# E.M.G. YADAVA WOMEN'S COLLEGE, MADURAI – 625 014.

(*An Autonomous Institution – Affiliated to Madurai Kamaraj University*)

Re-accredited **(3rd Cycle)** with Grade **A+** & **CGPA 3.51** by NAAC

# DEPARTMENT OF PHYSICS

## TANSCHE-CBCS with OBE

## MASTER OF SCIENCE

**PROGRAMME CODE - PP**

## COURSE STRUCTURE

(w.e.f. 2023 – 2023 Batch onwards)

# CRITERION - I

## *1.2.2 Details of Programmes offered through Choice Based Credit System (CBCS) / Elective Course System*

**Syllabus copies with highlights of contents focusing on Elective Course System**

**To be Noted:**

| HIGHLIGHTED | COURSE |
|---|---|
| | Elective |

Annexure - 7

# E.M.G.YADAVA WOMEN'S COLLEGE, MADURAI-14.

**(An Autonomous Institution – Affiliated to Madurai Kamaraj University)**
**Re-accredited (3rd Cycle) with Grade A+ and CGPA 3.51 by NAAC**

## DEPARTMENT OF PHYSICS- PG

## TANSCHE – CBCS WITH OBE

(w.e.f. 2023 – 2024 onwards)

### VISION

To enhance the knowledge of physics in teaching and research through holistic education

### MISSION

- ✓ Imparting quality education both in theoretical as well as experimental physics
- ✓ Providing students with rigorous and comprehensive courses that allow them to perform at a high level
- ✓ Striving for excellence in performance based teaching and research

### Programme Educational Objectives(PEOs) M.Sc.,

| S.No | On completion of the programme ,the student will be able to |
|---|---|
| **PEO1** | To Specialize knowledge and expertise to identify formulate, analyze and implement on the problems. |
| **PEO2** | To pursue higher studies in related fields of physics |
| **PEO3** | To enhance leadership quality to handle all kind of circumstances in diverse interdisciplinary learning environment |
| **PEO4** | To achieve successful employability in private/Government institutions or as on entrepreneur |
| **PEO5** | To inculcate the sense of ethics and effective communication skills |

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## Programme Outcomes (POs) with Graduate Attributes

| S.No | Graduate Attributes | On completion of the programme ,the student will be able to |
|---|---|---|
| **PO1** | Knowledge base | Exploration of knowledge and skills in their respective disciplines |
| **PO2** | Problem Analysis and Investigation | Acquire knowledge to analyze and solve problems to their respective field |
| **PO3** | Communication skills and design | Ability to carry out advance tasks and project successfully |
| **PO4** | Individual and Team work | Adequate project training, research activities in relevant skill sector and creating employable abilities |
| **PO5** | Professionalism, Ethics and Equality | Developing socio economic ethics executing their actions in all their decisions |
| **PO6** | Lifelong learning | Lifelong independent and reflective learning skills in their career. |

## Programme Specific Outcomes (POs) with Graduate Attributes

| S.No | Graduate Attributes | On completion of the programme ,the student will be able to |
|---|---|---|
| **PSO1** | Knowledge base | Develop experimental and data analysis skills through laboratory experiments |
| **PSO2** | Problem Analysis and Investigation | Recognize the importance of mathematical approaches and computing to describe the concept of physics |
| **PSO3** | Communication skills and design | Acquire subject knowledge and caliber sought by industry and education field |
| **PSO4** | Individual and Team work | Perform independent and group activities of projects to experience the aspects of research and to develop their presentation |
| **PSO5** | Professionalism, Ethics and Equality | Applying professional ethics contributing society to develop equity |
| **PSO6** | Lifelong learning | Recognizing the need and lifelong learning to solve real life problems |

**Eligibility for Admission:** Pass in B.Sc., Physics

**Duration of the Course:**

The students shall undergo prescribed courses of study for the period of two academic years under CBCS semester pattern with Outcome Based Education.

**Medium of Instruction**: English

**System:** TANSCHE - Choice Based Credit System with Outcome Based Education.

**Nature of the Course**

Courses are classified according to the following nature

1. Knowledge & Skill
2. Employability Oriented
3. Entrepreneurship Oriented

**Outcome Based Education (OBE) & Assessment**

Students understanding must be built on and assessed for wide range of learning activities, which includes different approaches and are classified along several bases, such as

**1. Based on purpose:**

- Formative (Internal tests, Assignment, Seminar, Quiz, Documentation, Case lets, ICT based Assignment, Mini Projects administered during the learning process)
- Summative (Evaluation of students learning at the end of instructional unit)

**2. Based on Domain knowledge: (Post Graduate Up to K5 Levels)**

- Assessment through K1, K2, K3, K4 & K5

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## DEPARTMENT OF PHYSICS- PG

## TANSCHE – CBCS WITH OBE

(w.e.f. 2023 – 2024 onwards)

## EVALUATION

Continuous Internal Assessment Test (CIA) : 25 Marks

Summative Examination : 75 Marks

Total : 100 Marks

### CIA-Continuous Internal Assessment: 25 Marks

| Components | Marks |
|---|---|
| Test (Average of two tests)<br>(Conduct for 120 marks and converted into 12 marks) | 12 |
| Creative Assignment | 3 |
| Assignment | 5 |
| Seminar | 5 |
| **Total** | **25** |

- Centralized system of Internal Assessment Tests
- There will be a two Internal Assessment Tests
- Duration of Internal Assessment Test I and II will be 2 1/2 hours.
- Students shall write retest on the genuine grounds if they are absent in either Test I & Test II with the approval of Head of the Department.

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## Question Paper Pattern for Continuous Internal Assessment Test I and Test II

| Section | Marks |
|---|---|
| A – Multiple Choice Questions (8x1Mark) | 8 |
| B – Short Answer (6 x 2 Marks) | 12 |
| C – Either Or type (4/8 x 5 Marks) | 20 |
| D – Open Choice type (2/4 x 10 Marks) | 20 |
| **Total** | **60** |

Conducted for 120 marks and converted into 15 marks

## Question Paper Pattern for Summative Examination

| Section | Marks |
|---|---|
| A – Multiple Choice Questions without choice (10x 1Mark) | 10 |
| B – Short Answer Questions without choice (5 x 2 Marks) | 10 |
| C – Either Or type (5/10 X 5Marks) | 25 |
| D – Open Choice type(3out of 5 X 10Marks) | 30 |
| **Total** | **75** |

- In respect of external examinations passing minimum is **45%** for Post Graduate Courses and in total, aggregate of **50%.**
- Latest amendments and revisions as per UGC and TANSCHE Norms are taken into consideration in curriculum preparation.

## Distribution of Marks in % with K levels CIA I, II & External Assessment

| Blooms Taxonomy | Internal Assessment | | External Assessment |
|---|---|---|---|
| | I | II | |
| Knowledge (K1 | 8 % | 8 % | 5 % |
| Understanding (K2) | 8 % | 8 % | 14 % |
| Apply (K3) | 24 % | 24 % | 27% |
| Analyze (K4) | 30 % | 30 % | 27% |
| Evaluate (K5) | 30% | 30% | 27% |

Annexure - 7

## BLUEPRINT FOR INTERNALASSESSMENT–I

## Articulation Mapping –K Levels with Course Learning Outcomes(CLOs)

| Sl.No | CLOs | K-Level | Section A | | Section B | | Section C | Section D | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | | MCQs (No Choice) | | Short Answers (No Choice) | | (Either or Type) | (Open Choice) | |
| | | | No. of Questions | K-Level | No. of Questions | K-Level | | | |
| 1 | CLO1 | Upto K5 | 1<br>2 | K1<br>K2 | 1<br>1 | K1<br>K3 | 1(K3)<br>1(K5) | 1(K4) | |
| 2 | CLO2 | Upto K5 | 2<br>1 | K1<br>K2 | 1<br>1 | K1<br>K2 | 1(K3)<br>(Each set of questions must be in the same level) | 1(K4)<br>1(K5) | |
| 3. | CLO3 | Upto K5 | 1<br>1 | K1<br>K2 | 1<br>1 | K2<br>K3 | 1(K4) | 1(K5) | |
| No. of Questions to be asked | | | 8 | | 6 | | 8 | 4 | 26 |
| No .of Questions to Be answered | | | 8 | | 6 | | 4 | 2 | 20 |
| Marks for each question | | | 1 | | 2 | | 5 | 10 | |
| Total Marks for each section | | | 8 | | 12 | | 40 | 40 | 100 |

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## BLUEPRINT FOR INTERNALASSESSMENT– II

## Articulation Mapping –K Levels with Course Learning Outcomes (CLOs)

| Sl.No | CLOs | K-Level | Section A | | Section B | | Section C | Section D | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | | MCQs (No Choice) | | Short Answers (No Choice) | | (Either or Type) | (Open Choice) | |
| | | | No. of Questions | K-Level | No. of Questions | K-Level | | | |
| 1 | CLO3 | UptoK5 | 1<br>2 | K1<br>K2 | 1<br>1 | K1<br>K3 | 1(K3)<br>1(K5) | 1(K4) | |
| 2 | CLO4 | UptoK5 | 2<br>1 | K1<br>K2 | 1<br>1 | K1<br>K2 | 1(K3)<br>(Each set of questions must be in<br>The same level) | 1(K4)<br>1(K5) | |
| 3. | CLO5 | Upto K5 | 1<br>1 | K1<br>K2 | 1<br>1 | K2<br>K3 | 1(K4) | 1(K5) | |
| No. of Questions to be asked | | | 8 | | 6 | | 8 | 4 | 26 |
| No. of Questions to Be answered | | | 8 | | 6 | | 4 | 2 | 20 |
| Marks for each question | | | 1 | | 2 | | 5 | 10 | |
| Total Marks for each section | | | **8** | | **12** | | **40** | **40** | **100** |

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## Distribution of Marks with choice K Levels CIA – I CIA and II-CIA

| CIA | K Levels | Section- A MCQ (No choice) | Section –B (Short Answer (No choice)) | Section- C (Either or Type) | Section-D (Open Choice) | Total Marks | % of Marks |
|---|---|---|---|---|---|---|---|
| I | K1 | 4 | 4 | | | 8 | 8 |
| | K2 | 4 | 4 | | | 8 | 8 |
| | K3 | | 4 | 20 | | 24 | 24 |
| | K4 | | | 10 | 20 | 30 | 30 |
| | K5 | | | 10 | 20 | 30 | 30 |
| | **Marks** | **8** | **12** | **40** | **40** | **100** | **100** |
| II | K1 | 4 | 4 | | | 8 | 8 |
| | K2 | 4 | 4 | | | 8 | 8 |
| | K3 | | 4 | 20 | | 24 | 24 |
| | K4 | | | 10 | 20 | 30 | 30 |
| | K5 | | | 10 | 20 | 30 | 30 |
| | **Marks** | **8** | **12** | **40** | **40** | **100** | **100** |

## Articulation Mapping –K Levels with Course Learning Outcomes (CLOs) for Internal Assessment (SEC)

| Sl.No | CLOs | K-Level | Section A | | Section B | | Section C | Section D | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | | MCQs (No choice) | | Short Answers (No choice) | | (Either/ or Type) | (open choice) | |
| | | | No. of Questions | K-Level | No. of Questions | K-Level | | | |
| 1 | CLO1 | Upto K4 | 2 | K1 | | | 2(K3&K3) | 1(K3) | |
| 2 | CLO2 | Upto K4 | 2 | K1 | | | 2(K3&K3) | 1(K4) | |
| 3 | CLO3 | Upto K4 | | | 2 | K2 | 2(K4&K4) | 1(K4) | |
| 4 | CLO4 | Upto K5 | | | 2 | K2 | 2(K5&K5) | 1(K5) | |
| 5 | CLO5 | Upto K5 | | | 2 | K2 | | 1(K5) | |
| No. of Questions to be asked | | | 4 | | 3 | | 8 | 5 | 20 |
| No. of Questions to be answered | | | 4 | | 3 | | 4 | 2 | 13 |
| Marks for each questions | | | 1 | | 2 | | 5 | 10 | |
| Total Marks for each section | | | 4 | | 6 | | 20 | 20 | 50 (Marks) |

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## Distribution of Section-wise Marks with K Levels for Internal Assessment (SEC)

| K Levels | Section A (MCQ'S) (No choice) | Section B(Short Answer) (No choice) | Section C(Either or Type) | Section D (Open Choice) | Total Marks | % of Marks |
|---|---|---|---|---|---|---|
| K1 | 4 | | | | **4** | **4** |
| K2 | | 6 | | | **6** | **6** |
| K3 | | | 20 | 10 | **30** | **30** |
| K4 | | | 10 | 20 | **30** | **30** |
| K5 | | | 10 | 20 | **30** | **30** |
| **Total Marks** | **4** | **6** | **40** | **50** | **100** | |

K1-Rememberingandrecallingfactswithspecificanswers.

K2- Basic understanding off acts and stating main ideas with general answers.

K3-Application oriented Solving Problems, Justifying the statement and deriving inferences

K4- Examining, analyzing, presentation and make inferences with evidences.

K5-Evaluating, making Judgments based on criteria

## Articulation Mapping –K Levels with Course Learning Outcomes(CLOs) for External Assessment

| Sl.No | CLOs | K-Level | Section A | | Section B | | Section C | Section D | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | | MCQs (No choice) | | Short Answers (No choice) | | (Either/orType) | (open choice) | |
| | | | No. of Questions | K-Level | No. of Questions | K-Level | | | |
| 1 | CLO1 | Upto K4 | 2 | K1&K2 | 1 | K1 | 2(K2&K2) | 1(K3) | |
| 2 | CLO2 | Upto K4 | 2 | K1&K2 | 1 | K2 | 2(K3&K3) | 1(K4) | |
| 3 | CLO3 | Upto K4 | 2 | K1&K2 | 1 | K3 | 2(K3&K3) | 1(K4) | |
| 4 | CLO4 | Upto K5 | 2 | K1&K2 | 1 | K4 | 2(K4 &K4) | 1(K5) | |
| 5 | CLO5 | Upto K5 | 2 | K1&K2 | 1 | K5 | 2(K5 &K5) | 1(K5) | |
| No. of Questions to be asked | | | 10 | | 5 | | 10 | 5 | 30 |
| No. of Questions to be answered | | | 10 | | 5 | | 5 | 3 | 23 |
| Marks for each question | | | 1 | | 2 | | 5 | 10 | |
| Total Marks for each section | | | 10 | | 10 | | 25 | 30 | 75 (Marks) |

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## Distribution of Section-wise Marks with K Levels for External Assessment

| K Levels | Section A (MCQ'S) (No choice) | Section B (Short Answer) (No choice) | Section C (Either or Type) | Section D (Open Choice) | Total Marks | % of Marks |
|---|---|---|---|---|---|---|
| K1 | 5 | 2 | - | - | **7** | **5** |
| K2 | 5 | 2 | 10 | - | **17** | **14** |
| K3 | - | 2 | 20 | 10 | **32** | **27** |
| K4 | - | 2 | 10 | 20 | **32** | **27** |
| K5 | - | 2 | 10 | 20 | **32** | **27** |
| **Total Marks** | **10** | **10** | **50** | **50** | **120** | **100** |

K1-Remembering and recalling facts with specific answers.

K2- Basic understanding of facts and stating main ideas with general answers.

K3-Application Oriented Solving Problems, Justifying the statement and deriving inferences

K4- Examining, analyzing, presentation and make inferences with evidences.

K5-Evaluating, making Judgments based on criteria

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## DEPARTMENT OF PHYSICS- PG

## TANSCHE – CBCS WITH OBE

(w.e.f. 2023 – 2024 onwards)

## M.Sc PHYSICS

## COURSE STRUCTURE-SEMESTER WISE

| Sem | Category | Course Code | Course Title | Teaching hrs (Per week) | Exam duration (hrs) | Marks allotted | | | Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | C.A | S.E | Total | |
| I | **CORE** | 23OPPH11 | Mathematical Physics | 7 | 3 | 25 | 75 | 100 | 5 |
| | **CORE** | 23OPPH12 | Classical Mechanics and Relativity | 7 | 3 | 25 | 75 | 100 | 5 |
| | **CORE** | 23OPPH1P | Practical-I | 6 | 3 | 40 | 60 | 100 | 4 |
| | **DSEC** | | DSEC-I | 5 | 3 | 25 | 75 | 100 | 3 |
| | **DSEC** | | DSEC-II | 5 | 3 | 25 | 75 | 100 | 3 |
| II | **CORE** | 23OPPH21 | Statistical Mechanics | 6 | 3 | 25 | 75 | 100 | 5 |
| | **CORE** | 23OPPH22 | Quantum mechanics-I | 6 | 3 | 25 | 75 | 100 | 5 |
| | **CORE** | 23OPPH2P | Practical-II | 6 | 3 | 40 | 60 | 100 | 4 |
| | **DSEC** | | DSEC-III | 5 | 3 | 25 | 75 | 100 | 3 |
| | **DSEC** | | DSEC-IV | 5 | 3 | 25 | 75 | 100 | 3 |
| | **SEC** | 23OPPHSEC21 | Microprocessor 8085 and Microcontroller 8051 | 2 | 3 | 25 | 75 | 100 | 2 |

**DSEC-Discipline Specific Elective Course**

**Semester I**

**DSEC-I** (Choose any one)

1. Linear and Digital ICs and Applications -23OPPHDSE1A
2. Physics of Nano Science and Technology -23OPPHDSE1B

**DSEC-II** (Choose any one)

1. Energy Physics -23OPPHDSE1C
2. Communication electronics -23OPPHDSE1D

**Semester II**

**DSEC-III** (Choose any one)

1. Plasma Physics -23OPPHDSE2A
2. Advanced Optics -23OPPHDSE2B

**DSEC-IV**(Choose any one)

1. Solar Energy Utilization -23OPPHDSE2C
2. Bio physics -23OPPHDSE2D

Annexure - 7

| Department of Physics | | | | | Class: I M.Sc., | | | |
|---|---|---|---|---|---|---|---|---|
| **Sem** | **Category** | **Course Code** | **Course Title** | **Credits** | **Contact Hours / Week** | **CIA** | **SE** | **Total** |
| I | DSEC | 23OPPHDSE1A | Linear and Digital ICs and Applications | 3 | 5 | 25 | 75 | 100 |

| Nature of the Course | | |
|---|---|---|
| **Knowledge and Skill Oriented** | **Employability Oriented** | **Entrepreneurship oriented** |
| ✓ | | |

## Course Objectives

1. To introduce the basic building blocks of linear integrated circuits.
2. To teach the linear and non-linear applications of operational amplifiers.
3. To introduce the theory and applications of PLL.
4. To introduce the concepts of waveform generation and introduce one special function ICs.
5. Exposure to digital IC‘s.

## Course Content:

| Unit | Course Content | Hours | K Level | CLO |
|---|---|---|---|---|
| I | **INTEGRATED CIRCUITS AND OPERATIONAL AMPLIFIER** - Introduction, Classification of IC‘s, basic information of Op-Amp 741 and its features, the ideal Operational amplifier, Op-Amp internal circuit and Op-Amp. Characteristics. | 15 | Up to K5 | CLO 1 |
| II | **APPLICATIONS OF OP-AMP** LINEAR APPLICATIONS OF OP-AMP: Solution to simultaneous equations and differential equations, Instrumentation amplifiers, V to I and I to V converters. NON-LINEAR APPLICATIONS OF OP-AMP: Sample and Hold circuit, Log and Antilog amplifier, multiplier and divider, Comparators, Schmitt trigger, Multivibrators, Triangular and Square waveform generators. | 15 | Up to K5 | CLO 2 |
| III | **ACTIVE FILTERS & TIMER AND PHASE LOCKED LOOPS** ACTIVE FILTERS: Introduction, Butterworth filters – 1st order, 2nd order low pass and high pass filters, band pass, band reject and all pass filters. TIMER AND PHASE LOCKED LOOPS: Introduction to IC 555 timer, description of functional diagram, monostable and astable operations and applications, Schmitt trigger, PLL - introduction, basic principle, phase detector/comparator, voltage controlled oscillator (IC 566), low pass filter, monolithic PLL and applications of PLL | 15 | Up to K5 | CLO 3 |

| | | | | |
|---|---|---|---|---|
| IV | **VOLTAGE REGULATOR & D toA AND A to D CONVERTERS** VOLTAGE REGULATOR: Introduction, Series Op-Amp regulator, IC Voltage Regulators, IC 723 general purpose regulators, Switching Regulator. D to A AND A to D CONVERTERS: Introduction, basic DAC techniques weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A to D converters -parallel comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC Specifications. | 15 | Up to K5 | CLO 4 |
| V | **CMOS LOGIC, COMBINATIONAL CIRCUITS USING TTL 74XX ICs** & **SEQUENTIAL CIRCUITS USING TTL 74XX ICs** CMOS LOGIC: CMOS logic levels, MOS transistors, Basic CMOS Inverter, NAND and NOR gates, CMOS AND-OR-INVERT and ORAND-INVERT gates, implementation of any function using CMOS logic. COMBINATIONAL CIRCUITS USING TTL 74XX ICs: Study of logic gates using 74XX ICs, Four-bit parallel adder (IC 7483), Comparator (IC 7485), Decoder (IC 74138, IC 74154), BCD to 7-segment decoder (IC7447), Encoder (IC74147), Multiplexer (IC74151), Demultiplexer (IC 74154). SEQUENTIAL CIRCUITS USING TTL 74XX ICs: Flip Flops (IC 7474, IC 7473), Shift Registers, Universal Shift Register (IC 74194), 4- bit asynchronous binary counter (IC 7493). | 15 | Up to K5 | CLO 5 |

**Book for study:**


1. D. Roy Choudhury, Shail B. Jain (2012), Linear Integrated Circuit, 4th edition, New Age International Pvt. Ltd., New Delhi, India
2. Ramakant A. Gayakwad, (2012), OP-AMP and Linear Integrated Circuits, 4th edition, Prentice Hall / Pearson Education, New Delhi.
3. B.L. Theraja and A.K. Theraja, 2004, A Textbook of Electrical technology, S. Chand & Co.
4. V.K. Mehta and Rohit Mehta, 2008, Principles of Electronics, S. Chand & Co, 12th Edition.
5. V. Vijayendran, 2008, Introduction to Integrated electronics (Digital & Analog), S. Viswanathan Printers & Publishers Private Ltd, Reprint. V.


**Books for Reference:**


1. Sergio Franco (1997), Design with operational amplifiers and analog integrated circuits, McGraw Hill, New Delhi.
2. Gray, Meyer (1995), Analysis and Design of Analog Integrated Circuits, Wiley International, New Delhi.
3. Malvino and Leach (2005), Digital Principles and Applications 5th Edition, Tata McGraw Hill, New Delhi
4. Floyd, Jain (2009), Digital Fundamentals, 8th edition, Pearson Education, New Delhi.
5. Integrated Electronics, Millman & Halkias, Tata McGraw Hill, 17th Reprint (2000)

**Web Resources / E-Books**

1. https://nptel.ac.in/course.html/digital circuits/
2. https://nptel.ac.in/course.html/electronics/operational amplifier/
3. https://www.allaboutcircuits.com/textbook/semiconductors/chpt7/field-effect-controlled-thyristors/
4. https://www.electrical4u.com/applications-of-op-amp/
5. https://www.geeksforgeeks.org/digital-electronics-logic-designtutorials/

**Pedagogy:**

Chalk and Talk, Power point presentations, Group Discussions, Quiz, Assignment and Seminar.

**Rationale for Nature of the course:**

This course will enable the students to comprehend the theory, concepts, characteristics and working principles of electronic devices like Combinational and Sequential circuits, semiconductors and their applications. The knowledge of various devices acquired by the students will help them to design, test, troubleshoot the semiconductor diodes, DAC/ADC converter and OPAMP.

**Activities to be given**

1. To upgrade the students to solve the problems.
2. Train the students to design and troubleshoot the given circuits.

**Course Learning Outcomes(CLOs):**

On the successful completion of the course. Students will be able to

| CLOs | Course Learning outcomes | K-Level |
|---|---|---|
| CLO1 | Learn about the basic concepts for the circuit configuration for the design of linear integrated circuits and develops skill to solve problems | Up to K5 |
| CLO2 | Develop skills to design linear and non-linear applications circuits using OpAmp and design the active filters circuits. | Up to K5 |
| CLO3 | Gain knowledge about PLL, and develop the skills to design the simple circuits using IC 555 timer and can solve problems related to it. | Up to K5 |
| CLO4 | Learn about various techniques to develop A/D and D/A converters. | Up to K5 |
| CLO5 | Acquire the knowledge about the CMOS logic, combinational and sequential circuits | Up to K5 |

## Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 2 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 1 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 1 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 1 | 3 |
| **CO5** | 3 | 3 | 3 | 2 | 1 | 1 |

**1-Basic Level 2- Intermediate Level 3.Advanced Level**

## Lesson Plan: (Total Hours: 75 Hrs)

| Units | Course content | Hours | Mode |
|---|---|---|---|
| **I** | Introduction, Classification of IC's,basic information of Op-Amp 741 and its features,the ideal Operational amplifier-Op-Amp internal circuit and Op-Amp. Characteristics. | 15 | Chalk and Talk & Seminar |
| **II** | LINEAR APPLICATIONS OF OP-AMP: Solution to simultaneous-equations and differential equations-Instrumentation amplifiers, V to I and I to V converters-NON-LINEAR APPLICATIONS OF OP-AMP: Sample and Hold circuit, Log and Antilog amplifier-multiplier and divider, Comparators, Schmitt trigger-Multivibrators, Triangular and Square waveform generators. | 15 | Chalk and Talk & Seminar |
| **III** | ACTIVE FILTERS: Introduction, Butterworth filters – 1st order, 2nd order low pass and high pass filters-band pass, band reject and all pass filters. Introduction to IC 555 timer, description of functional diagram,monostable and astable operations and applications, Schmitt trigger, PLLintroduction, basic principle, phase detector/comparator, voltage controlled oscillator (IC 566)-low pass filter, monolithic PLL and applications of PLL | 15 | Chalk and Talk & Seminar |
| **IV** | VOLTAGE REGULATOR: Introduction, Series Op-Amp regulator IC Voltage Regulators, IC 723 general purpose regulators, Switching Regulator basic DAC techniques weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC A to D converters -parallel comparator type ADC, counter type ADC Successive approximation ADC and dual slope ADC, DAC and ADC Specifications. | 15 | Chalk and Talk & Seminar |
| **V** | CMOS LOGIC: CMOS logic levels, MOS transistors, Basic CMOS Inverter, NAND and NOR gates,CMOS AND-OR-INVERT and ORAND-INVERT gates, implementation of any function using CMOS logic Study of logic gates using 74XX ICs, Four-bit parallel adder (IC 7483), Comparator (IC 7485), Decoder (IC 74138, IC 74154), Study of logic gates using Shift Registers,Universal Shift Register (IC 74194), 4- bit asynchronous binary counter (IC 7493). | 15 | Chalk and Talk & Seminar |

Annexure - 7

| Department of Physics | | | | | Class: I M.Sc ., | | | |
|---|---|---|---|---|---|---|---|---|
| **Sem** | **Category** | **Course Code** | **Course Title** | **Credits** | **Contact Hours / Week** | **CIA** | **SE** | **Total** |
| I | DSEC | 23OPPHDSE1B | Physics of Nanoscience and Technology | 3 | 5 | 25 | 75 | 100 |

| Nature of the Course | | |
|---|---|---|
| **Knowledge and Skill Oriented** | **Employability Oriented** | **Entrepreneurship oriented** |
| | ✓ | |

## Course Objectives:

1. Physics of Nanoscience and Technology is concerned with the study, creation, manipulation and applications at nanometer scale.
2. To provide the basic knowledge about nanoscience and technology.
3. To learn the structures and properties of nanomaterials.
4. To acquire the knowledge about synthesis methods and characterization techniques and its applications.

## Course Content

| Unit | Course Content | Hours | K Level | CLO |
|---|---|---|---|---|
| I. | **FUNDAMENTALS OF NANOSCIENCE AND TECHNOLOGY** Fundamentals of NANO – Historical Perspective on Nanomaterial and Nanotechnology -– Classification of Nanomaterials – Metal and Semiconductor Nanomaterials - 2D, 1D, 0D nanostructured materials - Quantum dots – Quantum wires – Quantum wells - Surface effects of nanomaterials. | 15 | Up to K5 | CLO1 |
| II. | **PROPERTIES OF NANO MATERIALS** : Physical properties of Nanomaterials: Melting points, specific heat capacity, and lattice constant - Mechanical behavior: Elastic properties – strength - ductility - superplastic behavior - Optical properties: - Surface Plasmon Resonance – Quantum size effects - Electrical properties - Conductivity, Ferroelectrics and dielectrics - Magnetic properties – super para magnetism – Diluted magnetic semiconductor (DMS). | 15 | Up to K5 | CLO2 |
| III. | **SYNTHESIS AND FABRICATION:** Physical vapour deposition - Chemical vapour deposition - sol-gel – Wet deposition techniques - electrochemical deposition method – Plasma arching – Electro spinning method - ball milling technique - pulsed laser deposition - Nanolithography: photolithography – Nano manipulator. | 15 | Up to K5 | CLO3 |

| | | | | |
|---|---|---|---|---|
| **IV.** | **CHARACTERIZATION TECHNIQUES**<br>Powder X-ray diffraction – X-ray photoelectron spectroscopy (XPS) - UV-visible spectroscopy – Photoluminescence - Scanning electron microscopy (SEM) - Transmission electron microscopy (TEM) - Scanning probe microscopy (SPM) - Scanning tunneling microscopy (STM) – Vibrating sample Magnetometer. | 15 | Upto K5 | CLO4 |
| **V.** | **APPLICATIONS OF NANOMATERIALS** : Sensors: Nanosensors based on optical and physical properties - Electrochemical sensors – Nano-biosensors. Nano Electronics: Nano bots - display screens - GMR read/write heads - Carbon Nano tube Emitters – Photo catalytic application: Air purification, water purification -Medicine: Imaging of cancer cells – biological tags - drug delivery - photodynamic therapy - Energy: fuel cells - rechargeable batteries – super capacitors – photo voltaics. | 15 | Upto K5 | CLO5 |

**Book for study:**


1. A textbook of Nanoscience and Nanotechnology, Pradeep T., Tata McGraw-Hill Publishing Co. (2012).
2. Principles of Nanoscience and Nanotechnology, M.A. Shah, Tokeer Ahmad, Narosa Publishing House Pvt Ltd., (2010).
3. Introduction to Nanoscience and Nanotechnology, K. K. Chattopadhyay and A.N. Banerjee, PHI Learning Pvt. Ltd., New Delhi, (2012).
4. Nanostructured Materials and Nanotechnology, Hari Singh Nalwa, Academic Press, (2002).
5. Nanotechnology and Nanoelectronics, D.P. Kothari,
6. V. Velmurugan and Rajit Ram Singh, Narosa Publishing House Pvt. Ltd, New Delhi. (2018)


**Books for Reference:**


1. Nanostructures and Nanomaterials – Huozhong Gao – Imperial College Press (2004).
2. Richard Booker and Earl Boysen, (2005) Nanotechnology, Wiley Publishing Inc. USA
3. Nano particles and Nano structured films; Preparation, Characterization and Applications, J. H. Fendler John Wiley and Sons. (2007)
4. Textbook of Nanoscience and Nanotechnology, B. S. Murty, et al., Universities Press. (2012)
5. The Nanoscope (Encyclopedia of Nanoscience and Nanotechnology),
6. Dr. Parag Diwan and Ashish Bharadwaj (2005) Vol. IV – Nanoelectronics Pentagon Press, New Delhi.


**WEB SOURCES/ E-Books**

1. www.its.caltec.edu/feyman/plenty.html
2. http://www.library.ualberta.ca/subject/nanoscience/guide/index.cfm
3. http://www.understandingnano.com
4. http://www.nano.gov
5. http://www.nanotechnology.com

**Pedagogy:**

Chalk and Talk, Seminar, Quiz, and Group Discussion.

**Rationale for Nature of the course:**

Learn about the basic concepts nanoscience and explore the different types of nanomaterials and Explore various physical, mechanical, optical, electrical and magnetic properties nanomaterials.

**Activities to be given**

1. To practice the students to Understand the basic of nanoscience and explore the different types of nanomaterials
2. Enhancing the students to Apply the concepts of nanoscience and technology in the field of sensors, robotics, purification of air and water and in the energy devices.

**Course Learning Outcomes (CLOs):**

On the successful completion of the course. Students will be able to

| CO | COURSE LEARNING OUTCOMES | K- Level |
|---|---|---|
| **CO1** | Understand the basic of nanoscience and explore the different types of nanomaterials and should comprehend the surface effects of the nanomaterials. | Up to K5 |
| **CO2** | Explore various physical, mechanical, optical, electrical and magnetic properties nanomaterials. | Up to K5 |
| **CO3** | Understand the process and mechanism of synthesis and fabrication of nanomaterials. | Up to K5 |
| **CO4** | Analyze the various characterization of Nano-products through diffraction, spectroscopic, microscopic and other techniques. | Up to K5 |
| **CO5** | Apply the concepts of nanoscience and technology in the field of sensors, robotics, purification of air and water and in the energy devices. | Up to K5 |

**Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 2 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 2 | 3 | 3 |
| **CO3** | 3 | 3 | 2 | 2 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 2 | 3 | 2 |
| **CO5** | 3 | 3 | 2 | 2 | 3 | 3 |

**1. Basic level 2. Intermediate level 3.Advance level**

**Lesson Plan (TOTAL HOURS : 75 hrs)**

| Units | Course content | Hours | Pedagogy |
|---|---|---|---|
| I | Fundamentals of NANO – Historical Perspective on Nano material and Nanotechnology-Classification of Nano materials – Metal and Semiconductor Nano materials 2D, 1D, 0D nano structured materials - Quantum dots –Quantum wires-Quantum wells - Surface effects of nanomaterials. | 15 | Chalk and Talk & Seminar |
| II | Nanomaterials: Melting points, specific heat capacity, and lattice constant-Mechanical behavior: Elastic properties – strength - ductility – super plastic behavior - Optical properties: - Surface Plasmon Resonance – Quantum size effects -Electrical properties - Conductivity, Ferroelectrics and dielectrics-Magnetic properties – super para magnetism – Diluted magnetic semiconductor (DMS). | 15 | Chalk and Talk & Seminar |
| III | Physical vapour deposition - Chemical vapour deposition - sol-gel-Wet deposition techniques - electrochemical deposition method-Plasma arching – Electro spinning method - ball milling technique-pulsed laser deposition-Nanolithography: photolithography – Nano manipulator. | 15 | Chalk and Talk & Seminar |
| IV | Powder X-ray diffraction – X-ray photoelectron spectroscopy (XPS)-UV-visible spectroscopy – Photoluminescence-Scanning electron microscopy (SEM) - Transmission electron microscopy (TEM)-Scanning probe microscopy (SPM)-Scanning tunneling microscopy (STM)-Vibrating sample Magnetometer. | 15 | Chalk and Talk & Seminar |
| V | Nanosensors based on optical and physical properties - Electrochemical sensors-Nano-biosensors. Nano Electronics: Nano bots - display screens - GMR read/write heads-Carbon Nano tube Emitters – Photo catalytic application: Air purification, water purification-Medicine: Imaging of cancer cells – biological tags - drug delivery-photodynamic therapy - Energy: fuel cells - rechargeable batteries super capacitors – photo voltaics. | 15 | Chalk and Talk & Seminar |

Annexure - 7

| Department of Physics | | | | | Class: I M.Sc., | | | |
|---|---|---|---|---|---|---|---|---|
| **Sem** | **Category** | **Course Code** | **Course Title** | **Credits** | **Contact Hours / Week** | **CIA** | **SE** | **Total** |
| I | DSEC | 23OPPHDSE1C | Energy Physics | 3 | 5 | 25 | 75 | 100 |

| Nature of the Course | | |
|---|---|---|
| **Knowledge and Skill Oriented** | **Employability Oriented** | **Entrepreneurship oriented** |
| | ✓ | |

## Course Objectives:

1. To learn about various renewable energy sources.
2. To know the ways of effectively utilizing the oceanic energy.
3. To study the method of harnessing wind energy and its advantages.
4. To learn the techniques useful for the conversion of biomass into useful energy.
5. To know about utilization of solar energy.

## Course Content

| Unit | Course Content | Hours | K Level | CLO |
|---|---|---|---|---|
| I. | **INTRODUCTION TO ENERGY SOURCES:** Conventional and non-conventional energy sources and their availability– prospects of Renewable energy sources– Energy from other sources– chemical energy–Nuclear energy– Energy storage and distribution. | 15 | Up to K5 | CLO1 |
| II. | **ENERGY FROM THE OCEANS** Energy utilization–Energy from tides– Basic principle of tidal power– utilization of tidal energy – Principle of ocean thermal energy conversion systems. | 15 | Up to K5 | CLO2 |
| III. | **WIND ENERGY SOURCES:** Basic principles of wind energy conversion–power in the wind–forces in the Blades– Wind energy conversion–Advantages and disadvantages of wind energy conversion systems (WECS) - Energy storage–Applications of wind energy. | 15 | Up to K5 | CLO3 |
| IV. | **ENERGY FROM BIOMASS:** Biomass conversion Technologies– wet and dry process– Photosynthesis Biogas Generation: Introduction–basic process: Aerobic and anaerobic digestion – Advantages of anaerobic digestion–factors affecting bio digestion and generation of gas- bio gas from waste fuel– properties of biogas-utilization of biogas. | 15 | Upto K5 | CLO4 |
| V. | **SOLAR ENERGY SOURCES:** Solar radiation and its measurements– solar cells: Solar cells for direct conversion of solar energy to electric powers–solar cell parameter–solar cell electrical characteristics– Efficiency–solar water Heater –solar distillation– solar cooking–solar greenhouse – Solar pond and its applications. | 15 | Upto K5 | CLO5 |

**Book for study:**

1. G.D. Rai, 1996, Non – convention sources of, 4th edition, Khanna publishers, New Delhi.
2. S. Rao and Dr. Paru Lekar, Energy technology.
3. M.P. Agarwal, Solar Energy, S. Chand and Co., New Delhi (1983).
4. Solar energy, principles of thermal collection and storage by S. P. Sukhatme, 2nd edition, Tata McGraw-Hill Publishing Co. Lt., New Delhi (1997).
5. Energy Technology by S. Rao and Dr. Parulekar.

**Books for Reference:**

1. Renewable energy resources, John Twidell and Tonyweir, Taylor and Francis group, London and New York.
2. Applied solar energy, A. B. Meinel and A. P. Meinal
3. John Twidell and Tony Weir, Renewable energy resources, Taylor and Francis group, London and New York.
4. Renewal Energy Technologies: A Practical Guide for Beginners C.S. Solanki-PHI Learning
5. Introduction to Non-Conventional Energy Resources -Raja et. al., Sci. Tech Publications

**WEB SOURCES / E-Books**

1.https://www.open.edu/openlearn/ocw/mod/oucontent/view.php?id=2411&print able=1

2. https://www.nationalgeographic.org/encyclopedia/tidal-energy/

3. https://www.ge.com/renewableenergy/wind-energy/what-is-wind-energy

4. https://www.reenergyholdings.com/renewable-energy/what-is-biomass/

5. https://www.acciona.com/renewable-energy/solar-energy/

**Pedagogy:**

Chalk and Talk, Seminar, PPT, Quiz, and Group Discussion.

**Rationale for Nature of the course:**

To learn about various renewable energy sources and to know the ways of effectively utilizing the various types of energy.

**Activities to be given**

1. Students are trained to to identify various forms of renewable and non-renewable energy sources.
2. Enhancing the students to understand the components of solar radiation and apply them to utilize solar energy.

## Course Learning Outcomes (CLOs):

At the end of the course, the student will be able to:

| CO | Course Learning Outcomes | K-Level |
|---|---|---|
| **CO1** | To identify various forms of renewable and non-renewable energy sources | Up to K5 |
| **CO2** | Understand the principle of utilizing the oceanic energy and apply it for practical applications. | Up to K5 |
| **CO3** | Discuss the working of a windmill and analyze the advantages of wind energy. | Up to K5 |
| **CO4** | Distinguish aerobic digestion process from anaerobic digestion. | Up to K5 |
| **CO5** | Understand the components of solar radiation, their measurement and apply them to utilize solar energy. | Up to K5 |

## Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 2 | 3 | 3 | 3 | 2 | 2 |
| **CO2** | 2 | 3 | 3 | 3 | 2 | 2 |
| **CO3** | 2 | 3 | 3 | 3 | 2 | 2 |
| **CO4** | 2 | 3 | 3 | 3 | 2 | 2 |
| **CO5** | 2 | 3 | 3 | 3 | 2 | 2 |

**1. Basic level 2. Intermediate level 3.Advance level**

**Lesson Plan: (TOTAL HOURS: 75 hrs)**

| Units | Course content | Hours | Pedagogy |
|---|---|---|---|
| **I** | Conventional and non-conventional energy sources and their availability-prospects of Renewable energy Sources-Energy from other sources– chemical energy-Nuclear energy– Energy storage and distribution. | 15 | Chalk and Talk & Seminar |
| **II** | Energy utilization–Energy from Tides-Basic principle of tidal power-utilization of tidal energy- Principle of ocean thermal energy conversion systems. | 15 | Chalk and Talk & PPT |
| **III** | Basic principles of wind energy conversion-power in the wind–forces in the Blades– Wind energy Conversion-Advantages and disadvantages of wind energy conversion systems (WECS)-Energy storage–Applications of wind energy. | 15 | Chalk and Talk & Seminar |
| **IV** | Biomass conversion Technologies– wet and dry process-Photosynthesis Biogas Generation: Introduction–basic process: Aerobic and anaerobic digestion – Advantages of anaerobic digestion-factors affecting bio digestion and generation of gas-bio gas from waste fuel-Properties of biogas-utilization of biogas. | 15 | Chalk and Talk & PPT |
| **V** | Solar radiation and its measurements–solar cells: Solar cells for direct conversion of solar energy to electric powers-solar cell parameter–solar cell electrical Characteristics-Efficiency–solar water Heater –solar distillation-solar cooking–solar greenhouse Solar pond and its applications. | 15 | Chalk and Talk & Seminar |

Annexure - 7

| Department of Physics | | | | | Class: I M.Sc., | | | |
|---|---|---|---|---|---|---|---|---|
| **Sem** | **Category** | **Course Code** | **Course Title** | **Credits** | **Contact Hours / Week** | **CIA** | **SE** | **Total** |
| I | DSEC | 23OPPHDSE1D | Communication Electronics | 3 | 5 | 25 | 75 | 100 |

| Nature of the Course | | |
|---|---|---|
| **Knowledge and Skill Oriented** | Employability Oriented | Entrepreneurship oriented |
| | ✓ | |

## Course Objectives:

1. To understand about antennas and wave propogation.
2. To acquire the knowledge about microwaves.
3. To understand about radar.
4. To study about the optical fiber.
5. To acquire the knowledge about the satellite communication.

## Course Content

| UNIT | Course Content | Hours | K-Level | CLO |
|---|---|---|---|---|
| I | **ANTENNAS AND WAVE PROPAGATION** Radiation field and radiation resistance of short dipole antennagrounded antenna-ungrounded antenna-antenna arrays-broadside and end side arrays-antenna gain-directional high frequency antennas-sky wave-ionosphere- Ecles and Larmor theory- Magnento ionic theoryground wave propagation | 15 | Up to K5 | CO1 |
| II | **MICROWAVES** Microwave generation—multi cavity Klystron-reflex klystronmagnetron travelling wave tubes (TWT) and other microwave tubesMASER-Gunn diode-wave guides-rectangular wave guides-standing wave indicator and standing wave ratio(SWR) | 15 | Up to K5 | CO2 |
| III | **RADAR AND TELEVISION:** Elements of a radar system-radar equation-radar performance Factors radar transmitting systems-radar antennas-duplexers-radar receivers and indicators-pulsed systems-other radar systems- colour TV transmission and reception-colour mixing principle-colour picture tubes- Delta gun picture tube-PIL colour picture tube-cable TV, CCTV and theatre TV energy released in fission – chain reaction – critical reaction – critical size- atom bomb – nuclear reactor – breeder reactor – importance of commissioning PFBR in our country – heavy water disposal, safety of reactors: seismic and floods –introduction to DAE, IAEA – nuclear fusion –thermonuclear reactions – differences between fission and fusion. | 15 | Up to K5 | CO3 |

| | | | | |
|---|---|---|---|---|
| IV | **OPTICAL FIBER**: Propagation of light in an optical fibre-acceptance angle-numerical aperture-step and graded index fibres-optical fibres as a cylindrical wave guide-wave guide equations-wave guide equations in step index fibres - fibre losses and dispersion-applications | 15 | Upto K5 | CO4 |
| V | **SATELLITE COMMUNICATION** Orbital satellites-geostationary satellites-orbital patterns-satellite system link models-satellite system parameters-satellite system link equation link budget-INSAT communication satellites | 15 | Upto K5 | CO5 |

**Book for study:**

1. R Handbook of Electronics by Gupta and Kumar, 2008 edition.
2. Electronic communication systems – George Kennedy and Davis, Tata McGraw Hill, 4th edition, 1988.
3. Taub and Schilling, principles of communication systems, second edition, Tata Mc Graw Hill (1991).
4. M. Kulkarani, Microwave and radar engineering, Umesh Publications, 1998.
5. Mono Chrome and colour television, R. R. Ghulathi.

**Books for Reference:**

1. Electronic communications – Dennis Roody and Coolen, Prentice Hall of India, IV edition, 1995.
2. Wayne Tomasi, Advanced electronics communication systems, fourth edition, Prentice Hall of India, 1998
3. Dennis Roddy and Coolen, 1995, *Electronics communications,*

Prentice Hall of India IV Edition.

4. Wayne Tomasi,1998 *"Advanced Electronics communication System"* 4th edition, Prentice Hall of India, 1998

5. S. Salivahanan, N. Suersh Kumar & A. Vallavaraj, 2009, Electronic Devices and Circuits, Tata McGraw-Hill Publishing Company Limited, New Delhi, Second Edition.

**Web Resources / E-Books**

1. https://www.geeksforgeeks.org/digital-electronics-logic-designtutorials/
2. https://www.polytechnichub.com/difference-analog-instrumentsdigital-instruments/
3. http://nptel.iitm.ac.in/
4. http://web.ewu.edu/
5. http://nptel.iitm.ac.in/

**Rationale for nature of Course:**

**Knowledge and Skill**: Study of the communication electronics leads to information which is of practical value to the physicist. it gives us information about the satellite communication and radar. students who undergo this course are successfully bound to get a better insight and understanding of the subject.

**Activities to be given:**

1. Enhancing the quality of students to understand about the optical fiber.
2. Train the students to understand the theory about satellite communication.

**Course Learning Outcomes (CLOs):**

At the end of the course, the student will be able to:

| CLO | Course Learning Outcomes | K level |
|---|---|---|
| CLO1 | Explain the concepts of antennae and propagation of waves | Up to K5 |
| CLO2 | Outline the basic foundation of microwaves | Up to K5 |
| CLO3 | Summarize about radar and television | Up to K5 |
| CLO4 | Describe about optical fiber | Up to K5 |
| CLO5 | Learn about satellite communication | Up to K5 |

**Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CLO1** | 3 | 3 | 2 | 3 | 3 | 3 |
| **CLO2** | 3 | 3 | 2 | 3 | 3 | 3 |
| **CLO3** | 3 | 3 | 3 | 3 | 3 | 3 |
| **CLO4** | 3 | 3 | 2 | 3 | 3 | 3 |
| **CLO5** | 3 | 3 | 3 | 3 | 3 | 3 |

**1-Basic Level 2- Intermediate Level 3- Advanced Level**

**Lesson Plan: (TOTAL HOURS: 75 Hrs)**

| Units | Course content | Hours | Mode |
|---|---|---|---|
| I | **ANTENNAS AND WAVE PROPAGATION** Radiation field and radiation resistance of short dipole antenna grounded antenna-ungrounded antenna-antenna arrays-broadside and end side arrays-antenna gain-directional high frequency antennas-sky wave-ionosphere Ecles and Larmor theory- Magnento ionic theory ground wave propagation | **15** | Chalk and Talk & PPT |
| II | **MICROWAVES** Microwave generation—multi cavity Klystron- -Gunn diode-wave guides-reflex klystron magnetron travelling wave tubes (TWT) and other microwave tubes MASER-rectangular wave guides-standing wave indicator and standing wave ratio(SWR) | **15** | Chalk and Talk & Seminar |
| III | **RADAR AND TELEVISION:** Elements of a radar system-radar equation-radar performance Factors radar transmitting systems-radar antennas – chain reaction – critical reaction – critical size- atom bomb – nuclear reactor –breeder reactor –IAEA – nuclear fusion –thermonuclear reactions – differences between fission and fusion-duplexers-radar receivers and indicators-pulsed systems-other radar systems- colour TV transmission and reception-colour mixing principle-colour picture tubes-Delta gun picture tube-PIL colour picture tube-cable TV, CCTV and theatre TV energy released in fission-importance of commissioning PFBR in our country – heavy water disposal, safety of reactors: seismic and floods –introduction to DAE, | **15** | Chalk and Talk & Seminar |
| IV | **OPTICAL FIBER**: Propagation of light in an optical fibre-acceptance angle- fibre losses and dispersion-applications-numerical aperture-step and graded index fibres-optical fibres as a cylindrical wave guide wave guide equations-wave guide equations in step index fibres-Ray dispersion in multimode step index fibers – Parabolic index fibers – Fiber fibre losses and dispersion-applications | 15 | Chalk and Talk & PPT |
| V | **SATELLITE COMMUNICATION** Orbital satellites-geostationary satellites- -satellite system link equation link budget-orbital patterns-satellite system link models-satellite system parameters-INSAT communication satellites | 15 | Chalk and Talk & Seminar |

Annexure - 7

| Department of Physics | | | | | Class: I M.Sc., | | | |
|---|---|---|---|---|---|---|---|---|
| **Sem** | **Category** | **Course Code** | **Course Title** | **Credits** | **Contact Hours / Week** | **CIA** | **SE** | **Total** |
| II | DSEC | 23OPPHDSE2A | Plasma Physics | 3 | 5 | 25 | 75 | 100 |

| Nature of the Course | | |
|---|---|---|
| **Knowledge and Skill Oriented** | **Employability Oriented** | **Entrepreneurship oriented** |
| ✓ | | |

## Course Objectives:

1. To understand the cross section of charged particles and to able to correlate the magnetic effect of ion and electrons in plasma state.
2. To learn the magneto-hydrodynamics concepts applied to plasma.
3. To explore the oscillations and waves of charged particles and thereby apply the Maxwell's equation to quantitative analysis of plasma.
4. To analyze the different principle and techniques to diagnostics of plasma.
5. To Study the possible applications of plasma by incorporating various electrical and electronic instruments.

## Course Content

| Unit | Course Content | Hours | K Level | CLO |
|---|---|---|---|---|
| I. | **FUNDAMENTAL CONCEPTS OF PLASMA**: Kinetic pressure in a partially ionized - mean free path and collision cross section - Mobility of charged particles - Effect of magnetic field on the mobility of ions and electrons-Thermal conductivity- Effect of magnetic field- Quasi- neutrality of plasma Debye shielding distance - Optical properties of plasma. | 15 | Upto K5 | CLO1 |
| II. | **MOTION OF CHARGED PARTICLES IN ELECTRIC AND MAGNETIC FIELD:** Particle description of plasma- Motion of charged particle in electrostatic field- Motion of charged particle in uniform magnetic field - Motion of charged particle in electric and magnetic fields- Motion of charged particle inhomogeneous magnetic field - Motion of charged particle in magnetic mirror confinement - motion of an electron in a time varying electric field- Magneto- hydrodynamics - Magneto-hydrodynamic equations – Condition for magneto hydrodynamic behavior. | 15 | Upto K5 | CLO2 |
| III. | **PLASMA OSCILLATIONS AND WAVES** : Introduction, theory of simple oscillations - electron oscillation in a plasma – Derivations of plasma oscillations by using Maxwell's equation - Ion oscillation and waves in a magnetic field - thermal effects on plasma oscillations - Landau damping - Hydro magnetic waves - Oscillations in an electron beam. | 15 | Upto K5 | CLO3 |

| | | | | |
|---|---|---|---|---|
| IV. | **PLASMA DIAGNOSTICS TECHNIQUES:** Single probe method - Double probe method - Use of probe technique for measurement of plasma parameters in magnetic field - microwave method - spectroscopic method - -laser as a tool for plasma diagnostics-X-ray diagnostics of plasma - acoustic method - conclusion. | 15 | Upto K5 | CLO4 |
| V. | **APPLICATIONS OF PLASMA PHYSICS:** Magneto hydrodynamic Generator - Basic theory - Principle of Working Fuel in MHD Generator - Generation of Microwaves Utilizing High Density Plasma - Plasma Diode. | 15 | Upto K5 | CLO5 |

**Book for study:**


1. Plasma Physics- Plasma State of Matter - S. N. Sen, Pragati Prakashan, Meerut.
2. Introduction to Plasma Physics-M. Uman
3. Krall, N. A., and A. W. Trivelpiece. Principles of Plasma Physics. Berkeley, CA: San Francisco Press, 1986. ISBN: 9780911302585.Tanenbaum, B. S. Plasma Physics. New York, NY: McGraw-Hill, 1967. ISBN: 9780070628120.
4. Goldston, R. J., and P. H. Rutherford. Introduction to Plasma Physics. Philadelphia, PA: IOP Publishing, 1995. ISBN: 9780750301831.
5. Hutchinson, I. H. Principles of Plasma Diagnostics. Cambridge, UK: Cambridge University Press, 2005. ISBN: 9780521675741.


**Books for Reference:**


1. Chen, F. F. Introduction to Plasma Physics. 2nd ed. New York, NY: Springer, 1984. ISBN: 9780306413322.
2. Introduction to Plasma Theory-D.R. Nicholson
3. Shohet, J. L. The Plasma State. San Diego, CA: Academic Press Inc., 1971. ISBN: 9780126405507.
4. Hazeltine, R. D., and F. L. Waelbroeck. The Framework of Plasma Physics. Boulder, CO: Westview Press, 2004. ISBN: 9780813342139.
5. Huddlestone, R. H., and S. L. Leonard. Plasma Diagnostic Techniques. San Diego, CA: Academic Press, 1965


**Web Resources / E-Books**

1. https://fusedweb.llnl.gov/Glossary/glossary.html
2. http://farside.ph.utexas.edu/teaching/plasma/lectures1/index.html
3. http://www.plasmas.org/
4. http://www.phy6.org/Education/whplasma.html
5. http://www.plasmas.org/resources.htm

**Pedagogy:** Chalk and Talk, Seminar, PPT, Quiz, and Group Discussion.

**Rationale for Nature of the course:**

To understand the modern plasma phenomenon in the universe and to explore the physical processes which acquire in the space environment.

**Activities to be given:**

1. To train the students to understand the plasma and learn the magneto-hydrodynamics concepts applied to plasma.
2. Enhancing the students to learn the possible applications of plasma by incorporating various electrical and electronic instruments.

**Course Learning Outcomes (CLO's):**

At the end of the course, the student will be able to:

| CLO | Course Learning Outcomes | K - Level |
|---|---|---|
| **CO1** | Understand the collision, cross section of charged particles and to able to correlate the magnetic effect of ion and electrons in plasma state. | Upto K5 |
| **CO2** | Understand the plasma and learn the magneto-hydrodynamics concepts applied to plasma. | Upto K5 |
| **CO3** | Explore the oscillations and waves of charged particles and thereby apply the Maxwell's equation to quantitative analysis of plasma. | Upto K5 |
| **CO4** | Analyze the different principle and techniques to diagnostics of plasma. | Upto K5 |
| **CO5** | Learn the possible applications of plasma by incorporating various electrical and electronic instruments. | Upto K5 |

**Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 1 | 1 | 2 |
| **CO2** | 3 | 3 | 2 | 1 | 1 | 2 |
| **CO3** | 3 | 3 | 2 | 2 | 1 | 2 |
| **CO4** | 3 | 3 | 3 | 2 | 1 | 2 |
| **CO5** | 3 | 3 | 3 | 2 | 1 | 2 |

1. **Basic level** **2. Intermediate level** **3.Advance level**

Annexure - 7

## Lesson Plan (TOTAL HOURS : 75 Hrs)

| Units | Course content | Hours | Mode |
|---|---|---|---|
| I | **FUNDAMENTAL CONCEPTS OF PLASMA** : Kinetic pressure in a partially ionized - mean free path and collision cross section Mobility of charged particles - Effect of magnetic field on the mobility of ions and electrons-Thermal conductivity- Effect of magnetic field- Quasi-neutrality of plasma Debye shielding distance - Optical properties of plasma. | 15 | Chalk and Talk & Seminar |
| II | **MOTION OF CHARGED PARTICLES IN ELECTRIC AND MAGNETIC FIELD:** Particle description of plasma- Motion of charged particle in electrostatic field-Motion of charged particle in uniform magnetic field - Motion of charged particle in electric and magnetic fields-Motion of charged particle inhomogeneous magnetic field -Motion of charged particle in magnetic mirror confinement - motion of an electron in a time varying electric field-Magneto- hydrodynamics -Magneto-hydrodynamic equations – Condition for magneto hydrodynamic behaviour. | 15 | Chalk and Talk & Seminar |
| III | **PLASMA OSCILLATIONS AND WAVES** : Introduction, theory of simple oscillations - electron oscillation in a plasma Derivations of plasma oscillations by using Maxwell's equation-Ion oscillation and waves in a magnetic field -thermal effects on plasma oscillations - Landau damping -Hydro magnetic waves - Oscillations in an electron beam. | 15 | Chalk and Talk & Seminar |
| IV | **PLASMA DIAGNOSTICS** TECHNIQUES**:** Single probe method - Double probe method - Use of probe technique for measurement of plasma parameters in magnetic field -microwave method - spectroscopic method - -laser as a tool for plasma diagnostics-X-ray diagnostics of plasma - acoustic method - conclusion. | 15 | Chalk and Talk & Seminar |
| V | **APPLICATIONS OF PLASMA PHYSICS:** Magneto hydrodynamic Generator - Basic theory -Principle of WorkingFuel in MHD Generator-Generation of Microwaves Utilizing High Density Plasma -Plasma Diode. | 15 | Chalk and Talk & Seminar |

Annexure - 7

| Department of Physics | | | | | Class: I M.Sc., | | | |
|---|---|---|---|---|---|---|---|---|
| **Sem** | **Category** | **Course Code** | **Course Title** | **Credits** | **Contact Hours / Week** | **CIA** | **SE** | **Total** |
| II | DSEC | 23OPPHDSE2B | Advanced Optics | 3 | 5 | 25 | 75 | 100 |

| Nature of the Course | | |
|---|---|---|
| **Knowledge and Skill Oriented** | **Employability Oriented** | **Entrepreneurship oriented** |
| | ✓ | |

**Course Objectives:**

1. To discuss the transverse character of light waves and different polarization phenomenon.
2. To Discriminate all the fundamental processes involved in laser devices and to analyze the design and operation of the devices
3. To Study the important characteristics of holograms and its applications.
4. To Demonstrate the basic configuration of a fiber optic – communication system and advantages
5. To Identify the properties of nonlinear interactions of light and matter.

**Course Content:**

| Unit | Course Content | Hours | K Level | CLO |
|---|---|---|---|---|
| I | **POLARIZATION AND DOUBLE REFRACTION:** Classification of polarization – Transverse character of light waves – Polarizer and analyzer – Malu's law – Production of polarized light – Wire grid polarizer and the polaroid – Polarization by reflection – Polarization by double refraction – Polarization by scattering – The phenomenon of double refraction – Normal and oblique incidence – Interference of polarized light: Quarter and half wave plates – Analysis of polarized light – Optical activity. | 15 | Upto K5 | CLO1 |
| II | **LASERS**: Basic principles – Spontaneous and stimulated emissions – Components of the laser – Resonator and lasing action – Types of lasers and its applications – Solid state lasers – Ruby laser – Nd:YAG laser – gas lasers – He-Ne laser – $CO_2$ laser – Chemical lasers – HCl laser – Semiconductor laser. | 15 | Upto K5 | CLO2 |
| III | **HOLOGRAPHY**: Principle of holography – Recording of the hologram – Reconstruction of the image – Theory – Some distinguishing characteristics of holographs – Practical applications of holography – Advances in holography. | 15 | Upto K5 | CLO3 |
| IV | **FIBER OPTICS** :Introduction – Total internal reflection – The optical fiber – Glass fibers – The coherent bundle – The numerical aperture – Attenuation in optical fibers – Single and multi-mode fibers – Pulse dispersion in multimode optical fibers – Ray dispersion in multimode step index fibers – Parabolicindex fibers – Fiber-optic sensors: precision displacement sensor – Precision vibration sensor. | 15 | Upto K5 | CLO4 |

| | | | | |
|---|---|---|---|---|
| V | **NON-LINEAR OPTICS**: Basic principles – Harmonic generation – Second harmonic generation – Phase matching – Third harmonic generation – Optical mixing – Parametric generation of light – Self-focusing of light. | 15 | Upto K5 | CLO5 |

**Book for study:**


1. B. B. Laud, 2017, Lasers and Non – Linear Optics, 3rd Edition, New Age International (P) Ltd.
2. Ajoy Ghatak, 2017, Optics, 6th Edition, McGraw – Hill Education Pvt. Ltd.
3. William T. Silfvast, 1996, Laser Fundamentals Cambridge University Press, New York
4. J. Peatros, Physics of Light and Optics, a good (and free!) electronic book
5. B. Saleh, and M. Teich, Fundamentals of Photonics, Wiley- Interscience


**Books for Reference:**


1. F. S. Jenkins and H. E. White, 1981, Fundamentals of Optics, (4th Edition), McGraw – Hill International Edition.
2. Dieter Meschede, 2004, Optics, Light and Lasers, Wiley – VCH, Varley GmbH.
3. Lipson, S. G. Lipson and H. Lipson, 2011, Optical Physics, 4th Edition, Cambridge University Press, New Delhi, 2011.
4. Y. B. Band, Light and Matter, Wiley and Sons (2006)
5. R. Guenther, Modern Optics, Wiley and Sons (1990)


**Web Resources / E-Books**

1. https://www.youtube.com/watch?v=WgzynezPiyc
2. https://www.youtube.com/watch?v=ShQWwobpW60
3. https://www.ukessays.com/essays/physics/fiber–optics–and–itapplications.php
4. https://www.youtube.com/watch?v=0kEvr4DKGRI
5. http://optics.byu.edu/textbook.aspx

**Pedagogy:**

Chalk and Talk, Seminar, PPT, Quiz, and Group Discussion.

**Rationale for Nature of the course:**

To know the concepts behind polarization and good pursue research work and application aspects of laser and to impart an extensive understanding of fiber and non – linear optics.

**Activities to be given**

1. To practice the students to demonstrate the basic configuration of a fiber optic – communication system.
2. Train the students to interpret the group of experiments that based on laser.

**Course Learning Outcomes (CLO's):**

**At the end of the course, the student will be able to:**

| CO | Course Learning Outcomes | K-Level |
|---|---|---|
| **CO1** | Discuss the transverse character of light waves and different polarization phenomenon | Upto K5 |
| **CO2** | Discriminate all the fundamental processes involved in laser devices and to analyze the design and operation of the devices | Upto K5 |
| **CO3** | Study the important characteristics of holograms and its applications. | Upto K5 |
| **CO4** | Demonstrate the basic configuration of a fiber optic – communication system and advantages | Upto K5 |
| **CO5** | Identify the properties of nonlinear interactions of light and matter | Upto K5 |

**Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 2 | 3 | 3 |
| **C02** | 3 | 3 | 3 | 2 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 2 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 3 |

1. **Basic level** **2. Intermediate level** **3.Advance level**

Annexure - 7

## Lesson Plan: (TOTAL HOURS: 75 Hrs)

| Units | Course content | Hours | Mode |
|---|---|---|---|
| I | **POLARIZATION AND DOUBLE REFRACTION:** Classification of polarization – Transverse character of light waves – Polarizer and analyzer – Malu's law Production of polarized light – Wire grid polarizer and the polaroid – Polarization by reflection -Polarization by double refraction – Polarization by scattering – The phenomenon of double refraction - Normal and oblique incidence – Interference of polarized light: Quarter and half wave plates – Analysis of polarized light – Optical activity. | 15 | Chalk and Talk & PPT |
| II | **LASERS** :Basic principles – Spontaneous and stimulated emissions – Components of the laser -Resonator and lasing action – Types of lasers and its applications -Solid state lasers – Ruby laser – Nd:YAG laser – gas lasers - He-Ne laser – $CO_2$ laser – Chemical lasers – HCl laser – Semiconductor laser | 15 | Chalk and Talk & Seminar |
| III | **HOLOGRAPHY**: Principle of holography – Recording of the hologram - Reconstruction of the image – Theory<br>Some distinguishing characteristics of holographs<br>Practical applications of holography – Advances in holography. | 15 | Chalk and Talk & Seminar |
| IV | **FIBER OPTICS** :Introduction – Total internal reflection – The optical fiber – Glass fibers –The coherent bundle – The numerical aperture – Attenuation in optical fibers Single and multi-mode fibers – Pulse dispersion in multimode optical fibers -Ray dispersion in multimode step index fibers – Parabolicindex fibers – Fiber- optic sensors: precision displacement sensor- Precision vibration sensor | 15 | Chalk and Talk & PPT |
| V | **NON-LINEAR OPTICS** :Basic principles – Harmonic generation - Second harmonic generation – Phase matching Third harmonic generation – Optical mixing -Parametric generation of light -Self-focusing of light | 15 | Chalk and Talk & Seminar |

Annexure - 7

| Department of Physics | | | | | Class: I M.Sc., | | | |
|---|---|---|---|---|---|---|---|---|
| **Sem** | **Category** | **Course Code** | **Course Title** | **Credits** | **Contact Hours / Week** | **CIA** | **SE** | **Total** |
| II | DSEC | 23OPPHDSE2C | Solar Energy Utilization | 3 | 5 | 25 | 75 | 100 |

| Nature of the Course | | |
|---|---|---|
| **Knowledge and Skill Oriented** | **Employability Oriented** | **Entrepreneurship oriented** |
| | ✓ | |

## Course Objectives:

1. To impart fundamental aspects of solar energy utilization.
2. To give adequate exposure to solar energy related industries
3. To harness entrepreneurship skills
4. To understand the different types of solar cells and channelizing them to the different sectors of society
5. To develop an industrialist mind set by utilizing renewable source of energy

## Course Content:

| UNIT | Course Content | Hours | K level | CLO |
|---|---|---|---|---|
| I | Conduction, Convection and Radiation – Solar Radiation at the earth's surface – Determination of solar time – Solar energy measuring instruments. | 15 | Upto K5 | CO1 |
| II | Physical principles of conversion of solar radiation into heat flat plate collectors - General characteristics – Focusing collector systems – Thermal performance evaluation of optical loss. | 15 | Upto K5 | CO2 |
| III | Types of solar water heater - Solar heating system – Collectors and storage tanks – Solar ponds – Solar cooling systems. | 15 | Upto K5 | CO3 |
| IV | Photo Voltaic principles – Types of solar cells – Crystalline silicon/amorphous silicon and Thermo - electric conversion - process flow of silicon solar cells- different approaches on the process- texturization, diffusion, Antireflective coatings, metallization. | 15 | Upto K5 | CO4 |

| | | | | |
|---|---|---|---|---|
| V | Use of nanostructures and nanomaterials in fuel cell technology - high and low temperature fuel cells, cathode and anode reactions, fuel cell catalysts, electrolytes, ceramic catalysts. Use of Nano technology in hydrogen production and storage. Industrial visit – data collection and analysis - presentation | 15 | Upto K5 | CO5 |

**Book for study:**


1. Solar Energy Utilisation –G.D Rai-Khanna Publisher-Delhi 1987.
2. Maheshwar Sharon, Madhuri Sharon, Carbon "Nano Forms And Applications" Mc.Graw Hill,2010
3. Soteris A. Kalogirou, „Solar Energy Engineering: Processes and Systems", Academic Press, London, 2009.
4. Tiwari G.N, "Solar Energy – Fundamentals Design, Modelling and applications, Narosa Publishing House, New Delhi, 2002
5. Sukhatme S.P. Solar Energy, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.


**Books for Reference:**


1. Energy – An Introduction to Physics – R.H.Romer, W.H.Freeman.(1976)
2. Solar energy thermal processes – John A.Drife and William. (1974)
3. John W. Twidell & Anthony D.Weir, 'Renewable Energy Resources,2005
4. John A. Duffie, William A. Beckman, Solar Energy: Thermal Processes, 4th Edition, john Wiley and Sons, 2013.
5. Duffie, J.A., Beckman, W.A. , "Solar Energy Thermal Process", John Wiley and Sons, 2007.


**Web Resources / E-Books**

1. https://pdfs.semanticscholar.org/63a5/a69421b69d2ce9f359bbfc86c63556 f9a4fb
2. https://books.google.vg/books?id=lXHcwZo9XwC&sitesec=buy&source=gbs_vpt_read
3. www.nptel.ac.in/courses/112105051
4. www.freevideolectures.com
5. http://www.e-booksdirectory.com

**Rationale for nature of Course**

**employability oriented:** Study of the solar energy utilisation leads to information which is of practical value to the physicist. it gives us information about the applications of solar energy. students who undergo this course are successfully bound to get a better insight and understanding of the subject.

**Activities to be given:**

1. Enhancing the quality of students to understand the solar energy.
2. Train the students to understand the heat transfer and solar radiation.

**Course Learning Outcomes (CLOs):**

At the end of the course, the student will be able to:

| CLO | Course Learning Outcomes | K-Level |
|---|---|---|
| CLO1 | Gained knowledge in fundamental aspects of solar energy utilization | Upto K5 |
| CLO2 | Equipped to take up related job by gaining industry exposure | Upto K5 |
| CLO3 | Develop entrepreneurial skills | Upto K5 |
| CLO4 | Skilled to approach the needy society with different types of solar cells | Upto K5 |
| CLO5 | Gained industrialist mindset by utilizing renewable source of energy | Upto K5 |

**Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CLO1** | 3 | 3 | 2 | 3 | 3 | 3 |
| **CLO2** | 3 | 3 | 2 | 3 | 3 | 3 |
| **CLO3** | 3 | 3 | 3 | 3 | 3 | 3 |
| **CLO4** | 3 | 3 | 2 | 3 | 3 | 3 |
| **CLO5** | 3 | 3 | 3 | 3 | 3 | 3 |

**1-Basic Level 2- Intermediate Level 3- Advanced Level**

Annexure - 7

## Lesson Plan: (TOTAL HOURS: 75 Hrs)

| Units | Course content | Hours | Mode |
|---|---|---|---|
| **I** | Conduction, Convection and Radiation – Solar Radiation at the earth's surface -Determination of solar time-Solar energy measuring instruments | 15 | Chalk and Talk & PPT |
| **II** | Physical principles of conversion of solar radiation into heat flat plate collectors -General characteristics – Focusing collector systems -Thermal performance evaluation of optical loss | 15 | Chalk and Talk & Seminar |
| **III** | Types of solar water heater - Solar heating system Collectors and storage tanks -Solar ponds – Solar cooling systems | 15 | Chalk and Talk & Seminar |
| **IV** | Photo Voltaic principles – Types of solar cells – Crystalline silicon/amorphous silicon and Thermo -electric conversion - process flow of silicon solar cells- different approaches on the process-texturization, diffusion, Antireflective coatings, metallization. | 15 | Chalk and Talk & PPT |
| **V** | Use of nanostructures and nanomaterials in fuel cell technology -high and low temperature fuel cells, cathode and anode reactions, fuel cell catalysts, electrolytes, ceramic catalysts-Use of Nano technology in hydrogen production and storage-Industrial visit – data collection and analysis - presentation | 15 | Chalk and Talk & Seminar |

| Department of Physics | | | | | Class: I M.Sc., | | | |
|---|---|---|---|---|---|---|---|---|
| **Sem** | **Category** | **Course Code** | **Course Title** | **Credits** | **Contact Hours / Week** | **CIA** | **SE** | **Total** |
| II | DSEC | 23OPPHDSE2D | Bio physics | 3 | 5 | 25 | 75 | 100 |

| Nature of the Course | | |
|---|---|---|
| **Knowledge and Skill Oriented** | **Employability Oriented** | **Entrepreneurship oriented** |
| | ✓ | |

## Course Objectives:

1. To understand the physical principles involved in cell function maintenance.
2. To understand the fundamentals of macromolecular structures involved in propagation of life.
3. To understand the biophysical function of membrane and neuron.
4. To understand various kinds of radiation and their effects on living system and to know the hazards posed by such radiations and the required precautions.
5. To understand the physical principles behind the various techniques available for interrogating biological macromolecules.

## Course Content:

| Unit | Course Content | Hours | K Level | CLO |
|---|---|---|---|---|
| **I** | **CELLULAR BIOPHYSICS** Architecture and Life Cycle of cells – Organelles of Prokaryotic and Eukaryotic cell – Cell size and shape – Fine structure of Prokaryotic and Eukaryotic cell organization – Compartment & assemblies membrane system – Extracellular matrix - Molecular mechanisms of Vesicular traffic - Electrical activities of cardiac and neuronal cells. | 15 | Upto K5 | CLO1 |
| **II** | **MOLECULAR BIOPHYSICS** Macromolecular structure: Protein structure – amino acids, peptide bonds, primary, secondary, tertiary and quaternary structures of proteins -Nucleic acid structure: nucleosides and nucleotides, RNA structure, DNA structure and conformation. Special Bio-macromolecules: Metalloproteins, nucleoproteins, ribozymes, chaperons and prions. | 15 | Upto K5 | CLO2 |
| **III** | **MEMBRANE AND NEURO BIOPHYISCS** Models membranes - Biological membranes and dynamics – Membrane Capacitors – Transport across cell and organelle membranes – Ion channels.<br>Nervous system: Organization of the nervous system –Membrane | 15 | Upto K5 | CLO3 |

| | | | | |
|---|---|---|---|---|
| | potential – Origins of membrane potential - Electrochemical potentials – Nernst equation – Goldman equation. | | | |
| **IV** | **RADIATION BIO PHYSICS** X-Ray: Effects on bio-macromolecules – Gamma Radiation: Molecular effects of gamma radiation, Radiation effects on nucleic acids and membranes, Effects on cell and organelles – UV radiation: Effects on biomacromolecules and proteins – Radiation hazards and protection – use of radiations in cancer. | 15 | Upto K5 | CLO4 |
| **V** | **PHYSICAL METHODS IN BIOLOGY** Spectroscopy: UV-Visible absorption spectrophotometry – Optical Rotatory Dispersion (ORD) – Structure Determination: X-ray Crystallography, Electron spin resonance (ESR) and biological applications. Chromatography: Thin layer chromatography (TLC), Gas liquid chromatography (GLC) – Centrifugation: Differential centrifugation, density gradient centrifugation. Electrophoresis: Gel electrophoresis, polyacrylamide gel electrophoresis. | 15 | Upto K5 | CLO5 |

**Book for study:**


1. The cell: A molecular approach, Geoffrey M. Cooper, ASM Press, 2013.
2. Biophysics, VasanthaPattabhi, N. Gautham, Narosa Publishing, 2009
3. Biophysics, P. S. Mishra VK Enterprises, 2010.
4. Biophysics, M. A Subramanian, MJP Publishers, 2005.
5. Bioinstrumentation, L. Veerakumari, MJP Publishers, 2006.


**Books for Reference:**


1. Chemical Biophysics by Daniel A Beard (Cambridge University Press, 2008).
2. Essential cell biology by Bruce Albert et al (Garland Science)
3. Biophysics, W. Hoppe, W. Lohmann, H. Markl and H. Ziegler. Springer Verlag, Berlin (1983).
4. Membrane Biophysics by Mohammad Ashrafuzzaman, Jack A. Tuszynski, (Springer science & business media).
5. Biological spectroscopyby Iain D. Campbell, Raymond A. Dwek


**Web Resources / E-Books**

1. General Bio: http://www.biology.arizona.edu/DEFAULT.html
2. Spectroscopy: http://www.cis.rit.edu/htbooks/nmr/inside.htm
3. Electrophoresis:http://learn.genetics.utah.edu/content/labs/gel/
4. Online biophysics programs: http://mw.concord.org/modeler/
5. https://blanco.biomol.uci.edu/WWWResources.html

**Pedagogy:**

Chalk and Talk, Seminar, Quiz, and Group Discussion.

**Rationale for Nature of the course:**

Learn about the basic concepts of biophysical function of membrane and neuron.

**Activities to be given**

To analyse and interpret data from various techniques available for biological macromolecules

**Course Learning Outcomes(CLOs):**

**At the end of the course, the student will be able to:**

| CLO | Course Learning Outcomes | K- Level |
|---|---|---|
| **CO1** | Understand the structural organization and function of living cells and should able to apply the cell signaling mechanism and its electrical activities. | Upto K5 |
| **CO2** | Comprehension of the role of biomolecular conformation to function. | Upto K5 |
| **CO3** | Conceptual understanding of the function of biological membranes and also to understand the functioning of nervous system. | Upto K5 |
| **CO4** | To know the effects of various radiations on living systems and how to prevent ill effects of radiations. | Upto K5 |
| **CO5** | Analyze and interpret data from various techniques viz., spectroscopy, crystallography, chromatography etc., | Upto K5 |

**Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 2 | 1 | 2 |
| **CO2** | 3 | 3 | 3 | 2 | 1 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 1 | 1 |
| **CO4** | 3 | 3 | 3 | 2 | 1 | 1 |
| **CO5** | 3 | 3 | 3 | 3 | 1 | 1 |

**1. Basic level 2. Intermediate level 3.Advance level**

Annexure - 7

## Lesson Plan (TOTAL HOURS :75 Hrs)

| Units | Course content | Hours | Mode |
|---|---|---|---|
| I | **CELLULAR BIOPHYSICS** Architecture and Life Cycle of cells – Organelles of Prokaryotic and Eukaryotic cell – Cell size and shape – Fine structure of Prokaryotic and Eukaryotic cell organization – Compartment & assemblies membrane system – Extracellular matrix - Molecular mechanisms of Vesicular traffic - Electrical activities of cardiac and neuronal cells. | 15 | Chalk and Talk & Seminar |
| II | **MOLECULAR BIOPHYSICS** Macromolecular structure: Protein structure – amino acids, peptide bonds, primary, secondary, tertiary and quaternary structures of proteins -Nucleic acid structure: nucleosides and nucleotides, RNA structure, DNA structure and conformation. Special Bio-macromolecules: Metalloproteins, nucleoproteins, ribozymes, chaperons and prions. | 15 | Chalk and Talk & Seminar |
| III | **MEMBRANE AND NEURO BIOPHYISCS** Models membranes - Biological membranes and dynamics – Membrane Capacitors – Transport across cell and organelle membranes – Ion channels. Nervous system: Organization of the nervous system –Membrane potential – Origins of membrane potential - Electrochemical potentials – Nernst equation – Goldman equation. | 15 | Chalk and Talk & Seminar |
| IV | **RADIATION BIO PHYSICS** X-Ray: Effects on bio-macromolecules – Gamma Radiation: Molecular effects of gamma radiation, Radiation effects on nucleic acids and membranes, Effects on cell and organelles – UV radiation: Effects on biomacromolecules and proteins – Radiation hazards and protection – use of radiations in cancer. | 15 | Chalk and Talk & Seminar |
| V | **PHYSICAL METHODS IN BIOLOGY** Spectroscopy: UV-Visible absorption spectrophotometry – Optical Rotatory Dispersion (ORD) – Structure Determination: X-ray Crystallography, Electron spin resonance (ESR) and biological applications. Chromatography: Thin layer chromatography (TLC), Gas liquid chromatography (GLC) – Centrifugation: Differential centrifugation, density gradient centrifugation. Electrophoresis: Gel electrophoresis, polyacrylamide gel electrophoresis. | 15 | Chalk and Talk & Seminar |