

B.Sc., PHYSICS

Syllabus

Program Code: UPH

2023 - Onwards



MANNAR THIRUMALAI NAICKER COLLEGE

(AUTONOMOUS)

Re-accredited with “A⁺” Grade by NAAC

PASUMALAI, MADURAI – 625 004

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS),

MADURAI – 625 004

B.SC PHYSICS CURRICULUM

(For the students admitted from the academic year 2023-2024 onwards)

Course Code	Title of the Course	Hrs	Credits	Maximum Marks		
				Int	Ext	Total
FIRST SEMESTER						
Part – I	Tamil / Alternative Course					
23UTAGT11	தமிழ் இலக்கிய வரலாறு - I	6	3	25	75	100
Part – II	English					
23UENGE11	General English - I	6	3	25	75	100
Part - III	Core Courses					
23UPHCC11	Properties of Matter and Acoustics	5	5	25	75	100
23UPHCP11	physics practical - I	4	4	25	75	100
Part - III	Elective Course					
23UMTEA11	Allied Mathematics - I	5	4	25	75	100
Part IV	Non Major Elective					
23UPHNM11	Physics for Every Day Life	2	2	25	75	100
Part IV	Foundation Course					
23UPHFC11	Introductory Physics	2	2	25	75	100
Total		30	23	175	525	700
SECOND SEMESTER						
Part – I	Tamil / Alternative Course					
23UTAGT21	தமிழ் இலக்கிய வரலாறு – II	6	3	25	75	100
Part – II	English					
23UENGE21	General English - II	6	3	25	75	100
Part - III	Core Courses					
23UPHCC21	Heat, Thermodynamics and Statistical Physics	5	5	25	75	100
23UPHCP21	Physics Practical 2	4	4	25	75	100
Part - III	Elective Course					
23UMTEA21	Allied Mathematics - II	5	4	25	75	100
Part IV	Non Major Elective					
23UPHNM21	Physics of Medical Instruments	2	2	25	75	100
Part IV	Skill Enhancement course					
23UPHSC21	Fundamentals of Astrophysics	2	2	25	75	100
Total		30	23	175	525	700

Course Code	Title of the Course	Hrs	Credits	Maximum Marks		
				Int	Ext	Total
THIRD SEMESTER						
Part – I	Tamil / Alternative course					
23UTAGT31	தமிழக வரலாறும் பண்பாடும்	6	3	25	75	100
Part – II	English					
23UENGE31	General English - III	6	3	25	75	100
Part - III	Core courses					
23UPHCC31	General Mechanics and Classical Mechanics	5	5	25	75	100
23UPHCP31	Physics Practical 3	3	3	25	75	100
Part - III	Elective / Allied courses					
23UCHEA31	Chemistry for Physical Sciences - I	4	3	25	75	100
23UCHEP31	Chemistry for Physical Sciences Practical - 1	2	2	25	75	100
Part - IV	Skill Based courses					
23UPHSC31	Communication Physics	1	1	25	75	100
23UPHSC32	Medical Instrumentation	2	2	25	75	100
Part - IV	Mandatory course					
23UEVSG41	Environmental Studies	1	-	-	-	-
Total		30	22	200	600	800
FOURTH SEMESTER						
Part – I	Tamil / Alternative course					
23UTAGT41	தமிழும் அறிவியலும்	6	3	25	75	100
Part – II	English					
23UENGE41	General English - IV	6	3	25	75	100
Part - III	Core courses					
23UPHCC41	Optics and Spectroscopy	5	5	25	75	100
23UPHCP41	Physics Practical 4	3	3	25	75	100
Part - III	Elective Allied courses					
23UCHEA41	Chemistry For Physical Sciences -II	4	3	25	75	100
23UCHEP41	Chemistry For Physical Sciences Practical - II	2	2	25	75	100
Part - IV	Skill Based courses					
23UPHSC41	Materials Science	2	2	25	75	100
23UPHSC42	Lasers and Fiber Optics	1	1	25	75	100
Part - IV	Mandatory course					
23UEVSG41	Environmental Studies	1	2	25	75	100
Total		30	24	225	675	900

Course Code	Title of the Course	Hrs	Credits	Maximum Marks		
				Int	Ext	Total
FIFTH SEMESTER						
Part - III	Core courses					
23UPHCC51	Electricity, Magnetism and Electromagnetism	6	5	25	75	100
23UPHCC52	Atomic and Nuclear Physics	6	4	25	75	100
23UPHCC53	Analog and Communication Electronics	6	4	25	75	100
23UPHCP51	Physics Practical 5	3	3	25	75	100
Part – III	Elective courses - I					
23UPHEC51	Nanoscience and Nanotechnology	4	2	25	75	100
23UPHEC52	Numerical Methods and C Programming					
Part - III	Elective courses / Project - II					
23UPHPR51	Project with Viva - Voce	3	3	25	75	100
23UPHEC53	Digital Photography					
Part - IV	Mandatory course					
23UVLEG51	Value Education	2	2	25	75	100
23UPHIN51	Internship Report	-	1	25	75	100
Total		30	24	200	600	800
SIXTH SEMESTER						
Part - III	Core courses					
23UPHCC61	Quantum Mechanics and Relativity	6	5	25	75	100
23UPHCC62	Solid State Physics	6	4	25	75	100
23UPHCC63	Digital Electronics and Microprocessor 8085	6	4	25	75	100
23UPHCP61	Physics Practical 6	3	3	25	75	100
Part - III	Elective courses - I					
23UPHEC61	Mathematical Physics	3	2	25	75	100
23UPHEC62	Energy Physics					
Part - III	Elective courses - II					
23UPHEC63	Advanced Mathematical Physics	4	3	25	75	100
23UPHEC64	Fundamentals of Molecular Spectroscopy					
Part - IV	Skill course					
23UPHSC61	Analysis of Climate Change	2	2	25	75	100
Part - V	Extension activities					
23UNCET61, 23UNSET61, 23UPEET61, 23URRET61 & 23UYRET61	N.C.C, N.S.S, Physical Education, R.R.C & Y.R.C	-	1	25	75	100
Total		30	24	200	600	800
Grand total		180	140	1175	3525	4700

FIFTH SEMESTER

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)**RESEARCH CENTRE OF PHYSICS****FOR THOSE WHO JOINED IN 2023-2024 AND AFTER**

Course Name	Electricity, Magnetism and Electromagnetism			
Course Code	23UPHCC51	L	P	C
Category	Core	6	-	5

COURSE OBJECTIVES:

- To classify materials based on their electrical and magnetic properties.
- To analyse the working principles of electrical gadgets.
- To understand the behaviour of dc, ac and transient currents.
- To know about the communication by electromagnetic waves.

UNIT - I**18****CAPACITORS AND THERMO ELECTRICITY**

capacitor principle – capacitance of spherical and cylindrical capacitors – capacitance of a parallel plate capacitor (with and without dielectric slab) – effect of dielectric – Carey Foster bridge – temperature coefficient of resistance – Seebeck effect – laws of thermo emf – Peltier effect – Thomson effect

UNIT - II**18****MAGNETIC EFFECTS OF CURRENT**

Biot and Savart's law – magnetic induction due to circular coil – magnetic induction due to solenoid – Helmholtz tangent galvanometer – force on a current element by magnetic field – force between two infinitely long conductors – torque on a current loop in a field – Ampere's circuital law – differential form

UNIT - III**18****MAGNETISM AND ELECTROMAGNETIC INDUCTION**

Magnetic induction B – magnetization M – relation between B, H and M – magnetic susceptibility – magnetic permeability – B-H curve – energy loss due to hysteresis – Importance of hysteresis curves – Faraday and Lenz laws – vector form – self-induction – coefficient of self-inductance of solenoid – Anderson's method – mutual induction – coefficient of mutual inductance between two coaxial solenoids – coefficient of coupling

UNIT - IV**18****TRANSIENT AND ALTERNATING CURRENTS**

The decay of current in a circuit containing resistance and inductance – growth and decay of charge in a circuit containing resistance and capacitor – growth and decay of charge in an LCR circuit (expressions for charge only) – peak, average and rms values of ac – LCR series and parallel circuits – resonance condition – Q factor – power factor.

UNIT - V**18****MAXWELLS EQUATIONS AND ELECTROMAGNETIC WAVES**

Maxwell's equations in vacuum (Differential form), material media – physical significance of Maxwell's equations – displacement current – plane electromagnetic waves in free space – velocity of light – Poynting vector.

Total Lecture Hours**90**

BOOKS FOR STUDY:

- 1. Murugesan. R., - Electricity and Magnetism, 13thEdn, 2016, S.Chandand Co, New Delhi.
- Unit I – 4.1- 4.7,7.1,8.1,8.2,8.4,8.5
- Unit II- 10.2, 10.4, 10.5-10.8, 10.10,10.17,10.18.
- Unit III-15.1 -15.5, 15.14, 15.16, 15.17,11.1,11.3,11.6,11.7,11.8.
- Unit IV- 12.2-12.3,12.5, 12.6,13.1,13.3,13.4
- Unit V – 16.1-16.5

BOOKS FOR REFERENCES:

- S Brijlal and Subramanian, Electricity and Magnetism, 6th Edn.,Ratanand Prakash, Agra.
- Brijlal, N.Subramanyan and JivanSeshan, Mechanics and Electrodynamics (2005), Eurasia Publishing House (Pvt.) Ltd., New Delhi.
- David J. Griffiths, Introduction to Electrodynamics, 2ndEdn. 1997, Prentice Hall
- India Pvt. Ltd., New Delhi
- D. Halliday, R. Resnik and J. Walker - Fundamentals of Physics, 6thEdn., Wiley, NY, 2001.

WEB RESOURCES:

- ❖ <https://www.edx.org/course/electricity>
- ❖ <https://www.udemy.com/courses/>
- ❖ <https://www.edx.org/course/magnetism>
- ❖ <http://www.hajim.rochester.edu/optics/undergraduate/courses.html>

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED		ENTREPRENEURSHIP		
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		GLOBAL	✓
Changes Made in the Course	Percentage of Change		27%	No Changes Made			New Course	
* Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.								

COURSE OUTCOMES:**K LEVEL**

After studying this course, the students will be able to:

CO1	Describe various thermo-electric effects and their properties.	K1 to K4
CO2	Apply Biot and Savart law to study the magnetic effect of electric current.	K1 to K4
CO3	Use Faraday and Lenz laws in explaining self and mutual inductance.	K1 to K4
CO4	Analyze the time variation of current and potential difference in AC circuits.	K1 to K4
CO5	Relate different physical quantities used to explain magnetic properties of materials.	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	2	2	3	2	2	3	2	3
CO2	2	3	3	3	2	2	3	2	3	3
CO3	3	2	3	2	3	3	2	3	3	3
CO4	3	3	3	3	3	2	3	2	2	2
CO5	2	2	3	3	2	3	3	3	3	2
S- STRONG			M – MEDIUM					L - LOW		

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
WEIGHTAGE	15	15	15	15	15
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3.0	3.0	3.0	3.0	3.0

LESSON PLAN:

UNIT	Electricity, Magnetism and Electromagnetism	HRS	PEDAGOGY
I	CAPACITORS AND THERMO ELECTRICITY capacitor principle – capacitance of spherical and cylindrical capacitors – capacitance of a parallel plate capacitor (with and without dielectric slab) – effect of dielectric – Carey Foster bridge – temperature coefficient of resistance – Seebeck effect – laws of thermo emf – Peltier effect – Thomson effect	18	Chalk & Talk, Videos, PPT and Demonstration
II	MAGNETIC EFFECTS OF CURRENT Biot and Savart's law – magnetic induction due to circular coil – magnetic induction due to solenoid – Helmholtz tangent galvanometer – force on a current element by magnetic field – force between two infinitely long conductors – torque on a current loop in a field - Amperes circuital law – differential form – divergence of magnetic field.	18	Chalk & Talk, Videos, PPT and Demonstration
III	MAGNETISM AND ELCTROMAGNETIC INDUCTION magnetic induction B – magnetization M - relation between B, H and M – magnetic susceptibility – magnetic permeability –B-H curve – energy loss due to hysteresis - Importance of hysteresis curves – Faraday and Lenz laws – vector form – self-induction – coefficient of self-inductance of solenoid – Anderson's method – mutual induction – coefficient of mutual inductance between two coaxial solenoids – coefficient of coupling	18	Chalk & Talk, Videos, PPT and Demonstration

IV	TRANSIENT AND ALTERNATING CURRENTS The decay of current in a circuit containing resistance and inductance – growth and decay of charge in a circuit containing resistance and capacitor – growth and decay of charge in an LCR circuit (expressions for charge only) – peak, average and rms values of ac – LCR series and parallel circuits – resonance condition – Q factor – power factor	18	Chalk & Talk, Videos, PPT and Demonstration
V	MAXWELLS EQUATIONS AND ELECTROMAGNETIC WAVES: Maxwell's equations in vacuum (Differential form), material media– physical significance of Maxwell's equations –displacement current – plane electromagnetic waves in free space – velocity of light – Poynting vector.	18	Chalk & Talk, Videos, PPT and Demonstration

Learning Outcome Based Education & Assessment (LOBE)						
Formative Examination - Blue Print						
Articulation Mapping – K Levels with Course Outcomes (COs)						
Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of Questions	K - Level		
CI	CO1	K1 – K4	2	K1, K2	2(K1, K1)	2(K3 , K3)
AI	CO2	K1 – K4	2	K1,K2	2(K2 , K2)	2(K4 , K4)
CI	CO3	K1 – K4	2	K1, K2	2(K2 , K2)	2(K3 , K3)
AII	CO4	K1 – K4	2	K1,K2	2(K3 , K3)	2(K4, K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	10	-	12	21.43	42.86
	K2	2	10	-	12	21.43	
	K3	-	-	16	16	28.57	28.57
	K4	-	-	16	16	28.57	28.57
	Marks	4	20	32	56	100	100
CIA II	K1	2			2	3.57	25
	K2	2	10		12	21.43	
	K3		10	16	26	46.43	46.43
	K4			16	16	28.57	28.57
	Marks	4	20	32	56	100	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

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

CO 5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1, K2	K1, K1	K2, K2
2	CO2	K1 – K4	2	K1, K2	K2, K2	K2, K2
3	CO3	K1 – K4	2	K1, K2	K2, K2	K3, K3
4	CO4	K1 – K4	2	K1, K2	K3, K3	K3, K3
5	CO5	K1 – K4	2	K1, K2	K4, K4	K4, K4
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	10		15	10.72	10.72
K2	5	20	32	57	40.71	40.71
K3		10	32	42	30.00	30.00
K4		10	16	26	18.57	18.57
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions				PART – A	
				(10 x 1 = 10 Marks)	
1.	Unit - I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit - I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit - II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit - II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit - IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit - IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit - V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit - V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions				PART – B	(5 x 5 = 25 Marks)
11. a)	Unit - I	CO1	K1	OR	
11. b)	Unit - I	CO1	K1		
12. a)	Unit - II	CO2	K2	OR	
12. b)	Unit - II	CO2	K2		
13. a)	Unit - III	CO3	K2	OR	
13. b)	Unit - III	CO3	K2		
14. a)	Unit - IV	CO4	K3	OR	
14. b)	Unit - IV	CO4	K3		
15. a)	Unit - V	CO5	K4	OR	
15. b)	Unit - V	CO5	K4		

Answer ALL the questions				PART – C	(5 x 8 = 40 Marks)
16. a)	Unit - I	CO1	K2	OR	
16. b)	Unit - I	CO1	K2		
17. a)	Unit - II	CO2	K2	OR	
17. b)	Unit - II	CO2	K2		
18. a)	Unit - III	CO3	K3	OR	
18. b)	Unit - III	CO3	K3		
19. a)	Unit - IV	CO4	K3	OR	
19. b)	Unit - IV	CO4	K3		
20. a)	Unit - V	CO5	K4	OR	
20. b)	Unit - V	CO5	K4		

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)**RESEARCH CENTRE OF PHYSICS****FOR THOSE WHO JOINED IN 2023-2024 AND AFTER**

Course Name	Atomic and Nuclear Physics			
Course Code	23UPHCC52	L	P	C
Category	Core	6	-	4

COURSE OBJECTIVES:

- To make students understand the development of atom models, quantum numbers, coupling schemes and analysis of magnetic moments of an electrons;
- To gain knowledge on excitation and ionization potentials, splitting of spectral lines in magnetic and electric fields;
- To get knowledge on radioactive decay; To know the concepts used in nuclear reaction;
- To understand the quark model of classification of elementary particles.

UNIT - I VECTOR ATOM MODEL: 18

Introduction to atom model – vector atom model – electron spin –spatial quantisation– quantum numbers associated with vector atom model – L-S and J-J coupling – Pauli's exclusion principle – magnetic dipole moment due to orbital motion and spin motion of the electron – Bohr magneton – Stern-Gerlach experiment – selection rules – intensity rule

UNIT - II ATOMIC SPECTRA: 18

Origin of atomic spectra – excitation and ionization potentials – Davis and Goucher's method – spectral terms and notations – fine structure of sodium D-lines – Zeeman effect –Larmor's theorem – quantum mechanical explanation of normal Zeeman effect – anomalous Zeeman effect (qualitative explanation) –Paschen-Back effect – Stark effect

UNIT - III RADIOACTIVITY: 18

discovery of radioactivity – natural radio activity – properties of alpha rays, beta rays and gamma rays –Geiger-Nuttal law – alpha particle spectra –Gammow's theory of alpha decay (qualitative study) – beta ray spectra – neutrino theory of beta decay – nuclear isomerism – internal conversion – non- conservation of parity in weak interactions.

UNIT - IV NUCLEAR REACTIONS: 18

conservation laws of nuclear reaction – Q-value equation for a nuclear reaction – threshold energy – scattering cross section – artificial radio activity – application of radio isotopes – classification of neutrons – models of nuclear structure – liquid drop model – shell model.

UNIT - V ELEMENTARY PARTICLES: 18

Classification of elementary particles – fundamental interactions – elementary particle quantum numbers –Iso-spin and strangeness quantum number – Conservation laws and symmetry – quarks – quark model (elementary ideas only) – discovery of cosmic rays – primary and secondary cosmic rays – latitude effect– altitude effect

Total Lecture Hours	90
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BOOKS FOR STUDY:

- 1. R. Murugesan, Modern Physics, S. Chand and Co. (All units) (Units I and II-Problems)
- 2. Brijlal and N. Subrahmanyam, Atomic and Nuclear Physics, S. Chand and Co. (All units)
- 3. J. B. Rajam, Modern Physics, S. Chand and Co.
- 4. Sehgal and Chopra, Modern Physics, Sultan Chand, New Delhi
- 5. Arthur Beiser– Concept of Modern Physics, McGraw Hill Publication, 6th Edition.

BOOKS FOR REFERENCES:

- 1. Perspective of Modern Physics, Arthur Beiser, McGraw Hill.
- 2. Modern Physics, S. Ramamoorthy, National Publishing and Co.
- 3. Laser and Non-Linear Optics by B.B.Laud, Wiley Eastern Ltd., New York, 1985.
- 4. Tayal, D.C. 2000 – Nuclear Physics, Edition, Himalaya Publishing House, Mumbai.
- 5. Irving Kaplan (1962) Nuclear Physics, Second Edition, Oxford and IBH Publish and Co, New Delhi.
- 6. J.B. Rajam– Atomic Physics, S. Chand Publication, 7th Edition.
- 7. Roy and Nigam, – Nuclear Physics (1967) First edition, Wiley Eastern Limited, New Delhi

WEB RESOURCES:**1. Materials Modeling 2.0**

- ❖ <http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html>

2. Photoelectric Effect Explained

- ❖ <https://makingphysicsfun.files.wordpress.com/2015/01/photoelectric-effect.pptx>

3. When does each type of decay occur?

- ❖ <https://www.khanacademy.org/science/physics/quantum-physics/in-in-nuclei/v/types-of-decay>

4. CBSE Class 12 || Physics || Nuclei || Animation || in English

- ❖ <https://www.khanacademy.org/science/in-in-class-12th-physics-india/nuclei>

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED		ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL			NATIONAL		GLOBAL	✓
Changes Made in the Course	Percentage of Change		34%	No Changes Made			New Course		
* Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.									

COURSE OUTCOMES:										K LEVEL	
After studying this course, the students will be able to:											
CO1	List the properties of electrons and positive rays, define specific charge of positive rays and know about different mass spectrographs									K1 to K4	
CO2	Outline photoelectric effect and the terms related to it, State laws of photoelectric emission, Explain experiments and applications of photo electric effect, Solve problems based on photoelectric equation									K1 to K4	
CO3	Explain different atom models, Describe different quantum numbers and different coupling schemes									K1 to K4	
CO4	Differentiate between excitation and ionization potentials, Explain Davis and Goucher's experiment, Apply selection rule, Analyse Paschen-Back effect, Compare Zeeman and Stark effect.									K1 to K4	
CO5	Understand the condition for production of laser, Appreciate various properties and applications of lasers.									K1 to K4	
MAPPING WITH PROGRAM OUTCOMES:											
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	
CO1	3	3	2	2	3	2	2	3	2	3	
CO2	2	3	3	3	2	2	3	2	3	3	
CO3	3	2	3	2	3	3	2	3	3	3	
CO4	3	3	3	3	3	2	3	2	2	2	
CO5	2	2	3	3	2	3	3	3	3	2	
S- STRONG			M – MEDIUM					L - LOW			
CO / PO MAPPING:											
COS		PSO1		PSO2		PSO3		PSO4		PSO5	
CO 1		3		3		3		3		3	
CO 2		3		3		3		3		3	
CO 3		3		3		3		3		3	
CO 4		3		3		3		3		3	
CO 5		3		3		3		3		3	
WEIGHTAGE		15		15		15		15		15	
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS		3.0		3.0		3.0		3.0		3.0	
LESSON PLAN:											
UNIT	Atomic and Nuclear Physics							HRS	PEDAGOGY		
I	introduction to atom model – vector atom model – electron spin –spatial quantisation– quantum numbers associated with vector atom model – L-S and J-J coupling – Pauli's exclusion principle – magnetic dipole moment due to							18	Chalk & Talk, Videos, PPT		

	orbital motion and spin motion of the electron – Bohr magnetron – Stern-Gerlach experiment – selection rules – intensity rule		
II	Origin of atomic spectra – excitation and ionization potentials – Davis and Goucher's method – spectral terms and notations – fine structure of sodium D-lines – Zeeman effect – Larmor's theorem – quantum mechanical explanation of normal Zeeman effect – anomalous Zeeman effect (qualitative explanation) – Paschen-Back effect – Stark effect.	18	Chalk & Talk, Videos, PPT
III	Discovery of radioactivity – natural radio activity – properties of alpha rays, beta rays and gamma rays – Geiger-Nuttall law – alpha particle spectra – Gamow's theory of alpha decay (qualitative study) – beta ray spectra – neutrino theory of beta decay – nuclear isomerism – internal conversion – non-conservation of parity in weak interactions.	18	Chalk & Talk, Videos, PPT
IV	Conservation laws of nuclear reaction – Q-value equation for a nuclear reaction – threshold energy – scattering cross section – artificial radio activity – application of radio isotopes – classification of neutrons – models of nuclear structure – liquid drop model – shell model.	18	Chalk & Talk, Videos, PPT
V	Classification of elementary particles – fundamental interactions – elementary particle quantum numbers – isospin and strangeness quantum number – Conservation laws and symmetry – quarks – quark model (elementary ideas only) – discovery of cosmic rays – primary and secondary cosmic rays – latitude effect – altitude effect.	18	Chalk & Talk, Videos, PPT

Learning Outcome Based Education & Assessment (LOBE)						
Formative Examination - Blue Print						
Articulation Mapping – K Levels with Course Outcomes (COs)						
Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of Questions	K - Level		
CI	CO1	K1 – K4	2	K1, K2	2(K1, K1)	2(K3 , K3)
AI	CO2	K1 – K4	2	K1,K2	2(K2 , K2)	2(K4 , K4)
CI	CO3	K1 – K4	2	K1, K2	2(K2 , K2)	2(K3 , K3)
AII	CO4	K1 – K4	2	K1,K2	2(K3 , K3)	2(K4, K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	10	-	12	21.43	42.86
	K2	2	10	-	12	21.43	
	K3	-	-	16	16	28.57	28.57
	K4	-	-	16	16	28.57	28.57
	Marks	4	20	32	56	100	100
CIA II	K1	2			2	3.57	25
	K2	2	10		12	21.43	
	K3		10	16	26	46.43	46.43
	K4			16	16	28.57	28.57
	Marks	4	20	32	56	100	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

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

CO 5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1, K2	K1, K1	K2, K2
2	CO2	K1 – K4	2	K1, K2	K2, K2	K2, K2
3	CO3	K1 – K4	2	K1, K2	K2, K2	K3, K3
4	CO4	K1 – K4	2	K1, K2	K3, K3	K3, K3
5	CO5	K1 – K4	2	K1, K2	K4, K4	K4, K4
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	10		15	10.72	10.72
K2	5	20	32	57	40.71	40.71
K3		10	32	42	30.00	30.00
K4		10	16	26	18.57	18.57
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions				PART – A (10 x 1 = 10 Marks)	
1.	Unit - I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit - I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit - II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit - II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit - IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit - IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit - V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit - V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions				PART – B	(5 x 5 = 25 Marks)
11. a)	Unit - I	CO1	K1		
OR					
11. b)	Unit - I	CO1	K1		
12. a)	Unit - II	CO2	K2		
OR					
12. b)	Unit - II	CO2	K2		
13. a)	Unit - III	CO3	K2		
OR					
13. b)	Unit - III	CO3	K2		
14. a)	Unit - IV	CO4	K3		
OR					
14. b)	Unit - IV	CO4	K3		
15. a)	Unit - V	CO5	K4		
OR					
15. b)	Unit - V	CO5	K4		

Answer ALL the questions				PART – C	(5 x 8 = 40 Marks)
16. a)	Unit - I	CO1	K2		
OR					
16. b)	Unit - I	CO1	K2		
17. a)	Unit - II	CO2	K2		
OR					
17. b)	Unit - II	CO2	K2		
18. a)	Unit - III	CO3	K3		
OR					
18. b)	Unit - III	CO3	K3		
19. a)	Unit - IV	CO4	K3		
OR					
19. b)	Unit - IV	CO4	K3		
20. a)	Unit - V	CO5	K4		
OR					
20. b)	Unit - V	CO5	K4		

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)**RESEARCH CENTRE OF PHYSICS****FOR THOSE WHO JOINED IN 2023-2024 AND AFTER**

Course Name	Analog and Communication Electronics			
Course Code	23UPHCC53	L	P	C
Category	Core	6	-	4

COURSE OBJECTIVES:

- To study the design, working and applications of semiconducting devices.
- To construct various electronic circuits.
- To study them in details.
- To study the basis of audio and video communication systems and the aspects of satellite and FibreOptic Communications.

UNIT - I **18**

DIODES :Diode characteristics – rectifiers - clipper circuits, clamping circuits. half wave rectifier, center tapped and bridge fullwave rectifiers, calculation of efficiency and ripple factor. DC power supply: Zener diode as voltage regulator

UNIT - II **18****TRANSISTOR AMPLIFIERS:**

Transistor configurations: CB, CE CC modes – I-V characteristics and hybrid parameters (CE mode only) – DC load line – Q point - Biasing circuits (Voltage divider bias) – RC coupled CE amplifier –power amplifiers – classification of power amplifiers: A, B, C – Push pull amplifiers .

UNIT - III **18****TRANSISTOR OSCILLATORS:**

Feedback amplifier - principle of feedback, positive and negative feedback of voltage and current gain, advantages of negative feedback – Barkhausen's criterion. Transistor oscillators: Hartely, Colpitt, Phase shift oscillators (no derivation)

UNIT - IV **18****OPERATIONAL AMPLIFIERS:**

Differential amplifiers – OPAMP characteristics –IC 741 pin configuration – inverting and non-inverting amplifiers –summing and difference amplifiers – differentiator and integrator – Astable multivibrator (square wave generator) – Monostable vibrator

UNIT - V **18**

MODULATION AND DEMODULATION: Theory of amplitude modulation - frequency modulation – comparison of AM and FM – phase modulation (no derivation – only definition) – pulse – demodulation: AM and FM detection - super heterodyne receiver (block diagram)

Total Lecture Hours	90
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BOOKS FOR STUDY:

- 1. V.K. Mehta - Principles of Electronics, 2018 Reprint S.Chand and Co. Ltd., 2004.
- Unit 1- 6.1,6.2,6.7-6.15,6.18
- Unit 2 – 12.1,12.6,12.17
- Unit 3 – 13.1-13.4,14.5-14.7,14.10-14.13
- Unit 5- 16.2-16.6,16.11-16.19,16.21-16.22
2. R. Murugesan and Kiruthiga Sivaprasath ,Modern Physics,Reprint 2022, S. Chand and Co
- Unit 2-35.2,35.3,35.4,35.6,35.6.3,35.8,35.10
- Unit 4-39.2-39.7,37.10-37.11

BOOKS FOR REFERENCES:

- B. Grob - Basic Electronics, 6th edition, McGraw Hill, NY, 1989.
- B.L. Theraja - A Text Book of Electrical Technology
- Herbert Taub and Donald schilling - Digital Integrated Electronics, McGraw Hill, NY.
- Ramakant A. – Op amp principles and linear integrated circuits, Gaykward
- Bagde and S. P. Singh - Elements of Electronics.
- Millman and Halkias- Integrated Electronics, Tata McGraw Hill

WEB RESOURCES:

- ❖ www.ocw.mit.edu
- ❖ www.ocw.mit.edu
- ❖ www.elprocus.com
- ❖ www.britannica.com

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED		ENTREPRENEURSHIP	
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL	✓	GLOBAL
Changes Made in the Course	Percentage of Change		17%	No Changes Made		New Course	

*** Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**

COURSE OUTCOMES:										K LEVEL	
After studying this course, the students will be able to:											
CO1	Explain the basic concepts of semiconductors devices.									K1 to K4	
CO2	know and classify the basic principles of biasing and transistor amplifiers									K1 to K4	
CO3	Acquire the fundamental concepts of oscillators.									K1 to K4	
CO4	Understand the working of operational amplifiers									K1 to K4	
CO5	Learn and analyze the operations of sequential and combinational digital circuits									K1 to K4	
MAPPING WITH PROGRAM OUTCOMES:											
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	
CO1	3	3	2	2	3	2	2	3	2	3	
CO2	2	3	3	3	2	2	3	2	3	3	
CO3	3	2	3	2	3	3	2	3	3	3	
CO4	3	3	3	3	3	2	3	2	2	2	
CO5	2	2	3	3	2	3	3	3	3	2	
S- STRONG			M – MEDIUM					L - LOW			
CO / PO MAPPING:											
COS		PSO1		PSO2		PSO3		PSO4		PSO5	
CO 1		3		3		3		3		3	
CO 2		3		3		3		3		3	
CO 3		3		3		3		3		3	
CO 4		3		3		3		3		3	
CO 5		3		3		3		3		3	
WEIGHTAGE		15		15		15		15		15	
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS		3.0		3.0		3.0		3.0		3.0	
LESSON PLAN:											
UNIT	Analog and Communication Electronics							HRS	PEDAGOGY		
I	DIODES diode characteristics – rectifiers - clipper circuits, clamping circuits. half wave rectifier, center tapped and bridge fullwave rectifiers, calculation of efficiency and ripple factor. DC power supply: Block diagram of a power supply, qualitative description of shunt capacitor filter, Zener diode as voltage regulator, temperature coefficient of Zener diode.							18	Chalk & Talk, Videos, PPT and Demonstration		
II	TRANSISTOR AMPLIFIERS: transistor configurations: CB, CE CC modes – I-V characteristics and							18	Chalk & Talk, Videos, PPT		

	hybrid parameters – DC load line – Q point self-bias – RC coupled CE amplifier – power amplifiers – classification of power amplifiers: A, B, C – push pull amplifiers – tuned amplifiers.		and Demonstration
III	TRANSISTOR OSCILLATORS: feedback amplifier - principle of feedback, positive and negative feedback of voltage and current gain, advantages of negative feedback - Barkhausen's criterion. Transistor oscillators: Hartely, Colpitt, Phase shift oscillators with mathematical analysis	18	Chalk & Talk, Videos, PPT and Demonstration
IV	OPERATIONAL AMPLIFIERS: differential amplifiers – OPAMP characteristics – IC 741 pin configuration – inverting and non-inverting amplifiers – unity follower – summing and difference amplifiers – differentiator and integrator – astable multivibrator (square wave generator) – monostable vibrator	18	Chalk & Talk, Videos, PPT and Demonstration
V	MODULATION AND DEMODULATION theory of amplitude modulation - frequency modulation – comparison of AM and FM – phase modulation – sampling theorem – pulse width modulation – pulse modulation systems: PAM, PPM, and PCM – demodulation: AM and FM detection - super heterodyne receiver (block diagram)	18	Chalk & Talk, Videos, PPT and Demonstration

Learning Outcome Based Education & Assessment (LOBE)						
Formative Examination - Blue Print						
Articulation Mapping – K Levels with Course Outcomes (COs)						
Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of Questions	K - Level		
CI	CO1	K1 – K4	2	K1, K2	2(K1, K1)	2(K3 , K3)
AI	CO2	K1 – K4	2	K1,K2	2(K2 , K2)	2(K4 , K4)
CI	CO3	K1 – K4	2	K1, K2	2(K2 , K2)	2(K3 , K3)
AII	CO4	K1 – K4	2	K1,K2	2(K3 , K3)	2(K4, K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	10	-	12	21.43	42.86
	K2	2	10	-	12	21.43	
	K3	-	-	16	16	28.57	28.57
	K4	-	-	16	16	28.57	28.57
	Marks	4	20	32	56	100	100
CIA II	K1	2			2	3.57	25
	K2	2	10		12	21.43	
	K3		10	16	26	46.43	46.43
	K4			16	16	28.57	28.57
	Marks	4	20	32	56	100	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

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

CO 5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1, K2	K1, K1	K2, K2
2	CO2	K1 – K4	2	K1, K2	K2, K2	K2, K2
3	CO3	K1 – K4	2	K1, K2	K2, K2	K3, K3
4	CO4	K1 – K4	2	K1, K2	K3, K3	K3, K3
5	CO5	K1 – K4	2	K1, K2	K4, K4	K4, K4
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	10		15	10.72	10.72
K2	5	20	32	57	40.71	40.71
K3		10	32	42	30.00	30.00
K4		10	16	26	18.57	18.57
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions				PART – A (10 x 1 = 10 Marks)	
1.	Unit – I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit – I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit – II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit – II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit – IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit – IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit – V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit – V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions				PART – B	(5 x 5 = 25 Marks)
11. a)	Unit - I	CO1	K1		
OR					
11. b)	Unit - I	CO1	K1		
12. a)	Unit - II	CO2	K2		
OR					
12. b)	Unit - II	CO2	K2		
13. a)	Unit - III	CO3	K2		
OR					
13. b)	Unit - III	CO3	K2		
14. a)	Unit - IV	CO4	K3		
OR					
14. b)	Unit - IV	CO4	K3		
15. a)	Unit - V	CO5	K4		
OR					
15. b)	Unit - V	CO5	K4		

Answer ALL the questions				PART – C	(5 x 8 = 40 Marks)
16. a)	Unit – I	CO1	K2		
OR					
16. b)	Unit – I	CO1	K2		
17. a)	Unit – II	CO2	K2		
OR					
17. b)	Unit – II	CO2	K2		
18. a)	Unit – III	CO3	K3		
OR					
18. b)	Unit – III	CO3	K3		
19. a)	Unit – IV	CO4	K3		
OR					
19. b)	Unit – IV	CO4	K3		
20. a)	Unit – V	CO5	K4		
OR					
20. b)	Unit – V	CO5	K4		

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)**RESEARCH CENTRE OF PHYSICS****FOR THOSE WHO JOINED IN 2023-2024 AND AFTER**

Course Name	Physics Practical 5			
Course Code	23UPHCP51	L	P	C
Category	Core Practical	-	3	3

COURSE OBJECTIVES:

- Demonstrate various optical phenomena principles, working, apply with various materials and interpret the results.

SEMESTER – V LIST OF EXPERIMENTS**45****Minimum of Eight Experiments from the list:**

1. Spectrometer -Diffraction grating -Normal incidence.
2. Spectrometer- Diffraction grating -minimum deviation.
3. Specific rotation of sugar solution.
4. Spectrometer – (i-d) curve.
5. Spectrometer – (i-i') curve.
6. Spectrometer - Hartmann's Interpolation formula
7. Potentiometer –Calibration of Ammeter
8. Carey Fosters bridge - Temperature coefficient of resistance of the coil.
9. Deflection Magnetometer – Determination of Magnetic moment of a bar magnet and B_H using circular coil carrying current.
10. Vibration magnetometer - Determination of B_H using circular coil carrying current– Tan B position.
11. B.G – Figure of Merit – Charge Sensitivity
12. AC circuits with L, C, R -Series resonance.
13. AC circuits with L,C,R - Parallel resonance
14. Anderson's Bridge (AC Method) - Self inductance
15. Maxwell's Bridge (AC Method) - Self inductance
16. Impedance and Power factor - L.R.circuit

Total Lecture Hours**45****BOOKS FOR STUDY:**

- Srinivasan.M.N., Balasubramanian.S., Ranganathan.R., A Text Book of Practical Physics, 2017 Edition, Sultan Chand & Sons

BOOKS FOR REFERENCES:

- Ouseph.C., Practical Physics and Electronics, 2013, S.Viswanathan.P.Ltd.

WEB RESOURCES:

- ❖ <https://nptel.ac.in/course.html/physics/experimental physics I, II and III>
- ❖ <https://nptel.ac.in/courses/115/105/115105110/>
- ❖ https://www.youtube.com/playlist?list=PLuiPz6iU5SQ8-rZn_LgLoRX7n8z4tHYK

Nature of Course	EMPLOYABILITY				SKILLORIENTED		✓	ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL			NATIONAL		✓	GLOBAL		
Changes Made in the Course	Percentage of Change			2%	No Changes Made				New Course		
* Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.											

COURSE OUTCOMES:										K LEVEL	
After studying this course, the students will be able to:											
CO1	Remembering the Aim and apparatus used in the experiment									K1 to K5	
CO2	Understanding of laws and formulas of the experiment									K1 to K5	
CO3	Applying the knowledge to do the experiment									K1 to K5	
CO4	Calculating and examining the aim of the experiment									K1 to K5	
CO5	Interpreting the result of the experiment									K1 to K5	
MAPPING WITH PROGRAM OUTCOMES:											
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	
CO1	3	3	1	1	2	3	3	3	1	3	
CO2	3	3	2	2	2	3	3	3	1	3	
CO3	3	3	3	3	3	3	3	3	2	3	
CO4	3	3	2	3	3	3	3	3	1	3	
CO5	3	3	2	2	2	3	3	3	1	3	
3 - STRONG			2 – MEDIUM					1 - LOW			
CO / PO MAPPING:											
COS		PSO1		PSO2		PSO3		PSO4		PSO5	
CO 1		3		3		3		3		3	
CO 2		3		3		3		3		3	
CO 3		3		3		3		3		3	
CO 4		3		3		3		3		3	
CO 5		3		3		3		3		3	
WEITAGE		15		15		15		15		15	
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS		3.0		3.0		3.0		3.0		3.0	

LESSON PLAN:

SEM	PRACTICAL 5	HRS	PEDAGOGY
I	1. Spectrometer– Grating - Normal incidence - Wave length of Mercury spectral lines. 2. Spectrometer – Grating - Minimum deviation - Wave length of Mercury spectral lines. 3. Spectrometer – (i-d) curve. 4. Spectrometer – (i-i') curve. 5. Potentiometer –Calibration of Ammeter 6. AC circuits with L, C,R -Series resonance. 7. AC circuits with L,C,R - Parallel resonance 8. Anderson's Bridge (AC Method) - Self inductance	45	Demonstration and Video

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total
25	75	100

Record Note and Attendance -10 mark Model examination - 15 mark

Total CIA - 25 mark

Model examination should be conducted for 30 mark and it has to be converted to 15 mark

Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)				
Internal	Cos	K Level	No. of. Questions	K - Level
CIA-I	CO1 – CO5	K1 – K5	1 Question for Each Student	K1 – K5
Question Pattern CIA - I		No. of Questions to be asked	1 Question for Each Student	
		No. of Questions to be answered	1	
		Marks for each question	30	
		Total Marks for each section	30	

Distribution of Marks with COs &K Level for Correction of CIA I					
	COs	K - Level	Distribution of the work of the experiment	K - Level	MARKS
CIA I	CO1	K1 to K5	Aim and apparatus	K1	2.0
	CO2	K1 to K5	Formula and Tabular Column	K3	5.0
	CO3	K1 to K5	Understanding and Observation	K5	10.0
	CO4	K1 to K5	Calculation and Graph	K4	10.0
	CO5	K1 to K5	Interpretation of result	K2	3.0
	Total Marks				30

Distribution of Marks with K Level CIA I					
	K Level	Distribution of the work of the experiment	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	Aim and apparatus	2	6.67	-
	K3	Formula and Tabular Column	5	16.67	
	K5	Understanding and Observation	10	33.33	23.34
	K4	Calculation and Graph	10	33.33	56.67
	K2	Interpretation of result	3	10.00	90.00
	Marks		30	100	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

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

K5 – Evaluating, interpreting and concluding the results with accurate measurements.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)			
COs	K - Level	No. of Questions	K – Level
CO1- CO5	K1 – K5	1 Question for Each Student	K1 – K5
No. of Questions to be Asked		1 Question for Each Student	
No. of Questions to be answered		1	
Marks for each question		75	
Total Marks for each section		75	

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)			
COs	K - Level	No. of Questions	K – Level
CO1- CO5	K1 – K5	1 Question for Each Student	K1 – K5
No. of Questions to be Asked		1 Question for Each Student	
No. of Questions to be answered		1	
Marks for each question		75	
Total Marks for each section		75	

Distribution of Marks with K Level				
K Level	Parameters for K-Level	Total Marks	% of (Marks without choice)	Consolidated %
K1	Aim and apparatus	10	13.33	13
K3	Formula and Tabular Column	15	20	20
K5	Understanding and Observation	30	40	40
K4	Calculation and Graph	15	20	20
K2	Interpretation of result	5	6.67	7
Marks		75	100	100

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)**RESEARCH CENTRE OF PHYSICS****FOR THOSE WHO JOINED IN 2023-2024 AND AFTER**

Course Name	Nanoscience and Nano Technology			
Course Code	23UPHEC51	L	P	C
Category	Elective	4	-	2
COURSE OBJECTIVES:				
In this course, the students will learn				
➤ the basics of nanoscience and Nanotechnology. ➤ the methods of synthesis ➤ the methods of characterisation of nanomaterials. ➤ the practical applications of nanomaterials. ➤ usefulness of nanotechnology in daily life				
UNIT - I NANOSCIENCE AND NANOTECHNOLOGY				12
nanoscale– nature and nanostructures – nanostructures: 0D, 1D,2D– surface to volume ratio– size effect –excitons– quantum confinement– metal based nanoparticles (metal and metal oxide) – nanocomposites (non-polymer based) – carbon nanostructures – fullerene –SWCNT and MWCNT				
UNIT - II PROPERTIES OF NANOMATERIALS				12
introduction–mechanical behavior –elastic properties – hardness and strength – ductility and toughness –superplastic behavior – optical properties – surface plasmon resonance – electrical properties – dielectric materials and properties – magnetic properties – super paramagnetism – electrochemical properties – properties of CNTs.				
UNIT - III FABRICATION METHODS AND VACUUM TECHNIQUES				12
top-down and bottom-up approaches – electrochemical method – chemical and physical vapour depositions (CVD and PVD) – plasma arc discharge – sputtering – thermal evaporation – pulsed laser deposition – ball milling – lithography: photolithography – e-beam lithography – sol-gel methods – synthesis of CNT.				
UNIT - IV CHARACTERIZATION TECHNIQUES				12
scanning probe microscopy – atomic force microscopy – scanning electron microscopy – transmission electron microscopy –powder XRD method: determination of structure and grain size analysis – UV-visible and photoluminescence spectroscopy.				
UNIT - V APPLICATIONS OF NANOMATERIALS				12
medicine: drug delivery – photodynamic therapy – molecular motors –energy: fuel cells –rechargeable batteries – supercapacitors– photovoltaics. sensors: nanosensors based on optical and physical properties – electrochemical sensors – nanobiosensors. nanoelectronics: CNTFET – display screens —applications of CNTs				
Total Lecture Hours				60

BOOKS FOR STUDY:

- K.K. Chattopadhyay and A.N.Banerjee, (2012), Introduction to Nanoscience and Nanotechnology, PHI Learning Pvt. Ltd.,
- M.A. Shah, Tokeer Ahmad (2010), Principles of Nanoscience and Nanotechnology, Narosa Publishing House Pvt Ltd.
- Mick Wilson, et al (2005) Nanotechnology, Overseas Press.

BOOKS FOR REFERENCES:

- Richard Booker and Earl Boysen, (2005) Nanotechnology, Wiley Publishing Inc. USA
- 2. J.H.Fendler (2007) Nano particles and nano structured films; Preparation, Characterization and Applications, John Wiley and Sons
- 3. B.S.Murty, et al (2012) Textbook of Nanoscience and Nanotechnology, Universities Press.

WEB RESOURCES:

- ❖ <https://nptel.ac.in/courses/113106093>
- ❖ <https://ocw.mit.edu/courses/2-57-nano-to-macro-transport-processes-spring-2012/resources/lecture-1-intro-to-nanotechnology-nanoscale-transport-phenomena/>
- ❖ http://www.phys.nthu.edu.tw/~spin/course/102S/102-2-21_nanophysics-introduction-Kwo-English.pdf

Nature of Course	EMPLOYABILITY				SKILL ORIENTED		✓	ENTREPRENEURSHIP		
Curriculum Relevance	LOCAL		REGIONAL			NATIONAL			GLOBAL	✓
Changes Made in the Course	Percentage of Change			40%	No Changes Made				New Course	
* Treat 20 % as each unit (20*5=100 %) and calculate the percentage of change for the course.										

COURSE OUTCOMES:**K LEVEL**

After studying this course, the students will be able to:

CO1	state the basics of nanoscience and Nanotechnology	K1 to K4
CO2	demonstrate the properties of nanomaterials	K1 to K4
CO3	explain the methods of synthesis of nanomaterials	K1 to K4
CO4	analyse the various characterization techniques	K1 to K4
CO5	Make use of the properties of nanomaterials and their possible applications	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

S- STRONG		M – MEDIUM			L - LOW	
CO / PO MAPPING:						
COS	PSO1	PSO2	PSO3	PSO4	PSO5	
CO 1	S	S	S	S	S	
CO 2	M	S	S	S	M	
CO 3	S	S	S	M	S	
CO 4	S	S	S	S	S	
CO 5	S	M	S	S	S	
WEIGHTAGE	S	S	S	S	S	
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3.0	3.0	3.0	3.0	3.0	
LESSON PLAN:						
UNIT	Nanoscience and Nano Technology			HRS	PEDAGOGY	
I	nanoscale– nature and nanostructures – nanostructures: 0D, 1D,2D– surface to volume ratio– size effect –excitons– quantum confinement			6	PPT	
	metal based nanoparticles (metal and metal oxide) – nanocomposites (non-polymer based) – carbon nanostructures – fullerene –SWCNT and MWCNT			6	PPT	
II	introduction–mechanical behavior –elastic properties – hardness and strength – ductility and toughness –superplastic behavior – optical properties			6	PPT	
	surface plasmon resonance – electrical properties – dielectric materials and properties – magnetic properties – super paramagnetism – electrochemical properties – properties of CNTs.			6	PPT	
III	top-down and bottom-up approaches – electrochemical method – chemical and physical vapour depositions (CVD and PVD)			6	PPT	
	plasma arc discharge – sputtering – thermal evaporation – pulsed laser deposition – ball milling – lithography: photolithography – e-beam lithography – sol-gel methods – synthesis of CNT.			6	PPT	
IV	scanning probe microscopy – atomic force microscopy – scanning electron microscopy			6	PPT	
	transmission electron microscopy –powder XRD method: determination of structure and grain size analysis – UV-visible and photoluminescence spectroscopy.			6	PPT	
V	medicine: drug delivery – photodynamic therapy – molecular motors – energy: fuel cells –rechargeable batteries – supercapacitors– photovoltaics.			6	seminars	
	sensors: nanosensors based on optical and physical properties – electrochemical sensors – nanobiosensors. nanoelectronics: CNTFET – display screens–applications of CNTs			6	Assignment	

Learning Outcome Based Education & Assessment (LOBE)
Formative Examination - Blue Print
Articulation Mapping – K Levels with Course Outcomes (COs)

Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of. Questions	K - Level		
CI AI	CO1	K1 – K4	2	K1, K2	2(K2,K2)	2(K3,K3)
	CO2	K1 – K4	2	K1, K2	2(K3,K3)	2(K4,K4)
CI AII	CO3	K1 – K4	2	K1, K2	2(K2,K2)	2(K3,K3)
	CO4	K1 – K4	2	K1, K2	2(K3,K3)	2(K4,K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II

	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	-	-	2	3.57	25
	K2	2	10	-	12	21.43	
	K3	-	10	16	26	46.43	46.43
	K4	-	-	16	16	28.57	28.57
	Marks	4	20	32	56	100	100
CIA II	K1	2	-	-	2	3.57	25
	K2	2	10	-	12	21.43	
	K3	-	10	16	26	46.43	46.43
	K4	-	-	16	16	28.57	28.57
	Marks	4	20	32	56	100	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

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

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	Cos	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)
2	CO2	K1 – K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)
3	CO3	K1 – K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)
4	CO4	K1 – K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)
5	CO5	K1 – K4	2	K1&K2	2 (K4,K4)	2 (K3,K3)
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	-	-	5	3.57	21.43
K2	5	20	-	25	17.86	20
K3	-	20	48	68	48.57	48.57
K4	-	10	32	42	30	30
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions			PART – A		(10 x 1 = 10 Marks)
1.	Unit - I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit - I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit - II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit - II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit - IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit - IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit - V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit - V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions				PART – B	(5 x 5 = 25 Marks)
11. a)	Unit - I	CO1	K2		
OR					
11. b)	Unit - I	CO1	K2		
12. a)	Unit - II	CO2	K3		
OR					
12. b)	Unit - II	CO2	K3		
13. a)	Unit - III	CO3	K2		
OR					
13. b)	Unit - III	CO3	K2		
14. a)	Unit - IV	CO4	K3		
OR					
14. b)	Unit - IV	CO4	K3		
15. a)	Unit - V	CO5	K4		
OR					
15. b)	Unit - V	CO5	K4		

Answer ALL the questions				PART – C	(5 x 8 = 40 Marks)
16. a)	Unit - I	CO1	K3		
OR					
16. b)	Unit - I	CO1	K3		
17. a)	Unit - II	CO2	K4		
OR					
17. b)	Unit - II	CO2	K4		
18. a)	Unit - III	CO3	K3		
OR					
18. b)	Unit - III	CO3	K3		
19. a)	Unit - IV	CO4	K4		
OR					
19. b)	Unit - IV	CO4	K4		
20. a)	Unit - V	CO5	K3		
OR					
20. b)	Unit - V	CO5	K3		

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)**RESEARCH CENTRE OF PHYSICS****FOR THOSE WHO JOINED IN 2023-2024 AND AFTER**

Course Name	Numerical Methods and C Programming			
Course Code	23UPHEC52	L	P	C
Category	Elective	4	-	2
COURSE OBJECTIVES:				
➤ To understand the methods in numerical differentiation and integration and to develop the problem solving skills of the student. To introduce and explain the basic structure, rules of compiling and execution of C programming.				
UNIT - I NUMERICAL SOLUTIONS				12
determination of zeros of polynomials – roots of linear and nonlinear algebraic and transcendental equations – bisection and Newton-Raphson methods – convergence and divergence of solutions.				
UNIT - II NUMERICAL DIFFERENTIATION, INTEGRATION AND CURVE FITTING				12
Newton's forward and backward interpolation – Lagrange's interpolation – Newton-Raphson method to find square root and cube roots – principle of least squares – fitting a straight line and exponential curve – trapezoidal rule – Simpson's 1/3 and 1/8 rule.				
UNIT - III ALGORITHM, FLOW CHART AND PROGRAM				12
Development of algorithm – flow chart for solving simple problems– average of set of numbers – greatest, smallest – conversion of Fahrenheit to Celsius and Celsius to Kelvin, miles to kilometer – sorting set of numbers in ascending and descending order – square matrix, addition, subtraction and multiplication of order (2x2) using arrays.				
UNIT - IV INTRODUCTION TO C				12
Importance of C – basic structure of C programming – constants, variables and data types – character set, key words and identifiers – declaration of variables and data types – operators – expressions: arithmetic, relational, logical, assignment – increment and decrement – conditional – comma operators.				
UNIT - V CONTROL STRUCTURE				12
Decision making with if, if-else, nested if – switch –go to – break – continue –while, do while, for statements – arrays, one dimensional and two dimensional – declaring arrays – storing arrays in memory – initializing arrays – simple programs.				
Total Lecture Hours				60

BOOKS FOR STUDY:

- Numerical methods, Singaravelu, Meenakshi publication, 4th Edn., 1999.
- Numerical methods P. Kandasamy, K. Thilagavathy, K. Gunavathi, S. Chand, 2016
- Programming in C, Balagurusamy, TMG, ND, 2012
- Numerical Analysis, M.K. Venkatraman, NPH, 2013
- Numerical Analysis, B.D. Gupta, Konark Publishers, New Delhi, 2013

BOOKS FOR REFERENCES:

- Schaum's outline series, Theory and Problems of programming in C, C. Byron and S. Gottfried, Tata McGraw Hill 2003
- Numerical methods and C Programming, Veerarajan, 2015.

WEB RESOURCES:

- ❖ <https://www.scribd.com/doc/202122350/Computer-Oriented-Numerical-Methods-by-V-Raja-Raman-Computer-Oriented-Numerical-Methods>
- ❖ [https://www.scirp.org/\(S\(1z5mqp453edsnp55rrgjt55\)\)/reference/referencespapers.aspx?referenceid=1682874](https://www.scirp.org/(S(1z5mqp453edsnp55rrgjt55))/reference/referencespapers.aspx?referenceid=1682874) – Applied Numerical Methods
- ❖ <https://nptel.ac.in/course/122106033/> - Computer Programming
- ❖ <https://nptel.ac.in/course/103106074/> - Numerical Methods
- ❖ https://onlinecourses.nptel.ac.in/noc20_ma33/preview - Computer-Oriented Numerical-Methods

Nature of Course	EMPLOYABILITY				SKILL ORIENTED		✓	ENTREPRENEURSHIP		
Curriculum Relevance	LOCAL		REGIONAL			NATIONAL			GLOBAL	✓
Changes Made in the Course	Percentage of Change				No Changes Made			New Course		✓
*Treat 20 % as each unit (20*5=100 %) and calculate the percentage of change for the course.										

COURSE OUTCOMES:**K LEVEL**

After studying this course, the students will be able to:

CO1	Understand the basic concept involved in root finding procedure such as Newton Raphson and Bisection methods, their limitations.	K1 to K4
CO2	Understand, how interpolation will be used in various realms of physics and Apply to some simple problems Analyze the newton forward and backward interpolation	K1 to K4
CO3	Understand the basics of algorithm and flow chart.	K1 to K4
CO4	Understand the basics of C-programming.	K1 to K4
CO5	Understand the arrays and control structure.	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	3	1	1	2	3	2	2	3
CO2	3	2	3	1	1	2	3	2	2	3
CO3	3	2	3	1	1	2	3	2	2	3
CO4	3	2	3	1	1	2	3	2	2	3
CO5	3	2	3	1	1	2	3	2	2	3
3- STRONG			2 – MEDIUM					1 - LOW		

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	2	3	1	1
CO 2	3	2	3	1	1
CO 3	3	2	3	1	1
CO 4	3	2	3	1	1
CO 5	3	2	3	1	1
WEIGHTAGE	3	3	3	3	3
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3.0	3.0	3.0	3.0	3.0

LESSON PLAN:

UNIT	Numerical Methods and C Programming	HRS	PEDAGOGY
I	determination of zeros of polynomials – roots of linear and nonlinear algebraic and transcendental equations – bisection and Newton-Raphson methods – convergence and divergence of solutions.	12	Chalk &Talk, PPT, Seminar
II	Newton's forward and backward interpolation – Lagrange's interpolation – Newton-Raphson method to find square root and cube roots – principle of least squares – fitting a straight line and exponential curve – trapezoidal rule – Simpson's 1/3 and 1/8 rule.	12	Chalk &Talk, PPT
III	Development of algorithm – flow chart for solving simple problems– average of set of numbers – greatest, smallest – conversion of Fahrenheit to Celsius and Celsius to Kelvin, miles to kilometer – sorting set of numbers in ascending and descending order – square matrix, addition, subtraction and multiplication of order (2x2) using arrays.	12	Chalk &Talk, Assignment

IV	Importance of C – basic structure of C programming – constants, variables and data types – character set, key words and identifiers – declaration of variables and data types – operators – expressions: arithmetic, relational, logical, assignment – increment and decrement – conditional – comma operators.	12	Chalk &Talk, Group discussion
V	Decision making with if, if-else, nested if – switch –go to – break – continue –while, do while, for statements – arrays, one dimensional and two dimensional – declaring arrays – storing arrays in memory – initializing arrays – simple programs.	12	Seminar, PPT, Chalk &Talk

Learning Outcome Based Education & Assessment (LOBE)						
Formative Examination - Blue Print						
Articulation Mapping – K Levels with Course Outcomes (COs)						
Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of. Questions	K - Level		
CI AI	CO1	K1 – K4	2	K1, K1	2 (K1, K1)	2 (K1, K1)
	CO2	K1 – K4	2	K2, K2	2 (K2, K2)	2 (K4, K4)
CI AII	CO3	K1 – K4	2	K1, K2	2 (K3, K3)	2 (K3, K3)
	CO4	K1 – K4	2	K1, K2	2 (K3, K3)	2 (K4, K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	10	16	28	50	71
	K2	2	10		12	21.4	
	K3						
	K4			16	16	28.6	29
	Marks	4	20	32	56	100	100
CIA II	K1	2			2	3.57	7
	K2	2			2	3.57	
	K3		20	16	36	64.29	64
	K4			16	16	28.57	29
	Marks	4	20	32	56	100	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

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

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	Cos	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1, K1	2 (K1, K1)	2 (K1, K1)
2	CO2	K1 – K4	2	K2, K2	2 (K2, K3)	2 (K4, K4)
3	CO3	K1 – K4	2	K1, K2	2 (K3, K3)	2 (K3, K3)
4	CO4	K1 – K4	2	K1, K2	2 (K3, K3)	2 (K4, K4)
5	CO5	K1 – K4	2	K1, K2	2 (K4, K4)	2 (K4, K4)
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	10	16	31	22.14	22
K2	5	5	-	10	7.14	7
K3		25	16	41	29.28	29
K4		10	48	58	41.42	42
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions PART – A				(10 x 1 = 10 Marks)	
1.	Unit - I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit - I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit - II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit - II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit - IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit - IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit - V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit - V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions PART – B (5 x 5 = 25 Marks)				
11. a)	Unit - I	CO1	K1	
OR				
11. b)	Unit - I	CO1	K1	
12. a)	Unit - II	CO2	K3	
OR				
12. b)	Unit - II	CO2	K3	
13. a)	Unit - III	CO3	K3	
OR				
13. b)	Unit - III	CO3	K3	
14. a)	Unit - IV	CO4	K3	
OR				
14. b)	Unit - IV	CO4	K3	
15. a)	Unit - V	CO5	K4	
OR				
15. b)	Unit - V	CO5	K4	

Answer ALL the questions PART – C (5 x 8 = 40 Marks)				
16. a)	Unit - I	CO1	K1	
OR				
16. b)	Unit - I	CO1	K1	
17. a)	Unit - II	CO2	K4	
OR				
17. b)	Unit - II	CO2	K4	
18. a)	Unit - III	CO3	K3	
OR				
18. b)	Unit - III	CO3	K3	
19. a)	Unit - IV	CO4	K4	
OR				
19. b)	Unit - IV	CO4	K4	
20. a)	Unit - V	CO5	K4	
OR				
20. b)	Unit - V	CO5	K4	

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)



RESEARCH CENTRE OF PHYSICS

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Project with Viva - Voce			
Course Code	23UPHPR51	L	P	C
Category	Project	-	3	3
Course Description: ➤ To identify, describe the problem and scope of project ➤ To collect, analyse and present data into significant form using appropriate tools ➤ To choose, plan and implement a proper approach in problem solving ➤ To work with team and ethically ➤ To present the findings in both oral and written form				

Guidelines For Internship:

1. There will be one Faculty guide.
2. A Group of two students join to do a project
3. The students should submit a Project Report (Maximum 30 Pages).
4. The Marks for Project Report will be awarded only on the basis of the Project Report with Viva - Voce.

The Project is conducted by the following Course Pattern.

Internal:

Presentation

Submission **25 Marks**

External:

Project Report

Viva Voce **75 Marks**

Total 100 Marks

Total Practical Hours 60

Nature of Course	EMPLOYABILITY			✓	SKILL ORIENTED			ENTREPRENEURSHIP		
Curriculum Relevance	LOCAL		REGIONAL			NATIONAL		✓	GLOBAL	
Changes Made in the Course	Percentage of Change				No Changes Made		✓	New Course		
* Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.										

COURSE OUTCOMES:									K - Level
CO1	Apply the skill of presentation and communication techniques								K1 to K4
CO2	work as an individual or in a team in development of projects.								K1 to K4
CO3	Analyze the available resources and to select most appropriate one								K1 to K4
CO4	Make use of the fundamentals of Chemistry to identify the related literature								K1 to K4
CO5	Explain the real life problems by using Chemistry and its Application.								K1 to K4

MAPPING WITH PROGRAM OUTCOMES:										
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S
S- STRONG			M – MEDIUM				L - LOW			

CO / PO MAPPING					
COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)**RESEARCH CENTRE OF PHYSICS****FOR THOSE WHO JOINED IN 2023-2024 AND AFTER**

Course Name	Digital Photography			
Course Code	23UPHEC53	L	P	C
Category	Elective	3	-	3
COURSE OBJECTIVES:				
➤ To study the basic principle of image formation ➤ To learn about the lenses and controlling the images ➤ To understand the camera using films classify and its types ➤ To analyse the digital image and postproduction				
UNIT - I				09
PHOTOGRAPHY AND BASIC PRINCIPLE OF IMAGE FORMATION Principle –chemical route and digital route –light, wavelengths,colours – shadows – light intensity and distance – making light form images –pin-hole images – practical limitations to pin-hole images – lens instead of pin-hole – focal length and image size – imaging of closer subjects.				
UNIT - II				09
LENSES – CONTROLLING THE IMAGES: Photographic lens – focal length and angle of view (problems) – focusing movement – aperture and f-numbers (problems) – depth of field– depth of focus – image stabilization – lenses for digital cameras – lens and camera care				
UNIT - III				09
CAMERA USING FILMS AND ITS TYPES: Camera and its essential components– shutter – aperture – light measurement – film housing – camera types: view camera– view finder camera – Reflex camera– single lens reflex (SLR) camera				
UNIT - IV				09
DIGITAL CAMERAS PRINCIPLE AND TYPES: principle of digital image capturing –comparison of digital and analog picture information – megapixel – grain, noise and pixel density – optical and digital zooming – image stabilizer – bit depth – white balance – colour modes – file formats (TIFF, RAW and JPEG) – storage cards and types – digital cameras: camera phones – compact camera – hybrid camera – digital SLR.				
UNIT - V				09
THE DIGITAL IMAGE – POSTPRODUCTION: Hardware: computer and its peripherals – software: saving digital file – basic editing: navigating the image – undo/redo/history – crop – rotate – brightness andcontrast – colourbalance – hue/saturation – dodge/burn – cloning andretouching – removing an element in an image – advanced editing: histogram/levels – curves – selection tools: magic wand – printing digital images: inkjet printer – laser printer – dye sub printer – lambda/light jet printers				
Total Lecture Hours				45

BOOKS FOR STUDY:

- Material will be given

BOOKS FOR REFERENCES:

- 1. Michel J.Langford , Anna Fox and Richard Sawdon Smith, Basic photography, 9th Edition, , 2010-NL, Focal press, London.
- 2. Henry Carroll, Read this if you want to take great photographs of people, Laurence King Publishing
- 3. Mark Galer, Digital Photography in Available Light essential skills, 2006, Focal press, London.
- 4.Paul Harcourt Davies, The Photographer's practical handbook, 2005, UK PRESS

WEB RESOURCES:

- ❖ <https://www.geeksforgeeks.org/fundamentals-of-image-formation/>
- ❖ <https://www.adorama.com/alcl/parts-of-a-camera/>
- ❖ <https://www.adorama.com/alcl/what-are-the-different-types-of-cameras-used-for-photography/>
- ❖ <https://a-million-pictures-recommendations.wp.hum.uu.nl/photographing-slides/the-digital-still-camera-and-its-components/>
- ❖ <http://www.greensville.net/brian/photography/Ultimate-Guide-To-Digital-Photography.pdf>

Nature of Course	EMPLOYABILITY			SKILL ORIENTED			ENTREPRENEURSHIP			✓	
Curriculum Relevance	LOCAL		REGIONAL			NATIONAL		✓	GLOBAL		
Changes Made in the Course	Percentage of Change				No Changes Made				New Course		✓
* Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.											

COURSE OUTCOMES:**K LEVEL**

After studying this course, the students will be able to:

CO1	Describe photography and basic principle of image formation	K1 to K4
CO2	Understand the lenses and controlling the images.	K1 to K4
CO3	Comprehend camera using films and its types	K1 to K4
CO4	Analyze the digital camera and its types.	K1 to K4
CO5	Relate the digital image.	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M		
CO2	M	S	S	S	M	S	S	M		
CO3	S	S	S	M	S	S	S	M		
CO4	S	S	S	S	S	S	S	M		
CO5	S	M	S	S	S	S	S	M		
3- STRONG			2 – MEDIUM					1 - LOW		

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	3	2
CO 2	3	3	3	3	2
CO 3	3	3	3	3	2
CO 4	3	3	3	3	2
CO 5	3	3	3	3	2
WEIGHTAGE	15	15	15	15	15
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3.0	3.0	3.0	3.0	3.0

LESSON PLAN:

UNIT	Digital Photography	HRS	PEDAGOGY
I	PHOTOGRAPHY AND BASIC PRINCIPLE OF IMAGE FORMATION Principle –chemical route and digital route –light, wavelengths,colours – shadows – light intensity and distance – making light form images – pin-hole images – practical limitations to pin-hole images – lens instead of pin-hole – focal length and image size – imaging of closer subjects.	09	Chalk & Talk, Videos, PPT and Demonstration
II	LENSES – CONTROLLING THE IMAGES: Photographic lens – focal length and angle of view (problems) – focusing movement – aperture and f-numbers (problems) – depth of field– depth of focus – image stabilization – lenses for digital cameras – lens and camera care	09	Chalk & Talk, Videos, PPT and Demonstration
III	CAMERA USING FILMS AND ITS TYPES: Camera and its essential components– shutter – aperture – light measurement – film housing – camera types: view camera– view finder camera – Reflex camera– single lens reflex (SLR) camera	09	Chalk & Talk, Videos, PPT and Demonstration

IV	DIGITAL CAMERAS PRINCIPLE AND TYPES: principle of digital image capturing –comparison of digital and analog picture information – megapixel – grain, noise and pixel density – optical and digital zooming – image stabilizer – bit depth – white balance – colour modes – file formats (TIFF, RAW and JPEG) – storage cards and types – digital cameras: camera phones – compact camera – hybrid camera – digital SLR.	09	Chalk & Talk, Videos, PPT and Demonstration
V	THE DIGITAL IMAGE – POSTPRODUCTION: hardware: computer and its peripherals – software: saving digital file – basic editing: navigating the image – undo/redo/history – crop – rotate – brightness and contrast – colour balance – hue/saturation – dodge/burn – cloning and retouching – removing an element in an image – advanced editing: histogram/levels – curves – selection tools: magic wand – printing digital images: inkjet printer – laser printer – dye sub printer – lambda/light jet printers.	09	Chalk & Talk, Videos, PPT and Demonstration

Learning Outcome Based Education & Assessment (LOBE)						
Formative Examination - Blue Print						
Articulation Mapping – K Levels with Course Outcomes (COs)						
Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of Questions	K - Level		
CI	CO1	K1 – K4	2	K1, K2	2 (K1, K1)	2 (K1, K1)
AI	CO2	K1 – K4	2	K1, K2	2 (K2, K2)	2 (K2, K2)
CI	CO3	K1 – K4	2	K1, K2	2 (K3, K3)	2 (K3, K3)
AII	CO4	K1 – K4	2	K1, K2	2 (K3, K3)	2 (K4, K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	10	16	28	50	100
	K2	2	10	16	28	50	
	K3						
	K4						
	Marks	4	20	32	56	100	100
CIA II	K1	2			2	3.57	7
	K2	2			2	3.57	
	K3		20	16	36	64.29	64
	K4			16	16	28.57	29
	Marks	4	20	32	56	100	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

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

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	Cos	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1, K2	2 (K1, K1)	2 (K1, K1)
2	CO2	K1 – K4	2	K1, K2	2 (K2, K2)	2 (K2, K2)
3	CO3	K1 – K4	2	K1, K2	2 (K3, K3)	2 (K3, K3)
4	CO4	K1 – K4	2	K1, K2	2 (K3, K3)	2 (K4, K4)
5	CO5	K1 – K4	2	K1, K2	2 (K4, K4)	2 (K4, K4)
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	10	16	31	22.14	22
K2	5	10	16	31	22.14	22
K3		20	16	36	25.71	26
K4		10	32	42	30	30
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions PART – A (10 x 1 = 10 Marks)					
1.	Unit - I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit - I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit - II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit - II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit - IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit - IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit - V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit - V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions PART – B (5 x 5 = 25 Marks)				
11. a)	Unit - I	CO1	K1	
OR				
11. b)	Unit - I	CO1	K1	
12. a)	Unit - II	CO2	K2	
OR				
12. b)	Unit - II	CO2	K2	
13. a)	Unit - III	CO3	K3	
OR				
13. b)	Unit - III	CO3	K3	
14. a)	Unit - IV	CO4	K3	
OR				
14. b)	Unit - IV	CO4	K3	
15. a)	Unit - V	CO5	K4	
OR				
15. b)	Unit - V	CO5	K4	

Answer ALL the questions PART – C (5 x 8 = 40 Marks)				
16. a)	Unit - I	CO1	K1	
OR				
16. b)	Unit - I	CO1	K1	
17. a)	Unit - II	CO2	K2	
OR				
17. b)	Unit - II	CO2	K2	
18. a)	Unit - III	CO3	K3	
OR				
18. b)	Unit - III	CO3	K3	
19. a)	Unit - IV	CO4	K4	
OR				
19. b)	Unit - IV	CO4	K4	
20. a)	Unit - V	CO5	K4	
OR				
20. b)	Unit - V	CO5	K4	

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)**RESEARCH CENTRE OF PHYSICS****FOR THOSE WHO JOINED IN 2023-2024 AND AFTER**

Course Name	Internship Report			
Course Code	23UPHIN51	L	P	C
Category	Summer Internship	-	-	1

Course Description

The students have to attend a 30 hours of Internship of their own choice to be carried out in II year summer vacation.

Guidelines For Internship:

1. The Project is conducted by the following Course Pattern. The internship period should be minimum 30 hours.
2. Each group should produce permission letter as well as the attendance certificate.
3. There will be one Faculty guide.
4. The students should submit an Internship Training Report (Maximum 30 Pages).
5. The Marks for Internship Training will be awarded only on the basis of the Internship Training Report.
6. Prior permission may be obtained from the organization in advance by the students concerned and information shall be passed onto the colleges thus enabling the training supervision by the concerned faculties authorized by the college.
7. Daily postal or electronic reporting should be obtained to ensure coherent and comprehensive training during the training period.
8. A final report [Institutional Training Record – ITR] containing the introduction of the industry, the profile of the company and a valid conclusion indicating the benefits of the training shall be given not exceeding 30 [A4] pages [in a spiral- bound form/pre-printed record designed for this purpose]

Internal

Presentation	}	25
Submission		

External

Project Report	}	75
Viva Voce		

Total **- 100**

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED		ENTREPRENEURSHIP	
Curriculum Relevance	LOCAL		REGIONAL	✓	NATIONAL		GLOBAL
Changes Made in the Course	Percentage of Change		No Changes Made		New Course		✓
* Treat 20 % as each unit (20*5=100%) and calculate the percentage of change for the course.							

COURSE OUTCOMES:	K LEVEL
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After studying this course, the students will be able to:

CO1	Introduce the learner to the setting and performance standards of both public and private organizations or governmental bodies.	K1 to K4
CO2	Able to cultivate the attitudes and work habits required for success in the workplace. Create a job experience record.	K1 to K4
CO3	Investigate career options by combining theory and experience, and get an appreciation for work and its role in the economy.	K1 to K4
CO4	Develop the student's interpersonal, communication, and other vital skills to expose them to professional role models.	K1 to K4
CO5	Examine abilities that employers value, such as communication, teamwork, and attention to detail.	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/P O	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	3	2	1	3				
CO2	3	2	1	1	2	3				
CO3	2	3	2	3	2	2				
CO4	3	3	1	2	1	2				
CO5	3	3	3	3	2	3				

3- STRONG

2 – MEDIUM

1 - LOW

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	2	1		
CO 2	2	3	1		
CO 3	3	2	1		
CO 4	3	3	1		
CO 5	3	2	1		
WEIGHTAGE	14	12	5		
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3	2	1		

SIXTH SEMESTER

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)**RESEARCH CENTRE OF PHYSICS****FOR THOSE WHO JOINED IN 2023-2024 AND AFTER**

Course Name	Quantum Mechanics and Relativity			
Course Code	23UPHCC61	L	P	C
Category	Core	6	-	5

COURSE OBJECTIVES:

- To understand the theory of relativity, its postulates and the consequences. To learn the importance of transformation equations and also to differentiate between special and general theory of relativity.
- To interpret the wave theory of matter with various theoretical and experimental evidences.
- To derive and use Schrodinger's wave equation and also learn about various operators.
- To solve Schrodinger's wave equation for simple problems and analyse to understand the solutions.

UNIT - I**18****SPECIAL THEORY OF RELATIVITY**

Michelson-Morley experiment—frames of reference – Galilean Relativity – postulates of special theory of relativity – Lorentz transformation – consequences – time dilation— Doppler effect – length contraction

UNIT - II**18****GENERAL THEORY OF RELATIVITY:**

variation of mass with velocity – Einstein's mass-energy relation—Inertial and Gravitational mass – Principle of equivalence – Experimental evidences for General theory of Relativity (Compulsary problems in variation of mass with velocity – Einstein's mass-energy relation)

UNIT - III**18****PHOTONS AND MATTER WAVES:**

Difficulties of classical physics and origin of quantum theory – black body radiation – Planck's law – Einstein's photoelectric equation – Compton effect– De Broglie waves – phase velocity and group velocity – Davisson and Germer's experiment – uncertainty principle (without illustration) (Compulsary problems in De Broglie waves)

UNIT - IV**18****OPERATORS AND SCHRÖDINGER EQUATION:**

Postulates of quantum mechanics – Wave function and its interpretation – Schrödinger's equation (Time dependent and Time independent Equation) – linear operators – Eigenvalue – Hermitian operator – properties of Hermitian operator– observable – operators for position, linear Momentum, angular momentum components

UNIT - V**18****SOLVING SCHRÖDINGER EQUATION FOR SIMPLE PROBLEMS:**

One-dimensional problems: (i) particle in a box, (ii) barrier penetration problem – quantum mechanical tunneling, (iii) linear harmonic oscillator. higher dimensional problems: (i) Rigid rotator (qualitative),

Total Lecture Hours**90**

BOOKS FOR STUDY:

- 1. Modern Physics, R. Murugesan, Kiruthiga Sivaprasath, S. Chand and Co., 17th Revised Edition, 2014
 Unit I – 1.2, 1.4, 1.6, 1.7, 1.8, 1.9, 1.10
 Unit II – 1.13, 1.14, 1.16
 Unit IV – 8.1, 10.1, 10.1.1, 10.1.5, 10.2.4
 Unit V – 8.3, 8.8, 8.8.1, 8.9, 8.11
2. Quantum Mechanics, G. Aruldas, PHI Learning Private Limited, Second Edition, 2000.
 Unit III – 3.5, 2.5, 2.6, 2.8, 3.2, 3.3, 3.4,

BOOKS FOR REFERENCES:

- 1. Modern Physics, R. Murugesan, Kiruthiga Sivaprasath, S. Chand and Co., 17th Revised Edition, 2014.
- 2. Concepts of Modern Physics, A. Beiser, 6th Ed., McGraw-Hill, 2003.
- 3. Special Theory of Relativity, S. P. Puri, Pearson Education, India, 2013.
- 4. Quantum Mechanics, Ghatak and Loganathan, Macmillan Publications.
- 5. Quantum mechanics – Satyaprakash and Swati Saluja. Kedar Nath Ram Nath and Co.
- 6. Fundamentals of Modern Physics, Peter J. Nolan, 1st Edition, 2014, by Physics
- 7. Quantum Mechanics, V. Devanathan, Narosa Pub. House, Chennai, 2005.
- 8. Quantum Mechanics, V. K. Thangappan, New Age International, New Delhi.
- 9. A Text Book of Quantum Mechanics, Mathews and Venkatesan, Tata McGraw Hill, New Delhi.
- 10. Introduction to Quantum Mechanics, Pauling and Wilson, McGraw Hill Co., New York.

WEB RESOURCES:

- ❖ <http://hyperphysics.phy-astr.gsu.edu/hbase/qapp.html>
- ❖ https://swayam.gov.in/nd2_ar19_ap83/preview
- ❖ https://swayam.gov.in/nd1_noc20_ph05/preview
- ❖ [Introduction to special relativity and Minkowski spacetime diagrams \(video\) | Khan Academy](#)

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED		ENTREPRENEURSHIP		
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		GLOBAL	✓
Changes Made in the Course	Percentage of Change		31%	No Changes Made		New Course		
* Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.								

COURSE OUTCOMES:										K LEVEL	
After studying this course, the students will be able to:											
CO1	Understand various postulates of special theory of relativity.									K1 to K4	
CO2	Appreciate the importance of transformation equations and also the general theory of relativity.									K1 to K4	
CO3	Realise the wave nature of matter and understand its importance									K1 to K4	
CO4	Derive Schrodinger equation and also realize the use of operators.									K1 to K4	
CO5	Derive Schrodinger equation and also realize the use of operators.									K1 to K4	
MAPPING WITH PROGRAM OUTCOMES:											
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	
CO1	3	3	2	2	3	2	2	3	2	3	
CO2	2	3	3	3	2	2	3	2	3	3	
CO3	3	2	3	2	3	3	2	3	3	3	
CO4	3	3	3	3	3	2	3	2	2	2	
CO5	2	2	3	3	2	3	3	3	3	2	
S- STRONG			M – MEDIUM					L - LOW			
CO / PO MAPPING:											
COS		PSO1		PSO2		PSO3		PSO4		PSO5	
CO 1		3		3		3		3		3	
CO 2		3		3		3		3		3	
CO 3		3		3		3		3		3	
CO 4		3		3		3		3		3	
CO 5		3		3		3		3		3	
WEIGHTAGE		15		15		15		15		15	
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS		3.0		3.0		3.0		3.0		3.0	
LESSON PLAN:											
UNIT	Quantum Mechanics and Relativity							HRS	PEDAGOGY		
I	SPECIAL THEORY OF RELATIVITY Michelson-Morley experiment–frames of reference – Galilean Relativity – postulates of special theory of relativity – Lorentz transformation – consequences – time dilation— Doppler effect – length contraction							18	Chalk & Talk, Videos, PPT and Demonstration		

II	GENERAL THEORY OF RELATIVITY: variation of mass with velocity – Einstein’s mass-energy relation– Inertial and Gravitational mass – Principle of equivalence – Experimental evidences for General theory of Relativity (Compulsary problems in variation of mass with velocity – Einstein’s mass-energy relation)	18	Chalk & Talk, Videos, PPT and Demonstrati on
III	PHOTONS AND MATTER WAVES: Difficulties of classical physics and origin of quantum theory – black body radiation – Planck’s law – Einstein’s photoelectric equation – Compton effect– De Broglie waves – phase velocity and group velocity – Davisson and Germer’s experiment – uncertainty principle (without illustration) (Compulsary problems in De Broglie waves)	18	Chalk & Talk, Videos, PPT and Demonstrati on
IV	OPERATORS AND SCHRÖDINGER EQUATION: Postulates of quantum mechanics – Wave function and its interpretation – Schrödinger’s equation(Time dependent and Time independent Equation) – linear operators – Eigenvalue – Hermitian operator – properties of Hermitian operator– observable – operators for position, linear Momentum, angular momentum components	18	Chalk & Talk, Videos, PPT and Demonstrati on
V	SOLVING SCHRÖDINGER EQUATION FOR SIMPLE PROBLEMS: One-dimensional problems: (i) particle in a box, (ii) barrier penetration problem – quantum mechanical tunneling, (iii) linear harmonic oscillator. higher dimensional problems: (i) Rigid rotator (qualitative),	18	Chalk & Talk, Videos, PPT and Demonstrati on

Learning Outcome Based Education & Assessment (LOBE)						
Formative Examination - Blue Print						
Articulation Mapping – K Levels with Course Outcomes (COs)						
Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of. Questions	K - Level		
CI	CO1	K1 – K4	2	K1, K2	2(K1, K1)	2(K3 , K3)
AI	CO2	K1 – K4	2	K1,K2	2(K2 , K2)	2(K4 , K4)
CI	CO3	K1 – K4	2	K1, K2	2(K2 , K2)	2(K3 , K3)
AII	CO4	K1 – K4	2	K1,K2	2(K3 , K3)	2(K4, K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	10	-	12	21.43	42.86
	K2	2	10	-	12	21.43	
	K3	-	-	16	16	28.57	28.57
	K4	-	-	16	16	28.57	28.57
	Marks	4	20	32	56	100	100
CIA II	K1	2			2	3.57	25
	K2	2	10		12	21.43	
	K3		10	16	26	46.43	46.43
	K4			16	16	28.57	28.57
	Marks	4	20	32	56	100	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

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

CO 5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1, K2	K1, K1	K2, K2
2	CO2	K1 – K4	2	K1, K2	K2, K2	K2, K2
3	CO3	K1 – K4	2	K1, K2	K2, K2	K3, K3
4	CO4	K1 – K4	2	K1, K2	K3, K3	K3, K3
5	CO5	K1 – K4	2	K1, K2	K4, K4	K4, K4
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	10		15	10.72	10.72
K2	5	20	32	57	40.71	40.71
K3		10	32	42	30.00	30.00
K4		10	16	26	18.57	18.57
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions				PART – A (10 x 1 = 10 Marks)	
1.	Unit – I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit – I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit – II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit – II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit – IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit – IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit – V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit – V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions				PART – B	(5 x 5 = 25 Marks)
11. a)	Unit - I	CO1	K1		
OR					
11. b)	Unit - I	CO1	K1		
12. a)	Unit - II	CO2	K2		
OR					
12. b)	Unit - II	CO2	K2		
13. a)	Unit - III	CO3	K2		
OR					
13. b)	Unit - III	CO3	K2		
14. a)	Unit - IV	CO4	K3		
OR					
14. b)	Unit - IV	CO4	K3		
15. a)	Unit - V	CO5	K4		
OR					
15. b)	Unit - V	CO5	K4		

Answer ALL the questions				PART – C	(5 x 8 = 40 Marks)
16. a)	Unit – I	CO1	K2		
OR					
16. b)	Unit – I	CO1	K2		
17. a)	Unit – II	CO2	K2		
OR					
17. b)	Unit – II	CO2	K2		
18. a)	Unit – III	CO3	K3		
OR					
18. b)	Unit – III	CO3	K3		
19. a)	Unit – IV	CO4	K3		
OR					
19. b)	Unit – IV	CO4	K3		
20. a)	Unit – V	CO5	K4		
OR					
20. b)	Unit – V	CO5	K4		

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)



RESEARCH CENTRE OF PHYSICS

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Solid State Physics			
Course Code	23UPHCC62	L	P	C
Category	Core	6	-	4

COURSE OBJECTIVES:

- To understand constituents, properties and models of nucleus.
- To give reason for radioactivity and study their properties.
- To learn about the principles of various particle detectors and accelerators.
- To acquire knowledge on different types of nuclear reactions and their applications.
- To know the reason for cosmic rays and their effect on the surface of earth and also understand the classification of elementary particles.

UNIT - I

18

BONDING IN SOLIDS, CRYSTAL STRUCTURE:

Types of bonding – ionic bonding – bond energy of NaCl molecule – covalent bonding – crystal lattice – lattice with basis – unit cell – Bravais lattices – Miller indices – procedure for finding them – packing of BCC and FCC structures – structures of NaCl and diamond crystals – X-rays – Bragg's law (simple problems) – experimental methods: Laue method (Compulsary problems in crystal structures)

UNIT - II

18

ELEMENTARY LATTICE DYNAMICS:

Lattice vibrations and phonons: linear mono atomic and diatomic chains. acoustical and optical phonons — Einstein and Debye theories of specific heat of solids – T₃ law (qualitative only) – properties of metals – classical free electron theory of metals (Drude-Lorentz) – Ohm's law – electrical and thermal conductivities – Weidemann Franz' law

UNIT - III

18

MAGNETIC PROPERTIES OF SOLIDS:

Permeability, susceptibility, relation between them – classification of magnetic materials – properties of dia, para, ferro, ferri and anti-ferro magnetism Langevin's theory of diamagnetism – Langevin's theory of paramagnetism – Curie-Weiss law – Weiss theory of ferromagnetism (qualitative only) – discussion of B-H curve – soft and hard magnets . (Compulsary problems in Permeability, susceptibility)

UNIT - IV

18

DIELECTRIC PROPERTIES OF MATERIALS:

Polarization and electric susceptibility – local electric field of an atom – dielectric constant and polarisability – polarization processes: electronic polarization – calculation of polarisability – ionic, orientational and space charge polarization – internal field – Clausius-Mosotti relation frequency dependence of dielectric constant – dielectric loss

UNIT - V**18****FERROELECTRIC and SUPERCONDUCTING PROPERTIES OF MATERIALS**

Ferroelectric effect:

Band gap (no derivation) – conductor, semiconductor (P and N type) and insulator –conductivity of semiconductor – mobility – Hall effect - Hall coefficient.

Superconductivity:

Experimental results –critical temperature –critical magnetic field –Meissner effect –type-I and type-II superconductors – London's equation and penetration depth – isotope effect – idea of BCS theory (no derivation)

Total Lecture Hours**90****BOOKS FOR STUDY:**

➤ Material will be given

BOOKS FOR REFERENCES:

- 1 Introduction to Solid State Physics, Kittel, Willey Eastern Ltd (2003).
- 2. Solid state Physics, Rita John, 1st edition, TataMcGraw Hill publishers (2014).
- 3. Solid State Physics , R L Singhal, Kedarnath Ram Nathand Co., Meerut (2003)
- 4. Elements of Solid State Physics, J.P. Srivastava, 2nd Edition, 2006, Prentice-Hall of India
- 5. Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill
- 6. Solid State Physics, N.W. Ashcroft and N.D. Mermin, 1976, Cengage Learning
- 7. Solid-state Physics, H. Ibach and H. Luth, 2009, Springer
- 8. Elementary Solid State Physics, 1/e M. Ali Omar, 1999, Pearson India
- 9. Solid State Physics, M.A. Wahab, 2011, Narosa Publishing House, ND
- 10. Puri and Babbar – Solid State Physics – S.Chand and Co. New Delhi.
- 11. Kittel - Introduction to solid state physics, Wiley and Sons, 7th edition.
- 12. Raghavan - Materials science and Engineering, PHI
- 13. Azaroff - Introduction to solids, TMH
- 14. S. O. Pillai - Solid State Physics, Narosa publication
- 15. A.J. Dekker - Solid State Physics, McMillan India Ltd.
- 16. Elements of Solid State Physics, J.P. Srivastava, 2nd Edition, 2006, Prentice-Hall of India

WEB RESOURCES:

- ❖ <https://nptel.ac.in/courses/115105099/>
- ❖ <https://nptel.ac.in/courses/115106061/>

Nature of Course	EMPLOYABILITY			✓	SKILL ORIENTED				ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL				NATIONAL				GLOBAL	✓
Changes Made in the Course	Percentage of Change			18%	No Changes Made				New Course			
* Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.												

COURSE OUTCOMES:	K LEVEL
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After studying this course, the students will be able to:

CO1	Classify the bonding and crystal structure also learn about the crystal structure analysis using X ray diffraction.	K1 to K4
CO2	Understand the lattice dynamics and thus learn the electrical COURSE OUTCOMES and thermal properties of materials.	K1 to K4
CO3	Give reason for classifying magnetic material on the basis of their behaviour.	K1 to K4
CO4	Comprehend the dielectric behavior of materials.	K1 to K4
CO5	Appreciate the ferroelectric and super conducting properties of materials.	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	2	2	3	2	2	3	2	3
CO2	2	3	3	3	2	2	3	2	3	3
CO3	3	2	3	2	3	3	2	3	3	3
CO4	3	3	3	3	3	2	3	2	2	2
CO5	2	2	3	3	2	3	3	3	3	2

S- STRONG

M – MEDIUM

L - LOW

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
WEIGHTAGE	15	15	15	15	15
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3.0	3.0	3.0	3.0	3.0

LESSON PLAN:

UNIT	Solid State Physics	HRS	PEDAGOGY
I	BONDING IN SOLIDS, CRYSTAL STRUCTURE: Types of bonding –ionic bonding – bond energy of NaCl molecule –covalent bonding –crystal lattice – lattice with basis – unit cell – Bravais lattices – Miller indices – procedure for finding them –packing of BCC and FCC structures – structures of NaCl and diamond crystals –X-rays – Bragg's law (simple problems) – experimental methods: Laue method	18	Chalk & Talk, Videos, PPT and Demonstration
II	ELEMENTARY LATTICE DYNAMICS: Lattice vibrations and phonons: linear mono atomic and diatomic chains. acoustical and optical phonons — Einstein and Debye theories of specific heat of solids – T ₃ law (qualitative only)–properties of metals – classical free electron theory of metals(Drude-Lorentz) – Ohm's law – electrical and thermal conductivities – Weidemann Franz' law	18	Chalk & Talk, Videos, PPT and Demonstration
III	MAGNETIC PROPERTIES OF SOLIDS: Permeability, susceptibility, relation between them – classification of magnetic materials – properties of dia, para, ferro, ferri and anti-ferro magnetism Langevin's theory of diamagnetism – Langevin's theory of paramagnetism– Curie-Weiss law – Weiss theory of ferromagnetism(qualitative only)- discussion of B-H curve– soft and hard magnets .	18	Chalk & Talk, Videos, PPT and Demonstration
IV	DIELECTRIC PROPERTIES OF MATERIALS: Polarization and electric susceptibility –local electric field of an atom – dielectric constant and polarisability – polarization processes: electronic polarization– calculation of polarisability – ionic, orientational and space charge polarization –internal field –Clausius-Mosotti relation frequency dependence of dielectric constant –dielectric loss	18	Chalk & Talk, Videos, PPT and Demonstration
V	FERROELECTRIC and SUPERCONDUCTING PROPERTIES OF MATERIALS Ferroelectric effect: Band gap (no derivation) – conductor, semiconductor (P and N type) and insulator –conductivity of semiconductor – mobility – Hall effect - Hall coefficient. Superconductivity: Experimental results –critical temperature –critical magnetic field – Meissner effect –type-I and type-II superconductors – London's equation and penetration depth – isotope effect – idea of BCS theory (no derivation)	18	Chalk & Talk, Videos, PPT and Demonstration

Learning Outcome Based Education & Assessment (LOBE)
Formative Examination - Blue Print
Articulation Mapping – K Levels with Course Outcomes (COs)

Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of. Questions	K - Level		
CI AI	CO1	K1 – K4	2	K1, K2	2(K1, K1)	2(K3 , K3)
	CO2	K1 – K4	2	K1,K2	2(K2 , K2)	2(K4 , K4)
CI AII	CO3	K1 – K4	2	K1, K2	2(K2 , K2)	2(K3 , K3)
	CO4	K1 – K4	2	K1,K2	2(K3 , K3)	2(K4, K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II

	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	10	-	12	21.43	42.86
	K2	2	10	-	12	21.43	
	K3	-	-	16	16	28.57	28.57
	K4	-	-	16	16	28.57	28.57
	Marks	4	20	32	56	100	100
CIA II	K1	2			2	3.57	25
	K2	2	10		12	21.43	
	K3		10	16	26	46.43	46.43
	K4			16	16	28.57	28.57
	Marks	4	20	32	56	100	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

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

CO 5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1, K2	K1, K1	K2, K2
2	CO2	K1 – K4	2	K1, K2	K2, K2	K2, K2
3	CO3	K1 – K4	2	K1, K2	K2, K2	K3, K3
4	CO4	K1 – K4	2	K1, K2	K3, K3	K3, K3
5	CO5	K1 – K4	2	K1, K2	K4, K4	K4, K4
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	10		15	10.72	10.72
K2	5	20	32	57	40.71	40.71
K3		10	32	42	30.00	30.00
K4		10	16	26	18.57	18.57
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions				PART – A	
				(10 x 1 = 10 Marks)	
1.	Unit – I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit – I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit – II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit – II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit – IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit – IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit – V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit – V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions				PART – B		(5 x 5 = 25 Marks)	
11. a)	Unit - I	CO1	K1	OR			
11. b)	Unit - I	CO1	K1				
12. a)	Unit - II	CO2	K2	OR			
12. b)	Unit - II	CO2	K2				
13. a)	Unit - III	CO3	K2	OR			
13. b)	Unit - III	CO3	K2				
14. a)	Unit - IV	CO4	K3	OR			
14. b)	Unit - IV	CO4	K3				
15. a)	Unit - V	CO5	K4	OR			
15. b)	Unit - V	CO5	K4				

Answer ALL the questions				PART – C	(5 x 8 = 40 Marks)
16. a)	Unit – I	CO1	K2		
OR					
16. b)	Unit – I	CO1	K2		
17. a)	Unit – II	CO2	K2		
OR					
17. b)	Unit – II	CO2	K2		
18. a)	Unit – III	CO3	K3		
OR					
18. b)	Unit – III	CO3	K3		
19. a)	Unit – IV	CO4	K3		
OR					
19. b)	Unit – IV	CO4	K3		
20. a)	Unit – V	CO5	K4		
OR					
20. b)	Unit – V	CO5	K4		

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)



RESEARCH CENTRE OF PHYSICS

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Digital Electronics and Microprocessor 8085			
Course Code	23UPHCC63	L	P	C
Category	Core	6	-	4
COURSE OBJECTIVES:				
➤ To learn all types of number systems, Boolean algebra and identities, digital circuits for addition and subtraction, flip-flops, registers, counters. ➤ To get the knowledge on fundamentals of 8085 architecture, instruction sets and simple programs.				
UNIT - I				18
Decimal, binary, octal, hexadecimal numbers systems and their conversions – codes: BCD, –code conversions – complements (1's, and 2's) –binary addition, binary subtraction using 1's and 2's complement methods – Boolean laws – De-Morgan's theorem –basic logic gates -universal logic gates (NAND and NOR) –standard representation of logic functions (SOP and POS) – minimization techniques (Karnaughmap: 2, 3 variables).				
UNIT - II				18
Adders, half and full adder – subtractors, half and full subtractor –parallel binary adder – magnitude comparator – multiplexers (4:1) and demultiplexers (1:4), encoder (8-line-to-3-line) and decoder (3-line-to-8-line), BCD to seven segment decoder				
UNIT - III				18
Flip-flops: S-R Flip-flop, J-K Flip-flop, T and D type flip-flops, master-slave flip-flop, truth tables, registers:- serial in serial out and parallel in and parallel out – counters asynchronous:- mod-8, mod-10, synchronous - 4-bit and ring counter – general memory operations, ROM, RAM (static and dynamic), PROM, EPROM, Programmable Array Logic (PAL)				
UNIT - IV				18
8085 Microprocessor: introduction to microprocessor – INTEL 8085 architecture – register organization – pin configuration of 8085, interrupts and its priority – Program Status Word (PSW) –instruction set of 8085 –addressing modes of 8085 –assembly language programming using 8085 –programmes for addition (8-Bit), subtraction (8-Bit).				
UNIT - V				18
I/O Interfaces: serial communication interface (8251-USART) – programmable peripheral interface (8255-PPI) – programmable interval timers (8253) – keyboard and display (8279).				
Total Lecture Hours				90

BOOKS FOR STUDY:

- 1. M.Morris Mano, “Digital Design “3rd Edition, PHI, NewDelhi.
- 2. Ronald J. Tocci. “Digital Systems-Principles and Applications” 6/e. PHI. New Delhi. 1999.(UNITS I to IV)
- 3. S.Salivahanaand S. Arivazhagan-Digital circuits and design
- 4. Microprocessor Architecture, Programming and Applications with the 8085 – Penram International Publishing, Mumbai.- Ramesh S.Gaonakar
- 5. Microcomputer Systems the 8086/8088 family – YU-Cheng Liu and GlenSA

BOOKS FOR REFERENCES:

- 1. Herbert Taub and Donald Schilling. “Digital Integrated Electronics” . McGraw Hill. 1985.
- 2. S.K. Bose. “Digital Systems”. 2/e. New Age International.1992.
- 3. D.K. Anvekar and B.S. Sonade. “Electronic Data Converters: Fundamentals andApplications”. TMH.1994.
- 4. Malvino and Leach. “Digital Principles and Applications”. TMG HillEdition
- 5. Microprocessors and Interfacing – Douglas V.Hall
- 6. Microprocessor and Digital Systems – Douglas V.Hall

WEB RESOURCES:

Introduction to Registers

❖ <https://youtu.be/-paFaxtTCKI>

3 Bit Asynchronous Up Counter

❖ https://youtu.be/s1DSZEaCX_g

3.Introduction to JK flip flop

❖ <https://youtu.be/j6krFp511HA?si=bKr8GieXBGUaxN12>

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED			ENTREPRENEURSHIP		
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		✓	GLOBAL	
Changes Made in the Course	Percentage of Change		38%	No Changes Made			New Course		

*** Treat 20 % as each unit (20*5=100 %) and calculate the percentage of change for the course.**

COURSE OUTCOMES:									K LEVEL
After studying this course, the students will be able to:									
CO1	Learn about number systems, Boolean algebra, logical operation and logic gates								K1 to K4
CO2	Understand the working of adder, subtractors , multiplexers and demultiplexers								K1 to K4
CO3	Get knowledge on flip-flops and storage devices								K1 to K4
CO4	Gain inputs on architecture of microprocessor 8085.								K1 to K4
CO5	Develop program writing skills .on microprocessor 8085.								K1 to K4

MAPPING WITH PROGRAM OUTCOMES:										
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	2	2	3	2	2	3	2	3
CO2	2	3	3	3	2	2	3	2	3	3
CO3	3	2	3	2	3	3	2	3	3	3
CO4	3	3	3	3	3	2	3	2	2	2
CO5	2	2	3	3	2	3	3	3	3	2
S- STRONG			M – MEDIUM					L - LOW		

CO / PO MAPPING:					
COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
WEIGHTAGE	15	15	15	15	15
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3.0	3.0	3.0	3.0	3.0

LESSON PLAN:			
UNIT	Digital Electronics and Microprocessor 8085	HRS	PEDAGOGY
I	Decimal, binary, octal, hexadecimal numbers systems and their conversions – codes: BCD,–code conversions –complements (1’s, and 2’s) –binary addition, binary subtraction using 1’s and 2’s complement methods – Boolean laws – De-Morgan’s theorem –basic logic gates -universal logic gates (NAND and NOR) –standard representation of logic functions (SOP and POS) – minimization techniques (Karnaughmap: 2, 3 variables).	18	Chalk & Talk, Videos, PPT and Demonstration
II	Adders,halfandfull adder –subtractors,halfandfullsubtractor –parallel binary adder – magnitude comparator – multiplexers (4:1) and demultiplexers (1:4), encoder (8-line-to-3- line) and decoder (3-line-to-	18	Chalk & Talk, Videos, PPT

	8-line), BCD to seven segment decoder		and Demonstration
III	Flip-flops: S-R Flip-flop , J-K Flip-flop, T and D type flip-flops, master-slave flip-flop, truth tables, registers:- serial in serial out and parallel in and parallel out – counters asynchronous:-mod-8, mod-10, synchronous - 4-bit and ring counter – general memory operations, ROM, RAM (static and dynamic), PROM, EPROM, Programmable Array Logic (PAL)	18	Chalk & Talk, Videos, PPT and Demonstration
IV	8085 Microprocessor: introduction to microprocessor – INTEL 8085 architecture – register organization –pin configuration of 8085, interrupts and its priority – Program Status Word (PSW) –instruction set of 8085 –addressing modes of 8085 –assembly language programming using 8085 –programmes for addition (8-Bit), subtraction (8-Bit).	18	Chalk & Talk, Videos, PPT and Demonstration
V	I/O Interfaces: serial communication interface (8251-USART) – programmable peripheral interface (8255-PPI) –programmable interval timers (8253) – keyboard and display (8279).	18	Chalk & Talk, Videos, PPT and Demonstration

Learning Outcome Based Education & Assessment (LOBE)						
Formative Examination - Blue Print						
Articulation Mapping – K Levels with Course Outcomes (COs)						
Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of Questions	K - Level		
CI AI	CO1	K1 – K4	2	K1, K2	2 (K1, K1)	2 (K1, K1)
	CO2	K1 – K4	2	K1, K2	2 (K2, K2)	2 (K2, K2)
CI AII	CO3	K1 – K4	2	K1, K2	2 (K3, K3)	2 (K3, K3)
	CO4	K1 – K4	2	K1, K2	2 (K3, K3)	2 (K4, K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	10	16	28	50	100
	K2	2	10	16	28	50	
	K3						
	K4						
	Marks	4	20	32	56	100	100
CIA II	K1	2			2	3.57	7
	K2	2			2	3.57	
	K3		20	16	36	64.29	64
	K4			16	16	28.57	29
	Marks	4	20	32	56	100	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

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

CO 5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	Cos	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1, K2	2 (K1, K1)	2 (K2, K2)
2	CO2	K1 – K4	2	K1, K2	2 (K2, K2)	2 (K2, K2)
3	CO3	K1 – K4	2	K1, K2	2 (K3, K3)	2 (K3, K3)
4	CO4	K1 – K4	2	K1, K2	2 (K3, K3)	2 (K4, K4)
5	CO5	K1 – K4	2	K1, K2	2 (K4, K4)	2 (K4, K4)
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	10	-	15	10.71	11
K2	5	10	32	47	33.57	33
K3		20	16	36	25.71	26
K4		10	32	42	30	30
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions PART – A				(10 x 1 = 10 Marks)	
1.	Unit - I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit - I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit - II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit - II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit - IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit - IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit - V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit - V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions PART – B (5 x 5 = 25 Marks)				
11. a)	Unit - I	CO1	K1	
OR				
11. b)	Unit - I	CO1	K1	
12. a)	Unit - II	CO2	K2	
OR				
12. b)	Unit - II	CO2	K2	
13. a)	Unit - III	CO3	K3	
OR				
13. b)	Unit - III	CO3	K3	
14. a)	Unit - IV	CO4	K3	
OR				
14. b)	Unit - IV	CO4	K3	
15. a)	Unit - V	CO5	K4	
OR				
15. b)	Unit - V	CO5	K4	

Answer ALL the questions PART – C (5 x 8 = 40 Marks)				
16. a)	Unit - I	CO1	K2	
OR				
16. b)	Unit - I	CO1	K2	
17. a)	Unit - II	CO2	K2	
OR				
17. b)	Unit - II	CO2	K2	
18. a)	Unit - III	CO3	K3	
OR				
18. b)	Unit - III	CO3	K3	
19. a)	Unit - IV	CO4	K4	
OR				
19. b)	Unit - IV	CO4	K4	
20. a)	Unit - V	CO5	K4	
OR				
20. b)	Unit - V	CO5	K4	

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)**RESEARCH CENTRE OF PHYSICS****FOR THOSE WHO JOINED IN 2023-2024 AND AFTER**

Course Name	Physics Practical 6			
Course Code	23UPHCP61	L	P	C
Category	Practical	-	3	3

COURSE OBJECTIVES:

- Demonstrate various optical phenomena principles, working, apply with various materials and interpret the results.

SEMESTER – VI LIST OF EXPERIMENTS**45**

1. Zener diode – voltage regulations
2. Bridge rectifier using diodes
3. Clipping and clamping circuits using diodes.
4. RC coupled CE transistor amplifier - single stage.
5. Hartley oscillator - transistor.
6. Astable multivibrator - transistor. Using IC's
7. Bistable multivibrator - transistor. Using IC's
8. Operational amplifier - differentiator and integrator.
9. 5V, IC Regulated power supply.
10. Study of gate ICs – NOT, OR, AND, NOR, NAND, XOR, XNOR
11. Verification of De Morgan's theorem using ICs –NOT, OR, AND gates
12. NAND as universal building block.
13. NOR as universal building block.
14. Half adder / Half subtractor using basic logic gate ICs
15. Microprocessor 8085 – addition (8 bit only)
16. Microprocessor 8085 – subtraction (8 bit only)
17. OPAMP – Adder and Subtractor

Total Hours**45****BOOKS FOR STUDY:**

- Srinivasan.M.N., Balasubramanian.S., Ranganathan.R., A Text Book of Practical Physics, 2017 Edition, Sultan Chand & Sons

BOOKS FOR REFERENCES:

- Ouseph.C., Practical Physics and Electronics, 2013, S.Viswanathan.P.Ltd.
- Singh Hemne,S.Chand and Co.New Delhi,2017
- Shukla.R.K.,New Age International,2nd Edition.,New Delhi

WEB RESOURCES:

- ❖ <https://www.slideshare.net/mobile/sunilrathore77398/basicanalogelectronics>
- ❖ <https://www.slideshare.net/mobile/PatruniChidanandaSas/basics-of-electronics-53962342>
- ❖ <http://www.sircrrengg.ac.in/images/Others/CSE/MP-LAB-MANUAL.pdf>
- ❖ https://www.youtube.com/playlist?list=PL_pGb42kre_QXwuaizYb21tSYpoHyXsCQ

Nature of Course	EMPLOYABILITY				SKILLORIENTED		✓	ENTREPRENEURSHIP		
Curriculum Relevance	LOCAL		REGIONAL			NATIONAL			GLOBAL	✓
Changes Made in the Course	Percentage of Change				No Changes Made			New Course		
* Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.										

COURSE OUTCOMES:										K LEVEL	
After studying this course, the students will be able to:											
CO1	Remembering the Aim and apparatus used in the experiment									K1 to K4	
CO2	Understanding of laws and formulas of the experiment									K1 to K4	
CO3	Applying the knowledge to do the experiment									K1 to K4	
CO4	Calculating and examining the aim of the experiment									K1 to K4	
CO5	Interpreting the result of the experiment									K1 to K4	
MAPPING WITH PROGRAM OUTCOMES:											
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	
CO1	3	3	1	1	2	3	3	3	1	3	
CO2	3	3	2	2	2	3	3	3	1	3	
CO3	3	3	3	3	3	3	3	3	2	3	
CO4	3	3	2	3	3	3	3	3	1	3	
CO5	3	3	2	2	2	3	3	3	1	3	
3 - STRONG			2 – MEDIUM					1 – LOW			
CO / PO MAPPING:											
COS		PSO1		PSO2		PSO3		PSO4		PSO5	
CO 1		3		3		3		3		3	
CO 2		3		3		3		3		3	

CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
WEITAGE	15	15	15	15	15
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3.0	3.0	3.0	3.0	3.0

LESSON PLAN:

SEM	Physics Practical 6	HRS	PEDAGOGY
VI	1. Zener diode – voltage regulations 2. Bridge rectifier using diodes 3. Clipping and clamping circuits using diodes. 4. RC coupled CE transistor amplifier - single stage. 5. Hartley oscillator - transistor. 6. Astable multivibrator - transistor. 7. Bistable multivibrator - transistor. 8. Operational amplifier - differentiator and integrator. 9. 5V, IC Regulated power supply. 10. Study of gate ICs – NOT, OR, AND, NOR, NAND, XOR, XNOR 11. Verification of De Morgan's theorem using ICs –NOT, OR, AND 12. NAND as universal building block. 13. NOR as universal building block. 14. Half adder / Half subtractor using basic logic gate ICs 15. Microprocessor 8085 – addition (8 bit only) 16. Microprocessor 8085 – subtraction (8 bit only)	45	Demonstration and Video

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total
25	75	100

Record Note and
Attendance -10
mark Model
examination - 15
mark

Total CIA - 25 mark

Model examination should be conducted for 30 mark and it has to be converted to 15 mark

Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)				
Internal	Cos	K Level	No. of. Questions	K - Level
CIA-I	CO1 – CO5	K1 – K5	1 Question for Each Student	K1 – K5
Question Pattern CIA - I		No. of Questions to be asked	1 Question for Each Student	
		No. of Questions to be answered	1	
		Marks for each question	30	
		Total Marks for each section	30	

Distribution of Marks with COs &K Level for Correction of CIA I					
	COs	K - Level	Distribution of the work of the experiment	K - Level	MARKS
CIA I	CO1	K1 to K5	Aim and apparatus	K1	2.0
	CO2	K1 to K5	Formula and Tabular Column	K3	5.0
	CO3	K1 to K5	Understanding and Observation	K5	10.0
	CO4	K1 to K5	Calculation and Graph	K4	10.0
	CO5	K1 to K5	Interpretation of result	K2	3.0
	Total Marks				30

Summative Examination: Duly completed Record: 15 mark

End Semester Exam: 60 marks

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)			
COs	K - Level	No. of Questions	K – Level
CO1- CO5	K1 – K5	1 Question for Each Student	K1 – K5
No. of Questions to be Asked		1 Question for Each Student	
No. of Questions to be answered		1	
Marks for each question		75	
Total Marks for each section		75	

Distribution of Marks with K Level				
K Level	Parameters for K-Level	Total Marks	% of (Marks without choice)	Consolidated %
K1	Aim and apparatus	10	13.33	13
K3	Formula and Tabular Column	15	20	20
K5	Understanding and Observation	30	40	40
K4	Calculation and Graph	15	20	20
K2	Interpretation of result	5	6.67	7
Marks		75	100	100

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)**RESEARCH CENTRE OF PHYSICS****FOR THOSE WHO JOINED IN 2023-2024 AND AFTER**

Course Name	Mathematical Physics			
Course Code	23UPHEC61	L	P	C
Category	Elective	3	-	2
COURSE OBJECTIVES:				
➤ To understand higher mathematical concepts which are applied to solve problems in Physics and similar situations				
UNIT - I MATRICES				09
Types of matrices – symmetric, Hermitian, unitary and orthogonal matrices– characteristic equation of a matrix – Eigen values and Eigen vectors of a matrix – Cayley-Hamilton theorem – inverse of matrix by Cayley-Hamilton theorem – similarity transformations – diagonalization of 2x2 real symmetric matrices.				
UNIT - II VECTOR CALCULUS				09
Vector differentiation – directional derivatives –definitions and Physical significance of gradient, divergence, curl – Laplace operators– vector identities – line, surface and volume integrals – statement, proof and simple problems for Gauss’s divergence theorem, Stoke’s theorem, Green’s theorem.				
UNIT - III ORTHOGONAL CURVILINEAR COORDINATES				09
Tangent basis vectors – scale factors – unit vectors in cylindrical and spherical coordinate systems – gradient of a scalar –divergence and curl of a vector – Laplacian in these coordinate systems.				
UNIT - IV FOURIER SERIES AND FOURIER TRANSFORMS				09
FOURIER SERIES: periodic functions –Dirichlet’s conditions – general Fourier series – even and odd functions and their Fourier expansions – Fourier cosine and sine – half range series – change of length of interval. Fourier analysis of square wave, saw-tooth wave, half wave/full wave rectifier wave forms.				
FOURIER TRANSFORMS: Fourier Integral theorem(Statement only)–Fourier, Fourier sine and Fourier cosine transforms, – Fourier transform of single pulse – trigonometric, exponential and Gaussian functions – inverse Fourier transform – convolution theorem.				
UNIT - V APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS				09
APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS (PDE): PDE for transverse vibrations in elastic strings (one dimensional wave equation) – one dimensional heat flow equation – solutions to these PDE’s by method of separation of variables – problems based on boundary conditions and initial conditions.				
Total Lecture Hours				45

BOOKS FOR STUDY:

- Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley, India.
- Mathematical Physics – P. K. Chattopadhyay, New Age, International Publishers.
- Mathematical Physics – B. D. Gupta.
- Mathematical Physics – H. K. Das, S. Chand and Co, New Delhi.

BOOKS FOR REFERENCES:

- Fourier Analysis by M.R. Spiegel, 2004, Tata McGraw-Hill.
- Engineering Mathematics III- B, M. K. Venkataraman,
- Applied Mathematics for Scientists and Engineers, Bruce R. Kusseand Erik A. Westwig, 2nd Ed, WILEY-VCH Verlag, 2006.
- Vector space and Matrices – J. C. Jain, Narosa Publishing House Pvt. Ltd.

WEB RESOURCES:

- ❖ www.khanacademy.org
- ❖ https://youtu.be/LZnRlOA1_2I
- ❖ <http://hyperphysics.phy-astr.gsu.edu/hbase/hmat.html#hmath>
- ❖ https://www.youtube.com/watch?v=2jymuM7OUU&list=PLhkiT_RYTEU27vS_SIED56gNjVJGO2qa

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED		✓	ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL			NATIONAL			GLOBAL	✓
Changes Made in the Course	Percentage of Change				No Changes Made			✓	New Course	
*Treat 20 % as each unit (20*5=100 %) and calculate the percentage of change for the course.										

COURSE OUTCOMES:**K LEVEL**

After studying this course, the students will be able to:

CO1	Explain about special type of matrices that are relevant in physics	K1 to K4
CO2	Review the vector calculus	K1 to K4
CO3	Understand the orthogonal curvilinear coordinates	K1 to K4
CO4	Explain about the fourier series and fourier transforms	K1 to K4
CO5	Review the partial differential equations	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	2	1	2	2	3	2	1	2
CO3	3	3	2	1	2	2	3	2	1	2
CO4	3	2	2	1	1	1	2	2	1	1
CO5	3	2	2	1	1	1	2	2	1	1

3- STRONG		2 – MEDIUM		1 - LOW	
CO / PO MAPPING:					
COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	2	1	2
CO 3	3	3	2	1	2
CO 4	3	2	2	1	1
CO 5	3	2	2	1	1
WEIGHTAGE	3	3	3	3	3
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3.0	3.0	3.0	3.0	3.0
LESSON PLAN:					
UNIT	Mathematical Physics			HRS	PEDAGOGY
I	Types of matrices – symmetric, Hermitian, unitary and orthogonal matrices– characteristic equation of a matrix – Eigen values and Eigen vectors of a matrix – Cayley-Hamilton theorem – inverse of matrix by Cayley-Hamilton theorem – similarity transformations – diagonalization of 2x2 real symmetric matrices.			09	Chalk &Talk, PPT, Seminar
II	Vector differentiation – directional derivatives –definitions and Physical significance of gradient, divergence, curl – Laplace operators– vector identities – line, surface and volume integrals – statement, proof and simple problems for Gauss’s divergence theorem, Stoke’s theorem, Green’s theorem.			09	Chalk &Talk, PPT
III	Tangent basis vectors – scale factors – unit vectors in cylindrical and spherical coordinate systems –gradient of a scalar –divergence and curl of a vector – Laplacian in these coordinate systems.			09	Chalk &Talk, Assignment
IV	FOURIER SERIES: periodic functions –Dirichlet’s conditions – general Fourier series – even and odd functions and their Fourier expansions – Fourier cosine and sine – half range series – change of length of interval. Fourier analysis of square wave, saw-tooth wave, half wave/full wave rectifier wave forms.			09	Chalk &Talk, Group discussion

	FOURIER TRANSFORMS: Fourier Integral theorem(Statement only)– Fourier, Fourier sine and Fourier cosine transforms, – Fourier transform of single pulse – trigonometric, exponential and Gaussian functions – inverse Fourier transform – convolution theorem.		
V	APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS (PDE): PDE for transverse vibrations in elastic strings (one dimensional wave equation) – one dimensional heat flow equation – solutions to these PDE's by method of separation of variables – problems based on boundary conditions and initial conditions.	09	Seminar, PPT, Chalk &Talk

Learning Outcome Based Education & Assessment (LOBE)						
Formative Examination - Blue Print						
Articulation Mapping – K Levels with Course Outcomes (COs)						
Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of. Questions	K - Level		
CI AI	CO1	K1 – K4	2	K1, K2	2 (K1, K1)	2 (K1, K1)
	CO2	K1 – K4	2	K1, K2	2 (K2, K2)	2 (K2, K2)
CI AII	CO3	K1 – K4	2	K1, K2	2 (K3, K3)	2 (K3, K3)
	CO4	K1 – K4	2	K1, K2	2 (K3, K3)	2 (K4, K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	10	16	28	50	100
	K2	2	10	16	28	50	
	K3						
	K4						
	Marks	4	20	32	56	100	100
CIA II	K1	2			2	3.57	7
	K2	2			2	3.57	
	K3		20	16	36	64.29	64
	K4			16	16	28.57	29
	Marks	4	20	32	56	100	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

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

CO 5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	Cos	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1, K2	2 (K1, K1)	2 (K1, K1)
2	CO2	K1 – K4	2	K1, K2	2 (K2, K2)	2 (K2, K2)
3	CO3	K1 – K4	2	K1, K2	2 (K3, K3)	2 (K3, K3)
4	CO4	K1 – K4	2	K1, K2	2 (K3, K3)	2 (K4, K4)
5	CO5	K1 – K4	2	K1, K2	2 (K4, K4)	2 (K4, K4)
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	10	16	31	22.14	22
K2	5	10	16	31	22.14	22
K3		20	16	36	25.71	26
K4		10	32	42	30	30
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions PART – A (10 x 1 = 10 Marks)					
1.	Unit - I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit - I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit - II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit - II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit - IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit - IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit - V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit - V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions PART – B (5 x 5 = 25 Marks)				
11. a)	Unit - I	CO1	K1	
OR				
11. b)	Unit - I	CO1	K1	
12. a)	Unit - II	CO2	K2	
OR				
12. b)	Unit - II	CO2	K2	
13. a)	Unit - III	CO3	K3	
OR				
13. b)	Unit - III	CO3	K3	
14. a)	Unit - IV	CO4	K3	
OR				
14. b)	Unit - IV	CO4	K3	
15. a)	Unit - V	CO5	K4	
OR				
15. b)	Unit - V	CO5	K4	

Answer ALL the questions PART – C (5 x 8 = 40 Marks)				
16. a)	Unit - I	CO1	K1	
OR				
16. b)	Unit - I	CO1	K1	
17. a)	Unit - II	CO2	K2	
OR				
17. b)	Unit - II	CO2	K2	
18. a)	Unit - III	CO3	K3	
OR				
18. b)	Unit - III	CO3	K3	
19. a)	Unit - IV	CO4	K4	
OR				
19. b)	Unit - IV	CO4	K4	
20. a)	Unit - V	CO5	K4	
OR				
20. b)	Unit - V	CO5	K4	

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)**RESEARCH CENTRE OF PHYSICS****FOR THOSE WHO JOINED IN 2023-2024 AND AFTER**

Course Name	Energy Physics			
Course Code	23UPHEC62	L	P	C
Category	Elective	3	-	2
COURSE OBJECTIVES:				
In this course, the students will learn				
➤ About various energy sources ➤ Solar energy and its application ➤ Usage of wind energy in daily life ➤ Biomass energy and its practical usage ➤ Energy storage devices				
UNIT - I INTRODUCTION TO ENERGY SOURCES				09
Energy consumption as a measure of prosperity – world energy future – energy sources and their availability – conventional energy sources – non-conventional and renewable energy sources – comparison – merits and demerits.				
UNIT - II SOLAR ENERGY				09
Solar energy Introduction – solar constant – solar radiation at the Earth's surface – solar radiation geometry – Solar radiation measurements – solar radiation data – solar energy storage and storage systems – solar pond – solar cooker – solar water heater – solar greenhouse – types of greenhouses – solar cells. .				
UNIT - III WIND ENERGY				09
Introduction – nature of the wind – basic principle of wind energy conversion – wind energy data and energy estimation – basic components of Wind Energy Conversion Systems (WECS) – advantages and disadvantages of WECS – applications – tidal energy				
UNIT - IV BIOMASS ENERGY				09
Introduction – classification – biomass conversion technologies – photosynthesis – fermentation – biogas generation – classification of biogas plants – anaerobic digestion for biogas – wood gasification – advantages and disadvantages.				
UNIT - V ENERGY STORAGE				09
Importance of energy storage- batteries - lead acid battery -nickel-cadmium battery – fuel cells – types of fuel cells – advantages and disadvantages of fuel cells – applications of fuel cells - hydrogen storage.				
Total Lecture Hours				45

BOOKS FOR STUDY:

- G.D.Rai, Non-Conventional Sources of Energy, Khanna Publishers, 2009, 4thEdn.
- S P Sukhstme, J K Nayak, Solar Energy, Principles of Thermal Collection and Storage, McGraw Hill, 2008, 3rdEdn.
- D P Kothari, K P Singal, RakeshRajan, PHI Learning Pvt Ltd, 2011, 2ndEdn.

BOOKS FOR REFERENCES:

- John Twidell and Tony Weir, Renewable Energy Resources, Taylor and Francis, 2005, 2ndEdn.
- S.A. Abbasi and NasemaAbbasi, Renewable Energy sources and their environmental impact, PHI Learning Pvt. Ltd, 2008.
- M. P. Agarwal, Solar Energy, S. Chand and Co. Ltd., New Delhi, 1982
- H. C. Jain, Non-Conventional Sources of Energy, Sterling Publishers, 1986.

WEB RESOURCES:

- ❖ <https://nptel.ac.in/courses/121106014>
- ❖ <http://www.nitttrc.edu.in/nptel/courses/video/121106014/lec4.pdf>
- ❖ <https://ocw.mit.edu/courses/15-031j-energy-decisions-markets-and-policies-spring-2012/resources/lecture-15-non-renewable-energy-resources/>

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED			ENTREPRENEURSHIP		
Curriculum Relevance	LOCAL		REGIONAL			NATIONAL	✓	GLOBAL	
Changes Made in the Course	Percentage of Change				No Changes Made		✓	New Course	
* Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.									

COURSE OUTCOMES:**K LEVEL**

After studying this course, the students will be able to:

CO1	Explain various energy sources	K1 to K4
CO2	Illustrate the applications of solar energy	K1 to K4
CO3	Summarize the energy obtained from wind	K1 to K4
CO4	Articulate the utility of biomass energy	K1 to K4
CO5	Relate the various energy storage methods	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

S- STRONG**M – MEDIUM****L - LOW**

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	2	1	2
CO 3	3	3	2	1	2
CO 4	3	2	2	1	1
CO 5	3	2	2	1	1
WEIGHTAGE	3	3	3	3	3
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3.0	3.0	3.0	3.0	3.0

LESSON PLAN:

UNIT	Energy Physics	HRS	PEDAGOGY
I	energy consumption as a measure of prosperity – world energy future – energy sources and their availability	4	PPT
	conventional energy sources – non-conventional and renewable energy sources – comparison – merits and demerits.	5	PPT
II	solar energy Introduction – solar constant – solar radiation at the Earth's surface – solar radiation geometry – Solar radiation measurements – solar radiation data	4	PPT
	solar energy storage and storage systems – solar pond – solar cooker – solar water heater – solar greenhouse – types of greenhouses – solar cells.	5	PPT
III	introduction –nature of the wind – basic principle of wind energy conversion – wind energy data and energy estimation	4	PPT
	basic components of Wind Energy Conversion Systems (WECS) – advantages and disadvantages of WECS – applications – tidal energy	5	PPT
IV	introduction – classification – biomass conversion technologies – photosynthesis	4	PPT
	fermentation - biogas generation –classification of biogas plants – anaerobic digestion for biogas – wood gasification – advantages and disadvantages.	5	PPT
V	importance of energy storage- batteries - lead acid battery -nickel-cadmium battery	4	seminars
	fuel cells – types of fuel cells – advantages and disadvantages of fuel cells – applications of fuel cells - hydrogen storage.	5	Assignment

Learning Outcome Based Education & Assessment (LOBE)
Formative Examination - Blue Print
Articulation Mapping – K Levels with Course Outcomes (COs)

Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of. Questions	K - Level		
CI AI	CO1	K1 – K4	2	K1, K2	2(K2,K2)	2(K3,K3)
	CO2	K1 – K4	2	K1, K2	2(K3,K3)	2(K3,K3)
CI AII	CO3	K1 – K4	2	K1, K2	2(K2,K2)	2(K3,K3)
	CO4	K1 – K4	2	K1, K2	2(K3,K3)	2(K4,K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II

	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	-	-	2	3.57	25
	K2	2	10	-	12	21.43	
	K3	-	10	16	26	46.43	46.43
	K4	-	-	16	16	28.57	28.57
	Marks	4	20	32	56	100	100
CIA II	K1	2	-	-	2	3.57	25
	K2	2	10	-	12	21.43	
	K3	-	10	16	26	46.43	46.43
	K4	-	-	16	16	28.57	28.57
	Marks	4	20	32	56	100	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

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

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	Cos	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1&K2	2 (K2,K2)	2 (K2,K2)
2	CO2	K1 – K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)
3	CO3	K1 – K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)
4	CO4	K1 – K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)
5	CO5	K1 – K4	2	K1&K2	2 (K4,K4)	2 (K3,K3)
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	-	-	5	3.57	21.43
K2	5	20	-	25	17.86	20
K3	-	20	48	68	48.57	48.57
K4	-	10	32	42	30	30
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions				PART – A	
				(10 x 1 = 10 Marks)	
1.	Unit - I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit - I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit - II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit - II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit - IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit - IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit - V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit - V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions				PART – B	(5 x 5 = 25 Marks)
11. a)	Unit - I	CO1	K2		
OR					
11. b)	Unit - I	CO1	K2		
12. a)	Unit - II	CO2	K3		
OR					
12. b)	Unit - II	CO2	K3		
13. a)	Unit - III	CO3	K2		
OR					
13. b)	Unit - III	CO3	K2		
14. a)	Unit - IV	CO4	K3		
OR					
14. b)	Unit - IV	CO4	K3		
15. a)	Unit - V	CO5	K4		
OR					
15. b)	Unit - V	CO5	K4		

Answer ALL the questions				PART – C	(5 x 8 = 40 Marks)
16. a)	Unit - I	CO1	K2		
OR					
16. b)	Unit - I	CO1	K2		
17. a)	Unit - II	CO2	K4		
OR					
17. b)	Unit - II	CO2	K4		
18. a)	Unit - III	CO3	K3		
OR					
18. b)	Unit - III	CO3	K3		
19. a)	Unit - IV	CO4	K4		
OR					
19. b)	Unit - IV	CO4	K4		
20. a)	Unit - V	CO5	K3		
OR					
20. b)	Unit - V	CO5	K3		

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)**RESEARCH CENTRE OF PHYSICS****FOR THOSE WHO JOINED IN 2023-2024 AND AFTER**

Course Name	Advanced Mathematical Physics			
Course Code	23UPHEC63	L	P	C
Category	Elective	4	-	3
COURSE OBJECTIVES:				
➤ The fundamentals of matrices and vector calculus learnt in earlier course will enable students to learn advanced topics and theorems. ➤ The special functions and applications of partial differential equations will be of use in research at a later stage.				
UNIT - I MATRICES:				12
Introduction – special types of matrices – transpose –conjugate– conjugate transpose– symmetric and anti symmetric –Hermitian and skew Hermitian – orthogonal and unitary – properties – characteristic equation – roots and characteristic vectors – diagonalization– Cayley–Hamilton theorem –simple problem				
UNIT - II VECTOR CALCULUS:				12
∇ operator – divergence – second derivative of vector functions or fields –Laplacian operator – curl of a vector – line integral – line Integral of a vector field around an infinitesimal rectangle – curl of conservative field – surface integral – volume integral (without problem) – Gauss's divergence theorem and proof – Stoke's theorem and proof –simple problems.				
UNIT - III SPECIAL FUNCTIONS:				12
Definition –Beta function – Gamma function – evaluation of Beta function – other forms of Beta function – evaluation of Gamma function – other forms of Gamma function – relation between Beta and Gamma functions – simple problems.				
UNIT - IV FROBENIUS METHOD AND SPECIAL FUNCTIONS:				12
Singular points of second order linear differential equations and importance –singularities of Bessels and Laguerre equations, Frobenius method and applications to differential equations: Legendre and Hermite differential equations – Legendre and Hermite polynomials – Rodrigues formula –generating function – orthogonality				
UNIT - V PARTIAL DIFFERENTIAL EQUATIONS:				12
Solutions to partial differential equations using separation of variables - Laplace's equation in problems of rectangular – cylindrical and spherical symmetry – conducting and dielectric sphere in an external uniform electric field – wave equation and its solution for vibrational modes of a stretched string				
Total Lecture Hours				60

BOOKS FOR STUDY:

- 1. Mathematical Physics, B.D. Gupta-Vikas Publishing House, 4 th Edition (2006)
- 2. Mathematical Physics, SatyaPrakash (Sultan Chand)

BOOKS FOR REFERENCES:

- 1. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris (2013, 7th Edn., Elsevier)
- 2. Mathematical Physics–H. K. Dass, Dr. Rama Verma (S. Chand Publishing)
- 3. Advanced Engineering Mathematics, Erwin Kreyszig (Wiley India)
- 4. Mathematical Physics and Special Relativity, M. Das, P.K. Jena and B.K. Dash (SrikrishnaPrakashan)

WEB RESOURCES:

1. Types of Matrices with Examples
<https://youtu.be/Kbv7rw6sUBo?si=apvHYFVmG-DhKLc3>
2. Gauss's Divergence Theorem
https://youtu.be/TORT20_HjMY?si=heLIwaDPiLyGV2jN
3. Evaluation of Beta function
<https://youtu.be/77fqtpUL9Y4?si=BzGTli6qRysWyNdi>
4. Express the $f(x)$ in terms of Legendre's polynomials example
<https://youtu.be/f86K0QerUug?si=XK0rcsvx9brv4-GW>

Nature of Course	EMPLOYABILITY	✓	SKILL ORIENTED		ENTREPRENEURSHIP	
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL	GLOBAL ✓
Changes Made in the Course	Percentage of Change		No Changes Made		New Course	✓
* Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.						

COURSE OUTCOMES:**K LEVEL**

After studying this course, the students will be able to:

CO1	Understand the special types of matrices	K1 to K4
CO2	Classify the integral and also learn about the Gauss's divergence theorem and Stoke's theorem	K1 to K4
CO3	Give reason for classifying special functions on the basis of problems	K1 to K4
CO4	Comprehend the Legendre and Hermite polynomials	K1 to K4
CO5	Analyse the partial differential equations and its solutions	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	2	2	3	2	2	3	2	
CO2	2	3	3	3	2	2	3	2	3	
CO3	3	2	3	2	3	3	2	3	3	
CO4	3	3	3	3	3	2	3	2	2	
CO5	2	2	3	3	2	3	3	3	3	
S- STRONG			M – MEDIUM					L - LOW		

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	1	3	-	2
CO 2	3	1	3	-	2
CO 3	3	1	3	-	2
CO 4	3	1	3	-	2
CO 5	3	1	3	-	2
WEIGHTAGE	3	3	3	3	3
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3.0	3.0	3.0	3.0	3.0

LESSON PLAN:

UNIT	Advanced Mathematical Physics	HRS	PEDAGOGY
I	Introduction – special types of matrices – transpose –conjugate– conjugate transpose– symmetric and anti symmetric –Hermitian and skew Hermitian – orthogonal and unitary – properties – characteristic equation – roots and characteristic vectors – diagonalization– Cayley–Hamilton theorem –simple problems	12	Chalk & Talk, Videos, PPT
II	Operator – divergence – second derivative of vector functions or fields –Laplacian operator – curl of a vector – line integral – line Integral of a vector field around an infinitesimal rectangle – curl of conservative field – surface integral – volume Integral (without problem) – Gauss’s divergence theorem and proof – Stroke’s theorem and proof –simple problems.	12	Chalk & Talk, Videos, PPT
III	Definition –Beta function – Gamma function – evaluation of Beta function – other forms of Beta function – evaluation of Gamma function – other forms of Gamma function – relation between Beta and Gamma functions – simple problems.	12	Chalk & Talk, Videos, PPT
IV	Singular points of second order linear differential equations and importance –singularities of Bessels and Laguerre equations, Frobenius method and applications to differential equations: Legendre and	12	Chalk & Talk, Videos, PPT

	Hermitedifferential equations – Legendre and Hermitepolynomials – Rodrigues formula –generating function – orthogonality		
V	Solutions to partial differential equations using separation of variables - Laplace"s equation in problems of rectangular – cylindrical and spherical symmetry – conducting and dielectric sphere in an external uniform electric field – wave equation and its solution for vibrational modes of a stretched string	12	Chalk & Talk, Videos, PPT

Learning Outcome Based Education & Assessment (LOBE)						
Formative Examination - Blue Print						
Articulation Mapping – K Levels with Course Outcomes (COs)						
Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of Questions	K - Level		
CI	CO1	K1 – K4	2	K1, K2	2(K2,K2)	2(K2,K2)
AI	CO2	K1 – K4	2	K1, K2	2(K3,K3)	2(K4,K4)
CI	CO3	K1 – K4	2	K1, K2	2(K2,K2)	2(K3,K3)
AII	CO4	K1 – K4	2	K1, K2	2(K3,K3)	2(K4,K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	-	-	2	3.57	54
	K2	2	10	16	28	50	
	K3	-	10		10	17.85	18
	K4	-	-	16	16	28.57	28
	Marks	4	20	32	56	100	100
CIA II	K1	2	-	-	2	3.57	25
	K2	2	10	-	12	21.43	
	K3	-	10	16	26	46.43	46.43
	K4	-	-	16	16	28.57	28.57
	Marks	4	20	32	56	100	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

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

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	Cos	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1&K2	2 (K2,K2)	2 (K2,K2)
2	CO2	K1 – K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)
3	CO3	K1 – K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)
4	CO4	K1 – K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)
5	CO5	K1 – K4	2	K1&K2	2 (K4,K4)	2 (K3,K3)
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	-	-	5	3.57	4
K2	5	20	16	41	29.28	29
K3	-	20	32	52	37.14	37
K4	-	10	32	42	30	30
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions PART – A				(10 x 1 = 10 Marks)	
1.	Unit - I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit - I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit - II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit - II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit - IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit - IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit - V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit - V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions PART – B				(5 x 5 = 25 Marks)
11. a)	Unit - I	CO1	K2	
OR				
11. b)	Unit - I	CO1	K2	
12. a)	Unit - II	CO2	K3	
OR				
12. b)	Unit - II	CO2	K3	
13. a)	Unit - III	CO3	K2	
OR				
13. b)	Unit - III	CO3	K2	
14. a)	Unit - IV	CO4	K3	
OR				
14. b)	Unit - IV	CO4	K3	
15. a)	Unit - V	CO5	K4	
OR				
15. b)	Unit - V	CO5	K4	

Answer ALL the questions PART – C				(5 x 8 = 40 Marks)
16. a)	Unit - I	CO1	K2	
OR				
16. b)	Unit - I	CO1	K2	
17. a)	Unit - II	CO2	K4	
OR				
17. b)	Unit - II	CO2	K4	
18. a)	Unit - III	CO3	K3	
OR				
18. b)	Unit - III	CO3	K3	
19. a)	Unit - IV	CO4	K4	
OR				
19. b)	Unit - IV	CO4	K4	
20. a)	Unit - V	CO5	K3	
OR				
20. b)	Unit - V	CO5	K3	

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)**RESEARCH CENTRE OF PHYSICS****FOR THOSE WHO JOINED IN 2023-2024 AND AFTER**

Course Name	Fundamentals of Molecular Spectroscopy			
Course Code	23UPHEC64	L	P	C
Category	Elective	4	-	3
COURSE OBJECTIVES:				
In this course, the students will learn				
➤ The general features of spectroscopy. ➤ The principle and applications of spectroscopy. ➤ The instrumentation of spectrophotometers ➤ The interaction of radiation with molecules ➤ Structural analysis of organic compounds using spectroscopy				
UNIT - I	General Features of Spectroscopy			12
Units and conversion factors - Introduction to spectroscopy- Nature of radiation- Energies corresponding to various kinds of radiation- interaction of electromagnetic radiation with matter- absorption, emission, transmission, reflection, dispersion, polarization and scattering. Uncertainty relation & natural line width and natural line broadening, rotational, vibrational & electronic energy levels.				
UNIT - II	IR Spectroscopy			12
Vibrational energy of diatomic molecule – Selection rules – vibrating diatomic molecule- diatomic vibrating rotator – asymmetry of rotation – vibration band – IR spectrophotometer – sample handling techniques – Fourier transform IR spectrometer – applications				
UNIT - III	UV and Visible Spectroscopy			12
The Nature of Electronic Excitations - Principles of Absorption Spectroscopy - Instrumentation- Chromophores and Auxochromes – Electronic transition in organic molecules – types; Solvent effect; selection rule for electronic transition - Woodward-Fieser rule for polyenes and Application of UV-visible spectroscopy.				
UNIT - IV	Mass Spectrometry			12
Sample Introduction, Ionization methods: Electronic Ionisation (EI) & Chemical Ionisation (CI), Desorption Ionization Techniques :FAB, SIMS, MALDI. Mass Analysis- The Magnetic Sector Mass Analyzer- Double-Focusing Mass Analyzers- Quadrupole Mass Analyzers, isotope abundance, Metastable ions.				
UNIT - V	NMR Spectroscopy			12
Nuclear Spin States- Nuclear Magnetic Moments- The Mechanism of Absorption (Resonance) - Population Densities of Nuclear Spin States- The Chemical Shift and Shielding- The Nuclear Magnetic Resonance Spectrometer- The Continuous-Wave (CW) Instrument- The Pulsed Fourier Transform (FT) Instrument- Proton NMR spectrum of ethanol.				
Total Lecture Hours				60

BOOKS FOR STUDY:

1. Unit - I - study material given
2. Pavia, Lampman & Kriz, Introduction to Spectroscopy.5th edition, Cengage Learning.

Unit II - chapter 2

Unit - III - chapter 10

Unit - IV - chapter 3 & 4

Unit - V - chapter 5

BOOKS FOR REFERENCES:

- C.N Banwell "Fundamentals of Molecular Spectroscopy", 4th edition ,McGraw Hill Education
- R. M. Silverstein, G.C.Bassler, T.C. Morrill, "Spectrometric Identification of Organic Compounds.6th edition, wiley
- W. Kemp, "Organic Spectroscopy" 3rd edition, Red Globe Press

WEB RESOURCES:

- ❖ <https://archive.nptel.ac.in/courses/104/106/104106122>
- ❖ <https://www.britannica.com/science/spectroscopy/Molecular-spectroscopy>
- ❖ <https://nptel.ac.in/courses/104101099>

COURSE OUTCOMES:**K LEVEL**

After studying this course, the students will be able to:

CO1	state the general features of spectroscopy	K1 to K4
CO2	demonstrate the principle and applications of vibrational spectroscopy	K1 to K4
CO3	make use of the theory of electronic spectroscopy in analyzing compounds	K1 to K4
CO4	analyse the structure of organic compounds using NMR spectroscopic techniques	K1 to K4
CO5	Explain the applications of mass spectrometry in identifying various types of molecules	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

S- STRONG

M – MEDIUM

L - LOW

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	S	S	S	S	S
CO 2	M	S	S	S	M

CO 3	S	S	S	M	S
CO 4	S	S	S	S	S
CO 5	S	M	S	S	S
WEIGHTAGE	S	S	S	S	S
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3.0	3.0	3.0	3.0	3.0

LESSON PLAN:

UNIT	Fundamentals of Molecular Spectroscopy	HRS	PEDAGOGY
I	Units and conversion factors - Introduction to spectroscopy- Nature of radiation- Energies corresponding to various kinds of radiation- interaction of electromagnetic radiation with matter- absorption, emission, transmission, reflection, dispersion, polarization and scattering. Uncertainty relation & natural line width and natural line broadening, rotational, vibrational & electronic energy levels.	12	PPT & chalk & talk
II	Vibrational energy of diatomic molecule – Selection rules – vibrating diatomic molecule- diatomic vibrating rotator – asymmetry of rotation – vibration band – IR spectrophotometer – sample handling techniques – Fourier transform IR spectrometer – applications	12	PPT
III	The Nature of Electronic Excitations - Principles of Absorption Spectroscopy - Instrumentation- Chromophores and Auxochromes – Electronic transition in organic molecules – types; Solvent effect; selection rule for electronic transition - Woodward-Fieser rule for polyenes and Application of UV-visible spectroscopy.	12	PPT
IV	Sample Introduction, Ionization methods: Electronic Ionisation (EI) & Chemical Ionisation (CI), Desorption Ionization Techniques :FAB, SIMS, MALDI. Mass Analysis- The Magnetic Sector Mass Analyzer- Double-Focusing Mass Analyzers- Quadrupole Mass Analyzers, isotope abundance, Metastable ions.	12	PPT
V	Nuclear Spin States- Nuclear Magnetic Moments- The Mechanism of Absorption (Resonance) - Population Densities of Nuclear Spin States- The Chemical Shift and Shielding- The Nuclear Magnetic Resonance Spectrometer- The Continuous-Wave (CW) Instrument- The Pulsed Fourier Transform (FT) Instrument- Proton NMR spectrum of ethanol.	12	Seminars & Assignment

Learning Outcome Based Education & Assessment (LOBE)
Formative Examination - Blue Print
Articulation Mapping – K Levels with Course Outcomes (COs)

Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of. Questions	K - Level		
CI AI	CO1	K1 – K4	2	K1, K2	2(K2,K2)	2(K2,K2)
	CO2	K1 – K4	2	K1, K2	2(K3,K3)	2(K4,K4)
CI AII	CO3	K1 – K4	2	K1, K2	2(K2,K2)	2(K3,K3)
	CO4	K1 – K4	2	K1, K2	2(K3,K3)	2(K4,K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II

	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	-	-	2	3.57	25
	K2	2	10	-	12	21.43	
	K3	-	10	16	26	46.43	46.43
	K4	-	-	16	16	28.57	28.57
	Marks	4	20	32	56	100	100
CIA II	K1	2	-	-	2	3.57	25
	K2	2	10	-	12	21.43	
	K3	-	10	16	26	46.43	46.43
	K4	-	-	16	16	28.57	28.57
	Marks	4	20	32	56	100	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

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

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	Cos	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1&K2	2 (K2,K2)	2 (K2,K2)
2	CO2	K1 – K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)
3	CO3	K1 – K4	2	K1&K2	2 (K2,K2)	2 (K3,K3)
4	CO4	K1 – K4	2	K1&K2	2 (K3,K3)	2 (K4,K4)
5	CO5	K1 – K4	2	K1&K2	2 (K4,K4)	2 (K3,K3)
No. of Questions to be Asked			10		10	10
No. of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	-	-	5	3.57	21.43
K2	5	20	-	25	17.86	20
K3	-	20	48	68	48.57	48.57
K4	-	10	32	42	30	30
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions				PART – A	
				(10 x 1 = 10 Marks)	
1.	Unit - I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit - I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit - II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit - II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit - IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit - IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit - V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit - V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions				PART – B	(5 x 5 = 25 Marks)
11. a)	Unit - I	CO1	K2		
OR					
11. b)	Unit - I	CO1	K2		
12. a)	Unit - II	CO2	K3		
OR					
12. b)	Unit - II	CO2	K3		
13. a)	Unit - III	CO3	K2		
OR					
13. b)	Unit - III	CO3	K2		
14. a)	Unit - IV	CO4	K3		
OR					
14. b)	Unit - IV	CO4	K3		
15. a)	Unit - V	CO5	K4		
OR					
15. b)	Unit - V	CO5	K4		

Answer ALL the questions				PART – C	(5 x 8 = 40 Marks)
16. a)	Unit - I	CO1	K2		
OR					
16. b)	Unit - I	CO1	K2		
17. a)	Unit - II	CO2	K4		
OR					
17. b)	Unit - II	CO2	K4		
18. a)	Unit - III	CO3	K3		
OR					
18. b)	Unit - III	CO3	K3		
19. a)	Unit - IV	CO4	K4		
OR					
19. b)	Unit - IV	CO4	K4		
20. a)	Unit - V	CO5	K3		
OR					
20. b)	Unit - V	CO5	K3		

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)**RESEARCH CENTRE OF PHYSICS****FOR THOSE WHO JOINED IN 2023-2024 AND AFTER**

Course Name	Analysis of Climate Change			
Course Code	23UPHSC61	L	P	C
Category	Skilled	2	-	2

COURSE OBJECTIVES:

This course aims to provide background of the Physics theory in Climate Change issues through analysis.

- Develop the knowledge and skills necessary to address climate Change
- Incorporate climate change mitigation solutions into national planning, policies, and strategies
- Encourage strategies that increase the ability to plan and manage successful climate change
- Increase ability to adapt and withstand climate-related risks and natural disasters
- To enhance the services provided by carbon sequestration

UNIT - I Concept of Climate Change	06
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Concept of climate change – climate change and environment-Lesson on poverty and climate change. Analysis on forest management and climate change.

UNIT - II Global Warming	06
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Global warming, sustainable development and World Trading Organization – climate change debates and India's response to International climate policy.

UNIT - III Climatic Policies	06
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Climate change - India's response to International climatic policies- Climatic policies.

UNIT - IV Climate Change and Energy	06
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India's Renewable Energy achievements and targets – Climate change and Nuclear energy implications on climate change and Institutions.

UNIT - V Carbon Trading	06
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Carbon Trading-Concept of personal carbon trading – Carbon tax – Carbon taxes compared to Cap- and – trade –Conclusion.

Total Lecture Hours	30
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BOOKS FOR STUDY:

- Study material will be given

BOOKS FOR REFERENCES:

- Dr.Devesh Bhowmik, Climate Change –The Introductory Analysis- Shandilya Publications, Newdelhi -2020

WEB RESOURCES:

❖ 1. Climate Change 2022: Impacts, Adaptation & Vulnerability
<https://youtu.be/SDRxfuEvqGg?si=gETceAPv2-PcqedY>

❖ 2. Climate Indicators and Sustainable Development
https://youtu.be/Xbgfl7bI_SE?si=2b8ssCP1wndzmPju

❖ 3. What is the 'Paris Agreement', and how does it work?
<https://youtu.be/5THr3bFj8Z4?si=2g9NUa2Z6pBbhm3i>

4. Nuclear Energy: Solution to Climate Change?
https://youtu.be/ihHtbBq9E1Y?si=QskGqZK_Fp7fZWk0

5. Here's what a carbon tax could mean for you | FT
https://youtu.be/EbF4s2LF_kg?si=kLdEWxGhUw1_FBJ4

Nature of Course	EMPLOYABILITY				SKILL ORIENTED				ENTREPRENEURSHIP			✓
Curriculum Relevance	LOCAL		REGIONAL		✓	NATIONAL				GLOBAL		
Changes Made in the Course	Percentage of Change				No Changes Made				New Course			✓
*Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.												

COURSE OUTCOMES:	K LEVEL
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After studying this course, the students will be able to:

CO1	Remembering the concepts of climate change	K1 to K2
CO2	Understanding the principles of global warming	K1 to K2
CO3	Recalling the climate policies	K1 to K2
CO4	To know about the nuclear energy implications on climate change	K1 to K2
CO5	Understanding the various types carbon tax	K1 to K2

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	3	3	3	2	3	2
CO2	2	3	3	3	2	3	3	2	2	2
CO3	3	3	3	2	3	3	3	2	3	2
CO4	3	3	3	3	3	3	3	2	2	2
CO5	3	2	3	3	3	3	3	2	2	3
S- STRONG			M – MEDIUM				L - LOW			

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	1	3	-	2
CO 2	3	1	3	-	2
CO 3	2	1	3	-	2
CO 4	2	1	3	-	3
CO 5	2	1	3		2
WEIGHTAGE	3	3	3	3	3
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	3.0	3.0	3.0	3.0	3.0

LESSON PLAN:

UNIT	Analysis of Climate Change	HRS	PEDAGOGY
I	Concept of climate change – climate change and environment-Lesson on poverty and climate change. Analysis on forest management and climate change.	6	Chalk & Talk, Videos, PPT
II	Global warming, sustainable development and W.T.O – climate change debates and India's response to International climate policy.	6	Chalk & Talk, Videos, PPT
III	Climate change - India's response to International climate policy- Climate policy	6	Chalk & Talk, Videos, PPT
IV	India's Renewable Energy achievements and targets – Climate change and Nuclear energy implications on climate change and Institutions.	6	Chalk & Talk, Videos, PPT
V	Carbon Trading-Concept of personal carbon trading – Carbon tax – Carbon taxes compared to Cap- and – trade –Conclusion.	6	Chalk & Talk, Videos, PPT

Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)				
Internal	Cos	K Level	Section A	
			MCQs	
			No. of. Questions	K - Level
CI AI	CO1	K1 – K2	25	K1,K2
	CO2	K1 – K2	25	K1,K2
CI AII	CO3	K1 – K2	25	K1,K2
	CO4	K1 – K2	25	K1,K2
Question Pattern CIA I & II		No. of Questions to be asked	50	
		No. of Questions to be answered	50	
		Marks for each question	1	
		Total Marks for each section	50	

* Two Formative examinations will be conducted as a part of Continuous Internal Assessment under which, 50 MCQ's will be asked [50X1=50 marks] from any 4 CO's. (Ist Test-2 CO's & IInd Test-2 CO's) in equal weightage

Distribution of Marks with K Level CIA I & CIA II					
	K Level	Section A (Multiple Choice Questions)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	30	30	60	100
	K2	20	20	40	
	K3				
	K4				
	Marks	50	50	100	100
CIA II	K1	30	30	60	100
	K2	20	20	40	
	K3				
	K4				
	Marks	50	50	100	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

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

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)				
S. No	COs	K - Level	Section A (MCQs)	
			No. of Questions	K – Level
1	CO1	K1-K2	15	K1,K2
2	CO2	K1-K2	15	K1,K2
3	CO3	K1-K2	15	K1,K2
4	CO4	K1-K2	15	K1,K2
5	CO5	K1-K2	15	K1,K2
No. of Questions to be Asked			75	
No. of Questions to be answered			75	
Marks for each question			1	
Total Marks for each section			75	
(Figures in parenthesis denotes, questions should be asked with the given K level)				

In summative examinations, 75 MCQ's will be asked [75X1=75 marks] from all 5 CO's in equal weightage.

Distribution of Marks with K Level				
K Level	Section A (Multiple Choice Questions)	Total Marks	% of (Marks without choice)	Consolidated %
K1	40	40	53	100
K2	35	35	47	
K3				
K4				
Marks		75	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.				