KALAIGNAR KARUNANIDHI GOVERNMENT ARTS COLLEGE FOR WOMEN

(AUTONOMOUS),PUDUKKOTTAI 622001

M.Sc. PHYSICS Programme

(CHOICE BASED CREDIT SYSTEM)

PG & Research Department of Physics

M.Sc Physics Syllabus

(For the candidate admitted from the academic year 2021 – 2022 onwards)

Kalaignar Karunanidhi Government Arts College for Women (Autonomous)
Pudukkkotai – 622 001
PG and Research Department of Physics

Upon completion of M.Sc., Physics degree programme, postgraduates will be able to

PO-1: Elaborate advanced and contemporary concepts, principles, theories and advancements in relevant fields.

PO-2: Execute critical investigation through various approaches, methods and evaluation strategies.

PO-3: Use software tools and techniques to cope up with latest trends in technological development.

PO-4: Compose the results of scientific work effectively, comprehend reports, design, documentation and make effectual presentations.

PO-5: Formulate professional, ethical and social values to excel as team leaders entrepreneurs, administrators, educators and researchers.

Upon completion of M.Sc., Physics degree programme, post graduates will be able to

PSO-1: Inculcate the students as being capable of vital thinking in understanding in the field Of Physics.

PSO-2: Develop, apply and discriminate knowledge prompting innovation in the theory of Physics.

PSO-3: Utilizing the principles and concepts of Physics to practical problems by developing software and technical methods

PSO-4: Turn out the expertly prepared in the thurst area of Physics to think fundamentally, investigate conceivable outcomes and take advantage of chances decidedly.

PSO-5: Show best expectation of ethical and professional behaviour as well as to life long learning in order to become a researcher to analyze the properties of different materials to be useful society.

KALAIGNAR KARUNANIDHI GOVERNMENT ARTS COLLEGE FOR WOMEN (AUTONOMOUS), PUDUKKOTTAI 622001

COURSE PATTERN AND SCHEME OF EXAMINATION FOR M.Sc. PHYSICS

CHOICE BASED CREDIT SYSTEM

(For the candidates admitted from the academic year 2021-22

Sem.		Course Code	Title of the Course	Ins. Hrs	Credit	Exam Hrs	CIA	SE	Total
I	1	21PPH01	Mathematical Physics	6	5	3	25	75	100
	2	21PPH02	Classical and Relativistic Mechanics	6	5	3	25	75	100
	3	21PPH03	Electronics	6	5	3	25	75	100
	4	21PPH04P	General Experiments	6	4	3	25	75	100
	5	21PPHE1	Numerical Methods	6	4	3	25	75	100
			Total	**30**	**23**				**500**
II	6	21PPH05	Quantum Mechanics	6	5	3	25	75	100
	7	21PPH06	Thermodynamics and Statistical Mechanics	6	5	3	25	75	100
	8	21PPH07	Spectroscopy	6	5	3	25	75	100
	9	21PPH08P	Electronics Experiments	6	4	3	25	75	100
	10	21PPHE2	Advanced Physics	6	4	3	25	75	100
			Total	**30**	**23**				**500**
		21PPHSSC1	**Self Study Course – I (Astrophysics)**				25	75	**100**

	1	21PPH09	Solid State Physics	6	5	3	25	75	100
	12	21PPH10	Nuclear and Particle Physics	6	5	3	25	75	100
	13	21PPH11	Electromagnetic Theory	6	5	3	25	75	100
III	14	21PPH12P	Analog and Digital Experiments	6	4	3	25	75	100
	15	21PPHE3	Microprocessor and Microcontroller	6	4	3	25	75	100
			Total	**30**	**23**				**500**
		21PPHSSC2	**Self Study Course – II** **Communication Electronics**				25	75	**100**
	16	21PPH13	Material Science	6	5	3	25	75	100
	17	21PPH14P	Microprocessor and Programming in C	6	4	3	25	75	100
	18	21PPHE4	Nano Physics	5	4	3	25	75	100
IV	19	21PPHE5	Laser and Fiber optics	5	4	3	25	75	100
	20	21PPHPR	Project	8	4				100
			Total	**30**	**21**				**500**
			Grand Total	**120**	**90**				**2000**

OVERALL TOTAL – SEMESTER-WISE

Semester	No. of Courses	Marks	Credits
I	5	500	23
II	5	500	23
III	5	500	23
IV	5	500	21
	20	**2000**	**90**

OVERALL TOTAL – COURSE-WISE

Subject	No. of Courses	Credit/ Course	Total Credits	Marks
Core Course – Theory	10	5	50	1000
Core Course – Practical	4	4	16	400
Elective	5	4	20	500
Project	1	4	4	100
Total	**20**		**90**	**2000**

Core Course: Theory

Sl. No.	Semester	Title of the paper
1	I	Mathematical Physics
2		Classical and Relativistic Mechanics
3		Electronics
4	II	Quantum Mechanics
5		Thermodynamics and Statistical Mechanics
6		Spectroscopy
7	III	Solid State Physics
8		Nuclear and Particle Physics
9		Electromagnetic Theory
10	IV	Material Science

Core Course: Practical

Sl. No.	Semester	Title of the Paper
1	I	General Experiments
2	II	Electronics Experiments
3	III	Analog and Digital Experiments
4	IV	Microprocessor and Programming in C

Elective Paper

Sl. No.	Semester	Title of the Paper
1	I	Numerical Methods
2	II	Advanced Physics
3	III	Microprocessor and Microcontroller
4	IV	Nano Physics
5	IV	Laser and Fiber Optics

CONTINUOUS INERNAL ASSESMENT PATTERN – M.Sc.

THEORY

Examination	**Max. Marks**	**Converted to**
Mid Semester (1 ½ Hours)	40	5
End Semester (1 ½ Hours	40	5
Model (3 Hours)	75	5
Seminar	5	5
Assignment	5	5
Total		**25**

PRACTICAL

External:

Practical:	60 Marks
Record:	10 Marks
Viva:	5 Marks
Total:	**75 Marks**

Internal:

Model Exam:	15 Marks
(Max.: 75 marks reduced to 15)	
Record:	5 Marks
Viva:	5 Marks
Total:	**25 Marks**

Elective Course

Sl. No.	Course	Sub. Code	Title of the Course	Ins. Hrs.	Credit
1	Elective-I	21PPHE1	Any one from ELEC Group - I	6	4
2	Elective -II	21PPHE2	Any one from ELEC Group - II	6	4
3	Elective -III	21PPHE3	Any one from ELEC Group – III	6	4
4	Elective -IV	21PPHE4	Any one from ELEC Group – IV	5	4
5	Elective -V	21PPHE5	Any one from ELEC Group – V	5	4

Elective Courses

ELEC Group – I

1. Numerical Methods
2. Biomedical instrumentations

ELEC Group – II

1. Advanced Physics
2. Electronic Devices and Applications

ELEC Group – III

1. Microprocessor and Microcontroller
2. Medical Physics and Ultrasonics

ELEC Group – IV

1. Nanophysics
2. Integrated Electronics Circuits

ELEC Group – V

1. Laser and Fiber Optics
2. Crystal Growth and Thin Films

QUESTION PAPER PATTERN – M.Sc. Physics

THEORY

Part	Type	Qn. No.	Unit	Marks for each Qn.	Total Marks
A	Answer All the Questions	1 & 2	I	2	20
		3 & 4	II		
		5 & 6	III		
		7 & 8	IV		

		9 & 10	V		
B	Internal Choice – Answer All the Questions	11a / 11b	I	5	25
		12a / 12b	II		
		13a / 13b	III		
		14a / 14b	IV		
		15a / 15b	V		
C	Answer any Three Questions	16	I	10	30
		17	II		
		18	III		
		19	IV		
		20	V		
	External Marks CIA				75 25
	Max. Marks				**100**

Semester: I **Credits: 5**
Hours/Week: 6 **Code : 21PPH01**

CORE COURSE I: MATHEMATICAL PHYSICS

General Objective: Mathematics is indispensable to physics as every physical situation has a mathematical basis. The course deals with application of mathematical methods to solve problems in physics. Though mathematical physics is a broad subject, this course covers some of the essential areas such as Fourier series, tensors, complex analysis, group theory and special function.

Course Objectives:

1. To report the usefulness of Fourier series in solving problems.
2. To study the ideas of Tensor analysis and its applications.
3. To understand the ideas of complex numbers.
4. To know the concept of group theory.
5. To realize the theory of special functions.

UNIT 1: Fourier series, Integrals and Transforms:

1.1 Fourier series – Definition – Dirichlet's conditions

1.2 Fourier integrals – Physical application – Full wave rectifier

1.3 Fourier transforms – Sine and cosine transforms – Applicationto boundary value problems

1.4 Laplace transform – Properties – Laplace transform of integrals – Inverse Laplace transform–Application – Solution of differential equation.

UNIT 2: Tensor Analysis :

2.1 Introduction – Coordinate transformation

2.2 Summation convention – Contra variant, covariant and mixed tensors

2.3 Rank of a tensor - Symmetric and anti-symmetric tensors

2.4 Invariant tensors –The Quotient rule – Kronecker delta and the Levi-civita tensor

2.5 Contraction of tensors - Product rule – Tensors of higher Ranks–Taylor's expansion – Laurent's series.

UNIT 3: Complex Variables:

3.1 Functions of a complex variable – Single and multivalued functions -Analytic function

3.2 Complex integration – Cauchy's integral theorem and integral formula

3.3 Poles, residues and evaluation of integrals –Cauchy's residue theorem

UNIT 4: Group Theory:

4.1 Groups, Subgroups, and Classes – Invariant Subgroups, Factor Groups – Homomorphism and isomorphism

4.2 Group Representation – Reducible and irreducible Representations – Schur'sLemmas I and II Statement(no proof) The orthogonality theorem – Character of a Representation, Character Tables

4.3 Representation of Groups and Quantum Mechanics – The three dimensional Rotation group SO(3) – Some Applications of Group theory in Physics.

UNIT 5: Special functions:

5.1 Definition – Beta and Gamma functions – Interrelations

5.2 Legendre's differential equation and functions – Bessel's equation and functions – Hermite equation and functions – Laguerre equation and functions

Books for Study

1. Mathematical Physics (Sixth Edition), SatyaPrakash, Sultan Chand & Sons, New Delhi 2016.
2. Mathematical Physics, B.D. Gupta, Vikas Publishing House Pvt. Ltd, New Delhi, 2001.
3. Group theory, A.W. Joshi

Books for Reference

1. Applied Mathematics for Engineers and Physicists, L.A. Pipes and L.R. Harvill, McGraw Hill Book Company, Singapore, 1970.
2. Mathematical Physics, B.S. Rajput, PragatiPrakashan, Meerut, 2001.

Web Resources

1. https://www.mathpages.com/rr/s5-02/5-02.html.
2. http://www.cse.salford.ac.uk/physics/gsmcdonald/H-Tutorials/Fourier- series.
3. http://www.math.s.chiba-u.ac.jp/~yasuda/ippansug/CV-bookfi.pdf
4. https://web.mst.edu/~lmhall/SPFNS/spfns.pdf

Course Outcomes:

On completion of the course the student will be Able to

	Course Outcomes	**Knowledge level**
CO-1	Design advanced Mathematical formulation relevant to Physics.	K6
CO-2	Formulate the problem through various methods.	K6
CO-3	Solve the complex equations by iteration method using software.	K6
CO-4	Analyze the group of outcomes into scientific work	K6
CO-5	Formulate special functions in the process of theoretical description of a physical phenomenon and Categorize the types of special functions.	K6

Course Designer: Mrs.S.Mugeshini

Mapping Matrix of COs, POs and PSOs

Semester	*Title of the Course*					*Course Code*	*Hours*			*Credits*
I	*Mathematical Physics*					*21PPH01*	*6*			*5*
Course Outcomes	*Programme Outcomes*					*Programme Specific outcomes*				
	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PSO1*	*PSO2*	*PSO3*	*PSO4*	*PSO5*
CO 1	✓		✓		✓	✓	✓	✓		✓
CO 2	✓	✓		✓	✓		✓		✓	✓
CO 3		✓	✓	✓		✓	✓	✓	✓	
CO 4		✓	✓	✓		✓	✓	✓	✓	
CO 5	✓		✓		✓		✓	✓	✓	✓
Number of Matches: 35										

Mapping	*1-20*	*21-40*	*41-60*	*61-80*	*81-100*
Matches	*1-14*	*15-29*	*30-34*	*35-44*	*45-50*
Relationship	*Very poor*	*Poor*	*Moderate*	*High*	*Very High*

Semester: I **Credits: 5**
Hours / Week: 6 **Code: 21PPH02**

CORE COURSE II: CLASSICAL AND RELATIVISTICMECHANICS

General Objective:

To study the fundamental principles of Lagrangian and Hamiltonian dynamics and in turn to understand the basic ideas of quantum statistics and nonlinear dynamics

Course Objectives

1. To demonstrate the fundamental concepts inthe dynamics of system of particles
2. To represent the equations of motion for complicated mechanical systems using the Lagrangian and Hamiltonian formulation of classical mechanics.
3. To develop math skills as applied to physics.
4. Develops special theory of relativity and relevant advanced formulations. Eg.,four dimensional Minkowski space.
5. Investigate some of the consequences of relativity theory in electromagnetism.

UNIT 1: Fundamental Principles and Lagrangian Formulation

1.1 Mechanics of a system of particles - Conservation laws Constraints

1.2 D'Alembert's principle and Lagrange's equation

1.3 Application of Lagrange's equation – Simple pendulum

1.4 Hamilton's principle – Lagrange's equation of motion from Hamilton's principle.

UNIT 2: Hamilton's Formulation

2.1 Hamilton's equations from variational principle – Principle of least action

2.2 Canonical transformation – Infinitesimal canonical transformations

2.3 Lagrange and Poisson brackets

2.4 Hamiltonian – Jacobi method.

UNIT 3: Rigid Body Dynamics and Oscillatory Motion

3.1 Euler's angles – Moments and products of Inertia – Euler's equation of motion – Symmetrical top

3.2 Theory of small oscillations – Frequencies of free vibration and normal coordinates – Free vibrations of a linear triatomic molecule.

UNIT 4: Relativistic Kinematics

4.1 Review of basic ideas of special theory of relativity – Minkowsky's four dimensional spaces

4.2 Geometrical interpretation of Lorentz transformation of space and time.

4.3 Geometrical representation of simultaneity, contraction and dilation.

4.4 Applications of special theory of relativity – Relativistic harmonic oscillator.

UNIT 5: Relativity and Electromagnetism

5.1 Maxwell's field equations and Gauge transformations – Equations of motion for the potentials A and Φ.
5.2 Lorentz transformations of space and time in four vector form.
5.3 Invariance of Maxwell's field equations in terms of four vectors.
5.4 Relativistic Lagrangian and Hamiltonian of a charged particle in an electromagnetic field.

Books for Study

1 Classical Mechanics (III Edition), Herbert Goldstein, Charles Poole and John Safko,Pearson Education Pvt. Ltd., 2003.
2. Classical Mechanics, S.L.Gupta, V. Kumar and H.V. Sharma, PragatiPrakashan, Meerut, 1982.
3. Relativistic Mechanics, Prakash, PragathiPrakashan, Meerut, 1980.

Books for Reference

1. Classical Mechanics, C.R. Mondal, Prentice Hall of India Pvt. Ltd., New Delhi,2001
2. Classical Mechanics, N.C. Rana and P.S. Joag, Tata McGraw – Hill Publishing Company Ltd.,New Delhi, 2003

Web Resource

1. **https://www.damtp.cam.ac.uk/user/tong/dynamics.html**
2. **http://www.users.math.umn.edu/~moreyjc/pdfs/Classical_Mechanics_Leonard_Susskind_ClassNotes.pdf**

Course Outcome

On completion of the course the student will be able to

	Course Outcomes	**Knowledge level**
CO-1	Apply the principle of understand the motion of a system in any set of coordinates.	K6
CO-2	Apply the Hamiltonion approach for numerical integration in order to decrucible the motion of a system.	K6
CO-3	Analyze the proportion of rigid body under motion and the chances of translational, rotational motion.	K6
CO-4	Analyze the behaviour of objects in space and time.	K6
CO-5	Analyze how electromagnetic objects are altered under Lorentz transformation, discriminate the knowledge to Maxwell's theory of electromagnetism.	K6

Course Designer: Dr. R. SANTHAKUMARI

Mapping Matrix of COs, POs and PSOs

Semester	*Title of the Course*					*Course Code*	*Hours*			*Credits*
I	*Classical and relativistic mechanics*					*21PPH02*	*6*			*5*
Course Outcomes	*Programme Outcomes*					*Programme Specific outcomes*				
	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PSO1*	*PSO2*	*PSO3*	*PSO4*	*PSO5*
CO 1	✓		✓		✓	✓	✓	✓		✓
CO 2	✓	✓		✓	✓		✓		✓	✓
CO 3		✓	✓	✓		✓	✓	✓	✓	✓
CO 4		✓	✓	✓		✓	✓	✓	✓	
CO 5	✓		✓		✓	✓	✓	✓	✓	✓
Number of Matches:37										

Mapping	*1-20*	*21-40*	*41-60*	*61-80*	*81-100*
Matches	*1-14*	*15-29*	*30-34*	*35-44*	*45-50*
Relationship	*Very poor*	*Poor*	*Moderate*	*High*	*Very High*

Semester: I **Credits: 5**
Hours/Week: 6 **Code: 21PPH03**

CORE COURSE III: ELECTRONICS

General Objectives

On completion of the course the learner will know the construction and working of electronic devices and also to understand the applications of electronics devices.

Course Objectives:

1. To interpret SCR, TRIAC, DIAC and UJT – Characteristics
2. To identify operational amplifier characteristics
3. To distinguish types of Transducers
4. To compare Logic families
5. To construct BCD Decade counter

UNIT 1: Electronic Devices

1.1 SCR – Characteristics – Parameters – Control circuits using SCR, TRIAC, DIAC and UJT – Characteristics – Parameters

1.2 Relaxation oscillator – UJT control of SCR, LED, LCD, Voltage variable capacitors diodes.

UNIT 2: Op-Amp Applications

2.1 Basic operational amplifier characteristics – Inverting amplifier – phase shifter – Scale changer – Non-inverting amplifier – Differential amplifier.

2.2 Voltage to current converter and current to voltage converter – Logarithmic amplifier

2.4 Schmitt trigger – Sine wave generator – Phase shift oscillator and Wein's bridge oscillator – Square wave – Triangular wave.

UNIT 3: IC 555 Timer Circuits and Transducers

3.1 Introduction – IC 555 Timer – Astablemultivibrator – Monostable multivibrator – Bistablemunltivibrator – Schmitt trigger

3.2 Transducers – Classification – Resistive position transducer – Inductive pressure transducer – Capacitive pressure transducer – Piezoelectric transducer – Strain gauge – LVDT.

UNIT 4: Digital Integrated Circuits and Data-Processing Circuits

4.1 Logic families – Characteristics of logic families

4.2 RTL circuit – DTL circuit – TTL circuit – ECL circuit – I^2L circuit –

4.3 MOS families – PMOS circuit – NMOS circuit – CMOS circuit

4.4 Multiplexer – Demultiplexer – Decoder (BCD to Decimal) – Encoder (Decimal to BCD)

4.5 Parity generators and checkers – Magnitude comparator.

UNIT 5: Sequential Logic Design and SemiconductorMemories

5.1 Shift registers – Parallel in serial out and parallel in parallel out.

5.2 Asynchronous and synchronous counters – BCD Decade counter – 4-bit Modulus counters (Employing feedback) – Ring counter – Johnson counter.

5.3 Memory devices –ROM – PROM – EPROM – RAM – Formation of Memory Banks – SRAM – DRAM.

Books for Study

1. Digital Principles and Applications, Donald P Leach, Albert Paul Malvino and Goutam, Saha, Tata McGraw – HillPublishing Company Ltd., New Delhi, 2011.
2. Electronics, Fundamentals and Applications (Eleventh Edition), D. Chattopadhyay, P.C.Rakshit, New Age International Publishers, New Delhi, 2010.
3. Basic Electronics – Solid State, B.L.Theraja, S.Chand & Company Pvt. Ltd., New Delhi, 2014.

Books for Reference

1. Linear Integrated Circuits, D. Roy Choudhury and Shall Jain, WileyEastern Ltd., NewDelhi, 2005.
2. Modern Digital Electronics (3rd Edition),R.P. Jain, Tata McGraw-Hill PublishinglCompany Ltd, New Delhi, 2003.

Web source

1. **https://www.electronics-tutorials**
2. https://en.wikipedia.org/wiki
3. https://www.electronicshub.org

Course Outcomes:

On completion of the course the student will be able to

	Course Outcomes	**Knowledge level**
CO-1	Understand the principle and advancement in electronic circuits.	K5
CO-2	Develop a circuit using operational amplifier to solve numericalequations.	K4
CO-3	Apply the knowledge of IC's in designing electronic devices.	K6
CO-4	Apply the principle of digital electronics to interface the computer ,develop a software to control thedigital system.	K4
CO-5	Investigate a new device for storage using the principle of counters	K4

Course Designer: Dr.B.BHUVANESWARI

Mapping Matrix of COs, POs and PSOs

Semester	*Title of the Course*					*Course Code*	*Hours*			*Credits*
I	*Electronics*					*21PPH03*	*6*			*5*
Course Outcomes	*Programme Outcomes*					*Programme Specific outcomes*				
	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PSO1*	*PSO2*	*PSO3*	*PSO4*	*PSO5*
CO 1	✓		✓		✓	✓	✓	✓		✓
CO 2	✓	✓		✓	✓		✓		✓	✓
CO 3	✓	✓	✓	✓		✓	✓	✓	✓	
CO 4		✓	✓	✓		✓	✓	✓	✓	
CO 5	✓		✓		✓		✓	✓	✓	✓
Number of Matches:36										
Mapping	*1-20*		*21-40*			*41-60*	*61-80*			*81-100*
Matches	*1-14*		*15-29*			*30-34*	*35-44*			*45-50*
Relationship	*Very poor*		*Poor*			*Moderate*	*High*			*Very High*

Semester: I **Credits: 4**

Hours / Week: 6 **Code: 21PPH04P**

CORE COURSE IV – PRACTICAL - I: GENERAL EXPERIMENTS

(Any Fifteen experiments only)

General Objective: Apply the basic principles of optics, heat, electricity and magnetism by doing relevant experiments.

Course Outcomes:

CO-1: Determine n, q, σ- of a Elliptical and Hyperbolic fringes. (K5)
CO-2: Apply the principle of light and find out the charge of an electron, refractive index and Polarizability of liquids using spectrometer. (K3)
CO-3: Determine the thermal conductivity of the material using Forbe's method.(K5)
CO-4: Verify the value of Stefan's constant.(K5)
CO-5: Analyze the resistivity of crystal samples using Four probe method. (K4)

(Any 15 Experiments to be done)

1. Determination of n, q, σ-Elliptical fringes.
2. Determination of n, q, σ-Hyperbolic fringes.
3. Four probe method – Determination of resistivity of crystal samples.
4. Determination of Hall coefficient and carrier concentration in SemiconductorsHall Effect method.
5. Charge of an electron by spectrometer.
6. Polarizability of liquids by finding the refractive index at different Wavelengthsusing Spectrometer.
7. Determination of Susceptibility-Quincke's method
8. Determination of refractive index of liquids using biprism (by scale & TelescopeMethod).
9. Forbe's method of determining thermal conductivity.
10. Rydberg's constant- Spectrometer.
11. Determination of specific rotatory power of sugar solution by Polarimeter.
12. Determination of Susceptibility by Guoy' s method.
13. e/m- Magnetron method.
14. Stefan's constant.
15. Self inductance of a coil - Anderson Bridge.
16. Self inductance of a coil – Rayleigh's Bridge.
17. Determination of thickness of a given mica film by using Michelson's Interferometer.
18. Determination of wave length of the given source by using Michelson's Interferometer.
19. Determination of wave length of monochromatic source by using biprism (by scale & telescope method).
20. Hysteresis - Magnetometer method.

Course Designer: Dr.M.RAGAMATHUNNISA

Semester: I **Credits: 4**

Hours/Week: 6 **Code: 21PPHE1**

ELECTIVE COURSE I: NUMERICAL METHODS

General Objective: To apply the mathematical concepts of Numerical methods to solve physical problems.

Course Objectives

1. To introduce the basic concepts of solving algebraic and transcendental equations.
2. To introduce the numerical techniques of interpolation in various intervals in real life situations.
3. Analyze matrices and linear systems of equations.
4. To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.
5. To import some basic ideas about algorithms and some simple programs.

UNIT1: Algebraic and Transcendental Equations

1.1 Bisection method-Iteration method and order of convergence – Method of False position

1.2 Newton–Raphson method and order of convergence-Horner's method.

UNIT 2: Interpolation

2.1 Finite differences

2.2 Newton forward and backward interpolation

2.3 Interpolation with unequal intervals – Lagrange's interpolation formula – Central differences

2.4 Interpolation formulae – Gauss's forward and backward formulae – Divided Differences - Newton divided differences formulae.

UNIT 3: Matrices and Linear systems of equations

3.1 Rank of a matrix - Eigen values and Eigen vector of a matrix – Largest eigen value by power method

3.2 Gauss elimination method – Gauss-Jordon method – Gauss Seidal method –Crout's method – Inverse of a matrix - Gauss Elimination method and Crout's method.

UNIT 4: Solutions of Differential equations and Numerical Integration

4.1 Differential equations – Picard's method - Euler's method – Modified Euler's method

4.2 Runge-Kutta method (Second and Fourth order)

4.3 Numerical integration – Trapezoidal rule – Simpson's 1/3 rule and 3/8 rule- Error in Trapezoidal rule.

UNIT 5: Numerical Algorithms in C

5.1 Bisection method - Newton–Raphson method – Newton forward and backward interpolation

5.2 Gauss Elimination method – Gauss-Seidal method – Trapezoidal rule – Simpson's 1/3 rule – Euler's method- Runge-Kutta Method.

Books for Study

1. Numerical methods in Science and Engineering, M.K.Venkatarman, NationalPublishing Company, Chennai,1977.
2. Introductory methods of Numerical Analyis, S.S.Sastry,Prentice Hall of India Pvt. Limited,New Delhi,1983.

Book for Reference

1. Numerical Methods, S.Arumugam, A.Thangapandi Isaac, A.Somasundaram ,Scitech,Publications (India) Pvt. Ltd., Chennai, 2009.

Web Resource:

1. http://www.bspublications.net/downloads/0523a9f25106ff_M_III_ch_1.pdf
2. https://en.wikipedia.org/wiki/Numerical_methods_for_ordinary_differential_equations

Course Outcomes:

On completion of the course the student will be able to

	Course Outcomes	**Knowledge level**
CO-1	find different methods for solving algebraic equations.	K5
CO-2	develop a software for solving polynomials.	K6
CO-3	solve linear equations using various numerical methods.	K6
CO-4	analyze the advancement in the field of Mathematical physics.	K4
CO-5	execute a program in C language for iteration process.	K4

Course Designer: Mrs.G. AMUDHA

Mapping Matixof COs, POs and PSOs

Semester	*Title of the Course*					*Course Code*	*Hours*			*Credits*
I	*Numerical Methods*					*21PPHE1*	*6*			*5*
Course Outcomes	*Programme Outcomes*					*Programme Specific outcomes*				
	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PSO1*	*PSO2*	*PSO3*	*PSO4*	*PSO5*
CO 1	✓		✓		✓	✓	✓	✓	✓	✓
CO 2	✓	✓		✓	✓		✓		✓	✓
CO 3		✓	✓	✓		✓	✓	✓	✓	
CO 4		✓	✓	✓		✓	✓	✓	✓	✓
CO 5	✓		✓		✓		✓	✓	✓	
Number of Matches:36										

Mapping	*1-20*	*21-40*	*41-60*	*61-80*	*81-100*
Matches	*1-14*	*15-29*	*30-34*	*35-44*	*45-50*
Relationship	*Very poor*	*Poor*	*Moderate*	*High*	*Very High*

Semester: II **Credits: 5**
Hours / Week: 6 **Code: 21PPH05**

CORE COURSE V: QUANTUM MECHANICS

General Objective: Introduce Dirac's bra-ket formulation of quantum mechanics and make Learner familiar with various approximation methods applied to atomic, nuclear and solid-state physics, and to scattering

Course Objectives

1. To understand the Schrodinger wave equation and General formulation of wave Mechanics
2. To know about the fundamental quantum mechanical approximation
3. To solve the analytical problem using Approximation Methods
4. To understand an object by scattering theory
5. To understand massive particles propagating at all velocities up to those comparable to the speed of light through relativistic quantum Mechanics

UNIT 1: Schrödinger Equation and General Formulation

1.1 Schrödinger Equation (Time dependent and Time independent) – Physical interpretation and condition on the wave function

1.2 Ehrenfest's theorem – Expectation values- Postulates of Quantum mechanics-Hermitian operators and their properties

1.3 Commutator relations – Uncertainty relations with proof – Bra and ket vectors – Equation of motion -Schrödinger, Heisenberg and interaction pictures.

UNIT 2: One Dimensional and Three Dimensional Problems

2.1 One dimensional problem: Square well potential - Rectangular barrier potential – Transmission and reflection coefficients – Linear harmonic oscillator (Operator method).

2.2 Three dimensional: Central forces and reduction of two body problem- Particle in a spherical well - Hydrogen atom – Rigid rotator.

UNIT 3: Approximation Methods

1.1 Non-degenerate and degenerate perturbation theories

1.2 Stark effect in hydrogen atom

3.3 Application to ground state of helium atom -Variation method – WKB approximation in hydrogen atom.

UNIT 4: Scattering Theory

4.1 The scattering problem – Formulation - Cross sections - Scattering amplitude

4.2 Green's function approach – Born approximation and its validity

4.3 Partial wave analysis- Optical theorem – Phase shifts – Scattering length and effective range.

UNIT 5: Relativistic Quantum Mechanics

5.1 Klein-Gordon equation for a free particle and in an electromagnetic field

5.2 Dirac's equation for a free particle – Spin – Charge and current

densities – Dirac matrices -Negative energy states – Zitterbewegung – Spin angular - momentum – Spin-orbit coupling.

Books for Stud

1. Book of Quantum Mechanics, P. M. Mathews and K. Venkatesan, Tata McGrawHill Company Ltd., New Delhi, 2005.
2. Quantum Mechanics (Third Edition), V. Devanathan, Naroso Publishing House, NewDelhi, 2012.

Books for Reference

1. Quantum Mechanics, L. Schiff, Tata McGraw HillPublishing Company Ltd., New Delhi,1968.
2. Quantum Mechanics (4th Edition), V.K. Thankappan, Wiley Eastern Ltd.,New Delhi, 2013.
3. Advanced Quantum Mechanics (Seventh Edition), B.S. Rajput, PragatiPrakashan, 2007.
4. Advanced Quantum Mechanics, SathyaPrakash, PragatiPrakashan, 2007.

Web Resources

1. https://en.wikipedia.org/wiki/Schr%C3%B6dinger_equation
2. http://hitoshi.berkeley.edu/221a/WKB.pdf
3. https://youtu.be/Kxv6zVC-Kos

Course Outcomes:

On completion of the course the student will be able to

	Course Outcomes	**Knowledge level**
CO-1	give theoretical explanation for the motion or behaviors of matter on atomic and subatomic scale.	K2
CO-2	apply the technique of separation of variables to solve problems in more than one dimension.	K6
CO-3	investigate analytical procedures and approaches for developing solution in the form of function to the exact solution for non-linear problems.	K4
CO-4	provide explore standard tool to explore solid state system. For understanding the scattering of waves and particle.	K6
CO-5	solve relativistic problem prompting to particles.	K3

Course Designer: Dr. R. SANTHAKUMARI

Mapping Matrix of COs, POs and PSOs

Semester	*Title of the Course*					*Course Code*	*Hours*			*Credits*
II	*Quantum Mechanics*					*21PPH05*	*6*			*5*
Course Outcomes	*Programme Outcomes*					*Programme Specific outcomes*				
	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PSO1*	*PSO2*	*PSO3*	*PSO4*	*PSO5*
CO 1	✓		✓		✓	✓	✓	✓	✓	✓
CO 2	✓	✓		✓	✓	✓	✓		✓	✓
CO 3		✓	✓	✓		✓	✓	✓	✓	
CO 4		✓	✓	✓		✓	✓	✓	✓	✓
CO 5	✓		✓		✓		✓	✓	✓	✓
Number of Matches:38										
Mapping	*1-20*		*21-40*			*41-60*	*61-80*			*81-100*
Matches	*1-14*		*15-29*			*30-34*	*35-44*			*45-50*
Relationship	*Very poor*		*Poor*			*Moderate*	*High*			*Very High*

Semester: II **Credit: 5**
Hours/Week: 6 **Code: 21PPH06**

CORE COURSE IV: THERMODYNAMICS AND STATISTICAL MECHANICS

General Objective: By studying this course Laws of thermodynamics, entropy can be recalled. Analysing the transport phenomenon of gases, fluctuations in thermodynamic quantities. Creating knowledge connecting relativity with kinematics and electrodynamics.

Course Objectives:

1. Laws of thermodynamics establish an exact relation between heat and work.
2. Discuss the transport phenomenon of gases. ie., microscopic analysis of non equilibrium phenomenon.
3. Deals fluctuations in thermodynamic quantities.
4. Study of classical ideas on statistical mechanics.
5. Analyze the quantum based statistics – Bose-Einstein and Fermi-Dirac.Outline blackbody radiation, specific heat capacity of solids (Debye and Einstein theory)

UNIT 1: Laws of Thermodynamics and Entropy

1.1 First law of thermodynamics

1.2 Entropy - Entropy changes in reversible and irreversible processes – Increase of entropy

1.3 Formulation of the Second law of thermodynamics in terms of Entropy –Thermodynamic potentials –Gibb's-Helmholtz relation

1.4 Third law of thermodynamics – Consequences –Nernst's heat theorem.

UNIT 2: Transport Properties of Gases

2.1 Maxwell-Boltzmann distribution law of velocities – Experimental proof

2.2 Viscosity – Effect of temperature on viscosity - Effect of pressure on viscosity

2.3 Boltzmann transport equation - Boltzmann transport equation for electrons and Lorentz solution

2.4 Chambers equation –Sommerfield theory of electrical conductivity.

UNIT 3: Fluctuations in Thermodynamic Quantities

3.1 Mean-square deviation - Fluctuations in energy, pressure, volume and enthalpy

3.2 Probability of one dimensional random work –Brownian movement

3.3 Fokker-Planck equation – Solutions of Fokker-Planck equation.

UNIT 4: Classical Statistical Mechanics

4.1 Micro and macro states - Phase space and ensembles Canonical, Micro Canonical and Grand canonical ensembles

4.2 Liouville's theorem – Striling's approximation

4.3 Thermodynamical probability –Maxwell–Boltzmann distribution law Partition function – Distribution of momentum, energy and velocity.

UNIT 5: Quantum Statistical Mechanics

5.1 Distribution Laws- Bose-Einstein and Fermi-Dirac –
5.2 Photons - Black body radiation - Planck's law of radiation
5.3 Phonons – Specific heat and heat capacity of solids –
5.4 Einstein's theory – Debye's theory – Identical particles – Bose-Einstein condensation.

Books for Study

1. Heat Thermodynamics and Statistical Physics (24th Edition), S. S. Singhal, J. P.Agarwal, SathyaPrakash,PragatiPrakashan, Meerut, 2012.
2. Statistical Mechanics, S. L. Gupta and V. Kumar, PragatiPrakashan, Meerut, 2001

Books for Reference

1. Statistical Mechanics, Agarwal B. K. and Melin Eisner, Wiley Eastern Ltd.,New Delhi,1989.
2. Heat and Thermodynamics, A.K. Saxena and C.M. Tiwari, Narosa Publishing House Pvt. Ltd., New Delhi, 2014.

Web Resources

1. https://youtu.be/-2aw4fiMLQk
2. https://youtu.be/z4wwWAWYkOM
3. https://youtu.be/Ii7rgIQawko

Course Outcomes:

On completion of the course the student will be able to

	Course Outcomes	**Knowledge level**
CO-1	understand the basic laws of thermodynamics and composing it with entropy.	K1
CO-2	apply the principle of thermodynamics to characteristic the materials properties.	K6
CO-3	discuss the conceivable outcome of measurement of the thermodynamical quantities.	K6
CO-4	apply principles stastical mechanics to selected problem. Use the tools, methodolotices of physics to communicate upon and explanation.	K6
CO-5	apply technique from statistical mechanics to arrange of situation.	K6

Course Designer: Dr.M.RAGAMATHUNNISA

Mapping Matrix of COs, POs and PSOs

Semester	*Title of the Course*					*Course Code*	*Hours*			*Credits*
II	*Thermodynamics and Statistical mechanics*					*21PPH06*	*6*			*5*
Course Outcomes	*Programme Outcomes*					*Programme Specific outcomes*				
	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PSO1*	*PSO2*	*PSO3*	*PSO4*	*PSO5*
CO 1	✓	✓	✓		✓	✓	✓	✓	✓	✓
CO 2	✓	✓		✓	✓		✓		✓	✓
CO 3	✓	✓	✓	✓		✓	✓	✓	✓	
CO 4		✓	✓	✓		✓	✓	✓	✓	✓
CO 5	✓		✓		✓		✓	✓	✓	✓
Number of Matches:38										

Mapping	*1-20*	*21-40*	*41-60*	*61-80*	*81-100*
Matches	*1-14*	*15-29*	*30-34*	*35-44*	*45-50*
Relationship	*Very poor*	*Poor*	*Moderate*	*High*	*Very High*

Semester: II **Credits: 5**
Hours / Week: 6 **Code: 21PPH07**

CORE COURSE VII: SPECTROSCOPY

General Objective: Spectroscopy can be used to detect, identify and quantify information about the atoms and molecules.

Course Objective

The learners will be able to

1. Summarize the basic properties of electromagnetic spectrum.
2. Apply the theory of Ultra violet spectroscopy.
3. Analyze the Infrared light interacting with molecule.
4. Explain the basics of Raman spectroscopy.
5. Design the information of complex molecules from their spectra.

UNIT 1: Introduction to Spectroscopy

1.1 Introduction to spectroscopy- Properties of electromagnetic radiation
1.2 Electromagnetic spectrum-Different types of molecular energies
1.3 Interaction of electromagnetic radiation with matter Molecular absorption of electromagnetic radiation-Methods of excitation-Theoretical principles of atomic spectroscopy – Spectra of alkali metals [Sodium].

UNIT 2: Ultra–Violet Spectroscopy

2.1 Theory of UV spectra – Types of transitions in organic molecules - Shape of UV absorption curves
2.2 Instrumentation – Double beam system – Applications – Detection of functional groups.

UNIT 3: IR Spectroscopy

3.1 Infra-red Spectroscopy – Range of infrared radiation
3.2 Vibrating diatomic molecule as a harmonic oscillator – Anharmonicoscillator – Vibrating rotator
3.3 FTIR double beam IR Spectrometer – Applications of FTIR to identify the substances – Comparison of FTIR and dispersive IR – Applications of IR to inorganic complexes.

UNIT 4: Raman Spectroscopy

4.1 Principle – Difference between IR and Raman Spectra
4.2 Quantum theory of Raman Effect – Pure Rotational Raman Spectra – Vibrational - Rotational Raman Spectra
4.3 Instrumentation – Applications in Physical and Organic Chemistry -Advantages of Raman Spectra over IR.

UNIT 5: Resonance Spectroscopy

5.1 NMR spectroscopy – Basic principles – Experimental method – Chemical shift – Factors influencing chemical shift - Analysis of NMR spectra
5.2 ESR – Basic principle -Fine structure and hyperfine structure – g factor – ESR spectrometer – Free radical studies and biological applications.

Books for Study

1. Spectroscopy (Atomic and Molecular), V Edition,Gurdeep R. Chatwal,

Sham Anand,Himalaya Publishing House, Mumbai, 2016.
2. Fundamentals of Molecular Spectroscopy (V Edition), C. N. Banwell,McGraw-Hill Company Ltd., New York, 2013.
3. Elements of Spectroscopy (XV Edition), Gupta, Kumar and Sharma, PragatiPrakashan, Meerut, New Delhi, 2000.

Books for Reference

1. Introduction to Molecular Spectroscopy, G.M. Barrow, Tata McGraw-Hill CompanyLtd., Singapore, 1985.
2. Organic Spectroscopy Principles and Applications, Jagohan,Narosha Publishing House, New Delhi, 2011.
3. Elementary Organic Spectroscopy-Principles and Chemical Applications, Y. R. Sharma. S. Chand & Company Pvt. Ltd., New Delhi, 2011.

Web Resources

1. **https://jasconic.com/learning-center/theory-of-spectroscopy/uv-vis- spectroscopy/**
2. **https://microbenotes.com/infrred-ir-spectroscopy**
3. **https://www.mt.com/in/en/home/applications/L1-Autochem-Applications/Raman-spectroscopy.html.**

Course Outcomes:

On completion of the course the student will be able to

	Course Outcomes	**Knowledge level**
CO-1	Summarize advanced acknowledge aboutinteraction of electromagnetic radiation with matter.	K2
CO-2	Apply formalism based on molecular symmetry to provide materials properties.	K2
CO-3	Classify the vibrational spectra obtained using IR and FTIR techniques.	K4
CO-4	Measure the wavelength in the Raman spectra	K5
CO-5	Detect free radicals in solution and possible environmental conformation using ESR techniques detect magnetic properties of nuclei using NMR technique.	K6

Course Designer: DR. A. JANAK

Mapping Matrix of COs, POs and PSOs

Semester	*Title of the Course*					*Course Code*	*Hours*			*Credits*
II	*Spectroscopy*					*21PPH07*	*6*			*5*
Course Outcomes	*Programme Outcomes*					*Programme Specific outcomes*				
	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PSO1*	*PSO2*	*PSO3*	*PSO4*	*PSO5*
CO 1	✓		✓	✓	✓	✓	✓	✓	✓	✓
CO 2	✓	✓		✓	✓		✓		✓	✓
CO 3	✓	✓	✓		✓	✓	✓	✓	✓	
CO 4		✓	✓	✓		✓	✓	✓	✓	✓
CO 5	✓		✓	✓	✓		✓	✓	✓	✓
Number of Matches:40										

Mapping	*1-20*	*21-40*	*41-60*	*61-80*	*81-100*
Matches	*1-14*	*15-29*	*30-34*	*35-44*	*45-50*
Relationship	*Very poor*	*Poor*	*Moderate*	*High*	*Very High*

Semester: II **Credits: 4**

Hours / Week: 6 **Code: 21PPH08P**

CORE COURSE VIII – PRACTICAL - II: ELECTRONICS EXPERIMENTS
(Any Fifteen experiments only)

General Objectives

The working principles of the electronics circuits which is used in devices can be studied based on the theoretical aspects

Course Objectives

1. Developythe puzzling aspects of topics with which students typically struggle.(K6)
2. Outline the basics about a *555 Timer* IC.(K2)
3. Analyze the AC power control applications, such as lamp dimming, powerregulators and motor control.(K4)
4. Classify the mediums based on light absorption and transmission.(K4)

(Any Fifteen experiments only)

1. IC Regulated Power Supply – IC 7805.
2. Schmitt Trigger – IC 555 Timer.
3. Astablemultivibrator using IC 555.
4. Monostablemultivibrator using IC 555.
5. 12-0-12 Dual regulated power supply.
6. Schmitt Trigger – IC 741.
7. Phase shift network and Oscillator using IC 741.
8. Wien's bridge oscillator using IC 741.
9. Half and Full wave precision rectifier using IC 741.
10. Wave generators (Ramp, Square and Triangular) – IC 741.
11. Astablemultivibrator IC 741.
12. Characteristics of LVDT (Linear variable differential transformer).
13. Characteristics of Strain gauge.
14. Characteristics of load cell.
15. Relaxation oscillator-UJT.
16. Characteristics of LDR.
17. Characteristics of SCR.
18. Numerical aperture-Diode laser.
19. Particle size determination using He-Ne Laser.
20. Determination of wavelength of the given source-He-Ne laser.

Course Designer: Dr.R.SANTHAKUMARI

Semester: II **Credits: 4**

Hours / Week: 6 **Code:21PPHE2**

ELECTIVE COURSE II: ADVANCED PHYSICS

General Objective: To recall the concepts of crystal systems and spectroscopy.

Course Objectives

1. To analyze the development of scientific instruments and analytical methods, such as x-rays, electron microscopy, NMR, and scanning tunneling microscopy continues, research on crystal growth,Thin Films, Liquid state Physics, Spectroscopy and structure characterization have been entered an atomic level, which makes the understanding of the physical, chemical properties of the material.
2. To propose of objectives for necessary thin film solar-related research,
3. To Understand different methods of Thin Film Preparation
4. To propose for understanding the Physics of fluid
5. To develop the knowledge in characterization methods in order to analyze the materials properties.

UNIT 1: Introduction to Crystal Growth

1.1 Crystal growth techniques –

1.2 Methods of crystal growth – Solution growth - Slow cooling method – Slow evaporation method – High temperature solution growth – Crystal growth from melt –

1.3 Czochralski method - Bridgeman technique – Uses of single crystals.

UNIT 2: Fundamentals of Thin Films

2.1 Physical deposition methods – Vacuum evaporation technique – Sputtering - Reactive Sputtering -RF Sputtering –

2.2 Chemical deposition methods- Chemical vapour deposition – Chemical solution deposition – Properties of thin films – Application of thin films.

UNIT 3: Liquid State Physics

3.1 Intermolecular forces in liquids – Dipole–Dipole attraction – London dispersion forces – Hydrogen bonding

3.2 Ultrasonic interferometer – Principal, construction and working – Pulse echo technique and working

3.3 Thermodynamic parameters – Internal pressure and free volume – Acoustical parameters – Adiabatic compressibility – Intermolecular free length – Acoustic impedance – Rao's constant – Wada's constant.

UNIT 4: Spectroscopy

4.1 Introduction – Types of spectra – Emission spectra – Absorption spectra

4.2 Infrared spectroscopy – Sources – IR instrumentation –

4.3 Modes of vibrations of atoms in poly atomic molecules – Stretching vibration – Bending vibration –

4.4 Factors influences the vibrational frequencies – Coupled vibrations and Fermi resonance – Electronic effects.

UNIT 5: Characterization Techniques

5.1 Structural Properties – X-ray diffractometery(XRD) – Principle and instrumentation

5.2 Optical Properties – UV–Vis–NIR double beam Spectrophotometer

5.3 Electrical Properties – Four probe technique–

5.4 Anti Bacterial activity – Agar diffusion well method – Agar diffusion disc method.

Books for Study

1. Introduction to Thin Films,K.Ravichandran,K. Swaminathan and B. Sakthivel,Research India Publications, New Delhi, 2013.
2. Spectroscopy (Atomic and Molecular), V Edition,Gurdeep R. Chatwal, Sham Anand,Himalaya Publishing House, Mumbai, 2002.
4. Science and Technology of Ultrasonics, Baldev Raj, V. Rajendran and P. Palanichamy,Narosa Publishing House, New Delhi, 2009.

Books for Reference

1. Thin Film Fundamentals, A. Goswami, New Age international Private Ltd., New Delhi,2008.
2. Fundamentals of Molecular Spectroscopy (V Edition), C. N. Banwell, McGraw-Hill, Company Ltd., NewYork, 1999.
3. Materials Science, Dr. S. Jayakumar, R. K. Publishers, Coimbatore, 2003.

Web Resources

1. **http://oaji.net/articles/2017/1992-1514879124.pdf**
2. **https://en.wikipedia.org/wiki/Crystal_growth**
3. **https://en.wikipedia.org/wiki/Thin_film**

Course Outcomes:

On completion of the course the student will be able to

	Course Outcomes	**Knowledge level**
CO-1	elaborate the advanced concepts in the field of crystal growth.	K2
CO-2	expertised in the thin film technology.	K6
CO-3	become a researches to analyze the properties of materials in the liquid state.	K6
CO-4	become a researcher in the field of Bio technology to study the protein interaction.	K3
CO-5	introduce and investigate new materials in the thrust are of physics, to various application.	K4

Course Designer: Dr.R.SANTHAKUMARI

Mapping Matrix of COs, POs and PSOs

Semester	*Title of the Course*					*Course Code*	*Hours*			*Credits*
II	*Advanced Physics*					*21PPHE2*	*6*			*5*
Course Outcomes	*Programme Outcomes*					*Programme Specific outcomes*				
	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PSO1*	*PSO2*	*PSO3*	*PSO4*	*PSO5*
CO 1	✓		✓		✓	✓	✓	✓	✓	✓
CO 2	✓	✓		✓	✓	✓	✓		✓	✓
CO 3		✓	✓	✓		✓	✓	✓	✓	
CO 4		✓	✓	✓		✓	✓	✓	✓	✓
CO 5	✓	✓	✓		✓		✓	✓	✓	✓
Number of Matches:37										

Mapping	*1-20*	*21-40*	*41-60*	*61-80*	*81-100*
Matches	*1-14*	*15-29*	*30-34*	*35-44*	*45-50*
Relationship	*Very poor*	*Poor*	*Moderate*	*High*	*Very High*

Semester: II **Credits:2**
Hours / Week: **Code: 21PPHSSC1**

SELF STUDY COURSE I: ASTROPHYSICS

General Objective: To study the basics of solar system, eclipses, seasons andcalendars.

Course Objectives:

1. Recall the basics of the solar system.
2. Realize the basic ideas of Moon
3. Outline the solar and lunar eclipses
4. Summarize the calendars
5. Understand the uses of various Astronomical Instruments

UNIT 1: Solar system

1.1 Introduction – The Sun – Mercury - Venus – Mars – Jupiter – Saturn– Uranus– Neptune– Pluto.

UNIT 2: The Moon

2.1 Sidereal month - Synodic month

2.2 Daily motion of the moon - Age of moon - Phase of moon – Position of moon at rising and setting - Summer and winter full moons

2.3 Lunar day and lunar time - Earth shine – Tides.

UNIT 3: Eclipses

3.1 Introduction – Umbra and penumbra

3.2 Lunar eclipse – Solar eclipse – Duration of lunar and solar eclipse– Comparison of solar and lunar eclipses.

UNIT 4: Seasons and calendar

4.1 Seasons (Qualitative analysis) - Causes of seasons –

4.2 Lunar and Solar calendar– Egyptian– Mayan – Roman– Julian – Gregorian– World calendar - Indian National calendar– Tamil and Malayalam calendars.

UNIT 5: Astronomical Instruments

5.1 Sidereal clock – Chronometer - Gnomon- Heliometer – Sextant

5.2 Chronograph – Spectroscope- Radio telescope.

Book for Study

1. "Astronomy" by Prof. S. Kumaravelu and Prof. SusheelaKumaravelu, revised edition 2013.

Web Resources

1. https://en.wikipedia.org/wiki/Solar_System
2. https://en.wikipedia.org/wiki/Moon
3. https://en.wikipedia.org/wiki/History_of_calendars

Course Outcomes:

On completion of the course the student will be able to

	Course Outcomes	**Knowledge level**
CO-1	Summarize solar system	K2
CO-2	Analyze the Ddaily motion of the moon , Phase of moon, Summer and winter full moons	K4
CO-3	Evaluate the solar and lunar eclipses	K5
CO-4	Classify the Seasons and calendars	K5
CO-5	Develop the astronomical instruments	K6

Course Designer: Dr.K.RENUKA DEVI

Mapping Matixof COs, POs and PSOs

Semester	*Title of the Course*					*Course Code*	*Hours*		*Credits*	
II	**ASTROPHYSICS**					**21PPHSSC1**	*6*		*5*	
Course Outcomes	*Programme Outcomes*					*Programme Specific outcomes*				
	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PSO1*	*PSO 2*	*PSO3*	*PSO4*	*PSO5*
CO 1	✓		✓		✓	✓	✓	✓	✓	✓
CO 2	✓	✓		✓	✓		✓		✓	✓
CO 3		✓	✓	✓		✓	✓	✓	✓	
CO 4		✓	✓	✓		✓	✓	✓	✓	✓
CO 5	✓		✓		✓		✓	✓	✓	
Number of Matches:36										

Mapping	*1-20*	*21-40*	*41-60*	*61-80*	*81-100*
Matches	*1-14*	*15-29*	*30-34*	*35-44*	*45-50*
Relationship	*Very poor*	*Poor*	*Moderate*	*High*	*Very High*

Semester: III **Credits:5**
Hours/Week:6 **Code:21PPH09**

CORE COURSE IX: SOLID STATE PHYSICS

General Objectives: To discern the fundamentals of solid structure of materials. Deliberate the properties of phonons. Convey the knowledge of free electron Fermi gas and get wide-open to semiconductor energy bands and the methods of calculation.

Course Objectives:

1. Gain knowledge about Sommerfield model and free electron theory.
2. Apply wave equation in a periodic potential.
3. Analyze dielectric constant and dipole moments.
4. Appraise the mechanism of superconductors, and the applications superconductors.
4. Discuss the polarizability - electronic, ionic and orientational polarizabilities

UNIT 1: Lattice Vibrations and Phonons

1.1 Lattice vibrations - Elastic vibrations of continuous media
1.2 Group velocity of harmonic wave trains – Wave motions of one
1.3 dimensional atomic lattice – Lattice with two atoms for primitive cell – Optical properties in the infrared
1.4 Phonons – Momentum of Phonons - Inelastic scattering of photons by long wavelength phonons.

UNIT 2: Free electron theory

2.1 The free electron gas – Drude Lorentz electron theory – Ohm's law - Electrical and thermal conductivities – Sommerfield model – Energy levels and density of states in one dimension
2.2 Fermi–Dirac distribution – Spin paramagnetism of free electrons – Thermionic emission Richardson equation –Hall effect.

UNIT 3: Band theory of Solids

3.1 Wave equation in a periodic potential and Bloch theorem – Kronig–Penny model-Acceleration and the effective mass of the electron
3.2 Distinction between metals, insulators and semiconductors Intrinsic and extrinsic semiconductor –Carrier concentration in intrinsic semiconductor.

UNIT 4: Dielectrics

4.1 Dipole moment - Polar and non-polar dielectrics -Polarization - Local electric field at an atom – Depolarisation field - Lorentz field - Field of dipoles inside cavity
4.2 Clausius–Mosotti equation - Measurement of dielectric constant and dipole moments
4.3 Polarizability - Electronic, ionic and orientationalpolarizabilities
4.4 Dielectric losses – Dielectric break down.

UNIT 5: Superconductivity

5.1 Mechanism of superconductors - Effects of magnetic field - A.C. resistivity - Critical currents - Meissner effect

5.2 Thermalproperties– Entropy -Specificheat-Thermal conductivity-Energy gap -Isotope effect - Mechanical effects - Penetration depth

5.3 Type I and Type II super conductors – Cooper pairs - BCS theory – Quantum tunneling – Josephson effect

5.4 Applications of superconductors.

Books for Study

1. Solid State Physics, S.L. Gupta and V. Kumar, K. Nath& Company, EducationalPublishers, Meerut, 2018.
3. Solid State Physics, K. Ilangovan, MJP Publishers, Chennai, 2012.

Books for Reference

1. Introduction to Solid State Physics, C. Kittel, Wiley Eastern Ltd., New Delhi,2019.
2. Solid State Physics, R.L Singhal, KedarnathRamnath& Co., New Delhi 2018.
3. Solid State Physics, S. O. Pillai, New age International Publishers, New Delhi,2018.
4. Solid State Physics, M. A. Wahab ,Narosa Publishing House, New Delhi, 2015.

Web Resources

1. https://users.aber.ac.uk
2. https://www.accessscience.com
3. http://hyperphysics.phy-astr.gsu.edu

Course Outcomes:

On completion of the course the student will be able to

	Course Outcomes	**Knowledge level**
CO-1	apply the classical quantum mechanical theories needed to understand the physical properties of solids.	K6
CO-2	apply innovations in the electron theory and band theory of solids.	K6
CO-3	classify the materials according to the properties.	K6
CO-4	analyze the materials in the thrust-area of electronics.	K6

CO-5	apply the principles and concepts of semiconductors to develop new material magnetic Levitation train to increases the speed.	K6

Course Designer: Dr.R.BHUVANESWARI

Mapping Matrix of COs, POs and PSOs

Semester	***Title of the Course***					***Course Code***	***Hours***			***Credits***
III	***Solid state physics***					***21PPH09***	***6***			***5***
Course Outcomes	***Programme Outcomes***					***Programme Specific outcomes***				
	PO1	***PO2***	***PO3***	***PO4***	***PO5***	***PSO1***	***PSO2***	***PSO3***	***PSO4***	***PSO5***
CO 1	✓		✓	✓	✓	✓	✓	✓		✓
CO 2	✓	✓		✓	✓		✓		✓	✓
CO 3		✓	✓	✓		✓	✓	✓	✓	
CO 4		✓	✓	✓		✓	✓	✓	✓	
CO 5	✓		✓		✓	✓	✓	✓	✓	✓
Number of Matches:37										

Mapping	***1-20***	***21-40***	***41-60***	***61-80***	***81-100***
Matches	***1-14***	***15-29***	***30-34***	***35-44***	***45-50***
Relationship	***Very poor***	***Poor***	***Moderate***	***High***	***Very High***

Semester: III **Credits: 5**
Hours/Week: 5 **Code: 21PPH10**

CORE COURSE X : NUCLEAR AND PARTICLE PHYSICS

General Objectives: To make the students to study the nuclear structure, nuclear reactions, fusion and fission and elementary particles.

Course Objectives

1. Recall the basic properties of nuclei and nuclear models.
2. Outline the theory of scattering of alpha particles, and mass spectroscopy.
3. Analyze the nuclear decay and radioactivity of Alpha, Beta and Gamma rays.
4. Distinguish the type of nuclear reactions and interpret about nuclear reactors.
5. Discuss the classifications of elementary particles and conservation laws.

UNIT 1: Nuclear properties and models

1.1 Nuclear mass and binding energy – Semi-empirical mass formula - Nuclear size - Charge radius - Spin and parity

1.2 Magnetic dipole moment - Electric moments - Electric quadrupole moments - Isospin

1.3 Nuclear forces - Meson theory of nuclear forces - Models of nuclear structure - Liquid drop model - Shell Model - Collective Model.

UNIT 2: Nuclear structure

2.1 Scattering of alpha particles –Electromagnetic method – Mesonic X – rays

2.2 Mass spectroscopy – Basic components of mass spectroscope – Nier and Robert's spectrometer

2.3 Proton-Electron theory – Proton-Neutron theory- Neutron-Positron theory- Anti proton-Neutron theory.

UNIT 3: Nuclear Decay and Radioactivity

3.1 Theory of alpha disintegration - Fine structure of alpha decay

3.2 Energetics of beta decay - Neutrino hypothesis - Fermi theory of beta decay - Selection rules

3.3 Gmma ray spectra and nuclear energy level - Radioactive transition in nuclei - Nuclear isomerism - Internal conversion – Resonance fluorescence.

UNIT IV: Nuclear Reactions

4.1 Types of nuclear reactions - Conservation laws – Fission – Fusion - Nuclear reaction kinematics - Nuclear cross section -

4.2 Briet Wigner dispersion formula and interpretation - Direct reaction - Striping and pick up reactions - Nuclear fission - Energy released in fission - Bohr Wheeler theory of Fission

4.3 Nuclear chain reaction – Four factor formula - Nuclear reactor -Disposal of radioactive waste – Nuclear fusion – Thermo nuclear reaction – Controlled thermo nuclear reaction.

UNIT V: Particle Physics

5.1. Introduction - Classification of elementary particle

5.2 Fundamental interaction - quantum numbers - Antiparticles
5.3 Resonances - Law in production and decay process - Conservation laws
5.4 Special symmetric groups - GelmanNeuman theory - Quark model - SU3 symmetry
5.5 Unification of fundamental interactions - CPT invariance and applications of symmetry arguments to particle reaction - Parity non conservation in week interaction

Books for Study

1. Nuclear Physics, S.N. Ghoshal, S. Chand & Company Pvt. Ltd., New Delhi, 2014.
2. Nuclear Physics, D. C. Tayal, Himalaya Publishing House, Mumbai, 2014.
3. Nuclear Physics (Second Edition), V. Devanathan, Narosa Publishing House Pvt.Ltd., New Delhi, 2013.

Books for Reference

1. Nuclear Physics, K. Ilangovan, MJP Publishers, Chennai, 2012.
2. Nuclear Physics (Second Edition), Irwing Kaplan, Addison-Wesley PublishingCompany, 1972.
3. Basic Ideas and Concepts in Nuclear Physics, II ed.,Heyde, K. 2005. OverseasPress, ISBN 81- 88689-08-4.

Web Resources:

1. https://en.wikipedia.org/wiki/Semi-empirical_mass_formula
2. https://qsstudy.com/physics/proton-neutron-theory
3. https://www.radioactivity.eu.com/site/pages/Neutrino_Hypothesis

Course Outcomes:

On completion of the course the student will be able to

	Course Outcomes	**Knowledge level**
CO-1	expand the knowledge of both initiately small and extremely large particles exists in the universe.	K2
CO-2	understand and explain phenomena in high energy nuclear physics and research the behaviour of nuclei under extreme condition.	K6
CO-3	apply nuclear physics and methods from the field of research, energy and medicine.	K3
CO-4	develop new instruments for the fields of space technology.	K5
CO-5	research the building blocks of the universe to understand dark matter and the origin and evolution of the universe.	K4

Course Designer: Dr.K.KARTHIKEYANI VIJAYAKUMARI

Mapping Matrix of COs, POs and PSOs

Semester	*Title of the Course*					*Course Code*	*Hours*			*Credits*
III	*Nuclear and particle Physics*					*21PPH10*	*5*			*5*
Course Outcomes	*Programme Outcomes*					*Programme Specific outcomes*				
	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PSO1*	*PSO2*	*PSO3*	*PSO4*	*PSO5*
CO 1	✓		✓		✓	✓	✓		✓	✓
CO 2	✓	✓		✓	✓		✓		✓	✓
CO 3		✓	✓	✓		✓	✓	✓	✓	
CO 4		✓	✓	✓		✓	✓		✓	✓
CO 5	✓		✓		✓		✓	✓	✓	✓
Number of Matches:35										

Mapping	*1-20*	*21-40*	*41-60*	*61-80*	*81-100*
Matches	*1-14*	*15-29*	*30-34*	*35-44*	*45-50*
Relationship	*Very poor*	*Poor*	*Moderate*	*High*	*Very High*

Semester: III **Credits: 5**
Hours / Week: 5 **Code: 21PPH11**

CORE COURSE XI: ELECTROMAGNETIC THEORY

General Objective: This course provides various laws in Electrostatics, Magnetostatics and its consequences. In electromagnetics Maxwell's equation, concept of gauge, gauge transformation can be analysed. Wave analysis provides knowledge about waveguides and TE and TM waves. Propagation of electromagnetic waves in different media can be analysed.

Course Objectives

1. Apply Green's function and find the boundary value problems in electrostatics.
2 Recall the basic laws in magnetostatics and apply it to find its boundary condition.
3. Analyze the concepts of displacement current and apply it to derive Maxwell's equation.
4. Summarize the reflection and refraction of electromagnetic waves.
5. Apply and analyze the concepts of interaction of electromagnetic waves with macroscopic matter.

UNITI: Electrostatics

1.1 Electric field – Gauss Law – Scalar potential – Surface distribution of charges and dipoles –

1.2 Poisson and Laplace Equations – Green's theorem – Dirichlet and Neumann boundary conditions – Electrostatic boundary value problems

1.3 Method of Images – Illustrations : Point charge in thepresence of (i) a grounded conductingsphere (ii) a charged, insulated and conducting sphere.

UNITII: Magnetostatics

2.1 Biot-Savart law – Force between current carrying conductors

2.2 Differential equations ofmagnetostatics and Ampere's law – Vector potential

2.3 Magnetic field of a localized currentdistribution, magnetic moment – Force and torque and energy of a localized current distribution in an external magnetic induction

UNIT III: Electromagnetics

3.1 Equation of continuity - Maxwell's displacement current – Maxwell equations – Maxwell equations in terms of vector and scalar potentials –

3.2 Concept of gauge - Gauge transformations – Lorentz gauge, Coulomb gauge

3.3 Poynting's theorem – Conservation of energy and momentum for a system of charged particles and electromagnetic fields.

UNIT IV: Wave Analysis

4.1 Wave analysis – Wave equation– Plane waves – Spherical waves

4.2 Boundary Conditions - Phase and Phase velocity – Group velocity

4.3 Reflection and refraction of Electromagnetic wave - Wave guide (Rectangular) – TE waves and TM waves.

UNIT V: Interaction of E.M.W with Matter

5.1 Electromagnetic waves in free space – Propagation of electromagnetic waves in Anisotropic dielectrics

5.2 Scattering and scatting parameters – Dispersion Normal and Anomalous – Dispersion in liquid and solids – Retarded potentials

5.3 Radiation from an oscilliry dipole – Radiation from a linear Antenna – 4 Vectors and Tensors.

Books for Study

1. Electromagnetic theory (Sixth edition), Chopra Agrawal, K. Nath& Company, Meerut, 2016.
2. Classical Electrodynamics, J. D. Jackson, Wiley Eastern Ltd., New Delhi, 2015.

Book for Reference

1. Introduction to Electrodynamics, D. Griffiths, Prentice-Hall, New Delhi, 1999.
2. The Feynman Lectures on Physics (Vol. II), R. P. Feynman et al., NarosaPublishingHouse,New Delhi, 1989.

Web Resources

1. https://youtu.be/ FS6csrxBPU
2. https://youtu.be/4sHmSF2tJKg
3. https://www.slideshare.net/sunilrathore77398/waveguidesppt

Course Outcome

On completion of the course the student will be able to

	Course Outcomes	**Knowledge level**
CO-1	develop and design various engineering applications involving electrmagnetic fields.	K2
CO-2	provides laboratory explosive to analyze the theory of magnetostatics.	K4
CO-3	applymaxwell's equations to determine field waves; energy and charge conservation conditions.	K6
CO-4	analyze the measurement of the influence of boundaries on waves.	K3
CO-5	devise an instrument for above polarization.	K6

Course Designer: Dr.M. RAGAMATHUNNISA

Mapping Matrix of COs, POs and PSOs

Semester	*Title of the Course*					*Course Code*	*Hours*			*Credits*
III	*Electromagnetic Theory*					*21PPH11*	*6*			*5*
Course Outcomes	*Programme Outcomes*					*Programme Specific outcomes*				
	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PSO1*	*PSO2*	*PSO3*	*PSO4*	*PSO5*
CO 1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 2	✓	✓		✓	✓		✓		✓	✓
CO 3		✓	✓	✓		✓	✓	✓	✓	
CO 4		✓				✓	✓	✓	✓	✓
CO 5	✓		✓		✓	✓	✓	✓	✓	✓
Number of Matches:38										

Mapping	*1-20*	*21-40*	*41-60*	*61-80*	*81-100*
Matches	*1-14*	*15-29*	*30-34*	*35-44*	*45-50*
Relationship	*Very poor*	*Poor*	*Moderate*	*High*	*Very High*

Semester: III **Credits: 4**
Hours/Week: 6 **Code: 21PPH12P**

CORE COURSEXII – PRACTICAL - III: ANALOG AND DIGITAL EXPERIMENTS
(Any 15 experiments)

General Objectives: To design various electronic circuits using IC and operational amplifiers.

Course Outcomes:

On completion of the course the student will be able to

1. To design Multiplexer and Demultiplexer and flip-flops.(K6)
2. To construct a Digital comparator using XOR and NAND gates.(K6)
3. To examine Boolean expressions using basic logic gates. (K4)
4. To construct a D/A converter using an Op-amp circuit. (K6)

(**Any 15 experiments)**

1. Study of Multiplexers
2. Study of Demultiplexers
3. Study of R-S Flip-Flop, D Flip-Flop and J-K Flip-Flop
4. Simplification of Boolean expressions - Basic logic gates
5 Simplification of Boolean expressions - Karnaugh map method
6. Half adder and Full adder
7. Half subtractor and Full subtractor
8. Digital comparator using Basic gates
9. Study of D/A converter – Resistance and ladder method
10. Four bit binary up counter using IC 7473
11. Four bit Down counter using IC 7473
12. Four bit binary adder/subtractor using IC 7483
13. Solving simultaneous equations – Operational amplifier
14. Integrator and Differentiator - Operational amplifier
15. Study of 7 segment display decoder 7447
16. Four bit Ring counter using IC 7473
17. Shift Register using IC 7473
18. Study of RAM
19. Modulus counters using IC 7473
20. Study of counters (0-9 and 0-99)
21. BCD adder
22. Decade counter 7490
23. Study of Arithmetic Logic Unit (ALU) – IC 74181

Course Designer: Dr.K.RENUKA DEVI

Semester: III **Credits: 4**
Hours / Week: 6 **Code: 21PPHE3**

ELECTIVE COURSE III: MICROPROCESSOR AND MICROCONTROLLER

General Objective: To study the basics of Microprocessors and Microcontroller 8051.

Course Objectives:

1. Recall the architecture and interfacing of 8085 microprocessors.
2. Apply the knowledge on peripheral devices
3. Summarize the concepts of 8085 microprocessor assembly language programmes.
4. Identify the basic concepts of 8051 microcontroller.
5. Examine the ideas on Microcontroller 8051 Instruction sets

UNIT I: Microprocessor Architecture and Interfacing

1.1 Intel 8085 Microprocessor architecture – Pin configuration – Instruction cycle – Timing diagram –

1,2 Instruction and data formats – Addressing modes – Intel 8085 instructions – Memory and I/O interfacing –

1.3 Data transfer schemes – Synchronous data transfer – Asynchronous data transfer

1.4 Interrupt driven data transfer –Interrupts of Intel 8085.

UNIT II: Peripheral devices and Microprocessor Applications

2.1 Programmable peripheral interface – Architecture of Intel 8255

2.2 Control word –- Programmable Interrupt Controller (PIC) Intel 8259

2.3 Analog to digital (A/D) converter – Clock for A/D converter

2.4 Block diagram of ADC 0800 – Interfacing of ADC 0800 – Digital to Analog Converter (DAC) – DAC 0800 – Stepper motor –Microprocessor-based traffic control.

UNIT III: Assembly language Programs

3.1 Assembly language – Examples of assembly language programs – Largest and smallest number in a data array – To arrange a series of numbers in descending order and ascending order – Sum of a series of a 8-bit numbers –

3.2 Multi byte addition – Multi byte decimal addition - Sum of a series of multi byte decimal numbers – Multi byte subtraction – Square root of a number - Block movement of data.

UNIT IV: Microcontroller 8051

4.1 Comparison of microprocessor and microcontroller - Features of 8051 – Architecture – Pin configuration –

4.2 Memory organization - External data and program memory

4.3 Input/output pins, Ports and circuits - Timers/Counters and their programming – Serial Port and their programming –

4.4 Interrupt Structure – External interrupts – Addressing modes.

UNIT V: 8051 Instruction set and Programming

5.1 Instruction set – Data transfer instructions – Arithmetic instructions – Logical instructions – Boolean variable manipulation instructions – Program and machine control instructions –

5.2 Simple programs – Addition of two 8-bit numbers – Addition of two 16-bit numbers – 2's complement – Unpacked the packed BCD number – Subtraction of two 8-bit number – Division – Multiplication - Largest number from a given 8-bit numbers – Ascending order.

Books for Study

1. Fundamentals of Microprocessor and Microcomputers, B. Ram, DhanpatRai Publications (P) Ltd., New Delhi, 2006.
2. Microprocessors and Microcontrollers (5th Edition), Atul. P. Godse, Deepali A. Godse, Technical Publications, Pune, 2008.

Books for Reference

1. Fundamentals of Microprocessor–8085 Architecture, Programming and Interfacing, V. Vijayendran, S. Viswanathan (Printers & Publishers), Pvt. Ltd., Chennai, 2006.
2. Microprocessor Architecture, Programming and Applications with the 8085 (5th Edition), Ramesh Gaonkar, Penram International Publishing (India) Pvt. Ltd, Mumbai, 2006.

Web Resources

1. http://lecturenotes.in/subject/22/microprocessor-and-microcontroller- mpmc
2. https://mrcet.com/downloads/digital notes/ECE/III%20Year/mpmc%20digtal%20notes.pdf
3. http://www.gpcet.ac.in/wp-content/uploads/2018/03/UNIT-5-MPI-LECTURE-NOTES.pdf
4. https://www.ic.unicamp.br/~pannain/mc404/aulas/pdfs/Art%20Of%20Intel%20x86%20Assembly.pdf

Course Outcomes:

On completion of the course the student will be able to

	Course Outcomes	**Knowledge level**
CO-1	Discuss the basic principles of microprocessor and its interfacing.	K2
CO-2	Applythe knowledge for architecture 8255 and 8259 and some of the microprocessor applications.	K3
CO-3	Develop a software programs through laboratory experiments.	K5
CO-4	Discuss the basic ideas of microcontroller 8051.	K6

CO-5	Formulate the simple programs using microcontroller 8051.	K5

Course Designer: Dr.R.BHUVANESWARI

Mapping Matrix of COs, POs and PSOs

Semester	*Title of the Course*					*Course Code*	*Hours*			*Credits*
III	*Microprocessor and Microcontroller*					*21PPHE3*	*6*			*5*
Course Outcomes	*Programme Outcomes*					*Programme Specific outcomes*				
	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PSO1*	*PSO2*	*PSO3*	*PSO4*	*PSO5*
CO 1	✓	✓	✓		✓	✓	✓	✓		✓
CO 2	✓	✓	✓	✓		✓	✓	✓	✓	
CO 3	✓	✓	✓			✓	✓	✓		
CO 4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 5	✓	✓	✓				✓	✓	✓	
Number of Matches:38										

Mapping	*1-20*	*21-40*	*41-60*	*61-80*	*81-100*
Matches	*1-14*	*15-29*	*30-34*	*35-44*	*45-50*
Relationship	*Very poor*	*Poor*	*Moderate*	*High*	*Very High*

Semester: III **Credits: 4**
Hours/Week: 6 **Code: 21PPSSC2**

SELF STUDY COURSE II: COMMUNICATION ELECTRONICS

General Objective: To understand the basic ideas of Radio, Microwave, Satellite, Fiber optic and digital communication systems.

Course Objectives

1. Explain the concepts of modulation, transmission and detection in radio communication systems.
2. Discribe the microwave communication especially the working of television.
3. Discuss the basics of RADAR communication.
4. Classify the optical fiber transmission link, fiber modes configurations and structures in fiber optic communication.
5. Analyze and apply the concepts and principles of mobile and satellite communication systems

UNIT 1: Radio Communication

1.1 Modulation – Theory of amplitude modulation and modulation index – Frequency modulation

1.2 AM transmitter – Direct FM transmitter - AM receiver – Tuned radio frequency receiver – Super heterodyne receivers- FM receiver

1.3 Basic principles of demodulation – The diode detector.

UNIT 2: TV Communication

2.1 Television – Principle of interlaced scanning -

2.2 TV camera system – Image orthicon – Vidicon – Principle of colour Television

2.3 PAL colour receiver – Colour Television - Picture tube –

2.4 High definition TV – LCD TV.

UNIT 3: Radar Communication

3.1 Basic Radar system – Radar range equation – Block diagram of a pulsed Radar system –

3.2 Plan position indicator – Search and Tracking Radar – Moving target indicator

3.3 Radar bacons – Range equation for Bacons - Applications.

UNIT 4: Optical Fibre Communication

4.1 Optical fibre transmission link - Development of optical fibre communications -

4.2 Classification of fibers and ray path – Step index fiber – Graded index fiber – Advantages of multimode fibers - Numerical aperture for step index fiber – Single path through optical data Link –

4.3 Block diagram of an optical receiver – Optical fibre communication system.

UNIT 5: Mobile and Satellite Communication

5.1 Cellular Mobile Communication - The concept of a cell – Basic cellular mobile radio system – The cell phone -

5.2 Satellite communication system – Satellite orbits – Geostationary orbit – Geosynchronous orbit – Basic components of satellite communication system –

5.3 Constructional features of satellites – Multiple access – FDMA – TDMA – SPADE – Communication package – Satellite communication in India.

Books for Study

1. Principles of Communication Engineering, Anokh Singh, A.K. Chopra, S.Chand& Company Ltd., New Delhi, 2006.
2. Optoelectronics and Fiber Optics Communication, C.K.Sarkar and D.C.Sarkar, NewAge International Pvt. Ltd., New Delhi, 2001.

Book for Reference

1. Semiconductor Physics and Optoelectronics, P.K.Palanisamy, Scitech Publications (India) Pvt. Ltd., Chennai, 2003.
2. Fiber Optic Communications, Joseph C. Palais, Prentice Hall International Editions, New Jersey, 1998.
3. Communication Electronics, N.D. Deshpande, D.A. Deshpande, P.K. Rangole, TataMcGraw-Hill Publishing Company, Ltd., New Delhi, 2000.

Web Resources

1. https://www.electronics-notes.com/articles/radio/modulation/amplitude-modulation-am.php
2. https://www.elprocus.com/radar-basics-types-and-applications/
3. https://www.britannica.com/technology/satellite-communication

Course Outcomes:

On completion of the course the student will be able to

	Course Outcomes	**Knowledge level**
CO-1	Discuss the concepts of modulation, transmission and detection in radio communication systems	K6
CO-2	Illustrate the working of television	K4
CO-3	Elaborate the RADAR communication system	K5
CO-4	Classify the different types of optical fibres	K2
CO-5	Explain the concept of mobile and satellite communication	K5

Course Designer: Mrs.N.RAJESWARI

Mapping Matrix of COs, POs and PSOs

Semester	*Title of the Course*					*Course Code*	*Hours*		*Credits*	
III	**COMMUNICATION ELECTRONICS**					**21PPSSC2**	*6*		*5*	
Course Outcomes	*Programme Outcomes*					*Programme Specific outcomes*				
	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PSO1*	*PSO 2*	*PSO3*	*PSO4*	*PSO5*
CO 1	✓		✓		✓	✓	✓	✓	✓	✓
CO 2	✓	✓		✓	✓		✓		✓	✓
CO 3		✓	✓	✓		✓	✓	✓	✓	
CO 4		✓	✓	✓		✓	✓	✓	✓	✓
CO 5	✓		✓	✓	✓		✓	✓	✓	✓
Number of Matches:37										

Mapping	*1-20*	*21-40*	*41-60*	*61-80*	*81-100*
Matches	*1-14*	*15-29*	*30-34*	*35-44*	*45-50*
Relationship	*Very poor*	*Poor*	*Moderate*	*High*	*Very High*

Semester: IV ***Credits*: *5***
Hours /Week 6 **Code: 21PPH13**

CORE COURSE XIII : MATERIAL SCIENCE

General Objective: To recall the concepts of Properties and applications of materials.

Course Objectives

1. Explain the optical properties of materials.
2. Discribe the optical properties of materials
3. Discuss the ceramic materials.
4. Classify the types of modern engineering materials
5. Analyze the properties of nano materials.

UNIT 1: Optical Properties of Materials

1.1 Absorption Process – Photoconductivity – Photo electric Effect – Photovoltaic effect – Photo luminescence –

1.2 Colour centers – Type of colour centers – Generation of colour centers

1.3 Maser and Laser (Basic principles only) - Absorption and emission – Population Inversion- Ammonia-beam maser.

UNIT 2: Magnetic Properties of Materials

2.1 Atomic theory of Magnetism – Quantum numbers – Origin of Permanent Magnetic moments –

2.2 Langevin's Classical theory of diamagnetism and Para magnetism –

2.3 Fundamentals of quantum theory of para magnetism – Para magnetism of Free electron – Ferro magnetism – Weiss molecular field

2.4 Temperature dependence of spontaneous magnetization – Physical origin of Weiss molecular field – Ferromagnetic domains – Domain theory – Ant ferromagnetism – Ferrimagnetisms and ferrites**.**

UNIT 3: Ceramic Materials

3.3 Introduction **-** Functional and structural classification of ceramics – Structure of ceramics – Cesium chloride, rock salt, zinc blende,wurzite,spiel,fluorite, limonite and silicate structures (Ortho, Pyro and Meta silicates) –

3.2 Polymorphism – Mechanical properties, electrical properties of ceramic phases – Applications of ceramics.

UNIT 4: Modern Engineering Materials

4.1 Metallic glasses- Properties and applications – Metallic glasses as transformer core material –

4.2 Nanophase materials – Properties and applications **-**

4.3 Shape memoryalloys (SMA) - Classification – Working principle – Basic component of SMA - Applications - Basic components of SMA-Principles of SMA accutors and sensors-Thermo elastic based shape memory alloys-4.4Applications of thermo elastic based SMAS – Polymers- Conducting polymer and applications.

UNIT 5: Nano Materials

5.1 Introduction – Properties of semi conducting Nano particles-Optical properties- Photo fragmentation- Columbic explosion-

5.2 Carbon Nano tubes – Fabrication – Structure-Solid disordered Nanostructures-Methods of synthesis-Mechanical and electrical properties.

Books for Study

1. Solid State Physics-Structure and Properties of Materials, M.A.Wahab., Narosa, Publishing House, New Delhi, 2014.
2. Introduction to Nanotechnology, Charles P.PooleJr, Frank J. Owens, Wiley Student, Education, Vietnam, 2007
3. Materials Science, M. Arumugam, Anuradha Agencies, Kumbakonam, 2003.
4. Materials Science, Dr.S.Jayakumar, R.K. Publishers, Coimbatore, 2003.

Books for Reference

1. Introduction to Solid State Physics, Charles Kittel, Wiley Eastern Limited, New Delhi, 2005.
2. Materials Science and Processes, S. K. HajraChoudhury, Indian Book Distributing Co.,Calcutta, 2003.

Web Resource

1. https://eng.libretexts.org/Bookshelves/Electrical_Engineering/Electrooptics/Book%3A_Direct_Energy_(Mitofsky)/07%3A_Lamps%2C_LEDs%2C_and_Lasers/7.01%3A_Absorption%2C_Spontaneous_Emission%2C_Stimulated_Emission.
2. https://youtu.be/kVQauRE7Jjg
3. http://blog.ncut.edu.tw/userfile/2819/chapter12.pdf

Course Outcomes:

On completion of the course the student will be able to

	Course Outcomes	**Knowledge level**
CO-1	Identity formulate and categorize the materialaccording to the theoretical knowledge in material science.	K4
CO-2	Elaborate written and communication skills in communicating material science and the relevant topics related in physics.	K6
CO-3	Utilizes a wide range of printed, electronic resources and understanding of physical phenomena.	K5
CO-4	Give analytical approach to modeling of physical phenomena.	K6
CO-5	Expertise the conceivable outcome of material science in the society.	K5

Course Designer: Mrs.S.MUGESHINI

Mapping Matrix of COs, POs and PSOs

Semester	*Title of the Course*					*Course Code*	*Hours*			*Credits*
IV	*Material Science*					*21PPH13*	*6*			*5*
Course Outcomes	*Programme Outcomes*					*Programme Specific outcomes*				
	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PSO1*	*PSO2*	*PSO3*	*PSO4*	*PSO5*
CO 1	✓		✓		✓	✓	✓	✓	✓	✓
CO 2	✓	✓		✓	✓		✓		✓	✓
CO 3		✓	✓	✓		✓	✓	✓	✓	
CO 4		✓	✓	✓		✓	✓	✓	✓	✓
CO 5	✓		✓	✓	✓		✓	✓	✓	✓
Number of Matches:37										

Mapping	*1-20*	*21-40*	*41-60*	*61-80*	*81-100*
Matches	*1-14*	*15-29*	*30-34*	*35-44*	*45-50*
Relationship	*Very poor*	*Poor*	*Moderate*	*High*	*Very High*

Semester: IV **Credits: 4**
Hours/Week: 6 **Code: 21PPH14P**

CORE COURSE XIV – PRACTICAL IV:MICROPROCESSOR AND PROGRAMMING IN 'C'

General Objectives: To develop the basics programming concepts of Microprocessor and C programming in solving some mathematical problems and their applications.

Course Outcomes

On completion of the course the student will be able to

1. Identify the link between theory and designing workable circuits. Demonstrate with the evolution of 8085 Microprocessor.
2. Analyze the basic concepts of C Programming.

(Any 15 Experiments – Choosing minimum of six from each part)

A. Microprocessor (8085) Experiment

1. Multibyte addition and Multibyte subtraction
2. 1's complement and 2's complement subtraction
3. Sum of a series of multibyte decimal numbers
4. 16 bit addition and Square root of a number
5. Conversion from decimal to octal, hexadecimal systems
6. Conversion from octal and hexadecimal to decimal systems
7. Interfacing hexadecimal keyboard (IC 8212)
8. Study of seven segment display
9. Study of timer interfacing (IC 8253)
10. Traffic control system using microprocessor
11. Study of DAC interface (DAC 0800)
12. Study of ADC interface (ADC 0809/0800)
13. Generation of square, triangular, saw tooth and sine waves using DAC 0800
14. Control of stepper motor using microprocessor

B.Computer Experiments (by C language)

1. Solving equation by Newton-Raphson's method
2. Solution of simultaneous linear algebraic equations by Gauss elimination method
3. Solution of simultaneous linear algebraic equations by Gauss-Seidal Method
5. Interpolation and extrapolation of data using least square curve fitting method
6. Interpolation and extrapolation of data using Lagrange and Newton method
7. Numerical integration by Simpson method
8. Numerical integration by Trapezoidal method
9. Numerical differentiation by Euler method
10. Numerical differentiation by Runge-Kutta method (IV order)

Course Designer: Mrs.G. AMUDHA

Semester: IV **Credits: 4**
Hours/Week: 5 **Code: 21PPHE4**

ELECTIVE COURSE IV: NANO PHYSICS

General Objective: This course creates basic science behind nanotechnology, carbon and its unique nature, prime materials in nanoworld. SEM,AFM, EDAX and SQUID categorize and characterise the nanomaterials. Applications of nano world pointout the significance of nanotechnology.

Course Objectives

1. Explain the foundations in nanaoscience.
2. Discribe the nano materials preparations.
3. Discuss the types of nano materials.
4. List the fabrication of nano materials.
5. Classify the applications of nano materials

UNIT 1: Foundations in Nano science

1.1 Science behind Nanotechnology – Materials, Structure and properties- Materials at nanoscale-

1.2 Quantum confinement in nanomaterials- Rationale behind the downsizing of the materials-

1.3 Surface chemistry of materials.

UNIT 2: Nano materials and its preparations

2.1 Quantumdots, Quantum wires, Quantum well, Carbon, Graphite, Diamond,Fullerenes,Graphene-

2.2 Carbon Nanotubes- Structure and types of carbon nanotubes -

2.3 Synthesis of Nanopowders - Topdown methods - Discharge method - Ball milling method – Bottom-up fabrication methods- Homogeneous Nucleation-Chemical Vapour Deposition (CVD) - The sol-gel method

UNIT 3: Prime Materials in Nanotechnology

3.1 Semiconductor Nanomaterials- Zinc oxide- Titanium dioxide- 3.2

3.2 Ceramic Nanomaterials- Aluminium oxide- Aluminium Hydroxide Nanomaterials- Polymers and composites-

3.3 Metal Nanomaterials- Silver, Gold, Iron and copper nanomaterials

3.4 Biomaterials.

UNIT 4: Nanofabrication

3.1 Principle- Construction and working of SEM.TEM.AFM- Characterization mechanism- Advantages and disadvantages – compositional analysis –

4.2. EDAX optical characterization - UV - VIS-NIR double beam spectrometer

4.3 Magnetic characterization - SQUID

UNIT 5: Applications of Nano world

5.1 Nano electronics – Nano photonics – Nanorobotics –

5.2 Band gap engineered quantum devices –

5.3 Nano computations – plasmonic wave fluids – Gold nano particles in catalysis

5.4 Bio medical applications.

Books for study

1. Nanotechnology ,The Science of Small , Dr. M.A.Shah and Dr.K.A. Shah wileyIndiaPrivate Limited, New Delhi.
2. Introduction to Nanotechnology, Charles P.Poole JR, Frank J.Ownes, Wiley IndiaPrivate Limited, New Delhi, 2009.

Books for Reference

1. Nanotechnology, Manoj Bhatia, Anmol Publications Pvt.Ltd., New Delhi, 2010.

2. Characterization of Nanomaterials and Thin Films, K. Ravichandran, K. Swaminathan, Dr.P.K. Praseetha, Dr.P. KavithaJazym publications, Trichy, 2015.

Web Resources

1. https://youtu.be/v1ojLHGYK78
2. https://youtu.be/fVXR-6N6eeQ
3. https://youtu.be/AEIzlmTBya0

Course Outcomes:

On completion of the course the student will be able to

	Course Outcomes	**Knowledge level**
CO-1	Get fundamental knowledge of the nanoscience and related fields.	K2
CO-2	Describe and use different approaches in nanomaterial synthesis, fabricationof CNT using technological development.	K3
CO-3	Characterize materials in nanometre scale and analyze the properties of CNT (Carbon nano tube).	K6
CO-4	Characterizing the nanomaterials using the concept of Physics in turn correlates nanotechnological aspects.	K2
CO-5	Work with interdisciplinary research group.	K4

Course Designer: Dr.M. RAGAMATHUNNISA

Mapping Matrix of COs, POs and PSOs

Semester	*Title of the Course*					*Course Code*	*Hours*			*Credits*
IV	*Nano Physics*					*21PPHE4*	*6*			*5*
Course Outcomes	*Programme Outcomes*					*Programme Specific outcomes*				
	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PSO1*	*PSO2*	*PSO3*	*PSO4*	*PSO5*
CO 1	✓	✓	✓		✓	✓	✓	✓	✓	✓
CO 2	✓	✓	✓	✓	✓		✓		✓	✓
CO 3		✓		✓		✓	✓	✓	✓	
CO 4		✓	✓	✓		✓	✓	✓	✓	✓
CO 5	✓		✓		✓		✓	✓	✓	✓
Number of Matches:38										

Mapping	*1-20*	*21-40*	*41-60*	*61-80*	*81-100*
Matches	*1-14*	*15-29*	*30-34*	*35-44*	*45-50*
Relationship	*Very poor*	*Poor*	*Moderate*	*High*	*Very High*

Semester: IV **Credits: 4**
Hours / Week: 5 **Code: 21PPHE5**

ELECTIVE COURSE V: LASER AND FIBER OPTICS

General Objective: To acquire the concepts of laser principles, types, applications and optical fiber, fiber optical communication system.

Course Objectives

The learners will be able to

1. Recall the basic principles of Laser.
2. Classify the different types of Lasers.
3. Apply the laser in industry and medicines.
4. Know the basic structure of optical fibres and discuss the Propagation of light through optical fiber.
5. Implementation of communication using optical fiber.

UNIT 1: Basic Principles of LASER

1.1 Basic Principle of Laser - Einstein Coefficients - Condition for light amplification

1.2 Population Inversion - Threshold Condition

1.3 Line shape function - Optical Resonators - Three level and four level systems.

UNIT 2: Types of Lasers

1.1 Solid State lasers - Ruby and Nd-YAG Laser - Gas lasers - He-Ne and CO_2 lasers - Semiconductor lasers – Heterojunction lasers - Liquid Dye lasers

1.2 Qswitching and mode locking.

UNIT 3: Applications of LASER

3.1 Application of laser in industry - Cutting and welding - Drilling - Surface Hardening - Medical applications

3.2 Laser as diagnostic and therapeutic tool -Holography - Theory of recording and reconstruction - Application of Holography.

UNIT 4: Optic Fibers

4.1 Fiber optic revolution - Basic characteristics of optical fiber - Acceptance angle - Numerical aperture - Propagation of light through optical fiber

4.2 Theory of mode formation - Classification of fibers - Step index and graded index fibers - Single mode and multi-mode fibers - Losses in fibers

4.3 Fabrication techniques of fibers.

UNIT 5: Fiber Optic Communication

5.1 Source and detectors for fiber optic communication

5.2 Laser and LED - Analog and digital modulation methods

5.3 Principle of optical detection - Pin and APD photodetectors - Noise -

5.4 Block diagram of a fiber optic communication system.

Books for Study

1. Laser systems and Applications, RichaShama, Vibhu Sharma, AITBS Publishers, India2010.
2. Introduction to Fiber Optics, K. Thyagarajan, AjoyGhatak, Cambridge UniversityPress,New Delhi, 1999.
3. Laser and Non Linear Optics, B.B. Laud, New age International Publishers, New Delhi, 2011.

Books for Reference

1. An Introduction to Laser: Theory and Applications, M. N. Avadhanulu, S. Chand and Company Pvt. Ltd., New Delhi, 2001.
2. Optical Fiber Communication, John. M. Senior, Cambridge University Press, NewDelhi, 1966.
3. Physics for Engineering, P.K. Palanisamy, Scitech Publishing Pvt Ltd., Chennai, 2009.

Web Resources

1. https://WWW.physics-and-radio-electronics.com/physics/laser/principleofworkingofalaser.html.
2. https://WWW.elprocus.com/basic-elements-of-fiber-optic-communication-system-and-its-working
3. https://WWW.neuport.com/n/laser-types.

Course Outcomes:

On completion of the course the student will be able to

	Course Outcomes	**Knowledge level**
CO-1	Describe and explain fundamental concepts in laser physics	K2
CO-2	Compare the function and properties of a different types of laser	K2
CO-3	Make use of Lasers applications including industry, Medicine and learn the basics science and techniques of holography.	K3
CO-4	Recognize and classify the structure of optical fire and types	K4
CO-5	Design the Block diagram for fibre optic communication system	K6

Course Designer: Dr. A. JANAKI

Mapping Matrix of COs, POs and PSOs

Semester	*Title of the Course*					*Course Code*	*Hours*		*Credits*	
IV	*Laser and Fibre Optics*					*21PPHE5*	*4*		*4*	
Course Outcomes	*Programme Outcomes*					*Programme Specific outcomes*				
	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PSO1*	*PSO2*	*PSO3*	*PSO4*	*PSO5*
CO 1	✓		✓		✓	✓	✓	✓	✓	✓
CO 2	✓	✓		✓	✓		✓		✓	✓
CO 3		✓	✓	✓		✓	✓	✓	✓	
CO 4		✓	✓	✓		✓	✓	✓	✓	✓
CO 5	✓		✓		✓		✓	✓	✓	✓
Number of Matches:37										

Mapping	*1-20*	*21-40*	*41-60*	*61-80*	*81-100*
Matches	*1-14*	*15-29*	*30-34*	*35-44*	*45-50*
Relationship	*Very poor*	*Poor*	*Moderate*	*High*	*Very High*

Semester: I **Credits: 4**

Hours / Week: 6 **Code:**

ELECTIVE COURSE: BIOMEDICAL INSTRUMENTATIONS

General Objective: To impart the knowledge to the Learner about biophysical methods, bio potential recorders and safety measurements.

Course Objectives :

1. To introduce the fundamentals of transducers as applicable to physiology.
2. To explore the working principles of various bio-potential recorders used in biomedical.
3. Describe the specialized medical equipments.
4. To give basic ideas about safety instrumentation.
5. Discuss the working principles and application of advanced biomedical instrumentation such as CT scan, MRI, PET, etc

UNIT 1: Bio potential Electrodes and Transducers

1.1 Introduction – Design of Medical instruments – Components of the biomedical instrument system

1.2 Bio potential electrodes – Bio potential transducers.

UNIT 2: Bio potential Recorders

2.1 Introduction – Characteristics of the recording system – Electrocardiography (ECG), Electroencephalography (EEG)

2.2 Electromyography (EMG), Recorders with high accuracy – Recorders for off line analysis.

UNIT 3: Specialized Medical Equipments

3.1 Blood cell counter – Electron microscope – Radiation detectors – Photometers and Colorimeters – Digital Thermometer – Audiometer

3.2 X-ray tube – X-ray machine – Radiography and fluoroscopy – Image intensifiers – Angiography.

UNIT 4: Safety Instrumentation

4.1 Radiation safety instrumentation – Physiological effects due to 50 Hz current passage

4.2 Micro shock and macro shock – Electrical accidents in hospitals – Devices to protect electrical hazards.

UNIT 5: Advances in Biomedical Instrumentation

5.1 Computers in medicine – Lasers in medicine – Endoscopes – Cryogenic surgery – Nuclear imaging techniques – Computer tomography – Ultrasonic imaging systems

5.2 Magnetic resonance imaging – Positron emission tomography – Digital subtraction angiography – Biofeedback instrumentation – Biomaterials.

Books for Study

1. Biomedical Instrumentation (Second Edition), M.Arumugam, Anuradha Publications,Kumbakonam, 2010.

Book for Reference

1. Medical Physics, John R. Cameron and Jamer G. Shofronicher, John Wiley, A. Wiley InterScience Publications, New York, 1978.

Web Resources:

1. http://library.abes.ac.in/E-Books/BioMedical%20Book%20Full%20Text%20New.pdf
2. https://alanmacy.com/books/the-handbook-of-human-physiological-recording/chapter-10-biopotential-signals/
3. https://www.fer.uniz
4. https://nptel.ac.in/courses/127/106/127106136/

Course Outcomes:

On completion of the course the student will be able to

	Course Outcomes	**Knowledge level**
CO-1	Discuss the applications of Bio potential electrodes and Transducers.	K6
CO-2	Explain the working principles of bio-potential recorders such as ECG, EEG and EMG.	K5
CO-3	Analyze the working principle of radiation detectors and audiometers used in biomedical applications.	K4
CO-4	Classify the safety instruments to protect from radiation and electrical hazards.	K2
CO-5	List out the advanced biomedical instruments and explain its working principles and applications	K1

Course Designer: Mrs.S.MUGESHINI

Mapping Matrix of COs, POs and PSOs

Semester	*Title of the Course*					*Course Code*	*Hours*			*Credits*
I	**Biomedical instrumentations**					**21PPH**	*6*			*5*
Course Outcomes	*Programme Outcomes*					*Programme Specific outcomes*				
	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PSO1*	*PSO2*	*PSO3*	*PSO4*	*PSO5*
CO 1	✓	✓	✓		✓	✓	✓	✓	✓	✓
CO 2	✓	✓	✓	✓	✓		✓		✓	✓
CO 3		✓		✓		✓	✓	✓	✓	
CO 4		✓	✓	✓		✓	✓	✓	✓	✓
CO 5	✓		✓		✓		✓	✓	✓	✓
Number of Matches:38										

Mapping	*1-20*	*21-40*	*41-60*	*61-80*	*81-100*
Matches	*1-14*	*15-29*	*30-34*	*35-44*	*45-50*
Relationship	*Very poor*	*Poor*	*Moderate*	*High*	*Very High*

Semester:II **Credits: 4**
Hours/Week:6 **Code:**

ELECTIVE COURSE: ELECTRONIC DEVICES AND APPLICATIONS

General Objective: To recall the concepts of IC's, Opto electronic device, Electronic instruments, Network filter andPulse and Digital communication.

Course Objectives

1. To introduce monolithic integrated circuits fabrication and logic families such as schottky TTL-ECL- NMOS-CMOS-Tristate logic circuits.
2. Analyze the working of optoelectronic devices.
3. Recall the Electronic instruments.
4. Describe the Network filter and Transmission.
5. Discuss the pulse and digital communication.

UNIT 1:Fabrication of IC and Logic Families

1.1 Fabrication of IC - Monolithic integrated circuit fabrication - IC pressure transducers - Monolithic RMS - Voltage measuring device - Monolithic voltage regulators

1.2 Integrated circuit multipliers - Integrated circuit logic - Schottky TTL – ECL - NMOS Logic - CMOS Logic - Tristate logic circuits.

UNIT 2: Opto Electronic Devices

2.1 Light sources and Displays - Light emitting diodes - Surface emitting LED - Edge Emitting LED - Seven segment display

2.2 LDR - Diode lasers - Photodetectors - Basic parameters - Photo diodes - Solar cells - Photo transistors - IR and UV detectors.

UNIT 3: Electronic Instruments

3.1 Introduction – Analog and Digital instruments – Functions of instruments – Electronics versus Electrical instruments – Essential of an Electronic instruments

3.2 The basic meter movement – Characteristics of moving coil meter moment – Converting basic meter to DC Ammeter.

UNIT 4: Network Filter and Transmission Lines

4.1 Symmetrical Network – Asymmetrical Network – Attenuators

4.2 Filters prototype filter – M-Derived filter – Crystal filter and Active filter – Transmission lines.

UNIT 5: Pulse and Digital Communication

5.1 Pulse communications - Types - Pulse Amplitude Modulation (PAM) - Pulse Time Modulation - Pulse Width Modulation (PWM) - Pulse Position Modulation (PPM)

5.2 Pulse Code Modulation (PCM) - Principles of PCM - Quantizing noise – Generation and Demodulation of PCM - Effects of Noise - Advantages and applications of PCM - Digital communication - Modem classification - Modes of modem operation - Modem interconnection - Modem interfacing.

Books for Study

1. Semiconductor Devices-Physics and Technology, S.M. Sze, Wiley Eastern Ltd., NewDelhi, 1985.
2. Integrated Electronics, Millman and Halkias, Mc-Graw-Hill International BookComany, New Delhi,1983.
3. Basic Electronics, B.L. Theraja, S.Chand& Company Ltd., 2008.
4. Principles of Communication Engineering, Anokh Singh, A.K. Chhabra, S.Chand& Company Ltd., 2006.

Books for Reference

1. Electronic Communication Systems 3rd Edition, George Kenndy, Tata McGraw- HillCompany Ltd., London, 1987.
2. Semiconductor Optoelectronic Devices, 2nd Edition, P. Bhattacharya, Prentice-Hall of India, New Delhi, 2002.
3.Integrated Circuits and Semiconductor Devices, J.Deboo and C.N.Burrous, TataMcGraw- Hill Company Ltd.,New York, 1987.
4. Linear Integrated Circuits, D. Roy Choudhury, Wiley Eastern Company Ltd., NewDelhi, 1991.

Web Resources

1. https://gradeup.co/integrated-circuit-fabrication-process-notes-for-ece-i-879 c0800-7c05 11e7-a411-e57f14d8698d
2. https://www.business.att.com/learn/tech-advice/symmetric-versus-asymmetric-whats-best- for-you.html
3. https://byjus.com/jee/pulse-modulation/

Course Outcomes:

On completion of the course the student will be able to

	Course Outcomes	Knowledge level
CO-1	Explain the fabrication of IC's and logic families.	K5
CO-2	Discuss the functions of opto electronic devices	K6
CO-3	Categorize the Analog and Digital instruments	K4
CO-4	Discuss the working of Symmetrical and Asymmetrical network	K6
CO-5	Categorize the types of PWM,PAM,PPM and PCM	K4

Course Designer: Mrs. D. CHANDRIKA

Mapping Matrix of COs, POs and PSOs

Semester	*Title of the Course*					*Course Code*	*Hours*		*Credits*	
II	**Electronic devices and applications**					*21PP*	*4*		*4*	
Course Outcomes	*Programme Outcomes*					*Programme Specific outcomes*				
	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PSO1*	*PSO2*	*PSO3*	*PSO4*	*PSO5*
CO 1	✓		✓		✓	✓	✓	✓	✓	✓
CO 2	✓	✓		✓	✓		✓		✓	✓
CO 3		✓	✓	✓		✓	✓	✓	✓	
CO 4		✓	✓	✓		✓	✓	✓	✓	✓
CO 5	✓		✓		✓		✓	✓	✓	✓
Number of Matches:37										

Mapping	*1-20*	*21-40*	*41-60*	*61-80*	*81-100*
Matches	*1-14*	*15-29*	*30-34*	*35-44*	*45-50*
Relationship	*Very poor*	*Poor*	*Moderate*	*High*	*Very High*

Semester:III **Credits: 4**

Hours/Week: 6 **Code:**

ELECTIVE COURSE: MEDICAL PHYSICS AND ULTRASONICS

General Objective: To provide Medical Physics support with the goal of improving the effectiveness and safety in the use of Physics and technologies in medicine.

Course Objectives :

1. To familiarize students with basic principles of Medical Physics.
2. To explore the working principles of various bio-potential recorders used in biomedical.
3. To Demonstrate about personal monitoring instruments and its applications.
4. Explain the characteristics of Ultrasonic waves and NDT methods.
5. Describe the principles of Ultrasound instrumentation and working mechanism.

UNIT 1: Medical Physics

1.1 Terminology – Physics of the skeleton – Composition of bones – Strength of bones – Lubrication of bones joint

1.2 Eye pressure – Pressure in the digestive system – Pressure in the skeleton – Pressure in the urinary bladder – Pressure effects while driving.

UNIT 2: Diagnostic Instrumentation

2.1 Electrical signals from heart – ElectroCardiogram – Electrical signals from brain - EEG – ElectroRetinoGraphy (ERG) – Principle and instrumentation

2.2 Laser based blood analyser – Laser based flow meter – Impedance – Cardiograph – Digital pH meter - Ultra scan – Basic principle of MRI scan – Radiography and Fluoroscopy comparison.

UNIT 3: Therapeutic Instrumentation

3.1 Short wave diathermy – Ultrasonic diathermy – Pace makers – Laser in glaucoma

3.2 Electro therapy - Heat therapy – Nuclear therapy – Local healing hypothermia – Radiation therapy – Role of isotopes in medicine.

UNIT 4: Characteristics of Ultrasonic waves

4.1 Longitudinal and transverse waves – Reflection, refraction and mode of conversion – Critical angle

4.2 Surface and lamb waves – Characterization by ultrasonic NDT method –

Correlation of tensile strength and attenuation coefficient with ultrasonic parameters (velocity and acoustic impedance).

UNIT 5: Ultrasound Instrumentation

5.1 Ultrasonic interferometer – Principle, construction and working – Pulse echo technique - Principle, construction and working

5.2 Thermodynamic parameters – Internal pressure – Free volume – Molecular cohesive energy – Enthalpy – vander Waal's constant – Acoustic parameters – Relaxation time – Rao's constant – Wada's constant.

Books for Study

1. Medical Physics, John R. Cameron and Jamer G. Shofronicher, John Wiely, A. Wiley Inter Science Publications, New York, 1978.
2. Biomedical Instrumentation, Dr. M. Arumugam, Anuratha Publications, Chennai, 2010.
3. Science and Technology of Ultrasonics, Baldev Raj, V. Rajendran and P. Palanichamy,Narosa Publishing House, New Delhi, 2009.

Books for Reference

1. Bio Physics, K.N. Ramachandra and Dokshina Murthy, Tamil Nadu Society, 1976.
2. Test Book of Ultrsonics, HAL, S.Chand and Company, New Delhi.

Web Resources

1. https://webvision.med.utah.edu/book/electrophysiology/the-electroretinogram-clinical-applications/
2. https://www.asminternational.org/documents/10192/22533690/05511G_SampleArticle.pdf/a8c3979c-3b35-f304-68f2-151271f2e3b8
3. https://vlab.amrita.edu/index.php?sub=1&brch=201&sim=803&cnt=2

Course Outcomes:

On completion of the course the student will be able to

	Course Outcomes	Knowledge level
CO-1	Evaluate Physical design, maintanance of different biomedical instruments used in the medical field.	K5
CO-2	Explain the working principles of bio-potential recorders such as ECG and ERG.	K5
CO-3	Discuss therapeutic instrumentation in Medical Physics.	K6
CO-4	Distinguish the longitudinal and transverse waves of ultrasonic waves.	K4
CO-5	Examine the characteristics and working of ultrasonic interferometers.	K4

Course Designer: Dr.R. BHUVANESHWARI

Mapping Matrix of COs, POs and PSOs

Semester	*Title of the Course*					*Course Code*	*Hours*			*Credits*
III	**Medical physics and ultrasonics**					**21PPH**	*6*			*5*
Course Outcomes	*Programme Outcomes*					*Programme Specific outcomes*				
	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PSO1*	*PSO2*	*PSO3*	*PSO4*	*PSO5*
CO 1	✓	✓	✓		✓	✓	✓	✓	✓	✓
CO 2	✓	✓	✓	✓	✓		✓		✓	✓
CO 3		✓		✓		✓	✓	✓	✓	
CO 4		✓	✓	✓		✓	✓	✓	✓	✓
CO 5	✓		✓		✓		✓	✓	✓	✓
Number of Matches:38										

Mapping	*1-20*	*21-40*	*41-60*	*61-80*	*81-100*
Matches	*1-14*	*15-29*	*30-34*	*35-44*	*45-50*
Relationship	*Very poor*	*Poor*	*Moderate*	*High*	*Very High*

Semester:IV **Credits: 4**
Hours/Week: 6 **Code:**

ELECTIVE COURSE : INTEGRATED ELECTRONICS CIRCUITS

General Objective: Analyze the logic processes, outline the analog and Integrated circuits.

Course Objectives :

1. To Recall the basic concepts of Integrated circuits.
2. To Analyze the working of an operational amplifier.
3. To Explain the working of Multimeter and CRO.
4. To Identify the solid state switching devices based on their functions.
5. To give the idea about fundamental properties of Logic circuits.

UNIT 1: Introduction to Integrated Circuits

1.1 Integrated circuit technology – Advantages
1.2 Basic bipolar integrated circuits – Epitaxial growth – Masking and etching – Diffusion of impurities –
1.3 Transistor of monolithic circuits –monolithic diodes
1.4 Integrated resistors – Integrated capacitors.

UNIT 2: Integrated Circuits as analog system

2.1 Linear analog system – Differential DC amplifier – Stable AC coupled amplifier
2.2 Analog integration and differentiation
2.3 Active filters – Butterworth filter – High-pass filter – Band pass filter – Band reject filter.

UNIT 3: Integrated Circuits as analog system

3.1 Combinational digital system – Standard gate assemblies – MSI adder – (nth stage of a full adder – serial operation
3.2 Read only memory (ROM) – Programming the ROM – ROM applications
3.3 Random access memory (RAM) – Basic RAM elements – Bipolar RAM – Static MOS RAM – Dynamic MOs RAM.

UNIT 4: Electronic Instruments

4.1 Introduction – Multimeter – Applications – Merits and demerits of multimeter
4.2 VTVM – Applications - Merits and demerits – CRO – Applications.

UNIT 5: Solid State Switching Devices

5.1 Introduction – Switching circuit – Mechanical switch – Electro-mechanical switch or relay –
5.2 Electronic switches – Advantages – Diode as a switch – Switching action of a transistor.

Books for Study

1. Digital and Micro Electronics: Analog Circuits and Systems, Jacob Millman, Tata Mc-Graw Hill Company Ltd., New Delhi, 1984.
2. Integrated Circuits (Eighth Edition), K.R. Botkar, Khanna Publications, 1994.
3. Foundations of Electronics, D. Chattopadhyay, P.C. Rakshit, B. Saha and N.N. Purkait,Wiely Eastern Limited, New York, 2000.
4. Principles of Electronics (11th Revised Edition), V.K. Metha and RohitMetha, S. Chand& Company Pvt. Ltd., New Delhi, 2008.

Books for Reference

1. Op-amp and Linear Integrated Circuits (IV Edition), Ramakant A. Gayakwad, PHI Learning Pvt. Ltd., New Delhi, 2013.
2. Introduction to System Design using Integrated Circuits (Third Edition), B.S. Sonde,New Age International Ltd., New Delhi, 1995.
3. Digital Principles and Applications (Fourth Edition), Malvino Leach, Tata McGraw-Hill, New Delhi, 1984.

Web Resources

1. https://www.circuitstoday.com/integrated-circuits
2. https://www.electronics-tutorials.ws/io/io_5.html
3. https://www.electricveda.com/digital-electronics/logic-families-in-digital-electronics-ttl-cmos-and-ecl
4. https://nptel.ac.in/courses/117/106/117106091/

Course Outcomes:

On completion of the course the student will be able to

	Course Outcomes	Knowledge level
CO-1	Explain the classifications and fabrication of Integrated circuits.	K2
CO-2	Elaborate and design the linear and non-linear applications of an operational amplifier.	K6
CO-3	Illustrate the function of electronic instruments and its applications.	K2
CO-4	List the working principle of solid state switching devices.	K1
CO-5	Infer the characteristics of Logic families and its types.	K2

Course Designer: Mrs.K. RAJAKUMARI

Mapping Matrix of COs, POs and PSOs

Semester	*Title of the Course*					*Course Code*	*Hours*		*Credits*	
IV	**Analog and integrated circuits**					*21PP*	*4*		*4*	
Course Outcomes	*Programme Outcomes*					*Programme Specific outcomes*				
	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PSO1*	*PSO2*	*PSO3*	*PSO4*	*PSO5*
CO 1	✓		✓		✓	✓	✓	✓	✓	✓
CO 2	✓	✓		✓	✓		✓		✓	✓
CO 3		✓	✓	✓		✓	✓	✓	✓	
CO 4		✓	✓	✓		✓	✓	✓	✓	✓
CO 5	✓		✓		✓		✓	✓	✓	✓
Number of Matches:37										

Mapping	*1-20*	*21-40*	*41-60*	*61-80*	*81-100*
Matches	*1-14*	*15-29*	*30-34*	*35-44*	*45-50*
Relationship	*Very poor*	*Poor*	*Moderate*	*High*	*Very High*

Semester:IV **Credits: 4**

Hours/Week: 6 **Code:**

ELECTIVE COURSE : CRYSTAL GROWTH AND THIN FILM PHYSICS

General Objective: Outline the crystal growth and thin films techniques.

Objectives

1. To understand the nucleation phenomena.
2. To develop the knowledge of experimental methods of crystal growth techniques.
3. To gain the growth aspects of thin film ideas.

UNIT 1: Fundamentals of Crystal Growth

1.1 Importance of crystal growth– Classification of crystal growth methods

1.2 Basic steps: Generation, transport and adsorption of growth reactants

1.3 Nucleation: Theories of nucleation – Classical theory of nucleation: Gibbs Thomson equations for vapour and solution – Kinetic theory of nucleation – Becker and Doring concept on nucleation rate – Energy of formation of a spherical nucleus

1.4 Statistical theory on nucleation: Equilibrium concentration of critical nuclei, Free energy of formation.

UNIT 2: Selection of solvents and solubility

2.1 Meir's solubility diagram – Saturation and supersaturation – Metastable zone width

2.2 Growth by restricted evaporation of solvent, slow cooling of solution and temperature gradient methods

2.3 Crystal growth in Gel media: Chemical reaction and solubility reduction methods.

UNIT 3: Basic principles of Thin films

3.1 Physical Vapour Deposition (PVD): Vapour phase crystallization in a closed system – Gas flow crystallization –

3.2 Chemical Vapour Deposition (CVD): Advantageous and disadvantageous.

3.3 Melt Growth Techniques -Czochralski pulling method – Bridgeman technique.

UNIT 4: Preparation of Thin Films

4.1 Spray pyrolytic process – characteristic feature of the spray pyrolytic process

4.2 Ion plating – Vacuum evaporation – Evaporation theory

4.3 The construction and use of vapour sources

4.4 Sputtering Methods of sputtering – Reactive sputtering – RF sputtering -DC planar magnetron sputtering.

UNIT 5 : Characterization techniques

5.1 X-Ray diffraction studies (XRD)- single and powder XRD equipment - Examination of typical XRD pattern

5.2 Spectroscopic Techniques: Fourier transform infrared analysis (FTIR) –Ultraviolet photoelectron spectroscopy (UPS), X-ray photoelectron spectroscopy (XPS), Auger electron spectroscopy (AES)

5.3 Electron imaging techniques and their applications: Principle and working of SEM, TEM, AFM and sample preparations.

Books for Study

1. Crystal Growth Process and Methods, 1st Edition, P. Santhanaragavan and P. Ramasamy, KRU Publications, Kumbakonam 2001.
2. Crystal Growth Processes, 1st Edition, J.C. Brice John Wiley, New York, 1986.

Books for Reference

1. Thin Film Deposition, Smith Donald. L, McGraw Hill, London (1995).
2. Thin Film Fundamentals, A. Goswami, New Age International (P) Limited, New Delhi, 1996.

Web Resources

1. https://www.aub.deu.lb/msfea/research/Documents/CFD-Nucleation
2. https://www.acadpubl.eu/hub/2018-119-12/articles/2/489.pdf
3. https://en.wikipedia.org/wiki/Bridgeman
4. https://nanografi.com/blog/sputtering-process-types-and uses
5. https://surface.mat.ethz.ch/research/advanced-surface-analysis

Course Outcomes:

On completion of the course the student will be able to

	Course Outcomes	**Knowledge level**
CO - 1	Outline the basic knowledge of growth phenomena and discuss the theoretical aspects of nucleation	K2
CO - 2	Apply the experimental ideas of low temperature solution growth mechanism	K3
CO - 3	Analyze the concepts on vapour growth techniques	K4
CO - 4	Explain the process of thin films sample preparation method	K5
CO - 5	Formulate the latest developments in characterization techniques and analyze the usage of materials	K5

Course Designer: Dr. T. Uma Devi

Mapping Matrix of COs, POs and PSOs

Semester	*Title of the Course*					*Course Code*	*Hours*		*Credits*	
IV	**Crystal growth and thin film physics**					**21PPH**	*6*		*5*	
Course Outcomes	*Programme Outcomes*					*Programme Specific outcomes*				
	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PSO1*	*PSO2*	*PSO3*	*PSO4*	*PSO5*
CO 1	✓	✓	✓		✓	✓	✓	✓	✓	✓
CO 2	✓	✓	✓	✓	✓		✓		✓	✓
CO 3		✓		✓		✓	✓	✓	✓	
CO 4		✓	✓	✓		✓	✓	✓	✓	✓
CO 5	✓		✓		✓		✓	✓	✓	✓
Number of Matches:38										

Mapping	*1-20*	*21-40*	*41-60*	*61-80*	*81-100*
Matches	*1-14*	*15-29*	*30-34*	*35-44*	*45-50*
Relationship	*Very poor*	*Poor*	*Moderate*	*High*	*Very High*