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

CBCS with OBE

MASTER OF SCIENCE

PROGRAMME CODE - OPP

COURSE STRUCTURE

(w.e.f. 2022 – 2023 Batch onwards)

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CRITERION - I

1.1.3 Details of courses offered by the institution that focus on employability / entrepreneurship / skill development during the year.

Syllabus copies with highlights of contents focusing on Employability / Entrepreneurship / Skill Development

To be Noted:

HIGHLIGHTED COLORS	COURSES
	Employability
	Skill Development
	Entrepreneurship
	Skilled & Employability

Annexure -7

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

(An Autonomous Institution - Affiliated to Madurai Kamaraj University)
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CBCS AND OBE
DEPARTMENT OF PHYSICS- PG
(w.e.f.2022-2023 Batch 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

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	Life long learning	Lifelong independent and reflective learning skills in their career.

Annexure -7

Programme Specific Outcomes (PSOs) 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	Life long learning	Recognizing the need and life long 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: Choice Based Credit System with Outcome Based Education

Courses of Study with Credit Distribution

Category	No. of Courses	No. of Credits
Core	16	64
Discipline Specific Elective course	4	16
Inter Disciplinary Course	2	4
Project	1	6
Total	**23**	**90**

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

Evaluation

Continuous Internal Assessment Test (CIA) : **25 marks**

Summative (External) : **75 marks**

Total : **100 marks**

CIA-Continuous Internal Assessment : 25 Marks

Components	Marks
Test (Average of three tests) (Conduct for 150 marks and converted into 15 marks)	15
Assignment	5
Seminar	5
Total	**25**

- ✓ Centralized system of Internal Assessment Tests
- ✓ There will be a three Internal Assessment Tests
- ✓ Duration of Internal Assessment Test will be 1 ¼ hours for Test I and 2 ½ hours for Test II and Test III
- ✓ Students shall write retest on the genuine grounds if they are absent in either Test I or Test II and Test III with the approval of Head of the department.

Question Paper Pattern for Continuous Internal Assessment Test I

Section	Marks
A – Multiple Choice Question (4x1 mark)	4
B– Short Answer (3x2 marks)	6
C – Either Or type (2/4 x 5 marks)	10
D – Open Choice type (1/2 x10 Marks)	10
Total	**30**

Question Paper Pattern for Continuous Internal Assessment Test II and Test III

Section	Marks
A – Multiple Choice Question (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**

Question Paper Pattern for Summative Examination

Section	Marks
A – Multiple Choice Questions (10x1mark)	10
B – Short Answer Questions without choice (5 x 2 Marks)	10
C – Either or type (5 X 5marks)	25
D – Open Choice type(3 out of 5 X 10 Marks)	30
Total	**75**

In respect of summative examinations passing minimum is 45% for post graduate and in total, aggregate of 50%.

Latest Amendments and Revisions as per UGC and TANSCHE Norms is taken into considerations in Curriculum preparation.

EVALUATION (PRACTICAL) -For core and Generic Elective course

Internal (Formative) : 40 marks
External (Summative) : 60 marks
Total :100 marks

Question Paper Pattern for Internal Practical Examination: 40 Marks

Annexure -7

S.No	Components	Marks
1	Model test - I	10
2	Model test - II	10
3	Observation note	10
4	Record book	10
	Total	**40**

Question Paper Pattern for External Practical Examination (Major): 60 Marks

S.No	Components	Marks
1	Experimental Procedure	20
2	Readings	20
3	Calculation	15
4	Result	5
	Total	**60**

Question Paper Pattern for External Practical Examination (Major): 60 Marks

In respect of external examinations passing minimum is 35% for Post Graduate Courses and in total, aggregate of 40%.

Latest amendments and revisions as per **UGC** and **TANSCHE** norm is taken into consideration to suit the changing trends in the curriculum.

Distribution of Marks in % with K levels CIAI, II, III & External Assessment

Blooms Taxonomy	Internal Assessment			External Assessment
	I	II	III	
Knowledge(K1)	8%	8%	8%	5%
Understanding(K2)	28%	12%	8%	14%
Apply(K3)	44%	40%	24%	27%
Analyze(K4)	20%	40%	40%	27%
Evaluate(K5)	-	-	20%	27%

Annexure -7

BLUE PRINT FOR INTERNAL ASSESSMENT - 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	CLO 1	Up to K 4	2 2	K1 K2	1 1 1	K1 K2 K3	2 (K2) 2(K3) (Each set of questions mustbe in the same level)	1(K3) 1(K4)	
No. of Questions to be asked			4		3		4	2	13
No. of Questions to be answered			4		3		2	1	10
Marks for each question			1		2		5	10	
Total Marks for each section			4		6		20	20	50

Annexure -7

BLUE PRINT FOR INTERNAL ASSESSMENT – 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	CLO 2	Up to K 4	2 2	K1 K2	1 2	K1 K2	2(K3) 2(K4)	1(K3) 1(K4)	
2	CLO 3	Up to K 4	2 2	K1 K2	1 2	K1 K2	2(K3) 2(K4) (Each set of questions must be inthe same level)	1(K3) 1(K4)	
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

BLUE PRINT FOR INTERNAL ASSESSMENT – III
Articulation Mapping - K Levels with Course Learning Outcomes (CLOs)

Sl.No	CLOs	K- Level	Section A MCQs (No Choice)		Section B Short Answers (No Choice)		Section C (Either or Type)	Section D (Open Choice)	Total
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLO 4	Up to K5	2 2	K1 K2	1 1 1	K1 K2 K3	2(K3) 2(K4)	1(K4) 1(K5)	
2	CLO 5	Up to K5	2 2	K1 K2	1 1 1	K1 K2 K3	2(K3) 2(K4) (Each set of questions must be inthe same level)	1(K4) 1(K5)	
No. of Questions tobe asked			8		6		8	4	26
No. of Questions tobe answered			8		6		4	2	20
Marks for each question			1		2		5	10	
Total Marks for each section			8		12		40	40	100

Distribution of Marks with K Levels CIA I, CIA II and CIA III

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	2	2			4	**8**
	K2	2	2	10	-	14	**28**
	K3		2	10	10	22	**44**
	K4				10	10	**20**
	Marks	**4**	**6**	**20**	**20**	**50**	**100**
II	K1	4	4			8	**8**
	K2	4	8			12	**12**
	K3			20	20	40	**40**
	K4			20	20	40	**40**
	Marks	**8**	**12**	**40**	**40**	**100**	**100**
III	K1	4	4			8	**8**
	K2	4	4			8	**8**
	K3		4	20		24	**24**
	K4			20	20	40	**40**
	K5				20	20	**20**
	Marks	**8**	**12**	**40**	**40**	**100**	**100**

Annexure -7

Articulation Mapping - K Levels with Course Learning Outcomes (CLOs) for Internal Assessment (IDC)

Sl. No	CLOs	K- Level	Section A		Section B		Section C	Section D	Totall
			MCQs (No choice)		Short Answers (No choice)		(Either/or Type)	(open choice)	
			No. of Questions	K-Level	No. of Questions	K-Level			
1	CLO 1	Up to K4	2	K1			2(K3&K3) 2(K3&K3 2 (K4&K4) 2 (K5&K5)	1(K3)	
2	CLO 2	Up to K4	2	K1				1(K4)	
3	CLO 3	Up to K4			2	K2		1(K4)	
4	CLO 4	Up to K5			2	K2		1(K5)	
5	CLO 5	Up to 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 question			1		2		5	10	
Total Marks for each section			4		6		20	20	50 (Marks)

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

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**	

Annexure -7

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/or Type)	(open choice)	
			No. of Questions	K-Level	No. of Questions	K-Level			
1	CLO 1	Up to K4	2	K1&K2	1	K1	2 (K2& K2)	1(K3)	
2	CLO 2	Up to K4	2	K1&K2	1	K2	2(K3& K3)	1(K4)	
3	CLO 3	Up to K4	2	K1&K2	1	K3	2 (K3 &K3)	1(K4)	
4	CLO 4	Up to K5	2	K1&K2	1	K4	2 (K4 & K4)	1(K5)	
5	CLO 5	Up to K5	2	K1&K2	1	K5	2 (K5 & K5)	1(K5)	
No. of Questions to beasked			10		5		10	5	30
No. of Questions to beanswered			10		5		5	3	23
Marks for each question			1		2		5	10	
Total Marks for each section			10		10		25	30	75 (Marks)

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 derivingInferences.

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

K5- Evaluating, making Judgments based on criteria

Annexure -7

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CBCS AND OBE

DEPARTMENT OF PHYSICS- PG

M.Sc PHYSICS

(w.e.f.2022-2023 Batch onwards)

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	22OPPH11	Mathematical Physics-I	5	3	25	75	100	4
	CORE	22OPPH12	Classical Mechanics	5	3	25	75	100	4
	CORE	22OPPH13	Advanced Electronics	5	3	25	75	100	4
	CORE		*General Physics Practical-I	4	-	-	-	-	
	CORE		*Electronics Practical-I	4	-	-	-	-	
	DSEC		DSEC -I	5	3	25	75	100	4
	IDC	22OPPHID1	Renewable Energy Resources	2	3	25	75	100	2
II	CORE	22OPPH21	Mathematical Physics – II	5	3	25	75	100	4
	CORE	22OPPH22	Thermodynamics & Statistical Mechanics	5	3	25	75	100	4
	CORE	22OPPH23	Electromagnetic theory	5	3	25	75	100	4
	CORE	22OPPH21P	*General Physics Practical-I	4	4	40	60	100	4
	CORE	22OPPH22P	*Electronics Practical-I	4	4	40	60	100	4
	DSEC		DSEC -II	5	3	25	75	100	4
	IDC	22OPPHID2	Astronomy and Astrophysics	2	3	25	75	100	2
	CORE	22OPPH31	Solid State Physics - I	6	3	25	75	100	4

III	**CORE**	22OPPH32	Quantum Mechanics-I	6	3	25	75	100	4
	CORE	22OPPH33	Nuclear Physics	5	3	25	75	100	4
	CORE		* General Physics Practical-II	4	-	-	-	-	-
	CORE		*Electronics Practical -II	4	-	-	-	-	-
	DSEC		**DSEC -III**	5	3	25	75	100	4
IV	**CORE**	22OPPH41	Solid State Physics - II	6	3	25	75	100	4
	CORE	22OPPH42	Quantum Mechanics-II	6	3	25	75	100	4
	CORE	22OPPH43	Molecular Spectroscopy	5	3	25	75	100	4
	CORE	22OPPH41P	* General Physics Practical -II	4	4	40	60	100	4
	CORE	22OPPH42P	*Electronics Practical -II	4	4	40	60	100	4
	DSEC		**DSEC -IV**	5	3	25	75	100	4
		22OPPHPR4	Project	-	3	20	80	100	6
			Total	**120**					**90**

* Practical examinations are conducted only in even semesters

DSEC: Discipline Specific Elective Course:

DSEC - I has to be chosen in Semester I from the following:

1. Numerical Methods -22OPPHDSE1A
2. Programming in C++ - 22OPPHDSE1B

DSEC -II has to be chosen in Semester II from the following:

1. Instrumentation -22OPPHDSE2A
2. Medical Physics - 22OPPHDSE2B

DSEC - III has to be chosen in Semester III from the following:

1. Nano physics -22OPPHDSE3A
2. Crystallography - 22OPPHDSE3B

DSEC - IV has to be chosen in Semester IV from the following:

1. Microprocessor -22OPPHDSE4A
2. Solar energy - 22OPPHDSE4B

Annexure -7

Department of Physics				Class: I M,Sc Physics				
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Hrs**	**CIA**	**External Exam**	**Total**
I	Core	22OPPH11	Mathematical Physics I	4	5	25	75	100

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

Course Objectives:

1. To understand the concepts of vectors and its applications
2. Study the Significant theorems of matrices
3. To acquire the knowledge about tensor
4. Apply the complex variables in solving integrals
5. To analyze the concept of Group theory

Unit	Course Contents	Hours	K Level	CLO
I	**Vectors** Gradient – The Divergence and Gauss's Theorem – The curl of a vector field and Stokes theorem – Green's theorem-Orthogonal curvilinear coordinates – Expression for gradient, divergence,curl and laplacian in cylindrical and Spherical coordinates-Application of vectors to Hydrodynamics – Equation of heat flow in solids-The gravitational potential	15	Upto K4	CLO1
II	**Matrices** Vectors as Matrices – Solution of linear equations – Linear transformations – Orthogonal and Unitary transformations – Similarity transformations – Eigen values, Eigen vectors; Characteristic equation of a matrix – Cayley - Hamilton theorem –Important theorems of Eigen values and Eigen vectors – Diagonalization of matrices	15	Upto K4	CLO2
III	**Tensors** Introduction – Coordinate transformation – Scalars, Contravarient vectors and Covariant vectors – Algebric operation of Tensors – Symmetric and Antisymmetric Tensors – Differentiation of Tensors –Covariant differentiation of vectors –Simple Applications of tensors.	15	Upto K4	CLO3

IV	**Complex Variables** Introduction – Analytic function– Cauchy Riemann differential equations – Line integral of complex functions– Cauchy integral theorem (simple proof) – Cauchy integral formula –Taylor's and Laurent's series-Singularities of an analytic function – Residues and their Evaluation – Cauchy Residue theorem	15	Upto K5	CLO4
V	**Group Theory** Introduction- Definitions of theorems of group theory – defining properties of a group – some examples of groups – Sub groups – Classes – Classes of symmetry operations – Representation of groups – Reducible and Irreducible representation-The great Orthogonality theorem and its consequences – Character table – Representation for cyclic groups.	15	Upto K5	CLO5

Books for study:-

1.SatyaPrakash, *Mathematical Physics,* Sultan Chand and Sons Educational Publishers, New Delhi, First Edition, Reprint 2009. [Unit I,II,III,V]

2.Albert.F, Cotton, *Chemical Application of Group theory,* John Wiley and sons Private Limited, New Delhi, Third Edition , 2011.[Unit V]

Chapters:

Unit : I	**Chapter 1**	**1.2 to 1.9,1.11,1.15,1.19**
Unit : II	**Chapter 2**	**2.27 to 2.35**
Unit : III	**Chapter 3**	**3.1 to 3.4,3.8,3.10,3.11,3.23, 3.38**
Unit : IV	**Chapter 6**	**6.1. to 6.4,6.9,6.10,6.14 ,6.16,6.20 to 6.24**
Unit : V	**Chapters1,2,3,4**	**1,2.1 to 2.4, 3.13,4.1,4.3 to4.5**

Book for Reference :-

1. Charlie Harper, *Introduction to Mathematical Physics*, Prentice Hall of India Pvt Limited, New Delhi, First Edition ,2005.

2. Gupta.B.D, *Mathematical Physics,* Vikas Publishing House, Pvt Limited, New Delhi, Fourth Edition, 2006.

3. Joshi.A.W, Matrices *and Tensors in Physics*, New age International Publishers, New Delhi, and 3rd edition

4.Kakani.S.L,Hemrajani.C, *Mathematical physics*, CBS Publishers & Distributors Pvt.Ltd., New Delhi, Second Edition,2004.

5.Raman.K.V, *Group theory and its applications to chemistry*, Tata McGraw Hill Limited, New Delhi, Reprint, Second Edition 2005.

Web Resources:

1. https://www.physics.uoguelph.ca/chapter-4-spherical-harmonics
2. **https://online.stat.psu.edu/stat505/lesson/4/4.5**
3. **https://www.cuemath.com/algebra/vector-algebra/**
4. **https://en.wikipedia.org/wiki/Tensor**

E-books

1. **http://202.38.64.11/~jmy/documents/ebooks/Hassani%20Mathematical%20Physics%20A%20Modem%20Introduction%20to%20Its%20Foundations%20-%20S.%20Hassani%20%5B0-387-98579-4%5D.pdf**
2. **https://goldbart.gatech.edu/PostScript/MS_PG_book/bookmaster.pdf**
3. **http://www.astrosen.unam.mx/~aceves/Metodos/ebooks/riley_hobson_bence.pdf**

Pedogogy

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

Rationale for Nature of the course:

Obtain the mathematical skill to solve physical problems

Activities to be given

1.Train the students for problem solving skill

2.Prepare the students to apply the practical problems

Course Learning Outcomes (CLOs):

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

CLO	Course Learning outcome	Knowledge level (According to Blooms Taxonomy)
CLO1	Apply the concept of vector & its applications	Up to K4
CLO2	Understand the basics significance theorems of matrices	Up to K4
CLO3	Acquire the knowledge of tensors	Up to K4
CLO4	Learning about the complex variables in solving integrals	Up to K5
CLO5	Analyse the concept of group theory	Up to K5

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
K4 –Examining, analyzing, presentation and make inferences with evidences
K5 – Evaluate , making Judgments based on criteria.

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

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

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

Lecture Plan

Units	Course Content	Hours	Total Hours	Pedagogy
I	Gradient – The Divergence and Gauss's Theorem – The curl of a vector field and Stokes theorem	4	15	Chalk and Talk
	Green's theorem-Orthogonal curvilinear coordinates	3		Chalk and Talk
	Expression for gradient, divergence,curl and laplacian in cylindrical and Spherical coordinates	4		Chalk and Talk
	Application of vectors to Hydrodynamics – Equation of heat flow in solids	4		Chalk and Talk & Seminar
II	Vectors as Matrices – Solution of linear equations – Linear transformations-The gravitational potential	2	15	Chalk and Talk
	Orthogonal and Unitary transformations – Similarity transformations	3		Chalk and Talk & Seminar
	Eigen values, Eigen vectors; Characteristic equation of a matrix	2		Chalk and Talk
	Cayley - Hamilton theorem.	3		Chalk and Talk
	Important theorems of Eigen values and Eigen vectors	3		Chalk and Talk
	Diagonalization of matrices	2		Chalk and Talk & Seminar

Annexure -7

III	Introduction – Coordinate transformation – Scalars	3	15	Chalk and Talk
	Contravarient vectors and Covariant vectors	3		Chalk and Talk
	Algebric operation of Tensors – Symmetric and Antisymmetric Tensors	3		Chalk and Talk
	Differentiation of Tensors –covariant differentiation of vectors	3		Chalk and Talk
	Simple Applications of tensor	3		Chalk and Talk & Seminar
IV	Introduction – Analytic function– Cauchy Riemann differential equations	4	15	Chalk and Talk,
	Cauchy integral theorem (simple proof)	3		Chalk and Talk
	Cauchy integral formula	2		Chalk and Talk
	Taylor's and Laurent's series-Singularities of an analytic function	3		
	Residues and their Evaluation – Cauchy Residue theorem	3		
V	Introduction- Definitions of theorems of group theory.	3	15	Chalk and Talk,
	Defining properties of a group – some examples of groups	3		Chalk and Talk & Seminar
	Sub groups – Classes – Classes of symmetry operations.	3		Chalk and Talk
	Representation of groups – Reducible and Irreducible representation	2		Chalk and Talk
	The great Orthogonality theorem and its consequences	2		Chalk and Talk & Seminar
	Character table – Representation for cyclic groups.	2		Chalk and Talk & Group Discussion

Annexure -7

Department of Physics				Class: I M,Sc Physics				
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Hrs**	**CIA**	**External Exam**	**Total**
I	Core	22OPPH12	Classical Mechanics	4	5	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.

Unit	Course Contents	Hours	K Level	CLO
I	**Lagrangian Methods** System of Particles – Conservation of energy – Work energy theorem – Conservative forces – Examples – Generalized coordinates – Degrees of freedom under constraints – D'Alemberts principles – Lagrangian function – Lagrange's equation – Application of Lagrange's equation – Single particle in space – Atwood's Machine - Time – Dependent Constraint.	15	Upto K4	CLO1
II	**Central field motion** Reduction to the equivalent one-body problem – The equation of motion and first integrals – The equivalent one-dimensional problem, and classification of orbits – The virial theorem – The differential equation for the orbit, and integrable power-law potentials – Conditions for closed orbits (Betrand's theorem) – The Kepler problem: Inverse square law of force – The motion in time in the Kepler problem.	15	Upto K4	CLO2
III	**Hamiltonian methods** Hamiltonian equations of motion – Cyclic coordinates and Routh's procedure – Physical significance of the Hamiltonian – Hamiltonian's equation from variational principle – The principle of least action. Canonical Transformations: The equation of canonical transformations – Examples of canonical transformation – Lagrangian brackets – Poisson brackets – Equations of motion in Poisson bracket notation – The Angular Momentum Poisson bracket relations.	15	Upto K4	CLO3

IV	**Small Oscillations** Formulation of the problem – The Eigen Value equation and the principal axis transformation – Frequencies of free vibration and normal coordinates – Free Vibrations of a linear triatomic molecule – Forced vibrations and the effect of dissipative forces.	15	Upto K5	CLO4
V	**Hamilton – Jacobi Theory** The Hamilton-Jacobi equation for Hamilton's principal function – The Harmonic oscillator problem as an example of the Hamilton-Jacobi method – The Hamilton – Jacobi equation for Hamilton's characteristic function – Separation of variables in the Hamilton – Jacobi equation – Action-angle variables in systems of one degree of freedom.	15	Upto K5	CLO5

Book for study:-

1. Goldstein.H, *Classical Mechanics*, Narosa Publication House, New Delhi, Twelth Edition ,2001.

Unit : I **Chapter 1** **1.1,1.2,1.3,1.4,1.6**

Unit : II **Chapter 3** **3.1 to 3.8**

Unit : III **Chapters 8,9** **8.1, 8.2, 8.3, 8.5, 8.6,9.1, 9.2, 9.4, 9.5,9.6**

Unit : IV **Chapter 6** **6.1, 6.2, 6.3, 6.4,6.5**

Unit : V **Chapter 10** **10.1 to 10.5**

Books for Reference :-

1. Aruldhas.G,*Classical Mechanics*,PHI learning private limited,New Delhi,Second Edition,2009.
2. Gupta,Kumar,Sharma,*Classical Mechanics* ,Pragati Prakashan, Meerut,twenty sixth Edition,2013.
3. Panat.P.V,*Classical Mechanics*,Narosa Publication house,New Delhi,Reprint Edition ,2006.
4. Sankar Rao.K.N,*Classical Mechanics*,University press(India) Private Limited,Hyderabad, First Edition,2011.
5. Upadhyaya.J.C,*Classical Mechanics*,Himalaya Publishing house, Second Edition,2005.

Web Resources:

1. https://www.unishivaaji.ac.in
2. https://ocw.mit.edu
3. https://ppc.inr.ac.ru
4. https://sites.astro.caltech.edu
5. https://scholar.harvard.edu

E-Books

1. http://poincare.matf.bg.ac.rs/~zarkom/Book_Mechanics_Goldstein_Classical_Mechanics_optimized.pdf
2. https://books.google.fm/books?id=u2JKuF1nM0wC&printsec=frontcover&source=gbs_book_other_versions_r&cad=2#v=onepage&q&f=false
3. file:///D:/Users/EMG/Downloads/Classical_Mechanics_2017.pdf

Pedagogy :

Chalk and Talk, Seminar, Quiz, Group Discussion.

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 Outcomes(CLOs):

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

	Course Learning outcomes	**Knowledge level(According to Blooms Taxonomy)**
CLO1	Remembering the basics of system of particles and the Lagrangian for solving the macroscopic physical problems.	Upto K4
CLO2	Understand the central force problems and find the normal modes of vibration of oscillating bodies.	Upto K4
CLO3	Apply the Hamiltonian's formalism for solving the macroscopic physical problems.	Upto K4
CLO4	Analyze the basic concepts in small oscillation.	Upto K5
CLO5	Evaluate the system using Hamilton – Jacobi Theory.	Upto K5

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
K4 –Examining, analyzing, presentation and make inferences with evidences
K5 – Evaluate , making Judgments based on criteria.

Annexure -7

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

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

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

Lecture Plan

Units	Course content	Hours	Total Hours	Pedagogy
I	System of Particles – Conservation of energy – Work energy theorem – Conservative forces – Examples	3	15	Chalk and Talk
	Generalized coordinates – Degrees of freedom under constraints – D'Alemberts principles	3		Chalk and Talk
	Lagrangian function – Lagrange's equation – Application of Lagrange's equation	3		Chalk and Talk
	Single particle in space – Atwood's Machine	3		Chalk and Talk
	Time – Dependent Constraint	3		Chalk and Talk & Seminar
II	Reduction to the equivalent one-body problem – The equation of motion and first integrals	3	15	Chalk and Talk
	The equivalent one-dimensional problem, and classification of orbits	3		Chalk and Talk & Seminar
	The virial theorem – The differential equation for the orbit, and integrable power-law potentials	3		Chalk and Talk
	Conditions for closed orbits (Betrand's theorem) – The Kepler problem: Inverse square law of force	3		Chalk and Talk
	The motion in time in the Kepler problem	3		Chalk and Talk
III	Hamiltonian equations of motion – Cyclic coordinates and Routh's procedure	3	15	Chalk and Talk
	Physical significance of the Hamiltonian – Hamiltonian's equation from variational principle – The principle of least action	3		Chalk and Talk
	Canonical Transformations: The equation of canonical transformations – Examples of canonical transformation	3		Chalk and Talk
	Lagrangian brackets – Poisson brackets	3		Chalk and Talk
	Equations of motion in Poisson bracket notation – The Angular Momentum Poisson bracket	3		Chalk and Talk & Seminar

	relations			
IV	Small Oscillations-Formulation of the problem	3	15	Chalk and Talk
	The Eigen Value equation and the principal axis transformation	3		Chalk and Talk & Seminar
	Frequencies of free vibration and normal coordinates	3		Chalk and Talk & Group Discussion
	Free Vibrations of a linear triatomic molecule	3		Chalk and Talk & Seminar
	Forced vibrations and the effect of dissipative forces.	3		Chalk and Talk
V	The Hamilton-Jacobi equation for Hamilton's principal function	3	15	Chalk and Talk
	The Harmonic oscillator problem as an example of the Hamilton-Jacobi method	3		Chalk and Talk & Seminar
	The Hamilton – Jacobi equation for Hamilton's characteristic function	3		Chalk and Talk
	Separation of variables in the Hamilton – Jacobi equation	3		Chalk and Talk
	Action-angle variables in systems of one degree of freedom	3		Chalk and Talk & Seminar

Annexure -7

Department of Physics				Class: I M.Sc Physics				
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Hrs**	**CIA**	**External Exam**	**Total**
I	Core	22OPPH13	Advanced Electronics	4	5	25	75	100

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

Course Objectives:

1. To understand the basis of semiconductor devices.
2. To study the concepts of Operational amplifier.
3. To review IC 555 Timers.
4. To develop knowledge about karnaugh map and combinational circuit.
5. To learn about flip flop and counters.

Unit	Course Contents	Hours	K Level	CLO
I	**Semiconductor PN Junction diodes** Introduction – N-type semiconductors – P-type semiconductors –PN Junction diodes – Diode current equation – Zener diode – Reverse characteristic –applications – Tunnel diode – V-I Characteristics - Applications – Schottky diode - Applications – JFET – Operation of JFET – Characteristics of JFET – JFET parameters – MOSFETs – Working of a Depletion type MOSFET.	15	Up to K4	CLO1
II	**Operational amplifier** Evolution of Op-Amp – Symbol and terminals of an Op-Amp, Op-Amp characteristics and parameters – Op-Amp comparators – Schmitt trigger – Inverting amplifier – Inverting summing (Adder) – Non inverting amplifier – Voltage follower – Non inverting summing amplifier – Difference amplifier – Op-Amp differentiator - Op-Amp integrator.	15	Up to K4	CLO2
III	**D/A and A/D Converters and IC 555 Timer** Binary weighted Resistors D/A Converter – R–2RResistive ladder D/A Converter – Counter type A/D Converter - Successive approximation A/D Converter – Parallel Comparator A/D Converter – IC 555 timer – Internal structure – Schmitt trigger – Astable Multivibrator – Monostable Multivibrator.	15	Up to K34	CLO3
IV	**Karnaugh map & combination circuit** Karnaugh map – Minterms – Relation between K map and truth table – 2,3 and 4 Variable K map using Minterms – Don't care conditions – Maxterms – K map using Maxterms – Multiplexers – Demultiplexers – Decoders – Encoders.	15	Up to K5	CLO4
V	**Flip flops & Counters**	15	Up to K5	CLO5

	Introduction – SR flip flop – SR using NOR gates – clocked SR – Edge triggered - D flip flop – JK flip flop – JK master slave Flip flop – T Flip flop – Register – Shift register - Ring Counter – Asynchronous Counter – Synchronous Counter.			

Books for Study:

1. R.S. Sedha, Applied Electronics, S. Chand and company limited, New Delhi, Reprint 2008 (Unit-I)
2. V.Vijayendran, Introduction to Integrated Electronics Digital and Analog, S. Vishwanathan (Printers and Publishers) private limited, Chennai, First edition, 2010. (unit- II,III,IV,V)

Unit: I	**Chapters 10,12,13,16**	**10.9, 10.10,12.1,12.5, 13.2, 13.3, 13.6-13.8, 13.11, 13.15, 13.16, 16.3, 16.5,16.6,16.11, 16.14,16**
Unit: II	**Chapters 13,14**	**13.2-13.4, 14.1-14.10,**
Unit: III	**Chapters 16,17**	**16.1-16.4, 16.6, 17.1-17.4**
Unit: IV	**Chapters 6,8**	**6.1-6.8, 8.1-8.4**
Unit: V	**Chapters 9,10**	**9.1, 9.3-9.6, 10.1-10.3, 10.5, 10.6**

Reference Books:

1. Ghosh. B, *Fundamental Principles of Electronics,* ArunabhaSen Books and Allied (p) Ltd, Kolkata, Second Edition, 2011.

2.Jose Robin.G, Ubaldraj.A,*Analog electronics and Digital electronics,* Indra Publications, Marthandam, First Edition, 2008.

3. Malvino leach, *Digital principles and applications,*Tata McGraw Hill Publishing company limited, New Delhi, Fifth Edition, 2002.

4.RohitMehtha, V.K.Mehtha, *Principles of Electronics*, S. Chand and company Ltd, New Delhi, Eleventh Edition, 2012.

5.SanthiramKal, *Basic Electronics devices circuits and IT Fundamentals,*PHI Learning Private Ltd, New Delhi, Tenth Edition, 2010.

Web Resources:

1. https://www.eeweb.com/characteristics-of-junction-field-effect-transistors-jfet/
2. https://www.electronicsforu.com/technology-trends/learn-electronics/operational-amplifier-basics
3. https://www.gacbe.ac.in/pdf/ematerial/18BCS13C-U5.pdf
4. https://youtu.be/feBvhLFQEDk

5. https://youtu.be/4l5bBnljieY

E-books:

1. https://soaneemrana.org/onewebmedia/DIGITAL%20PRINCIPLES%20AND%20APPLICATION%20BY%20LEACH%20&%20MALVINO.pdf
2. http://univ.ency-education.com/uploads/1/3/1/0/13102001/fundamental_electrical_and_electronic_principles.pdf
3. https://oiipdf.com/millman-halkias-integrated-electronics

Pedagogy:

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

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	Knowledge level(According to Blooms Taxonomy)
CLO1	Remembering the basics of diodes and understanding the characteristics of JFET and MOSFET.	Up to K4
CLO2	Apply the basics of Operational Amplifier and solve problems on Differentiator and Integrator.	Up to K4
CLO3	Learning the basic principles of D/A and A/D converters.	Up to K4
CLO4	Acquire the knowledge about karnaugh map and working principles of combinational circuits.	Up to K5
CLO5	Analyse the operations of various flip flops and understanding the concepts of counters.	Up to K5

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
K4 –Examining, analyzing, presentation and make inferences with evidences
K5 – Evaluate , making Judgments based on criteria.

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

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

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

Lecture plan

Units	Course Content	Hours	Total Hours	Pedagogy
I	Introduction – N-type semiconductors – P-type semiconductors –PN Junction diodes – Diode current equation	3	15	Chalk and Talk& Group discussion
	Zener diode – Reverse characteristic of a Zener diode – Zener diode applications	3		Chalk and Talk
	Tunnel diode – V-I Characteristic of a tunnel diode - Tunnel diode applications	3		Chalk and Talk
	Schottky diode -Schottky diode applications – JFET – Operation of JFET	3		Seminar
	Characteristics of JFET – JFET parameters – MOSFETs – Working of a Depletion type MOSFET	3		Chalk and Talk & Seminar
II	Evolution of Op-Amp – Symbol and terminals of an Op-Amp	3	15	Chalk and Talk
	Op-Amp characteristics and parameters – Op-Amp comparators – Schmitt trigger	3		Chalk and Talk & Seminar
	Inverting amplifier – Inverting summing (Adder) – Non inverting amplifier	3		Chalk and Talk
	Voltage follower – Non inverting summing amplifier – Difference amplifier	3		Seminar
	Op-Amp differentiator-Op-Amp integrator.	3		Chalk and Talk & Seminar
III	Binary weighted Resistors D/A Converter – R–2R Resistive ladder D/A Converter	3	15	Chalk and Talk
	Counter type A/D Converter - Successive approximation A/D Converter	3		Seminar
	Parallel Comparator A/D Converter	3		Chalk and Talk
	IC 555 timer – Internal structure	3		Chalk and Talk

	Schmitt trigger – Astable Multivibrator – Monostable Multivibrator.	3		Chalk and Talk & Seminar
IV	Karnaugh map – Minterms- Relation between K map and truth table	3	15	Chalk and Talk
	2,3 and 4 Variable K map using Minterms	3		Chalk and Talk
	Don't care conditions	3		Chalk and Talk
	Maxterms – K map using Maxterms	3		Chalk and Talk
	Multiplexers – Demultiplexers – Decoders – Encoders.	3		Chalk and Talk & Seminar
V	Introduction – SR flip flop – SR using NOR gates	3	15	Chalk and Talk
	clocked SR – Edge triggered - D flip flop	3		Chalk and Talk & Seminar
	JK flip flop – JK master slave Flip flop – T Flip flop	3		Chalk and Talk
	Register – Shift register	3		Chalk and Talk
	Ring Counter – Asynchronous counter – synchronous counter	3		Chalk and Talk & Group Discussion

Annexure -7

Department of Physics				Class: I M,Sc Physics				
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Hrs**	**CIA**	**External Exam**	**Total**
I	DSE	22OPPHDSE1A	Numerical methods	4	5	25	75	100

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

Course Objectives:

1. To provide suitable and effective methods called Numerical Methods, for obtaining approximate representative numerical results of the problems.
2. To analyze different interpolation techniques.
3. To recall the curve fitting procedures.
4. To rejuvenate the concepts of numerical integration and differentiation.
5. To solve partial differential equations.

Unit	Course Contents	Hours	K Level	CLO
I	**Solution of Algebraic and Transcendental Equations** The Bisection Method–The Method of False position- The Iteration Method –Newton Raphson Method –Ramanujan's Method-The secant Methods-Solution to system of Nonlinear equations-The method of iteration	15	Upto K4	CLO1
II	**Interpolation** Finite Differences-Forward Differences – Backward differences – Central Differences – Detection of errors by use of difference tables-Differences of a polynomial – Newton's formula for interpolation –Central difference interpolation formula-Gauss's central difference formula-detection of errors.	15	Upto K4	CLO2
III	**Least squares and B-splines** Fitting a straight Line-Nonlinear Curve Fitting- Curve Fitting by a sum of Exponentials-Weighted least square approximation-Linear Weighted Least squares approximation-Nonlinear Weighted Least squares approximation-Least square solution - Representations of B-splines-computation of B-splines - chebyshev Polynomials -Economization of power series.	15	Upto K4	CLO3
IV	**Numerical integration and linear system of equations** Numerical integration – Trapezoidal rule – Simpson's 1/3 rule-Simpson's 3/8 rule – Error Analysis- Solution of linear systems-Direct Methods – Matrix Inversion Method-Gauss elimination Method–Solution of linear system Iterative Methods – The Eigen value problem.	15	Upto K5	CLO4

V	**Numerical solution of ordinary and partial differential equations** Introduction-solution by Taylor's series – Picard's method of successive approximations – Euler's method – Modified Euler's method –Error estimates for the Euler method-Runge kutta methods-Laplace's equation- Jacobi's Method – Gauss-Seidel Method.	15	Upto K5	CLO5

Book for study:

1.Sastry .S.S, *Introductory methods of Numerical analysis,* Prentice Hall of India private limited ,New Delhi, Fourth Edition , 2005.

Unit : I **Chapter 2** **2.2-2.7,2.12,2.12.1**

Unit : II **Chapter 3** **3.3,3.3.1- 3.3.3,3.4- 3.7,3.7.1**

Unit : III **Chapter 4** **4.2.1 - 4.2.3,4.3,4.3.1,4.3.2,4.5.1- 4.5.3, 4.7.1,4.7.2**

Unit : IV **Chapters 5,6 5.4,5.4.1 - 5.4.3, 6.3,6.3.1,6.3.2,6.4,6.5**

Unit : V **Chapters 7,8 7.1- 7.4,7.4.1,7.4.2,7.5,8.3 - 8.3.2**

Reference Books:

1. Arumugam .S, Somasundaram .A, Thangapandian Issac.A, *Numerical methods*,Sci Tech Publications India Pvt Ltd,Chennai,Second Edition,2002.

2. Burden.R.L,&Faires.T.D, *Numerical analysis*,Thomson Asia Pvt Ltd, Seventh Edition, Bangalore, 2002.

3.Kandasamy.P, Thilagavathi.K,Gunavathy.k, *Numerical methods*,S.Chand&company Ltd**,**New Delhi ,Third Edition, 2005.

4. Sankara Rao.K, *Numerical methods for scientists and engineers*, Prentice hall India, New Delhi ,Second Edition ,2004.

5. Veerarajan Ramachandran, *Numerical methods*, Tata Mc Graw Hill Ltd.,

New Delhi ,Second Edition, 2006.

Web Resources:

1. **http://www.math.utep.edu/Faculty/nsharma/public_html/m4329_lect03.pdf**
2. **https://en.wikibooks.org/wiki/Introduction_to_Numerical_Methods/Interpolation**
3. https://pages.mtu.edu/~shene/COURSES/cs3621/NOTES/spline/B-spline/bspline-basis.html
4. https://www.youtube.com/watch?v=3d6DsjIBzJ4
5. https://www.youtube.com/watch?v=aY6Y66cc4rE

E-books:

1. http://www.aerostudents.com/courses/applied-numerical analysis/IntroductoryMethodsOf

NumericalAnalysis.pdf

2. https://drive.google.com/file/d/1V6ceyYISDU9bbbsm4WRks2RpCOzYifv7/view
3. http://www.ikiu.ac.ir/public-files/profiles/items/090ad_1410599906.pdf

Pedagogy:

Group Discussions, Quiz, Assignment, Brain Storming Activity. Seminar

Rationale for Nature of the course:

It is the area of mathematics and computer science that creates , analyses and implements algorithms for obtaining numerical solutions to problems involving continuous variables. it is concerned with all aspects of the numerical solution of a problem, from the theoretical development and understanding of numerical methods to their practical implementation as reliable and efficient computer programs.

Activities to be given

1.To Strengthen the students to solve the problems.
2.Enhancing the students to solve iteration methods.

Course Learning Outcomes(CLOs)

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

CLOs	Course Learning outcomes	Knowledge level(According to Blooms Taxonomy)
CLO1	Remembering the basics of the algebraic and transcendental equations.	Up to K4
CLO2	Understanding the Forward, Backward and central differences of interpolation.	Up to K4
CLO3	Acquire knowledge about the Least squares and B-splines.	Up to K4
CLO4	Analyze the differential equation using an appropriate numerical method and root finding methods.	Up to K5
CLO5	Evaluating the simultaneous solutions for different types of numerical methods.	Up to K5

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
K4 –Examining, analyzing, presentation and make inferences with evidences
K5 – Evaluate , making Judgments based on criteria.

Annexure -7

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

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

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

Lecture Plan

Units	Course Contents	Hours	Total Hours	Pedagogy
I	The Bisection Method	3	15	Chalk and Talk
	The Method of False position-The Iteration Method	3		Chalk and Talk
	Newton Raphson	3		Chalk and Talk
	Method Ramanujan's Method -The secant Methods-	3		Chalk and Talk
	Solution to system of Nonlinear equations -The method of iteration	3		Chalk and Talk
II	Finite Differences-Forward Differences	3	15	Chalk and Talk
	Backward differences – Central Differences	3		Chalk and Talk
	Differences of a polynomial-Newton's formula for interpolation	3		Chalk and Talk
	Central difference interpolation formula	3		Chalk and Talk
	Gauss's central difference formulae	3		Chalk and Talk
III	Fitting a straight Line-Nonlinear Curve Fitting- Curve Fitting by a sum of Exponentials	3	15	Seminar
	Weighted least square approximation-Linear Weighted Least squares approximation	3		Brain storming activity
	Nonlinear Weighted Least squares approximation-Least square solution	3		Chalk and Talk
	Representations of B-splines-computation of B-splines	3		Seminar
	chebyshev Polynomials -Economization of power series.	3		Chalk and Talk & Seminar
IV	Numerical integration – Trapezoidal rule – Simpson's 1/3 rule	3	15	Chalk and Talk
	Simpson's 3/8 rule-Error Analysis	3		Chalk and Talk& Seminar
	Solution of linear systems-Direct Methods	3		Chalk and Talk & Group Discussion

Annexure -7

	Matrix Inversion Method- Gauss elimination Method	3		Chalk and Talk & Group
	Solution of linear system Iterative Methods – The Eigen value problem	3		Chalk and Talk
V	Introduction-solution by Taylor's series –	3	15	Seminar
	Picard's method of successive approximations- Euler's method	3		Chalk and Talk & Seminar
	Modified Euler's method-Error estimates for the Euler method	3		Chalk and Talk
	Runge kutta methods-Laplace's equation	3		Chalk and Talk
	Jacobi's Method-Gauss-Seidel Method	3		Chalk and Talk & Seminar

Annexure -7

Department of Physics				Class: I M,Sc Physics				
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Hrs**	**CIA**	**External Exam**	**Total**
I	DSE	22OPPHDSE1B	Programming in C++	4	5	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	**Emplability Oriented**	**Entrepreneurship oriented**
	✔	

Course Objectives:

1. The course is designed to provide the knowledge of C++ language.
2. To develop skill for developing the different programs.
3. To appreciate and apply the programming concepts.
4. To know overloading, inheritance concepts.
5. The student will be able to envelop logical thinking.

Unit	Course Contents	Hours	K Level	CLO
I	**Principles of Oop, Tokens, Expressions and Control Structures** Procedural Vs object oriented programming – Basic concepts of object oriented programming – Benefits of OOP – object oriented Languages – Applications of OOP –A simple C++ Program-Output operator-The i/o stream file-Name space-Return type of main()-structure of C++ program – Basic data types –User-defined data types-Derived data types-Declaration variables-Reference variables-Operators in C++-Scope resolution operator-Manipulators-Expression and their types – Control Structure.	15	Upto K4	CLO1
II	**Functions and Classes** Introduction-The main Function –Function prototyping-Call by Reference-Return by reference-Inline functions–Default arguments–Const arguments-functions Overloading – Specifying a class – Defining member functions –Nesting of member functions-arrays within a class.	15	Upto K4	CLO2
III	**Constructors and Destructors, Operator Overloading** Constructors– Mutiple constructor in a class-Constructors with default arguments-Copy Constructor-dynamic Constructor–destructors-Defining operator overloading-overloading unary operator-overloading binary operators-overloading binary operators using friend functions-	15	Upto K4	CLO3

	Rules for over loading operators –type conversion-Basic to class type-Class to basic type-One class to another class type.			
IV	**Inheritance, Pointers** Introduction of Inheritance-Defining derived classes-single inheritance-Multilevel inheritance-Multiple inheritance-Hierarchical inheritance-Hybrid inheritance-abstract classes-pointers –Declaring and initializing pointers- Manipulation pointers-arrays of pointers-pointers and strings-pointers to functions	15	Upto K5	CLO4
V	**Managing console I/O Operations, Files** C++ stream classes- unformatted I/O operations-overloaded operators-Put() and get() functions-getline() and write() functions-Formatted console I/O operations-Defining field width:width()-Setting precision:Precision()-Filling and padding:fill()-formatting flags,Bit-fields and setf()-Classes for file stream operations-opening and closing a file-opening file using constructor-opening files using open()-Detecting end-of-file-Updating a file:Random acess-Error handling during file operations-Command-line arguments.	15	Upto K5	CLO5

Book for study:

1. Balagurusamy.E, *Object Oriented Programming with C++*, Tata Mc Graw Hill Company, New Delhi , Fourth Edition, 2011.

Unit : I Chapters (1.3-1.8,2.3,2.6,3.5-3.7,3.10,3.12-3.14,3.17,3.19,3.24)

Unit : II Chapters (4.1-4.9,5.3,5.4,5.7,5.9)

Unit : III Chapters (6.2,6.4-6.5,6.7-6.8,6.11,7.2-7.5,7.7-7.8)

Unit : IV Chapters (8.1-8.3,8.5-8.8,8.10,9.2-9.4,9.6)

Unit : V Chapters (10.3,10.4,10.5,11.2-11.4,11.8-11.10)

Reference books:

1.Herbert Schildt, *The Complete Reference C++*, Tata Mc Graw Hill Company, New Delhi ,Fourth Edition,2009.

2.Mike McGrath, *C++ Programming in easy steps*, Dreamtech Press, New Delhi,Third Edition,2011.

3.Radha Ganesan.P ,*Programming with C ++* , Scitech Publication**,** Chennai**,**First Edition,2002.

4**.**Ravichandran.D, *Programming with C++*, Tata Mc Graw Hill Company, New Delhi,Second Edition,2002.

5. Robert Laffore, *Object oriented programming using C++*,Sams publishing, carmal Indiana, Fourth Edition,2002.

Web Resources:

1.**https://msbrijuniversity.ac.in/assets/uploads/newsupdate/ConstructorandDestructors.pdf**
2.https://msbrijuniversity.ac.in/assets/uploads/newsupdate/InheritanceinC++.pdf
3. **https://stackoverflow.com/questions/2879700/c-array-of-pointers**
4. https://www.youtube.com/watch?v=2j5Ic2V7wq4
5.https://www.youtube.com/watch?v=ns3k-Lz7qWUttps://www.youtube.com/watch?v=C08I_N0HxF8

E-books:

1. file:///D:/Users/EMG/Downloads/toaz.info-balaguruswamy-object-oriented-programming -with-c-fourth-editionpdf-pr_757ceed746e55e6343d344c3a68f9e4a.pdf
2. https://books.google.com.sl/books?id=ZQ6UWN6_nGYC&printsec=frontcover#v=onepage&q&f=false
3. https://docs.google.com/file/d/0ByYLraYXu0PHYVJHcEFtcFFCNVE/edit?resourcekey=0-nHyVtTRABz2Vrg0Lx8voYQ

Pedagogy :

Chalk and Talk, Seminar, Quiz, Group Discussion.

Rationale for Nature of the course:

Contemporary research in physics and related sciences almost always involves the use of computers. They are used for data collection and analysis, numerical analysis, simulations, and symbolic manipulation. Computational physics has become a third way of doing physics and complements traditional modes of theoretical and experimental physics.

Activities to be given

1.Enrich the students to solve different programs in C++ language.
2.Upgrading the students knowledge to the overloading and inheritance concepts.

Course Learning Outcomes(CLOs)

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

CLOs	Course Learning outcomes	Knowledge level(According to Blooms Taxonomy)
CLO1	Remembering the Basic concepts of OOP, Derived data type, Expressions and Control Structures.	Up to K4
CLO2	Understanding the various type's functions and classes.	Up to K4
CLO3	Applying the knowledge of Constructors, Destructors and operator overloading.	Up to K4
CLO4	Analyze the concept of Inheritance and Pointers.	Up to K5
CLO5	Evaluate the managing console I/O Operations, and Files.	Up to K5

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
K4 –Examining, analyzing, presentation and make inferences with evidences
K5 – Evaluate , making Judgments based on criteria.

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

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

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

Lecture Plan

Units	Course Contents	Hours	Total Hours	Pedagogy
I	Procedural Vs object oriented programming – Basic concepts of object oriented programming – Benefits of OOP	3	15	Seminar
	object oriented Languages – Applications of OOP –A simple C++ Program	3		Chalk and Talk
	Output operator-The i/o stream file-Name space-Return type of main()	3		Chalk and Talk& Group discussion
	structure of C++ program – Basic data types –User-defined data types-Derived data types	3		Chalk and Talk
	Declaration variables-Reference variables-Operators in C++-Scope resolution operator-Manipulators-Expression and their types – Control Structure.	3		Chalk and Talk, Seminar
II	**Signal Generators:** Introduction – Variable AF Oscillator	3	15	Chalk and Talk
	Introduction-The main Function –Function prototyping	3		Chalk and Talk
	Call by Reference-Return by reference	3		Group discussion
	Inline functions–Default arguments–Const arguments-functions Overloading	3		Seminar
	Specifying a class – Defining member functions	3		Chalk and Talk

	Nesting of member functions-arrays within a class.	3		Chalk and Talk
III	Constructrs–Mutiple constructor in a class	3	15	Chalk and Talk
	Constructors with Default arguments-Copy Constructor-dynamic constructor	3		Group discussion
	Destructors-Defining operator overloading	3		Seminar
	overloading binary operators using friend functions-Rules for over loading operators	3		Chalk and Talk
	overloading binary operators using friend functions-Rules for over loading operators	3		Chalk and Talk
IV	Introduction of Inheritance-Defining derived classes-single inheritance-Multilevel inheritance	3	15	Chalk and Talk
	Multiple inheritance-Hierarchical inheritance	3		Chalk and Talk& Seminar
	Hybrid inheritance-abstract classes-pointers	3		Chalk and Talk & Group Discussion
	Declaring and initializing pointers- Manipulation pointers	3		Chalk and Talk & Group
	arrays of pointers-pointers and strings-pointers to functions.	3		Chalk and Talk
V	C++ stream classes- unformatted I/O operations-overloaded operators	3	15	Chalk and Talk
	Put() and get() functions-getline() and write() functions	3		Chalk and Talk & Seminar
	Formatted console I/O operations-Defining field width:width()	3		Chalk and Talk
	Setting precision:Precision()-Filling and padding:fill()-formatting flags,Bit-fields and setf()-	3		Seminar
	Classes for file stream operations-opening and closing a file-opening file using constructor	3		Chalk and Talk & Seminar

Annexure -7

Department of Physics				Class: I M,Sc Physics				
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Hrs**	**CIA**	**External Exam**	**Total**
I	IDC	22OPPHID1	Renewable Energy Resources	2	2	25	75	100

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

Course Objectives:

1. To study the Fundamentals of Energy sciences.
2. To understand Formation and applications of different forms of solar Energy.
3. To learn energy produce from wind energy.
4. Production and use of biomass energy. Study the main application for geothermal Energy.
5. To create several self employment opportunities in non- conventional energy Resources.

Unit	Course Content	Hrs	K-Level	CLO
I	**Fundamentals of Energy Science** Introduction-Energy, economy and social development- Classification of energy resources-Consumption trend of primary energy resources- Energy chain-common form of energy- Advantages and disadvantages of conventional energy sources-Environmental aspects of energy.	6	Upto K4	CLO1
II	**Solar Energy** Introduction-solar collectors-solar water heater-solar industrial heating system-Solar refrigeration and air conditioning systems-Solar cookers-Solar Furnace- -Solar dryer.	6	Upto K4	CLO2
III	**Wind Energy** Introduction-Origin of winds-Nature of winds-Wind turbine siting-Major applications of wind power- Wind energy storage- Environmental aspects- Wind energy program in India.	6	Upto K4	CLO3

IV	**Biomass Energy** Introduction- Photosynthesis process-Usable form of biomass, their composition and fuel properties-Biomass resources-Biomass conversion Technologies- Energy farming.	6	Upto K5	CLO4
V	**Geothermal Energy** Introduction -Application-Origin and distribution of geothermal energy- Types of geothermal resources-Analysis of geothermal resources.	6	Upto K5	CLO5

Book for Study:

1. Khan B.H, *Non-conventional energy Resources*, Tata McGraw Hill Education Private Limited, New Delhi,2012.

Unit : I Chapters 1.1,1.2,1.4,1.5,1.7,1.8,1.9,1.12,1.12.1,1.12.2,1.12.3,1.12.4,1.12.5

Unit : II Chapters 5.1,5.2,5.2.1 - 5.2.3,5.2.5 - 5.2.8,5.3,5.5,5.6,5.7,5.8,5.10

Unit : III Chapters 7.1,7.2,7.3,7.3.1,7.3.2,7.4,7.5, 7.12, 7.13,7.14

Unit :IV Chapters 8.1-8.5,8.11

Unit : V Chapters 9.1-9.4,9.4.1,9.5

Reference Books:

1.Chetansinghsolanki , *Renewable energy technologies* ,PHI learning private limited, Newdelhi

2.Kothari D.P, Singal k.c. ,Rakeshranjan,*Renewable energy source and emerging technologies*

3.Rai G.D, *Solar energy utilization*, Khanna Publishers, New Delhi 4th Edition,2008.

4.Rai G.D, *Non Conventional Energy Sources*, Khanna Publishers, New Delhi 4th Edition,2008.

5.TiwariG.N, *Solar energy fundamentals,design modeling and application*, Narosa Publishing house, NewDelhi.

. **Web Resources:**

1. https://en.wikipedia.org/wiki/Renewable_energy

2. https://www.britannica.com/science/solar-energy
3. **https://www.youtube.com/watch?v=U62Pxj4pkUA**
4.**https://www.youtube.com/watch?v=qSWm_nprfqE**
5.**https://www.youtube.com/watch?v=oos7fETc2OE**
6. https://en.wikipedia.org/wiki/Geothermal_energy

E–B**ooks**

7.https://www.iare.ac.in/sites/default/files/lecture_notes/IARE_RES_LECTURE_NOTES_0.pdfenergy physics ope correction (20.11.21).docx

8. https://mnre.gov.in/img/documents/uploads/file_f-1597797108502.pdf

9. http://rael.berkeley.edu/old_drupal/sites/default/files/old-site-files/2001/Herzog-Lipman-Kammen-RenewableEnergy-2001.pdf

Rationale for Nature of the course:

This non major elective course is non- conventional energy related cources and study the many application for the renewable energy.

Pedagogy :

Chalk and Talk, Seminar, Quiz, Group Discussion

Course Learning Outcomes (CLOs)

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

CLOs	Course Learning outcomes	Knowledge level (According to Blooms Taxonomy)
CLO1	Remembering and understanding the basics of renewable energy sources	Up to K4
CLO2	Understanding usage of solar energy and study the solar applications	Up to K4
CLO3	Learning the origin of wind energy and study its uniqueness of wind energy	Up to K4
CLO4	Understanding and study the biogass production from waste	Up to K5
CLO5	Classify the types of geothermal resources and study many applications	Up to K5

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
K4 –Examining, analyzing, presentation and make inferences with evidences
K5 – Evaluate , making Judgments based on criteria.

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

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

1. Basic level 2.Intermediate level 3. Advanced level

Lecture Plan

Units	Course Contents	Hours	Total Hours	Pedagogy
I	Introduction-Energy, economy and social development-Classification of energy resources	2	6	Chalk and Talk& Group discussion
	Consumption trend of primary energy resources-Energy chain-common form of energy	2		Chalk and Talk
	Advantages and disadvantages of conventional energy sources-Environmental aspects of energy.	2		Chalk and Talk& Seminar
II	Introduction-solar collectors-solar water heater	2	6	Chalk and Talk& Group discussion
	solar industrial heating system-Solar refrigeration and air conditioning systems	2		Chalk and Talk
	Solar cookers-Solar Furnace- Solar dryer.	2		Chalk and Talk& Seminar
	Introduction-Origin of winds-Nature of winds	1	6	Chalk and Talk
	Wind turbine siting-Major applications of wind power-	3		Chalk and Talk

III	Wind energy storage			
	Environmental aspects- Wind energy program in India	2		Chalk and Talk& Seminar
IV	Introduction- Photosynthesis process-	1	6	Chalk and Talk
	Usable form of biomass, their composition and fuel properties	2		Chalk and Talk& Seminar
	Biomass resources -biomass conversion Technologies- Energy farming.	3		Chalk and Talk & Group Discussion
V	Introduction-Application	2	6	Chalk and Talk
	Origin and distribution of geothermal energy	2		Chalk and Talk & Seminar
	Types of geothermal resources-Analysis of geothermal resources.	2		Chalk and Talk & Group Discussion

Annexure -7

Department of Physics				Class: I M,Sc Physics				
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Hrs**	**CIA**	**External Exam**	**Total**
II	Core	22OPPH21	Mathematical Physics II	4	5	25	75	100

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

Course objectives:

1. Understanding the basic concept of differential equations
2. To Gain the knowledge about Bessel and Legendre functions
3. Study the concept of hermite functions
4. Apply the partial differential equation to solve the problem
5. To Learn the properties Fourier series and transform

Units	Course Contents	Hours	K Level	CLO
I	**Differential equation** First order differential equation by method of separation of variables-solution of linear differential equation of first order and its solution- solution of linear differential equation of first order by the method of integrating factor-Solution of First order differential equation Reducible to linear form(Bernoulli's equation)-Solution of Second order differential equation by power series solution: Frobenius' method	15	Upto K4	CLO1
II	**Special functions I** The Beta function – The Gamma function – Relation between Beta and Gamma function- Legendre's differential equation and Legendre's function – The generating function for $P_n(x)$ – Rodrigue's formula for the Legendre's polynomial - The Legendre's coefficients- nth orthogonality $P_n(x)$ – Recurrence Formulae- Hermite Differential Equation and Hermite Polynomials-Generating function of Hermite Polynomials- Recurrence Formulae for Hermite Polynomials.	15	Upto K4	CLO2
III	**Special functions II** Bessel's differential equation – The Bessel's function of order n of the second kind – Recurrence Formulae – Generating function- Orthonormality of Bessel's Functions: Expansion of an arbitrary function in a Series of Bessel's functions-	15	Upto K4	CLO3

	- Laguerre's Differential equation and Laguerre polynomial-The generating function for Laguerre polynomial - Rodrigue's formula for the Laguerre's polynomial			
IV	**Partial Differential Equation** Partial Differential Equation-Solution of Partial Differential Equation by the method of separation of variables-Solution of laplace's equation in Cartesian coordinates-Solution of heat flow equation: Method of separation of variables-Linear Flow in Semi-infinite solid	15	Upto K5	CLO4
V	**Fourier Series,Fourier &Laplace transforms**Fourier Series- Half Range Series –Complex Form – Change of Interval-Parsevel's theorem- Fourier's Transform – Properties of Fourier's Transform – Fourier Transform of a Derivative – Laplace transform-Properties of Laplace transform	15	Upto K5	CLO5

Book for study:

1.Satya Prakash, *Mathematical Physics*, Sultan chand and sons Educational Publishers, New Delhi, Reprint, First Edition, 2009.

Chapters:

Unit : I Chapter 7 7.1,7.3,7.4,7.4(a &b),7.5,7.8

Unit : II Chapters 4,7 4.1 to 4.7,7.11 to7.17,7.33 to 7.35

Unit : III Chapter 7 7.21to7.26,7.29,7.38to7.40

Unit : IV Chapter 9 9.1to 9.4,9.8,9.9

Unit : V Chapters 8,10 8.1 to 8.4, 8.8, 10.1 to 10.4,10.9,10.10

Reference Books:

1.Charlie Harper, *Introduction to Mathematical Physics* , Prentice Hall of India Pvt. Limited, New Delhi ,First Edition ,2005.

2.Gupta.B.D, *Mathematical Physics,* Vikas Publishing House, PVT Limited, New Delhi, Fourth Edition ,2006.

3.Joshi.A.W,*Matrices and Tensors in Physics*, New age International Publishers,New Delhi, Third Edition.

4.Kakani.S.L,Hemrajani.C,*Mathematical physics*, CBS Publishers & Distributors Pvt.Ltd.,New Delhi,Second Edition,2004.

5.Raman.K.V, *Group theory and its applications to chemistry*, Tata Mc Graw Hill Limited,New Delhi, Reprint, Second Edition 2005.

Web Resources:

1.https://math.hawaii.edu/~yuen/242handouts/Math242-chapters-16-17.pdf

2.https://en.wikipedia.org/wiki/Legendre_polynomials

3.https://en.wikipedia.org/wiki/Bessel_polynomials

4.https://www.youtube.com/watch?v=O3ahEHAX-KU

5. https://www.khanacademy.org/science/electrical-engineering/ee-signals/ee-fourier-series/v/ee-fourier-series-intro

E-books

1.**http://202.38.64.11/~jmy/documents/ebooks/Hassani%20Mathematical%20Physics%20A%20Modem%20Introduction%20to%20Its%20Foundations%20-%20S.%20Hassani%20%5B0-387-98579-4%5D.pdf**

2. **https://goldbart.gatech.edu/PostScript/MS_PG_book/bookmaster.pdf**

3. **http://www.astrosen.unam.mx/~aceves/Metodos/ebooks/riley_hobson_bence.pdf**

Pedagogy

Chalk and Talk, Seminar, Quiz, Group Discussion.

Rationale for Nature of the course:

It is the development of mathematical methods for application to problems in physics.

Activities to be given

1. Encourage the students to solve the problems
2. Practice the students to learn the special functions.

Course Learning Outcomes (CLOs):

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

CLOs	Course Learning outcomes	Knowledge level (According to Blooms Taxonomy)
CLO1	Acquire the knowledge of differential equation	Up to K4
CLO2	Understand the mathematical methods of Legendre and Hermite functions.	Up to K4
CLO3	Generalise the knowledge of special functions and their properties.	Up to K4
CLO4	Analyse partial differential equation in solving heat equation.	Up to K5
CLO5	.Understand the concept of Fourier series and Fourier transform	Up to K5

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
K4 –Examining, analyzing, presentation and make inferences with evidences
K5 – Evaluate , making Judgments based on criteria.

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

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

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

Lecture Plan

Units	**Course Contents**	**Hours**	**Total Hours**	**Pedagogy**
I	First order differential equation by method of separation of variables-solution of linear differential equation of first order and its solution	5	15	Chalk and Talk& Group discussion
	solution of linear differential equation of first order by the method of integrating factor	4		Chalk and Talk
	Solution of First order differential equation Reducible to linear form(Bernoulli's equation)	3		
	Solution of Second order differential equation by power series solution: Frobenius' method.	3		Chalk and Talk& Seminar
II	The Beta function – The Gamma function – Relation between Beta and Gamma function- Legendre's differential equation and Legendre's function	4	15	Chalk and Talk& Group discussion
	The Legendre's coefficients- n th orthogonality $P_n(x)$ – Recurrence Formulae	3		Chalk and Talk
	Hermite Differential Equation and Hermite Polynomial	3		Chalk and Talk& Seminar
	Generating function of Hermite Polynomials	3		Chalk and Talk

	Recurrence Formulae for Hermite Polynomials	2		Chalk and Talk
III	Bessel's differential equation – The Bessel's function of order n of the second kind	3	15	Chalk and Talk
	Recurrence Formulae –Generating function-Orthonormality of Bessel's Functions	3		Chalk and Talk,Seminar
	Expansion of an arbitrary function in a Series of Bessel's functions	3		Chalk and Talk
	Laguerre's Differential equation and Laguerre polynomial	3		Chalk and Talk
	The generating function for Laguerre polynomial - Rodrigue's formula for the Laguerre's polynomial	3		Chalk and Talk& Seminar
IV	Partial Differential Equation-Solution of Partial Differential Equation by the method of separation of variables	5	15	Chalk and Talk
	Solution of laplace's equation in Cartesian coordinates	5		Chalk and Talk& Seminar
	Solution of heat flow equation: Method of separation of variables-Linear Flow in Semi-infinite solid	5		Chalk and Talk & Group Discussion
V	Fourier Series- Half Range Series –Complex Form – Change of Interval-Parsevel's theorem	5	15	Chalk and Talk
	Fourier's Transform – Properties of Fourier's Transform	5		Chalk and Talk & Seminar
	Fourier Transform of a Derivative – Laplace transform-Properties of Laplace transform	5		Chalk and Talk & Group Discussion

Annexure -7

Department of Physics				Class: I M,Sc Physics				
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Hrs**	**CIA**	**External Exam**	**Total**
II	Core	22OPPH22	Thermodynamics and Statistical Mechanics	4	5	25	75	100

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

Course Objectives

1. Understand the phase space and ensembles
2. Gain the knowledge about method of ensembles
3. Discuss the different types of statistical distribution
4. Know more about the ideal Fermi dirac gas and ideal bose Einstein gas
5. Learn the concept of phase transistions

Unit	Course Contents	Hours	K Level	CLO
I	**Thermodynamics** First law of thermodynamics – The Two specific heats –Latent Heat Equations –Entropy a Point Function –Calculation of entropy change in different process – Maxwell's Thermodynamical Relations –The two Tds equations. **Applications of laws of thermodynamics** Clausius Clapeyron's latent heat equation – The Triple point; Thomson's Theorem– Adiabatic stretching of a wire – Application to Paramagnetic salts; Magneto-Caloric effect – Application to surface Films .	15	Upto K4	CLO1
II	**Phase Space** Phase space-Volume in phase space-Number of phase cells in given energy range of harmonic oscillator- Number of phase cells in given energy range of three dimensional free particle-Ensembles-Canonical Ensemble-Microcanonical Ensemble-grand canonical ensemble-uses of ensemble-Liouvilles theorem- Stastical Equilibrium-Thermal Equilibrium-Connection between statistical and thermodynamic quantities.	15	Upto K4	CLO2
III	**Method of Ensembles** Micro Canonical ensemble – perfect gas in micro canonical ensemble –Gibbs paradox – partition function and its correlation	15	Upto K4	CLO3

	with thermodynamic quantities-Gibbs canonical ensemble-Thermodynamic functions for canonical ensemble-Grand canonical ensemble-Partition function and thermodynamic functions for Grand canonical ensemble-Perfect gas in Grand canonical ensemble-comparison of ensembles.			
IV	**Distribution laws** Identical particles and symmetry requirements –Bose-Einstein statistics –Fermi-Dirac statistics-Maxwell-Boltzmann statistics-Evaluation of constants α and β- Results of three statistics-Thermodynamic Interpretation of the parameters α and β-Black body radiation and the Planck radiation law.	15	Upto K5	CLO4
V	**Bose Einstein and Fermi dirac gas:** Energy and pressure of the gas-Gas degeneracy-Bose Einstein condensation-Liquid Helium-Thermodynamic functions of degenerate Fermi dirac gas-Compressiblity of Fermi gas. **Phase transistions** Phase transistions- Phase transistions of first and second kind-Phase transistions of the second kind: The Ising model - one dimensional ising model	15	Upto K5	CLO5

Books for Study:

1. Sharma,Sankar,*Thermodynamics and Statistical physics*,Himalaya publishing house Pvt Ltd,Mumbai,First Edition,2011. [Unit I]

2.Gupta.S.L,Kumar.V ,*Elementary Statistical mechanics*, Pragati Prakashan,Meerut,Twenty third Edition ,2009.[Unit II,III,IV,V]

Unit : I	**Chapters 2,6**	**2.7,2.9,5.10,5.12,5.21,6.1,6.4,6.6-6.7,6.13-6.15**
Unit : II	**Chapter 1**	**1.1,1.3,1.4,1.7,1.10,1.11,1.14**
Unit : III	**Chapters 3**	**3.0,3.0.2,3.0.3,3.0.4,3.1,3.1.3,3.2(1,2,3)**
Unit : IV	**Chapters 6**	**6.1-6.7,6.10**
Unit : V	**Chapter 8,9**	**8.0-8.2,8.4,9.1-9.2**
	Chapter 13	**13.1,13.2,13.5,13.7**

Reference Books:

1.Garg.S.C., Bansal.R.M., Ghosal.C.K., *Thermal Physics*, McGraw Hill Education, New Delhi, Second Edition.

2. Gupta .A.B, Roy. A.B, *Thermal Physics,* Arunabha Sen Books & Allied (P) Ltd, kolkata, First Edition, 2002.

3.Jayaraman .D.Dr, Ilangovan. K. Dr ,*Thermal Physics& Statistical Mechanics*,S.viswanathan (Printers & Publisher) Pvt.Ltd, First Edition, 2009.

4.Panat.P.V, *Thermodynamics and Statistical mechanics, Na*rosa publishing house, New Delhi, First Edition, 2011.

5.Saxena.A.K, *An Introduction* to *Thermodynamics and Statistical mechanics, Na*rosa Publishing house, New Delhi, First Edition, 2011.

Web Resources :

1. **https://www.sciencedirect.com/topics/engineering/phase-space**
2. **https://www3.nd.edu/~powers/ame.20231/notes.pdf**
3. **http://gdckulgam.edu.in/Files/f07ef270-7e91-4716-8825-2966f17cc0f7/Menu/Plancks_Radiation_law_3da32a73-3848-4135-bd19-e110bd2dfdbd.pdf**
4. **https://itp.uni-frankfurt.de/~gros/Vorlesungen/TD/6_Phase_transitions.pdf**
5. **https://ps.uci.edu/~cyu/p238C/LectureNotes/IsingModel/IsingModel.pdf**

E-books:

1. https://farside.ph.utexas.edu/teaching/sm1/statmech.pdf
2. **http://www.tapir.caltech.edu/~sperhake/Lectures/Notes/StatPhys/notes.pdf**
3. **http://www.teorfys.lu.se/staff/Carl-Olof.Almbladh/FYS023/statfys.pdf**
4. **http://www.damtp.cam.ac.uk/user/tong/statphys/sp.pdf**

Pedagogy :

Chalk and Talk, Seminar, Quiz, Group Discussion

Rationale for Nature of the course:

Thermodynamics and stastical mechanics gives the basic foundations in thermal physics

Activities to be given

Practice the students to solve thermodynamical problems

Annexure -7

Course Learning Outcomes(CLOs)

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

CLOs	Course Learning outcomes	Knowledge level(According to Blooms Taxonomy)
CLO1	Understanding and applying the basics of thermodynamics	Up to K4
CLO2	Remembering the facts about phase space	Up to K4
CLO3	Gain the knowledge about method of ensembles	Up to K4
CLO4	Applying the distribution laws in statistical mechanics	Up to K5
CLO5	Analyzing the concept of phase transition	Up to K5

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
K4 –Examining, analyzing, presentation and make inferences with evidences
K5 – Evaluate , making Judgments based on criteria.

Mapping of Course Learning Outcomes(CLOs) with Program 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

Lecture Plan

Units	Course content	Hours	Total Hours	Pedagogy
I	First law of thermodynamics – The Two specific heats –Latent Heat Equations	3	15	Chalk and Talk
	Entropy a Point Function –Calculation of entropy change in different process	3		Chalk and Talk
	Maxwell's Thermodynamical Relations –The two Tds equations	3		Chalk and Talk
	Clausius Clapeyron's latent heat equation – The Triple point	2		Chalk and Talk
	Thomson's Theorem - Adiabatic stretching of a wire	2		Chalk and Talk & Seminar
	Application to Paramagnetic salts; Magneto-Caloric effect – Application to surface Films	2		Chalk and Talk & Group Discussion
II	Phase space-Volume in phase space-Number of phase cells in given energy range of harmonic oscillator	3	15	Chalk and Talk
	Number of phase cells in given energy range of three dimensional free particle-Ensembles	3		Chalk and Talk & Seminar
	Canonical Ensemble-Microcanonical Ensemble	3		Chalk and Talk
	grand canonical ensemble-uses of ensembles-Liouvilles theorem	3		Chalk and Talk
	Connection between statistical and thermodynamic quantities	3		Chalk and Talk
III	Micro Canonical ensemble – perfect gas in micro canonical ensemble –Gibbs paradox	4	15	Chalk and Talk
	partition function and its correlation with thermodynamic quantities-Gibbs canonical ensemble	4		Chalk and Talk
	Grand canonical ensemble-Partition function and thermodynamic functions for Grand canonical ensemble	4		Chalk and Talk
	Perfect gas in Grand canonical ensemble-comparison of ensembles	3		Chalk and Talk
IV	Identical particles and symmetry requirements	4	15	Chalk and Talk
	Bose-Einstein statistics –Fermi-Dirac statistics-Maxwell-Boltzmann statistics	4		Chalk and Talk& Seminar
	Evaluation of constants α and β- Results of three statistics-Thermodynamic Interpretation of the parameters α and β	4		Chalk and Talk & Group
	Black body radiation and the Planck radiation law	3		Chalk and Talk
	Energy and pressure of the gas-Gas degeneracy-Bose Einstein condensation	3		Chalk and Talk

V	Liquid Helium-Thermodynamic functions of degenerate Fermi dirac gas	3	15	Chalk and Talk & Seminar
	Compressiblity of Fermi gas	2		Chalk and Talk
	Phase transistions- Phase transistions of first and second kind	3		Chalk and Talk
	Phase transistions of the second kind: The Ising model	2		Chalk and Talk & Seminar
	Bragg-willam's approximation: The standard Mean Field Approximation-one dimensional ising model	2		Chalk and Talk & Group Discussion

Annexure -7

Department of Physics				Class: I M,Sc Physics				
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Hrs**	**CIA**	**External Exam**	**Total**
II	Core	22OPPH23	Electromagnetic theory	4	5	25	75	100

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

Course Objectives:

1. To understand the concepts of electrostatic fields.
2. To study the concepts of magnatostatics.
3. To acquire the knowledge of Maxwell's equations.
4. To apply the electromagnetic wave propagation.
5. To analyze the electrodynamics and relativity.

Unit	Course Contents	Hours	K Level	CLO
I	**Divergence and curl of electric fields** Field lines and Gauss law –The divergence of **E** – Applications of Gauss law -The curl of E. Electric potential: Introduction to potential – Comments on potential – Poisson's equations and Laplace equations – The potential of a localized charge distribution – Electrostatic boundary conditions.. **Multiple expansion**: Approximate potentials at large distances – The monopole and dipole terms – Origin of coordinates in multiple expansions – The electric field of a dipole. Gauss law in the presence of dielectrics – Boundary Conditions.	15	Upto K4	CLO1
II	**The divergence and curl of B** Straight line currents – The divergence and curl of **B** – Applications of Ampere's law – Comparison of magneto statics and electrostatics – Magnetic vector potential – Magneto static boundary conditions – Multiple expansion of the vector potentials – The auxiliary magnetic field **H**-Boundary conditions – Ampere's law in magnetized materials– Faraday's law – Electromagnetic induction – Inductance – Energy in magnetic fields.	15	Upto K4	CLO2
III	**Maxwell's equations and potentials** Maxwell's equations and magnetic charge -Maxwell's equations in matter – Boundary conditions. Potential formulations**:** Scalar and vector potentials - Gauge	15	Upto K4	CLO3

	transformations – Coulomb Gauge and Lorentz Gauge– Retarded potentials-Lienard-Wiechert potentials – The fields of a point charge in motion -Newton's third law in electrodynamics – Poynting's theorem.			
IV	**Electromagnetic waves** The wave equation in one-dimension – Sinusoidal waves- Boundary conditions –Polarization- The wave equation for E and B –Monochromatic plane waves in vacuum – Energy and momentum of EM waves – Propagation in linear media – Reflection and transmission at normal incidence and oblique incidence-Electromagnetic waves in conductor-Refelection at a conducting surface .	15	Upto K5	CLO4
V	**Electromagnetic radiation and relativity** Dipole radiation — Electric dipole radiation – Magnetic dipole radiation – Radiation from arbitrary Source.– Power radiated by a point charge- Radiation reaction – Magnetism as a relativistic phenomenon – The transformation of fields- Relativistic mechanics-Proper time and Proper velocity- Relativistic energy and momentum-The field tensor.	15	Upto K5	CLO5

Book for study:-

1.David.J.Griffiths, *Introduction to electrodynamics*, PHI Learning private Limited, New Delhi, Third Edition,2011.

Chapters:

Unit : I	**Chapters**	**2(2.2.1 to 2.24,2.31 to 2.3.5)**
		3(3.41 to 3.44)
		4(4.1.4, 4.3.1 ,4.3.3 ,4.4.1)
Unit : II	**Chapters**	**5(5.3.1 to 5.3.4,5.4.1 to 5.4.3)**
		6(6.3.1,6.3.3)
		7(7.21 to 7.2.4)
Unit : III	**Chapters**	**7(7.3.3 to 7.3.6)**
		10(10.1.1 to 10.1.3,10.2.1,10.3.1,10.3.2)
		8(8.1.2)
Unit : IV	**Chapter**	**9(9.1.1 to 9.1.4,9.2.1 to 9.23, 9.31.to 9.3.3,9.4.1 to 9.4.2)**
Unit : V	**Chapters**	**11(11.1.1 to 11.1.4,11.2.1,11.2.2)**
		12(12.3.1 to 12.3.2, 12.2,12.2.1,12.2.2,12.2.3)

Reference Books:-

1.Nishit Mathur, *Text Book of Magnetism*, Green Leaf Publications, Varanasi, First Edition,2013.

2.Rai choudhary.S, Shobhit Mahajan, *Electricity ,Magnetism and Electromagnetic Theory*, Tata McGraw Hill Education Private Limited, New Delhi, First Edition,2012.

3.Tayal.D.C, *Electricity and Magnetism*, Himalaya Publishing House, Mumbai, Fourth Edition,2007.

4. Laud.B.B. *Electromagnetics*,New Age International, Third Edition

5.Vasudeva.N,*Fundamentals of Magnetism and Electricity*, S.Chand & Company Pvt Ltd, New Delhi, First Edition, 2008.

Web Resources:

1.https://www.youtube.com/watch?v=FltPFgWZnaI

2..https://www.youtube.com/watch?v=j_slBI7nUlk

3. https://www.electrical4u.com/electromagnetic-theory

4. https://ocw.mit.edu/courses/physics/8-311-electromagnetic-theory-spring-2004

5. https://en.wikipedia.org/wiki/Electromagnetism

E-Books

1. http://himafi.fmipa.unej.ac.id/wp-content/uploads/sites/16/2018/09/Introduction-to-Electrodinamic.pdf
2. file:///D:/Users/EMG/Downloads/electricity-magnetism-and-electromagnetic-theory-9781259004599-1259004597_compress.pdf
3. https://lagboxspace.files.wordpress.com/2014/10/bleaneybleaney-electricitymagnetism2nded_text.pdf

Pedagogy :

Chalk and Talk, Seminar, Quiz, Group Discussion.

Rationale for Nature of the course:

The course is the learning of essential basis for understanding the theoretical methods and system used for electrical energy and power relies on key concepts from electromagnetic theory.

Activities to be given

1. Enhancing the quality of students to solve electrostatic and magneto static problems.
2. Train the students to analyze the electrodynamics and relativity problems.

Annexure -7

Course Learning Outcomes(CLOs)

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

CLOs	Course Learning outcomes	Knowledge level(According to Blooms Taxonomy)
CLO1	Remembering and understanding the basics of electrostatics and solve boundary value problems.	Up to K4
CLO2	Understanding the basics of Magnetostatics and solve problems on magnetic vector potential.	Up to K4
CLO3	Applying the Maxwell's equations, role of gauge transformations, scalar and vector potentials.	Up to K4
CLO4	Analyzing the knowledge of the propagation of EM waves in waveguides	Up to K5
CLO5	Evaluating the electromagnetic radiation and relativity.	Up to K5

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

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

K5- Evaluate , making Judgments based on criteria.

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

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

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

Annexure -7

Lecture Plan

Units	Course Contents	Hours	Total Hours	Pedagogy
I	Field lines and Gauss law –The divergence of **E** – Applications of Gauss law	3	15	Chalk and Talk
	The curl of E. Electric potential: Introduction to potential – Comments on potential – Poisson's equations and Laplace equations	3		Chalk and Talk
	The potential of a localized charge distribution – Electrostatic boundary conditions.	3		Chalk and Talk
	Multipole expansion: Approximate potentials at large distances – The monopole and dipole terms	3		Group discussion
	Origin of coordinates in multipole expansions – The electric field of a dipole.Gauss law in the presence of dielectrics – Boundary Conditions.	3		Seminar
II	Straight line currents – The divergence and curl of **B** – Applications of Ampere's law – Comparison of magneto statics and electrostatics	4	15	Chalk and Talk
	Magnetic vector potential – Magnetostatic boundary conditions – Multipole expansion of the vector potentials	3		Chalk and Talk
	The auxiliary magnetic field **H**-Boundary conditions	3		Group discussion
	Ampere's law in magnetized materials–Faraday's law – Electromagnetic induction	3		Chalk and Talk
	Inductance – Energy in magnetic fields.	2		Seminar
III	Maxwell's equations and magnetic charge -Maxwell's equations in matter – Boundary conditions	3	15	Chalk and Talk
	Potential formulations-Scalar and vector	2		Chalk and Talk
	Gauge transformations – Coulomb Gauge and Lorentz Gauge	4		Group discussion
	Retarded potentials-Lienard-Wiechert potentials	3		Chalk and Talk
	The fields of a point charge in motion -Newton's third law in electrodynamics – Poynting's theorem.	3		Seminar
IV	The wave equation in one-dimension – Sinusoidal waves- Boundary conditions –	3	15	Chalk and Talk
	Polarization- The wave equation for E and B	3		
	Monochromatic plane waves in vacuum – Energy and momentum of EM waves	3		Seminar
	Propagation in linear media – Reflection and transmission at normal incidence and oblique incidence	3		Chalk and Talk

	Electromagnetic waves in conductor-Reflection at a conducting surface.	3		Group Discussion
V	Dipole radiation — Electric dipole radiation – Magnetic dipole radiation	3	15	Chalk and Talk
	Radiation from arbitrary Source.– Power radiated by a point charge- Radiation reaction	3		Chalk and Talk & Seminar
	Magnetism as a relativistic phenomenon – The transformation of fields	3		Group discussion
	Relativistic mechanics-Proper time and Proper velocity	3		Seminar
	Relativistic energy and momentum-The field tensor.	3		Chalk and Talk & Seminar

Annexure -7

Department of Physics				Class: I M,Sc Physics				
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Hrs**	**CIA**	**External Exam**	**Total**
II	DSE	22OPPHDSE2A	Instrumentation	4	5	25	75	100

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

Course Objectives:

1. To know about the Oscilloscope.
2. To understand the Signal Generators.
3. To gain knowledge about Measuring Instruments.
4. To study the type of Recorders
5. To learn about the Transducers

Unit	Course Contents	Hours	K Level	CLO
I	**Oscilloscope** Introduction-Block Diagram of Oscilloscope – Simple CRO – Vertical Amplifier – Horizontal Deflecting System – Triggered Sweep CRO – Trigger Pulse Circuit – Delay Line in Triggered Sweep – Typical CRT Connections – High Frequency CRT – Dual Beam CRO -Measurement of Frequency by Lissajous Method	15	Upto K4	CLO1
II	**Signal Generators** Introduction – Variable AF Oscillator – Basic Standard Signal Generator-Modern Laboratory Signal Generator – AF Sine and Square Wave Generator – Function Generator – Square and Pulse Generator – Random Noise Generator - Video Pattern Generator – Color Bar Generator.	15	Upto K4	CLO2
III	**Measuring instruments** Introduction – Output Power Meters – Field Strength Meter – Stroboscope – Phase Meter –Q Meter: factors errors- - impedance measurement – Susceptance method- RX Meters – Analog pH Meter.	15	Upto K4	CLO3
IV	**Recorders** Introduction – Strip Chart Recorder – Galvanometer Type Recorder – Null Type Recorder – Circular Chart Recorder – X-Y Recorder – Magnetic Recorders – Frequency Modulation Recording – Digital Data Recording.	15	Upto K5	CLO4
V	**Transducers** Introduction – Electrical Transducer – Selecting a Transducer – Resistive Transducer – Resistive Position	15	Upto K5	CLO5

	Transducer – Resistive Thermometer – Thermistor –Piezo Electrical Transducer – Photo Electric Transducer.			

Book for study:-

1. Kalsi.H.S, *Electronic Instrumentation*, Tata MC Graw Hill Publishing Company Limited, New Delhi, Second Edition, reprint 2005.

Unit : I **Chapter 7** **7.1, 7.4 -7.10, 7.12 - 7.15, 7.20**

Unit : II **Chapter 8** **8.1, 8.3, 8.4, 8.6 to 8.10**

Unit : III **Chapter 10** **10.1 to 10.5.10.7, 10.9**

Unit : IV **Chapter 12** **12.1 to 12.9**

Unit : V **Chapter 13** **13.1 to 13.5, 13.7,13.8, 13.15,13.16**

Book for Reference :-

1. Albert.D,Helfrick,William.D,Cooper, *Modern Electronics Intrumentation and Measurement techniques*, PHI Learning Private Limited, New Delhi, 2011, First Edition
2. Basudev Ghosh, *Fundamental Principles of Electronics*, Books and Allied (p) Ltd, Kolkata, Second Edition,2011.
3. Jose Robin.G, Ubald Raj .A , *Basic Electronics and Applied Electronics*, Indira Publication, Marthandam, Second Edition, 2004.
4. Rangan.C.S, Sarma.G.R,Mani.VSV, *Instrumentation Devices& systems* , Tata McGraw Hill Education Private Limited, New Delhi, Second Edition,2012.
5. Salivahanan.S,Sureshkumar.N, A.Vallavaraj, *Electronic devices &circuits*, Tata MC Graw Hill Publishing Company Limited, New Delhi, First Edition, 2011.

Web Resources:

1. https://www.tutorialspoint.com/electronic_measuring_instruments/electronic_measuring_instruments_basics_of_oscilloscopes.htm
2. http://www.hunter.cuny.edu/physics/courses/physics222/repository/files/pdf/ElectronicsLab8.pdf
3. https://www.taborelec.com/Different-Types-of-Signal-Generators
4. https://circuitglobe.com/classification-of-measuring-instruments.html
5. https://www.electrical4u.com/transducer-types-of-transducer

E-books:

1. https://toaz.info/doc-viewer
2. https://www.google.co.in/books/edition/Electronic_Devices_and_Circuits_second_e/z5nL2x7Z5X4C?hl=en&gbpv=1&printsec=frontcover
3. https://www.google.co.in/books/edition/A_Textbook_of_Applied_Electronics/ldGpLGVbs

DgC?hl=en&gbpv=1&printsec=frontcover

Pedagogy:

Chalk and Talk, Seminar, Quiz, Group Discussion.

Rationale for Nature of the course:

Students can pursue career in electronic industry, Instrumentation centres and Electrical ans Mechanical Industry.

Activities to be given

1. Enrich the students to handle oscilloscope and signal generators.
2. Practice the students to analyze recorders and transducers.

Course Learning Outcomes(CLOs)

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

CLOs	Course Learning outcomes	Knowledge level(According to Blooms Taxonomy)
CLO1	Remembering the basics of CRO and Amplifiers	Up to K4
CLO2	Understanding the knowledge about Signal Generator	Up to K4
CLO3	Apply the knowledge in measuring instruments.	Up to K4
CLO4	Analyzing the performance of recorders	Up to K5
CLO5	Evaluate the working principle of various types of transducers.	Up to K5

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
K4 –Examining, analyzing, presentation and make inferences with evidences
K5 – Evaluate , making Judgments based on criteria.

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

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

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

Annexure -7

Lecture Plan

Units	Course Content	Hours	Total Hours	Pedagogy
I	**Oscilloscope :**Introduction-Block Diagram of Oscilloscope – Simple CRO – Vertical Amplifier	4	15	Chalk and Talk
	Horizontal Deflecting System – Triggered Sweep CRO	3		Chalk and Talk
	Trigger Pulse Circuit – Delay Line in Triggered Sweep	3		Chalk and Talk, seminar
	Typical CRT Connections – High Frequency CRT – Dual Beam CRO	3		Chalk and Talk seminar &
	Measurement of Frequency by Lissajous Method	2		Chalk and Talk.
II	**Signal Generators:** Introduction – Variable AF Oscillator	3	15	Chalk and Talk
	Basic Standard Signal Generator- Modern Laboratory Signal Generator	3		Chalk and Talk, seminar
	– AF Sine and Square Wave Generator	2		Chalk and Talk
	Function Generator – Square and Pulse Generator	3		Chalk and Talk, seminar
	Random Noise Generator - Video Pattern Generator	4		Chalk and Talk, seminar
III	**Measuring instruments:** Introduction – Output Power Meters	3	15	Chalk and Talk
	Field Strength Meter – Stroboscope – Phase Meter	3		Chalk and Talk
	Q Meter: factors errors- - impedance measurement – Susceptance method	5		Chalk and Talk
	RX Meters	2		Chalk and Talk, seminar
	Analog pH Meter	2		Chalk and Talk & Seminar
IV	**Recorders:** Introduction – Strip Chart Recorder	3	15	Chalk and Talk
	Galvanometer Type Recorder	3		Chalk and Talk & Seminar
	Null Type Recorder – Circular Chart Recorder	3		Chalk and Talk
	X-Y Recorder – Magnetic Recorders –	3		Chalk and Talk & Seminar
	Frequency Modulation Recording - Digital Data Recording	3		Chalk and Talk
V	**Transducers:** Introduction – Electrical Transducer – Selecting a Transducer	3	15	Chalk and Talk
	Resistive Transducer – Resistive Position Transducer	3		Chalk and Talk & Seminar
	Resistive Thermometer – Thermistor	3		Chalk and Talk, seminar
	Piezo Electrical Transducer	3		Chalk and Talk
	Photo Electric Transducer	3		Chalk and Talk & Seminar

Annexure -7

Department of Physics				Class: I M,Sc Physics				
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Hrs**	**CIA**	**External Exam**	**Total**
II	DSE	22OPPHDSE2B	Medical physics	4	5	25	75	100

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

Course Objectives:

1. To Know about the system of human body
2. To Understand the concepts of diagnostic X-ray
3 .To Gain knowledge about the medical instruments
4. To Study the type of medical equipment's
5. To Learn about advanced bio-medical instrumentation

Unit	Course Contents	Hours	K Level	CLO
I	**Human physiological systems** Introduction-Cells and their structures-nature of cancer cells-Transport of ion through the cell membrane-Resting and action potential-Bioelectric potential-Nerve tissues and organs-Different system of human body.	15	Upto K4	CLO1
II	**Bio Potential Recorders** Characteristics of the recording system-Electrocardiography(ECG)-)-Electromyography(EMG)-Electroretinography(ERG)&Electrooculography(EOG)-Recorders with high accuracy- Recorders for off line analysis. Physiological Assist Devices: Pacemakers	15	Upto K4	CLO2
III	**Operation Theatre Equipments** Surgical diathermy-Shortwave diathermy –Microwave diathermy-Ultrasonic Diathermy- Therapeutic effect of heat-Ventilators-Anesthesia machine-Blood flowmeters-Cardiac output Measurements -Blood gas analysers -Oxymeters-Elements of intensive care monitoring -Bio-Telemetry: Elements of bio-telemetry system-Design of a bio-telemetry system- Radio telemetry Systems-Problems in implant telemetry-Uses of bio-telemetry.	15	Upto K4	CLO3
IV	**Specialised Medical Equipment**	15	Upto K5	CLO4

	Blood cell Counter-Electron Microscope-Radiation detectors-Digital thermometer-Audiometers-X-ray tube-X-ray machine-Radiography and fluoroscopy-Image Identifiers-Angiography-Application of X-ray examination.			
V	**Advances in Biomedical Instrumentation** Computers in Medicine-Lasers in Medicine-Endoscopes-Cryogenic Surgery-Nuclear Imaging techniques-Computer tomography-Thermography -Magnetic resonance imaging-Positron emission tomography-Digital substraction angiography-Biofeedback instrumentation	15	Upto K5	CLO5

Book for study:-

1. Arumugam.M,Biomedical Intrumentation,Anuradha Publications, Kumbokonam,Second Edition,2007.

Chapters:

Unit: I Chapter 1 1.1-1.8
Unit: II Chapter 4 4.2-4.3,4.5-4.8,5.2
Unit: III Chapter 6,8 6.2-6.6,6.8-6.11, 6.14-6.16,8.2-8.6
Unit: IV Chapter 7 7.2-7.4,7.6-7.13.
Unit : V Chapters 10 10.2-10.8,10.10-10.14.

Reference books:-

1. Anadanatarajan, *Biomedical instrumentation and Measurements*, PHIlearning private Limited, NewDelhi, FirstEdition, 2007.

2. Arora.M.P, *Biophysics*, Himalaya publishing House, Mumbai, First Edition,2011.

3.Cromwell.L,Pfeiffer.E.A,Weibell.F.J, *Biomedical Instrumentation and Measurements*,Prentice Hall of India Pvt Ltd,2006, New Delhi, Second Edition.

Some useful websites

Web Resources:

1. https://en.wikipedia.org/wiki/List_of_systems_of_the_human_body
2 https://en.wikipedia.org/wiki/Electrocardiography
3. https://www.nhs.uk/conditions/electrocardiogram
4. https://en.wikipedia.org/wiki/X-ray
5. https://www.physics-and-radio-electronics.com/physics/laser/applicationsoflasers.html

E-Books

1.https://books.google.co.in/books?id=I5598H1Nx70C&printsec=frontcover&redir_esc=y#v=onepage&q&f=false

2.https://pdfcoffee.com/biomedical-instrumentation-and-measurements-pdf-free.html

3.https://www.acsce.edu.in/acsce/wp-content/uploads/2020/03/Biomedical-Sensors-Instruments.pdf

Pedagogy :

Chalk and Talk, Seminar, Quiz, Group Discussion.

Rationale for Nature of the course:

This course is mainly work-related skill and essential technically principle of radiation and its achieve in the medical field

Activities to be given:

1. Train the students to handle the medical equipments.
2. Practice the students to analyze the system of human body.

Course Learning Outcomes(CLOs)

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

CLOs	Course Learning outcomes	Knowledge level(According to Blooms Taxonomy)
CLO1	Understand the knowledge of basic system of human cells	Up to K4
CLO2	Apply the characteristics of bio potential recorders	Up to K4
CLO3	Demonstrate a working knowledge of theatre equipment's	Up to K4
CLO4	Study and analysis the X-rays machine	Up to K5
CLO5	Explain the different types of medical instrumentation	Up to K5

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
K4 –Examining, analyzing, presentation and make inferences with evidences
K5 – Evaluate , making Judgments based on criteria.

Annexure -7

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

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

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

Lecture Plan

Units	Course content	Hours	Total Hours	Pedagogy
I	Introduction-Cells and their structures-nature of cancer cells	3	15	Chalk and Talk
	Transport of ion through the cell membrane	3		Chalk and Talk
	Resting and action potential	3		Chalk and Talk
	Bioelectric potential-Nerve tissues and organs	3		Chalk and Talk
	Different system of human body.	3		Chalk and Talk
II	Characteristics of the recording system-Electrocardiography(ECG	3	15	Chalk and Talk and Group discussion
	Electroencephalography(EEG)-Electromyography(EMG)	3		Chalk and Talk
	Electroretinography(ERG) &Electrooculography(EOG	3		Chalk and Talk and Group discussion
	Recorders with high accuracy-Recorders for off line analysis.	3		Chalk and Talk
	Physiological Assist Devices: Pacemakers-Pacemaker batteries	3		Chalk and Talk
III	Surgical diathermy-Shortwave diathermy – Microwave diathermy-Ultrasonic Diathermy	3	15	Chalk and Talk
	Therapeutic effect of heat-Ventilators-Anaesthesia machine-Blood flow meters	3		Chalk and Talk
	-Cardiac output Measurements-Pulmonary function analysers-Gas analysers-Blood gas analysers -Ox meters	3		Chalk and Talk and Group discussion
	Elements of intensive care monitoring -Bio-Telemetry:	3		Chalk and Talk
	Elements of bio-telemetry system-Design of a bio-telemetry system-Radio telemetry Systems-Problems in implant telemetry-Uses of bio-telemetry.	3		Chalk and Talk & Seminar

Annexure -7

IV	Blood cell Counter-Electron Microscope-Radiation detectors	3	15	Chalk and Talk
	Photometers and Colorimeters-Digital thermometer-Audiometers	3		Chalk and Talk & Seminar
	X-ray tube-X-ray machine.	3		Chalk and Talk and Group discussion
	Radiography and fluoroscopy-Image Identifiers-Angiography	3		Chalk and Talk & Seminar
	Application of X-ray examination.	3		Chalk and Talk
V	Computers in Medicine-Lasers in Medicine	3	15	Chalk and Talk and Group discussion
	Endoscopes-Cryogenic Surgery	3		Chalk and Talk & Seminar
	Nuclear Imaging techniques-Computer tomography	3		Chalk and Talk
	Thermography-Ultrasonic Imaging Systems-Magnetic resonance imaging	3		Chalk and Talk and Group discussion
	Positron emission tomography-Digital substraction angiography-Biofeedback instrumentation.	3		Chalk and Talk & Seminar

Annexure -7

Department of Physics				Class: I M,Sc Physics				
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Hrs**	**CIA**	**External Exam**	**Total**
II	IDC	22OPPHID2	Astronomy & Astrophysics	2	2	25	75	100

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

Course Objectives:

1. To understand the concepts history of Astronomy.
2. To study the concepts of earth motion in space.
3. To acquire the knowledge of the moon.
4. To apply the scientific language the origin of the solar system.
5. To analyze the major constellations to the stars.

Unit	Course Content	Hrs	K-Level	CLOs
I	**History of astronomy –** Ancient Astronomy-Surya sidhanta-Modern Astronomy- Tycho Brahe- John Kepler- Galileo- Sir Isaac Newton – Edmund Halley- M.Leavitt	6	Upto K4	CLO1
II	**The earth -** The zones of earth- shape of the earth- radius of the earth- rotation of earth-Foucault's pendulum experiment-gyroscope experiment	6	Upto K4	CLO2
III	**The moon-** Introduction- phases of moon- successive phases of moon- lunar librations- summer and winter full moons- path of the moon with respect to the sun- Surface structure of the moon- The tides	6	Upto K4	CLO3
IV	**The solar system-**Introduction- The sun- Mercury- Venus-Mars-Jupiter- Satrurn- Uranus-Neptune	6	Upto K5	CLO4

V	**The stellar universe And Stars-**Introduction- Stellar motion- Solar motion- Constellation- The milky way-survey of constellations-spring constellations-summer constellations - Distance of stars- Magnitude of stars- Absolute magnitudes- The colour and size of the stars- Star clusters.	6	Upto K5	CLO5

Book for study:-

1. Kumara velu. S, Susheela kumaravelu , *Astronomy* , Sivakasi Art printers,sivakasi, Second Revised Edition, 2007.

Unit : I Chapter:19 Page.no [601-608]

Unit :II Chapter:3 Page.no [98,116,126,128,129,130]

Unit :III Chapter:12 Page.no [372,375,377,379,381,388,390]

Unit :IV Chapter:17 Page.no [511-528,536-551]

Unit :V Chapter:18 Page.no [565,566,567,571,577,581,583,584,588,591]

Book for Reference :-

1. Abhyankar .K.D, *Astro Physics-Stars and Galaxies*, University Press (India) Ltd, Hyderabad,First edition, 2001.
2. BaidyanathBasu, Tanuka Chattopadhyay, Sudhindra Nath Biswas, *An Introduction to Astro Physics*, PHL Learning Private Ltd, New Delhi,Second Edition,2010.
3. Kumara velu. S, Susheela kumaravelu , *Space Research* , Sivakasi Art printers,sivakasi, First Edition, 2002.
4. Singhal.R.P,Elements of Space Physics , PHL Learning Private Ltd, New Delhi, First Edition,2009.

Web Resources:

1. http://www.astronomy.com
2. http://www.astronomylinks.com
3. http://sciencing.com/explanation-phases-moon-6395764.html
4. https://www.livescience.com/our-solar-system.html
5. https://astrobackyard.com/types-of-stars/

E- books:

1. http://solar-center.stanford.edu/teachers/Our-Solar-System-Book.pdf
2. https://d3bxy9euw4e147.cloudfront.net/oscms-prodcms/media/documents/Astronomy-LR.pdf

3. https://www.sisd.net/cms/lib/TX01001452/Centricity/Domain/834/Astronomy%20Textbook%20Part%201.pdf

Pedagogy

Chalk and Talk, Seminar,Quiz, Group Discussion.

Rationale for Nature of the course:

This concept makes unexpectedly large contributions to formal and informal science education, given the small number of research astronomers. This course also provides promising opportunities for international cooperation.

Course Learning Outcomes(CLOs)

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

CLOs	Course Learning outcomes	Knowledge level (According to t Blooms Taxonomy)
CLO1	Remembering the basic concepts of Astronomy	Up to K4
CLO2	Learning and understanding the facts of the earth	Up to K4
CLO3	Analysis and the about the phase of moon	Up to K4
CLO4	Learning the concepts of principle solar system	Up to K5
CLO5	Analyzing and examining above the constellations	Up to K5

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
K4 –Examining, analyzing, presentation and make inferences with evidences
K5 – Evaluate , making Judgments based on criteria.

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

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

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

Annexure -7

Lecture Plan

Units	Course content	Hours	Total Hours	Pedagogy
I	Ancient Astronomy - Surya Sidhanta	2	6	Chalk and Talk
	Modern Astronomy- Tycho Brahe - John Kepler	2		Chalk and Talk & Seminar
	Galileo – Sir Isaac Newton- Edmund Halley – M.Leavitt	2		Chalk and Talk & Seminar
II	The Zones of earth	1	6	Chalk and Talk
	Shape of the earth	1		Chalk and Talk
	Radius of the earth	1		Chalk and Talk
	Rotation of earth	1		Chalk and Talk
	Foucault's pendulum experiment	1		Chalk and Talk
	Gyroscope experiment	1		Chalk and Talk & Seminar
III	Introduction – Phase of moon Successive phases of moon	2	6	Chalk and Talk
	Lunar librations- Summer and Winter full oons	2		Chalk and Talk
	Path of the moon with respect to the sun	1		Chalk and Talk
	Surface structure of the moon –the Tides	1		Chalk and Talk
IV	Introduction - The Sun	1	6	Chalk and Talk
	Mercury – Venus	1		Chalk and Talk
	Mars	1		Chalk and Talk
	Jupiter	1		Chalk and Talk
	Saturn -Uranus	1		Chalk and Talk
	Neptune	1		Chalk and Talk
V	Introduction –Stellar motion –Solar motion	1	6	Chalk and Talk
	Constellation –The Milky way	1		Chalk and Talk
	Survey of constellations – Spring Constellations	1		Chalk and Talk
	Summer Constellations – Distance of stars – Magnitude of stars	1		Chalk and Talk
	Absolute magnitudes – The colour and size of the stars and star clusters	2		Chalk and Talk

Annexure -7

Department of Physics				Class: I M,Sc Physics				
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Hrs**	**CIA**	**External Exam**	**Total**
I &II	Core	22OPPH21P	General physics practical -I	4	4	40	60	100

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

Course Objectives :

To expose the students to experiments in the Mathematical modeling, optics, and properties of matter.

Unit	Content	Hrs	K-Level	CLO
I	1.Cauchy's constant 2.Hyperbolic fringes 3.Edser Butler Fringes	12	Upto K4	CLO1
II	1.Hartman's Interpolation formula. 2.Wien's Bridge Network 3.Resolving power of a prism	12	Upto K4	CLO2
III	1. Numerical Methods I (Simpson's 1/3 rule & Trapezoidal rule) 2.Numerical Methods II (Bisection and Newton Raphson method) 3.Numerical Methods III (Runge Kutta Method)	12	Upto K4	CLO3
IV	1.Elliptical Fringes 2.Hollow Prism-To find the Refractive index of the liquids 3.Four probe method- To find the band gap of the given material	12	Upto K5	CLO 4
V	1. Maxwell's Bridge 2.Anderson Bridge 3.Refractive Index of Liquids using Laser	12	Upto K5	CLO5

Reference Books:

1. M.N.Srinivasan, S.Balasubramanian, R.Ranganathan, A Text Book of Practical Physics, 2007, Sultan Chand & Sons.

2. Indu Prakash & Ramakrishna, A Text Book of Practical Physics, 2008, Kitab Mahal Agencies

3. S.R. GovindaRajan, T. Murugaiyan, S. SundaraRajan, Practical Physics, 2006, Rochouse & Sons

4. Dr.R.K.Shukla, Dr.Anchal Srivastava, Practical Physics, 2017, New Age International (P) Ltd.

5. Indu Prakash, Ram Krishna, A.K. Jha, Textbook of Practical Physics, 2011, Kitab Mahal.

Pedagogy

Demonstration and Practical sessions.

Course Learning Outcomes(CLOs)

CLOs	Course Learning Outcomes	Knowledge Level(According to Blooms Taxonomy)
CO1	Understand the given problem in terms of domain knowledge in the field of physics.	Up to K4
CO2	Design appropriate Experiment /Test for the given problem.	Up to K4
CO3	Demonstrate skill in doing the experiment by choosing the appropriate technique and instruments and record data.	Up to K4
CO4	Analyze the data collected and infer the outcome and represent the analysis in meaningful form.	Up to K5
CO5	Communicate the findings in appropriate scientific terminology.	Up to K5

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
K4 –Examining, analyzing, presentation and make inferences with evidences
K5 – Evaluate , making Judgments based on criteria.

Annexure -7

Mapping of Course Learning Outcomes CLOs with Programme Outcomes POs

CLOs	PO1	PO2	PO3	PO4	PO5	PO6
CLO 1	3	3	3	2	3	3
CLO 2	3	3	3	1	3	2
CLO 3	3	3	3	1	3	2
CLO 4	3	3	3	1	3	2
CLO 5	3	3	3	1	3	3

1 – Basic Level 2 – Intermediate Level 3- Advance Level

Lesson Plan

UNIT	Topics to be Covered	Hours	Mode
I	Cauchy's constant Hyperbolic fringes Maxwell's Bridge	6 6	Demo & Practical Session
II	Hartman's Interpolation formula. Wien's Bridge Network Resolving power of a prism	12	Demo & Practical Session
III	Numerical Methods I (Simpson's 1/3 rule & Trapezoidal rule) Numerical Methods II (Bisection and Newton Raphson method) Numerical Methods III (Runge Kutta Method)	12	Demo & Practical Session
IV	Elliptical Fringes Hollow Prism-To find the Refractive index of the liquids Four probe method- To find the band gap of the given material	6 6	Demo & Practical Session
V	Edser Butler Fringes Anderson Bridge Refractive Index of Liquids using Laser	6 6	Demo & Practical Session

Annexure -7

Department of Physics				Class: I M,Sc Physics				
Sem	**Course Type**	**Course Code**	**Course Title**	**Credits**	**Hrs**	**CIA**	**External Exam**	**Total**
I &II	Core	22OPPH22P	Electronics practical -I	4	4	40	60	100

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

Course Objective :

To expose the students to understand the fundamental concepts of diode,OP AMP and ICs for the application of various instruments with practical observations.

Unit	Content	Hrs	K-Level	CLO
I	1.Zener diode-Regulated power supply(5 V) 2. Wave shaping (diodes) 3. IC Regulated power supply	12	Upto K4	CLO1
II	4. OP amp as an Integrator and Differentiator 5. OP amp Characteristics(Inverting, Non Inverting, Input Impedence,Output Impedence) 6. Karnaugh map	12	Upto K4	CLO2
III	7. Astable multivibrator using IC 555 and Transistor 8. Monostable multivibrator using IC 555 and Transistor 9. Hartley oscillator using Transistor	12	Upto K4	CLO3
IV	10. Colpitts oscillator using Transistor 11. Relaxation oscillator using UJT 12. Construction of dual regulated power supply.	12	Upto K5	CLO4
V	13.OP amp waveform generator 14. Bistable multivibrator using IC 555 15. Three bit D/A convertor.	12	Upto K5	CLO5

Reference Books:

1. M.N.Srinivasan, S.Balasubramanian, R.Ranganathan, A Text Book of Practical Physics, 2007, Sultan Chand & Sons.

2. Indu Prakash & Ramakrishna, A Text Book of Practical Physics, 2008, Kitab Mahal Agencies

3. S.R. GovindaRajan, T. Murugaiyan, S. SundaraRajan, Practical Physics, 2006, Rochouse & Sons

4. Dr.R.K.Shukla, Dr.Anchal Srivastava, Practical Physics, 2017, New Age International (P) Ltd.

5. Indu Prakash, Ram Krishna, A.K. Jha, Textbook of Practical Physics, 2011, Kitab Mahal.

Pedagogy

Projector, Demonstration and Practical sessions.

Course Learning Outcomes(CLOs)

CLOs	Course Learning Outcomes	Knowledge Level(According to Blooms Taxonomy)
CLO1	Identify the link between theory and designing workable circuits	Up to K4
CLO2	Design appropriate Experiment /Test for the given problem.	Up to K4
CLO3	Demonstrate skill in doing the experiment by choosing the appropriate technique and instruments and record data.	Up to K4
CLO4	Analyze the data collected and infer the outcome and represent the analysis in meaningful form.	Up to K5
CLO5	Communicate the findings in appropriate scientific terminology.	Up to K5

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
K4 –Examining, analyzing, presentation and make inferences with evidences
K5 – Evaluate , making Judgments based on criteria.

Annexure -7

Mapping of Course Learning Outcomes CLOs with Programme Outcomes POs

CLOs	PO1	PO2	PO3	PO4	PO5	PO6
CLO 1	3	3	3	2	3	1
CLO 2	3	3	3	1	3	3
CLO 3	3	3	3	1	3	2
CLO 4	3	3	3	1	3	3
CLO 5	3	3	3	1	3	3

1 – Basic Level 2 – Intermediate Level 3- Advance Level

Lesson Plan

UNIT	Topics to be Covered	Hours	Mode
I	1.Zener diode-Regulated power supply(5 V) 2. Wave shaping (diodes) 3. IC Regulated power supply	6 6	Demo & Practical Session
II	4. OP amp as an Integrator and Differentiator 5. OP amp Characteristics(Inverting, Non Inverting, Input Impedence,Output Impedence) 6. Karnaugh map	12	Demo & Practical Session
III	7. Astable multivibrator using IC 555 and Transistor 8. Monostable multivibrator using IC 555 and Transistor 9. Hartley oscillator using Transistor	12	Demo & Practical Session
IV	10. Colpitts oscillator using Transistor 11. Relaxation oscillator using UJT 12. Construction of dual regulated power supply	6 6	Demo & Practical Session
V	13 OP amp waveform generator 14. Bistable multivibrator using IC 555 15. Three bit D/A convertor	6 6	Demo & Practical Session