

நறுமலர் தீபம்
இணைய வழி முதுகலை இயற்பியல்
பயிற்சி மையம்

தருமபுரி மாவட்டம் – 8122190917

(எப்பொழுது வேண்டுமானாலும் வகுப்புகளை கவனித்துக் கொள்ளும்
அப்ளிகேஷன் வசதி உண்டு)

PG TRB - SYLLABUS- PHYSICS

1.MATHEMATICAL PHYSICS

- Dimensional analysis:
- Differential equation (ordinary and partial) – order of equation –
- Expressions for gradient, divergence, curl and Laplacian –
- vector algebra and vector calculus – Gauss divergence theorem – Green's theorem – Stokes' theorem.
- Matrix: Cayley – Hamilton theorem, inverse of matrix – Eigen values and Eigen vectors.
- Polynomials: Hermite, Bessel and Legendre Functions.
- Special function: Beta and Gamma functions.
- Probability: Elementary probability theory – Random variables – Binomial – Poisson and Normal distribution.
- Complex variables: Analytic functions – Singular points – Cauchy's integral theorem and formula -Taylor's and Laurent's expansions, poles, Calculus of residues and evaluation of integrals.
- Integral transforms: Fourier series and Fourier transform and their properties.

2.CLASSICAL MECHANICS

- Mechanics of particles and systems of particles:
- Constraints and Generalized coordinates,
- Law of conservation of Energy, Linear and Angular momentum, Conservative and Non-

Conservative systems, Degrees of freedom, Holonomic – Nonholonomic – Scleronomic systems.

- Lagrangian Formalism: Lagrange equations of motion – D'Alembert's principle – Applications (Simple pendulum, Atwood's machine, Harmonic Oscillator, Electrical circuit).
- Hamiltonian Formalism: Hamilton's equation of motion – Cyclic co-ordinates – Hamilton's equation from variational principle, Principle of least action, Canonical transformation, Liouville's theorem.
- Rigid body Dynamics: Euler's angles – Moment of inertia tensor,
- Euler's equation of motion – Symmetrical top,
- Special theory of Relativity: Inertial and Non- inertial frames, Lorentz transformation, Lorentz inverse transformation, Length contraction, Time dilation, Mass invariance, Einstein's mass-energy relation.

3.ELECTROMAGNETIC THEORY

- Electrostatics: Coulomb's law – Gauss's law and its application.
- Laplace and Poisson's equations.
- Magnetostatics: Biot Savart's law – Ampere's law – Magnetic scalar and vector potentials – magnetic susceptibility – Equation of continuity – Displacement current –
- Maxwell's equations (free space and linear isotropic media) –
- Electromagnetic waves – Poynting's theorem –
- Dielectrics: Retarded potentials – Polarization – Radiation from a linear antenna – Transmission lines and Wave guides.

4.QUANTUM MECHANICS

- Failures of Classical mechanics – Black body radiation – Wave and particle duality –
- Postulates of Quantum mechanics – Wave function and properties –
- Expectation values – Heisenberg's uncertainty principle –
- Schrodinger equations (time – dependent and time- independent).
- Eigen value problems: Particle in a box (1D and 3D), Particle in a finite potential well & barrier, Tunnelling, Harmonic oscillator.
- Operators: Ladder operators, Angular momentum operator,
- Hydrogen atom, spin – Stern Gerlach experiment.

- Approximation methods: Variational principle, Time independent(1st and 2nd order) degenerate and non-degenerate perturbation theory –
- Time-Dependent perturbation theory – Fermi’s golden rule, Identical particles.
- Relativistic Quantum Mechanism: Pauli’s spin Matrices, Dirac and Klein Gordon equation.
- Commutators.
- Scattering theory: Scattering cross-section, Scattering by a central potential, Partial wave analysis, Breit-Wigner formula.

5.THERMODYNAMICS AND STATISTICAL MECHANICS

- Laws of thermodynamics and their consequences – thermodynamic system (closed and open)
- thermodynamic processes (isothermal, adiabatic, isochoric, isobaric, isotropic) –
- cyclic process – thermodynamic potentials (U, S, G, H) – relation between them.
- Specific heat – equation of state – intensive and extensive variables –
- The P-V diagram – Carnot cycle and its efficiency –
- Entropy – reversible and irreversible – T-S diagram – Equipartition theorem.
- Phase space – micro and macro states – Liouville’s theorem – ensembles – partition function
- classical (MB distribution) – Maxwell’s distribution of velocities – Kinetic Theory of gases – Pressure exerted by gas – Mean free path – Mean – RMS and most probable speed –
- Quantum (BE & FD distribution) statistics – applications to black body radiation – Bose Einstein condensation.

6.ATOMIC PHYSICS AND SPECTROSCOPY

- Quantum states of an electron in an atom –
- Hydrogen atom spectrum – Electron spin -Spin orbit coupling –
- Fine structure – Relativistic correction –
- Spectroscopic terms and selection rules –
- Hyperfine structure – Exchange symmetry of wave functions –
- Pauli’s exclusion principle –
- Hund’s rule – Periodic table – Alkali type spectra –
- LS and JJ Coupling –
- Zeeman, Paschen – Back and Stark effects.
- Principles of ESR, NMR,

- Chemical shift – Frank Condon principle –
- Born Oppenheimer approximation – Electronic, rotational and vibrational spectra of diatomic molecules, Selection rules.

7.SOLID STATE PHYSICS

- Crystal Physics: Lattice, Crystal structures – Bravais lattices – Miller indices – Reciprocal lattices –
- Lattice Dynamics: Monoatomic, diatomic lattices –
- Theories of specific heat – Einstein’s and Debye’s model for lattice specific heat.
- Classical free electron theory: Drude model – Thermal conductivity – Wiedemann Franz law.
- Energy bands in solids: Energy bands in metals, insulators and semiconductors,
- E-k diagram – Density of states – Brillouin zones – Wave equation of electron in a Periodic potential.
- Semiconductor Physics: Types of semiconductors – Mobility – Carrier concentration of charge carriers –
- Bloch’s theorem – Kronig – Penney model.
- Dielectrics: Polarization Mechanism – Clausius – Mossotti Equation – Piezo, Pyro and Ferroelectricity.
- Magnetism: Dia, Para, Ferro, Anti-Ferro and Ferri magnetism.
- Superconductivity: Meissner effect – Type I and Type II superconductivity – BCS theory – Josephson effect.

8.NUCLEAR AND PARTICLE PHYSICS

- Nuclear properties (size, shape, charge distribution, spin and parity) –
- Binding energy, Nuclear force – Liquid drop model – semi – empirical mass formula,
- Shell model and Collective model –
- Deuteron, Ground state of deuteron – excited state of deuteron –
- Meson theory of nuclear force – Yukawa potentials –
- Elementary ideas of alpha, beta and gamma decays – Radioactive decay –
- Fission, Fusion – Chain reaction – Nuclear reactor.
- Elementary particles: Classification of elementary particles,
- Fundamental interactions (EM, Strong, Weak, Gravitational) and their quantum numbers

(charge, spin, parity, isospin, strangeness, etc.) –Gell-MannNishijima formula.

- Elementary particles – Classifications – Quark model, Baryons and Mesons, Parity non-conservation in weak interaction

9.ELECTRONICS

- Semiconducting devices: Diodes – Junction diode – Rectification – Zener diode – Light Emitting Diode.
- Junction Transistors: common base, common emitter and common collector configurations – Static characteristics – Transistors as amplifier and oscillators – FET, JFET, MOSFET.
- IC: Fabrication technology, Monolithic IC Processing.
- 555 Timer, Phase shift, Wien bridge oscillators.
- Operational Amplifier (IC 741): Op-Amp characteristics, Inverting and Non-inverting Amplifiers, Adder, Subtractor, Differentiator and Integrator.
- Digital techniques and applications: Flip Flops, Registers – Counters.
- Digital integrated circuits: Logic gates, NAND and NOR – Universal building blocks – Half and Full adder.
- Communication Electronics: Modulation and Demodulation (AM, FM, Phase), Transmitter and Receiver, Satellite and Fiber optic communication.

10.EXPERIMENTAL PHYSICS

- Units and dimension of physical quantities – significant figures.
- Data interpretation and analysis, precision and accuracy, error analysis, propagation of errors, Least square fitting.
- Measurement of fundamental constants – e, h, c – Detection of X-rays, gamma rays, Charged particles, neutrons.
- Ionization chamber – proportional counter – Measurement of e/m ratio – Measurement of Hall voltage, mobility and charge carrier concentration –
- measurement of resistance and capacitance in series and parallel.

S.No	TEST	SYLLABUS
UNIT 1.MATHEMATICAL PHYSICS		
1.	TEST -1	<ul style="list-style-type: none"> ❖ Dimensional analysis: ❖ Differential equation (ordinary and partial) – order of equation – ❖ Expressions for gradient, divergence, curl and Laplacian – ❖ vector algebra and vector calculus – Gauss divergence theorem – Green’s theorem – Stokes’ theorem.
2.	TEST -2	<ul style="list-style-type: none"> ❖ Matrix: Cayley – Hamilton theorem, inverse of matrix – Eigen values and Eigen vectors. ❖ Polynomials: Hermite, Bessel and Legendre Functions. ❖ Special function: Beta and Gamma functions. ❖ Probability: Elementary probability theory – Random variables – Binomial – Poisson and Normal distribution.
3.	TEST - 3	<ul style="list-style-type: none"> ❖ Complex variables: Analytic functions – Singular points – Cauchy’s integral theorem and formula -Taylor’s and Laurent’s expansions, poles, Calculus of residues and evaluation of integrals. ❖ Integral transforms: Fourier series and Fourier transform and their properties.
UNIT II – CLASSICAL MECHANICS		
1	TEST - 4	<ul style="list-style-type: none"> ❖ Mechanics of particles and systems of particles: ❖ Constraints and Generalized coordinates, ❖ Law of conservation of Energy, Linear and Angular momentum, Conservative and Non-Conservative systems, Degrees of freedom, Holonomic – Nonholonomic – Scleronomic systems.
2	TEST - 5	<ul style="list-style-type: none"> ❖ Lagrangian Formalism: Lagrange equations of motion – D’Alembert’s principle – Applications (Simple pendulum, Atwood’s machine, Harmonic Oscillator, Electrical circuit). ❖ Hamiltonian Formalism: Hamilton’s equation of motion – Cyclic coordinates – Hamilton’s equation from variational principle, Principle of least action, Canonical transformation, Liouville’s theorem.
3	TEST - 6	<ul style="list-style-type: none"> ❖ Rigid body Dynamics: Euler’s angles – Moment of inertia tensor, ❖ Euler’s equation of motion – Symmetrical top,

		<ul style="list-style-type: none"> ❖ Special theory of Relativity: Inertial and Non- inertial frames, Lorentz transformation, Lorentz inverse transformation, Length contraction, Time dilation, Mass invariance, Einstein’s mass-energy relation.
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UNIT-III – ELECTROMAGNETIC THEORY

1	TEST – 7	<ul style="list-style-type: none"> ❖ Electrostatics: Coulomb’s law – Gauss’s law and its application. ❖ Laplace and Poisson’s equations. ❖ Magnetostatics: Biot Savart’s law – Ampere’s law – Magnetic scalar and vector potentials – magnetic susceptibility – Equation of continuity – Displacement current –
2	TEST – 8	<ul style="list-style-type: none"> ❖ Maxwell’s equations (free space and linear isotropic media) – ❖ Electromagnetic waves – Poynting’s theorem – ❖ Dielectrics: Retarded potentials – Polarization – Radiation from a linear antenna – Transmission lines and Wave guides.

UNIT-IV – QUANTUM MECHANICS

1	TEST – 9	<ul style="list-style-type: none"> ❖ Failures of Classical mechanics – Black body radiation – Wave and particle duality – ❖ Postulates of Quantum mechanics – Wave function and properties – ❖ Expectation values – Heisenberg’s uncertainty principle – ❖ Schrodinger equations (time – dependent and time- independent).
2	TEST – 10	<ul style="list-style-type: none"> ❖ Eigen value problems: Particle in a box (1D and 3D), Particle in a finite potential well & barrier, Tunnelling, Harmonic oscillator. ❖ Operators: Ladder operators, Angular momentum operator, ❖ Hydrogen atom, spin – Stern Gerlach experiment. ❖ Approximation methods: Variational principle, Time independent(1st and 2nd order) degenerate and non-degenerate perturbation theory –
3	TEST – 11	<ul style="list-style-type: none"> ❖ Time-Dependent perturbation theory – Fermi’s golden rule, Identical particles. ❖ Relativistic Quantum Mechanism: Pauli’s spin Matrices, Dirac and Klein Gordon equation. ❖ Commutators.

❖ Scattering theory: Scattering cross-section, Scattering by a central potential, Partial wave analysis, Breit-Wigner formula.

UNIT-V- THERMODYNAMICS AND STATISTICAL MECHANICS

1	TEST – 12	<ul style="list-style-type: none"> ❖ Laws of thermodynamics and their consequences – thermodynamic system (closed and open) ❖ thermodynamic processes (isothermal, adiabatic, isochoric, isobaric, isotropic) – ❖ cyclic process – thermodynamic potentials (U, S, G, H) – relation between them.
2	TEST – 13	<ul style="list-style-type: none"> ❖ Specific heat – equation of state – intensive and extensive variables ❖ The P-V diagram – Carnot cycle and its efficiency – ❖ Entropy – reversible and irreversible – T-S diagram – Equipartition theorem. ❖ Phase space – micro and macro states – Liouville’s theorem – ensembles – partition function
3	TEST – 14	<ul style="list-style-type: none"> ❖ classical (MB distribution) – Maxwell’s distribution of velocities – Kinetic Theory of gases – Pressure exerted by gas – Mean free path – Mean – RMS and most probable speed – ❖ Quantum (BE & FD distribution) statistics – applications to black body radiation – Bose Einstein condensation.

UNIT-VI – ATOMIC PHYSICS AND SPECTROSCOPY

1	TEST – 15	<ul style="list-style-type: none"> ❖ Quantum states of an electron in an atom – ❖ Hydrogen atom spectrum – Electron spin -Spin orbit coupling – ❖ Fine structure – Relativistic correction – ❖ Spectroscopic terms and selection rules –
2	TEST – 16	<ul style="list-style-type: none"> ❖ Hyperfine structure – Exchange symmetry of wave functions – ❖ Pauli’s exclusion principle – ❖ Hund’s rule – Periodic table – Alkali type spectra – ❖ LS and JJ Coupling –

3	TEST – 17	<ul style="list-style-type: none"> ❖ Zeeman, Paschen – Back and Stark effects. ❖ Principles of ESR, NMR, ❖ Chemical shift – Frank Condon principle – ❖ Born Oppenheimer approximation – Electronic, rotational and vibrational spectra of diatomic molecules, Selection rules.
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UNIT-VII- SOLID STATE PHYSICS

1	TEST – 18	<ul style="list-style-type: none"> ❖ Crystal Physics: Lattice, Crystal structures – Bravais lattices – Miller indices – Reciprocal lattices – ❖ Lattice Dynamics: Monoatomic, diatomic lattices – ❖ Theories of specific heat – Einstein’s and Debye’s model for lattice specific heat.
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2	TEST – 19	<ul style="list-style-type: none"> ❖ Classical free electron theory: Drude model – Thermal conductivity – Wiedemann Franz law. ❖ Energy bands in solids: Energy bands in metals, insulators and semiconductors, ❖ E-k diagram – Density of states – Brillouin zones – Wave equation of electron in a Periodic potential.
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3	TEST – 20	<ul style="list-style-type: none"> ❖ Semiconductor Physics: Types of semiconductors – Mobility – Carrier concentration of charge carriers – ❖ Bloch’s theorem – Kronig – Penney model. ❖ Dielectrics: Polarization Mechanism – Clausius – Mossotti Equation – Piezo, Pyro and Ferroelectricity.
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4	TEST – 21	<ul style="list-style-type: none"> ❖ Magnetism: Dia, Para, Ferro, Anti-Ferro and Ferri magnetism. ❖ Superconductivity: Meissner effect – Type I and Type II superconductivity – BCS theory – Josephson effect.
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UNIT-VIII- NUCLEAR AND PARTICLE PHYSICS

1	TEST – 22	<ul style="list-style-type: none"> ❖ Nuclear properties (size, shape, charge distribution, spin and parity) ❖ Binding energy, Nuclear force – Liquid drop model – semi – empirical mass formula, ❖ Shell model and Collective model –
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2	TEST – 23	<ul style="list-style-type: none"> ❖ Deuteron, Ground state of deuteron – excited state of deuteron – ❖ Meson theory of nuclear force – Yukawa potentials – ❖ Elementary ideas of alpha, beta and gamma decays – Radioactive decay – ❖ Fission, Fusion – Chain reaction – Nuclear reactor.
3	TEST – 24	<ul style="list-style-type: none"> ❖ Elementary particles: Classification of elementary particles, ❖ Fundamental interactions (EM, Strong, Weak, Gravitational) and their quantum numbers (charge, spin, parity, isospin, strangeness, etc.) –Gell-MannNishijima formula.
4	TEST – 25	<ul style="list-style-type: none"> ❖ Elementary particles – Classifications – Quark model, Baryons and Mesons, Parity non-conservation in weak interaction.

UNIT IX– ELECTRONICS

1	TEST – 26	<ul style="list-style-type: none"> ❖ Semiconducting devices: Diodes – Junction diode – Rectification – Zener diode – Light Emitting Diode. ❖ Junction Transistors: common base, common emitter and common collector configurations – Static characteristics – Transistors as amplifier and oscillators – FET, JFET, MOSFET.
2	TEST – 27	<ul style="list-style-type: none"> ❖ IC: Fabrication technology, Monolithic IC Processing. ❖ 555 Timer, Phase shift, Wien bridge oscillators. ❖ Operational Amplifier (IC 741): Op-Amp characteristics, Inverting and Non-inverting Amplifiers, Adder, Subtractor, Differentiator and Integrator.
3	TEST – 28	<ul style="list-style-type: none"> ❖ Digital techniques and applications: Flip Flops, Registers – Counters. ❖ Digital integrated circuits: Logic gates, NAND and NOR – Universal building blocks – Half and Full adder. ❖ Communication Electronics: Modulation and Demodulation (AM, FM, Phase), Transmitter and Receiver, Satellite and Fiber optic communication

UNIT-X– EXPERIMENTAL PHYSICS

1	TEST –	<ul style="list-style-type: none"> ❖ Units and dimension of physical quantities – significant figures.
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	29	<ul style="list-style-type: none"> ❖ Data interpretation and analysis, precision and accuracy, error analysis, propagation of errors, Least square fitting. ❖ Measurement of fundamental constants – e, h, c – Detection of X-rays, gamma rays, Charged particles, neutrons.
2	TEST – 30	<ul style="list-style-type: none"> ❖ Ionization chamber – proportional counter – Measurement of e/m ratio – Measurement of Hall voltage, mobility and charge carrier concentration – ❖ measurement of resistance and capacitance in series and parallel
TOTAL SLAP TESTS: 30		
1.	(TEST – 31) to (TEST-40)	TOTAL UNIT MODEL EXAMS: 10
2.	(TEST – 41) to (TEST-43)	FIRST FIVE UNITS– 3 TIMES
3.	(TEST – 44) to (TEST-46)	SECOND FIVE UNITS– 3 TIMES
4.	(TEST – 47) to (TEST-50)	FULL LENGTH TEST– 4 TIMES
5	(TEST – 51) to (TEST-66)	TAMIL ELEGIBILITY TEST
		9th BOOK – 4 TEST
		10th BOOK – 4 TEST
		11th BOOK – 4 TEST
	12th BOOK – 4 TEST	
6	(TEST – 67) to (TEST-86)	PSYCHOLOGY TEST-20 TEST
TOTAL EXAMS– 86		

