

GOVERNMENT ARTS COLLEGE (AUTONOMOUS)

KUMBAKONAM 612 002

Re - accredited With 'A' Grade by NAAC & Affiliated to Bharathidasan University

DEPARTMENT OF PHYSICS

(Effective for those admitted from 2020-2021 onwards)



SYLLABI

M.Sc., PHYSICS

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KUMBakonam
DEPARTMENT OF PHYSICS
Scheme for the M.Sc., Students
Under Choice Based Credit System
From 2020 – 2021 Onwards

SEM	COURSE	PAPER	INST. Hrs/ week	Credit	Exam Hours	Marks		Total
						Int	Ext	
I	Core Course – I	Mathematical Physics – I	6	5	3	25	75	100
	Core Course – II	Classical Dynamics & Relativity	6	5	3	25	75	100
	Core Course – III	Electronics	5	5	3	25	75	100
	Elective Course – I	Crystal Growth and Thin Film Physics	5	4	3	25	75	100
	Core Course – IV	Practical – I : General & Electronics	4 + 4	4	3	40	60	100
	TOTAL			30	23	-	-	-
II	Core Course – V	Mathematical Physics – II	6	5	3	25	75	100
	Core Course – VI	Quantum Mechanics	6	5	3	25	75	100
	Core Course - VII	Statistical Mechanics And Electromagnetic Theory	5	5	3	25	75	100
	Elective Course – II	Microprocessor and Microcontroller	5	4	3	25	75	100
	Core Course - VIII	Practical – II : General and Electronics experiments	4 + 4	4	3	40	60	100
	TOTAL			30	23	-	-	-
III	Core Course - IX	Solid State Physics	5	5	3	25	75	100
	Core Course - X	Nuclear and Particle Physics	5	5	3	25	75	100
	Elective Course – III	Object – Oriented Programming using C++	5	4	3	25	75	100
	Core Course - XI	Practical – III : Advanced General and Electronics	4 + 4	4	3	40	60	100
	Elective Course – IV	Practical – IV : Microprocessor and Microcontroller Programming	4 + 4	4	3	40	60	100
	TOTAL			30	22	-	-	-
IV	Core Course - XII	Atomic and Molecular Spectroscopy	5	5	3	25	75	100
	Core Course - XIII	Communication Electronics	5	5	3	25	75	100
	Elective Course – V	Lasers, Nano Materials and Applications	5	4	3	25	75	100
	Core Course - XIV	Practical – V : Computer Programming with C and C++	4 + 4	4	3	40	60	100
	Core Course - XV	Project	7	4	-	-	-	100
	TOTAL			30	22	-	-	-
GRAND TOTAL			120	90	-	-	-	2000

P.G. Course Structure

Core Course (Theory)	-	10
Core Course (Practical)	-	4
Elective Course	-	5
Project	-	1
		<hr/>
Total	-	20
		<hr/>

COMMON SCHEME FOR THEORY PAPERS

Part – A [10 × 2 = 20]

Two short answer questions from each unit (5 units) 10 questions:

- (1) & (2) – Unit I
- (3) & (4) – Unit II
- (5) & (6) – Unit III
- (7) & (8) – Unit IV
- (9) & (10) – Unit V

Part – B [5 × 5 = 25]

Two questions from each unit (5 units) either or type:

- (11) a (or) b – Unit I
- (12) a (or) b – Unit II
- (13) a (or) b – Unit III
- (14) a (or) b – Unit IV
- (15) a (or) b – Unit V

Part – C [3 × 10 = 30]

(Answer any three)

Five long answer questions one from each unit (5 units):

- (16) Unit I
- (17) Unit II
- (18) Unit III
- (19) Unit IV
- (20) Unit V

PROGRAMME OUTCOMES (POs)

1. Knowledge Development.
2. Employability skills.
3. Developing new projects and designs.
4. Experimental Skills.
5. Grooming the candidates to explore knowledge independently.
6. Design and conduct of demos/create models to analyze/interpret data.
7. Acquire the expertise to solve any dynamical system.
8. Develop skills to contribute to R&D.
9. Groomed to collate information from different sources and gain coherent understanding of the subject.
10. Groomed to become professionally competent to develop independent thinking.
11. Inculcate the skills to exploit learning resources including libraries, e-resources etc. to stay abreast of recent developments.
12. To help the students accomplish tasks either individually or as member of a group in multidisciplinary settings.
13. Framing of the curriculum, to inculcate ethical values, social responsibility professional competence, pragmatic wisdom, commitment to nation in the area of science and technology.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

1. Problem solving skills
2. Learn basics of core and applied physics.
3. Exposure to classical, quantum, mathematical, statistical, condensed matter, electromagnetic theory and nuclear physics.
4. Specialized understanding of advanced topics like Nonlinear Dynamics, crystal growth, thin films and nano materials.
5. Expertise to develop coding skills and numerical simulation.
6. Developing extra disciplinary/interdisciplinary skills to understand natural phenomena.
7. Research aptitude towards experimental and theoretical physics.
8. Explore avenues of research in Institute of Plasma Research (IPR), Physical Research Laboratory(PRL), Institute of Physics (IOP), Saha Institute of Nuclear Physics(SINP), Raman Research Institute(RRI), IISc, IISER, CECRI, etc.

CC – I : MATHEMATICAL PHYSICS – I [CODE: 20P1P1]
(Effective for those admitted from 2020-2021 onwards)

Objectives:

- To acquire mathematical knowledge and apply it to various physical problems.
- To develop problem solving ability related to physical problems.

UNIT I: Vector Fields

Concept of vector and scalar fields - Gradient, divergence, curl and Laplacian – Vector identities – Line integral, surface integral and volume integral – Gauss theorem, Green's Theorem, Stoke's theorem – Orthogonal curvilinear coordinates – Expressions for gradient, divergence, curl and Laplacian in cylindrical and spherical co-ordinates.

UNIT II: (a) Vector spaces

Definitions – Linear independence of vectors – Bilinear and quadratic forms – change of Basis – Schmidt's orthogonalization process – Schwartz inequality.

(b) Tensors

Transformation of coordinates – Summation convention – Contravariant, Covariant and mixed tensors – Rank of tensor – Symmetric and antisymmetric tensors – Contraction of tensors – Raising and lowering of suffixes – Moment of Inertia tensor.

UNIT III: Matrix Theory

Solution of linear algebraic equations – Rank of a matrix – Characteristic equation of a matrix – Eigen values and Eigen vectors – Trace of a matrix – Caley – Hamilton theorem – Reduction of a matrix to diagonal form – Jacobian method– Hermitian and unitary matrices – Direct sum and products of matrices – Sylvester's theorem – Functions of matrices.

UNIT IV: Complex Analysis

Functions of complex variables – Differentiability – Cauchy-Reimann conditions – Complex integration – Cauchy's integral theorem and integral formula – Taylor's and Laurent's series – Residues and singularities – Cauchy's Residue theorem – Evaluation of definite integrals.

UNIT V: Integral Transforms

Fourier series – Dirichlet's condition – Determination of Fourier coefficients – Fourier integrals – Faltung theorem – Application to heat and wave equation – Laplace transform – Convolution theorem – Inverse Laplace transform – Solution of ordinary differential equations.

Books for Study and Reference:

Relevant chapters in

1. A. W. Joshi, Matrices and Tensors in Physics, Wiley Eastern Ltd., New Delhi (1975).
2. Eugene Butkov, Mathematical Physics, Addison Wesley, London (1973).
3. L. A. Pipes and L. R. Harvill, Applied Mathematics for Engineers and Physicists, Mc Graw Hill Company, Singapore (1967).
4. P. K. Chattopadhyay, Mathematical Physics, Wiley Eastern Ltd., New Delhi(1990)
5. A. K. Ghatak, T. C. Goyal and S. J. Chua, Mathematical Physics, Macmillan, New Delhi(1995)
6. G. Arfken and H. J. Weber, Mathematical Methods for Physicists, 4th ed. Prism Books, Bangalore, (1995).
7. M. D. Greenberg, Advanced Engineering Mathematics, 2nd ed. International ed.,Prentice – Hall International, NJ,(1998)
8. E. Kreyszig, Advanced Engineering Mathematics, 8th ed., Wiley, NY, (1999).
9. A.B.Gupta , Fundamentals of Mathematical Physics, Books and Allied Pvt. Limited,India,2010

COURSE OUTCOMES (COs):

By the end of the course, the students will be able to

- CO1:** Acquire Knowledge of vector calculus for application to problems in Electromagnetic theory, Fluid dynamics etc.
- CO2:** Basics of Tensors and its applications.
- CO3:** Knowledge of Matrix theory.
- CO4:** Understand the use of complex variables for solving definite integrals.
- CO5:** Obtain the knowledge of Fourier and Laplace transforms
- CO6:** Expertise of special functions and their application in Initial value problems and Boundary value problems.

MAPPING OF POs AND PSOs WITH COs

COURSE OUTCOMES	PROGRAMME OUTCOMES (POs)													PROGRAMME SPECIFIC OUTCOMES(PSOs)								
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8	
CO 1	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 2	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓			
CO 3	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 4	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 5	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

CC - II : CLASSICAL DYNAMICS & RELATIVITY [CODE: 20P1P2]
(Effective for those admitted from 2020-2021 onwards)

Objectives:

- To understand the fundamental principles of classical mechanics.
- To understand the applications of classical mechanics.
- To learn and apply the concepts of Relativistic mechanics.

UNIT I: Fundamental Principles and Lagrangian Formulation

Mechanics of a particle and system of particles - conservation laws – constraints –Types of constraints – generalized coordinates – D’ Alembert’s principle and Lagrange’s equation – Problem: Free particle in a system – Atwood’s machine – Time dependent constraint – bead sliding on a rotating wire – Hamilton’s principle – Lagrange’s equation of motion from Hamilton’s principle – conservation theorems and symmetry properties.

UNIT-II: Two body central force problems

Equations of motion and first integrals - The equivalent one - dimensional problem and classification of orbits - The Kepler problem - Inverse square law of force, the Laplace Runge - Lenz Vector - Scattering in a central force field - Scattering in laboratory and centre of mass frames.

UNIT III: Hamilton’s Formulation

Hamilton’s canonical equations of motion – Hamilton’s equations from variational principle – Principle of least action – Generating functions – Canonical transformations – Poisson brackets – Hamilton – Jacobi method – Solution of Kepler’s problem by Hamilton –Jacobi method-Action and angle variables

UNIT IV: Rigid Body Dynamics and Oscillatory Motion

Euler angles – Moments and products of inertia – Euler’s equations – Symmetrical top. Theory of small oscillations – Normal modes and frequencies – Two coupled harmonic oscillators – Linear triatomic molecule.

UNIT V: Relativity

Review of basic ideas of special relativity – Energy momentum four vector – Minkowski’s four dimensional space – Lorentz transformation in Minkowski’s space – Compositions of Lorentz Transformation about two orthogonal directions – Invariance of Maxwell’s equations under Lorentz transformation – Elements of general theory of relativity.

Books for study and Reference

Relevant chapters in

1. H. Goldstein, Classical Mechanics, Narosa Book distributors, New Delhi (1980)
2. N. C. Rana and P. S. Joag, Classical Mechanics, Tata McGraw Hill, New Delhi (1991).
3. S.L. Gupta, V. Kumar and H.V. Sharma, Classical Mechanics, Pragati Prakashan, Meerut (2001).

COURSE OUTCOMES (COs):

By the end of the course, the students will be able to

CO1: Acquire fundamental knowledge of classical dynamics.

CO2: Use D'Alemberts principle to drive the lagrange equations of motion.

CO3: Understand theory of small oscillations in normal modes and their frequencies.

CO4: Understand the Lagrangian and Hamiltonian methods.

CO5: Understand the basic ideas of Solutions.

CO6: Gain the knowledge of relativity and its consequences.

MAPPING OF POs AND PSOs WITH COs

COURSE OUTCOMES	PROGRAMME OUTCOMES (POs)													PROGRAMME SPECIFIC OUTCOMES(PSOs)									
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8		
CO1	✓	✓	✓	✓	✓		✓			✓	✓	✓		✓	✓	✓	✓		✓	✓			
CO2	✓		✓		✓		✓		✓		✓			✓		✓			✓	✓	✓		
CO3	✓		✓	✓	✓	✓	✓				✓			✓	✓	✓			✓	✓	✓		
CO4	✓		✓		✓	✓				✓	✓		✓	✓	✓	✓			✓	✓	✓		
CO5	✓		✓	✓			✓				✓					✓		✓	✓	✓	✓		
CO6	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓			✓	✓	✓	✓	✓	✓	✓		

CC III : ELECTRONICS [CODE: 20P1P3]
(Effective for those admitted from 2020-2021 onwards)

Objective:

- To acquire the basic knowledge of advanced special semi conductor devices, working principle of operational amplifier and its day today applications and to understand the fundamentals of digital circuits and integrated circuits.

UNIT I : Special Semiconductor devices

Metal Semiconductor interfaces – Varactor diode – Schottky diode – Tunnel diode – JFET – construction – Theory of operation – Drain characteristics – Transfer characteristics – JFET parameters – DC biasing – DC load line – CSJFET Amplifier – Depletion and Enhancement type MOSFET – Construction – Working – Unijunction Transistor (UJT) – Construction – Characteristics – Relaxation oscillator – Silicon controller Rectifier (SCR) – Construction – Characteristics – Application in power control – DIAC – TRIAC – Construction – Characteristics.

UNIT II: Transducers and Opto electronic devices

Transducers: Resistive position transducer – Capacitive pressure transducer – Tachometer – Electromagnetic flow meter – Linear variable differential transformer – Construction and working – Piezoelectric transducer – Strain Gauge – Resistance temperature detectors – Thermistors – Thermocouples – Carbon Microphone – Crystal Microphone – Loud speaker.

Opto electronic devices: Photo multiplier tube – Photo conductive cells – construction – working Applications – photo diode – Photo transistor – Construction – Characteristics – Applications – Laser diode – Light Emitting Diode (LED) – Construction.

UNIT III: Operational Amplifier and Applications

Op-Amp differentiator – Integrator – Comparator – Current to voltage converter – Solving simultaneous and differential equations – Active filters: Low pass, high pass, band pass and band rejection filters – Wien's bridge oscillator – Phase shift oscillator – Square wave generator – Triangular wave generator – Schmitt trigger – Monostable multivibrator – Basis principles of phase locked loops.

UNIT IV: Digital Circuit techniques

Half adder – Full adder – Half subtractor – Full subtractor - Multiplexer – DeMultiplexer – Decoder – BCD to Seven segment decoder – Encoder – SR, Clocked SR, JK, D and T Flip flops – Shift right shift registers – Shift left shift registers – Ring counter – Ripple/asynchronous counter – Mod-16 counter – Up/Down (Mod-10) counter.

UNIT V: Digital converters and Integrated circuits

Basic digital to analog conversion – Binary Weighted resistor DAC – Binary R – 2R ladder DAC – Basic Analog to digital conversion – Counter type ADC Successive approximation ADC – Dual slope ADC – Fabrication of monolithic integrated circuits – Monolithic resistors, diodes, transistors and capacitors – 555 timer – description of the functional diagram – Monostable operation.

Books for Study (Relevant chapters in)

1. B.L. Theraja, Basic Electronics solid state, S.Chand & Company Ltd., 2001.
2. V.K. Mehta, Rohit Mehta, Principles of Electronics, S. Chand & Company Ltd., 2010.
3. Dr. S. Durai, Dr. T.E. Parthasarathy, Electronics Part I, S. Viswanathan (Printers & Publishers) Pvt. Ltd., 1997.
4. D. Roy choudhury and S. Jain, Linear integrated circuits, New Age International Publications, New Delhi, 2010.
5. V. Vijayendran, Introduction to integrated electronics, Digital & Analog, S. Vishwanathan (Printers & Publishers) Pvt. Ltd., 2007.
6. Dr. R.K. Kar, Electronics (Classical & Modern), Books & Allied (P) Ltd., 2007.

Books for Reference

1. J. Millman, C. Halkias, Electronic devices and circuits, Mc Graw-Hill international editions, (2010).
2. J. Millman, C. Halkias, and C.D. Parikh, Integrated Electronics, Analog and Digital Circuits and systems (TMGH) 2010.
3. D.P. Leach and A.P. Malvino, Digital principles and Application, Tata McGraw-Hill, New Delhi, 2006.
4. R.P. Jain, Modern digital electronics, Tata Mc Graw-Hill, New Delhi, 1998.
5. R.A. Gayakwad, Op-Amps & Linear integrated circuits, Printince Hall, New Delhi, 1999.

COURSE OUTCOMES (COs):

By the end of the course, the students will be able to

CO1 : Understand the basic concepts of special Semiconductor devices and its applications.

CO2 : Acquire knowledge Transducers and Opto electronic devices

CO3 : Gain knowledge about interfacing devices.

CO4 :Learn about the Operational Amplifier and Applications.

CO5 : Understand the concept of Digital Circuit techniques.

CO6 :Apply the circuit theory to design sequential logic circuits.

MAPPING OF POs AND PSOs WITH COs

COURSE OUTCOMES	PROGRAMME OUTCOMES (POs)													PROGRAMME SPECIFIC OUTCOMES(PSOs)								
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8	
CO1	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓		✓	✓	✓	✓			✓	✓	
CO2	✓		✓		✓		✓	✓	✓		✓			✓		✓			✓	✓	✓	
CO3	✓		✓	✓	✓	✓	✓	✓			✓	✓		✓	✓	✓			✓	✓	✓	
CO4	✓		✓		✓	✓		✓		✓	✓		✓	✓	✓	✓			✓	✓	✓	
CO5	✓		✓	✓			✓	✓			✓			✓		✓	✓		✓	✓	✓	
CO6	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	

EC – I : CRYSTAL GROWTH AND THIN FILM PHYSICS
[CODE: 20P1P4EC]
(Effective for those admitted from 2020-2021 onwards)

Objective:

- To understand the theories and techniques involved in crystal growth and thin film science.

UNIT I: Basic concepts and Growth kinetics

Nucleation – Types of nucleation- Kinetic theory of nucleation – Formation of critical nucleus-Induction period measurement by conductivity method – Nucleation rate – Energy of formation of spherical and cylindrical nucleus –Theories of crystal growth – Surface energy theory – Diffusion theory – Adsorption (Volmer) theory – Kossel's theory.

UNIT II: Solution, Flux and Gel growth

Solution growth: Characteristics of solvent – Solubility and super solubility – Expression for supersaturation – Miers T-C diagram – Slow cooling, solvent evaporation and temperature gradient methods – Advantages. Flux growth – Properties of flux – Advantages and disadvantages – Gel growth – Principle – Types of gel – Structure of gel – Single and double diffusion techniques – Advantages.

UNIT III: Melt, Hydrothermal and Vapour growth

Melt growth – Czochralski, Bridgman, Verneuil and Zone melting methods. Hydrothermal growth – Characteristics of autoclave – Growth of Quartz – Advantages and disadvantages – Vapour growth – Physical vapour transport – Chemical vapour transport – Advantages and limitation.

UNIT IV: Thin film deposition techniques

Fundamentals of thin film – Methods- Deposition techniques – Physical methods – Evaporation – Thermal evaporation – Flash evaporation – electron beam method – Sputtering – Diode sputtering – Reactive sputtering – R.F sputtering – Chemical methods – Thermal decomposition – Chemical vapour deposition – Electro deposition.

UNIT V: Film growth and characterization

Substrate – Cleaning methods – Substrate effect – Nucleation and film growth – Incorporation of defects and impurities – AFM– Thickness determination – Microbalance technique – Multiple beam interferometry – FECO technique – Interaction of electrons with a solid – EPMA – XPS (ESCA).

Books for study:

1. P. Santhanaragavan and P.Ramasamy, Crystal Growth Process and Methods (KRV Publications, Kumbakonam, 2001).
2. I.V. Markov, Crystal Growth for Beginners: Fundamentals of Nucleation, Crystal Growth and Epitaxy (2004) 2nd Edition.
3. A. Goswami, Thin Film Fundamentals (New Age, New Delhi, 2008)
4. J. C. Brice, Crystal Growth Process (John Wiley, New York, 1986).

COURSE OUTCOMES (COs):

By the end of the course, the students will be able to

- CO1:** Understand the concepts related to crystal growth, epitaxy and the necessary concepts in thermodynamics and kinetics.
- CO2:** Explain the connection between growth parameters and the quality and properties of the grown materials.
- CO3:** Awareness of recent trends in crystal growth, super lattices and heterostructures.
- CO4:** Knowledge of the preparation techniques of thin films using physical and chemical deposition method.
- CO5:** To impart the basic knowledge on nanoscience and nanotechnology and understand the exotic properties of nanostructured materials.
- CO6:** Study the various techniques available for the processing of nanostructured materials.
- CO7:** Acquire in-depth knowledge of at least one specialization area within the field of nano science and nanoscale.
- CO8:** Gain fundamental knowledge to undertake research.

MAPPING OF POs AND PSOs WITH COs

COURSE OUTCOMES	PROGRAMME OUTCOMES (POs)													PROGRAMME SPECIFIC OUTCOMES(PSOs)							
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8
CO 1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓
CO 2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓
CO 3	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
CO 4	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
CO 5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		✓	✓	✓
CO 6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		✓	✓	✓	✓	✓
CO 7	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
CO 8	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓			✓	✓		✓	✓	✓

CC - IV PRACTICAL – I [CODE: 20P1PP1]

GENERAL & ELECTRONICS (Effective for those admitted from 2020-2021 onwards)

OBJECTIVES:

- To understand the basic laws / principles and theoretical background of the physical instruments.
- To provide a hands - on learning experience.
- To calculate various physical parameters.

(Choosing a minimum of six experiments from each part)

A. General Experiments

1. Determination of q , n , σ by elliptical fringes method
2. Determination of q , n , σ by hyperbolic fringes method
3. Determination of Bulk modulus of a liquid by Ultrasonic wave propagation
4. Determination of Stefan's constant
5. Determination of dielectric constant at high frequency by Lecher wire
6. Determination of e/m of an electron by magnetron method
7. Determination of e/m of an electron by Helical coil method

B. Electronics Experiments

8. Design and study of monostable multivibrator
- 9 Design and study of Wein Bridge oscillator (Op-Amp)
- 10 Design and study of Phase shift oscillator (Op-Amp)
11. Characteristics of LDR
12. Characteristics of UJT & relaxation oscillator
13. Common source amplifier using FET
14. Tuned drain oscillator – FET

COURSE OUTCOMES (COS):

By the end of the course, the students will be able to

CO1: Understand the fundamentals of physics.

CO2: Application of simple concepts to perform experiments.

CO3: Apply the theory to determine various properties of the materials given.

CO4: Familiarity to handle the instruments.

CO5: Conduct of Electronic circuit experiments.

CO6: Expertise to develop experimental skills.

MAPPING OF POs AND PSOs WITH COs

COURSE OUTCOMES	PROGRAMME OUTCOMES (POs)													PROGRAMME SPECIFIC OUTCOMES(PSOs)							
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8
CO 1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
CO 2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
CO 3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
CO 4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
CO 5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
CO 6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓

CC – V : MATHEMATICAL PHYSICS – II [CODE: 20P2P5]
(Effective for those admitted from 2020-2021 onwards)

Objective:

- To acquire knowledge about differential and partial differential Equations, Special Functions, Numerical analysis and Group Theory and to develop the problem solving ability.

UNIT I: Special Functions

Gamma and Beta functions – Hermite, Legendre, Bessel and Laguerre differential equations- series solution – Rodrigue’s formula – Generating functions – Orthogonality relations – Recurrence relations.

UNIT II: Second Order Differential Equations

Linear second order differential equations with constant and variable coefficients – Complimentary function and particular integrals-- Variation of parameters – Frobenius method – Physical examples: Classical harmonic oscillator- Damped simple harmonic motion- Forced vibrations.

UNIT III: Partial differential equations

Method of forming partial differential equation – Solution by direct integration – Method of separation of variables – Partial differential equations in Physics problems – Laplace equation-Wave equation – Equation of vibrating string – One dimensional heat flow .

UNIT IV:

Numerical Analysis

Solutions of algebraic and transcendental equations – Bisection method – Iteration method – Newton-Raphson method.

Interpolation

Forward, Backward and Central differences – Newton’s interpolation formula – Stirling and Bessel central difference interpolation formula – Lagrange’s interpolation formula.

Numerical Integration – Simpson Rule- Numerical differentiation- Runge Kutta IV order.

UNIT V: Group Theory

Basic definitions – Multiplication Table – Subgroups, Cosets and Classes – Direct product groups – Point groups – Representation theorem – Homomorphism and Isomorphism – Reducible and irreducible representation – The great Orthogonality theorem – Character table – C_{2v} as example.

Books for Study and Reference

Relevant chapters in

1. L. A. Pipes and L. R. Harvill, Applied Mathematics for Engineers and Physicists (Mc Graw Hill, Singapore, 1970)
2. E. Kreyszig, Advanced Engineering Mathematics (Wiley Eastern, New Delhi, 1983)
3. G. Arfken and H. J. Weber, Mathematical Methods for Physicists (Prism Books, Bangalore, 1995)
4. A. K. Ghatak, I. C. Goyal and A.J. Chua, Mathematical Physics (Mc Millan, New Delhi, 1995)
5. P.K Chattopadhyay, Mathematical Physics (Wiley Eastern, New Delhi, 1990)
6. W.W. Bell, Special functions for Scientists and Engineers (Van Nostrand, New York, 1968)
7. A.W. Joshi, Elements of Group theory for Physicists (Wiley Eastern, New Delhi, 1971)
8. F. A. Cotton, Chemical Applications of Group Theory (Wiley Eastern, New Delhi, 1987)
9. S. S. Sastry, Introductory Methods of Numerical Analysis, Eastern Economy Edition, Fifth Edition.

COURSE OUTCOMES (COs):

By the end of the course, the students will be able to

CO1: Acquire Knowledge of Special Functions

CO2: Basics of Differential Equations

CO3: Understand the use of Partial differential equations.

CO4: Expertise of Numerical Analysis.

CO5: Knowledge of group theory and its application to spectroscopy and Nuclear Physics.

CO6: Acquisition of relevant mathematical skills to predict the dynamics of physical systems.

MAPPING OF POs AND PSOs WITH COs

COURSE OUTCOMES	PROGRAMME OUTCOMES (POs)													PROGRAMME SPECIFIC OUTCOMES(PSOs)								
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8	
CO 1	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 2	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓			
CO 3	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 4	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 5	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

CC – VI : QUANTUM MECHANICS [CODE: 20P2P6]
(Effective for those admitted from 2020-2021 onwards)

Objective:

- To make the students understand the fundamental concepts of quantum mechanics and their applications to microscopic systems.

UNIT I: General Formulation of Quantum Mechanics

Schrodinger's one dimensional time independent and time dependent equations – Physical interpretation of wave equation – Normalized and orthogonal wave functions – Expectation values - Operator formalism – Hermitian operator and its properties – Hilbert space – Dirac's Bra and Ket notation – properties – Operation of linear operators on Bra and Ket vectors – Uncertainty principle – uncertainty relation for operators – Minimum uncertainty condition.

Representation Theory: Schrodinger's – Heisenberg, interaction pictures – Comparison.

UNIT II: Applications of Schrodinger's equation and Scattering Theory

Applications of Schrodinger's equation: Linear Harmonic oscillator – Solution to one dimensional Schrodinger's equation – Rectangular barrier potential – Rigid rotator – Hydrogen atom.

Scattering Theory: Scattering cross section and Amplitude – Green's function in scattering theory – Born Approximation – Validity criteria for Born Approximation.

UNIT III: Time independent and dependent perturbation theory

Time independent perturbation theory: Non-degenerate and degenerate perturbation theories (first order) – Stark effect – First order Stark effect in Hydrogen atom- WKB approximation – Validity – Variation method

Time dependent perturbation theory: First order – Transition probability – Fermi-Golden rule – Harmonic perturbation.

UNIT IV: Angular Momentum and Spin matrices

Orbital angular Momenta – Commutation rules among position, Linear momentum and Angular momentum – Spin angular momentum – Pauli's spin matrices - Total angular momentum – Ladder operators – Eigen values for J^2 and J_z – Addition of angular momenta – Clebsch –Gordan coefficients – Recursion relation and construction of C. G coefficients – Calculation of C.G Coefficients for $J_1 = \frac{1}{2}$ and $J_2 = \frac{1}{2}$.Identical particles with spin – Symmetric and Asymmetric wave functions – Pauli's exclusion principle.

UNIT V: Relativistic Wave Equation

Klein – Gordon equation for a free particle and Hydrogen atom – Dirac equation for a free particle – Plane wave solution – Negative energy states – Dirac equation in a central field – Spin of a Dirac particle – Spin- orbit coupling.

Books for Study and Reference:

1. L.Schiff, Quantum Mechanics, Tata McGraw Hill, New Delhi.
2. P.M. Mathews and K.Venkatesan, A text book of Quantum Mechanics, Tata McGraw Hill, New Delhi.
3. S.L. Gupta and I.D. Gupta, Advanced Quantum theory and fields, S. Chand and Co, New Delhi.
4. V. K. Thankappan, Quantum Mechanics, Wiley –Eastern, New Delhi.
5. J. Singh , Quantum Mechanics, Fundamentals and Applications to Technology, John-Wiley, New York.
6. A. Goswami, Quantum Mechanics, W. C. Brown, Dubuque.
7. Suresh Chandra, Quantum Mechanics, CBS publishers, New Delhi.
8. Satya Prakash, Advanced Quantum Mechanics, Kedarnath Publication, New Delhi.

COURSE OUTCOMES (COs):

By the end of the course, the students will be able to

CO1: Understand the fundamental concepts of quantum mechanics.

CO2: Understand the importance Schrodinger equation and their simple applications.

CO3: Understand approximation methods like time independent degenerate ,non-degenerate Perturbation theories, variation methods etc.

CO4: Study scattering theory and calculate scattering amplitude and cross section.

CO5: Understand the basic ideas of Clebsch-Gorden coefficients.

CO6: Understand the basics of relativistic quantum mechanics and its wide ramifications.

MAPPING OF POs AND PSOs WITH COs

COURSE OUTCOMES	PROGRAMME OUTCOMES (POs)													PROGRAMME SPECIFIC OUTCOMES(PSOs)							
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8
CO 1	✓	✓	✓				✓		✓		✓				✓	✓		✓	✓	✓	
CO 2	✓		✓		✓	✓	✓		✓		✓			✓	✓	✓		✓	✓	✓	
CO 3	✓						✓				✓			✓	✓	✓		✓		✓	
CO 4	✓		✓	✓		✓	✓			✓	✓	✓		✓	✓	✓			✓	✓	
CO 5	✓		✓				✓		✓		✓			✓	✓	✓		✓	✓		
CO 6	✓		✓		✓		✓			✓	✓			✓	✓	✓		✓	✓	✓	

CC – VII : STATISTICAL MECHANICS & ELECTROMAGNETIC THEORY
[CODE: 20P2P7]
(Effective for those admitted from 2020-2021 onwards)

Objectives:

- To study the consequences of laws of thermodynamics.
- To study principles and application of classical and quantum statistical mechanics.
- To study the basics of electromagnetic theory and propagation of electromagnetic waves

UNIT I: Thermodynamics and their Consequences

Energy and first law of thermodynamics – Heat content and heat capacity – Specific heat – Entropy and second law of thermodynamics – Thermodynamic potential and the reciprocity relations – Maxwell's relations – Deductions – Properties of thermodynamics relations – Gibb's –Helmholtz relation – Thermodynamic equilibrium - Nernst Heat theorem of third law – Consequences of third law – Phase- Gibb's phase rule – Chemical potential.

UNIT II: Classical Statistical Mechanics

Macro and micro states – Statistical equilibrium – Phase space and ensembles – Micro canonical ensemble and Grand canonical ensembles – Liouville's theorem – Maxwell-Boltzmann distribution law – Principles of equipartition of energy – Partition function – Relation between partition function and thermodynamic quantities.

UNIT III: Quantum Statistical Mechanics

Black body and Planck's radiation – Photons – Ideal Bose gas energy, pressure and thermal properties – Bose-Einstein condensation – Liquid Helium – Fermi-Dirac gas – Properties – Degeneracy – Electron gas – Free electron model and thermionic emission – Fermi Energy – Richardson Dushman equation – Ising model.

UNIT IV: Electromagnetics

Faraday's law of induction – Current density – Ampere's Circuital law – Basics of dielectrics – Maxwell's displacement current – Maxwell's equations – Maxwell equations in terms of vector and scalar potentials – Gauge transformations – Lorentz gauge, Coulomb gauge – Poynting's theorem – Conservation of energy – Dynamics of charged particles in static and uniform electromagnetic fields.

UNIT V: Plane Electromagnetic waves and wave propagation

Plane waves in a non conducting medium – Linear and circular polarization, Stoke's parameters – Reflection and refraction of electromagnetic waves at a plane interface between dielectrics – Fields at the surface of and within a conductor – Propagation of electromagnetic waves in hollow metallic cylinders: Cylindrical and rectangular wave guides – TM and TE modes.

Books for Study and Reference

Relevant chapters in

1. K.Huang, Statistical Mechanics (Willey Eastern Limited, New Delhi, 1963).
2. B. K. Agarwal and M. Eismer, Statistical Mechanics (Willey Eastern Limited, New Delhi, 1994).
3. F. Reif, Fundamentals of Statistical and Thermal Physics(Mc Graw Hill, Singapore, 1985)
4. Electromagnetic theory –Chopra and Agarwal
5. Electromagnetic Theory and applications – Chatopadhyaya
6. Classical Electrodynamics – J.D. Jackson.
7. Statistical Mechanics- Gupta Kumar- S.Chand & Co.

COURSE OUTCOMES (COs):

By the end of the course, the students will be able to

CO1: Understand the laws of thermodynamics and give an account of the relevant quantities used to describe the macroscopic system, thermodynamic potentials etc.

CO2: Describe the Reciprocity theorem, Thermodynamic Equilibrium and Nernst Heat theorem.

CO3: Give an account of kinetic theory of gases.

CO4: Give a flavor of MB Statistics, Boltzmann transport equation and mean free path.

CO5: Introduce the concept of ensembles and phase space.

CO6: Describe Maxwell Boltzmann distribution and its applications.

CO7: Illustrate the role of Electromagnetic.

CO8: Describe the importance Plane Electromagnetic waves and wave propagation.

MAPPING OF POs AND PSOs WITH COs

	PROGRAMME OUTCOMES (POs)													PROGRAMME SPECIFIC OUTCOMES(PSOs)							
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8
CO 1	✓		✓		✓	✓			✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	
CO 2	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	
CO 3	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	
CO 4	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	
CO 5	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		
CO 6	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	
CO 7	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	
CO 8	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	

EC - II : MICROPROCESSOR AND MICROCONTROLLER

[CODE: 20P2P8EC]

(Effective for those admitted from 2020-2021 onwards)

Objectives:

- To acquire knowledge about microprocessor and apply it to various interfacing applications.
- To introduce the basics of micro controller.

UNIT I : Digital Computer Architecture And 8085 Microprocessor

Basic components of a digital computer – CPU – I/O – Memory – Semi Conductor memory – RAM, ROM etc., – 8085 microprocessor Architecture – Bus System – Various registers – Pin configuration of 8085. Timing diagrams for OP code fetch cycle and READ and WRITE operations.

UNIT II : Programming With 8085

Instruction set – Data transfer group – Arithmetic group – Logical group – Branch group – stack and I/O control instructions -Addressing modes – Direct, register Indirect – immediate and implicit. Programming in the 8085 – Addition, Subtraction, Multiplication, Division, Biggest and Smallest of a set of numbers-Ascending and Descending order.

UNIT III : Data transfer and Interrupt structure

Data transfer schemes – Synchronous and asynchronous – Direct memory Access (DMA) – Cycle stealing – Burst mode – Memory interfacing – Memory mapped I/O scheme – I/O mapped memory scheme – interfacing memory ICs with 8085 – Interrupts of 8085 – Hardware and software – interrupts call location - pending interrupts – hand shaking.

UNIT IV : Interfacing

Interfacing devices and peripheral subsystems-Types of interfacing devices-programmable peripheral Interface (8255) – programmable DMA controller (8257) – programmable Interrupt controller (8259) – ADC & DAC-Stepper motor interfacing-Applications –Temperature measurement-Digital clock (using 8085).

UNIT V : Microcontroller

Microcontroller and Embedded Processors – Overview of 8051 family-Pin description of 8051-Register – Program Counter – PSW, SFR – Loop and Jump instruction – Time delay generation and Calculation – Addressing mode – Arithmetic and Logical Instruction – Bit Instruction.

Books for study:

1. R.F.Coughlin and F.F.Driscoll, 'Operational amplifiers and linear integrated circuits', Pearson Education Inc, New Delhi, 2001.
2. R.Gaonkar, Microprocessor Architecture programming and applications, Wiley Eastern Ltd., New Delhi, 1985.
3. Marris Mano, Computer System Architecture, PHI Ltd., New Delhi, 1994.
4. B.Ram, Fundamentals of Microprocessors and Microcomputers, Dhanapat Rai and Sons, New Delhi, 1995.
5. Malvino, Electronic principles, Tata McGraw Hill Ltd., New Delhi, 1995
6. Muhammad Ali Mazidi and Janice Gillispie Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson Education, New Delhi, 2000.

Books for Reference:

1. T.L. Floyd "Electronic devices", Pearson education, New York 2004.
2. T.L. Floyd "Digital Fundamentals" Pearson education, New York 2004.
3. P.Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press Cambridge 1995.
4. Microcomputer Systems: The 8086/8088 Family, Yu cheng Liu and Glenn A Gibson, Prentice hall of India PVT Ltd, New Delhi, 2004,
5. A.Nagoor Kani, Microprocessor and Microcontroller, 1st Edition, RBA Publications, Chennai – 2006.

COURSE OUTCOMES (COs):

By the end of the course, the students will be able to

CO 1 : Understand the basic ideas of operational amplifier and its applications.

CO 2 : Acquire knowledge of microprocessor 8085, 8086 and microcontroller 8051.

CO 3 : Gain knowledge about interfacing devices.

CO 4 : Learn and write the assembly language programs.

CO 5 : Apply the circuit theory to design sequential logic circuits.

CO 6 : Construction of ALU as a midway to build a digital computer.

MAPPING OF POs AND PSOs WITH COs

COURSE OUTCOMES	PROGRAMME OUTCOMES (POs)													PROGRAMME SPECIFIC OUTCOMES(PSOs)								
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8	
CO 1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓		
CO 2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓		
CO 3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓		
CO 4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓		
CO 5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓		
CO 6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓		

CC – VIII : PRACTICAL – II [CODE: 20P2PP2]
GENERAL AND ELECTRONICS
(Effective for those admitted from 2020-2021 onwards)

OBJECTIVES:

- To understand the basic laws / principles and theoretical background of the physical instruments.
- To provide a hands - on learning experience.
- To calculate various physical parameters.

GENERAL:

1. Determination of wavelength of spectral lines – Brass arc spectrum
2. Determination of wavelength of spectral lines – Copper arc spectrum
3. Determination of wavelength of spectral lines – Iron arc spectrum
4. Rydberg's constants using spectrometer
5. Hartmann's constants using spectrometer
6. B-H curve – Anchor ring
7. Forbe's method – Thermal conductivity of a good conductor
8. e/m – Spectrometer
9. Planck's constant
10. Anderson's Bridge
11. Thermionic work function
12. Photo transistor – Characteristics

ELECTRONICS:

1. DIAC, TRIAC Characteristics
2. Op-amp characteristics
3. Op-amp – Adder, Subtractor, Integrator, Differentiator
4. Construction of Schmitt trigger
5. NAND and NOR as Universal gates
6. Op-amp as waveform generator
7. Half adder and Full adder using NAND gates
8. Half and Full Subtractor
9. Clipping and Clamping circuits
10. K-Map verification
11. Dual power supply
12. OP-AMP filter circuits

COURSE OUTCOMES (COS):

By the end of the course, the students will be able to

CO1: Understand the fundamentals of physics.

CO2: Application of simple concepts to perform experiments.

CO3: Apply the theory to determine various properties of the materials given.

CO4: Familiarity to handle the instruments.

CO5: Conduct of Electronic circuit experiments.

CO6: Expertise to develop experimental skills.

MAPPING OF POs AND PSOs WITH COs

COURSE OUTCOMES	PROGRAMME OUTCOMES (POs)													PROGRAMME SPECIFIC OUTCOMES(PSOs)							
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8
CO 1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
CO 2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
CO 3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
CO 4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
CO 5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
CO 6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓

CC – IX : SOLID STATE PHYSICS [Code: 20P3P9]
(Effective for those admitted from 2020-2021 onwards)

Objectives:

- To learn the basics of crystal structure.
- To understand theories for the description of certain properties and phenomena of solid states.

UNIT I: Crystal structure

Basics of crystal systems – Symmetry elements in a crystal – Point groups and Space Groups – Bravais lattices – Defects and dislocations – Bonding of solids - Bragg's law – Atomic scattering factor – Experimental X-ray diffraction methods of crystal structure analysis – Laue method – Rotating crystal method – Powder method – Ordered phases of matter: Translational and Orientational orders – Kinds of liquid crystalline order – Quasicrystals.

UNIT II: Lattice vibration and Thermal properties:

Vibration of monoatomic lattices – diatomic lattice vibration – Quantisation of lattice vibration – Phonon momentum – N-Process and Umklapp process – Local Phonon modes – Inelastic scattering of Photons by long wave phonons – Lattice specific heat – Classical Theory – Electronic specific heat – Einstein's and Debye's Theory.

UNIT III: Band theory of solids:

Free electron gas in three dimension – Drude and Sommerfeld model of electrical and thermal conductivity – Widemann Franz law – Bloch theorem – Kronig–Penney model – Velocity of electrons according to Band theory – Brillouin zones – Number of possible wave functions per band – Distinction between metals, insulators and semiconductors – Metal-insulator transition – Hall effect.

UNIT IV: Magnetism:

Origin of permanent magnetic moment – Quantum theory of paramagnetism – Paramagnetism of rare earth and iron group ions – Ferromagnetism – Weiss theory – Molecular field – Heisenberg's exchange interaction – Ferro magnetic domains – Domain structure – Origin of Domains – Bloch Walls – Coercive force and hysteresis – Antiferromagnetic order – Ferrimagnetism - Ferrites.

UNIT V: Dielectrics and Superconductivity:

Dielectrics: Polarization – Dielectric constant and Polarisability – Clausius-Mossotti equation – Electronic, Ionic and Orientational polarisability – Ferro electric crystals classification – Polarisation catastrophe.

Superconductivity: Zero resistance – Behaviour in magnetic field – Meissner effect – Type I & Type II superconductors – London equation – Penetration depth – BCS theory, AC and DC Josephson effects (Qualitative study) – Properties and applications of superconductors - High T_c superconductors.

Books for study and Reference:

1. Gupta Kumar Sharma, Solid State Physics, K. Nath & Co, Meerut, 2013.
2. S.L. Kakani and C.A. Hemaranjini, Text book of Solid State Physics, Sultan Chand & sons, New Delhi, 1996.
3. R.K. Puri and V.K. Babbar, Solid State Physics, S. Chand & Company Ltd, New Delhi, 1996.
4. B. Saxena, R. Gupta and P. Saxena, Fundamentals of Solid State Physics, Pragati Prakashan, Meerut, 2016.
5. S.O. Pillai, Solid State Physics, New age international, New Delhi, 2006.
6. Charles Kittel, Introduction to Solid State Physics, John Wiley & Sons Inc, USA, 2005.

COURSE OUTCOME (COs):

By the end of the course, the students will be able to

- CO1:** Able to correlate the X-ray diffraction pattern for a given crystal structure based on the corresponding reciprocal lattice and understand the types of crystalline imperfections
- CO2:** To enhance the ability of students to understand electron and band theories.
- CO3:** Able to explain how the predicted electronic properties of solids differ in the classical free electron theory, quantum free electron theory and the nearly free electron theory.
- CO4:** To explain various magnetic phenomena and describe the different types of magnetic ordering based on the exchange interaction.
- CO5:** Acquisition of knowledge concerning the electrical behavior of dielectric materials (polar and non-polar)
- CO6:** Explain the structural dependence of electrical, optical and mechanical properties of modern engineering materials.

MAPPING OF POs AND PSOs WITH COs

COURSE OUTCOMES	PROGRAMME OUTCOMES (POs)													PROGRAMME SPECIFIC OUTCOMES (PSOs)							
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8
CO 1	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓		✓	✓	✓
CO 2	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓		✓
CO 3	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
CO 4	✓	✓	✓		✓		✓	✓	✓	✓			✓	✓	✓	✓		✓	✓		✓
CO 5	✓		✓	✓	✓		✓		✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓
CO 6	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓

CC – X : NUCLEAR AND PARTICLE PHYSICS [CODE: 20P3P10]
(Effective for those admitted from 2020-2021 onwards)

Objective:

- To acquire knowledge about nuclear structure, Radioactive Decays, Nuclear Fission and Fusion, Nuclear Reactions and Elementary Particles.

UNIT I: Nucleus and Nuclear forces

Nuclear mass – Nuclear stability, Binding energy, Mass defect and Packing fraction – Weiszacker's semi empirical mass formula – Mass parabolas for isobaric nuclei – Nuclear magnetic moment – Determination of nuclear magnetic moment by magnetic resonance method – Electric Quadrupole moment.

Ground state of Deuteron – n-p scattering at low energies – spin dependence – scattering length – effective range – exchange forces – meson theory

UNIT II: Radioactive decays:

Gamow's theory of Alpha decay – Geiger-Nuttal law – Beta decay – Neutrino hypothesis – Fermi theory of Beta decay – Selection rules – non conservation of parity – Gamma emission – Internal conversion – Nuclear isomerism – Basic principles of particle detectors – Ionization chamber – Cloud chamber – Bubble chamber –GM counter– Scintillation counter- Semiconductor detector.

UNIT III: Nuclear reactions and nuclear models:

The Q-equation – Nuclear reaction cross section – Compound nucleus – energy levels – reciprocity theorem – Briet-Wigner dispersion formula for resonance scattering and reactions – optical model – shell model – liquid drop model – collective model.

UNIT IV: Accelerators and reactors:

Linear accelerators -Cyclotron – Synchrocyclotron – Betatron – Electron synchrotron — Nuclear fission – Mass distribution of fission fragments – spontaneous fission – Bohr – Wheeler theory – Nuclear chain reaction – Homogeneous reactors – Heterogeneous reactors – Nuclear fusion – Thermonuclear reactions as source of stellar energy.

UNIT V: Elementary particles:

Classification of elementary particles – General ideas of gravitational, strong, weak and electromagnetic interactions – conservation laws and their validity – The C.P.T theorem – Strangeness – Gellmann-Nishijima relation – SU(3) classification of Hadrons – Octets and Decuplets – Elementary ideas of quarks.

Books for Study and Reference

Relevant chapters in

1. K.S. Krane, Introductory Nuclear Physics (Tata McGraw Hill, New Delhi, 1987).
2. D.C. Tayal, Nuclear Physics
3. Pandya and Yadav, Nuclear Physics
4. R. C. Sharma, Nuclear Physics
5. S.B. Patel, Nuclear Physics: An Introduction (Wiley-Eastern, New Delhi, 1991).
6. B.L. Cohen Concepts of Nuclear Physics (Tata McGraw Hill, New Delhi, 1988).
7. S.N.Ghoshal-Nuclear Physics

COURSE OUTCOMES (COs):

By the end of the course, the students will be able to

- CO1:** Understand the fundamentals of nuclear properties and deuterons.
CO2: Illustrate the radioactive processes and their corresponding decay.
CO3: Realize the importance of nuclear energy resources through various nuclear reactions.
CO4: Apply the knowledge of elementary particles in the field of research on particle accelerators.
CO5: Acquire a thorough knowledge on fission and fusion reactions for production of energy as well as weapons.
CO6: Demonstrate the basic principles and applications of nuclear physics in the field of atomic research.

MAPPING OF POs AND PSOs WITH COs

COURSE OUTCOMES	PROGRAMME OUTCOMES (POs)													PROGRAMME SPECIFIC OUTCOMES(PSOs)							
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8
CO 1	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓			✓	✓	✓
CO 2	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓			✓	✓	✓
CO 3	✓		✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		✓
CO 4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓
CO 5	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
CO 6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓			✓	✓	✓

EC – III: OBJECT – ORIENTED PROGRAMMING USING C++
[CODE: 20P3P11EC]
(Effective for those admitted from 2020-2021 onwards)

Objectives:

- To understand the basic concepts of object oriented programming using C++
- To impart practical training of real time problems in C++

UNIT-I: Basics of OOP and C++ Programming

Basic concepts of Object-Oriented Programming –Advantages – Benefits of OOP and applications– Structure of C++ Program – Tokens, Expressions. Control Structures - Decision Making and Statements : If .. else ,jump, goto, break, continue, Switch case statements - Loops in C++ : For,While, Do – Operators – scope resolution, member dereferencing, memory management operators – Manipulators – Operator overloading - Overloading unary, binary operators.

UNIT-II : Classes and Inheritance

Functions in C++ - Inline functions – Function Overloading - class – specifying a class-Defining member functions - Objects – private and static member functions – array of objects - friend function - Constructors – types - Destructors - Inheritance– Single, Multilevel, Multiple, Hierarchical, Hybrid inheritance.

UNIT-III: Pointer and templates

Pointers –Pointer to Class , Object – this pointer – Pointers to derived classes and Base classes -Virtual Functions and Polymorphism-Managing Console I/O Operations – Files – File stream classes – file modes – Sequential Read / Write operations – Binary and ASCII Files – Random Access Operation.

UNIT-IV: Libraries and system development

Templates – Class templates – Function templates - Exception Handling – Throwing, catching and trying mechanisms - Standard Template Library – Containers – Algorithms – iterators - Object oriented system development – Procedure oriented – Object oriented paradigms – String manipulation.

UNIT- V: Programs

1. Write a Program using class to represent a Bank Account with Data Members – Name of depositor, Account number, Type of account and balance and member functions- deposit amount- withdrawal amount. Show name and balance. Check the program with own data
2. Write the program to read an integer and find the sum of all the digits until it reduces to a single digit using constructor, destructor and default constructor.
3. Prepare pay roll of an employee using inheritance.
4. a. Write a program to find the number of vowels in a given text.
b. Write the program to check for palindrome.
5. Prepare electricity bill for customers generating and handling any two exceptions.

Book for study and programs of unit v :

1. E. Balagurusamy, OBJECT-ORIENTED PROGRAMMING WITH C++, Tata Mc-Grawhill Publication, 6th Ed 2013.

REFERENCE BOOKS:

1. Ashok N Kamthane , OBJECT-ORIENTED PROGRAMMING WITH ANSI AND TURBOC C++, Pearson Education publication. 2003.
2. Maria Litvin & Gray Litvin , C++ for you, Vikas publication, 2002.
3. John R Hubbard, Programming with C++, 2nd Edition, TMH publication, 2002.

COURSE OUTCOMES (COs):

By the end of the course, the students will be able to

- CO1:** Understand the difference between the top-down and bottom up approach.
CO2: Describe the object oriented programming approach in connection with C++.
CO3: Apply the concepts of object oriented programming and procedural programming
CO4: Illustrate the process of data file manipulations using C++.
CO5: Apply virtual and pure virtual function and complex programming situations.
CO6: To apply object oriented (or) non-object oriented techniques to solve bigger computing problems.
CO7: Understand dynamic memory management techniques using pointers, constructors, destructors etc.,
CO8: Describe the concepts of function overloading ,virtual functions and polymorphism.
CO9: Classify inheritances.
CO10: Develop the expertise to write source codes in C++.

MAPPING OF POs AND PSOs WITH COs

	PROGRAMME OUTCOMES (POs)													PROGRAMME SPECIFIC OUTCOMES(PSOs)							
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8
CO 1	✓		✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓		✓		✓	
CO 2	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓		✓		✓	
CO 3	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓		✓		✓	✓
CO 4	✓	✓	✓	✓	✓	✓	✓			✓	✓		✓	✓	✓	✓		✓		✓	
CO 5	✓	✓	✓	✓	✓	✓	✓			✓	✓		✓	✓	✓	✓		✓		✓	
CO 6	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓		✓		✓	
CO7	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓		✓		✓	
CO8	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	
CO9	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓		✓		✓	
C10	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓		✓		✓	

CC - XI: PRACTICAL - III [CODE: 20P3PP3]

ADVANCED GENERAL AND ELECTRONICS

(Effective for those admitted from 2020-2021 onwards)

OBJECTIVES:

- Understand the basic laws/ principles of semiconductor devices.
- To learn the applications of active devices
- Acquire practical knowledge of electronic devices/components.
- To provide a hands-on learning experience.

Minimum twelve experiments

1. Magnetic Susceptibility – Guoy’s Method
2. Magnetic Susceptibility – Quincke’s Method
3. Michelson Interferometer – Determination of separation of wavelengths of sodium lines
4. Michelson Interferometer – Thickness of the thin film
5. Op-Amp D/A Converter
6. 0 – 99 Counter
7. 7490 as a scalar
8. Seven segment decoder and Mod 16 counter
9. Ultrasonic Interferometer- determination of velocity
10. Four probe method
11. Junction Characteristics
12. Shift Register
13. Encoder and Decoder
14. Multiplexer and DeMultiplexer.
15. 555 Timer – Multivibrators.
16. Laser: Determination of wavelength and particle size
17. Hall Effect
18. Photo Voltaic Cell

COURSE OUTCOMES (COs):

By the end of the course, the students will be able to

CO1: Learn the working of semiconductor devices and its applications.

CO2: Explore the applications of Transistors.

CO3: Design the analog circuits independently.

CO4: Expertise in hands-on learning.

CO5: Create models and demos using electronic devices.

CO6: Expertise in analog/digital electronic circuits and their branches.

MAPPING OF POs AND PSOs WITH COs

COURSE OUTCOMES	PROGRAMME OUTCOMES (POs)													PROGRAMME SPECIFIC OUTCOMES(PSOs)								
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8	
CO 1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓		
CO 2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓		
CO 3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓		
CO 4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓		
CO 5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓		
CO 6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓		

EC - IV: PRACTICAL - IV [CODE: 20P3PP4EC]

MICROPROCESSOR AND MICROCONTROLLER PROGRAMMING

(Effective for those admitted from 2020-2021 onwards)

OBJECTIVES:

- To develop programming skills of Microprocessor.
- To develop programming skills of Microcontroller.

Any twelve experiments only

1. Microprocessor – Arithmetic Operation
2. Microprocessor – Largest, Smallest, Ascending , Descending
3. Microprocessor – Square and Square root
4. Microprocessor – Hexadecimal and Decimal Conversion
5. Microprocessor – 16-bit arithmetic operation
6. Microprocessor – Stepper Motor
7. Microprocessor – Display of Character and Words
8. Microprocessor – Display of rolling message
9. Microprocessor – Display of blinking message
10. Microprocessor – Generation of square and triangular wave
11. Microprocessor – Saw tooth and stair-case waves
12. Microprocessor – Generation of sine waves
13. Microprocessor – Study of 8-digit 7-segment display
14. Microprocessor – Interface with CRO
15. Microcontroller – Addition and subtraction
16. Microcontroller – Multiplication and division
17. Microcontroller– Ascending and Descending order
18. Microcontroller – Stepper motor.

COURSE OUTCOMES:

By the end of the course, the students will be able to

CO1: Understand and apply the basic knowledge of computational physics in solving various physical problems.

CO2: Write C++ Programmes for different applications.

CO3: Demonstrate ability to handle arithmetic operations using assembly language.

CO4: Set up programming strategies and select proper mnemonics and run their program on the training boards.

CO5: Practice different types of programming keeping in mind technical issues and evaluate possible causes of discrepancy in practical's.

CO6: Develop testing and experimental procedures on Microprocessor and microcontroller to analyze their operation under different cases.

CO7: Demonstrate the ability to interact effectively on a social and interpersonal level with fellow students.

MAPPING OF POs AND PSOs WITH COs

COURSE OUTCOMES	PROGRAMME OUTCOMES (POs)													PROGRAMME SPECIFIC OUTCOMES(PSOs)							
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8
CO 1	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
CO 2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓			✓		✓	✓	✓	✓
CO 3	✓	✓		✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓
CO 4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓		✓	✓
CO 5	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
CO 6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓		✓	✓	✓	✓
CO7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓

CC – XII : SPECTROSCOPY
[CODE: 20P4P12]
(Effective for those admitted from 2020-2021 onwards)

Objectives:

- To understand the atomic spectra and Quantum Chemistry of molecules.
- To study the principles of Microwave, Infrared, Raman and Resonance spectroscopy and its application.

UNIT I: Atomic Spectra

Vector atom model and Quantum numbers – Pauli's exclusion principle and atomic structures – periodic table – spectra of alkali and alkaline elements – fine and hyper fine structure of spectral lines – complex spectra – effect of magnetic and electric fields on the spectrum of an atom Zeeman effect (Normal and anomalous) – Paschen-Back effect – Stark effect

UNIT II: Molecular Spectra

The variation method-Application of variation method – Orbitals – Types of Hybridization – molecular orbital method (MO method) – Bonding and anti –bonding molecular orbitals – The hydrogen molecule ion – Huckel's molecular approximation – Application to Butadiene and Benzene.

UNIT III: Microwave and IR Spectroscopy

Microwave Spectroscopy: Rotational spectra of diatomic molecules – Effect of isotopic substitution – The non rigid rotator – Rotational spectra of polyatomic molecules – Linear, symmetric top and asymmetric top molecules – Experimental techniques.

IR Spectroscopy: Vibrating diatomic molecules – Diatomic vibrating rotator – Linear and symmetric top molecules – Analysis by infrared techniques – Characteristics and group frequencies.

UNIT IV: Raman and Electronic Spectroscopy of molecules

Raman Spectroscopy: Raman effect – Quantum theory of Raman effect – Rotational and Vibrational Raman shift of diatomic molecules – Selection rules – Applications – Laser Raman spectrometer.

Electronic Spectroscopy of molecules: Electronic spectra of diatomic molecules – The Franck-Condon principle – Dissociation energy and dissociation products – Rotational fine structure of electronic vibration transitions.

UNIT V: Resonance Spectroscopy

NMR: Basic principles –Quantum mechanic description – Spin-spin and spin-lattice relaxation times – Chemical shift and Coupling constant – NMR,NQR Spectrometer

ESR: Basic principles – ESR spectrometer – Nuclear interaction and hyperfine structure – Relaxation effects – g- factor – Characteristics – Free radical studies and Biological applications.

Books for Study and Reference

1. C.N. Banwell, Fundamentals of molecular spectroscopy (McGraw Hill, New York, 1981)
2. B.P. Straughan and S. Walker, Spectroscopy Vol.I (Chapman and Hall, New York, 1976)
3. R.P. Feynman et al. The Feynman Lectures in physics Vol III (Narosa, New Delhi, 1989)
4. H.S. Mani and G.K. Mehta, Introduction to Modern physics (Affiliated East West, New Delhi, 1991)
5. A.K. Chandra, Introductory Quantum chemistry (Tata McGraw Hill, New Delhi, 1989)
6. Pople, Schneiduer and Berstein, High resolution NMR (McGraw Hill, New York)
7. Manaschanda, Atomic structure and chemical bond (McGraw Hill, New Delhi, 1991)
8. Ira N. Levine, Quantum chemistry (Prentice-Hall, New Delhi, 1994)
9. Arthur Beiser, Concepts of Modern physics (McGraw Hill, New York, 1995)
10. C.P. Slitcher, Principles of Magnetic Resonance (Harper and Row).

COURSE OUTCOMES (COs):

By the end of the course, the students will be able to

- CO1:** Understand the concepts of atomic spectra and other features of alkali spectra.
- CO2:** Apply the knowledge of Quantum chemistry of molecules in computational research.
- CO3:** Analyze FTIR spectra and apply the instrumentation techniques in recording Infrared (IR) spectrum.
- CO4:** Comprehend the basics and importance of Raman spectroscopy and also able to extend the concepts of electronic spectroscopy to UV – visible analysis.
- CO5:** Identify the appropriate spectral technique as an analytical tool to investigate the characteristics of materials.

MAPPING OF POs AND PSOs WITH COs

COURSE OUTCOMES	PROGRAMME OUTCOMES (POs)													PROGRAMME SPECIFIC OUTCOMES (PSOs)							
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8
CO 1	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓			✓	✓	✓
CO 2	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 3	✓	✓		✓	✓			✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		
CO 4	✓		✓	✓	✓		✓	✓	✓	✓		✓		✓	✓				✓	✓	✓
CO 5	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓

CC - XIII : COMMUNICATION ELECTRONICS [CODE: 20P4P13]
(Effective for those admitted from 2020-2021 onwards)

Objectives:

- Introducing various antennas and their properties for communication.
- Introducing knowledge about the generation and applications of microwaves and also RADAR
- To give the knowledge about the propagation of signals and the conversion of analog signal into digital signals based on various parameters
- To introduce the basic ideas about communications through optical fiber cables.
- To study about the signal processing technique in colour television regarding light and sound.

UNIT I : ANTENNAS

Introduction – Antenna equivalent circuits – Radiation fields – Polarization – Isotropic radiator – Power gain of an Antenna – Effective area of an Antenna - Effective length of an Antenna – Half wave Dipole Vertical Antennas – Non resonant Antennas - VHF – UHF Antennas – Microwave Antennas.

UNIT II : TYPES OF MICROWAVE SOURCE AND RADAR

Introduction – Magnetron – Magnetron oscillation – Travelling wave Tube amplifiers – Klystrons – Microwave radar systems - applications of Microwaves – RADAR – Equation of RADAR – Range – Applications.

UNIT III: COMMUNICATIONS SYSTEMS

ANALOG : Amplitude modulation – Modulation index – Frequency spectrum for sinusoidal AM – Average power for sinusoidal AM – Non sinusoidal modulation.

DSBSC – Amplitude transmitters – AM Receivers

SSB: Introduction – SSB generation – SSB reception – S /N Ratio for SSB – Balanced Modulators DIGITAL: Introduction – PAM – PCM – PFM- PTM- PPM – PWM – Frequency shift keying Phase shift keying – Differential phase shift keying.

UNIT IV: FIBRE OPTIC COMMUNICATIONS:

Fibre construction – Step and graded index optic fibre – Total internal reflection - Principles of light transmission in a Fibre – Expression for acceptance angle - Numerical aperture - Losses in Fibers – Dispersion – Light sources of Fibre Optics – Pin diode – Photo Detectors - Photo avalanche diode – Connectors and Splices – Fibre Optic Communication System – advantages.

UNIT V: TELEVISION

Elements of television system – Picture transmission – Sound transmission – Picture reception – Sound reception – Colour television – Essentials of colour television – Perception – Three colour theory – Luminescence – Hue and saturation – TV camera– Image orthicon– Vidicon luminescence signal TV display tubes -LCD–LED screen (Basic concepts only)- Delta gun and Precision in line picture tubes – Convergence adjustments – Signal transmission – modulation of colour difference signals- Flexible.

Books for study:

1. Millman and Halkias, Integrated Electronics, Tata Mc Grawhill Ltd., New Delhi, 1987.
2. Malvino, Electronic Principles, Tata McGraw hill Ltd., New Delhi, 1985.
3. Dennis Roddy, John Coolen Electronic Communications (Fourth Edition) Prentice Hall of India Private Ltd, 1997.
4. 4 R.R.Gulati, Monochrome and Colour Television, Wiley Eastern, New Delhi, 1995.

COURSE OUTCOMES (COs):

By the end of the course, the students will be able to

- CO1:** Explain the operation of VHF, UHF and microwave antenna.
CO2: Explain the operation of VHF,UHF and microwave antenna.
CO3: Understand the principle of microwave propagation and its applications..
CO4: Demonstrate the working principle, design and applications of colour television.
CO5: To understand the basics of satellite communications.
CO6: Understand the concepts of fiber fabrications
CO7: Understand the role of transmitter and receiver in satellite Communication networks.
CO8: Study of basics of cellular communications.
CO9: Understand the concept of colour television.

MAPPING OF POs AND PSOs WITH COs

	PROGRAMME OUTCOMES (POs)													PROGRAMME SPECIFIC OUTCOMES(PSOs)							
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8
CO 1	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓			✓		✓	✓
CO 2	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
CO 3	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
CO 4	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
CO 5	✓		✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓			✓	✓	✓	✓
CO 6	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
CO 7	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
CO 8	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
CO 9	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓

EC - V : LASERS, NANO MATERIALS AND APPLICATIONS
[CODE: 20P4P14EC]
(Effective for those admitted from 2020-2021 onwards)

Objectives:

- To enrich the knowledge in the field of laser and to learn the structures, properties, characterization and applications of nanomaterials.

UNIT-I: LASERS

Principles of lasers – Population inversion – Laser Pumping quality factor – threshold condition – Schallow and Townes condition - He-Ne Laser – CO₂ Lasers – Nd-YAG Laser – Intrinsic semiconductor Laser – Holography – Recording and reconstruction of image – transmission technique only.

UNIT – II : INTRODUCTION TO NANOMATERIALS

Nanoparticle – classifications – Principles of Top- down and Bottom- up approaches – Chemistry of nanoparticle synthesis – Nucleation and growth of nanoparticles – Fullerence : Variations – properties – Quantum dots – Metal nanoparticles – fabrication – optical properties – applications.

UNIT – III : SYNTHESIS AND PROCESSING OF NANOMATERIALS

Synthesis of metallic and semi conductor nanoparticle - Physical and Chemical techniques – Ball milling – Laser ablation – Photo , e-beam , X-Ray lithography – Molecular Beam Epitaxy (MBE) – Plasma arching – Sol Gel technique – Electro chemical etching technique .

**UNIT – IV : FABRICATION AND CHARACTERIZATION OF NANO
STRUCTURED MATERIALS**

Nano wires growth techniques – VLS and electrochemical etching technique – Carbon nanotubes – formation – growth – types and structure – Estimation of particle size – SEM, TEM – SPM – STEM – block diagram – working.

UNIT – V : APPLICATIONS OF NANOMATERIALS

Molecular electronics and nanoelectronics – Nanorobots – Biological applications of nanoparticles – catalysis by gold nanoparticles – Band-gap engineered quantum devices – Nanomechanics – CNT emitters – Photoelectrochemical cells – Photonic crystals – Plasmon waveguides.

Books for study

1. Nanotechnology- S.Shanmugam, TBH edition.
2. Nano the essential- T.Pradeep – McGraw Hill edition, Chennai.
3. G.Cao, Nanostructures and nanomaterials (Imperial college press London, 2004)

Books for References

1. Nanoscale materials in chemistry, Kenneth J. Klabunde, 2001 Wiley & sons, Publication.
2. C.P. Poole and F.J. Owens, Introduction to Nanotechnology – Wiley, New Delhi, 2003.

COURSE OUTCOMES (COs):

By the end of the course, the students will be able to

- CO1:** Understand the concept of laser and its applications.
CO2: Explain the Basic concepts of Nano materials.
CO3: Able to synthesis the Nano materials.
CO4: Knowledge of fabricating Nano materials.
CO5: Apply the nano materials in industrial sectors.
CO6: Understand the through knowledge about the Nano materials.

MAPPING OF POs AND PSOs WITH COs

COURSE OUTCOMES	PROGRAMME OUTCOMES (POs)													PROGRAMME SPECIFIC OUTCOMES(PSOs)							
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8
CO 1	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓			✓	✓	✓
CO 2	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 3	✓	✓		✓	✓			✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		
CO 4	✓		✓	✓	✓		✓	✓	✓	✓		✓		✓	✓				✓	✓	✓
CO 5	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓
CO 6	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓

Computer Programming with C and C++

(Effective for those admitted from 2020-2021 onwards)

Any twelve programs

OBJECTIVES:

- To develop programming skills in C programming in solving some mathematical problems and their applications.
- To understand numerical methods for employing such as C++ for simulation for different physical problems and graphic analysis of physical data.

‘C’ PROGRAMMING:

1. Matrix Addition, Subtraction
2. Ascending and Descending Order
3. Hartmann’s Constant
4. Iteration Method
5. Least Square Curve Fitting
6. Lagrangian Interpolation Method
7. Newton-Raphson method
8. Quadratic equation
9. Matrix multiplication
10. Matrix transpose

C++ PROGRAMMING:

1. Simple and Compound Interest using class and object.
2. Biggest and smallest number in an array.
3. Matrix multiplication.
4. Program to create a class FLOAT that contains one float data member.
Overload all the four Arithmetic operators so that they operate on the object FLOAT.
5. Program to create a class STRING using any 5 STRING functions.
6. Program to create class, which consists of EMPLOYEE Detail like E_Number, E_Name, Department, Basic, Salary, Grade. Write a member function to get and display them.
Derive a class PAY from the above class and write a member function to calculate DA, HRA and PF depending on the grade.

COURSE OUTCOMES:

By the end of the course, the students will be able to

CO1: Understand and apply the basic knowledge of computational physics in solving various physical problems.

CO2: Write C Programmes for different applications.

CO3: Demonstrate ability to handle arithmetic operations using assembly language.

CO4: Set up programming strategies and select proper mnemonics and run their program on the training boards.

CO5: Practice different types of programming keeping in mind technical issues and evaluate possible causes of discrepancy in practical's.

CO6: Write C++ Programmes for different applications.

CO7: Demonstrate the ability to interact effectively on a social and interpersonal level with fellow students.

MAPPING OF POs AND PSOs WITH COs

COURSE OUTCOMES	PROGRAMME OUTCOMES (POs)													PROGRAMME SPECIFIC OUTCOMES(PSOs)							
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8
CO 1	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
CO 2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓			✓		✓	✓	✓	✓
CO 3	✓	✓		✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓
CO 4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓		✓	✓
CO 5	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
CO 6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓		✓	✓	✓	✓
CO7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓

CC XV : PROJECT WORK [CODE: 20P4PPW]

In this course, students are required to undertake a project work on a research problem and submit their results as a report followed by oral presentation in front of a viva-voce committee.

SEM	COURSE	PAPER	CODE
I	Core Course – I	Mathematical Physics – I	20P1P1
	Core Course – II	Classical Dynamics & Relativity	20P1P2
	Core Course – III	Electronics	20P1P3
	Elective Course – I	Crystal Growth and Thin Film Physics	20P1P4EC
	Core Course – IV	Practical – I : General & Electronics	20P1PP1
II	Core Course – V	Mathematical Physics – II	20P2P5
	Core Course – VI	Quantum Mechanics	20P2P6
	Core Course – VII	Statistical Mechanics and Electromagnetic Theory	20P2P7
	Elective Course – II	Microprocessor and Microcontroller	20P2P8EC
	Core Course - VIII	Practical – II : General and Electronics experiments	20P2PP2
III	Core Course - IX	Solid State Physics	20P3P9
	Core Course - X	Nuclear and Particle Physics	20P3P10
	Elective Course – III	Object – Oriented Programming using C++	20P3P11EC
	Core Course - XI	Practical – III : Advanced General and Electronics	20P3PP3
	Elective Course – IV	Practical – IV : Microprocessor and Microcontroller Programming	20P3PP4EC
IV	Core Course - XII	Atomic and Molecular Spectroscopy.	20P4P12
	Core Course - XIII	Communication Electronics	20P4P13
	Elective Course – V	Lasers, Nano Materials and Applications	20P4P14EC
	Core Course - XIV	Practical – V : Computer Programming with C and C++	20P4PP5
	Core Course - XV	Project	20P4PPW