MANNAR THIRUMALAI NAICKER COLLEGE

PASUMALAI, MADURAI– 625 004

(An Autonomous Institution Affiliated to Madurai Kamaraj University)

(Re-accredited with 'A' Grade by NAAC)

M.Sc., Physics

SYLLABUS AND REGULATIONS

UNDER
CHOICE BASED CREDIT SYSTEM (CBCS)
(For those who joined during 2018-2019 and after)

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 = $\frac{\sum(MarksXcredits)}{\sum(Credits)}$

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
(For those who joined in 2018-2019 and after)

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)	Elective 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									**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	Electromagnetic Theory	1	6	5	25	75	100
18PPHN31 18PPHN32	Non Major Elective a)Microprocessor and Microcontroller b) Medical Physics	1	6	4	25	75	100
18PPHCP3	Practical – III Electronics – II	-	3	-	-	-	-
18PPHPR1	Project /Review of recent aspects of physics	-	3	-	-	-	-
TOTAL		**4**	**30**	**19**			**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	Elective a. Nano Science & Technology b. Network and communications	1	6	4	25	75	100
18PPHCP3	Practical – III Electronics – II	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**			**600**

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DEPARTMENT OF PHYSICS
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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.

Prepared by:Dr.S.S.JAYABALAKRISHNAN

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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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MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)
DEPARTMENT OF PHYSICS
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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.

Prepared by:Dr.S.S.JAYABALAKRISHNAN

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DEPARTMENT OF PHYSICS
(For those who joined in 2018-2019 and after)

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

Prepared by: Dr.S.S.JAYABALAKRISHNAN

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DEPARTMENT OF PHYSICS
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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)

Prepared by:Dr.S.S.JAYABALAKRISHNAN

MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)
DEPARTMENT OF PHYSICS
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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

MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)
DEPARTMENT OF PHYSICS
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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

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

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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)
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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

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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

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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