Balagurusamy (2018) Object Oriented Programming with C++, Tata McGraw Hill, Seventh Edition.

**References**

1. Mike McGrath (2017) C++ Programming, Fifth Edition.
2. Hanumanth Ladwa (2021) Object Oriented Programming with C++.

CO-PO Mapping with Programme outcomes: Programming in C ++ Code: **22KP1PELP1:2**

| CO/PO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| *1* | 3 | - | - | 1 | - | - | - | - | - | - |
| *2* | 3 | 2 | - | - | - | 2 | - | - | - | - |
| *3* | 2 | 2 | - | 2 | - | - | - | - | - | - |
| *4* | 2 | - | - | 2 | - | - | - | - | - | - |
| *5* | 3 | 2 | - | - | - | 2 | - | - | - | - |

1 – Low, 2 – Moderate, 3 – High Correlation

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# SEMESTER-II

| SEM 2 | CC 5 | ELECTROMAGNETIC THEORY | 22KP2P05 | Ins. Hrs. 7 | Credit:5 |
|---|---|---|---|---|---|

**Course Objectives:** To introduce the basic mathematical concepts related to electromagnetic vector fields. To provide the basic skills required to understand, develop, and design various applications involving electromagnetic fields.

| CO | Statement |
|---|---|
| 1 | Recognize the basic mathematical concepts related to electric field and potential. |
| 2 | Articulate the principles of electrostatics to the solutions of problems relating to electric field, electric potential, boundary conditions and electric energy density. |
| 3 | Correlate the principles of magneto statics to the solutions of problems relating to the magnetic field, magnetic potential, boundary conditions and magnetic energy density. |
| 4 | Describe the concepts related to Maxwell's equations, energy in electromagnetic field and gauge transformation. |
| 5 | Apply Maxwell's equations to study the properties of plane waves in space and understand the theory behind total internal reflection. |

**Unit I: Electrostatics**

Electric charge density: Volume, surface and linear charge density - Coulomb's law – Electric Intensity – Electric Potential - Gauss's law – Poisson and Laplace equations - Application of Gauss's law: Field due to a straight uniformly charged wire - Multipole Expansion of a Charge Distribution – Dielectrics and its polarization - Electric displacement (D) – Dielectric constant – Polarizability - Electrostatic Energy.

**Unit II: Boundary Value Problems in Electrostatics:**

Boundary conditions - Method of separation of variables in Cartesian coordinates – Application: Parallel plate capacitor - Method of separation of variables in cylindrical coordinates – Application: cylindrical shell – Method of Images – Point charge near an infinite grounded conducting plane: Calculation of position and magnitude of image charge, calculation of field and Force between the plane and charge.

**Unit III: Magnetostatics**

Current density - Ampere's Force law - Biot-Savart law – Application: B due to a long straight wire- Ampere's circuital law – Application: B inside a long solenoid and B at a point on the axis of a toroid - Force on conductors and charges- Force between two parallel wires - Magnetic scalar potential - Magnetic vector potential - Magnetic susceptibility and permeability.

**Unit IV: Field equations and Conservation laws**

Equation of continuity - Displacement current – Maxwell's equations (Differential form) – Derivation of Maxwell's equation - Maxwell's equations in integral form - Energy in the electromagnetic field (Poynting's theorem) - Poynting vector - Electromagnetic Potentials - Maxwell's equation in terms of electromagnetic potentials - Gauge transformations (Concept of gauge) - Lorentz gauge.

**Unit V: Plane Electromagnetic Wave Propagation and Interaction with matter**

Electromagnetic waves in free space - Propagation of electromagnetic waves in isotropic dielectrics - Propagation of electromagnetic waves in anisotropic dielectrics - Boundary condition for the electromagnetic field vectors (B, E, D and H) - Reflection and refraction at the boundary of nonconducting media – Fresnel equation - Brewster's angle and degree of polarization - Total internal reflection.

**Unit VI: Flux Meter: Construction & Its Working (Only for CIA)**

Fluxmeter - Working Principle - Construction and working - Advantages and Disadvantages of Flux meter - Applications of Flux Meter.

https://www.watelectronics.com/flux-meter-construction-working/

**Textbooks**

1. K.K. Chopra and G.C. Agarwal, Electromagnetic Theory (K. Nath & Co., Meerut).
2. Gupta, Kumar, Singh (2019) Electrodynamics Pragati Prakashan, Meerut.
3. J.D. Jackson (1999) Classical Electrodynamics, 3rd edition, John-Wiley, New York.
4. Satyaprakash (2005) Electromagnetic Theory and Electrodynamics Kedarnath & Ramnath & Co Meerut.

**References**

D.J. Griffiths (2014) Introduction to Electrodynamics, 4th edition, Pearson, Essex.

CO - PO Mapping with Programme outcomes: **Electromagnetic theory**
**Code: 22KP2P05**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | - | - | - | - | - | - | - | - |
| CO2 | 2 | 3 | - | - | - | - | - | - | 2 | - |
| CO3 | 2 | 2 | - | - | - | 3 | - | - | - | - |
| CO4 | 2 | 2 | - | - | - | - | - | - | 2 | - |
| CO5 | - | 2 | - | 2 | - | 2 | - | - | - | - |

1 – Low, 2 – Moderate, 3 – High Correlation

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| SEM 2 | CC6 | QUANTUM MECHANICS | 22KP2P06 | Ins. Hrs. 7 | Credit: 5 |
|---|---|---|---|---|---|

**Course Objectives:** To gain basic knowledge on quantum mechanics and develop skills to solve simple physical systems. To introduce the ideas of relativistic quantum mechanics.

| CO | Statement |
|---|---|
| 1 | Acquire the conceptual knowledge in Quantum mechanics through the study of postulates and theorems. |
| 2 | Understand the techniques of operators, Eigen values and Eigen functions. |
| 3 | Identify the features of exactly solvable systems. |
| 4 | Analyze the differences and descriptions of micro physical world from macro physical world under different potentials and scaling. |
| 5 | To solve physical systems with different approximation techniques. |

**Unit I: Schrodinger Equation and General Formulation**

Postulates of quantum mechanics – Derivation of Schrodinger's wave equations– physical interpretation of wave function $\psi$ –Normalisation– expectation values – Ehrenfest theorem - Hermitian operator and its properties – uncertainty relation among operators.

**Unit II: Exactly Solvable Systems**

Particle in a box – degenerate and non-degenerate states - Linear harmonic oscillator – solving the one dimensional Schrodinger equation – abstract operator method – barrier penetration problem – rectangular barrier potential – rigid rotator.

**Unit III: Approximation methods**

Time independent perturbation theory – Non-degenerate case (first order perturbation) – Stark effect – first order stark effect of hydrogen atom – WKB approximation – application of WKB to tunnelling problem and quantization rules. Time dependent perturbation theory – harmonic perturbation – sudden approximation.

**Unit IV: Quantum theory of scattering**

The scattering cross section – scattering amplitude – Green's function approach – Born approximation and its application to square well potential – Rutherford scattering formula – partial wave analysis method – scattering in hard sphere.

**Unit V: Relativistic Quantum Mechanics**

Klein-Gordan equation for a free particle and its solution – Dirac equation for a free particle and Dirac matrices – plane wave solution – charge and current densities – negative energy states – spin of a Dirac particle – spin-orbit coupling.

**Unit VI: Quantum Technology (Only for CIA)**

Quantum computing (Qubits) , Quantum Sensors, Quantum imaging and Quantum metrology.

**Textbooks**


1. P.M. Mathews and K. Venkatesan, 1987,A text book of Quantum Mechanics, Tata McGraw Hill, New Delhi.
2. SatyaPrakash, 2013, Quantum Mechanics, PragatiPrakashan, Meerut.


**References**


1. V. Devanathan, 2005, Quantum Mechanics, Narosa Publishing House, New Delhi.
2. A.K. Ghatak and S. Loganathan, 2004, Quantum Mechanics theory and applications, Macmillan, Chennai.


CO-PO Mapping with Programme Outcomes: **Quantum Mechanics** **Code: 22KP2P06**

| CO/PO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 2 | - | 2 | - | - | - | - | - | - |
| 2 | 2 | - | - | - | - | 3 | - | - | - | - |
| 3 | - | - | - | - | - | 2 | - | 2 | 2 | - |
| 4 | - | 3 | - | - | - | - | 3 | - | - | 3 |
| 5 | 2 | - | - | - | - | 3 | - | - | - | 2 |

1 – Low, 2 – Moderate, 3 – High Correlation

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| SEM 2 | CC7 | CONDENSED MATTER PHYSICS | 22KP2P07 | Hours :6 | Credit:5 |
|---|---|---|---|---|---|

**Course Objectives:** To provide an extended knowledge of the principles and techniques of solid state physics. The course covers the Physical understanding of matter from an atomic view point, structure, thermal, electrical, magnetic and superconductivity properties of matter.

| CO | Statement |
|---|---|
| 1 | Acquire knowledge of the fundamental concept of crystals and describe the common structure |
| 2 | Articulate the knowledge of lattice vibrations, thermal properties and discuss the Einstein's and Debye's theory |
| 3 | Interpret the concepts of free electron theory and understand the Kronig penny model and band structure. |
| 4 | Elevate the para and ferro magnetism, pattern of domains and hysteresis |
| 5 | Understand the concepts of dielectric property and structure of superconducting materials and its applications |

**Unit I: Crystal Structure**

Basis and crystal structure- Unit cell – Primitive - Lattice cell- point group- Space group (information only) – Two, Three types of Bravais lattices - Miller indices – Interplanar Distance of lattice planes - common crystal structures : NaCl, CsCl, Zinc blende structure and diamond cubic structure - atomic scattering factor – geometrical structure – X-ray diffraction techniques – powder method.

**Unit II : Lattice Vibrations and Thermal Properties**

Vibration of crystals with mono atomic basis – First Brillouin Zone – Two atoms per primitive Basis – Quantization of Elastic waves – Phonons – Momentum of phonons – Inelastic scattering of neutrons by phonons – Lattice heat capacity - Einstein's Theory of specific Heats – – Debye Approximation - Debye's Model of lattice Specific Heat.

**Unit III: Free Electron Theory and Semiconductor Crystals**

Drude Lorentz free electron theory - Electrical Conductivity – Thermal Conductivity – Energy levels and density of states in one dimension – Motion in Magnetic Fields – Hall effect - Nearly Free Electron Model And Origin of the energy gap – Kronig Penny Model – Band Structure of Silicon and Germanium – Effective mass in semiconductors.

**Unit IV: Magnetic Properties of Solids**

Magnetic dipole moment – Quantum theory of Para Magnetism – Hund's rules – Adiabatic Demagnetisation -Paramagnetic susceptibility of conduction Electrons -

Ferromagnetic order – Temperature dependence of saturation magnetism – Ferromagnetic Domains – Origin of domains – Hysteresis and coercivity .

**Unit V: Dielectrics and Super Conductiviity**

Dielectric Polarization – Macroscopic Electric field - Local Field at an Atom –Clausius Mossotti Relation - Super conductivity – Meissner effect contradicts the Maxwell's equations – Type 1 and type II Superconductors - Thermodynamic effect –specific heat – A.C and D. C Josephson effect - BCS Theory – Cooper pair - London Equations - Application of Super conductors

**Unit VI: PRACTICUM (Only for CIA)**

i) Laue and powder Pattern analyses
ii) Determination of Hall Voltage and Calculation of Hall Co-efficient)

**Text Books**

1. C. Kittel, 2006, Introduction to Solid State Physics, 7th Edition, Wiley Eastern, New Delhi.
2. S. O. Pillai, 2014,Solid State Physics, Seventh Edition, New Age International, New Delhi,
3. J.P. Srivastava , 2006, Elements of Solid State Physics, Prentice-Hall of India.
4. Gupta & Kumar, 2014,Solid State Physics, , K.Nath & Co.Meerut.

**References**

1. N. W. Ashcrof and N. D. Mermin, 1976, Solid State Physics , Harcourt College Publishers, Philadelphia.
2. J. S. Blakemore,1985, Solid State Physics, Second Edition, Cambridge University Press, Cambridge, London.
3. A. J. Dekker, 2000, Solid State Physics, Published by Macmillan India.
4. T. P. Sheahen, 1994, Introduction to High-Temperature Superconductors, Plenum press, New York.
5.J. R. Christman 1988, Fundamentals of Solid State Physics, John Wiley & Sons, NY.

CO-PO Mapping with Programme Outcomes: **Condensed Matter Physics**

**Code: 22KP2P07**

| CO/PO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | | 3 | | | 3 | | 3 | | |
| 2 | | 3 | | | | 3 | | | 3 | 3 |
| 3 | | | | 3 | | 3 | | 3 | 3 | |
| 4 | 3 | | | | | 3 | | | 3 | |
| 5 | 3 | | | | 3 | | 3 | | | |

1 – Low, 2 – Moderate, 3 – High Correlation

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HOD

| SEM 2 | CC8(P) | PRACTICAL - II | 22KP2P08P | Ins.Hrs. 6 | Credit : 4 |
|---|---|---|---|---|---|

**Course Objectives:** To train the students to learn the techniques in Physics so that they can investigate various relevant aspects and be confident to handle sophisticated instruments.

| CO | Statement |
|---|---|
| 1 | Create knowledge in Experimental analysis and in design techniques. |
| 2 | Analyze the data to arrive at a valid conclusion and apply the computational thinking. |
| 3 | Express their skills with design consideration of Electronic circuits. |
| 4 | Integrate the strengths of the liberal arts tradition with the theoretical foundation to enter in to the research. |
| 5 | Determine the different laser parameters using the methods involved in Laser beam technique |

**Practical II**
**Select any Twelve experiments**

**General Experiments**

1.Determination of Young's Modulus, Rigidity Modulus and Poisson's ratio by Hyperbolic fringes method.

2. Rydberg's constant using Spectrometer.

3. Four probe method – Determination of resistivity

4. Determination of magnetic susceptibilityof solid by Guoy method.

5. Determination of compressibility of a liquid by Ultrasonic Interferometer.

6. Photoelectric effect – Detremination of Planck's constant

7. Determination of Thermal Conductivity by Forbe's method.

8. Specific rotation by Polarization

## Electronics Experiments

1. Characteristics of FET
2. Characteristics of UJT
3. Characteristics of SCR
4. Characteristics of LDR
5. FET oscillator.
6. Transistor Power amplifier
7. Relaxation oscillator using UJT
8. K- map simplification – implementation basic and universal gates by SOP & POS
9. Parity Checker
10. Encoder and Decoder
11. Characteristics of Op-amp,open loop, closed loop gain, input impedance,output impedance, CMRR
12. Constuct and study of Phase shift oscillator using Transistor.
13. Zener diode using Voltage regulator

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| SEM 2 | NME 1 | ASTRO PHYSICS | 22KP2PELO1 | Ins. Hrs.4 | Credit : 3 |
|---|---|---|---|---|---|

**Course Objectives:** Astro Physics seek to understand the Universe and our place in it. Main motto is to enhance the student's knowledge to discover how the Universe works, explore how it began and evolved, search for life on planets around other stars.

| COs | Statement |
|---|---|
| 1 | Acquire the knowledge on the elements of space dynamics, solar system with their small bodies, universe and its neighbors and life in universe. |
| 2 | Understand the basic concepts of space dynamics, solar system: structure, activity and its features etc. |
| 3 | Evaluate the great number of diverse phenomena in the Universe through Physics like origin and nature of universe |
| 4 | Apply the scientific thinking to the real world problems and qualitative analysis about the solar system and their members. |
| 5 | Understand and demonstrate the formation of solar and lunar eclipses. |

**Unit-I: Elements of Space Dynamics**

Man's quest for space – the energy requirements – Rocket propulsion –sub orbital flights – Artificial earth satellites – Lunar and planetary probes

**Unit-II: The Heart of the Solar System**

Vital statistics of the Sun – the solar photosphere – the Fraunhoffer lines –structure of solar atmosphere – the solar interior – Sunspots and solar activity – other features of the solar activity – Radio studies of the quiet Sun– Radio radiation of the distributed Sun.

**Unit-III: Small Bodies in the Solar System**

Asteroids – Meteorites – Comets as members of the Solar system – Physical Properties of comets – Origin and evolution of comets – Space studies of comets – Meteors – an inventory of satellites – the large satellites – Medium, small and tiny satellites – Planetary rings.

**Unit-IV: Our Home and the nearest neighbour**

Earth: Gross properties – internal structure – the terrestrial atmosphere –the Earth's magnetic field – motions – Solar terrestrial relations – the Earth in space – atmospheric circulation in the troposphere. MOON: Some basic facts – telescopic studies – internal structure – surface features – Origin of the Moon – the lunar environment – Solar and Lunar eclipses.

**Unit-V: Life in the Universe**

Nature of life on Earth – A survey of objects in the Solar System – Pre Mariner search for life on Mars – Post Mariner search for life on Mars – Life outside the Solar system – the search for life in the Universe.

**Unit VI: Practicum (Not for Semester Examination)**

**Skill development exercise**

(i) Calculate the frequency allocation of satellite channels

(ii) Method of finding Anti Satellite frequency band

**Text Books**


1. KD. Abhyankar; (1999): Astrophysics of the Solar System, University Press Pvt. Ltd. Hyderabad.

2. R.Murugeshan; (2007): Modern Physics, S.Chand & Company Ltd, Chennai.


**References**


1. Robert C Hymes; (1971): Introduction to Space Science, John Wiley & Sons, New Delhi.


CO-PO Mapping with Programme Outcomes: **Astro Physics** **Code:** 22KP2PELO1

| CO/PO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| *1* | - | 3 | - | - | - | 2 | - | - | - | - |
| *2* | - | - | - | - | - | - | - | - | - | - |
| *3* | | 3 | - | - | - | 2 | - | - | 3 | - |
| *4* | - | - | - | - | - | 2 | - | - | 3 | - |
| *5* | - | - | - | - | 3 | - | - | - | - | - |

1 – Low, 2 – Moderate, 3 – High Correlation

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| SEM 2 | ECC1 | LASER PHYSICS | 22KP2SSP1 | Ins. Hrs. - | Credit: 3 |
|---|---|---|---|---|---|

**Course Objectives:** To understand the basics of light in Physics and describe the concepts of lasers. To understand the types and applications of lasers in current technology.

| CO | Statement |
|---|---|
| 1 | Recall the basics of light and lasers in Physics. |
| 2 | Summarize the concepts of lasers. |
| 3 | Understand the principles of lasers. |
| 4 | Classify the types of lasers. |
| 5 | Interpret the applications of lasers in daily life. |

**Unit-I: Light**

Electromagnetic Spectrum- Light- Rectilinear propagation of light- Laws of Reflection and Refraction- Dispersion- Interference- Diffraction- Polarization- Scattering (Basic definitions only).

**Unit-II: LASER**

Introduction of Laser- Concept of Laser- Population Inversion- Condition for population Inversion- Interaction of light with materials- Stimulated absorption- Spontaneous emission- Stimulated emission- Difference between Spontaneous emission and Stimulated emission.

**Unit-III: Laser principle**

Introduction- Basic components of laser system- Active medium- Methods for pumping action-optical pumping- Electrical discharge- Direct conversion- Characteristics- High directionality- High Intensity- Highly monochromatic- Highly Coherent- Difference between ordinary light and laser light.

**Unit-IV: LASER Types**

Types of Laser: Ruby Laser- Helium-Neon Laser- $CO_2$ Laser- Semiconductor Laser- Nd: YAG Laser.

**Unit-V: Applications**

Lasers in medicine: surgery- ophthalmology- cancer treatment.

Lasers in Industries: cutting- welding- drilling.

Lasers in Holography: Hologram- recording and reconstruction of hologram.

**Unit-VI: Emerging Trends in LASER technology** (Only for CIA)

History of LASER technology- From Maser to Laser- Evoloution of laser- Laser in use today: Lasers in Fashion Industry- Lasers in Automotive industry- Lasers in Agriculture- Lasers in Household- Conclusion.

**Textbooks**


1. Brijlal and Subrahmanyam, (2004) A Text Book of Optics, S. Chand & Co., New Delhi.
2. Dr. P. Mani, 2014 Engineering Physics-I, Dhanam Publications,. Chennai.
3. M. N. Avadhanulu, 2008 An Introduction to LASERS Theory and Applications, S. Chand & Co., New Delh


**References**


1. A.K. Ghatak, 1984 Lasers theory and Applications, Rajiv Bery for Macmillan India Ltd., Chennai.
2. G. Vijayakumari, 2013, Engineering Physics, Vikas Publications, New Delhi.


CO-PO Mapping with Programme Outcomes: **Laser Physics** Code: **22KP2SSP1**

| CO/PO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| *1* | 3 | 3 | - | - | 3 | - | - | 3 | - | - |
| *2* | 3 | - | 3 | - | 3 | - | - | 3 | - | - |
| *3* | 3 | - | 3 | - | - | - | - | 3 | - | - |
| *4* | - | - | - | - | 1 | - | - | 3 | - | - |
| *5* | 3 | - | - | 3 | - | - | - | - | - | 3 |

1- Low 2- Moderate 3- High Correlation

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# SEMESTER-III

| SEM 3 | CC9 | SPECTROSCOPY | 22KP3P09 | Ins. Hrs. 7 | Credit: 6 |
|---|---|---|---|---|---|

**Course Objectives:** Familiarize with the basic principles of spectroscopy and their applications in the determination of atomic structure, chemical composition and physical properties of materials. To understand the basic experimental techniques of different types of spectroscopy.

| CO | Statement |
|---|---|
| 1 | Discuss the rotational spectra and vibrational spectra of molecules. |
| 2 | Describe the different types of spectroscopy for structural determination |
| 3 | Explain the principle and experimental techniques of IR, UV, Raman NMR, ESR and Mossbauer spectroscopy |
| 4 | Analyze and identify the spectroscopy of different molecules. |
| 5 | Develop skills on handling various types of spectrometer. |

**Unit I: Microwave spectroscopy**

Regions of the electromagnetic spectrum – Microwave spectroscopy – Rotation of molecules – Rotational spectra of rigid diatomic molecules – Spectrum of a Non-Rigid Rotator - Polyatomic molecules – rotational spectra of linear molecules - symmetric top molecules – Techniques and Instrumentation (microwave spectrometer).

**Unit II: Infra-Red spectroscopy and Raman spectroscopy**

IR Spectroscopy: Energy of a Diatomic molecule - Diatomic Vibrating Rotator – vibration rotation spectrum of carbon monoxide – Infra red spectrometer.

Raman Spectroscopy: Quantum theory of Raman effect – Pure rotational Raman spectra for linear molecules and symmetric top molecules – Vibrational Raman spectra – Raman spectrometer.

**Unit III: Electronic Spectroscopy of atoms and molecules**

The Shape of Atomic orbitals – Energies of atomic orbitals – Hydrogen atom spectra Electronic spectra of diatomic molecules –Born – Oppenheimer approximation – Intensity of Vibrational – Electronic Spectra - Frank-Condon Principle – Electronic spectra of polyatomic molecules – Re-emission of energy by an excited molecule – Photo electron spectrometer.

**Unit IV: Nuclear Magnetic Resonance Spectroscopy**

Magnetic properties of nuclei – Resonance condition –Bloch equation – Shielding and de-shielding effects – chemical shift – Relaxation processes - spin lattice and spin-spin relaxation time – coupling constants - NMR instrumentation – Limitations of NMR Spectroscopy.

**Unit V: ESR and Mossbauer Spectroscopy**

**ESR Spectroscopy:** Principle of ESR – Resonance conditions – Experimental study – ESR Spectrometer – ESR spectra of free radicals in solutions – $CH_3$ Radical – $C_6H_6$ - Benzene anion.

**Mossbauer Spectroscopy:** Recoilless emission and absorption – Mossbauer spectrometer – Isomer shift – Application of Mossbauer spectroscopy – electronic structure – molecular structure.

**Unit VI: Skill development exercise (Only for CIA)**

Identifying the molecular structure by of molecules byFTIR, UV and Raman spectroscopy.

**Textbooks**


1. C.N. Banwell (1981) Fundamentals of Molecular Spectroscopy,McGraw Hill, NewYork.
2. G. Aruldhas (2006) Molecular Structure and Spectroscopy,Prentice Hall, New Delhi.


**References**


1. Michael Hollas (2004) Modern Spectroscopy,Wiley India, New Delhi.
2. B.P. Straughan and S. Walker (1976) Spectroscopy Volumes I-III, Chapman and Hall, New York.


CO-PO Mapping with Programme outcomes: **Spectroscopy Code: 22KP3P09**

| CO/PO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| *1* | 2 | 2 | - | - | 3 | - | - | - | - | - |
| *2* | - | 3 | 2 | - | - | 2 | - | - | - | - |
| *3* | 3 | - | - | 2 | - | 3 | - | - | - | - |
| *4* | - | - | - | - | - | - | - | 2 | 2 | - |
| *5* | 2 | - | 3 | - | - | 3 | - | - | - | 3 |

1 – Low, 2 – Moderate, 3 – High Correlation

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HOD

| SEM 3 | CC10 | NUCLEAR AND PARTICLE PHYSICS | 22KP3P10 | Hours :7 | Credit:5 |
|---|---|---|---|---|---|

**Course Objectives:** To study the fundamentals of nucleus with deuteron system and explain the origin of nuclear forces. To illustrate different nuclear models that exposes the structure of nucleus. To explain the theories of various radioactive decays and nuclear reactions.

| CO | Statement |
|---|---|
| 1 | Articulate in-depth of nucleus to determine the energy and analyze the origin of nuclear forces |
| 2 | Acquire the knowledge of Decay and determine the age of minerals, examine the internal conversion of nucleus |
| 3 | Illustrate different nuclear models, Exposure of Stripping and Pick up reactions , Q value determination |
| 4 | Interpret the knowledge of Energy Released in Fission, nuclear design and the stellar energy estimation |
| 5 | Description of the elementary particle and understand the interaction of elementary particles |

**Unit 1: Nuclear Structure**

Nuclear size –mass –mass defect and Packing fraction- Nuclear binding energy curve and nuclear stability - semi empirical mass formula – Deutron – Ground state of Deutron – Experimental Data on low- energy n-p scattering – Determination of phase shift for low energy neutron- proton scattering – Meson theory of nuclear forces.

**Unit II: Radioactive Decay**

Radio Activity – law of Soddy Russell and Fajans – Ideal Equilibrium – Transient Equilibrium – Secular Equilibrium – Determination of age of minerals – Radio carbon dating.

Alpha decay and nuclear potential barrier – Geiger Nuttal law – Gamow's theory of alpha decay - Pauli's Neutrino Hypothesis – Fermi theory of beta decay – Absorption of Gamma rays by matter – Internal conversion .

**Unit III: Nuclear Model and Nuclear Reactions**

Conservation laws in nuclear reactions – Q value of a Reaction – Nuclear Reaction Cross Section - Theory of Stripping and Pick up reactions – Breit – Wigner Dispersion Formula. Liquid drop Model – Magic numbers – Shell Model – The Mayer – Jensen Shell Model.

**Unit IV: Nuclear Fission and Fusion**

Types of fission – Energy Released in Fission – Kinetic Energy Distribution of Fission Fragments – Neutron emission of fission – Bohr Wheeler's Theory of Nuclear Fission.

Four factor formula – General aspects of nuclear reactor design – Nuclear Fusion – The Plasma – Nuclear reactions in the plasma - Stellar Energy – Controlled Thermo Nuclear Fusion Reactions.

**Unit V : Elementary Particles**

Classification of Elementary Particles – Fundamental interactions among particles – Conservation of laws – Gellmann – Nishijima Relation – Time reversal – CPT Theorem – Quark Model – SU(3) Symmetry – Gellmann okubo mass formula – Quark Composition of mesons and baryons.

**Unit VI: Gamma rays (Only for CIA)**

1. A gamma ray scintillation spectrometer, using gamma rays of known energy, and use it to measure the energy of an "unknown" gamma ray.

2. To use positron annihilation radiation to determine the mass of the electron and to observe correlated gamma rays.

**Text Books**

1.D.C. Tayal, 2004,Nuclear Physics (Himalaya Publishing House, New Delhi)

2.D.N.Srivastava, Basic Nuclear Physics Pragati Prakashan., Meerut.

3.Satya Prakash, 2005, Nuclear Physics and Particle Physics Sultan Chand and Sons

**References**

1. M. L. Pandya & R.P.S. 1995, Yadav Elements of Nuclear Physics (Kedar Nath Ram Nath Delhi)

2. R. D. Evans: 1955,The Atomic nucleus, TMH publishing.
(E-book :https://archive.org/stream/atomicnucleus032805mbp#page/n366/mode/1up)

3. K. S. Krane, 1987, Introductory Nuclear Physics (John-Wiley, New York)

4. S. B. Patel, 1991,Nuclear Physics : An Introduction (Wiley-Eastern, New Delhi)

5. S.N. Ghoshal, Nuclear Physics (S. Chand & Company, New Delhi)

6. R.A. Serway and R.J. Beichner, 2000, Physics for Scientists and Engineers withModern Physics, 5th Ed. (Thomson Learning Inc.,)

7. A. Beiser, 1995 Concepts of Mordern Physics, 5th Ed. (McGraw-Hill)

CO-PO Mapping with Programme outcomes: **Nuclear and Particle physics**

**Code: 22KP3P10**

| CO/PO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| *1* | 3 | - | 3 | - | - | 2 | - | - | 3 | - |
| *2* | 3 | - | 3 | - | - | 3 | - | 3 | - | - |
| *3* | 3 | 3 | - | - | 2 | - | - | - | - | 2 |
| *4* | - | - | 3 | 3 | - | 2 | - | - | 3 | - |
| *5* | - | 3 | - | - | 2 | - | 2 | - | 3 | - |

1 – Low, 2 – Moderate, 3 – High Correlation

Staff In-charge

HOD

| SEM 3 | CC11(P) | PRACTICAL - III | 22KP3P11P | Ins.Hrs. 6 | Credit : 4 |
|---|---|---|---|---|---|

**Course Objectives:** To train the students to learn the techniques in Physics so that they can investigate various relevant aspects and be confident to handle sophisticated instruments.

| CO | Statement |
|---|---|
| 1 | Create knowledge in Experimental analysis and in design techniques. |
| 2 | Analyze the data to arrive at a valid conclusion and apply the computational thinking using C Programming |
| 3 | Express the skills, and design the Analog and Digital circuits |
| 4 | Integrate the strengths of the liberal arts tradition with the theoretical foundation to enter in to the research. |
| 5 | Determine and study the interface, arithmetic operation, waves using microprocessor |

## Practical III

1. Construction of dual power supply for IC experiment 0-5, 9-0-9v
2. Op-amp characteristics
3. Op-amp – Sign Changer, Differentiator, Integrator,
4. DIAC, TRIAC Characteristics
5. NAND and NOR as Universal gates
6. Half adder and Full adder using NAND gates
7. Half and Full Subtractor using NAND gates
8. Verification of De Morgan's theorem using NAND gates and simplification of Boolean expressions
9. Multiplexer
10. Demultiplexer
11. Microprocessor- Arithmetic Operation
12. Microprocessor- Largest, Smallest
13. Microprocessor - Ascending , Descending
14. Microprocessor – Conversion from decimal to to octal, hexa decimal system
15. Microprocessor – Conversion from octal, hexa to decimal system

16. Microprocessor – Display of Character and Words
17. Microprocessor – Generation of sine waves
18. C – Programming - Ascending and Descending Order
19. Solving equations by Newton-Raphson method
20. Solving equations by Successive Approximation Method
21. Solution of simultaneous linear algebraic equations by Gauss elimination method
22.Interpolation and Extrapolation of data using Lagrange and Newton method
23. Numerical Integration by trapezoidal method
24. Numerical differentiation by Runge Kutta method (II) method
25. Numerical - Quadratic equation.

Staff In-charge

HOD

| SEM 3 | MBE2 | COMMUNICATION ELECTRONICS | 22KP3PELP2:1 | Ins.Hrs.6 | Credit : 4 |
|---|---|---|---|---|---|

**Course Objectives:** To understand and the basic concepts of the circuits in radio communications, be able to interpret and analyze the characteristics of the main components of communication electronics.

| CO | Statement |
|---|---|
| 1 | Create knowledge in microwave analysis and design techniques. |
| 2 | Apply knowledge of Mathematics, science and Engineering fundamentals to the Solution of complex engineering problems in electronic circuits and communication system. |
| 3 | Express their skills with design consideration of fibre optics system. |
| 4 | Integrate the strengths of the liberal arts tradition with the theoretical foundation to enter in to the research. |
| 5 | Acquire knowledge in broadband using fibre optic cables |

**Unit I: Transmission Systems and Antennas**

Transmission System – Signal – Transmission – Antenna – Directions of an Antenna - Non resonant antenna – loop antenna – Radiation fields - Working of the Radiation field - Polarization – Linear Polarization - Circular Polarization - Isotropic Radiator – Power gain.

Effective parameters of an antenna – Effective area of an antenna – Effective length of an antenna – Dipole antenna -Dipole arrayed antenna – Advantages of Dipole array antenna - VHF,UHF - Microwave antennas – Thin linear antenna.

**Unit – II: Fiber Structure and Properties**

Optical Fibre - Fiber structure – Optic Cable – Total reflection in a Fibre – Parameters of the Optical Fibres – Numerical aperture - Fiber materials – Fiber fabrication – Mechanical properties of fibres – Attenuation – Single distortion in optical waveguides : Intermodal dispersion – Material dispersion – Waveguide dispersion – Group Delay : Intermodal delay dispersion - mode coupling.

**Unit – III: Satellite Communications**

Satellite Communication – Elements of Satellite Communication – Types of Satellites - Ground station – Antenna angle of elevation and transmission path – Height of Geostation orbits: Problems – Satellite works – Frequency allocation - polarization –Anti satellite Frequency band - Various blocks of equipment about the satellite – Block Diagram of network control station (NCS).

**Unit –IV: Cellular Communications**

Basic ideas of Cellular network – Operational principles of WDM – the 2*2 fiber Coupler – Fiber grating filters – Erbium Doped Fiber Amplifiers – Application mechanism – EDFA architecture – Performance of WDM+EDFA system – Link Bandwidth – Optical power requirements for a specific BER – Cross talk – Optical CDMA – Interconnecting telephone traffic between remote stations.

**Unit –V: Microwaves and Colour Television Microwave Generation and Applications**

Klystron – Magnetron – Microwave propagation through wave guides – Crystal detection – measurement of SWR – Transmitters and receivers.

**Colour Television**

Introduction – Perception – Three colour theory – Luminescence – TV camera – Image Orthicon – Vidicon – LCD Colour Television

**Unit – VI: Fibre Optics Technology (Only for CIA)**

Designing: Optical couplers – Optical switches – Fibre optic cables: internet and bandwidth

**Text Books**


1. G. Kennedy, Tata McGraw; (1995): Electronic communication system, Hill, New Delhi
2. D.Roddy and Coolen; (2005): Electronics communication, Prentice, Hall Ltd, New Delhi


**References**


1. M.Schwaiirts, W.R Bannet; (1996) : Communication systems and techniques, Hill-, New Delhi
2. S.D. Personick; (2007): Fiber optics technology and applications, Khanna publishers, New Delhi.
3. J.Millman & C.Halkias Tata; (2001): Electronic devices and circuits, McGraw Hill, New Delhi.


**Source**

https://scihub.wikicn.top/

CO-PO Mapping with Programme Outcomes: **Communication Electronics**
**Code: 22KP3PELP2:1**

| CO/PO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| *1* | 3 | 2 | 2 | 1 | 1 | - | 1 | 2 | 3 | - |
| *2* | 1 | 3 | 1 | - | | - | 1 | - | - | 3 |
| *3* | 1 | 3 | 3 | - | - | 1 | 1 | 1 | - | 3 |
| *4* | 1 | 2 | - | - | 3 | - | 1 | - | - | - |
| *5* | 3 | 2 | 2 | - | - | - | 1 | - | - | 2 |

1 – Low, 2 – Moderate, 3 – High Correlation

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| SEM 3 | MBE 2 | PHYSICS FOR COMPETITIVE EXAMINATIONS | 22KP3PELP2:2 | Ins. Hrs. 6 | Credit: 4 |
|---|---|---|---|---|---|

**Course Objectives:** To understand basic principles and laws in thermodynamics, nuclear physics, mathematical physics, electronics and molecular physics. To analyse, understand and solve the physics problems in competitive exams like NET/SLET and CSIR-JRF.

| CO | Statement |
|---|---|
| 1 | Development of essential mathematical skills to solve problems arising in various branches of physics |
| 2 | Interpretimportance of ,the laws of thermodynamics thermodynamic potentials and differentiate classical statistics and quantum statistics. |
| 3 | Acquire knowledge about analog and digital electronic devices and circuits. |
| 4 | Perceive the basics of atomic physics understand the physics behind molecular spectroscopy. |
| 5 | Articulate in-depth of nucleus, Understand the reaction of fission and fusion, Estimate the steller energy. |

**Unit – I: Mathematical Physics**

Functions of complex variables – Differentiability - Cauchy-Riemann Conditions - Complex Integration - Cauchy's integral theorem - Cauchy integral formula - Taylor's series. Gamma functions - Beta functions – Transformation of Gamma functions – Different forms of Beta functions – Proofs of Beta function - Relation between Beta and Gamma Function – Properties of Beta Function - Properties of Gamma Function

**Unit – II: Thermodynamic and Statistical Physics**

Laws of thermodynamics - Thermodynamic potentials – Maxwell relations – Phase equilibria – Phase space – Micro and Macro states – Micro canonical, Canonical and Grand canonical ensembles – Partition functions – Free energy – Classical and quantum statistics - Black body radiation and Planck's distribution law.

**Unit – III: Electronics and Experimental Methods**

Semiconductor devices – diodes – transistors – field effect devices – homo – hetero junction devices – device structure – device characteristics – opto electronic devices – solar cells – photo detectors – LEDs – operational amplifiers and their applications – Digital techniques and applications – registers – counter – comparators – A/D and D/A converters – Data interpretation and analysis – precision and accuracy – error analysis.

**Unit - IV: Atomic and Molecular Physics**

Quantum states of an electron in an atom –electron spin – spectrum of helium and alkali atom – LS & JJ couplings – Zeeman, Paschen-Bach & Stark effect – Electron spin resonance – Nuclear magnetic resonance – chemical shift – Electronic, rotational, vibrational and Raman spectra of diatomic molecules, selection rules.

**Unit – V: Nuclear and Particle Physics**

Nuclear Size, and charge distribution - binding energy - nuclear stability- Nuclear Liquid drop Model - Theories of alpha and beta decay, types of nuclear reactions -Types of fission – Energy Released in Fission Nuclear – The fusion - Stellar Energy- Classification of Elementary particles and their quantum numbers - Quark model- Quark Composition of mesons and baryons.

**Unit VI: Practicuum (Only for CIA)**

Logical and Analytical thinking for Physics problems.

**Textbooks**


1. H.K. Dass; (2008): Mathematical Physics, S. Chand, New Delhi.
2. A. Singaravelu; (2009) :Engineering Mathematics I , Meenakshi Agency, Chennai
3. V. K Mehta & Rohit Mehta (2019) Principles of Electronics, S. Chand & Co.
4. C.N. Banwell, (1981) Fundamentals of Molecular Spectroscopy, McGraw Hill, NewYork.


**References**


1. L.A. Pipes and L.R. Harvill (2009), Applied Mathematics for Engineering and Physicists, Khanna publishers, New Delhi.
2. V. Vijayendran, (2010) Introduction to Integrated Electronics (Digital & Analog), S.Viswanathan, PVT. LTD


CO-PO Mapping with Programme outcomes: **Physics for Competitive Examinations, Code: 22KP3PELP2:2**

| CO/PO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| *1* | - | - | - | - | - | - | - | - | - | - |
| *2* | 2 | 1 | - | 2 | - | | - | - | - | - |
| *3* | 3 | - | 3 | - | - | - | | 3 | - | - |
| *4* | - | 3 | - | - | 2 | - | - | - | - | - |
| *5* | - | - | - | - | - | - | - | - | - | - |

1 – Low, 2 – Moderate, 3 – High Correlation

Staff In-charge HOD

| SEM 3 | NME 2 | ULTRASONICS | 22KP3PELO2 | Ins. Hrs. 4 | Credit: 3 |
|---|---|---|---|---|---|

**Course Objectives:** To learn the basic concepts of ultrasonic waves and to acquire the knowledge on the applications of ultrasonic waves in various fields.

| CO | Statement |
|---|---|
| 1 | Acquire the knowledge of ultrasound and study its properties. |
| 2 | Understand the concepts of transducer and explain its working. |
| 3 | Identify the different measurement techniques of ultrasound. |
| 4 | Discuss the applications of ultrasound in various fields. |
| 5 | Justify the Non destructive Testing (NDT) by ultrasound. |

**Unit I:Fundamentals of Ultrasound**

Introduction – Classification of sound waves – different modes of ultrasonic waves – Compressional – Shear – Rayleigh – Lamb waves – Characteristic properties of ultrasonic waves – velocity – specific acoustic impedance – acoustic intensity and pressure.

**Unit II: Ultrasonic Transducers**

Different types of sources of ultrasound – Mechanical method – Electrostatic method – Magnetostrictivemethod – Piezoelectric method.

**Unit III: Measurement Techniques of Ultrasound**

Detection of Ultrasonic waves – Optical method – Electrical method – Pulse echo overlap method – Resonance ultrasound spectroscopy .

**Unit IV: Applications of Ultrasound – General and Advanced**

Classification of Ultrasonic Applications – Welding – Cleaning – Food industry – Sensor for temperature and pressure measurements – Echo sounder – Length meters – Level meters.

**Unit V: Ultrasonic Non-Destructive Testing**

Advantages of NDT – Classification of Non-Destructive Testing – ultrasonic testing – Classification of ultrasonic testing – Pulse echo – Flaw Detector – Different types of scan – A-scan, B-scan, C-scan.

**Unit VI : Underwater Acoustics (Not for Semester Exam)**

Ocean Parameters – Oceanographic instruments – Classification – Acoustic Exploration for Mining.

Textbooks

1. Baldev Raj, Rajendran V, Palanichamy P, (2009), *Science and Technology of Ultrasonics*, Second edition, Narosa Publishing House Pvt Ltd, New Delhi,.

References

1. Dale Ensminger and Leonard J. Bond, (1988), Ultrasonics: Fundamentals, Technologies and Applications, Third Edition, CRC Press.

CO-PO Mapping with Programme Outcomes: **Ultrasonics** **Code:** 22KP3PELO2

| CO/PO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| *1* | 3 | - | - | - | - | - | - | - | - | - |
| *2* | - | 3 | - | - | - | 2 | - | - | - | - |
| *3* | - | - | 3 | - | - | - | 2 | - | - | - |
| *4* | 3 | - | - | - | - | - | - | - | 3 | - |
| *5* | - | - | 2 | - | - | - | - | - | - | 3 |

1 – Low, 2 – Moderate, 3 – High Correlation

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| SEM 3 | ECC3 | SOLAR ENERGY | 22KP3SSP2 | Ins.Hrs. | Credit:3 |
|---|---|---|---|---|---|

**Course Objective:** To introduce the awareness of non- conventional energy. To make the students to understand the present day crisis of need for conserving energy and alternative are provided

| CO | STATEMENT |
|---|---|
| 1 | Describe the layers of the sun. Demonstrate knowledge of the electromagnetic spectrum. |
| 2 | Illustrate the impacts on non-conventional energy. |
| 3 | Applying knowledge of fabricate solar cells for energy storage purpose |
| 4 | Explain the principles that underlie the ability of various nature phenomena to deliver solar energy |
| 5 | Understand the solar energy utilization, discuss the basics of solar cooking. |

**Unit - I: Structure of Sun**

Thermonuclear reactions- Structure of Sun- Solar Constant- Electromagnetic Spectrum- Beam and diffuse radiations- Basic Earth Sun angles- Determination of Solar time.

**Unit - II: Impacts of non-conventional energy**

Conservation of energy - energy crisis and possible solutions -Patterns of energy consumptions: domestic sector, agricultural sector - Conservation principles: domestic sector, Agricultural sector - Energy Alternatives - impact due to non-conventional energy sources.

**Unit- III :Photo Voltaic Power**

Photo Voltaic generation - Merits and demerits - Solar Cell- Types of Solar Cells- Applications of Solar Cells.

**Unit - IV: Renewable energy sources**

Bio mass- Photo synthesis- wind energy- ocean thermal energy- open cycle and closed cycle- tidal energy- geothermal energy (basic ideas only).

**Unit- V: Applications of Solar Energy Utilization**

1) Crop Drier
2) Solar Cooker
3) Solar Distillation(Solar Stills)
4) Solar Green House

**Unit - VI: Current contour (Only for CIA)**

1.PV panels 2.Solar batteries and storage 3.Solar cars and electric vehicles 4.Solar roofs and roads

**Textbooks**

1. Solar Energy utilization - G. D. Rai.(Khanna Publishers 2012)
2. Solar Energy- S.P.Sukhatme (TMH 1999)
3. Energy Physics -K.Karuppannan , N.Suganthi(Priya Publications,Karur

**References**

1. Solar Energy utilization - G. D. Rai.(Khanna Publishers 2012)
2. Solar Energy- S.P.Sukhatme (TMH 1999)

CO-PO Mapping with Programme Outcomes **SOLAR ENERGY Code: 22KP3SSP2**

| CO/PO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| *1* | 3 | 3 | 1 | | | | | | | |
| *2* | 3 | 3 | 3 | | | | | | | |
| *3* | 3 | 1 | 3 | 1 | | | | | | 1 |
| *4* | 3 | 1 | 1 | | | | | 1 | | |
| *5* | 3 | 3 | 3 | 1 | | | | 1 | | |

1 – Low, 2 – Moderate, 3 – High Correlation

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HOD

# SEMESTER-IV

| SEM 4 | CC12 | NANO PHYSICS | 22KP4P12 | Hours :6 | Credit:4 |
|---|---|---|---|---|---|

**Course Objectives:** This course is designed to introduce the fundamentals of nanoscale systems. To introduce various synthesis methods, characterization and applications of nanomaterials.

| CO | Statement |
|---|---|
| 1 | Classification of materials and elevate the Different methods of fabrication. |
| 2 | Gain the knowledge of Nanoparticles, interpret the data of Nanostructures, DNA Double wire |
| 3 | Articulate in depth knowledge of nanofluids and nano biosensor and to rectify the problems in cooling |
| 4 | Interpret the characterization techniques of nano particles in different methods |
| 5 | Discuss the applications and to evaluate its impact on Defence, Medical and agriculture |

**Unit I: Nano Scale & Synthesis Rout**

Classification of materials (0D,1D, 2D Dimensions) - Top down Techniques: nanolithography - Combution synthesis- bottom Up approaches: Sputter deposition process- Sol-Gel synthesis

Quantum wire - Quantum dots - Exciton Confinement in Quantum Dots - Quantum well – Quantum Mechanics of Confined Nanoclusters - Microemulsion based Method for Nanomaterials – Solvothermal Synthesis – Magnetic nano materials.

**Unit II: Nano Materials**

Small Carbon clusters – Discovery of $C_{60}$ – Structure of $C_{60}$ - Superconductivity in $C_{60}$. Carbon Nano Tubes –Fabrication - Structure – Electrical , vibrational, mechanucal properties – Fuel cells - Biological materials – Sizes of Building Blocks and Nanostructures - Anisotropic Nanoparticles- Gold Silver Nano rods

**Unit III: Nano Fluids and Nano Biosensor**

Challenges in cooling Technology – Thermal conductivity Enhancement in Nano Fluids – Advantages in NanoFluids – Less Pumping power – Stability – Less clogging – Applications of Nanofluids- Biosensor – Types of Nano sensors – Nano nose – Nano sized optical Biosensors

**Unit IV:Characterization Techniques**

Fourier Transform Infrared Spectroscopy (FTIR) - X-RAY Powder Diffraction Method (XRD) - Scanning Electron Microscopy (SEM) - Energy Dispersive x-ray Spectroscopy (EDAX) - Transmission Electron Microscopy (TEM) - X-ray Photoelectron Spectroscopy (XPS) - Vibration Sample Magnetometer (VSM).

**Unit V:Applications**

Defence and Security- Nano tribology – Head Disk Capacity – Micro Electro Mechanical Systems (MEMS) – Nanobiology – Therapeutic applications – Polymers- Diagnostic Applications –Gold nano Particle for Imaging – Nanotechnology in Agriculture and Food – Industrial applications of nanotechnology

**Unit - 6. Practicum (Only for CIA)**

1.Synthesis of Au, Ag and CdS nanoparticles for studying the size induced optical properties

2. Analysis of powder XRD pattern of nanoparticles - index, calculation of size, lattice parameters

**Text Books**

1.Charles P. Poole, Jr. and Frank J. Owens, 2007,Introduction to Nanotechnology (John Wiley & Sons)

2.T.Pradeep, Nanoscience And Nanotechnology, McGraw Hill Education,Chennai

3.T.Pradeep, Nanotechnology The Essential, McGraw Hill Education,Chennai

4. K.K. Chattopadhyay and A. N. Banerjee, 2009,Introduction to Nanoscience and Technology (PHI Learning Private Limited)

5.S,Shanmugam, Nanotechnology, MJP Publishers, Chennai.

**References**

1. Sulabha K. Kulkarni, 2011, Nanotechnology: Principles & Practices (Wiley, Capital Publishing Company, Third Edition)

2. Bharat Bhushan, 2004,Springer Handbook of Nanotechnology (Spinger-Verlag Berlin Heidelberg, New York)

3. Guozhong Cao and Ying Wang, 2011, Nanostructures and Nanomaterials: Synthesis, Properties, and Applications, Volume 2 (World Scientific Publishing Co. Pte. Ltd)

4.John H. Davies, The principles of low-dimensional semiconductors an introduction.

CO-PO Mapping with Programme outcomes: **Nanophysics Code: 22KP4P12**

| CO/PO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 2 | - | - | 3 | - | - | - | 3 | - |
| 2 | - | - | - | 3 | 3 | - | - | 3 | - | - |
| 3 | - | - | 3 | - | 3 | 3 | - | - | 3 | - |
| 4 | 3 | 3 | - | - | - | 3 | - | - | - | - |
| 5 | - | 3 | - | 3 | 3 | - | - | - | 3 | - |

1 – Low, 2 – Moderate, 3 – High Correlation

Staff In-charge

HOD

| SEM 4 | CC13 | CRYSTAL GROWTH AND THIN FILM PHYSICS | 22KP4P13 | Ins. Hrs. 6 | Credit: 4 |
|---|---|---|---|---|---|

**Course Objectives:** To understand the theoretical concepts involved in Crystal Growth and thin film sciences and to learn the basic characterizing techniques of materials.

| CO | Statement |
|---|---|
| 1 | Gain knowledge on the theories of nucleation of crystals, understand their mechanisms and differentiate the types of nucleation. |
| 2 | Understand the growth of single crystals by melt techniques. |
| 3 | Analyze the properties and characteristics of crystals by different solution growth techniques. |
| 4 | Describe the relation between deposition technique, film structure, and film properties. |
| 5 | Learn the construction and working of different equipment to study the characterization of thin films. |

**Unit I: Basic Concepts, Nucleation and Kinetics of Growth**

Significance of single crystals – Crystal growth techniques - Nucleation – Classical theory of nucleation – Gibbs Thomson equation for solution – energy of formation of a nucleus – Spherical nucleus – Cylindrical nucleus – Kinetics of crystal growth – Various steps in crystal growth processes.

**Unit II: Crystal Growth from Melt**

Different techniques in melt growth – Bridgman technique – Container selection – Crystal pulling – Equilibrium – Phase transformation – advantages – disadvantages – Growth of lithium niobate and lithium tantalate crystals – liquid encapsulated czochralski technique – growth of GaAs.

**Unit III: Crystal Growth from Solution**

Low temperature solution growth – Solution, solubility and supersolubility – Expression for supersaturation – Methods of crystallizaiton – slow cooling method – solvent evaporation – temperature gradient method – crystal growth system – growth of potassium dihydrogen phosphate – High temperature solution growth – Principles of flux growth – Choice of flux – preparation of growth solution - growth of potassium titanyl phosphate.

**Unit IV: Basics of thin film and deposition techniques**

Thin film - Advantages of thin film devices over their bulk counterparts - Film growth stages - Nucleation stage - Island structure stage - Coalescence stage - Channel stage and continuous film stage - Applications of thin film.

Physical deposition methods - Vacuum evaporation - Thermal evaporation – Electron beam evaporation - Pulsed laser deposition - Chemical deposition methods - Chemical vapour deposition- Spray pyrolysis – SILAR method.

**Unit V: Characterization of Thin Films**

**Thickness measurement:** Weight gain method - Surface profilometer. **Structural properties:** Principle of X-ray powder diffraction - Instrumentation details and working of X-ray diffractometer. **Electrical properties:** Electrical resistivity - Sheet resistance – Mobility - Carrier concentration – Resistivity - Four point probe method - Hall probe method. **Optical properties:** UV-vis-NIR double beam spectrophotometer - Transmission and absorption spectra of thin films - Optical band gap - Absorption co-efficient.

**Unit - 6. Practicum (Only for CIA)**

Non-linear optical crystals - Thin film sensors.

**Text Books**


1. P. Santhanaragavanand P. Ramasamy, 2001, Crystal Growth Process andMethods, KRU Publications, Kumbakonam.
2. K. Ravichandran, K. Swaminathan, B. Sakthivel, 2013, Introduction to Thinfilm, Research India Publication, New Delhi.
3. C. Bricc, 1986,Crystal Growth Process, John Wiley, New York.


**Books for reference**


1. K. L.Chopra, 1979, Thin film phenomena, Robert E. Krieger Publishing company.


CO-PO Mapping with Programme outcomes: **Crystal Growth and Thin Film Physics**
**Code: 22KP4P13**

| CO/PO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| *1* | 3 | 3 | - | - | 3 | - | - | - | - | - |
| *2* | - | 2 | - | - | - | - | 3 | - | - | - |
| *3* | 3 | - | - | - | - | - | - | - | 3 | 2 |
| *4* | 3 | - | - | 3 | - | - | - | - | - | - |
| *5* | 3 | 1 | - | - | - | 2 | - | - | - | - |

1 – Low, 2 – Moderate, 3 – High Correlation

Staff In-charge

HOD

4-5

| SEM 4 | CC14(P) | PRACTICAL - IV | 22KP4P14P | Ins.Hrs. 6 | Credit : 4 |
|---|---|---|---|---|---|

**Course Objectives:** To train the students to learn the techniques in Physics so that they can investigate various relevant aspects and be confident to handle sophisticated instruments.

| CO | Statement |
|---|---|
| 1 | Create knowledge in Experimental analysis and in design techniques. |
| 2 | Analyze the data to arrive at a valid conclusion and apply the computational thinking using C Programming |
| 3 | Express the skills, and design the Analog and Digital circuits |
| 4 | Integrate the strengths of the liberal arts tradition with the theoretical foundation to enter in to the research. |
| 5 | Determine and study the interface, arithmetic operation, waves using microprocessor |

**Practical IV**

1. Construction of Schmitt trigger
2. Op-amp – sign wave – wien's oscillator
3. OP-amp- Low pass filter, High pass filter
4 .Op- amp- Clipping and Clamping circuits
5.Op- amp – Wave Generator- square, ramp wave generator
6. OP-amp – All pass filter
7. Study of Flip-Flops
8. One bit digital Compartor using EXOR and NAND gates
9.Digital Comparator- 4 Bit using ICs
10.Study of counter( 0-9) using IC 7447 AND IC 7490
11.Study of (0-99) counter (IC 7490)
10.Asynchronous Counter - up Counter and Down Counter
12.D/A conversion R-2R and weighted resistor method
13.Frequency divider using IC 555
14. Microprocessor – 16-bit arithmetic operation
15. Microprocessor – Control of Stepper Motor
16.Microprocessor – Study of ADC interfacing

16.Microprocessor – Study of ADC interfacing
17.Microprocessor – Study of DAC interfacing
18. Microprocessor – Generation of square and triangular wave
19. Microprocessor – Saw tooth and stair-case waves
20. Microprocessor – Study of 8-digit 7-segment display
21. Microprocessor – Traffic control system
22. Microcontroller – Addition and subtraction
23. Microcontroller – Multiplication and division
24. Interpolation and Extrapolation of data using Least Square Curve Fitting
25. Numerical differentiation by Runge Kutta method (IV) method
26. Solving the Matrix mulplication.
27.Solution of simultaneous linear algebraic equations by Gauss- Seidal method.
28.Numerical differentiation by Euler method.
29.Numerical Integration by Simpson method.

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| SEM 4 | MBE 3 | NUMERICAL AND COMPUTATIONAL PHYSICS | 22KP4PELP3:1 | Ins.Hrs.6 | Credit : 4 |
|---|---|---|---|---|---|

**Course Objectives:** The course is designed to enable students of various computational methods and also to identify the suitable iteration method that will lead to an accurate result in a short time. Students are trained to write programs in C language effectively.

| CO | Statement |
|---|---|
| 1 | Identify modern programming methods and describe the extent and limitations of computational methods in physics. |
| 2 | Calculate the numerical differentiation and integration whenever and wherever routine is not applicable. |
| 3 | Understand and apply numerical methods to find out solution of algebraic equation using different methods under different conditions, and numerical solution of system of algebraic equation. |
| 4 | Process, analyse and plot data from a variety of physical phenomena and interpret their meaning |
| 5 | Apply various interpolation methods and finite difference concepts. |

**Unit – I: Curve Fitting and solution of algebraic and transcendental equation**

Principle of least Square method: Fitting a straight line - Fitting a parabola – Fitting a exponential curve: $ae^{bx}$ , $be^{ax}$

Bisection method – successive approximation – Newton Raphson method –convergence of Newton Raphson method and geometrical interpolation.

**Unit – II: Numerical Integration and Differentiation**

Newton Forward difference formula - Newton backward difference formula -Trapezoidal rule – Simpson rule – Extended Simpson's rule – Simpson's 1/3 rule – Simpson's 3/8 rule – Application of Simpson's rule.

**Unit – III: Numerical solution of ordinary differential equation**

Solution by Taylor series - Euler's method - Runge Kutta method: First order and second order equation.

**Unit – IV: C Programming**

Constants and variables – I/O operators and statements – Header files – Main function – Conditional statements – Switch statement – Void function – Function programmer – Loops: for, while and do while statements – Arrays – Break, continue and goto statements.

**Unit – V: Programme, algorithm and flowchart in C**

Programme – Straight line, Parabola, Simpson rule, Trapezoidal rule, Euler's and Runge Kutta method.

**Unit – VI: Mat lab Graphics (only for CIA)**

2D Plots- Planar Plots, Log Plots, Scatter Plots, Graph of a Function–Titles, Labels, Text in Graph: Line Types ,Marker types.

**Text books**


1. Venkatraman. M.K; (1970): Numerical Methods in Science and Engineering, National Publishing Company, Chennai.

2. A. Singaravelu; (2012): Numerical Methods, Meenakshi Agency, New Delhi

3. S.S. Shastra; (1977): introductory methods of Numerical Analysis, Prentice, Hall Ltd, New Delhi


**References**


1. E. Balagurusamy; (2000): Programming in C, Tata MCGraw Hill Pub. Co., New Delhi

2. K. R. Venugopal and R.P Sudep; (1999): Programming with C, Tata McGraw Hill Pub. Co., New Delhi


CO-PO Mapping with Programme Outcomes: **Numerical and Computational** Physics

**Code: 22KP4PELP3:1**

| CO/PO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| *1* | 1 | 2 | - | - | - | 2 | - | - | 2 | - |
| *2* | 3 | 3 | | 1 | | - | - | - | - | - |
| *3* | 3 | 3 | - | - | - | 1 | - | - | - | - |
| *4* | 3 | 3 | - | - | - | - | - | - | 1 | - |
| *5* | - | - | - | - | - | 1 | 3 | - | 3 | - |

1 – Low, 2 – Moderate, 3 – High Correlation

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| SEM 4 | MBE3 | MEDICAL PHYSICS | 22KP4PELP3:2 | Ins.Hrs.6 | Credit : 4 |
|---|---|---|---|---|---|

**Course Objectives:** The objective of the course is to understand the major application of physics to Medicine. Acquiring knowledge of forces, pressure and the importance of temperature in human body and uunderstand how electric signals generate in human body and the working of EMG and ECG.

| COs | Statements |
|---|---|
| 1 | Apply knowledge of forces, pressure and the importance of temperature in human body. |
| 2 | Illustrate the application of sound and light in Medicine and medical imaging. |
| 3 | Express how the electric signals generate in human body and the working of EMG and ECG |
| 4 | Integrate the use of X – rays and radioactivity for diagnosis and treatment. |
| 5 | Understand the physics principles involved in respiration and cardiovascular system. |

**Unit I: Mechanics of Human Body**

Static, Dynamic and Frictional forces in the Body – Composition, properties and functions of Bone – Heat and Temperature – Temperature scales – Clinical thermometer – Thermography – Heat therapy – Cryogenics in medicine – Heat losses from Body – Pressure in the Body – Pressure in skull, Eye and Urinary Bladder.

**Unit II: Physics of Respiratory and Cardiovascular System.**

Body as a machine – Airways – Blood and Lungs Interactions-Measurement of Lung volume –Structure and Physics of Alveoli – Breathing mechanism – Airway resistance – Components and functions of Cardiovascular systems –work done by Heart – Components and flow of Blood – Laminar and Turbulent flow – blood Pressure: direct and indirect method of measuring –Heart sounds.

**Unit III: Electricity in the Body**

Nervous system and Neuron – Electrical potentials of Nerves-Electric signals from Muscles, Eye and Heart – Block diagram and working to record EMG - Normal ECG wave form – Electrodes for ECG – Amplifier and Recording device – Block diagram and working to record ECG – Patient monitoring – Pace maker.

**Unit IV: Sound and Light in Medicine**

General properties of sound – Stethoscope - Generation, detection and characteristics of Ultrasound –Ultrasound imaging technique – A scan and B scan methods of ultrasound imaging – properties of light – Applications of visible UV, IR light, and Lasers in medicine – Microscope – Eye as an optical system – Elements of the Eye – Ophthalmology Instruments.

**Unit V : Diagnostic X-Rays and Nuclear Medicine**

Production and properties of X-rays – Basic Diagnostic X-ray Machine – X-ray image – Live X-ray image – X-ray computed Tomography – Characteristics of Radio activity – Radioisotopes and Radio nuclides – Radioactivity sources for Nuclear medicine – Basic Instrumentation and clinical applications – Principles of Radiation Therapy – Nuclear medicine imaging devices – Radiation sources

**Unit VI: Diseases (Only for CIA)**

**Lung disease** - Pulmonary fibrosis disease: Symptoms and treatment – Lung cancer - Best foods for lung health

**Text Books**

1. John R. Cameron and James G. Skofronick, John Wiley &Sons; (1978): Medical Physics, Wiley Interscience Publications,

**References**

1. R.S.Chandpur; (1987): Hand book of Biomedical Instrumentation, Tata McGraw Hill Publication Co., New Delhi.

CO-PO Mapping with Programme Outcomes: **Medical Physics** **Code: 22KP4PELP3:2**

| CO/PO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | - | - | 2 | - | - | 1 | - | - | 1 | 1 |
| 2 | 3 | - | - | - | - | 1 | - | - | - | - |
| 3 | 2 | - | - | - | - | - | - | 1 | - | - |
| 4 | - | 3 | - | - | - | 2 | - | - | - | - |
| 5 | 3 | - | - | - | - | - | - | - | - | - |

1 – Low, 2 – Moderate, 3 – High Correlation

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