M.Sc., PHYSICS

Syllabus

Program Code: PPH

2018 - Onwards

MANNAR THIRUMALAI NAICKER COLLEGE

(AUTONOMOUS)

Re-accredited with "A" Grade by NAAC

PASUMALAI, MADURAI – 625 004

Regulations

Eligibility condition for admission

For admission to Post Graduate Programmers (P.G) a candidate should have passed the 3years degree course (under 10 + 2 + 3 pattern) (B.Sc., Physics) recognized by the university as equivalent there to.

Duration

Two years. Each year consists of 2 semesters. The duration of a semester is 90 working days.

Attendance

75% of the classes in each semester shortage of attendance can be condoned as per existing university rules.

Evaluation procedure:

A mark Statement with CGPA $= \dfrac{\sum(Marks X credits)}{\sum(Credits)}$

Where the summations are over all paper appeared up to the current semester.

Examinations: 3 hours duration. Total marks 100 for all papers
External Internal ratio 75:25 with 2 Internal tests.

The scheme of Examination

The components for continuous internal assessment are:

Two tests and their average --15 marks

Seminar /Group discussion --5 marks

Assignment --5 marks

Total --25 marks

Pattern of the question paper (Summative Examinations)

The question paper may have 3 parts.

Duration of the Summative Examinations is 3 hours

The components for continuous internal assessment are:

Part –A

Six multiple choice questions (answer all)   6 x01= 06 Marks

Part –B

Two questions ('either …. or 'type)   2 x 07=14 Marks

Part –C

One question out of two   1 x 10 =10 Marks

Total   30 Marks

Pattern of the question paper for the Summative Examinations:

Note: Duration- 3 hours

Part –A

Ten multiple choice questions   10 x01   = 10 Marks

(No Unit shall be omitted; not more than two questions from each unit.)

Part –B

Five Paragraph questions ('either …. or 'type)   5 x 07   = 35 Marks

(One question from each Unit)

Part –C

Three Essay questions out of five   3 x 10   =30 Marks

(One question from each Unit)

Total   75 Marks

Minimum Marks for a Pass

A) Theory :

    1. 50% of the aggregate (Internal +Summative Examinations).

    2. No separate pass minimum for the Internal Examinations.

    3. 34 marks out of 75 is the pass minimum for the Summative Examinations.

B) Practical :

1. No separate pass minimum for internal
2. 45% is the pass minimum for the External
3. 50% of the aggregate (external + internal)

C) Project :

1. No separate pass minimum for internal
2. 45% is the pass minimum for the External
3. 50% of the aggregate (external + internal)
4. Minimum of 25 pages in the project work excluding

    1. Introduction
    2. Reference
    3. Bibliography
    4. Tables
    5. Graphs

PROGRAMME SPECIFIC OUTCOMES

PSO1: To enable the studies to Learn different theoretical papers such as mathematical   physics, classical and statistical physics and Quantum Mechanics for the strong base for higher studies.

PSO2: To enable the studies Solve real problems with the help of the formula and concepts studied.

PSO3: To enable the studies Study physical phenomena and their interpretations for regular uses.

PSO4: To enable the studies Constrict equipments to carryout experiments for studying the characterizations.

MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)
DEPARTMENT OF PHYSICS
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COURSE PATTERN

S.No	Subject Semester	1	2	3	4	5	6	Total Hours	Total Credits
1	I	Core 6(5)	Core 6(5)	Core 6(5)	Elective 6(4)	Prac 3(0)	Prac 3(0)	30	19
2	II	Core 6(5)	Core 6(5)	Core 6(5)	Elective 6(4)	Prac 3(3)	Prac 3(3)	30	25
3	III	Core 6(5)	Core 6(5)	Core 6(5)	NME 6(4)	Prac 3(0)	Project 3(0)	30	19
4	IV	Core 6(5)	Core 6(5)	Core 6(5)	Elective 6(4)	Prac 3(4)	Project 3(4)	30	27
TOTAL								**120**	**90**

SEMESTER-I

Subject Code	Subjects	No. of Course	Hours /week	Credits	Maximum Marks		
					Int	Ext	Total
18PPHC11	Mathematical Physics – I	1	6	5	25	75	100
18PPHC12	Classical and Statistical Mechanics	1	6	5	25	75	100
18PPHC13	Electronics – I	1	6	5	25	75	100
18PPHE11 18PPHE12	Elective a. Energy Physics b. Computational Physics	1	6	4	25	75	100
18PPHCP1	Practical – I Non- Electronics	-	3	-	-	-	-
18PPHCP2	Practical – II Electronics – I	-	3	-	-	-	-
	TOTAL	**4**	**30**	**19**			**400**

SEMESTER-II

Subject Code	Subjects	No. of Course	Hours /week	Credits	Maximum Marks		
					Int	Ext	Total
18PPHC21	Mathematical Physics – II	1	6	5	25	75	100
18PPHC22	Quantum Mechanics – I	1	6	5	25	75	100
18PPHC23	Electronics –II	1	6	5	25	75	100
18PPHE21 18PPHE22	Elective a) Analytical Instrumentation b) Crystal Physics	1	6	4	25	75	100
18PPHCP1	Practical – I Non- Electronics	1	3	3	40	60	100
18PPHCP2	Practical – II Electronics – I	1	3	3	40	60	100
	TOTAL	**5**	**30**	**25**			**600**

SEMESTER-III

Subject Code	Subjects	No. of Course	Hours /week	Credits	Maximum Marks		
					Int	Ext	Total
18PPHC31	Solid State Physics – I	1	6	5	25	75	100
18PPHC32	Quantum Mechanics – II	1	6	5	25	75	100
18PPHC33	Electrodynamics	1	6	5	25	75	100
18PPHN31	**Non Major Elective** Nanotechnology	1	6	4	25	75	100
18PPHCP3	Practical – III	-	3	-	-	-	-
18PPHPR1	Project /Review of recent aspects of physics	-	3	-	-	-	-
	TOTAL	**4**	**30**	**19**	**100**	**300**	**400**

SEMESTER-IV

Subject Code	Subjects	No. of Course	Hours /week	Credits	Maximum Marks		
					Int	Ext	Total
18PPHC41	Solid State Physics – II	1	6	5	25	75	100
18PPHC42	Nuclear Physics	1	6	5	25	75	100
18PPHC43	Molecular Spectroscopy	1	6	5	25	75	100
18PPHE41 18PPHE42 18PPHE43	**Elective** Astro Physics Network and communications Advanced Optics	1	6	4	25	75	100
18PPHCP3	Practical – III	1	3	4	40	60	100
18PPHPR1	Project /Review of recent aspects of physics	1	3	4	40	60 (40+20)	100
	TOTAL	**6**	**30**	**27**	**180**	**420**	**600**

FIRST SEMESTER

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Programme	: M.Sc., Physics	**Paper**	: Core
Semester	: I	**Hours**	: 6
Subject Code	: 18PPHC11	**Credits**	: 5

MATHEMATICAL PHYSICS – I

Course Outcomes:
CO1:To acquire knowledge of Vector Algebra and its applications.
CO2: To understand the fundamentals of matrices.
CO3: To learn the concepts of Fourier series and Fourier transforms.
CO4: To know the special functions and their physical applications.

Unit I
Vectors:

Vector Algebra - The gradient of a scalar field -The divergence of a vector function – Gauss Divergence theorem - Curl of a vector function–Stoke's theorem –Green's theorem - Successive applications of the operator ∇ - Orthogonal curvilinear coordinates –Applications of vectors to hydrodynamics –The equation of heat flow in solids.

Unit II
Matrices:

Algebraic operations on Matrices – Sub-matrices – Partitioning of Matrices - Special types of a Matrices – Symmetric and Antisymmetric Matrices- Hermitian matrices – Determinant of a matrix – Orthogonal Matrices – Unitary Matrices – Trace of a matrix – Rank of a matrix – Solutions of Linear Equations – Eigen values, Eigen vectors.

Unit III
Fourier series, Fourier Integrals & Fourier Transforms:

Fourier series – Dirichlet's theorem and conditions -Evaluation of integrals by means of power series – Uses and properties of Fourier series - Fourier Integrals and Fourier transform - Properties of Fourier transforms - Fourier transform of a derivative -Fourier Sine & Cosine transforms of derivatives -Fourier transform of functions of two or three variables - Finite Fourier transforms -Some applications of Fourier transform.

Unit IV

Special Functions I:

Legendre differential equation and Legendre functions-Generating function for $P_n(x)$

Rodrigue's formula for the Legendre polynomials – Orthogonal properties of Legendre polynomials – Recurrence formulae for $P_n (x)$ – The beta function – Symmetry property of beta function – Evaluation of beta function – Transformation of beta function - The Gamma function –Evaluation of gamma function – Transformation of gamma function – Relation between beta function and Gamma function.

Unit V

Special Functions II:

Bessel's differential equations: Bessel's function of first and second kind - Recurrence formula for $J_n (x)$ – Generating function for $J_n (x)$ – Orthonormality of Bessel's functions – Hermite differential equation and Hermite polynomials -Generating function of Hermite polynomials - Recurrence formula for Hermite polynomials -Rodrigue's formula for Hermite polynomials – Orthogonality of Hermite polynomials

Text Book

Sathya Prakash, **Mathematical physics**, Sultan chand& Sons Educational publishers, IV Edition/ 2005.

Unit – I

Chapter 1 (Section 1.1(a,b,d,e) 1.2 to 1.9, 1.11, 1.15, 1.17(a,b))

Unit – II

Chapter2 (Section 2.1 to2.5, 2.9 to 2.12, 2.14, 2.17 to 2.19, 2.23, 2.27, 2.31)

Unit – III

Chapter 7 (Section 7.1 to 7.8, 7.10)

Chapter 9 (Section 9.2 to 9.5, 9.7, 9.8)

Unit – IV

Chapter 4 (Section 4.1(a,b)-4.7)

Chapter 6 (Section 6.7 to 6.11)

Unit – V

Chapter 6 (Section 6.17, 6.21, 6.22 6.25, 6.29-6.33)

Reference Book(s):

1. A.W.Joshi, **Matrices and Tensors in Physics,** Wiley Eastern Ltd., II Edition, 2004.

2. B.D.Gupta, **Mathematical Physics,** Vikas Publishing house Private Ltd. New Delhi, III Edition, 2005.

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Programme	: M.Sc., Physics	**Paper**	: Core
Semester	: I	**Hours**	: 6
Subject Code	: 18PPHC12	**Credits**	: 5

CLASSICAL AND STATISTICAL MECHANICS

Course Outcomes:

CO1: To study the Hamiltonian formulation of classical mechanics and apply it to simple systems.

CO2: To acquire knowledge of canonical transformation and Poisson's Brackets.

CO3: To observe the oscillatory motion of the particles.

CO4: To be familiar with Bose and Fermi ideal systems.

UNIT – I:

Hamiltonian Formulation:

Introduction – Hamiltonian – Hamilton's Equations of Motion – Physical Significance of H – Advantage of Hamiltonian Approach – Deduction of Canonical Equations from a Variational Principle . Applications of Hamilton's Equations of Motion: Simple Pendulum – Compound Pendulum – 2–D Isotropic Harmonic Oscillator – Particle Moving Near the Surface of the Earth – Particle in a Central Field of Force. Procedure to Eliminate Consideration of Ignorable Coordinates:

The Routhian Function – Principle of Least Action.

UNIT – II:

Canonical Transformations: Transformation – Point Transformation – Canonical Transformation – Generating Function – Advantage of Canonical Transformations – Examples – Condition for a Transformation to be Canonical – Bilinear Invariant Condition – Poisson brackets – Properties – Invariance of Poisson Brackets with respect to Canonical Transformation – Equation of Motion in Poisson Bracket Form – Jacobe's Identity – The Angular Momentum and Poisson's Brackets – Poisson's Brackets in Quantum Mechanics – Lagrange's Brackets – Properties – Relation between Lagrange and Poisson Brackets – Problems.

UNIT – III:

Statistical Mechanics:

Introduction – Ideal Gas – Gibb's Paradox – Equipartition Theorem. Quantum Statistics: Symmetry of Wave functions – Distribution Functions – Boltzmann's Limit of Boson and Fermion Gases. Evaluation of Partition – Function Partition Function for Diatomic Molecules: Translational Partition Function – Rotational Partition Function – Vibrational Partition Function – Electronic Partition Function – Equation of State for an Ideal Gas – the Quantum Mechanical Paramagnetic Susceptibility.

UNIT – IV:

Ideal Bose Systems:

Photon Gas – Radiation Pressure – Radiation Density – Emissivity – Equilibrium Number of Photons in the Radiation Cavity – Einstein's Derivation of Planck's Law – Bose Einstein Condensation – Specific Heat from Lattice Vibrations – Debye's Model of Solids–Phonon Gas.

UNIT – V:

Ideal Fermi Systems:

Fermi Energy – Fermi Energy using Uncertainty Principle – Mean Energy of Fermions at 'O' K – Fermi Gas in Metals – Atomic Nucleus as an Ideal Fermion Gas – Fermi Energy as a Function of Temperature – Electronic Specific Heat – Compressibility of Fermi Gas – Pauli's Paramagnetism – Relativistic Degenerate Electron Gas – White Dwarfs.

Text Books:

01. Gupta S.L., Kumar V., and Sharma H.V., Classical Mechanics 22nd Edition, Pragati Prakashan, Meerut,
   UNIT – I: 3.1–3.7, 3.9, 3.10, 2.12
   UNIT – II: 3.11–3.12, 3.21–3.24, 3.26–3.29

02. Laud B.B., Fundamentals of Statistical Mechanics, New Age International Pvt. Ltd., 1998.
   UNIT – III: Chapter 6.8–6.10, Chapter 8
   UNIT – IV: Chapter 9
   UNIT – V: Chapter 10

References:

01. Herbert Goldstein, Classical Mechanics, Addition Wesley Publishing Company, New Delhi.
02. Gupta S.L., and Kumar V., Statistical Mechanics, Pragate Prakashan, 22nd Edition, 2008.
03. Agarwal B.K., Melvin Eisner, Statistical Mechanics, 2nd Edition, New Age International Pvt. Ltd.,

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Programme	: M.Sc., Physics	**Paper**	: Core
Semester	: I	**Hours**	: 6
Subject Code	: 18PPHC13	**Credits**	: 5

ELECTRONICS – I

Course Outcomes:

CO1: To get knowledge of communication system through modulation.
CO2: To appreciate the applications of operational amplifier.
CO3: To familiarize semiconductor devices and their importances.
CO4: To understand the different microwave devices and oscillators.

Unit - I

Communication systems: Amplitude Modulation Theory:

Frequency spectrum of the AM wave - Representation of AM - Generation of AM:- Grid and Plate modulated class *C* amplifications -Single -Side band techniques - evolution and description of SSB - Suppression of carrier - Suppression of unwanted sideband - Extensions of SSB.

Frequency Modulator:

Mathematical representation of FM - Frequency spectrum of the FM wave - Effects of noise on carrier - Pre emphasis and de emphasis- Generation of FM - Direct and Indirect methods.

Unit- II

Operational Amplifier:

Operational Amplifier - The differential amplifier using Op-amp - The emitter-coupled differential amplifier–Wave forms using Op-amp-Astable and Monostable Multivibrators-Basic operational amplifer – Operational amplifer stages and parameters - Ideal volatage transfer curve - Open and Closed loop Op-amp – Applications-Adder-Subtracter - Integrator, differentiator and active filters.

Unit – III

Semiconductor devices:

Construction and operation of JFET- Applications of JFET, Operation of MOSFET- comparision of MOSFET and JFET- UJT relaxation oscillator. Four layer diode(Shockley diode) V-I characteristics - Silicon controlled rectifier-Thyristor rating–Rectifier circuits using SCR – Triac – Diac – Wave form shaping circuits:Diode clippers-clampers-multivibrators-triggering methods for bistable multivibrators- Schmitt trigger.

Unit-IV

Microwave devices and circuits

Auxiliary Components: Directional couplers - Isolations and circulators – Mixers - Detector mounts - Microwave triodes – Multicavity Klystron - Reflex Klystron – Magnetron-Travelling wave tube (TWT) – Gunn Effect - Gunn diodes and applications- Other microwave diodes: PIN diodes, Schottky barrier diode, backward diode.

Unit - V

Oscillators:

Introduction-Classification of Oscillators-Condition for Oscillation-General Form of an LC Oscillator-Hartley Oscillator - Collpitt Oscillator-Clapp Oscillator-Franklin Oscillator-Armstrong Oscillator-RC Oscillators-Wien-Bridge Oscillator-Frequency range of RC and LC Oscillator- Oscillator Using FET

Text Book(s)

Text book - 1

Geroge Kennedy, Electronics Communication System, Tata McGraw Hill Education

Private Limited New Delhi, Fourth Edition 2005

Text book - 2

S.Salivahanan, N.Sureshkumar, A.Vallavaraj, Electronic Devices and Circuits,

Tata McGraw Hill Education Private Limited, New Delhi, II Edition/2008

Unit I – (From Text book 1)

Chapter- 3- Sections - 3.1, 3.2.

Chapter- 4- Sections- 4.1 to 4.4

Chapter -5 - Sections 5.1 to 5.3

Unit II – (From Text book 2)

Chapter 9 - Sections- 9.2 to 9.4

Chapter 20- Sections- 20.1, to 20.8, 12.12

Unit III – (From Text book -2)

    Chapter 7 – Sections- 7.1 to 7.4, 7.8 to 7.12

    Chapter 8 – Sections-8.1 to 8.8

    Chapter 16- sections – 16.1to 16.8

    Chapter 17- Sections -17.2

 Unit IV-(From Text book -1)

    Chapter 10 – Sections- 10.5

    Chapter 11 – Sections- 11.1 to11.5

    Chapter 12 – Sections- 12.6, 12.8

Unit V – (From Text book 2)

    Chapter 15 – Sections- 15.1 to 15.9,15.11,15.12,15.77 &15.20

Reference Book(s)

    1.Millman&Halkias, Integrated Electronics,Tata McGraw Hill Company,2002

    2.Millman&Halkias, Electronics Devices and Circuits,McGraw Hill International

    Book Company,1985.

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Programme	: M.Sc., Physics	**Paper**	: Elective I (a)
Semester	: I	**Hours**	: 6
Subject Code	: 18PPHE11	**Credits**	: 4

ENERGY PHYSICS

Course Outcomes:

CO1: To get the knowledge of renewable energy sources

CO2: To acquire knowledge of solar powered devices.

CO3: To acquaint with various types of non-conventional energy sources.

CO4: To observe the effect and causes of pollutions.

Unit –I Fundamentals of energy

Classification of energy resources'-consumption trend of primary energy sources- importance of nonconventional energy sources –Common forms of energy –advantages and disadvantages-world energy status – energy scenario in India- salient features of energy conservation –principles of energy conservation.

Unit – II   Solar energy:

The sun as a source of energy- sun earth radiation spectrum-measurements of solar radiation –solar radiation data-solar time-solar collectors-solar cookers-solar green house-solar dryer-solar thermo mechanical systems-solar cell fundamentals-solar cell characteristics-solar PV systems-solar PV applications.

Unit – III Wind Energy:

Origin of wind – Nature of wind – major applications of wind power – wind energy conversion systems (WECS)-effects of wind speed and grid condition –wind energy storage- environmental aspects- wind energy program in India.

Unit –IV Bio-Energy:

  Photo synthesis process-biomass resources-biomass conversion technologies-biomass gasification –bio mass liquefaction – biomass to ethanol production – biogas production from waste biomass – energy farming – biomass energy program in India

Unit-V Environmental Pollution:

Air pollution: Sources of air pollution – Classification – Effects – Control devices of air pollution – Water pollution: Sources of water pollution – Classification– Effects–Control devices of water pollution-Soil pollution: Sources of soil pollution – Classification– Effects–Control devices of soil pollution.

Text Book(s)

Text book - 1

B.H Khan, Non – Conventional Energy Resources, Mc Graw Hill Education (India) Private limited, Third Edition, 2017.

Unit – I

     Chapter 1-Sections 1.1, 1.3 – 1.9, 1.15.1, 1.16,

    Chapter 2- Sections 2.1 to 2.3

Unit – II

    Chapter 4- Sections 4.1- 4.4, 4.8 - 4.10

    Chapter 5-Sections 5.1 – 5.3, 5.7 -5.10, 5.12

    Chapter 6 – Sections 6.1 – 6.3, 6.6

Unit – III

    Chapter 7 – Sections – 7.1- 7.5, 7.9 – 7.14,

Unit - IV

    Chapter- 8 Section 8.1 – 8.5, 8.7-8.11

Unit- V   Prepared by department

Reference Book(s)

G.D.Rai, Solar energy Utilization, Khanna Publishers, Fifth Edition /2005

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Programme	: M.Sc., Physics	**Paper**	: Elective I (b)
Semester	: I	**Hours**	: 6
Subject Code	: 18PPHE12	**Credits**	: 4

COMPUTATIONAL PHYSICS

Course Outcomes:

CO1: To understand numerical methods for finding algebraic solutions.

CO2: To get the knowledge of interpolation method.

CO3: To learn the fundamentals of programming concepts.

CO4: To improve the programming skills through C++ language and apply it in practicals.

Unit-I

Solution of Algebraic and Transcendental equations:

The method of bisection – Newton – Raphson method - The Secant method – Matrix Inversion method - The Gauss Elimination method - LU decomposition of Matrix(Lower diagonal to upper diagonal) – LU decomposition from Gauss elimination.

Unit - II

Interpolation:

Difference tables – Forward difference Table – Backward difference Table – Newton's formulae for Interpolation – Gauss formulae for Interpolation – Lagrange's Interpolation formula - Truncation error in interpolation - Least squares approximation.

Unit - III

Numerical Integration & Solution of Differential Equations:

Numerical integration - Simpson's1/3 rule – Trapezoidal rule- Rungekutta method- Euler's method- Predictor-corrector method.

Unit- IV

Data types & Statements:

Identifiers and Keywords – Constants – C++ operators – Declaration of variables – Statements – Simple C++ Programmes – Control systems – Conditional expressions – Switch statements – Loop statements – Breaking statements – Defining a function – Return statements – Types of functions – Structures within structures

UNIT - V

Structures, Classes and Inheritance:

Structures & Classes – Declaration of class – Member functions – Defining the

object of a class – Accessing and member of a class – Classes within a classes – Constructors – Destructors –   Single inheritance – Types of Base classes – Multiple inheritance.

Text Book(s)

Text book - 1

S.S.Sastry, Introductory methods of Numerical Analysis, Prentice Hall of India Pvt. Ltd, Fourth Edition 2005

Text book - 2

D.Ravichandran, Programming with C++, The McGraw-Hill Publishing Company Limited, Thirteenth reprint 2001

Unit – I
        Chapter 2 (Sections. 2.2,2.5,2.7)
         Chapter 6(Sections: 6.3,6.3.1,6.3.2,6.3.3,,6.3.7,6.3.10)
Unit – II
        Chapter 5 (Sections.5.4,5.4.1,5.4.2)
        Chapter 7(Sections.7.4,7.5,7.6)
Unit – III
        Chapter 3 (Sections. 3.3,3.3.1,3.3.2,3.9,3.9.1, 3.9.2)
        Chapter 4 (Sections.4.2,4.3)
 Unit – IV (from text book 2)
        Chapter 1-(Sections1.1-1.3)
        Chapter 2-(Sections2.1-2.3)
        Chapter 3-(Sections3.1-3.4)
        Chapter 4-(Sections 4.1-4.3)
Unit- V (from text book 2)
         Chapter 7-(Sections7.1-7.3,7.6)
         Chapter 8-(Sections8.1-8.6,8.10)
         Chapter 9-(Sections9.1-9.2)
         Chapter 10-(Sections 10.1-10.3,10.7)

Reference Book(s)

1. A.Singaravelu, Numerical Methods, Meenakshi Agency,2003

2. Steven C.Chopra Raymond P.Canale, Numerical Methods for Engineers, McGraw

Hill International Editions, Third Edition (2002)

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Programme : M.Sc., Physics	**Paper** : Practical
Semester : I&II	**Hours** : 3
Subject Code : 18PPHCP1	**Credits** : 3

PRACTICAL – I
Non - Electronics

Course Outcomes:
CO1: To make the students to know the experimental techniques of exposure of Equipments and their handling procedures.
CO2: To understand the concepts and principles by verifying with experimental results.
CO3: To understand different numerical methods and their applications.
CO4: To do the numerical methods programming with C^{++} language.

ANY TWELVE EXPERIMENTS:

1. Error analysis of experimental data

2. Least square and curve fitting
3. Refractive index of a liquid hollow prism
4. Determination of Cauchy's constant
5. Determination of young's modulus and Poisson's ratio of a plastic scale by forming hyperbolic fringes.
6. Determination of Young's modulus and Poisson's ratio of a plastic scale by forming elliptical fringes.
7. Determination of the coefficient of coupling between the pair of coils using Anderson's Bridge
8. Determination of mutual inductance of a pair of coils by forming Maxwell's Bridge
9. Wien's bridge and Owen's bridge
10. De Sauty's Bridge
11. Calibration of Electro Magnet
12. Runge-Kutta Method I& II using C++ Programming
13. Gauss Elimination Method using C++ Programming
14. Simpsons Rule using C++ Programming
15. Trapezoidal Rule using C++ Programming

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Programme	: M.Sc., Physics	**Paper**	: Practical
Semester	: I&II	**Hours**	: 3
Subject Code	: 18PPHCP2	**Credits**	: 3

PRACTICAL – II
Electronics – I

Course Outcomes:

CO1: To acquire knowledge of semiconductor devices and their applications.
CO2: To understand the concepts of OPAMPS and their uses.
CO3: To study oscillator and amplifier circuits.
CO4: To develop the skills in handling instruments and measuring devices.

ANY TWELVE EXPERIMENTS

1. FET amplifier

2. UJT characteristics

3. Single Stage Amplifier - Frequency response and bandwidth determination

4. IC Regulated Power Supply [Single (5v) and Dual (12-0-12)]

5. Phase shift oscillator

6. Wien bridge oscillator

7. Sawtooth Wave generator

8. Emitter follower

9. UJT – Relaxation oscillator

10. Two stage RC coupled amplifier – with and without feedback

11. Wave shaping circuits – Clipping and Clamping

12. Passive RC filter circuits – Low, High and Band pass filters – using OP AMP

13. Astable Multivibrators – using OP AMP

14. Bistable Multivibrators – using IC 555

15. Multiplexer and Demultiplexer circuits.

Prepared by: Dr.S.S.JAYABALAKRISHNAN

SECOND SEMESTER

MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)
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Programme	: M.Sc., Physics	Paper	: Core
Semester	: II	Hours	: 6
Subject Code	: 18PPHC21	Credits	: 5

MATHEMATICAL PHYSICS-II

Course Outcomes:

CO1: To study the concept of complex variable equations and formula.
CO2: To observe the evaluations of types of integrals and tenser analysis.
CO3: To learn group theory and theory and their physical applications.
CO4: To get knowledge of probability through various distribution.

Unit-I

Complex Variables:

Introduction - Functions of a Complex variable - The derivative and the Cauchy - Riemann differential equations - Line integrals of complex functions -Cauchy's integral theorem -Cauchy's integral formula

Unit – II

Residues:

Singular points of an analytic function - The point at infinity –Residues and their Evaluation – Residue at a simple pole – Residue at a pole of order m>1 – The Residue at infinity – Cauchy Residue theorem - Evaluation of definite integrals –Trigonometric functions of $\cos\theta$ and $\sin\theta$: Integration round the unit circle – Evaluation of certain improper real integrals – Evaluation of infinite integrals by Jordan's Lemma.

Unit - III

Tensor Analysis:

Introduction - Algebra of tensors - Quotient law -Fundamental tensor - Cartesian tensor -Four vectors in special relativity - covariant formulation of electrodynamics.

Unit -IV

Group Theory:

Introduction - Definitions of Group theory - Abelian group - Some examples of groups – cyclic groups – Group multiplication table – The rearrangement theorem - Subgroups - Classes –The product of classes –Isomorphism and Homomorphism Cayley's theorem- Group symmetry of a square - Representations of groups –Reducible and Irreducible Representations – Some theorems on Representations - The Great orthogonally theorem and its consequences - Character tables.

Unit - V

Probability:

Definition – Sample space – Mutually exclusive events – Theorem of total probability – Compound events and theorems – Binomial theorem of probability -The Binomial distribution - The Poisson distribution - The normal or Gaussian distribution – The standard deviation as the sum of distribution.

Text Book(s)

Text book - 1

SathyaPrakash, Mathematical physics, Sultan chand & Sons Educational publishers

IV Edition/ 2005

Text book - 2

A.W.Joshi, Matrices and Tensors in Physics, Wiley Eastern Ltd, II Edition/ 2004

Unit – I (From Text book – 1)

Chapter 5 (Section 5.1 to 5.16)

Unit – II (From Text book – 1)

Chapter 5 (Section 5.22 to 5.25(c))

Unit – III (From Text book – 2)

Chapter 15 (Section 15.1 to 15.5)

Chapter 16 (Section 16.1 to 16.8)

Chapter 17 (Section 17.1)

Chapter 18 (Section 18.1 to 18.4)

Chapter 19 (Section 19.3, 19.4)

Chapter 20 (Section 20.1, 20.2)

Chapter 21 (Section 21.1 to 21.3)

Unit - IV (From Text book – 1)

Chapter 12 (Section 12.1 to 12.7, 12.9, 12.10, 12.13, 12.15, 12.17, 12.18 to 12.22)

Unit - V (From Text book – 1)

Chapter 11(Section 11.1-11.7, 11.12, 11.19-11.22)

Reference Book(s):

1. Pipes and Harvill, Applied Mathematics for Engineers and Physicists, McGraw Hill International Book Company, III Edition,1970

2. B.D. Gupta, Mathematical Physics, VikasPublishing house Private Ltd. New Delhi, III Edition,2005

Prepared by: Dr. S.S. JAYABALAKRISHNAN

MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)
DEPARTMENT OF PHYSICS
(For those who joined in 2018-2019 and after)

Programme	: M.Sc., Physics	**Paper**	: Core
Semester	: II	**Hours**	: 6
Subject Code	: 18PPHC22	**Credits**	: 5

QUANTUM MECHANICS – I

Course Outcomes:
CO1: To get familiarized with the basics of quantum mechanics.
CO2: To understand Schrodinger's formulation of wave mechanics.

CO3: To solve three dimensional problems using Schrodinger's method.

CO4: To study various appreciation methods.

Unit I

Quantum theory and Wave Mechanical concepts:

Limitations of classical physics – Black body radiation: Photoelectric effect - Specific heat of solids – Planck's Quantum hypothesis – Einstein's theory of Photoelectric effect – Compton effect – Bohr Model of Hydrogen atom – Particle in a Box – Correspondence Principle – The Stern-Gerlach experiment – Inadequacy of Quantum theory – Wave Mechanical concepts: Wave nature of particles – Uncertainty Principle: Principle of Superposition – Wave Packet – Time - Dependent Schrodinger equation – Interpretation of Wave function – Ehrenfest's Theorem – Time-Independent Schrodinger equation – Stationary States.

Unit II

General Formalism of Quantum Mechanics:

Linear Vector Space – Linear operator – Eigen functions and Eigen values – Hermitian Operator – Postulates of Quantum Mechanics [Postulate 1-4] – Simultaneous Measurability of Observables – General Uncertainty Relation – Dirac's Notation – Equations of Motion: Schrodinger representations, Heisenberg representations and Interaction representations.

Unit III

Exactly soluble Eigen value Problem:

One –Dimensional Eigen value problem: Square-Well Potential with rigid walls and Square-Well Potential with finite walls – Square Potential Barrier – Alpha Emission – Kronig-Penney Square- Well periodic potential – Three dimensional Eigenvalue problems: Particle moving in a spherical symmetric potential – Systems of two Interacting particles – Rigid rotator – Hydrogen atom –The Free particle – Three dimensional Square- Well potential – The Deutron.

Unit IV

Time- Independent perturbation Theory:

Basic Concepts-Nondegenerate Energy levels-Anharmonic Oscillator: First –order Correction- The Ground state of Helium-Effect of Electric field on the ground state of Hydrogen- Degenerate Energy levels-Effect of Electric field on the n=2 state of hydrogen - Spin-orbit Interaction.

Unit V

Approximation methods:

The Variational Principle- Rayleigh-Ritz method-Variation Method for Excited states- The Hellmann-Feynman Theorem- The Ground state of Helium – The Ground state of Deuteron. **WKB approximation**: The WKB Method- The Connection Formulas-Validity of WKB Method-Barrier Penetration-Alpha Emission-Bound states in a potential well.

Text Book(s)

Text book - 1

G.Aruldhas, Quantum Mechanics, PHI Learning Private Limited, Second Edition 2013

Unit – I (From Text book – 1)

    Chapter 1 (Section 1.1 to 1.4, 1.6, 1.12-1.15)

    Chapter 2 (Section 2.1-2.9)

  Unit – II (From Text book – 1)

    Chapter 3 (Section 3.1 to 3.9)

  Unit – III (From Text book – 1)

Chapter 4 (Section 4.1 to 4.4,4.6)

Chapter 5 (Section 5.1 to 5.4, 5.6 to 5.8)

Unit – IV (From Text book – 1)

Chapter 9 (Section 9.1to 9.8)

Unit – V (From Text book – 1)

Chapter 10 (Section 10.1 to 10.6)

Chapter 11 (Section 11.1 to 11.6)

Reference Book(s):

1. P M Mathews & K Venkatesan, A Textbook of Quantum Mechanics,Tata McGraw Hill

Education Private Limited,Second Edition 2010

2. Kakani, Quantum Mechanics, Tata McGraw Hill Education Private Limited,

Third Edition ,2012

Prepared by:Dr.S.S.JAYABALAKRISHNAN

MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)
DEPARTMENT OF PHYSICS
(For those who joined in 2018-2019 and after)

Programme	: M.Sc., Physics	**Paper**	: Core
Semester	: II	**Hours**	: 6
Subject Code	: 18PPHC23	**Credits**	: 5

ELECTRONICS - II

Course Outcomes:

CO1: To understand the basic principles of logic circuits.

CO2: To be familiar with conditional and data processing circuits.

CO3: To induce basic knowledge about the complex digital system construction.

CO4: To know about the constructions of registers and counters.

UNIT – I

Simplifications of Boolean Functions:

The Map Method – Two and Three Variable Maps – Four-Variable Map – Five and six-Variable Maps – Product of Sums Simplification – NAND and NOR Implementation – Other Two-Level Implementations – Don't-Care Conditions.

UNIT –II

Combinational Logic:

Introduction – Design Procedure – Adders – Subtractors – Code Conversion – Analysis Procedure – Multilevel NAND Circuits – Multilevel NOR Circuits – Exclusive- OR and Equivalence Functions.

UNIT – III

Combinational Logic with MSI and LSI:

Introduction – Binary Parallel Adder – Carry propogation-Decimal Adder – BCD adder – Magnitude Comparator – Decoders – Demultiplexers – Encoders – Multiplexers – Read-Only Memory (ROM) – Programmable Logic Array (PLA).

UNIT – IV

Sequential Logic:

Introduction –Flip-Flops – Triggering of Flip-Flops – Analysis of Clocked Sequential Circuits – State Reduction and Assignment – Flip-Flop Excitation Tables – Design Procedure – Design of Counters – Design with State Equations.

UNIT – V

Registers, Counters and the Memory Unit:

Introduction – Registers – Register with parallel load – Sequential logic implementation – Shift Registers – Serial transfer – Bidirectional Shift register with parallel load – Serial addition – Ripple Counters – Binary Ripple Counter – BCD Ripple counter – Synchronous Counters – Binary Counter – Binary Up-Down counter – BCD counter – Timing Sequences – Johnson Counter.

Text book(s):

Text book - 1

  M.Morris Mano, Digital Logic and Computer Design, Prentice –Hall of India Private Limited, 2004

 Unit – I (From Text book – 1)

  Chapter 3 (Section 3.1 to 3.8) (P No: 72 -102)

 Unit – II (From Text book – 1)

  Chapter 4 (Section 4.1 to 4.9)

 Unit – III (From Text book – 1)

  Chapter 5 (Section 5.1 to 5.8)

 Unit – IV (From Text book – 1)

  Chapter 6 (Section 6.1 to 6.9)

 Unit – V (From Text book – 1)

  Chapter 7 (Section 7.1 to 7.6)

Reference Book(s):

1. S.Salivahanan and S.Arivazhagan, Digital Circuits and Design, Vikas Publishing House PVT Ltd, Second Edition / 2003

2. Leach and Malvino, Digital principles and applications, Tata Mc-Graw Hill Publishing company Ltd,Fifth Edition / 2005

Prepared by:Dr.S.S.JAYABALAKRISHNAN

MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)
DEPARTMENT OF PHYSICS
(For those who joined in 2018-2019 and after)

Programme	: M.Sc., Physics	**Paper**	: Elective II(a)
Semester	: II	**Hours**	: 6
Subject Code	: 18PPHE21	**Credits**	: 4

ANALYTICAL INSTRUMENTATION

Course Outcomes:

CO1: To enable the students to understand the basic concepts of analytical Instruments used in physics.

CO2: To know the Instrumentations of emission and absorption spectrometry.

CO3: To understand the Instrumentation of source, detection and handling technique in characterizations.

CO4: To compare different techniques of instrumentation with their efficiency and uses.

Unit I: UV, visible and IR spectrophotometry

Ultraviolet absorption spectrophotometry – Instrumentation – Detectors – Filters – Monochromators.

Instruments for absorption photometry.

Unit II: Atomic emission spectroscopy

Spectroscopic Sources – Atomic emission spectrometer – Photographic and Photoelectric detection. Infrared spectrophotometry – Instrumentation – Radiation sources – Detectors – Fourier Transform Interferometer.

Unit III: X-ray and Raman spectroscopy

Instrumentation – Detectors – X-ray fluorescence spectrometer.

Laser Raman spectrometer – Laser sources – Detectors – Sample handling.

Unit IV: NMR and ESR spectroscopy

NMR basic principles – Continuous wave NMR spectrometer – ESR basic principles – ESR spectrometer.

Scanning Electron Microscope (SEM) – Electron Spectroscopy for Chemical Analysis (ESCA)

Unit V: **Flame emission atomic absorption spectroscopy**

Instrumentation for Flame Spectrometer methods – Flame emission spectrometry – Atomic Absorption Spectrometry.

Atomic fluorescence spectrometry – Comparison of FES and AAS.

Text Books:

1. Instrumental methods of Analysis – H.H. Willard &Merritretal CBS Pub & Co, New Delhi

2. Molecular Spectroscopy – P.S. Sindu, TMH, New Delhi

Reference Books:

Spectroscopy Vol. I & II Ed. Straugan& Walker Chapman & Hail, 1976

MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)
DEPARTMENT OF PHYSICS
(For those who joined in 2018-2019 and after)

Programme	: M.Sc., Physics	**Paper**	: Elective II (b)
Semester	: II	**Hours**	: 6
Subject Code	: 18PPHE22	**Credits**	: 4

CRYSTAL PHYSICS

Course Outcomes:

1. To provide a qualitative idea on the fundamentals of growing crystals methods.

2. To understand the experimental procedure to grow

3. To learn linear and non-linear optical studies of ----

4. To study the thermal & hardness characterization of crystals.

UNIT-I: Nucleation

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-super saturation-steady state nucleation rate-nucleation parameters.

UNIT-II :Solution and Gel Growth Techniques

Low temperature solution growth-slow cooling methods-temperature gradient method-criteriafor optimizing solution growth parameters-basic apparatus for solution growth. Gel growth-structure of silica gel and gelling mechanism-nucleation control-merits of gel method-experimental methods chemical reaction method-chemical reduction method-complex de complex method-solubility reduction method-sol gel method.

UNIT-III : **High Temperature and Other Techniques Of Growth**

Growth from melt-Bridgman, Czochralski, zone melting, Verneuil techniques-physical vapor deposition-flux growth-chemical vapor deposition chemical vapor transport-hydrothermal growth epitaxial growth.

UNIT-IV : Optical Studies

Atomic absorption spectroscopy-UV-Visible-NIR spectroscopy-Experimental set ups for Fourier Transform Infrared analysis, FT-Raman vibrational spectroscopy and NMR-Illustrations with selected crystals-Nonlinear optical phenomenon (qualitative)-Kurtz powder SHG method-photoconductivity ands chematic set up for measurements-negative photoconductivity.

UNIT-V : **Crystal Characterization**

Thermal analysis-methods of thermal analysis-thermogravimetric analysis (TGA)-Differential thermal analysis (DTA)-Differential Scanning Calorimetry (DSC)-Mechanical studies-methods of hardness testing(qualitative)-Vickers hardness testing-correlation of microhardness with other properties-estimation of hardness number and work hardening coefficient (n)-dielectric studies-dielectric constant and dielectric loss measurements.

BOOKS FOR REFERENCE:

1. Brice J. C. (1986), 'Crystal Growth Process', John Wiley and Sons, New York.

2. Pamplin B.R. (1980), 'Crystal Growth', Pergman Press, London.

3. Henisch H.K. (1988), 'Crystals in gels and Liesegang rings', Cambridge Univ. Press. USA

4. R.T. Sane and Jagdish K Ghadge 'Thermal Analysis Theory and applications' Quest

   Publications 1997

5. V G Dmitriev, G.G. Gurzadyan, D.N. Nikigosyan; 'Handbook of Nonlinear optical

   crystals' Springer - Verlag 1991

6. Joshi V.N. (1990), 'Photoconductivity', Marcel Dekker, New York.

7. Santhanaraghavan P. and Ramasamy P. Crystal growth Process and Methods, (2000) KRU

   Publications, Kumbakonam.

Prepared by :Dr. S.S. JAYABALAKRISHNAN

MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)
DEPARTMENT OF PHYSICS
(For those who joined in 2018-2019 and after)

Programme	: M.Sc., Physics	**Paper**	: Practical
Semester	: I&II	**Hours**	: 3
Subject Code	: 18PPHCP1	**Credits**	: 3

PRACTICAL – I

Non – Electronics

Course Outcomes:

CO1: To make the students to know the experimental techniques of exposure of Equipments and their handling procedures.

CO2: To understand the concepts and principles by verifying with experimental results.

CO3: To understand different numerical methods and their applications.

CO4: To do the numerical methods programming with C^{++} language.

ANY TWELVE EXPERIMENTS:

1. Error analysis of experimental data
2. Least square and curve fitting
3. Refractive index of a liquid hollow prism
4. Determination of Cauchy's constant
5. Determination of young's modulus and Poisson's ratio of a plastic scale by forming hyperbolic fringes.
6. Determination of Young's modulus and Poisson's ratio of a plastic scale by forming elliptical fringes.
7. Determination of the coefficient of coupling between the pair of coils using Anderson's Bridge
8. Determination of mutual inductance of a pair of coils by forming Maxwell's Bridge
9. Wien's bridge and Owen's bridge
10. De Sauty's Bridge
11. Calibration of Electro Magnet
12. Runge-Kutta Method I&II using C++ Programming
13. Gauss Elimination Method using C++ Programming
14. Simpsons Rule using C++ Programming
15. Trapezoidal Rule using C++ Programming

MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)
DEPARTMENT OF PHYSICS
(For those who joined in 2018-2019 and after)

Programme	: M.Sc., Physics	Paper	: Practical
Semester	: I&II	Hours	: 3
Subject Code	: 18PPHCP2	Credits	: 3

PRACTICAL – II
Electronics – I

Course Outcomes:
CO1: To acquire knowledge of semiconductor devices and their applications.
CO2: To understand the concepts of OPAMPS and their uses.
CO3: To study oscillator and amplifier circuits.
CO4: To develop the skills in handling instruments and measuring devices.

ANY TWELVE EXPERIMENTS

1. FET amplifier

2. UJT characteristics

3. Single Stage Amplifier - Frequency response and bandwidth determination

4. IC Regulated Power Supply [Single (5v) and Dual (12-0-12)]

5. Phase shift oscillator

6. Wien bridge oscillator

7. Sawtooth Wave generator

8. Emitter follower

9. UJT – Relaxation oscillator

10. Two stage RC coupled amplifier – with and without feedback

11. Wave shaping circuits – Clipping and Clamping

12. Passive RC filter circuits – Low, High and Band pass filters – using OP AMP

13. Astable Multivibrators – using OP AMP

14. Bistable Multivibrators – using IC 555

15. Multiplexer and Demultiplexer circuits.

Prepared by: Dr.S.S.JAYABALAKRISHNAN

THIRD SEMESTER

MANNAR THIRUMALAI NAICKER COLLEGE(Autonomous)
DEPARTMENT OF PHYSICS
(For those who joined in 2018-2019 and after)

Programme : PG	**Part III**	**: Core**
Semester : III	**Hours per week**	**: 6**
Subject Code : 18PPHC31	**Credit**	**: 5**

SOLID STATE PHYSICS – I

Course Outcomes:
CO1: To Study the concept of crystal structures.
CO2: To understand the different type of bonds in a crystals.
CO3: To get knowledge of vibration of molecules.
CO4: To know about the Fermi gas and Fermi surfaces.

Unit – I Crystal structure: Periodic arrangements of atoms: Concepts of a lattice - lattice translation vectors- primitive lattice cell two and three dimensional lattice types-Miller indices of crystal planes- simple crystal structures like Sodium Chloride, Cesium Chloride, hexagonal and face centered close packed structures - diamond structure and cubic zinc sulphide structure.

Wave diffraction and the reciprocal Lattice: Diffraction of waves by crystals-Bragg's law- reciprocal lattice to sc, bcc and fcc lattices- Fourier analysis of the basis and structure factors of bcc and fcc lattices.

Unit –II Crystal binding and Elastic constants: Inert gas crystals- Van der waals-London interaction-repulsive interaction- ionic crystals - covalent crystals - metallic crystals-hydrogen bonds - atomic radii-analysis of elastic strains- Dilation- Stress components - elastic compliance and stiffness – constants – elastic energy density – elastic stiffness constant of cubic crystal- Bulk modulus and compressibility - elastic waves in cubic crystals [1 0 0] & [1 1 0] directions.

Unit – III Phonons I: Crystal vibrations: Vibrations of linear mono atomic and diatomic basis- quantization of elastic waves- phonon momentum.

Phonons II – Thermal properties**:** Planck distribution - density of states in one and three dimensions - Einstein and Debye theories of specific heat- anharmonicity of lattice vibrations-thermal expansion- Thermal conductivity - Normal Umklapp processes.

Unit –IV Free electron Fermi gas: Energy levels in one dimension- Fermi Dirac distribution for a free electron gas- periodic boundary condition and free electron gas in three dimension - Heat capacity of the electron gas- Ohm's law- Matthiessen rule - Hall effect- Wiedmann - Franz law-

     Energy Bands: Nearly free electron model- Bloch function – Kronig-Penny model- approximate solution near a zone boundary.

Unit –V Fermi surfaces and metals: Reduced and periodic zone schemes- construction of Fermi surfaces- electron orbits- tight-binding method for energy bands- Wigner -Seitz method and cohesive energy- quantization of orbits in magnetic fields - De Hass-van Alphen effect.

     Point defects: Lattice vacancies –diffusion-metals. Color centers: F centers-other centers in alkali halides.

Text Book:

1. Charles Kittel, Introduction to Solid State Physics, John Wiley & Sons, VIIIth Edition Reprint, New Delhi 2015.

    Unit I   – Chapters 1&2   Unit II   – Chapter 3

    Unit III – Chapters 4&5   Unit IV – Chapters 6&7

    Unit V   – Chapters 9&20

 Reference Books:

1. S.O. Pillai, Solid State Physics, New Age Publications, New revised sixth edition,New Delhi,

  2006.

2. N.W. Aschroft and N.D. Merin, Solid State Physics**,** Holt, Rinehart and Winston Publishers,

  Third Edition, New York 2016.

3. M.A.Wahab, Solid State Physics, Narosa Publishing House, Third Edition, New Delhi,1999.

MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)
DEPARTMENT OF PHYSICS
(For those who joined in 2018-2019 and after)

Programme	**: PG**	**Part III**	**: Core**
Semester	**: III**	**Hours per week**	**: 6**
Subject Code : 18PPHC32		**Credit**	**: 5**

QUANTUM MECHANICS – II

Course Outcomes:
CO1: To get the knowledge of the Heisenberg model.
CO2: To understand the concept of scattering cross sections.
CO3: To reveal the theory of relativistic wave equation.
CO4: To understand the effect of symmetries in Quantum mechanics.

Unit-I: Representations, Transformations and Symmetries:

Heisenberg Method - Matrix Representation of Wave Function-Matrix Representation of Operator - Properties of Matrix Elements - Schrödinger Equation in Matrix Form - Eigen Value Problem-Unitary Transformation-Linear Harmonic Oscillator: Matrix Method - Symmetry Transformation - Translation in Space-Translation in Time-Rotation in Space-Space Inversion - Time Reversal.

Unit-II: Angular momentum:

Angular Momentum Operators-Angular Momentum Commutation Relation - Eigen values and Eigenfunction of L^2 and L_z-Eigenvalues of J^2 and J_z - Angular Momentum Matrices -Spin Vectors for Spin(1/2) System - Addition of Angular momentum : Clebsh - Gordan Coefficient

Unit-III: Many electron Atoms:

Indistinguishable particles – Pauli principles – Inclusion of spin – Spin functions for two electrons – Spin functions for three electrons – The helium atom – General field approximation – Thomas-fermi model of the atom – Hartree equation – Hartree-Fock equation.

Unit-IV: Scattering Theory:

Scattering Cross Section-Scattering Amplitude-Partial Waves - Scattering by a Central Potential: Partial Wave Analysis - Scattering by an Attractive Square Well Potential-Breit Wigner Formula - Scattering Length-Expression for Phase Shifts -Integral Equation - Born Approximation - Scattering by a Screened Coulomb Potential - Validity of Born Approximation.

Unit-V: Relativistic Wave Equations:

Klein-Gordan Equation - Interpretation of the Klein - Gordan Equation-Particle in a Coulomb Field-Dirac's Equation for a Free Particle-Dirac Matrices-Covariant Form of Dirac Equation-Probability Density-Plane Wave Solution - Negative Energy States-Spin of the Dirac Particle - Magnetic Moment of the Electron - Spin Orbit Interaction-Radial Equation for an Electron in a Central Potential - Hydrogen Atom.

Text Book:

1. Aruldhas.G, Quantum Mechanics, Second Edition , PHI Learning Private Limited, 2013.

Unit – I

   Chapter 6 (Section 6.1 to 6.8) Chapter 7 (Section 7.1 to 7.6)

Unit – II

   Chapter 8 (Section 8.1 to 8.9)

Unit – III

   Chapter 13 (Section 13.1 to 13.10)

Unit – IV

   Chapter 14 (Section 14.1 to 14.4, 14.6 to 14.13)

Unit – V

   Chapter 15 (Section 15.1 to 15.14)

Reference Books:

1. Mathews.P.M and Venkatesan.K, A Text book of Quantum Mechanics, Second Edition Tata McGraw Hill Education Private Limited, 2012, New Delhi.
2. Kakani, Quantum Mechanics, Third Edition, Tata McGraw Hill Education Private Limited, 2012, New Delhi.
3. Devanathan.V, Quantum Mechanics, Second Edition Narosa Publishing House Private Ltd., 2011, New Delhi.

MANNAR THIRUMALAI NAICKER COLLEGE(Autonomous)
DEPARTMENT OF PHYSICS
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Programme	: PG	Part III	: Core
Semester	: III	Hours per week	: 6
Subject Code	: 18PPHC33	Credit	: 5

ELECTRODYNAMICS

Course Outcomes:
CO1: To understand the principles of conservation of charge and superposition in electrostatics
CO2: To determine electric field energy due to charge distribution in a material media
CO3: To analyze the propagation of electromagnetic waves in a material medium
CO4: To study the electromagnetic radiation due to a charge distribution.

UNIT - I ELECTROSTATICS AND ELECTRIC FIELDS IN MATTER

Poisson's equation and Laplace's equation – potential of a localized charge distribution – electrostatic boundary conditions. Work and energy in electrostatics: work done to move a charge - energy of point charge distribution - energy of continuous charge distribution. Laplace's equation: Laplace's equation in one, two, and three dimensions - boundary conditions and uniqueness theorem – conductors and second uniqueness theorem. Separation of variables: Cartesian and spherical coordinates. Multipole expansion: Approximate potentials at large distances - monopole and dipole terms - origin of coordinates in multipole expansions - electric field of a dipole. Polarization: Dielectrics - induced dipoles - alignment of polar molecules. Field of a polarized object: Bound charges - physical interpretation of bound charges - field inside a dielectric.

UNIT - II MAGNETOSTATICS AND MAGNETIC FIELDS IN MATTER

Lorentz force law: Magnetic fields – magnetic forces – currents. Biot-Savart law: Steady currents – magnetic field of steady current. Divergence and curl of **B**: Applications of Ampere's law – comparison of magnetostatics and electrostatics. Magnetic vector potential: Vector potential – magnetostatic boundary conditions – multipole expansion of the vector potential. Magnetization: Diamagnets, paramagnets and ferromagnets - torques and forces on magnetic dipoles – effect of a magnetic field on atomic orbits. Field of a magnetized object: Bound currents – physical interpretation of bound currents – magnetic field inside matter.

UNIT - III ELECTRODYNAMICS AND CONSERVATION LAWS

Maxwell's equations: Ampere's law – magnetic charge – Maxwell's equations in matter – boundary conditions. Charge and energy: Continuity equation - Poynting's theorem.

UNIT - IV ELECTROMAGNETIC WAVES

Electromagnetic waves in vacuum: Wave equation for **E** and **B** – monochromatic plane waves – energy and momentum in electromagnetic waves. Electromagnetic waves in matter: Propagation in linear media – reflection and transmission at normal incidence – reflection and transmission at oblique incidence. Absorption and dispersion: Electromagnetic waves in conductors – reflection at a conducting surface – frequency dependence of permittivity.

UNIT - V RADIATION AND RELATIVISTIC ELECTRODYNAMICS

Guided waves: Wave guides - waves in a rectangular wave guide – coaxial transmission line. Dipole radiation: Electric dipole radiation – magnetic dipole radiation. Relativistic electrodynamics: Magnetism as a relativistic Phenomenon – field transform – field tensor – electrodynamics in tensor notation – relativistic potentials.

Text Book

Griffiths, D.J., "**Introduction to Electrodynamics**", Third Edition, Prentice Hall of India Pvt. Ltd., 2003, New Delhi.

UNIT I	:	Chapter 2: Sections 2.3.3 to 2.4
		Chapter 3: Sections 3.1, 3.3 and 3.4
		Chapter 4: Sections 4.1 and 4.2
UNIT II	:	Chapter 5: Full except 5.3
		Chapter 6: Sections 6.1 and 6.2
UNIT III	:	Chapter 7: Sections: 7.33 to 7.36
		Chapter 8: Section 8.1
UNIT IV	:	Chapter 9: Sections 9.2 to 9.4
UNIT V	:	Chapter 9: Section 9.5
		Chapter 11: Sections 11.1.1 to 11.1.3
		Chapter 12: Section 12.3

Reference Books

1. Capri.A.Z., and Panat.P.V., "**Introduction to Electrodynamics**", Third Edition, Narosa Publishing House, New Delhi, 2006.

2. Greimer.W., Bromley, D.A., "**Electrodynamics"** Springer Berlin Heidelberg, 2006.

3. Jackson, J.D., "**Classical Electrodynamics**", Third Edition, Wiley India Pvt. Ltd. 2007, New Delhi.

4. Puri, S.P., "**Classical Electrodynamics**", First Edition, Narosa Publishing House Pvt. Ltd., 2011, New Delhi.

5. Shiozawa, T., Fleagle, J., "**Classical Relativistic Electrodynamics**", Springer Berlin Heidelberg, 2006.

MANNAR THIRUMALAI NAICKER COLLEGE(Autonomous)
DEPARTMENT OF PHYSICS
(For those who joined in 2018-2019 and after)

Programme	: PG	Part IV	: NME
Semester	: III	Hours per week	: 6
Subject Code	: 18PPHN31	Credit	: 4

NANOTECHNOLOGY

Course Outcomes:
CO1: To know about the basic concepts of nanotechnology.
CO2: To study the solid state nature of the crystals.
CO3: To acquire the knowledge of nanotubes and nanowires.
CO4: To describe MEMS basic process and manufacturing technologies.
CO5: To discuss nanocomposites synthesis and applications.

Unit - I Basic Concepts of Nanotecnology:

Origin-Fundamental Concepts: Simple to complex- Molecular nanotecnology. Nanomaterials, Bottom up and top down approaches , Bio materials, Speculative. Tools and Techniques: Implications: Health and environmental concerns-regulations. Energy applications: consumer products, economic benefits. Applications: medicine, chemistry and environment, energy, information and communication, heavy industry, consumer goods.

Unit – II Nano Crystal Structure:

Crystal structure and electronic properties-Quasi crystal: mathematical description-physics and material science of quasi crystals. Spin glass: magnetic behavior-model of Sherrington and Kirkpatrick-non-ergodic behavior and applications. Semiconductor device fabrications: wafer, processing, wafer test, device test, die preparation, packaging, list of steps and hazardous materials.

Fullerene: Prediction and discovery-variations. Buckyball: boron buckyball-variations of buckyball. Carbon nanotubes-Properties of fullerenes: Aromaticity, chemistry, solubility, quantum mechanics, safety and toxicity, superconductivity and fullerite.

Unit – III Nanotubes: Types of carbon nanotubes and related structures-properties-syntheses-potential and current applications-boron nitride nanotubes-optical properties-single walled nanotubes-carbon nanotube chemistry-colossal carbon tubes-silicon nanotubes.

Nanowires: Synthesis of nanowires-physics of nanowires-molecular wires-fabrications of nanowires at surfaces -atom chains and nanowires-solar nanowires-efficiency and low cost-nanowire battery.

Unit – IV Micro and nano electro magnetic system: materials for MEMS manufacturing-MEMS basic processes-MEMS manufacturing technologies-MEMS thermal actuator-micro-opto-electromechanical systems-nano electro mechanical systems.

Nanomaterial Synthesis and Applications: Uniformity of nanomaterials-properties-nanoscale iron particles-magnetic nanoparticles- nanoshell particles-nanotoxicity.

Unit – V Oxide Nanoprecurcers: Synthesis of oxide nanoparticles-size determination of nanoparticles -synthesis of low agglomerated nanoprecursors.

Nanocomposites: Applied condition-processing-properties: mechanical-air permeability-reduction in cost. Novel polymers / Inorganic hybrids-resins for composites.

Text book:

WM Breck, Nanotechnology volume 1, CBS Publications & Distributors Pvt Ltd., Ist Edition, 2016.

Unit – I: Chapter 1
 Unit –II: Chapters 3 and 4(up to page 75) except 39 to 44
Unit – III: Chapters 5 and 6
Unit – IV: Chapters 8 and 15
Unit – V: Chapters 16 and 21

Reference Books:

1. Richard Boker and Earl Baysen, Nano technology, Wiley Dreamtech India (p) Ltd., Ist Edition, 2005, Bengaluru.

2. Suryanarayanan.C and Koch. C.C - Nano Crystalline Materials- Current Research and Future Directions, Hyperfine Interactions Journal, Ist Edition,2000.

3. Alian, N., "An Introduction to Nanoscience and Nanotechnology", First Edition, Wiley India   Pvt. Ltd., 2015, New Delhi.

FOURTH SEMESTER

MANNAR THIRUMALAI NAICKER COLLEGE(Autonomous)
DEPARTMENT OF PHYSICS
(For those who joined in 2018-2019 and after)

Programme	: PG	Part III	: Core
Semester	: IV	Hours per week	: 6
Subject Code	: 18PPHC41	Credit	: 5

SOLID STATE PHYSICS - II

Course Outcomes:

CO1: To study the concept of superconductivity in metals.
CO2: To get the knowledge of magnetization in bulk materials.
CO3: To bring the detailed ideas of dielectric and ferro electric crystals.
CO4: To understand about various defects and diffusion in metals.

Unit – I : Superconductivity

Meissner effect - Heat capacity - Energy gap - Microwave and infrared properties and isotope effect - Stabilization energy of a superconductor - London theory of Meissner effect - Coherence length - BCS theory - Single particle tunneling DC and AC Josephson effects - Macroscopic quantum interference - High temperature super conductors .

Unit – II : Magnetisation:

Langevin diamagnetism equation and quantum theory of diamagnetism - Quantum theory of para magnetism - Hund's rules - Crystal splitting factor - Van Vleck temperature independent para magnetism.

ferromagnetism: Curie point, Weiss molecular field theory, saturation magnetization - Quantization of spin waves (magnons) and thermal excitation of domain walls and origin of domains - Coercivity and hysteresis.

Unit – III : Plasmas Polaritons Polarons and Exictons:

Longitudinal plasma oscillation - Plasmons - Electrostatic screening - Screened Coulomb potential Mott transition - Screening and phonons in metals - Polaritons and LST relation – Electron - electron interaction - Electron - phonon interaction and polarons - Peierls instability.

Optical process and Excitons: Kramers-Kronig Dispersion - Frenkel and Mott-Wannier excitons - Exciton condensation - Raman Effect in crystals.

Unit – IV : Dielectrics and Ferro-electrics

Maxwell's equations- Polarization- Macroscopic electric field- Depolarization field(E_1)- local electric field at an atom –Lorentz field (E_2)- Field of dipoles inside cavity (E_3) – Dielectric constant and polarizability – Structural phase transitions – Ferro electric crystals

– Displacive transitions – Soft Optical phonons – Landau theory of phase transitions – First and Second order– Antiferro electricity – ferro electric domains – Piezo electricity.

Unit – V : Dislocations:

Phenomenon of slip - Edge and screw dislocations - Burgers vectors - Stress fields of dislocations - Strength of alloys - Substitutional solid solutions - Hume - Rothery rules - Elementary theory of order - Kondo effect.

Text book:

Charles Kittel, Introduction to Solid State Physics, JohnWiley & Sons,VIII Edition, 2015, New Delhi.

Unit – I   Chapter 10
Unit – II   Chapters 11&12
Unit – III Chapters 14&15
Unit – IV Chapter 16
Unit – V   Chapters   21 & 22

Reference Book:

1. Philip Phillips, Advanced Solid State Physics, Second Edition, Cambrige University Press, 2012, New York.
2. Singh.R.J, Solid State Physics, First Edition, Pearson, 2012, Chennai.
3. Rudden.M.N and Wilson.J, Elements of Solid State Physics, Second Edition, Wiley Publishers, 1993, New Delhi.

MANNAR THIRUMALAI NAICKER COLLEGE(Autonomous)
DEPARTMENT OF PHYSICS
(For those who joined in 2018-2019 and after)

Programme   : PG   Part III   : Core
Semester   : IV   Hours per week   : 6
Subject Code : 18PPHC42   Credit   : 5

NUCLEAR PHYSICS

Course Outcomes:

CO1: To acquire the knowledge about the constituents of nucleus.
CO2: To know about detectors for nuclear particles.
CO3: To study the activities of nuclear fission and fusion processes.
CO4: To understand the concepts of Elementary particles.

Unit – I Physical tools and Nuclear reaction:

Detectors for nuclear particles: Proportional counter- Geiger counter- Scintillation counter-Semiconductor detectors-Compton Suppressed Germanium detectors-Cloud and bubble chambers. Particle accelerators: Van de Graaff Generators- Cyclotron-Synchrotron-Betatron. Beta ray Spectrometer.

The Q Equation: Types of nuclear reaction - The balance of mass and energy in nuclear reactions - The Q equation - Solution of the Q equation -Centre of mass frame in nuclear physics.

Unit – II Nucleus and Radioactive decays:

Rutherford scattering and estimation of the nuclear size - Measurement of nucleus radius - Constituents of the nucleus and their properties - Nuclear spin - Moments and statistics.

Alpha Rays: Range of alpha particles - Disintegration energy of spontaneous alpha decays- Alpha decay paradox - Barrier penetration.

Beta Rays: Continuous beta - Ray spectrum - Difficulties   encounter to understand it- Pauli's neutrino hypothesis - Fermi's theory of beta decay - The detection of neutrino- Parity non - Conservation in beta decay.

Introduction to Gamma Emission: Gamma - ray emission - Selection rules - Internal conversion - Nuclear isomerism.

Unit – III The liquid drop of Nucleus and Nuclear fission:

Binding energies of nuclear - Plot of B/A against A - Weizsachers semi - Empirical mass formula - Mass parabolas: Prediction of stability against β decay for members of an isobaric family - Stability limits against spontaneous fission - Barrier penetration - Decay probabilities for spontaneous Fission - Nucleon emission.

Nuclear Energy: Neutron induced fission - Asymmetrical fission - Mass yield - Emission of delayed neutrons by fission fragments - Energy released in the fission of 235 U - Fission of lighter nuclei - Fission chain reaction -Neutron cycle in a thermal nuclear reactor - Nuclear reactors.

Unit – IV Shell Model of Nucleus:

The evidence that led to the shell model - Main assumptions of the single particle shell model - Spin-orbit coupling of an electron bound in an atom – Spin - orbit coupling in nuclei for a single particle shell model – Parabolic potential – The single-particle shell model - Square well potential - Prediction of the shell model - The collective model of a nucleus.

Unit – V Elementary Particles :

Classification of elementary particles - Particle interactions (Gravitational, electromagnetic, strong, weak) - Conservation laws - Invariance under charge, parity , C.P, C.P.T - Electrons and positrons - Protons and anti- protons - Neutrons and anti- neutrons - Neutrinos and anti- neutrinos - Meson: muons, Pions, K- meson ,η - mesons, Hyperons : Λ -, Ξ, ∑, Ω- hyperons. Quarks.

Text books:

1. Patel. S.B, Nuclear Physics - An Introduction, II Edition, New Age International (P) Limited, 2008, Chennai.

2. Tayal, D.C, Nuclear Physics, Revised and Enlarged Edition, Himalaya Publishing House, 2008, New Delhi.

Unit – I (From Text book – 1)

     Chapter 1(Section 1.1.1 to 1.1.5)

     Chapter 3(Section 3.1 to 3.6)

Unit – II (From Text book – 1)

     Chapter 4 (Section 4.I.1 to 4.II.3, 4.IV.1 to 4.IV.4)

Unit – III (From Text book – 1)

Chapter 5 (Section 5.1 to 5.7)

Chapter 6 (Section 6.1 to 6.9)

Unit – IV (From Text book – 1)

Chapter 7 (Section 7.1 to 7.9).

Unit – V (From Text book – 2)

Chapter 18 (Section 18.1 to 18.15 & 18.19).

Reference Books:

1. Roy. R.R and Nigam. B.P, Nuclear Physics (Theory and experiment), Third Edition, Wiley Eastern Ltd, 2006.

2. Pandya. M.L, Yadav. R.P.S and Amiya Dash, Elements of Nuclear Physics, Eighth Edition, Kedar nath Ram nath, 2018, Meerut.

3. Devanathan.V, Nuclear Physics, Second Edition, Narosa publishing House Pvt, Ltd., 2011, New Delhi.

MANNAR THIRUMALAI NAICKER COLLEGE(Autonomous)
DEPARTMENT OF PHYSICS
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Programme : PG	Part III	: Core
Semester : IV	Hours per week	: 6
Subject Code : 18PPHC43	Credit	: 5

MOLECULAR SPECTROSCOPY

Course Outcomes:
CO1: To study the experimental methods for various spectroscopy
CO2: To get the knowledge of spectrum analysis
CO3: To know about the applications of molecular spectroscopy
CO4: To understand spin resonance spectroscopy.

Unit – I Microwave spectroscopy:

Classification of molecules – Interaction of radiation with rotating molecule – Rotational spectra of rigid diatomic molecules – Isotope effect – Intensity of rotational lines – Non – rigid rotator – Linear polyatomic molecules – Symmetric top molecules – Asymmetric top molecules – Stark effect – Quadrupole hyperfine interaction Microwave Spectrometer - Information derived from rotational spectra.

Unit – II Infrared spectroscopy:

Vibration energy of a diatomic molecule – Infrared selection rules – Vibrating diatomic molecule – Diatomic vibrating rotator – Asymmetry of rotational – vibrational band – Vibrations of polyatomic molecules – Hydrogen bonding – Rotational –Vibrational spectra of polyatomic molecule – IR Spectrometer – Sample handling technique – FTIR Spectroscopy -Applications.

Unit – III Raman spectroscopy:

Theory of Raman scattering – Rotational Raman spectra – Vibrational Raman spectra – Mutual Exclusion Principle – Raman spectrometer – Sample handling techniques – Structure determination using IR and Raman spectroscopy – Industrial applications – Resonance Raman scatteting – Raman microscopy.

Unit – IV Electronic spectra of molecules:

Vibrational coarse structure – Vibrational analysis of band systems – Progressions and sequences – Information derived from vibrational analysis – Franck – Condon Principle – Rotational fine structure of Electronic Vibration spectra – The FortratParabolae – dissociation – Predissociation – Photoelectron spectroscopy.

Unit – V Spin – resonance spectroscopy:

Nuclear Magnetic Resonance: Magnetic properties of nuclei – Resonance condition – NMR Instrumentation – Relaxation process – Bloch equations – Chemical shift – Indirect Spin – Spin Interaction – Interpretation of certain NMR Spectra - Electron Spin Resonance: Principle of ESR – ESR Spectrometer – Hyperfine structure.

Text book:

 G. Aruldhas, Molecular Structure and Spectroscopy, II Edition, PHI Learning Pvt Limited, New Delhi, 2011.

Unit – I
      Chapter 6(Section 6.1 to 6.6, 6.8 to 6.12, 6.14, 6.15)
Unit – II
      Chapter 7 (Section 7.1, 7.3 to 7.7, 7.10, 7.11, 7.16 to 7.19)
 Unit – III
       Chapter 8 (Section 8.1 to 8.7, 8.12, 8.15 to 8.17)
 Unit – IV
      Chapter 9 (Section 9.1 to 9.12).
 Unit – V
      Chapter 10(Section10.1 to 10.3, 10.5 to 10.9, 10.20).
      Chapter 11 (Section 11.1 to 11.3, 11.5)

Reference Books:

1. Michael, H. J., Modern Spectroscopy , Fourth Edition , Wiley India Pvt. Ltd., 2014, New Delhi.
2. Yadav. M. S, A Text book of Spectroscopy, Anmol Publications Pvt. Ltd., 2008, New Delhi.
3. Sindhu. P. S , Molecular Spectroscopy, First Edition , PMH, 1988, New Delhi.

MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)
DEPARTMENT OF PHYSICS
(For those who joined in 2018-2019 and after)

Programme	**: PG**	**Part III**	**: Elective**
Semester	**: IV**	**Hours per week**	**: 6**
Subject Code	**: 18PPHE41**	**Credit**	**: 4**

ASTRO PHYSICS

Course Outcomes:

CO1: To acquire the knowledge about the Classification of Stars.
CO2: To know about Sun and Atmosphere of Stars.
CO3: To study about the Multiple Stars.
CO4: To understand the classification of Variable Stars.

Unit – I Spectral Classification of Stars

Bolzmann's formula – Saha's Equation of thermal ionization. Harvard system of spectral classification: Hendry draper (HD) Catalogue luminosity effect on stellar spectra – Importance of ionization theory in Astrophysics – Spectroscopic Parallax – Hertzsprung – Russell diagram.

Unit – II The Sun-

Sun – A Typical Star. The Photosphere: Limb-darkening – Solar Granulation – Faculae – The chromospheres – Solar Corona – Prominences – The eleven year solar cycle and Sun spots – the solar Magnetic fields – Theory of Sun spots – Solar Flares – Radio emission from the Sun – solar wind - the Solar Neutrino puzzle.

Unit – III Atmosphere of Stars

Some important definitions **–** The equation of transfer – The solution of the equation of the transfer – Process of absorption in Stellar Atmosphere – Continuous absorption by the negative hydrogen ion in cooler stars – Analysis of spectral line Broadening – The curve of growth – Stellar Temperatures – The chemical composition of Stars.

Unit – IV Binary and multiple Stars

Visual Binary – spectroscopic Binary – Eclipsing binary – Multiple Stars – Origin of binary stars – Stellar masses and mass luminosity relation – mass transfer in close binary systems.

Unit – V Variable stars

Classification of variable stars – The Cepheid group of variables – Period luminosity relations of Cepheid Group of variables – RV Tauri Variables – Long Period Variables (Mira – Type Variables) Red Irregular and semi regular variables –Beta Canis Majoris Variables (β Cephei Stars) – U Geminorum Stars –(SS Cygni or Dwarf Novae) – Flare Stars – A Survey of variable stars as a whole – The Pulsation theory of variable stars.

Text book:

1. Baidyanath Basu, Tanuka Chattopadhyay, Sudhindra Nath Biswas, An Introduction to Astro Physics, Second Edition Asoke K. Ghosh, PHI Learning PVT Ltd, New Delhi – 110001, 2011.

Unit –I :   Chapter 4

Unit –II : Chapter 5

Unit –III: Chapter 6

Unit –IV : Chapter 7

Unit –V: Chapter 8

Reference Books

1. Jean Dufay, Introduction to Astro Physics, Dover Publications, INC, 2012, New Delhi.

2. Badmanabhan, Theoratical Astro Physics, Volume - I, Cambridge University Press, 2010. Chennai – 600031.

3. Abhyankar. K. D, Astro Physcis: Stars and galaxies, Universities Press, 2001, Hyderabad – 500 029,

MANNAR THIRUMALAI NAICKER COLLEGE(Autonomous)
DEPARTMENT OF PHYSICS
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Programme : PG	Part III	: Elective
Semester : IV	Hours per week	: 6
Subject Code : 18PPHE42	Credit	: 4

NETWORK AND COMMUNICATIONS

Course Outcomes:
CO1: To know the concepts of network topology
CO2: To understand the Internet and data communications systems
CO3: To study the Microwave Communication process
CO4: To familiarize tele Communication through Satellite.

Unit – I   New technologies in IT:

E-Commerce and E-Business-Web design: creating web site-web hosting-web promotion. Web Technologies: HTML-XHTML-CSS-JAVA script-PHP-data base on the web. Computer security: Types of computer crimes- physical access restrictions- passwords- Fire wells, codes, shields and Audits through authorized and unauthorized access. Cryptography: Computer virus, bombs and worms, multimedia applications- Virtual reality.

Unit – II: Internet and Data communication

Introduction to Internet – World Wide Web – advantages of Internet – Internet Protocal– Internet software – Bowsers – TCP, FTP, HTTP, and WAIS. communication network architecture – Standard organisations - Data communication circuits - netwoks – serial, plarallel data transfer.

Unit – III Microwave Communications:

Microwave Communication – Advantages and Disdavantages of microwave transmission –Analog versus Digital microwave – Propagation of Microwaves –Diversity– Production switching arrangements– FM microwave radio stations– Line of sight path Characteristics

Unit –IV: Telecommunications:

Communication processors: Modems-multiplexers, concentrators and controllers. Communication Media- Twisted-pair wires- Coaxial cables-fiber optics cables-microwaves systems- communications satellites. Tele communication Softwares: Functions. Types of

Newtorks : LAN,WAN.Network topologies: Star ,ring, Linear bus tree. Network Protocals-network architecture.

Unit – V : Satellite communications:

Satellite Communication – Kepler's law- Satellite orbits – orbital patterns– Geo stationary Satellites –Antenna look angels – orbital spacing – satellite systems – link modules.

Text books

1. Alexis Leon & Mathews Leon, Fundamentals of Information Technology, Second Edition, Vikas Publishing House Pvt Ltd, 1999, Noida.
2. Wayne Tomasi, Advanced Electronic Communications system, VI Edition, Prentice Hall of India Pvt Ltd, 2004, New Delhi.

Unit I-(From text book 1)

Chapter-27-36(all sections)
Unit -2-(From text book 1)
Chapter-21(all sections)
(From text book 2)
Chapter – 3(3.1-3.10)
Unit- 3 (From text book 2)
Chapter -13(13.1-13.11)
Unit-4 (From text book 1)
Chapter -18(all sections)
Unit-5(From text book 2)

Chapter -14(14.1-14.9)

Reference Books:

1. Rajaraman.V, Fundamentals of computers, II Edition, Prentice Hall of India Pvt Ltd, 1998, New Delhi.
2. Behrouz A.Forouzan, Data Communications and Networking, Fourth Edition, McGraw Hill Higher Education, 2007, New Delhi.
3. Brijendra Singh, Data Communications and Computer Networks, Fourth Edition, Prentice Hall India Learning Private Ltd., 2014, New Delhi.

MANNAR THIRUMALAI NAICKER COLLEGE(Autonomous)
DEPARTMENT OF PHYSICS
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Programme : PG	**Part III**	**: Elective**
Semester : IV	**Hours per week**	**: 6**
Subject Code : 18PPHE43	**Credit**	**: 4**

ADVANCED OPTICS

Course outcomes:

CO1: To acquire the knowledge about the magneto and electro optic effects.
CO2: To know about laser principles and types.
CO3: To study the holographic formation and applications.
CO4: To understand the principles and applications of fiber and non-linear optics and their applications.

Unit – I : Magneto – optics and Electro – optics :

Determination of magnetic rotation – Classical theory of Faraday effects - Electro-optic effect – Kerr electro – optic effect – Determination of speed of light by Kerr cell – Significance of the velocity of light.

Unit – II: Lasers

Absorption and emission of radiation by matter – Einstein's theory : A and B co-efficient ––– Population inversion : different methods – Basic laser system : Main components _ Optical resonator : Q- value – Threshold condition for laser action – An alternative expression for threshold condition – Typical lasers: Pulsed Ruby laser – Continuous He-Ne laser – CO_2 laser – Nd :YAG laser – Semiconductor laser – Properties and uses of a laser beam.

Unit – III :Holography

Basic principle of holography – Recording of a hologram – Reconstruction of image from hologram – Theory of holography: A short mathematical note – Features of hologram – Some advances in holography – Applications of holography.

Unit – IV : Fibre Optics : Basic principle of fibre optics

Structure and classification – Acceptance angle and numerical aperture – Fractional index change – Skip distance : Number of internal reflections – Ray path in a graded – index (GRIN) fibre – Dispersion: Intermodal dispersion – Intramodal dispersion - Fibre optic sensors – Losses in optical fibre – Mechanisms of attenuation – Fibre optics communication system – Advantages of optical fibre communication – Applications of fibre optics.

Unit – V: **Non- linear optics**

Linear and non-linear optics – Harmonic generation – Wave propagation and momentum conservation – Momentum mismatch: Phase matching condition, angle tuning – Sum and difference of frequency generation – Self-focusing phenomenon of light – Stimulated Raman scattering.

Text book:

1**.** B. Gupta, Modern Optics, Third Edition, Arunabha sen Books & Allied (P) Ltd., New Delhi 2012.

Reference Books

1. Grant R. Fowles, Introduction to Modern optics, Second Edition, Dover Publications, INC., 2012, New York.

2. Guenther. B.D, Modern optics, Second Edition, Oxford University Press, 2015, New York.

3. S.He. Guang, Non- linear optic and Photonics, Oxford University Press, 2014, New York.

Unit I- (Chapter - 19)

Unit -2-(Chapter – 21.1 to 21.14)

Unit- 3 (Chapter – 21.18 to 21.21)

Unit-4 Chapter -22.1 to 22.11)

Unit-5 Chapter –(24.1 to 24.8)

MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)
DEPARTMENT OF PHYSICS
(For those who joined in 2018-2019 and after)

Programme : PG	**Part III** : Practical
Semester : III & IV	**Hours per week : 03**
Subject Code : 18PPHCP3	**Credit : 04**

PRACTICAL - III

ANY 12 EXPERIMENTS

1. IC 555 Timers – Square wave generation, Scimit trigger or triangle wave generation

2. Solving simultaneously equations (Two variables only) using IC 741.

3. Half adder and Full adder circuits using ICs.

4. Optimizations of Boolean functions – Karnaugh Map Method.

5. Microprocessor based experiments – Addition, Subtraction and Mulplication.

6. Microprocessor based experiments- Ascending and Desending order

7. Study of basic the characteristics of op-amp

8. Construction of op-amp inverting & non-inverting amplifiers and study of their frequency response curves.

9. Construction of op-amp differentiator and integrator and study of their frequency response curves.

10. Construction and study of schematic trigger and its hysteresis.

11. Determination of Boltzmann Constant (K) and error estimation.

12. Laser based diffraction experiments

13. Refractive index of liquids using LASER

14. Refractive index of liquids using Newton's rings

15. Measurement of conductivity of thin film using four probe method.

MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)
DEPARTMENT OF PHYSICS
(For those who joined in 2018-2019 and after)

Programme	**: PG**	**Part III**	**: Project**
Semester	**: III & IV**	**Hours per week**	**: 3**
Subject Code	**: 18PPHPR1**	**Credit**	**: 4**

PROJECT WORK AND VIVA-VOCE

Course Outcomes:

CO1: To develop the ability of the students to prepare a project.

CO2: To get clear idea about the new concepts in our field apart from the syllabus.

CO3: To discuss the analytical instrumentations used.

CO4: To analyse the social use of the project.

Regulations for the Project Report

- Evaluation method for project:

	Max Marks		Credits
	Internal	External	
Project Evaluation	40	40	
Viva Voce		20	
Total	100		4

- Internal examiners are the respective supervisors.

- Viva voce examination to be evaluated by the external examiner.

- The report of the project must be in the prescribed form. It should be typed neatly in MS word with the equation editor or using Latex. The font size of the letter should be 13 or points with double space.

- The format of the project should have the following components.

First page should contain:

Title of the project report.

Name of the candidate

Register number.

Name of the supervisor.

Address of the institution

Month and year of submission.

1. Contents.
2. Declaration by candidate
3. Certificate by supervisor
4. Acknowledgement
5. Preface
6. Chapter 1 – Preliminaries.
7. Other chapters
8. References

The number of pages in the project may be 40 to 50

Each page should contain atleast 18 lines.

Four copies of the project report with spiral binding should be submitted.