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)

Annexure - 7

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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

Annexure - 7

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

Annexure - 7

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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) (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.

Annexure - 7

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 2	K1 K2	1 1	K1 K3	1(K3) 1(K5)	1(K4)	
2	CLO2	Upto K5	2 1	K1 K2	1 1	K1 K2	1(K3) (Each set of questions must be in the same level)	1(K4) 1(K5)	
3.	CLO3	Upto K5	1 1	K1 K2	1 1	K2 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

Annexure - 7

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 2	K1 K2	1 1	K1 K3	1(K3) 1(K5)	1(K4)	
2	CLO4	UptoK5	2 1	K1 K2	1 1	K1 K2	1(K3) (Each set of questions must be in The same level)	1(K4) 1(K5)	
3.	CLO5	Upto K5	1 1	K1 K2	1 1	K2 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**

Annexure - 7

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)

Annexure - 7

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)

Annexure - 7

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	Core	23OPPH11	Mathematical Physics	5	7	25	75	100

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

Course Objectives

1. To equip students with the mathematical techniques needed for understanding theoretical treatment in different courses taught in their program.
2. To extend their manipulative skills to apply mathematical techniques in their fields.
3. To help students apply mathematics in solving problems of Physics.

Course content:

Unit	Course Content	Hours	K Level	CLO
I	**LINEAR VECTOR SPACE -**Basic concepts – Definitions- examples of vector space – Linear independence Scalar product- Orthogonality – Gram-Schmidt orthogonalization procedure – linear operators – Dual space- ket and bra notation – orthogonal basis – change of basis – Isomorphism of vector space – projection operator –Eigen values and Eigen functions – Direct sum and invariant subspace – orthogonal transformations and rotation.	21	Up to K5	CLO 1
II	**COMPLEX ANALYSIS-**Review of Complex Numbers -de Moivre's theorem- Functions of a Complex Variable- Differentiability -Analytic functions- Harmonic Functions- Complex Integration- Contour Integration, Cauchy – Riemann conditions – Singular points – Cauchy's Integral Theorem and integral Formula -Taylor's Series Laurent's Expansion- Zeros and poles – Residue theorem and its Application: Potential theory - (1) Electrostatic fields and complex potentials - Parallel plates, coaxial cylinders and an annular region (2) Heat problems - Parallel plates and coaxial cylinders.	21	Up to K5	CLO 2
III	**MATRICES-** Types of Matrices and their properties, Rank of a Matrix - Conjugate of a matrix - Adjoint of a matrix - Inverse of a matrix - Hermitian and Unitary Matrices Trace of a matrix- Transformation of matrices - Characteristic equation - Eigen values and Eigen vectors - Cayley–Hamilton theorem – Diagonalization.	21	Up to K5	CLO 3
IV	**FOURIER TRANSFORMS & LAPLACE TRANSFORMS -** Definitions - Fourier transform and its inverse - Transform of Gaussian function and Dirac delta function -Fourier transform of derivatives - Cosine and sine transforms -	21	Up to K5	CLO 4

	Convolution theorem. Application: Diffusion equation: Flow of heat in an infinite and in a semi - infinite medium - Wave equation: Vibration of an infinite string and of a semi - infinite string. Laplace transform and its inverse - Transforms of derivatives and integrals – Differentiation and integration of transforms - Dirac delta functions Application - Laplace equation: Potential problem in a semi - infinite strip.			
V	**DIFFERENTIAL EQUATIONS-** Second order differential equation- Sturm-Liouville's theory - Series solution with simple examples - Hermite polynomials - Generating function Orthogonality properties - Recurrence relations – Legendre polynomials Generating function - Rodrigue formula – Orthogonality properties - Dirac delta function- One dimensional Green's function and Reciprocity theorem Sturm-Liouville's type equation in one dimension & their Green's function.	21	Up to K5	CLO 5

Book for study:

1. George Arfken and Hans J Weber, 2012, Mathematical Methods for Physicists – A Comprehensive Guide (7th edition), Academic press.
2. P.K. Chattopadhyay, 2013, *Mathematical Physics* (2nd edition), New Age, New Delhi
3. A W Joshi, 2017, Matrices and Tensors in Physics, 4th Edition (Paperback), New Age International Pvt. Ltd., India
4. B. D. Gupta, 2009, *Mathematical Physics* (4th edition), Vikas Publishing House, New Delhi.
5. H. K. Dass and Dr. Rama Verma, 2014, Mathematical Physics, Seventh Revised Edition, S. Chand & Company Pvt. Ltd., New Delhi.

Books for Reference:

1. E. Kreyszig, 1983, Advanced Engineering Mathematics, Wiley Eastern, New Delhi,
2. D. G. Zill and M. R. Cullen, 2006, Advanced Engineering Mathematics, 3rd Ed. Narosa, New Delhi.
3. S. Lipschutz, 1987, Linear Algebra, Schaum's Series, McGraw - Hill, New York 3. E. Butkov, 1968, Mathematical Physics Addison Wesley, Reading, Massachusetts.
4. P. R. Halmos, 1965, Finite Dimensional Vector Spaces, 2nd Edition, Affiliated East West, New Delhi.
5. C. R. Wylie and L. C. Barrett, 1995, Advanced Engineering Mathematics, 6 th Edition, International Edition, McGraw-Hill, New York

Web Resources/ e-Books:

1. www.khanacademy.org
2. https://youtu.be/LZnRlOA1_2I
3. http://hyperphysics.phy-astr.gsu.edu/hbase/hmat.html#hmath
4. https://www.youtube.com/watch?v=_2jymuM7OUU&list=PLhkiT_RYTEU27vS_SlED56gNjVJGO2qaZ

5. https://archive.nptel.ac.in/courses/115/106/115106086/

Pedagogy:

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

Rationale for Nature of the course:

Obtain the mathematical skill to solve physical problems

Activities to be given:

We will be providing students with intellectual problems, theory application problems, group discussion and other practical works and also insist them to check the Books for References and web resources.

Course Learning Outcome (CLOs)

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

CO	Course Outcome	K-level
CO1	Understand use of bra-ket vector notation and explain the meaning of complete orthonormal set of basis vectors, and transformations and be able to apply them	Up to K5
CO2	Able to understand analytic functions, do complex integration, by applying Cauchy Integral Formula. Able to compute many real integrals and infinite sums via complex integration.	Up to K5
CO3	Analyze characteristics of matrices and its different types, and the process of diagonalization.	Up to K5
CO4	Solve equations using Laplace transform and analyze the Fourier transformations of different function, grasp how these transformations can speed up analysis and correlate their importance in technology	Up to K5
CO5	To find the solutions for physical problems using linear differential equations and to solve boundary value problems using Green's function. Apply special functions in computation of solutions to real world problems	Up to K5

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

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

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

Annexure - 7

LESSON PLAN: TOTAL HOURS (105 Hrs)

Unit	Description	Hours	Mode
I	Basic concepts – Definitions- examples of vector space – Linear independence Scalar product- Orthogonality – Gram-Schmidt orthogonalization procedure – linear operators – Dual space- ket and bra notation – orthogonal basis – change of basis – Isomorphism of vector space – projection operator –Eigen values and Eigen functions – Direct sum and invariant subspace – orthogonal transformations and rotation	**21**	Chalk & Talk, Seminar and Group Discussion
II	**COMPLEX ANALYSIS-**Review of Complex Numbers -de Moivre's theorem- Functions of a Complex Variable- Differentiability -Analytic functions- Harmonic Functions- Complex Integration- Contour Integration, Cauchy – Riemann conditions – Singular points – Cauchy's Integral Theorem and integral Formula -Taylor's Series Laurent's Expansion- Zeros and poles – Residue theorem and its Application: Potential theory - (1) Electrostatic fields and complex potentials - Parallel plates, coaxial cylinders and an annular region (2) Heat problems - Parallel plates and coaxial cylinders	21	Chalk & Talk, Seminar and Group Discussion
III	**MATRICES** :Types of Matrices and their properties, Rank of a Matrix - Conjugate of a matrix - Adjoint of a matrix - Inverse of a matrix - Hermitian and Unitary Matrices Trace of a matrix- Transformation of matrices - Characteristic equation - Eigen values and Eigen vectors - Cayley–Hamilton theorem – Diagonalization	21	PPT, Chalk & Talk, Seminar and Group Discussion
IV	**FOURIER TRANSFORMS & LAPLACE TRANSFORMS** - Definitions - Fourier transform and its inverse - Transform of Gaussian function and Dirac delta function -Fourier transform of derivatives - Cosine and sine transforms - Convolution theorem. Application: Diffusion equation: Flow of heat in an infinite and in a semi - infinite medium - Wave equation: Vibration of an infinite string and of a semi - infinite string. Laplace transform and its inverse - Transforms of derivatives and integrals – Differentiation and integration of transforms - Dirac delta functions Application - Laplace equation: Potential problem in a semi - infinite strip	21	Chalk & Talk, Seminar and Group Discussion
V	**DIFFERENTIAL EQUATIONS-** Second order differential equation- Sturm-Liouville's theory - Series solution with simple examples - Hermite polynomials - Generating function Orthogonality properties - Recurrence relations – Legendre polynomials Generating function - Rodrigue formula – Orthogonality properties - Dirac delta function- One dimensional Green's function and Reciprocity theorem Sturm-Liouville's type equation in one dimension & their Green's function.	21	Chalk & Talk, Seminar and Group Discussion

Annexure - 7

Department of Physics					Class: I M.Sc.,			
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**SE**	**Total**
I	Core	23OPPH12	Classical Mechanics and Relativity	5	7	25	75	100

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

Course Objectives

1. To study the Lagrangian methods.
2. To learn about the central field motion.
3. To study the Hamiltonian formulations.
4. To study the mechanics of small oscillations.
5. To learn about Hamilton – Jacobi Theory.

Course content:

Unit	Course Content	Hours	K Level	CLO
I	Mechanics of a single particle – mechanics of a system of particles – conservation laws for a system of particles – constraints – holonomic & non-holonomic constraints – generalized coordinates – configuration space – transformation equations – principle of virtual work.	21	Up to K5	CLO 1
II	D'Alembert's principle – Lagrangian equations of motion for conservative systems – applications: (i) simple pendulum (ii) Atwood's machine (iii) projectile motion.	21	Up to K5	CLO 2
III	Phase space – cyclic coordinates – conjugate momentum – Hamiltonian function – Hamilton's canonical equations of motion – applications: (i) simple pendulum (ii) one dimensional simple harmonic oscillator (iii) motion of particle in a central force field.	21	Up to K5	CLO 3
IV	Formulation of the problem – transformation to normal coordinates – frequencies of normal modes – linear triatomic molecule.	21	Up to K5	CLO 4
V	Inertial and non-inertial frames – Lorentz transformation equations – length contraction and time dilation – relativistic addition of velocities – Einstein's mass-energy relation – Minkowski's space – four vectors – position, velocity, momentum, acceleration and force in for vector notation and their transformations	21	Up to K5	CLO 5

Book for study:

1. H. Goldstein, 2002, *Classical Mechanics*, 3rd Edition, Pearson Edu.
2. J. C. Upadhyaya, *Classical Mechanics*, Himalaya Publshing. Co. New Delhi.
3. R. Resnick, 1968, *Introduction to Special Theory of Relativity*, Wiley Eastern, New Delhi.
4. R. G. Takwala and P.S. Puranik, Introduction to Classical Mechanics –Tata – McGraw Hill, New Delhi, 1980.
5. N. C. Rana and P.S. Joag, Classical Mechanics - Tata McGraw Hill, 2001

Books for Reference:

1. K. R. Symon, 1971, *Mechanics*, Addison Wesley, London.
2. S. N. Biswas, 1999, *Classical Mechanics*, Books & Allied, Kolkata.
3. Gupta and Kumar, *Classical Mechanics*, Kedar Nath.
4. T.W.B. Kibble, *Classical Mechanics*, ELBS.
5. Greenwood, *Classical Dynamics*, PHI, New Delhi.

Web Resources/E-Books:

1. http://poincare.matf.bg.ac.rs/~zarkom/Book_Mechanics_Goldst ein_Classical_Mechanics_optimized.pdf
2. https://pdfcoffee.com/classical-mechanics-j-c-upadhyay-2014editionpdf-pdf-free.html
3. https://nptel.ac.in/courses/122/106/122106027/
4. https://ocw.mit.edu/courses/physics/8-09-classical-mechanicsiii-fall-2014/lecture-notes/
5. https://www.britannica.com/science/relativistic-mechanics

Pedagogy:

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

Rationale for Nature of the course:

In this course, Classical Mechanics which is the study of macroscopic mechanical systems is considered from different perspectives of Lagrangian and Hamiltonian methods. Practical applications of these general principles towards simple problems of oscillatory systems, rigid bodies would enhance comprehension of the principles of Classical Mechanics and develop the skills necessary to analyze the behavior of the mechanical systems based on variety of mathematical methods of Classical Mechanics

Activities to be given

1. To practice the students to solve the problems in Lagarangian methods.
2. Enhancing the students to solve the problems related to Hamiltonian formulations.

Course Learning Outcome (CLOs)

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

CO	Course Learning Outcomes	K-level
CO1	Understand the fundamentals of classical mechanics.	Up to K5
CO2	Apply the principles of Lagrangian and Hamiltonian mechanics to solve the equations of motion of physical systems.	Up to K5
CO3	Apply the principles of Lagrangian and Hamiltonian mechanics to solve the equations of motion of physical systems.	Up to K5
CO4	Analyze the small oscillations in systems and determine their normal modes of oscillations.	Up to K5
CO5	Understand and apply the principles of relativistic kinematics to the mechanical systems.	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.Advanced Level

Annexure - 7

LESSON PLAN: TOTAL HOURS (105 Hrs)

Unit	Description	Hours	Mode
I	Mechanics of a single particle – mechanics of a system of particles – conservation laws for a system of particles – constraints – holonomic & non-holonomic constraints – generalized coordinates – configuration space – transformation equations – principle of virtual work.	21	Chalk & Talk, Seminar and Group Discussion
II	D'Alembert's principle – Lagrangian equations of motion for conservative systems – applications: (i) simple pendulum (ii) Atwood's machine (iii) projectile motion.	21	Chalk & Talk, Seminar and Group Discussion
III	Phase space – cyclic coordinates – conjugate momentum – Hamiltonian function – Hamilton's canonical equations of motion – applications: (i) simple pendulum (ii) one dimensional simple harmonic oscillator (iii) motion of particle in a central force field.	21	PPT, Chalk & Talk, Seminar and Group Discussion
IV	Formulation of the problem – transformation to normal coordinates – frequencies of normal modes – linear triatomic molecule.	21	Chalk & Talk, Seminar and Group Discussion
V	Inertial and non-inertial frames – Lorentz transformation equations – length contraction and time dilation – relativistic addition of velocities – Einstein's mass-energy relation – Minkowski's space – four vectors – position, velocity, momentum, acceleration and force in for vector notation and their transformations	21	Chalk & Talk, Seminar and Group Discussion

Department of Physics					Class: I M.Sc.,			
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**SE**	**Total**
I	Core	23OPPH1P	Practical-I	4	6	40	60	100

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

Course Objectives

1. To expose the students to experiments in the Mathematical modeling, optics, and properties of matter.
2. To expose the students to understand the fundamental concepts of diode, OP-AMP and ICs for the application of various instruments with practical observations.

List of Experiments: (Any Twelve Experiments)

1. Determination of Young's modulus and Poisson's ratio by Hyperbolic fringes - Cornu's Method
2. Determination of Viscosity of the given liquid – Meyer's disc 3. Measurement of Coefficient of linear expansion- Air wedge Method 4. B-H loop using Anchor ring.
5. Determination of Thickness of the enamel coating on a wire by diffraction
6. Determination of Rydberg's Constant - Hydrogen Spectrum
7. FP Etalon
8. Determination of Thickness of air film. - Solar spectrum – Hartmann's formula. Edser and Butler fringes.
9. Measurement of Band gap energy- Thermistor
10. Determination of Planck Constant – LED Method
11. Determination of Specific charge of an electron – Thomson's method.
12. Determination of Compressibility of a liquid using Ultrasonics
13. Determination of Wavelength, Separation of wavelengths - Michelson Interferometer
14. GM counter – Characteristics, inverse square law and absorption coefficient.
15. Measurement of Conductivity - Four probe method.
16. Arc spectrum – Iron.
17. Molecular spectra – AlO band.
18. Measurement of wavelength of Diode Laser / He – Ne Laser using Diffraction grating.
19. Determination of Diffraction pattern of light with circular aperture using Diode/He-Ne laser.
20. Study the beam divergence, spot size and intensity profile of Diode/He-Ne laser.

21. Measurements of Standing wave and standing wave co-efficient, Law of Inverse square, Receiver end transmitter behavior, Radiation Pattern - Microwave test bench
22. UV-Visible spectroscopy – Verification of Beer-Lambert's law and identification of wavelength maxima – Extinction coefficient.
23. Construction of relaxation oscillator using UJT
24. FET CS amplifier –frequency response, input impedance, output impedance
25. Study of important electrical characteristics of IC741
26. V- I Characteristics of different colours of LED.
27. Study of attenuation characteristics of Wien's bridge network and design of Wien's bridge oscillator using Op-Amp.
28. Study of attenuation characteristics of Phase shift network and design of Phase shift oscillator using Op-Amp.
29. Construction of Schmidt trigger circuit using IC 741 for a given hysteresis- application as squarer.
30. Construction of square wave Triangular wave generator using IC 741
31. Construction of a quadrature wave using IC 324
32. Construction of pulse generator using the IC 741 – application as frequency divider
33. Construction of Op-Amp- 4 bit Digital to Analog converter (Binary Weighted and R/2R ladder type)
34. Study of Binary to Gray and Gray to Binary code conversion.
35. Study of R-S, clocked R-S and D-Flip flop using NAND gates
36. Study of J-K, D and T flip flops using IC 7476/7473
37. Arithmetic operations using IC 7483- 4-bit binary addition and subtraction.
38. Study of Arithmetic logic unit using IC 74181.
39. Construction of Encoder and Decoder circuits using ICs.

Book for Study:

1. Practical Physics, Gupta and Kumar, Pragati Prakasan.
2. Kit Developed for doing experiments in Physics- Instruction manual, R. Srinivasan K.R Priolkar, Indian Academy of Sciences.
3. Electronic Laboratory Primer a design approach, S. Poornachandra, B. Sasikala, Wheeler Publishing, New Delhi.
4. Electronic lab manual Vol I, K ANavas, Rajath Publishing.
5. Electronic lab manual Vol II, K ANavas, PHI eastern Economy Edition

Book for Reference:

1. Advanced Practical Physics, S.P Singh, PragatiPrakasan.
2. An advanced course in Practical Physics, D. Chattopadhayay, C.R Rakshit, New Central Book Agency Pvt. Ltd
3. Op-Amp and linear integrated circuit, Ramakanth A Gaykwad, Eastern Economy Edition.
4. A course on experiment with He-Ne Laser, R.S. Sirohi, John Wiley & Sons (Asia) Pvt. Ltd.
5. Electronic lab manual Vol II, Kuriachan T.D, Syam Mohan, Ayodhya Publishing.

Pedagogy: Demonstration and practical sessions

COURSE OUTCOMES:

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

CO	Course Outcomes	K Level
CO1	Understand the strength of material using Young's modulus.	Up to K5
CO2	Acquire knowledge of thermal behaviour of the matetials.	Up to K5
CO3	Understand theoretical principles of magnetism through the experiments.	Up to K5
CO4	Acquire knowledge about arc spectrum and applications of laser	Up to K5
CO5	Improve the analytical and observation ability in Physics Experiments	Up to K5

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

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

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

LESSON PLAN: TOTAL HOURS (90 Hrs)

Unit	Description	Hours	Mode
I	1. Determination of Young's modulus and Poisson's ratio by Hyperbolic fringes - Cornu's Method 2. Determination of Viscosity of the given liquid – Meyer's disc 3. Measurement of Coefficient of linear expansion- Air wedge Method 4. B-H loop using Anchor ring. 5. Determination of Thickness of the enamel coating on a wire by diffraction 6. Determination of Rydberg's Constant - Hydrogen Spectrum 7. FP Etalon 8. Determination of Thickness of air film. - Solar spectrum – Hartmann's formula. Edser and Butler fringes.	18	Demonstration and practical sessions
II	9. Measurement of Band gap energy- Thermistor 10. Determination of Planck Constant – LED Method 11. Determination of Specific charge of an electron – Thomson's method. 12. Determination of Compressibility of a liquid using Ultrasonics 13. Determination of Wavelength, Separation of wavelengths - Michelson Interferometer . 14. GM counter – Characteristics, inverse square law and absorption coefficient. 15. Measurement of Conductivity - Four probe method. 16. Arc spectrum – Iron.	18	Demonstration and practical sessions
III	17. Molecular spectra – AlO band. 18. Measurement of wavelength of Diode Laser / He – Ne Laser using Diffraction grating. 19. Determination of Diffraction pattern of light with circular aperture using Diode/He-Ne laser. 20. Study the beam divergence, spot size and intensity profile of Diode/He-Ne laser. 21. Measurements of Standing wave and standing wave co-efficient, Law of Inverse square, Receiver end transmitter behavior, Radiation Pattern - Microwave test bench 22. UV-Visible spectroscopy – Verification of Beer-Lambert's law and identification of wavelength maxima – Extinction coefficient. 23. Construction of relaxation oscillator using UJT 24. FET CS amplifier –frequency response, input impedance, output impedance	18	Demonstration and practical sessions

IV	25. Study of important electrical characteristics of IC741 26. V- I Characteristics of different colours of LED. 27. Study of attenuation characteristics of Wien's bridge network and design of Wien's bridge oscillator using Op-Amp. 28. Study of attenuation characteristics of Phase shift network and design of Phase shift oscillator using Op-Amp. 29. Construction of Schmidt trigger circuit using IC 741 for a given hysteresis-application as squarer. 30. Construction of square wave Triangular wave generator using IC 741 31. Construction of a quadrature wave using IC 324 32. Construction of pulse generator using the IC 741 – application as frequency divider	18	Demonstration and practical sessions
V	33. Construction of Op-Amp- 4 bit Digital to Analog converter (Binary Weighted and R/2R ladder type). 34. Study of Binary to Gray and Gray to Binary code conversion. 35. Study of R-S, clocked R-S and D-Flip flop using NAND gates 36. Study of J-K, D and T flip flops using IC 7476/7473 37. Arithmetic operations using IC 7483- 4-bit binary addition and subtraction. 38. Study of Arithmetic logic unit using IC 74181. 39. Construction of Encoder and Decoder circuits using ICs.	18	Demonstration and practical sessions

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** 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	Core	23OPPH21	Statistical Mechanics	5	6	25	75	100

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

Course Objectives

1. To acquire the knowledge of thermodynamic potentials and to understand phase transition in thermodynamics
2. To identify the relationship between static and thermodynamic quantities
3. To comprehend the concept of partition function, canonical and Grand canonical ensemble
4. To grasp the fundamental knowledge about the three types of statics.
5. To get in depth knowledge about phase transition and fluctuation of thermodynamic properties vary with time.

Course Content:

Unit	Course Content	Hours	K Level	CLO
I	**PHASE TRANSITIONS:** Thermodynamic potentials - Phase Equilibrium - Gibb's phase rule - Phase transitions and Ehrenfest's classifications –Third law of Thermodynamics. Order parameters – Landau's theory of phase transition - Critical indices - Scale transformations and dimensional analysis.	18	Up to K5	CLO1
II	**STATISTICAL MECHANICS AND THERMODYNAMICS** Foundations of statistical mechanics - Specification of states of a system - Micro canonical ensemble - Phase space – Entropy - Connection between statistics and thermodynamics – Entropy of an ideal gas using the micro canonical ensemble - Entropy of mixing and Gibb's paradox.	18	Up to K5	CLO2
III	**CANONICAL AND GRAND CANONICAL ENSEMBLES** Trajectories and density of states - Liouville's theorem - Canonical and grand canonical ensembles - Partition function - Calculation of statistical quantities - Energy and density fluctuations.	18	Up to K5	CLO3

IV	**CLASSICAL AND QUANTUM STATISTICS** Density matrix - Statistics of ensembles - Statistics of indistinguishable particles - Maxwell-Boltzmann statistics - Fermi-Dirac statistics – Ideal Fermi gas – Degeneracy - Bose-Einstein statistics - Plank radiation formula - Ideal Bose gas - Bose-Einstein condensation.	18	Upto K5	CLO4
V	**REAL GAS, ISING MODEL AND FLUCTUATIONS** Cluster expansion for a classical gas - Virial equation of state – Calculation of the first Virial coefficient in the cluster expansion - Ising model - Mean field theories of the Ising model in three, two and one dimensions - Exact solutions in one dimension. Correlation of space-time dependent fluctuations - Fluctuations and transport phenomena - Brownian motion - Langevin's theory - Fluctuation-dissipation theorem - The Fokker-Planck equation	18	Upto K5	CLO5

Book for study:

1. S. K. Sinha, 1990, Statistical Mechanics, Tata McGraw Hill, New Delhi.

2. B. K. Agarwal and M. Eisner, 1998, Statistical Mechanics, Second Edition New Age International, New Delhi.

3. J. K. Bhattacharjee, 1996, Statistical Mechanics: An Introductory Text, Allied Publication, New Delhi.

4.F. Reif, 1965, Fundamentals of Statistical and Thermal Physics, McGraw -Hill, New York.

5.M. K. Zemansky, 1968, Heat and Thermodynamics, 5th edition, McGraw-Hill New York.

Books for Reference:

1. R. K. Pathria, 1996, Statistical Mechanics, 2nd edition, Butter WorthHeinemann, New Delhi.
2. L. D. Landau and E. M. Lifshitz, 1969, Statistical Physics, Pergamon Press, Oxford.
3. K. Huang, 2002, Statistical Mechanics, Taylor and Francis, London
4. W. Greiner, L. Neise and H. Stoecker, Thermodynamics and Statistical Mechanics, Springer Verlang, New York.
5. A.B. Gupta, H. Roy, 2002, Thermal Physics, Books and Allied, Kolkata.

Web Resources / E-Books

1. https://byjus.com/chemistry/third-law-of-thermodynamics/
2. https://web.stanford.edu/~peastman/statmech/thermodynamics.html
3. https://en.wikiversity.org/wiki/Statistical_mechanics_and_thermodyna mics
4. https://en.wikipedia.org/wiki/Grand_canonical_ensemble
5. https://en.wikipedia.org/wiki/Ising_model

Pedagogy:

Chalk and Talk, Seminar, Quiz, Group Discussion

Rationale for Nature of the course:

Thermodynamics and statstical mechanics gives the basic foundations in thermal physics

Activities to be given

Practice the students to solve thermodynamical and Stastical problems

Course Learning Outcomes(CLOs)

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

CLOs	Course Learning outcomes	K - Level
CLO1	Acquire the knowledge of thermodynamic potentials and to understand phase transition in thermodynamics	Up to K5
CLO2	Identify the relationship between stastic and thermodynamic quantities	Up to K5
CLO3	Comprehend the concept of partition function, canonical and Grand canonical ensemble	Up to K5
CLO4	Grasp the fundamental knowledge about the three types of stastics	Up to K5
CLO5	Get in depth knowledge about phase transistion and fluctuation of thermodynamic properties vary with time	Up to K5

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

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	3	3	2	3	3
CLO2	3	3	2	1	2	3
CLO3	3	3	3	2	3	3
CLO4	3	3	3	3	3	3
CLO5	2	3	3	2	3	3

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

Annexure - 7

Lesson Plan: (TOTAL HOURS: 90 Hrs)

Units	Course content	Hours	Mode
I	**PHASE TRANSITIONS** Thermodynamic potentials - Phase Equilibrium - Gibb's phase rule -Phase transitions and Ehrenfest's classifications-Third law of Thermodynamics. Order parameters Landau's theory of phase transition -Critical indices - Scale transformations and dimensional analysis	18	Chalk and Talk,PPT & Seminar
II	**STATISTICAL MECHANICS AND THERMODYNAMICS** Foundations of statistical mechanics - Specification of states of a system -Micro canonical ensemble - Phase space – Entropy-Connection between statistics and thermodynamics – Entropy of an ideal gas using the micro canonical ensemble-Entropy of mixing and Gibb's paradox.	18	Chalk and Talk, PPT & Seminar
III	**CANONICAL AND GRAND CANONICAL ENSEMBLES** Trajectories and density of states - Liouville's - Canonical and grand canonical ensembles -theorem Partition function - Calculation of statistical quantities-Energy and density fluctuations	18	Chalk and Talk,PPT & Seminar
IV	**CLASSICAL AND QUANTUM STATISTICS** Density matrix - Statistics of ensembles - Statistics of indistinguishable particles Maxwell-Boltzmann statistics - Fermi-Dirac statistics- Ideal Fermi gas – Degeneracy - Bose-Einstein statistics - Plank radiation formula Ideal Bose gas - Bose-Einstein condensation.	18	Chalk and Talk,PPT & Seminar
V	**REAL GAS, ISING MODEL AND FLUCTUATIONS** Cluster expansion for a classical gas - Virial equation of state –coefficient in the cluster expansion - Ising model-Calculation of the first Virial - Meanfield theories of the Ising model in three, two and one dimensions-Exact solutions in one dimension. Correlation of space-time dependent fluctuations -Fluctuations and transport phenomena - Brownian motion - Langevin's theory - Fluctuation-dissipation theorem - The Fokker-Planck equation	18	Chalk and Talk,PPT & Seminar

Department of Physics					Class: I M.Sc.,			
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**SE**	**Total**
II	Core	23OPPH22	Quantum Mechanics -I	5	6	25	75	100

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

Course Objectives

1. To develop the physical principles and the mathematical background important to quantum mechanical descriptions
2. To describe the propagation of a particle in a simple, one-dimensional potential.
3. To formulate and solve the Schrodinger's equation to obtain eigenvectors and energies for particle in a three-dimensional potential.
4. To explain the mathematical formalism and the significance of constants of motion, and see their relation to fundamental symmetries in nature
5. To discuss the Approximation methods like perturbation theory, Variational and WKB methods for solving the Schrödinger equation.

Course Content:

Unit	Course Content	Hours	K Level	CLO
I	**BASIC FORMALISM :** Interpretation of the wave function – Time dependent Schrodinger equation –Time independent Schrodinger equation – Stationary states – Ehrenfest's theorem – Linear vector space – Linear operator – Eigen functions and Eigen Values – Hermitian Operator – Postulates of Quantum Mechanics – Simultaneous measurability of observables – General Uncertainty relation	18	Upto K5	CLO1
II	**ONE DIMENSIONAL AND THREEDIMENSIONAL ENERGY EIGEN VALUE PROBLEMS:** Square – well potential with rigid walls – Square well potential with finite walls – Square potential barrier – Alpha emission – Bloch waves in a periodic potential – Kronig-penny square – well periodic potential – Linear harmonic oscillator: Operator method – Particle moving in a spherically symmetric potential – System of two interacting particles – Hydrogen atom – Rigid rotator.	18	Upto K5	CLO2

III	**GENERAL FORMALISM :** Dirac notation – Equations of motions – Schrodinger representation – Heisenberg representation – Interaction representation – Coordinate representation – Momentum representation – Symmetries and conservation laws – Unitary transformation – Parity and time reversal	18	Upto K5	CLO3
IV	**APPROXIMATIO N METHODS :** Time independent perturbation theory for non-degenerate energy levels – Degenerate energy levels – Stark effect in Hydrogen atom – Ground and excited state – Variation method – Helium atom – WKB approximation – Connection formulae (no derivation) – WKB quantization – Application to simple harmonic oscillator.	18	UptoK5	CLO4
V	**ANGULAR MOMENTUM :**Eigenvalue spectrum of general angular momentum – Ladder operators and their algebra – Matrix representation – Spin angular momentum – Addition of angular momenta – CG Coefficients – Symmetry and anti – symmetry of wave functions – Construction of wave-functions and Pauli's exclusion principle.	18	UptoK5	CLO5

Book for study:

1. P. M. Mathews and K. Venkatesan, A Text book of Quantum Mechanics, 2nd edition(37th Reprint),Tata McGraw-Hill, New Delhi, 2010.
2. G. Aruldhas, Quantum Mechanics, 2nd edition, Prentice Hall of India, New Delhi, 2009.
3. David J Griffiths, Introduction to Quantum Mechanics. 4th edition, Pearson, 2011.
4. SL Gupta and ID Gupta, Advanced Quantum Theory and Fields, 1st Edition, S.Chand& Co., New Delhi, 1982.
5. A. Ghatak and S. Lokanathan, Quantum Mechanics: Theory and Applications, 4thEdition, Macmillan, India, 1984.

Books for Reference:

1. E. Merzbacher, Quantum Mechanics, 2nd Edition, John Wiley and Sons, New York, 1970.
2. V. K. Thankappan, Quantum Mechanics, 2nd Edition, Wiley Eastern Ltd, New Delhi, 1985.
3. L. D. Landau and E. M. Lifshitz, Quantum Mechanics, 1st edition, Pergomon Press, Oxford, 1976.
4. S. N. Biswas, Quantum Mechanics, Books and Allied Ltd., Kolkata, 1999.
5. V. Devanathan, Quantum Mechanics, 2nd edition, Alpha Science International Ltd, Oxford , 2011.

Web Resources / E-Books

1. http://research.chem.psu.edu/lxjgroup/download_files/chem565c7.pdf
2. http://www.feynmanlectures.caltech.edu/III_20.html

3. http://web.mit.edu/8.05/handouts/jaffe1.pdf
4. https://hepwww.pp.rl.ac.uk/users/haywood/Group_Theory_Lectures/ Lecture_ 1.pdf
5. https://theory.physics.manchester.ac.uk/~xian/qm/chapter3.pdf

Pedagogy: Chalk and Talk, Seminar, Quiz, Group Discussion

Rationale for Nature of the course:

To understand the basic Quantum mechanics and to explore the physical processes in today's environment.

Activities to be given: Practice the students to solve the quantum mechanical problems.

Course Learning Outcomes(CLOs)

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

CLOs	Course Learning outcomes	K- Level
CLO1	Develop the physical principles and the mathematical background important to quantum mechanical descriptions	UptoK5
CLO2	Describe the propagation of a particle in a simple, one-dimensional potential.	UptoK5
CLO3	Formulate and solve the Schrodinger's equation to obtain eigenvectors and energies for particle in a three-dimensional potential	UptoK5
CLO4	Explain the mathematical formalism and the significance of constants of motion, and see their relation to fundamental symmetries in nature	UptoK5
CLO5	Discuss the Approximation methods like perturbation theory, Variational and WKB methods for solving the Schrödinger equation	UptoK5

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

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	3	3	2	3	3
CLO2	3	3	2	1	2	3
CLO3	3	3	3	2	3	3
CLO4	3	3	3	3	3	3
CLO5	2	3	3	2	3	3

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

Lesson Plan : (TOTAL HOURS : 90 Hrs)

Units	Course content	Hours	Mode
I	**BASIC FORMALISM :** Interpretation of the wave function – Time dependent Schrodinger equation —Time independent Schrodinger equation – Stationary states – Ehrenfest's theorem-Linear vector space – Linear operator – Eigen functions and Eigen Values – Hermitian Operator - Postulates of Quantum Mechanics – Simultaneous measurability of observables – General Uncertainty relation	18	Chalk and Talk & Seminar
II	**ONE DIMENSIONAL AND THREEDIMENSIONAL ENERGY EIGEN VALUE PROBLEMS:** Square – well potential with rigid walls – Square well potential with finite walls – Square potential barrier-Alpha emission – Bloch waves in a periodic potential – Kronig-penny square – well periodic potential-Linear harmonic oscillator: Operator method – Particle moving in a spherically symmetric potential-System of two interacting particles – Hydrogen atom – Rigid rotator	18	Chalk and Talk & Seminar
III	**GENERAL FORMALISM :** Dirac notation – Equations of motions – Schrodinger representation -Heisenberg representation – Interaction representation-Coordinate representation – Momentum representation – Symmetries and conservation laws-Unitary transformation – Parity and time reversal	18	Chalk and Talk & Seminar
IV	**APPROXIMATIO N METHODS :** Time independent perturbation theory for non-degenerate energy levels– Connection formulae (no derivation) - Degenerate energy levels – Stark effect in Hydrogen atom – Ground and excited state— Variation method – Helium atom – WKB approximation-WKB quantization – Application to simple harmonic oscillator.	18	Chalk and Talk & Seminar
V	**ANGULAR MOMENTUM :** Eigenvalue spectrum of general angular momentum – Ladder operators and their algebra -Matrix representation – Spin angular momentum -Addition of angular momenta – CG Coefficients - Symmetry and anti – symmetry of wave functions-Construction of wave-functions and Pauli's exclusion principle.	18	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	Core	23OPPH2P	Practical-II	4	6	40	60	100

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

Course Objectives:

1. To expose the students to experiments in the Mathematical modeling, optics, and properties of matter.
2. To expose the students to understand the fundamental concepts of diode, OP-AMP and ICs for the application of various instruments with practical observations.

List of Experiments: (Any Twelve Experiments)

1. Determination of Young's modulus and Poisson's ratio by Elliptical fringes - Cornu's Method
2. Determination of Stefan's constant of radiation from a hot body
3. Measurement of Coefficient of linear expansion- Air wedge Method
4. Measurement of Susceptibility of liquid - Quincke's method
5. B-H curve using CRO
6. Measurement of Magnetic Susceptibility - Guoy's method
7. LG Plate
8. Arc spectrum: Copper
9. Determination of Solar constant
10. Determination of e/m - Millikan's method
11. Miscibility measurements using ultrasonic diffraction method
12. Determination of Thickness of thin film. - Michelson Interferometer
13. GM Counter-Feather's analysis: Range of Beta Rays.
14. Iodine absorption spectra
15. Molecular spectra – CN bands.
16. Determination of Refractive index of liquids using diode Laser/ He-Ne Laser.

17. Determinationm of Numerical Apertures and Acceptance angle of optical fibres using Laser Source.

18. Measurement of Dielectricity-Microwave test bench

19. Hall effect in Semiconductor. Determine the Hall coefficient, carrier concentration and carrier mobility.

20. Interpretation of vibrational spectra of a given material.

21. Study of Modulus Counter

22. Construction of Multiplexer and Demultiplexer using ICs.

23. Determination of I-V Characteristics and efficiency of solar cell.

24. IC 7490 as scalar and seven segment display using IC7447

25. Solving simultaneous equations – IC 741 / IC LM324

26. Op-Amp –Active filters: Low pass, High pass and Band pass filters (Second Order) Batter worth filter

27. Construction of Current to Voltage and Voltage to Current Conversion using IC 741.

28. Construction of second order butter worth multiple feedback narrow band pass filter

29. Realization of analog to digital converter (ADC) using 4-bit DAC and synchronous counter IC74193

30. Construction of square wave generator using IC 555 – Study of VCO

31. Construction of Schmidt trigger circuit using IC555 for a given hysteresis – Application as squarer

32. Construction of pulse generator using the IC 555 – Application as frequency divider

33. BCD to Excess- 3 and Excess 3 to BCD code conversion

34. Study of binary up / down counters - IC 7476 / IC7473

35. Shift register and Ring counter and Johnson counter- IC 7476/IC 7474

36. Study of synchronous parallel 4-bit binary up/down counter using IC 74193

37. Study of asynchronous parallel 4-bit binary up/down counter using IC 7493

Books for Reference:

1.An advanced course in Practical Physics, D. Chattopadhayay, C.R Rakshit, New Central Book Agency Pvt. Ltd

2.Advanced Practical Physics, S.P Singh, Pragati Prakasan

3.A course on experiment with He-Ne Laser, R. S. Sirohi, John Wiley & Sons (Asia) Pvt. Ltd

Pedagogy

Projector, Demonstration and Practical sessions.

Course Learning Outcomes(CLOs):

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

	Course Learning Outcomes	K Level
CO1	Understand the strength of material using Young's modulus.	Upto K5
CO2	Acquire knowledge of thermal behaviour of the matetials.	Upto K5
CO3	Understand theoretical principles of magnetism through the experiments.	Upto K5
CO4	Acquire knowledge about arc spectrum and applications of laser	Upto K5
CO5	Improve the analytical and observation ability in Physics Experiments	Upto K5

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

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

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

LESSON PLAN: TOTAL HOURS (90 Hrs)

Unit	Description	Hours	Mode
I	1. Determination of Young's modulus and Poisson's ratio by Elliptical fringes - Cornu's Method 2. Determination of Stefan's constant of radiation from a hot body 3. Measurement of Coefficient of linear expansion- Air wedge Method 4. Measurement of Susceptibility of liquid - Quincke's method 5. B-H curve using CRO 6. Measurement of Magnetic Susceptibility - Guoy's method 7. LG Plate 8. Arc spectrum: Copper	18	Demonstration and practical sessions
II	9. Determination of Solar constant 10. Determination of e/m - Millikan's method 11. Miscibility measurements using ultrasonic diffraction method	18	Demonstration and practical sessions

	12. Determination of Thickness of thin film. - Michelson Interferometer 13. GM Counter-Feather's analysis: Range of Beta Rays. 14. Iodine absorption spectra 15. Molecular spectra – CN bands. 16. Determination of Refractive index of liquids using diode Laser/ He-Ne Laser.		
III	17. Determination of Numerical Apertures and Acceptance angle of optical fibres using Laser Source. 18. Measurement of Dielectricity-Microwave test bench 19. Hall effect in Semiconductor. Determine the Hall coefficient, carrier concentration and carrier mobility. 20. Interpretation of vibrational spectra of a given material. 21. Study of Modulus Counter 22. Construction of Multiplexer and Demultiplexer using ICs. 23. Determination of I-V Characteristics and efficiency of solar cell. 24. IC 7490 as scalar and seven segment display using IC7447	18	Demonstration and practical sessions
IV	25. Solving simultaneous equations – IC 741 / IC LM324 26. Op-Amp –Active filters: Low pass, High pass and Band pass filters (Second Order) Batter worth filter 27. Construction of Current to Voltage and Voltage to Current Conversion using IC 741. 28. Construction of second order butter worth multiple feedback narrow band pass filter 29. Realization of analog to digital converter (ADC) using 4-bit DAC and synchronous counter IC74193 30. Construction of square wave generator using IC 555 – Study of VCO 31. Construction of Schmidt trigger circuit using IC555 for a given hysteresis – Application as squarer 32. Construction of pulse generator using the IC 555 – Application as frequency divider	18	Demonstration and practical sessions
V	33. BCD to Excess- 3 and Excess 3 to BCD code conversion 34. Study of binary up / down counters - IC 7476 / IC7473 35. Shift register and Ring counter and Johnson counter- IC 7476/IC 7474 36. Study of synchronous parallel 4-bit binary up/down counter using IC 74193 37. Study of asynchronous parallel 4-bit binary up/down counter using IC 7493	18	Demonstration and practical sessions

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 Some distinguishing characteristics of holographs 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. 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

Annexure - 7

Department of Physics					Class: I M.Sc.,			
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**SE**	**Total**
II	SEC	23OPPHSEC21	Microprocessor 8085 and Microcontroller 8051	2	2	25	75	100

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

Course Objectives:

1. To provide an understanding of the architecture and functioning of microprocessor 8085A.
2. To learn the methods of interfacing I/O devices and memory to microprocessor.
3. To study the concepts of 8085A programming function and their applications.
4. To Acquire the architecture and instruction sets of microcontroller 8051.

Course Content:

Unit	Course Contents	Hours	K Level	CLO
I.	**8085 PROGRAMMING, PERIPHERAL DEVICES AND THEIR INTERFACING:** Instruction set - Addressing modes - Programming techniques - Memory mapped I/O scheme- I/O mapped I/O scheme - Programmable peripheral interface (PPI) - Control group and control word- Programmable communication interface Programmable counter /interval timer.	6	Upto K4	CLO1
II.	**8085 INTERFACING APPLICATIONS**: Seven segment display interface - Interfacing of Digital to Analog converter and Analog to Digital converter - Stepper motor interface - Measurement of electrical quantities –Voltage and current) Measurement of physical quantities (Temperature an strain).	6	Upto K4	CLO2
II.	**8051 MICROCONTROLLER HARDWARE:** Introduction – Features of 8051 – 8051 Microcontroller Hardware: Pin-out 8051, Central Processing Unit (CPU), internal RAM, Internal ROM, Register set of 8051 – Memory organization of 8051 – Input/ Output pins, Ports and Circuits – External data memory and program memory: External program memory, External data memory.	6	Upto K4	CLO3

V.	**8051 INSTRUCTION SET AND ASSEMBLY LANGUAGE PROGRAMMING:** Addressing modes – Data moving (Data transfer) instructions: Instructions to Access external data memory, external ROM / program memory, PUSH and POP instructions, Data exchange instructions.	6	Upto K5	CLO4
V.	**INTERRUPT PROGRAMMING AND INTERFACING TO EXTERNAL WORLD**: 8051 Interrupts – Interrupt vector table – Enabling and disabling an interrupt – Timer interrupts and programming – Programming external hardware interrupts – Serial communication interrupts and programming – LED Interface Seven segment display interface- Interfacing of Digital to Analog converter and Analog to Digital converter	6	Upto K5	CLO5

Book for study:

1. A. NagoorKani, Microprocessors & Microcontrollers, RBA Publications (2009).
2. A. P. Godse and D. A. Godse, Microprocessors, Technical Publications, Pune (2009).
3. Ramesh Gaonkar, Microprocessor Architecture, Programming and Applications with 8085, Penram International Publishing (2013).
4. B. Ram, Fundamentals of Microprocessors & Microcontrollers, DhanpatRai publications New Delhi (2016).
5. V. Vijayendran, 2005, Fundamentals of Microprocessor-8085", 3rd Edition S.Visvanathan Pvt, Ltd.

Books for Reference:

1. Douglas V. Hall, Microprocessors and Interfacing programming and Hardware, Tata Mc Graw Hill Publications (2008)
2. Muhammad Ali Mazidi, Janice GillispieMazidi, Rolin D. Mckinlay, The 8051 Microcontroller and Embedded Systems, Pearson Education (2008).
3. Barry B. Brey, 1995, The Intel Microprocessors 8086/8088, 80186, 80286, 80386 and 80486, 3rd Edition, Prentice- Hall of India, New Delhi.
4. J. Uffrenbeck, "The 8086/8088 Family-Design, Programming and Interfacing, Software, Hardware and Applications", Prentice-Hall of India, New Delhi.
5. W. A. Tribel, Avtar Singh, "The 8086/8088 Microprocessors: Programming, Interfacing, Software, Hardware and Applications", Prentice-Hall of India, New Delhi.

Web Resources / E-Books

1. https://www.tutorialspoint.com/microprocessor/microprocessor_8085_architecture.html
2. http://www.electronicsengineering.nbcafe.in/peripheral-mapped-io-interfacing/
3. https://www.geeksforgeeks.org/programmable-peripheral-interface-8255/
4. http://www.circuitstoday.com/8051-microcontroller
5. https://www.elprocus.com/8051-assembly-language-programming/

Pedagogy:

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

Rationale for Nature of the course:

Learn about the basic concepts of architecture and functioning of microprocessor 8085 and able to write simple assembly language programs for 8051 Microcontroller.

Activities to be given

1. To practice the students to Gain knowledge of architecture and working of 8085 microprocessors.
2. Enhancing the students to write simple assembly language programs for 8051 Microcontroller.

Course Learning Outcomes (CLOs):

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

CLO	Course Learning Outcomes	K- Level
CO1	Gain knowledge of architecture and working of 8085 microprocessor.	Upto K4
CO2	Get knowledge of architecture and working of 8051 Microcontroller.	Upto K4
CO3	Be able to write simple assembly language programs for 8085A microprocessor.	Upto K4
CO4	Able to write simple assembly language programs for 8051 Microcontroller.	Upto K5
CO5	Understand the different applications of microprocessor and microcontroller.	Upto K5

Annexure - 7

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

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	3	3	3	1
CO2	2	1	1	1	1	1
CO3	3	3	3	3	3	1
CO4	3	3	3	3	3	1
CO5	3	3	3	3	4	

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

Lesson Plan (TOTAL HOURS: 30 Hrs)

Units	Course content	Hours	Mode
I	**8085 PROGRAMMING, PERIPHERAL DEVICES AND THEIR INTERFACING:** Instruction set - Addressing modes - Programming techniques - Memory mapped I/O scheme- I/O mapped I/O scheme - Programmable peripheral interface (PPI) - Control group and control word- Programmable communication interface Programmable counter /interval timer.	6	Chalk and Talk & Seminar
II	**8085 INTERFACING APPLICATIONS**: Seven segment display interface - Interfacing of Digital to Analog converter and Analog to Digital converter - Stepper motor interface - Measurement of electrical quantities –Voltage and current) Measurement of physical quantities (Temperature an strain).	6	Chalk and Talk & Seminar
III	**8051 MICROCONTROLLER HARDWARE:** Introduction – Features of 8051 – 8051 Microcontroller Hardware: Pin-out 8051, Central Processing Unit (CPU), internal RAM, Internal ROM, Register set of 8051 – Memory organization of 8051 – Input/ Output pins, Ports and Circuits – External data memory and program memory: External program memory, External data memory.	6	Chalk and Talk & Seminar
IV	**8051 INSTRUCTION SET AND ASSEMBLY LANGUAGE PROGRAMMING:** Addressing modes – Data moving (Data transfer) instructions: Instructions to Access external data memory, external ROM / program memory, PUSH and POP instructions, Data exchange instructions.	6	Chalk and Talk & Seminar
V	**INTERRUPT PROGRAMMING AND INTERFACING TO EXTERNAL WORLD**: 8051 Interrupts – Interrupt vector table – Enabling and disabling an interrupt – Timer interrupts and programming – Programming external hardware interrupts – Serial communication interrupts and programming – LED Interface Seven segment display interface- Interfacing of Digital to Analog converter and Analog to Digital converter	6	Chalk and Talk & Seminar