2020

M.Sc PHYSICS

Course Structure and Syllabus

(For the candidates admitted from the academic year 2020-2021 onwards)

CHOICE BASED CREDIT SYSTEM (CBCS)

THANTHAI HANS ROEVER COLLEGE (AUTONOMOUS)

(Nationally Re-Accredited by NAAC with B++)

(Affiliated to Bharathidasan University, Tiruchirappalli)

ELAMBALUR, PERAMBALUR – 621 220

THANTHAI HANS ROEVER COLLEGE (AUTONOMOUS)

ELAMBALUR, PERAMBALUR – 621 220

PG & RESEARCH DEPARTMENT OF PHYSICS

VISION

To blossom as an institution of excellence, enabling, empowering and enlightening the youth and shaping them as fully developed human beings with the capacity to unfold their full mental potentiality resulting in the attainment of the wisdom to live constructively and meaningfully.

MISSION

- To provide congenial and stress- free environment and opportunities for the enhancement of knowledge and acquisition skills through the best exposure and training possible.
- To offer multifaceted and need-based academic programmes and to promote extension activities.
- To adopt technology-enabled new methods, approaches and techniques so that the teaching-learning process becomes learner-centred and learner-friendly.
- To maximize the participation of all the stakeholders in the development of the institution and the region.
- To sensitize the youth towards inclusive growth for socio-economic change, sustainable development, gender equality, eco-friendliness, etc.
- To enable the youth to experience the effects of globalization and facilitate them to grow as responsible citizens and leaders.
- To inspire them, through value-based education, to embrace the entire humanity while firmly rooted in the Indian ethos.
- To provide regular placement training and placement opportunities.
- To kindle the spirit of creativity and enhance research activities and enable them to attain international standards.

PROGRAMME OUTCOMES

Upon completion of the programme, the postgraduate will be able to

1. Gain advanced knowledge resulting in entrepreneurship; innovation and newer opportunities for being employable in public and private sectors, research and development organizations.
2. Apply enhanced new techniques and adopt new technologies needed in the respective disciplines.
3. Appreciate the diversity of behavior in professional practice and act in accordance with the core values of chosen profession.
4. Demonstrate the knowledge, values and skills to be critical consumer of research practice and possess investigative skills to evaluate the practice.
5. Engage in lifelong learning process, have the ability to communicate the findings of Languages / Commerce / Management studies / Social Work / Computing Sciences / Physical Sciences / Biological Sciences / Life Sciences with the current knowledge.

PROGRAMME SPECIFIC OUTCOMES

1. Conceptual knowledge and awareness on the impact of Physics.
2. Observational acquired experimental skills measuring and computational techniques.
3. Problem analyzing and solving skill: understanding and logical thinking, reasoning and troubleshooting.
4. Acquire analytical and logical skills for Higher education.
5. Research oriented internship and employability enhancement.

Thanthai Hans Roever College (Autonomous) Elambalur, Perambalur – 621220
M.Sc. Physics – Course Structure under **CBCS**
(For the candidates Aamitted from the Academic year 2020-2021 onwards)

Semester	Course Code	Title of the Course	Ins. Hours/ Weeks	Credits	Exam Hours	CIA (Max)	ESE (Max)	Total (Max)
1	20PPH1CC1	Mathematical Physics - I	6	4	3	25	75	100
1	20PPH1CC2	Classical Mechanics and Relativity	6	4	3	25	75	100
1	20PPH1CC3	Thermodynamics and Statistical Mechanics	8	4	3	25	75	100
1	20PPH1CC4	Electronics	5	4	3	25	75	100
1	20PPH1CP1	Physics Practical – I	5	4	3	40	60	100
		Total	**30**	**20**	**-**	**-**	**-**	**500**
2	20PPH2CC5	Mathematical Physics - II	6	5	3	25	75	100
2	20PPH2CC6	Electromagnetic Theory	6	5	3	25	75	100
2	20PPH2CP2	Physics Practical – II	8	4	3	40	60	100
2	20PPH2EC1:1	Numerical methods and Programming	5	5	3	25	75	100
2	20PPH2EC2:1	Microprocessor and Microcontroller	5	5	3	25	75	100
		Total	**30**	**24**	**-**	**-**	**-**	**500**
3	20PPH3CC7	Quantum Mechanics	6	5	3	25	75	100
3	20PPH3CC8	Spectroscopy	6	5	3	25	75	100
3	20PPH3CP3	Physics Practical – III	8	4	3	40	60	100
3	20PPH3EC3:1	Crystal Growth and Thin film Physics	5	5	3	25	75	100
3	20PPH3EC4:1	Nonlinear Optics	5	5	3	25	75	100
		Total	**30**	**24**	**-**	**-**	**-**	**500**
4	20PPH4CC9	Condensed Matter Physics	6	5	3	25	75	100
4	20PPH4CC10	Nuclear & Particle Physics	5	5	3	25	75	100
4	20PPH4CP4	Physics Practical – IV	8	4	3	40	60	100
4	20PPH4EC5:1	Nanophysics	5	4	3	25	75	100
4	20PPH4PW	Project Work – Dissertation – 80 Marks; Viva – 20 Marks	6	4	-	-	-	100
		Total	**30**	**22**	**-**	**-**	**-**	**500**
		Grand Total	**120**	**90**	**-**	**-**	**-**	**2000**

List of Major based Elective Courses

Elective	Course Code	Title of the Course
Elective -1	20PPH2EC1:1 20PPH2EC1:2	1.Numerical methods and Programming 2.Numerical methods
Elective –2	20PPH2EC2:1 20PPH2EC2:2	1.Microprocessor and Microcontroller 2.Advanced Microprocessor
Elective - 3	20PPH3EC3:1 20PPH3EC3:2	1.Crystal Growth and Thin film Physics 2.Thin Film Physics
Elective - 4	20PPH3EC4:1 20PPH3EC4:2	1.Nonlinear Optics 2.Biophysics
Elective –5	20PPH4EC5:1 20PPH4EC5:2	1.Nanophysics 2.Nanoscience

Note:

Project : 100 Marks
Dissertation : 80 Marks
Viva Voce : 20 Marks

- ❖ Core Course - 10
- ❖ Core Practical - 04
- ❖ Elective Course - 05
- ❖ Project - 01

1. Theory Internal 25 marks External 75 marks
2. Practical Internal 40 marks Internal 60 marks
3. Separate passing minimum is prescribed for Internal and External
   a) The passing minimum for CIA shall be 40% out of 25 marks (i.e. 10 marks)
   b) The passing minimum for University Examinations shall be 40% out of 75 marks (i.e. 30 marks)
   c) The passing minimum not less than 50% in the aggregate.

MATHEMATICAL PHYSICS – I

Core Course: I
Course Code: 20PPH1CC1
Hours / Week: 6
Credit: 4

Semester: I
Maximum Marks: 100
Internal Marks : 25
External Marks : 75

COURSE OUTCOMES

After successfully completing the course, the student will have a good understanding of the following topics and their applications:

- Usefulness of vector integration theorems and relation between surface, line and volume integration are shown. Application of these theorems in electromagnetic theory and other physical problems are illustrated.
- Understand the usefulness of matrices and matrix operations in different physical contexts
- Discuss the tensor analysis
- Complex analysis, residues and singularities
- Group theory classes and symmetry

UNIT-I: VECTOR ANALYSIS AND VECTOR SPACES

Concept of gradient, divergence, curl and Laplacian - Gauss's divergence theorem, Green's theorem and Stoke's theorem (statement and proof) - Orthogonal curvilinear coordinates - Expression for gradient, divergence, curl and Laplacian in cylindrical and spherical co-ordinates (Theory). Linearly dependent and independent sets of vectors - Inner product (problems)- Schmidt's orthogonalization process.

UNIT-II: MATRICES

Types of Matrices and their properties, Rank of a Matrix, Eigenvalue Equations and their solutions, Theorems on Matrices; Diagonalisation and Diagonalisation of different matrices; Characteristic equation of a matrix - Cayley-Hamilton's theorem – Sylvester's theorem.

UNIT–III: TENSOR ANALYSIS

Definition of Tensors – Contravariant, covariant and mixed tensors – Rank of a tensor - addition and subtraction of Tensors – Summation convention- Symmetric and Anti-symmetric Tensor – Contraction and direct product – Quotient rule- Pseudo tensors, Levi-Civita Symbol - Dual tensors, irreducible tensors-Metric tensors-Christoffel symbols – Equations of a Geodesic.

UNIT-IV: COMPLEX VARIABLE

Functions of complex variables – Differentiability – Cauchy-Riemann 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: GROUP THEORY

Definition - Subgroups - Cyclic groups and abelian groups - Homomorphism and isomorphism of groups - Classes - Symmetry operations and symmetry elements - Representations of groups - Reducible and irreducible representations - Character tables for simple molecular types (C2v and C3v point group molecules).

BOOKS FOR REFERENCE:

1. Mathematical Physics, B.D. Gupta, Vikas Publishing House Pvt. Ltd, 1995.
2. Mathematical Physics, B.S.Rajput, 20th Edition, PragatiPrakashan, 2008.
3. Mathematical Physics, H.K. Dass and Rama Verma, S.Chand and Company Ltd, 2010.
4. Mathematical Physics, P.K. Chattopadhyay, Wiley Eastern Limited, 1990.
5. Introduction to Mathematical physics, Charlie Harper, Prentice Hall of India Pvt.Ltd, 1993.
6. Applied Mathematics for Engineers and Physicists, L.A. Pipes and L.R. Havevill, McGraw HillPublications Co., 3rd Edition, 1971.
7. Theory and Problems of Laplace Transforms, Murray R. Spigel, Schaum's outline series, McGrawHill, 1986.
8. Matrices and Tensors in Physics, A.W. Joshi, Wiley Eastern limited, 3rd Edition, 1995.
9. Mathematical Physics, Satya Prakash, Sultan Chand & Sons, New Delhi, 4th Edition, 2004.

Relationship Matrix for course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code		Title of the Course				Hours		Credits	
I	20PPH1CC1		MATHEMATICAL PHYSICS – I				6		4	
Course Outcomes (Cos)	Programme Outcomes					Programme Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓			✓	✓	✓		✓	✓	✓
CO2	✓	✓		✓	✓	✓		✓	✓	
CO3	✓			✓	✓	✓		✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓		✓	✓	✓
CO5	✓		✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 38, Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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CLASSICAL MECHANICS AND RELATIVITY

Core Course: II | Semester: I
Course Code: 20PPH1CC2 | MaximumMarks : 100
Hours / Week: 6 | Internal Marks : 25
Credit: 4 | External Marks : 75

COURSE OUTCOMES

After successfully completing the course, the student will have a good understanding of the following topics and their applications:

• Derivation of Euler Lagrange equations for a system of particles (D'Alembert'spriciple and Variational Principle)
• Description of Hamiltons equations of motion
• Discussion on the centre force problem: Kepler's problem, classical scattering
• Obtain the resonant frequencies and the normal modes of a linear triatomic molecule and discuss thenature of oscillations
• Derivation of the relativistic addition of velocity formula for parallel velocities in the special theory of relativity and Lagrangian and Hamiltonian of realistic particles.

UNIT I: LAGRANGIAN FORMALISM

Constraints and Degrees of Freedom - Generalized Coordinates: Generalized displacement, acceleration, momentum, force & potential – Virtual work- D’Alemberts principle- Lagrange’s equation of motion - Application of Lagrange’s equation of motion: Linear Harmonic Oscillator, Simple pendulum, Atwood machine.

UNIT II: HAMILTONIAN FORMALISM

Phase space – Hamiltonian – Hamilton’s canonical equation of motion - Significance of H - Deduction of canonical equation from variation principle - Application of Hamilton’s equation of motion: Bead on a rotating wire, particle in a core - Principle of least action - Canonical transformations - Generating function and different forms.

UNIT III: HAMILTON – JACOBI METHOD

Hamilton Jacobi method - Solution of harmonic oscillator by Hamilton Jacobi method – Application of Hamilton Jacobi method: Particle falling freely - Kepler problem - Poisson’s brackets: Definition, Equation of motion in Poisson’s bracket.

UNIT IV: RIGID BODY AND THEORY OF SMALL OSCILLATIONS

Rigid bodies – Moments and products of inertia – Euler’s angles – Euler’s equation of motion of a rigid body – Motion of a symmetric top in a gravitational field – Theory of small oscillations – Normal coordinates and normal modes – Linear triatomic molecules.

UNIT V: RELATIVITY

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

BOOKS FOR STUDY

1. S.L. Gupta, V. Kumar & H.V. Sharma, Classical Mechanics, PragatiPrakashan, Meerut, 2010.
2. H. Goldstein, Classical Mechanics, Addison Wesley, London, 2002.

BOOKS FOR REFERENCES

1. John Robert Toyler, Classical Mechanics, University Science books, Sausation, Californiya, 2005.
2. David Morin, Introduction to classical mechanics with problems and solutions, Cambridge University press, 2008.

Relationship Matrix for course Outcomes, Programme Outcomes and Programme Specific Outcomes:

<table>
<tr><td>Semester</td><td colspan="2">Code</td><td colspan="4">Title of the Course</td><td colspan="2">Hours</td><td colspan="2">Credits</td></tr>
<tr><td>I</td><td colspan="2">20PPH1CC2</td><td colspan="4">CLASSICAL MECHANICS AND RELATIVITY</td><td colspan="2">6</td><td colspan="2">4</td></tr>
<tr><td rowspan="2">Course Outcomes (Cos)</td><td colspan="5">Programme Outcomes</td><td colspan="5">Programme Specific Outcomes</td></tr>
<tr><td>PO1</td><td>PO2</td><td>PO3</td><td>PO4</td><td>PO5</td><td>PSO1</td><td>PSO2</td><td>PSO3</td><td>PSO4</td><td>PSO5</td></tr>
<tr><td>CO1</td><td>✓</td><td>✓</td><td></td><td>✓</td><td></td><td>✓</td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>CO2</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>CO3</td><td>✓</td><td></td><td>✓</td><td></td><td>✓</td><td>✓</td><td></td><td>✓</td><td></td><td>✓</td></tr>
<tr><td>CO4</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>CO5</td><td>✓</td><td></td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td><td>✓</td><td>✓</td><td></td></tr>
<tr><td colspan="11">Number of Matches(✓) = 34, Relationship: Moderate</td></tr>
</table>

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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THERMODYNAMICS AND STATISTICAL MECHANICS

Core Course: III	Semester: I
Course Code: 20PPH1CC3	Maximum Marks: 100
Hours / Week: 5	Internal Marks : 25
Credit: 4	External Marks : 75

COURSE OUTCOMES

Upon completion of this course students should able to

- Understand the ways to calculate the thermo dynamical quantities theoretically
- Describe the Liouville theorem and detailed description on different ensembles
- Derive Bose Einstein condensation
- Understand Fermi Dirac condensation
- Illustrate the way to obtain phase transition and their applications in calculating thermo dynamical quantities

UNIT I: THERMODYNAMICS AND RADIATION

Laws of thermodynamics - Entropy and second law of thermodynamics – Principle of increase of entropy - Thermodynamic Potential and Reciprocity relation – Enthalpy, Helmholtz and Gibb's functions – ClausiusClapeyron's equation.

UNIT II: CLASSICAL STATISTICAL MECHANICS

Phase space and ensembles – Types of ensembles: Microcanonical, canonical & grand canonical - Liouville's theorem – Statistical equilibrium – Thermal equilibrium - Elementary ideas of partition functions - Connection between statistical and thermodynamical quantities - Micro and macro states - Maxwell-Boltzmann distribution law - Distribution of energy and velocity - Principle of equipartition of energy - Boltzmann's entropy relation.

UNIT III: BOSE EINSTEIN STATISTICS

Quantum statistics of identical particles – Density matrix – Bose-Einstein distribution law – Black body radiation – Planck's radiation law – Specific heat of solids – Einstein's theory – Debye's theory.

UNIT IV: FERMI DIRAC STATISTICS

Fermi-Dirac distribution law – Ideal Fermi-Dirac gas – Fermi energy – Degeneracy: weak degeneracy, strong degeneracy – Electron gas in metals – Thermionic emission of electrons – Specific heat of gases – Variation with temperature: Monoatomic, diatomic and polyatomic gases.

UNIT V: PHASE TRANSITION

Phase transition- Phase transition of first and second kind - Critical exponent – Yang and Lee theory - Phase transitions of second kind: The Ising model - Bragg Williams approximation-one dimensional Ising and Heisenberg models.

BOOKS FOR STUDY

1. Gupta & Kumar, Statistical Mechanics, PragatiPrakashan, Meerut, 24th edition, 2011.
2. Satya Prakash, J.P. Agarwal, Statistical Mechanics, KedarNath Ram Nath& Co., Meerut, 2005.

REFERENCES

1. B.K. Agarwal and M. Eisner, Statistical Mechanics, New Age International Publishers, 2nd Edition, 1998, Reprint 2005.
2. B.B. Laud, Fundamentals of Statistical Mechanics –New Age International Publishers, New Delhi,2nd Edition 2012.
3. Kerson Huang, Statistical Mechanics, John Wiley & Sons, New Delhi, 2nd Edition, 1983, Reprint 2009. 19
4. F. Reif, Fundamentals of Statistical and Thermal physics, Waveland Press, Illinois, 2009.
5. F. W. Sears, G. L. Salinger, Thermodynamics, Kinetic theory & Statistical Thermodynamics, Narosa Publishing House, New Delhi, 3rd Edition, Reprint 2013.

Relationship Matrix for course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code		Title of the Course				Hours		Credits	
I	20PPH1CC3		THERMODYNAMICS AND STATISTICAL MECHANICS				5		4	
Course Outcomes (Cos)	Programme Outcomes					Programme Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓	✓		✓		✓
CO2	✓	✓			✓	✓		✓	✓	
CO3	✓	✓	✓	✓	✓	✓		✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓		✓	✓	✓
CO5	✓	✓	✓	✓		✓		✓	✓	
Number of Matches(✓) = 38 , Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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ELECTRONICS

Core Course: IV
Course Code: 20PPH1CC4
Hours / Week: 5
Credit: 4

Semester: I
MaximumMarks: 100
Internal Marks: 25
External Marks: 75

COURSE OUTCOMES

After successfully completing the course, the student will have a good understanding of the following topics and their applications:

- Study the Characteristics of MOSFET
- Understanding of basic concept of Semiconductor, Photo Diode and LED, Solar cell.
- Study and characteristic of dc and ac analysis of Operational Amplifier
- Study the signal processing and its applications
- Understanding the IC fabrication and IC timer

UNIT I: SPECIAL SEMICONDUCTORS

JFET- Structure and working – I-V characteristics under different conditions – Biasing circuits – CS amplifier design – AC analysis – MOSFET: Depletion and enhancement type MOSFFT – FET as a voltage variable resistor - Common source amplifier at high frequencies - Common drain amplifier at high frequencies

UNIT II: SEMICONDUCTOR DEVICES

UJT characteristics – Relaxation oscillator — Application in power control DIAC, TRIAC. Silicon Controlled Rectifier (SCR) Characteristics - SCR power control - Tunnel diode - Optoelectronics: Photo resistor, Photo diode, Photo transistor, LED, Photo voltaic effect, Solar cells.

UNIT III: OPERATIONAL AMPLIFIER

Operational amplifier characteristics – Inverting and non-inverting amplifier – Instrumentation amplifier – Voltage follower – Integrating and differential circuits – Log & antilog amplifiers – Opamp as comparator – Voltage to current and current to voltage conversions - Active filters: Low pass, high pass, band pass & band rejection filters - Solving simultaneous and differential equations.

UNIT IV: SIGNAL PROCESSING & DATA ACQUISITION

Wave form generators and wave shaping circuits - Sinusoidal oscillators - Phase shift oscillator - Wein bridge Oscillator - Crystal oscillator – Multivibrators - Comparators - Schmitt trigger - Square wave & triangular wave generators - Pulse generators - IC 555 timer and its application - Signal and signal processing - Analog multiplexer and demultiplexer - D/A converters - A/D converters.

UNIT V: IC FABRICATION AND IC TIMER

Basic monolithic ICs – Epitaxial growth – Masking – Etching impurity diffusion - Fabricating monolithic resistors, diodes, transistors, inductors and capacitors – Circuit layout – Contacts and inter connections – Charge Coupled Device (CCD) – Description of the functional diagram – Mono stable operation – Applications of mono shots – Astable operation - Pulse generation.

BOOKS FOR STUDY

1. Albert Malvino, David J Bates, Electronics Principles, 7th Edition, Tata McGraw Hill PublishingCompany Ltd., New Delhi, 2007.
2. V. K. Mehta, Principles of Electronics, S. Chand & Co, New Delhi, 2015.

BOOKS FOR REFERENCES

1. Jacob Millman& Arvin Grabel, Microelectronics, Tata McGraw Hill Publishing Company Ltd., New Delhi, 22nd Reprint, 2009.
2. Thomas L. Floyd, Electronic Devices, Pearson Education, New York, 2004.
3. J. Milman and C.C. Halkias, Integrated Electronics, Tata McGraw Hill, New Delhi, 1991.
4. A. Mottershed, Semiconductor Devices and Applications, New Age Int. Publications, New Delhi.

Relationship Matrix for course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code		Title of the Course			Hours		Credits		
I	20PPH1CC4		ELECTRONICS			5		4		
Course Outcomes (Cos)	Programme Outcomes					Programme Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓		✓	✓	✓	✓	✓	✓
CO2	✓	✓		✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Number of Matches(✓) =48 , Relationship: Very High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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PHYSICS PRACTICAL - I
GENERAL& ELECTRONICS PRACTICAL

Core Practical - I	Semester: I
Course Code: 20PPH1CP1	MaximumMarks : 100
Hours / Week: 8	Internal Marks : 40
Credit: 4	External Marks : 60

Any **TWELVE** Experiments (choosing a minimum of six experiments from each part)

COURSE OUTCOMES
Understand various technique and concepts in General Physics experiments

- Understand various technique and concepts in electronics experiments
- Develop the skill in handling instruments
- Various techniques and concepts in electronics
- Study the characteristics of FET, UJT and SCR.
- Design and study the Multivibrator

A. General Experiments
1. Determination of q, n, b by elliptical fringes method
2. Determination of q, n, b by hyperbolic fringes method
3. Determination of bulk modulus of a liquid by ultrasonic wave propagation
4. Determination of Stefan's constant
5. Identification of prominent lines by spectrum photography – Copper spectrum
6. Identification of prominent lines by spectrum photography – Iron spectrum
7. BH loop – Energy loss of a magnetic material – Anchor ring using B.G.
8. Determination of dielectric constant at high frequency by Lecher wire
9. Determination of e/m of an electron by magnetron method
10. Determination of e/m of an electron by Thomson's method
11. Determination of L of a coil by Anderson's method
12. Photoelectric effect (Planck's constant Determination)

B. Electronics Experiments
13. Study of a feedback amplifier – Determination of band width, input and output impedances.
14. Design and study of monostable multivibrator
15. Design and study of bistable multivibrator
16. Design and study of phase shift Oscillator (Op-amp)
17. Characteristics of FET
18. Characteristics of UJT
19. Characteristics of SCR
20. Common source amplifier using FET
21. Common drain amplifier using FET
22. Relaxation oscillator using UJT (or) Op-amp

Relationship Matrix for course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Course			Hours		Credits		
I	20PPH1CP1	PHYSICS PRACTICAL - I			8		4		

Course Outcomes (Cos)	Programme Outcomes					Programme Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓		✓	✓	✓	✓		✓	✓
CO2	✓	✓		✓	✓	✓	✓		✓	✓
CO3	✓	✓		✓	✓	✓	✓		✓	✓
CO4	✓	✓		✓	✓	✓	✓		✓	✓
CO5	✓	✓		✓	✓	✓	✓		✓	✓
Number of Matches(✓) = 45, Relationship: Very High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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MATHEMATICAL PHYSICS – II

Core Course: V
Course Code: 20PPH2CC5
Hours / Week: 6
Credit: 5

Semester: II
Maximum Marks : 100
Internal Marks : 25
External Marks : 75

COURSE OUTCOMES

After successfully completing the course, the student will have a good understanding of the following topics and their applications:

- Probability and its applications in physics problems.
- Special functions for Legender and Bessel Polynomials
- Special functions for Hermite and Laguerre polynomial
- Partial ordinary Differential Equations and its applications
- Properties of Laplace transform and inverse transform, various related and few applications.

UNIT-I: PROBABILITY

Probability - Addition rule of Probability - Multiplication Law of Probability - Probability distribution - Binomial distribution – The first four moments of Binomial distribution - Poisson distribution - Normal distribution – The first four moments of Poisson and Normal distribution - Applications of Binomial, Poisson and Normal distributions – Central limit theorem.

UNIT-II: SPECIAL FUNCTIONS – I

Gamma and Beta function- Legendre's differential equation: Legendre polynomials - Generating functions - Recurrence relation - Rodrigue's formula - Orthogonality; Bessel's differential equation: Bessel polynomials - Generating functions - Recurrence relation - Rodrigue's formula – Orthogonality.

UNIT-III: SPECIAL FUNCTIONS – II

Hermite differential equation – Generating functions – Hermite polynomials - Recurrence relations – Rodrigue's formula - Orthogonality: Laguerre differential equations – Generating functions - Laguerre polynomials - Recurrence relation - Rodrigue's formula – Orthogonality.

UNIT-IV: PARTIAL DIFFERENTIAL EQUATIONS

Solution of Laplace Differential Equation - Two dimensional flow of heat in cartesian and cylindrical co-ordinates. Solution of heat flow equation in one dimension - Solution of wave equation - Transvers e vibrations of a stretched string (Theory).

UNIT - V: INTEGRAL TRANSFORMS

Fourier transforms - cosine and sine transforms - Linearity theorem - Parseval's theorem - solution of differential equation. Laplace transforms - Definition - Linearity, shifting and change of scale properties. Inverse Laplace transforms – Definition - Problems - Solution of differential equation (problems using the above methods).

BOOKS FOR REFERENCE:

1. Mathematical Physics, B.D. Gupta, Vikas Publishing, 1995.
2. Mathematical Physics, B.S. Rajput, 20th Edition, PragatiPrakashan, 2008.
3. Mathematical Physics, H.K. Dass and Rama Verma, Chand and Company Ltd, 2010.
4. Mathematical physics, P.K. Chattopadhyay, Wiley Eastern Limited, 1990.

5. Introduction to Mathematical Physics, Charlie Harper, Prentice Hall of India Pvt. Ltd, 1993.
6. Applied Mathematics for Engineers and Physicists, L.A. Pipes and L.R. Havevill, 3rd Edition, McGraw Hill, 1971.
7. Theory and problems of Laplace Transforms, Murray R. Spigel, International edition, McGraw Hill, 1986.

Relationship Matrix for course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Course			Hours		Credits		
II	20PPH2CC5	MATHEMATICAL PHYSICS – II			6		5		

Course Outcomes (Cos)	Programme Outcomes					Programme Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓				
CO2	✓		✓	✓		✓		✓	✓	
CO3	✓		✓	✓		✓		✓	✓	
CO4	✓	✓	✓	✓	✓	✓			✓	
CO5	✓	✓	✓	✓	✓	✓		✓		
Number of Matches(✓) = 32, Relationship: Moderate										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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ELECTROMAGNETIC THEORY

Core Course: VI	Semester: II
Course Code: 20PPH2CC6	Maximum Marks : 100
Hours / Week: 6	Internal Marks : 25
Credit: 5	External Marks : 75

COURSE OUTCOMES

After completion of this course the students will be able to explain the following

- Explains the fundamentals of electrostatics
- Brief out the various concepts of magneto statics
- Illustrates the application of electromotive force
- Describes the elementary ideas of electromagnetic wave
- Gives idea to apply the application of electromagnetic wave

UNIT -I: ELECTROSTATICS

Coulomb's law; the electric field – line, flux and Gauss's Law in differential form - the electrostatic potential; conductors and insulators; Gauss's law - application of Gauss's law – curl of E - Poisson's equation; Laplace's equation – work and energy in electrostatics – energy of a point charge distribution – energy of continuous charge distribution – induced charges – capacitors. Potentials: Laplace equation in one dimension and two dimensions – Dielectrics – induced dipoles – Gauss's Law in the presence of dielectrics.

UNIT- II: MAGNETOSTATICS

Lorentz force – magnetic fields – magnetic forces – currents – Biot-Savart Law – divergence and curl of B – Ampere's Law – Electromagnetic induction - comparison of magneto statics and electrostatics – Magnetic vector potential. Magnetization: effect of magnetic field on atomic orbit – Ampere's Law in magnetized materials – ferromagnetism.

UNIT-III: **ELECTROMOTIVE FORCE**

Ohm's Law – electromotive force – motional emf – Faraday's Law – induced electric field – inductance – energy in magnetic field – Maxwell's equation in free space and linear isotropic media – continuity equation – Poynting theorem.

Electromagnetic waves in vacuum: Waves in one dimension – wave equation – sinusoidal waves – reflection and transmission – Polarization.

UNIT-IV: ELECTROMAGNETIC WAVES

The wave equation for E and B – Monochromatic Plan waves – energy and momentum in electromagnetic waves – electromagnetic waves in matters –TE waves in rectangular wave guides – the co-axial transmission line. Potentials: potentials and fields – scalar and vector potentials – Gauge transformation – Coulomb Gauge and Lorentz Gauge – Lorentz force law in potential form.

UNIT-V: APPLICATION OF ELECTROMAGNETIC WAVES

Boundary conditions at the surface of discontinuity – Reflection and refraction of E.M waves at the interface of non – Conducting media – Kinematic and dynamic properties – Fresnel's equation – Electric field vector 'E' parallel to the plane of incidence and perpendicular to the plane of incidence – Reflection and transmission co-efficient at the interface between two non–Conducting media – Brewster's law and degree of polarization – Total internal reflection.

BOOK FOR STUDY:

1. Introduction to Electrodynamics – David J. Griffiths, 4th Edition, Pearson.
2. Electromagnetic Theory and Electrodynamics, SathyaPrakash, KedarNathRamNath and Co, 2017.
3. Electromagnetics, B.B Laud, Wiley Eastern Company, 2000.
4. Fundamentals of Electromagnetic, Wazed Miah, Tata McGraw Hill, 1980.
5. Basic Electromagnetics with Application, Narayanarao, (EEE) Prentice Hall, 1997.

BOOKS FOR REFERENCE:

1. Fundamentals of Electromagnetic Theory, Third edition, Narosa Publishing House, New Delhi – John R.Reitz, Frederick J Milford and Robert W.Christy, 1998.
2. Classical Electrodynamics – J.D. Jackson, II Edition, Wiley Eastern Limited, 1993.
3. Electromagnetic Fields and Waves – P.Lorrain and D.Corson.
4. Electromagnetics , B.B Laud, Wiley Eastern Company, 2000.

Relationship Matrix for course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Course			Hours		Credits		
II	20PPH2CC6	ELECTROMAGNETIC THEORY			6		5		
Course Outcomes (Cos)	Programme Outcomes				Programme Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓		✓	✓		✓		
CO2	✓		✓	✓	✓	✓		✓	✓	✓
CO3	✓	✓	✓		✓	✓		✓	✓	
CO4	✓		✓	✓	✓	✓		✓		✓
CO5	✓	✓	✓		✓	✓		✓	✓	
Number of Matches(✓) =35 , Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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PHYSICS PRACTICAL - II
MICROPROCESSOR AND C PROGRAMMING

Core Practical - II	Semester: II
Course Code: 20PPH2CP2	MaximumMarks : 100
Hours / Week: 8	Internal Marks : 40
Credit: 4	External Marks : 60

(Any TWELVE only - Choosing a minimum of six experiments from each part)

COURSE OUTCOMES

- Understand various technique and concepts in Electronics experiments
- Develop the skill in handling instruments
- Various techniques and concepts in Electronics
- Learn Arithmetic Programs
- Students will acquire hands on knowledge of programming practice in C

A. Microprocessor Practicals

1. 8 bit addition, subtraction using 8085. (With and Without Carry)
2. 8 bit multiplication and division using 8085.
3. 16 bit addition, 2's complement and 1's complement subtraction.
4. Conversion from decimal to octal and hexa systems.
5. Conversion from octal, hexa to decimal systems.
6. Study of ADC interfacing (ADC 0809).
7. Study of DAC interfacing (DAC 0900).
8. Traffic control system using microprocessor interfacing.
9. Control of stepper motor using microprocessor interfacing.
10. Arithmetic programs using microcontroller.

B. Computer Practicals (By C Language)

1. Roots of algebraic equations - Newton-Raphson method.
2. Least-squares curve fitting – Straight-line fit.
3. Solution of simultaneous linear algebraic equations – Gauss elimination method.
4. Solution of simultaneous linear algebraic equations – Gauss-Seidal method.
5. Interpolation – Lagrange method.
6. Numerical integration – Composite Trapezoidal rule.
7. Numerical integration – Composite Simpson's rules.
8. Numerical differentiation – Euler method.
9. Solution of ordinary differential equations – Runge-Kutta 2nd order method.
10. Solution of ordinary differential equations – Runge-Kutta 4th order method.

Relationship Matrix for course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Course				Hours		Credits		
II	20PPH2CP2	PHYSICS PRACTICAL - II				8		4		
Course Outcomes (Cos)	Programme Outcomes					Programme Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓		✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Number of Matches(✓) =48 , Relationship: Very High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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NUMERICAL METHODS AND PROGRAMMING

Elective Course: I
Course Code: 20PPH2EC1:1
Hours / Week: 5
Credit: 5

Semester: II
Maximum Marks : 100
Internal Marks : 25
External Marks : 75

COURSE OUTCOMES

After successfully completing the course, the student will have a good understanding of the following topics and their applications:

- Understand the concept of errors and the measurements
- Describes the concept of Numerical Integration
- Explains Numerical Solution of ordinary Differential Equation
- Understand the concept of Interpolation formulas
- Find out the solution of Linear and Non-Linear equations

UNIT-I: ERRORS AND THE MEASUREMENTS

General formula for errors – Errors of observation and measurement - Absolute and relative errors, Machine Epsilon - Error propagation - Conditioning and stability - Error estimation-Empirical formula -Graphical method – Method of averages – Least square fitting – curve fitting - parabola, exponential.

UNIT II: NUMERICAL INTEGRATION

Newton cotes formula - Trapezoidal rule - Simpsons 1/3 rule - Simpsons 3/8 rule - Booles rule - Gaussian quadrature method - (2 point and 3 point formulae) – Giraffe's root square method for solving algebraic equation.

UNIT III: NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS

Nth order ordinary differential equations – Power series approximation – Pointwise method – Solutions of Taylor series – Euler's method – Improved Euler's method – Runge-Kutta method: second and fourth order – Runge-Kutta method for solving first order differential equations – C program for solving ordinary differential equations using RK method

.

UNIT IV: INTERPOLATION

Linear interpolation – Lagrange interpolation - Gregory–Newton forward and backward interpolation formula – Central difference interpolation formula – Gauss forward and backward interpolation formula – Divided differences: Properties – Newton's interpolation formula for unequal intervals – C programming for Lagrange's interpolation.

UNIT V: SOLUTION OF LINEAR & NONLINEAR EQUATIONS

Need and scope of simultaneous linear equations - Existence of solutions - Solution by elimination - Gauss elimination method with and without pivoting - Applications to electrical networks - C program for implementing Gauss elimination method with pivoting. Roots of nonlinear equations: Newton-Raphson's method for a single nonlinear equation - Extension to a system of nonlinear equations - Finding multiple roots by deflation and synthetic division - Program in C for Newton-Raphson method for finding the roots of a single nonlinear equation.

BOOKS FOR STUDY

1. T.Veerarajan, T.Ramachandran, Numerical Methods With Programs in C, Tata McGraw Hill Publishing Company,New Delhi,2008.
2. E. Balagurusamy, Numerical Methods, Tata McGraw Hill Publishing Company, New Delhi, 1999.

REFERENCES

1. M.K. Venkataraman, Numerical Methods in Science and Engineering, National Publishing Co., Madras,1996.
2. S.S. Sastry, Introductory Methods of Numerical Analysis, Prentice Hall, 2005.
3. S. Rajasekaran, Numerical Methods in Science and Engineering, S. Chand Limited, 2003.

Relationship Matrix for course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Course				Hours		Credits	
II	20PPH2EC1:1	NUMERICAL METHODS AND PROGRAMMING				5		5	
Course Outcomes (Cos)	Programme Outcomes					Programme Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) = 45, Relationship: Very High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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MICROPROCESSOR AND MICROCONTROLLER

Elective Course: II	Semesters: II
Course Code: 20PPH2EC2:1	Maximum Marks : 100
Hours / Week: 5	Internal Marks : 25
Credit: 5	External Marks : 75

COURSE OUTCOMES

- Grasp the fundamentals of the Intel 8085 Microprocessor Architecture, memory mapping and data transfer schemes, know the addressing modes and perform Arithmetic operation andsorting of a given data
- know the architecture and memory organization of the Intel 8051 Microcontroller and the design of timers, counters and registers using it as well as understand the modes of operation and control
- learn the architecture, operating mode and addressing modes of Intel 8086
- learn the instruction set and assembly language programming for implementing arithmetic operations and sorting of a given data set using Intel 8051
- know the various peripheral devices of Intel 8051and interfacing them

UNIT-I: MICROPROCESSORS 8085 ARCHITECTURE

Intel 8085 microprocessor: Introduction – Pin configuration- Architecture and its operations - Machine cycles of 8085. Interfacing of memory and I/O devices. Instruction classification: number of bytes, nature of operations- Instruction format. Vectored and non-vectored interrupts.

UNIT-II: 8085 ASSEMBLY LANGUAGE PROGRAMMING

Instruction set: Data transfer operations - Arithmetic operations Logical operations – Branching and machine control operations. Addressing modes. Writing assembly language programs: Looping, counting and indexing. Counters and time delays - Stack - subroutine. Translation from assembly language to machine language.

UNIT-III: MICROPROCESSOR 8086

Intel 8086 microprocessor: Introduction – Architecture - Pin configuration- Operating modes: Minimum mode, Maximum mode. Memory addressing: 8-bit data from even and odd address bank, 16-bit data from even and odd address bank. Addressing modes. Interrupts: Hardware interrupts – Software interrupts –Interrupt priorities.
Simple programs.

UNIT – IV: MICROCONTROLLER 8051 ARCHITECTURE AND PROGRAMMING

Introduction to microcontroller and embedded system. Difference between microprocessor and microcontroller. 8051 microcontroller : Pin configuration, Architecture and Key features. 8051. Data types and directives Instruction set: Data transfer instructions - Arithmetic instructions – Logical instructions- Branching instructions- Single bit instructions. Addressing modes. Simple programs using 8051 instruction set.

UNIT – V: INTERFACING OF MICROPROCESSOR 8085

Basic concepts of programmable device - 8255 Programmable Peripheral Interface (PPI) – interface of ADC and DAC. 8257 Direct Memory Access (DMA) controller. Basic concepts of serial I/O and data communication – interface of 8251 Universal Synchronous Asynchronous Receiver Transmitter (USART).

BOOKS FOR REFERENCE:

1. Microprocessor Architecture, Programming and Applications with 8085/8080, Ramesh S. Gaonkar, New Age International 6th edition, 2013.
2. Microprocessors and Interfacing-Programming and Hardware, Douglas V. Hall, Tata McGraw Hill, 1993.
3. Microprocessors and Microcontrollers by A.P.Godse and D.A.Godse, Technical Publications, Pune.
4. Advanced Microprocessors and Interfacing, Badri Ram, Tata McGraw Hill, 2001.
5. The 8051 Microcontroller and Embedded systems, Muhammad Ali Mazidi and Janice Mazidi. Pearson Education, 2000.
6. The 8051 Microcontroller Architecture, Programming and Applications. Kenneth J. Ayala. Penram International publishing Pvt. Ltd., second edit, 1996.

Relationship Matrix for course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Course				Hours		Credits		
II	20PPH2EC2:1	MICROPROCESSOR AND MICROCONTROLLER				5		5		
Course Outcomes (Cos)	Programme Outcomes					Programme Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓		✓
CO3	✓	✓	✓	✓	✓	✓	✓		✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Number of Matches(✓) = 47, Relationship: Very High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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QUANTUM MECHANICS

Core Course: VII | Semester: III
Course Code: 20PPH3CC7 | Maximum Marks : 100
Hours / Week: 6 | Internal Marks : 25
Credit: 5 | External Marks : 75

COURSE OUTCOMES

Upon completion of this course students should able to

• Explaining the postulates of quantum mechanics.
• Identification of features of certain exactly solvable systems.
• Describing the time-independent and time-dependent perturbation theories.
• Describe the method of angular momentum and commutation relation.
• Application of the Born approximation and partial wave analysis to simple systems.
Determine the solution of a relativistic free Dirac particle.

UNIT I: SCHRODINGER EQUATION AND GENERAL FORMULATION

Physical meaning and conditions on the wave function - Schrodinger equation – Expectation values and Ehrenfest's theorem – Hermitian operators and their properties – Commutator relations - Uncertainity relation - Bra and ket vectors - Hilbert space – Schrodinger, Heisenberg and interaction pictures.

UNIT II: APPROXIMATE METHODS

Time independent perturbation theory in non-degenerate case - Ground state of Helium atom - Degenerate case - Stark effect in hydrogen - Variation method & its application to Hydrogen molecule - WKB approximation and its application.

UNIT III: TIME DEPENDENT PERTURBATION THEORY

Time dependent perturbation theory - First and second order transitions - Transition to continum of states - Fermi Golden rule - Constant and Harmonic perturbation - Transition probabilities - Selection rules for dipole radiation.

UNIT IV: ANGULAR MOMENTUM

Orbital angular momentum - Spin angular momentum - Total angular momentum operators - Commutation relations of total angular momentum with components - Ladder operators - Commutation relation of Jz with J+ and J- - Eigen values of J2, Jz - Matrix representation of J2, Jz, J+ and J- - Addition of angular momenta - Clebsch Gordon coefficients – (J1=1/2,J2=1/2).

UNIT V: SCATTERING THEORY & RELATIVISTIC QUANTUM MECHANICS

Scattering cross section – Green's function – Born approximation – Partial wave analysis – Klein-Gordon equation for a free particle and in an electromagnetic field – Dirac equation for a free particle – Dirac matrices.

BOOKS FOR STUDY

1**.** Gupta, Kumar & Sharma, Quantum Mechanics, 23rd Edition, 2004.
2. P.M. Mathews &K.Venkatesan, A Text Book of Quantum Mechanics, Tata McGraw Hill, New Delhi, 2005.
3. Ghatak**,** Ajoy**,** Lokanathan, S**.**Quantum Mechanics: Theory and Applications, 2004.

REFERENCES
1. I. Schiff, Quantum Mechanics, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 3rd Edition, 2010.
2. Satyaprakash, Quantum Mechanics, PragatiPrakashan.
3. Merzbacher E, Quantum Mechanics, Wiley and Sons, USA, 3rd Edition, 1998.

Relationship Matrix for course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code		Title of the Course				Hours		Credits	
III	20PPH3CC7		QUANTUM MECHANICS				6		5	
Course Outcomes (Cos)	Programme Outcomes					Programme Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓		✓	✓	
CO2	✓	✓		✓		✓				
CO3	✓		✓	✓	✓		✓		✓	
CO4	✓	✓			✓	✓		✓		
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) = 32, Relationship: Moderate										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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SPECTROSCOPY

Core Course: VIII
Course Code: 20PPH3CC8
Hours / Week: 6
Credit: 5

Semester: III
Maximum Marks : 100
Internal Marks : 25
External Marks : 75

COURSE OUTCOMES

- Understand the basic knowledge of Microwave spectroscopy
- Describe the concept of infra-red spectroscopy
- Understand the basic knowledge of Raman spectroscopy
- Explain the Instrumentation and application of NMR and ESR
- Describe Nuclear Quadrupole interaction and its applications.

UNIT-I: MICROWAVE SPECTROSCOPY

Rotation of Molecules – Rigid Rotator (Diatomic Molecules) – Expression for the Rotational Constant - Intensity of Spectral Lines – Effect of Isotopic Substitution - Molecular Parameters (Bond Length, Bond Angle, Dipole Moment) from Rotation Spectra – Techniques and Instrumentation.

UNIT II: INFRARED SPECTROSCOPY

Vibrational energy of a diatomic molecule- Infrared selection rules-Vibrating diatomic molecule-Diatomic vibrating rotator- Vibrations of polyatomic molecules-Fermi resonance-Rotation vibration spectra of polyatomic molecules-Normal modes of vibration in crystal-Interpretation of vibrational spectra-Group frequencies-IR spectrophotometer-Instrumentation-Sample handling techniques-Fourier Transform Infrared spectroscopy-Applications

UNIT III: RAMAN SPECTROSCOPY

Introduction-Theory of Raman scattering-Rotational Raman spectra-Vibrational Raman spectra-Mutual Exclusion principle-Raman spectrometer-Sample handling techniques-Polarization of Raman scattered light-Structure determination using IR and Raman spectroscopy-Raman investigation of phase transitions-Resonance Raman scattering-Nonlinear Raman phenomena-Preliminaries-Hyper Raman effect-Stimulated Raman scattering-Inverse Raman effect-Coherent Anti-Stokes Raman scattering .

UNIT IV: NUCLEAR MAGNETIC AND ELECTRON SPIN RESONANCE SPECTROSCOPY

Basic principles – Quantum theory of NMR - magnetic resonance – relaxation processes – chemical shifts – spin-spin coupling - Spectra and molecular structure – Fourier Transform NMR –Instrumentation – Applications.Basic principles – Quantum theory - g-factor – Nuclear Interaction and Hyperfine structure – Relaxation effects - Hyperfine interaction – line widths – ESR spectrometer – Instrumentation – applications.

UNIT V: NUCLEAR QUADRUPOLE RESONANCE AND MOSSBAUER SPECTROSCOPY

Basic theory - Nuclear Electric quadrupole interaction – Energy levels – Transition frequency – Excitation and Detection – Effect of magnetic field – Instrumentation – applications. Mossbauer effect - recoilless emission and absorption - hyperfine interaction - chemical isomer shift - magnetic hyperfine and electric quadruple interactions – Instrumentation – applications.

BOOKS FOR REFERENCE:

1. Colin N. Banwell, Elaine M. McCash, Fundamentals of Molecular Spectroscopy (Fourth Edition), Tata McGraw-Hill Publishing Company Ltd, 1995.
2. J.D. Graybeal, Molecular Spectroscopy, McGraw-Hill, New York, 1988.
3. Hollas, Michael, Modern Spectroscopy (Fourth Edition) John Wiley, New York, 2004.
4. R.P Straughen, S.Walker, Spectroscopy Vols.I,II and III, Chapman & Hall, London, 1976.

Relationship Matrix for course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code		Title of the Course			Hours		Credits		
III	20PPH3CC8		SPECTROSCOPY			6		5		
Course Outcomes (Cos)	Programme Outcomes					Programme Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓		✓
CO3	✓	✓	✓		✓	✓	✓		✓	✓
CO4	✓		✓	✓	✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Number of Matches(✓) = 46, Relationship: Very High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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PHYSICS PRACTICAL - III
SOLID STATE PHYSICS PRACTICAL

Core Practical - III	Semester: III
Course Code: 20PPH3CP3	Max. Marks : 100
Hours / Week: 8	Internal Marks : 40
Credit: 4	External Marks: 60

Any TWELVE only

COURSE OUTCOMES

Understand various technique and concepts in General Physics experiments

- Understand various technique and concepts in electronics experiments
- Develop the skill in handling instruments
- Various techniques and concepts in electronics
- Learn Forbe's method
- Understanding the characteristics of Laser iode

1. Four probe method – Determination of resistivity of powdered samples.
2. Determination of carrier concentration and Hall coefficients in semiconductors.
3. Determination of magnetic susceptibility of liquid by Guoys method.
4. Determination of magnetic susceptibility of liquids by Quincke's method.
5. Determination of dielectric constant of a liquid by RF oscillator method.
6. Determination of wavelength and thickness of a film by using Michelson's interferometer.
7. Brass spectrum – Determination of composition.
8. Charge of an electron by spectrometer.
9. Polarizability of liquids by finding the refractive indices at different wavelengths.
10. Determination of wavelength of monochromatic source using biprism.
11. Determination of refractive index of liquids using biprism (by scale & telescope method).
12. Determination of specific rotatory power of a liquid using polarimeter.
13. Rydberg's constant using spectrometer.
14. Determination of coefficient of coupling by AC bridge method.
15. Magnetoresistance of powder samples using CE bridge.
16. Forbe's method of determining thermal conductivity.
17. Particle size determination using He-Ne Laser.
18. Laser diode characteristics.
19. Determination of dielectric loss using CRO.

Relationship Matrix for course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Course				Hours		Credits	
III	20PPH3CP2	PHYSICS PRACTICAL - III				8		4	

Course Outcomes (Cos)	Programme Outcomes					Programme Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓		✓	✓	✓	✓	✓	✓
CO4	✓		✓	✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Number of Matches(✓) =48 , Relationship: Very High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Prepared By **Checked By** **HOD**

CRYSTAL GROWTH AND THIN FILM PHYSICS

Elective Course: III
Course Code: 20PPH3EC3:1
Hours / Week: 5
Credit: 5

Semester: III
MaximumMarks: 100
Internal Marks: 25
External Marks: 75

COURSE OUTCOMES

On completion of this course the student will be able to carry out

- Understand the Growth of crystals using several techniques such as Slow Evaporation Method
- Study the Melt Method,Physical Vapour Deposition (PVD) and Chemical Vapour Deposition (CVD) and Gel Growth
- Understand the preparation of thin films using various Physicaland Chemical Methods
- To know the characterization of thin films using Scanning Electron Microscopy (SEM), Electron Probe Micro-analysis
- Understand the working of X-Ray Photo Electron Spectroscopy and Mass Spectroscopy

UNIT I: NUCLEATION

Introduction - Kinds of nucleation - Equilibrium stability and meta stable state - Classical theory of nucleation -Effect of soluble impurities on nucleation - Determination of solubility - Methods of induction period measurements - Steady state nucleation rate - Nucleation parameters.

UNIT II: LOW TEMPERATURE GROWTH TECHNIQUES

Solution Growth Technique: Low temperature solution growth: solution, solubility and super solubility – Expression of super saturation – Mier's T-C diagram - Constant temperature bath and crystallizer – Seed preparation and mounting - Slow cooling and solvent evaporation methods.

Gel Growth Technique: Principle – Various types – Structure of gel – Importance of gel – Experimental procedure: Chemical reaction method, Single and double diffusion method, Chemical reduction method, Complex and decomplexion method – Advantages of gel method.

UNIT III: MELT AND VAPOUR GROWTH TECHNIQUES

Melt technique: Bridgman technique - Basic process – Various crucibles design - Thermal consideration – Vertical Bridgman technique - Czochralski technique: Experimental arrangement – Growth process.

Vapour technique: Vacuum technology - Physical vapour deposition – Chemical vapour deposition (CVD) – Chemical vapour transport.

UNIT IV: PREPARATIVE TECHNIQUES OF THIN FILM

Physical methods: Vacuum evaporation, Sputtering - Chemical methods: Spray pyrolysis, Electrochemical method - Types of electrodes: Counter, Working, Reference electrode - Electro and electroless coating – Sol-gel method: Dip coating - Spin coating.

UNIT V: CHARACTERIZATION TECHNIQUES

Structural: XRD: Single and Powder – Molecular: FTIR Spectroscopy – Functional group analysis – Optical: UV-Vis-NIR spectroscopy – optical constants: film thickness measurements- Electrical: Four probe technique Dielectric: dielectric constant and dielectric loss.

BOOKS FOR STUDY

1. Brice J. C., Crystal Growth Process, John Wiley and Sons, New York, 1986.
2. P. SanthanaRaghavan and P. Ramasamy, Crystal Growth, KRU Publications, 1st Edition.
3. A. Goswami, Thin Film Fundamentals, New Age International Publishers, 2008

BOOK FOR REFERENCES

1. Brice J.C., The growth of crystals from liquids, North Holland Publishing Company, Amsterdam, 1973.
2. Henisch H.K., Crystals in gels and Liesegang rings, Cambridge Univ. Press, USA, 1988.
3. H.H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, Thin Film Fundamentals, CBS, Publishers and Distributors, New Delhi.
4. Kasturi L. Chopra, Thin film Phenomena, McGraw Hill Book Company, 1969.
5. Smith Donald. L, Thin Film Deposition, McGraw Hill, London, 1995.

Relationship Matrix for course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Course				Hours		Credits	
III	20PPH3EC3:1	CRYSTAL GROWTH AND THIN FILM PHYSICS				5		5	
Course Outcomes (Cos)	Programme Outcomes					Programme Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓	✓		✓
CO4	✓	✓		✓	✓		✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Number of Matches(✓) =47 , Relationship: Very High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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NONLINEAR OPTICS

Elective Course: IV
Course Code: 20PPH3EC4:1
Hours / Week: 5
Credit: 5

Semester: III
MaximumMarks: 100
Internal Marks : 25
External Marks : 75

COURSE OUTCOMES

Having successfully completed the course, the student will be able to:

- Explain the fundamental theory of laser actions. Illustrate the working various type of lasers
- Describe the elementary ideas of nonlinear optics
- Elaborates the utilization of NLO phenomenon in multiphoton process.
- Understand the behavior of NLO materials
- Illustrates the application of Fiber Optics

UNIT I: LASERS

Gas lasers – He-Ne, Ar^+ ion lasers – Solid state lasers – Ruby – Nd:YAG, Ti sapphire – Organic dye laser – Rhodamine – Semiconductor lasers – Diode laser, p-n-junction laser and GaAs laser.

UNIT II: BASICS OF NONLINEAR OPTICS

Wave propagation in an anisotropic crystal – Polarization response of materials to light – Harmonic generation – Second harmonic generation – Sum and difference frequency generation– Phase matching – Third harmonic generation – Terahertz -- Bistability – Self-focusing.

UNIT III: MULTIPHOTON PROCESSES

Two photon process – Theory and experiment – Three photon process – Parametric generation of light – Oscillator – Amplifier – Stimulated Raman scattering – Intensity dependent refractive index -- Optical Kerr effect -- Foucault effect – Photorefractive, electronic and optic effects.

UNIT IV: NONLINEAR OPTICAL MATERIALS

Basic requirements – Inorganics – Borates – Organics – Urea, Nitroaniline –Semiorganics – Thoreau complex – Laser induced surface damage threshold.

UNIT V: FIBER OPTICS

Step – Graded index fibers – Wave propagation – Fiber modes – Single and multimode fibers –Numerical aperture – Dispersion – Fiber bandwidth – Fiber losses - Scattering, absorption, bending, leaky mode and mode coupling losses – Attenuation coefficient -- Material absorption.

BOOKS FOR STUDY:

1. K.R. Nambiar, Lasers: Principles, Types and Applications (New Age Inter-national Publishers Ltd, New Delhi, 2014).
2. B.B. Laud, Lasers and Nonlinear Optics, 3rd Edn. (New Age, New Delhi, 2011).
3. R.W. Boyd, Nonlinear Optics, 2nd Edn. (Academic Press, New York, 2003).
4.G.P. Agarwal, Fiber-Optics Communication Systems, 3rd Edn. (John Wiley, Singapore, 2003).

BOOKS FOR REFERENCE:

1. W.T. Silvast, Laser Fundamentals (Cambridge University Press, Cambridge, 2003).
2. D.L. Mills, Nonlinear Optics – Basic Concepts (Springer, Berlin, 1998).

Relationship Matrix for course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Course			Hours		Credits		
III	20PPH3EC4:1	NONLINEAR OPTICS			5		5		
Course Outcomes (Cos)	Programme Outcomes					Programme Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓		✓	✓		✓	✓			✓
CO4	✓	✓		✓	✓		✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Number of Matches(✓) =44 , Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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CONDENSED MATTER PHYSICS

Core Course: IX
Course Code: 20PPH4CC9
Hours / Week: 6
Credit: 5

Semester: IV
Max. Marks : 100
Internal Marks : 25
External Marks : 75

COURSE OUTCOMES

After completion of this course the students will be able to explain the following

- Introduction to crystal system and X-ray diffraction methods.
- Discuss lattice vibrations and lattice heat capacity
- Explain dielectric and ferro electric properties
- Discussion on para, ferro and ferri-magnetic properties.
- Discussion on superconductivity.

UNIT I: STATES OF MATTER

Crystalline and amorphous - Unit cell - Bravais lattices - Symmetry point groups – Space groups – Reciprocal lattice (definition and properties) - Reciprocal lattice of SC, BCC, FCC and HCP lattices - Miller indices - Atomic scattering factor – Diffraction – Structure factor - X-ray diffraction - Laue equations - Interpretation of Bragg's equation - Ewald construction.

UNIT II: LATTICE VIBRATIONS AND THERMAL PROPERTIES

Vibration of monatomic lattices – Lattices with two atoms per primitive cell – Quantization of lattice vibrations – Phonon momentum – Inelastic scattering of neutrons by phonons – Lattice heat capacity – Einstein model – Density of modes in one-dimension and three-dimension – Debye model of the lattice heat capacity – Free electron Fermi gas: Drude model – Electrical conductivity, electronic heat capacity - Hall effect & thermionic power – Electron motion in periodic potential: energy bands in solids, metals, semiconductors and insulators.

UNIT III: DIELECTRICS

Defects and dislocations – Dielectrics: Internal electric field – Polarizability – Clausiusmosotti equation -Ferroelectric crystals and their types – Polarization catastrophe – Landau theory of phase transition: First and second order – Antiferro, pyro and piezoelectric crystals.

UNIT IV: MAGNETISM

Langevin theory of para magnetism - Quantum theory of para magnetism - Curie law – Ferromagnetism - Weiss molecular field theory - Domain theory - Anti ferromagnetism - Neel theory – Ferrimagnetism - Ferrites-spin waves - Experimental techniques to study magnetic properties.

UNIT V: SUPERCONDUCTIVITY

Occurrence of Superconductivity – Meissner effect – Thermodynamics of superconducting transition – London equation – Coherence length – BCS theory – Flux quantization – Type I and Type II Superconductors – Josephson superconductor tunneling – DC and AC Josephson effect – SQUID – Recent developments in high temperature superconductivity – Application of superconductors.

BOOKS FOR STUDY

1. C. Kittel, Introduction to Solid State Physics, Wiley India Edition, New Delhi, 7th Edition, Reprint2008.
2. S. O. Pillai, Solid State Physics, New Age International, New Delhi, 2006.

REFERENCES

1. B.S. Saxena, R.C. Gupta & P.N. Saxena, Solid State Physics, PragatiPrakashan, Meerut.
2. J.P. Srivastava, Elements of Solid state physics, Prentice-Hall of India Pvt Ltd, New Delhi, Second Edition, 2006.
3. S.L. Kupta and V. Kumar, Solid State Physics, K. Naths Educational Publishers, Meerut, 2006.

Relationship Matrix for course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Course				Hours		Credits		
IV	20PPH4CC9	CONDENSED MATTER PHYSICS				6		5		
Course Outcomes (Cos)	Programme Outcomes					Programme Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO3	✓		✓	✓		✓				
CO4	✓	✓			✓	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) =38 , Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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NUCLEAR AND PARTICLE PHYSICS

Core Course: X	Semester: IV
Course Code: 20PPH4CC10	Max. Marks : 100
Hours / Week: 5	Internal Marks : 25
Credit: 5	External Marks : 75

COURSE OUTCOMES

After completion of this course the students will be able to explain the following

- Explains the fundamentals of nuclear properties
- Illustrates the radioactivity process and their corresponding theories
- Briefs out the various nuclear reactions and mechanisms behind it
- Understand the concept of accelerators and reactors
- Elaborates the elementary particles and the fundamentals of particle physics

UNIT I: BASIC NUCLEAR PROPERTIES

Nuclear size, shape, mass – Charge distribution – Spin and parity – Binding energy – Semi empirical mass formula – Nuclear stability – Mass parabola - Nature of nuclear forces – Ground state of deuteron – Magnetic dipole moment of deuteron – Proton-neutron scattering at low energies, Scattering length, phase shift – Exchange forces – Meson theory.

UNIT II: RADIOACTIVE DECAYS

Alpha emission – Geiger-Nuttal law – Gamow theory – Neutrino hypothesis – Fermi theory of beta decay – Selection rules – Non-conservation of parity – Gamma emission – Selection rules - Interaction of charged particles and X-rays with matter – Basic principles of particle detectors – Ionization chamber – Proportional counter and G.M counters – Solid state detectors – Scintillation and semiconductor detectors.

UNIT III: NUCLEAR REACTIONS AND NUCLEAR MODELS

Q-values and kinematics of nuclear cross sections – Energy and angular dependence – Reciprocity theorem – Breit-Wigner formula – Compound nucleus – Resonance theory – Optical model – Shell model – Liquid drop model – Collective model.

UNIT IV: ACCELERATORS AND REACTORS

Cyclotron – Synchrocyclotron – Betatron – Synchrotron – Linear accelerators - Characteristics of fission – Mass distribution of fragments – Radioactive decay processes – Fission cross section – Energy in fission – Bohr-Wheeler's theory of nuclear fission – Fission reactors – Thermal reactors – Homogeneous reactors – Heterogeneous reactors – Basic fusion processes - Characteristics of fusion – Solar fusion – Controlled fusion reactors.

UNIT V: PARTICLE PHYSICS

Production of new particles in high energy reaction - Classification of elementary particles - Fundamental interaction - Quantum numbers – Anti particles - Resonances - Law in production and decay process – Symmetry and conservation laws - Special symmetric groups – Gell-Mann Nishijima theory - Quark model - SU3 symmetry - Unification of fundamental interactions - CPT invariance and applications of symmetry arguments to particle reaction - Parity non conservation in weak interaction - Relativistic kinematics.

BOOKS FOR STUDY

1. D.C. Tayal, Nuclear Physics, Himalaya Publishing House, Mumbai, 2004.
2. M.L. Pandya and R.P.S. Yadav, Elements of Nuclear Physics, KedarNath Ram Nath, 2004.

REFERENCES

1. K. S. Krane, Introductory Nuclear Physics, John-Wiley, New York, 1987. 27
2. V. Devanathan, Nuclear Physics, Naroso Publishing House, 2006.
3. S. B. Patel, Nuclear Physics: An Introduction, Wiley-Eastern, New Delhi, 1991.
4. Bernard L. Cohen - Concepts of Nuclear Physics, Tata McGraw Hill Publishing Co., New Delhi.

Relationship Matrix for course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Course				Hours		Credits		
IV	20PPH4CC10	NUCLEAR AND PARTICLE PHYSICS				5		5		
Course Outcomes (Cos)	Programme Outcomes					Programme Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓		✓		✓	✓	✓	✓	
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO3	✓		✓			✓		✓		
CO4	✓				✓	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓	✓	✓	✓		
Number of Matches(✓) =34 , Relationship: Moderate										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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PHYSICS PRACTICAL - IV
ANALOG AND DIGITAL ELECTRONICS LAB

Core Practical - IV	Semester: IV
Course Code: 20PPH4CP4	Max. Marks : 100
Hours / Week: 8	Internal Marks : 40
Credit: 4	External Marks : 60

Any TWELVE only

COURSE OUTCOMES

- Understand various technique and concepts in electronics experiments
- Develop the skill in handling instruments
- Various techniques and concepts in electronics
- Learn the different kinds of Ics
- Understanding gates and ICs

1. Logic gates – Universality of NAND / NOR gates Using IC's
2. Verification of Demorgan's theorems and Boolean Expressions
3. Astable and monostablemultivibrator using IC 555
4. FET amplifier (CD and CS configuration)
5. Phase shift network and Oscillator using IC 741
6. Construction of dual regulated power supply
7. Half and Full wave precision rectifier using IC 741
8. Characteristics of LDR
9. Digital to analog converter - R-2R method and Weighted method
10. Study the function of multiplexer and demultiplexer
11. Study the function of decoder and encoder
12. Flip flops
13. Half adder and Full adder (using only NAND & NOR gates)
14. Half subtractor and Full Subtractor (using only NAND & NOR gates)
15. Digital comparator using XOR and NAND gates
16. BCD to seven segment display
17. Study of counter using IC 7490 (0-9 and 00-99)

Relationship Matrix for course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Course				Hours		Credits		
IV	20PPH4CP4	PHYSICS PRACTICAL - IV				8		4		
Course Outcomes (Cos)	Programme Outcomes					Programme Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓		✓	✓	✓	✓	✓	✓
CO4	✓		✓	✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Number of Matches(✓) =48 , Relationship: Very High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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NANOPHYSICS

Elective Course: IV
Course Code: 20PPH3EC5:1
Hours / Week: 5
Credit: 5

Semester: III
Max. Marks : 100
Internal Marks : 25
External Marks : 75

COURSE OUTCOMES

- Students may gain knowledge of Nanomaterials and their merits
- Students learned about the fundamentals of Carbon nano structure
- Synthesis of Nanomaterials and various methods
- Understanding the experimental characterization techniques
- They would able to expand their knowledge on applications of nanomaterials

UNIT I: INTRODUCTION TO NANO AND TYPES OF NANOMATERIALS

Need and origin of nano -- Nano and energetic – Top-down and bottom-up approaches – Introductory ideas of 1D, 2D and 3D nanostructured materials – Quantum dots -- Quantum wire – Quantum well -- Exciton confinement in quantum dots.

UNIT II: CARBON NANOSTRUCTURES

Carbon molecules and carbon bond -- C60: Discovery and structure of C60 and its crystal - Superconductivity in C60 -- Carbon nanotubes: Fabrication – Structure – Electrical properties – Vibrational properties – Mechanical properties – Applications (fuel cells, chemical sensors, catalysts).

UNIT III: FABRICATION OF NANOMATERIALS

Synthesis of oxide nanoparticles by sol-gel method -- Electrochemical deposition method – Electrospinning method – Lithography -- Atomic layer deposition - Langmuir--Blodgett films -- Zeolite cages -- Core shell structures – Organic and inorganic hybrids.

UNIT IV: CHARACTERIZATION OF NANOMATERIALS

Principles, experimental set-up, procedure and utility of scanning electron microscopy (SEM), transmission electron microscopy (TEM), scanning tunneling microscope (STM) and scanning probe microscopy (SPM).

UNIT V: APPLICATIONS

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. T.Pradeep et al., A Textbook of Nanoscience and Nanotechnology (Tata McGraw Hill, New Delhi, 2012).
2. R.W. Kelsall, I.W. Hamley and M. Geoghegan, Nanoscale Science and Nanotechnology (John-Wiley & Sons, Chichester, 2005).
3. G. Cao, Nanostructures and Nanomaterials (Imperial College Press, London, 2004).
4. C.P. Poole and F.J. Owens, Introduction to Nanotechnology (Wiley, New Delhi, 2003).

BOOKS FOR REFERENCE:

1. H.S. Nalwa, Nanostructured Materials and Nanotechnology (Academic Press, San Diego, 2002).
2. M. Wilson, K. Kannangara, G. Smith, M. Simmons, B. Raguse, Nanotechnology: Basic Science and Emerging Technologies (Overseas Press, New Delhi, 2005).

Relationship Matrix for course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code	Title of the Course			Hours		Credits		
IV	20PPH3EC5:1	NANOPHYSICS			5		5		
Course Outcomes (Cos)	Programme Outcomes				Programme Specific Outcomes				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓		✓	✓	✓	✓	✓	
CO4	✓		✓	✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Number of Matches(✓) = 47, Relationship: Very High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Prepared By **Checked By** **HOD**