VBS Purvanchal University, Jaunpur

Syllabus
B.Sc. (Three Year Degree Course)
Physics

Physics- First Year			
Sl. No.	Paper	Paper Name	Maximum Marks
1	I	Mechanics.	50
2	II	Waves and Oscillations.	50
3	III	Electricity and Semiconductor Electronics	50
4	----	Practical	50
		Total Marks	200

Physics- Second Year			
Sl. No.	Paper	Paper Name	Maximum Marks
1	I	Thermal Physics.	50
2	II	Optics.	50
3	III	Atomic Physics	50
4	----	Practical	50
		Total Marks	200

Physics- Third Year			
Sl. No.	Paper	Paper Name	Maximum Marks
1	I	Quantum Mechanics.	50
2	II	Statical Mechanics and Solid State Physics	50
3	III	Basic Digital Electronics and Photonic Devices	50
4	IV	Electromagnetic Theory, Laser, Holography	50
5	----	Practical	100
		Total Marks	300

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Syllabus
Physics
B. Sc. – First Year
Paper-I: Mechanics.

Maximum Marks: 50

Unit-I: Vector:

Reciprocal System of vectors, Vectors differentiation: Gradients, Divergence and curl; gauss, Stoke's & Green's Theorems and their applications, Vectors Identities.

Unit-II: Moment of Inertia:

Physical significance, radius of gyration, Theorems of parallel and perpendicular axis, moment of inertia of rod, ring, disc rectangular and cylindrical rods, hollow and solid cylinders and spheres, spherical shell, motion on inclined plane, compound pendulum.

Unit-III: Motion Under a central Force:

Two particle problem reduced mass, lab and Centre of mass co-ordinate systems, motion in an inverse squire field, Kepler's law, Motion of satellite, Geostationary Satellite Mechanics of Non-rigid Bodies

Strain and stress in an isotropic homogeneous medium, Elastic moduli and relations between them, Torsion of cylinders, Bending of beams, Internal energy of a strained body.

Unit-IV: Fluid Mechanics:

Ideal Fluids, Equation of continuity, Streamline flow, Rotational and irrotational flows, Eluer's equation of motion. Viscous fluids, Poiscuile's equation, Viscosity cylinder method Stoker's law Variation of viscosity with temp.

Special Theory Relativity:

Inference of Michelson Morley experiments, Postulates of special theory of relativity, Lorentz transformations, Length contraction. Time dilation, Simultaneity in relativity theory.

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Paper-II: Waves and Oscillations

Unit-I:

Simple Harmonic motion of Mechanical & system. Lissajous figures. Energy in HSM. Damped Harmonic motion in mechanical & Electrical system.

Unit-II:

Oscillations of system with two or more degree of freedom, Normal modes, Vibration of string and rectangular membrane. Forced oscillation of Mechanical and electrical systems, Resonance, sharpness of resonance. Mechanical & Electrical impedances. Elementary theory of filters.

Unit-III: Waves

Stationary Waves Phenomenon of beats and modulation Wave velocity and group velocity Waves in absorptive and dispersive media.

Fourier analysis:

Analysis of squire Wave, saw tooth Wave and rectified sinusoidal Wave. Electromagnetic waves: Maxwell's Equation, pointing vector, E.M. Waves and its propagation in free space.

Unit-IV: Acoustics of building

Acoustic condition for a good hall reverberation time and Sabine formula. Ultrasonics: Production, Properties and application.

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Paper-III: Electricity and Semiconductor Electronics:

Unit-I: Electrostatics

Electric field due to a dipole, polar and nonpolar dielectric materials. Polarization and displacement. Vector, Electric field in Dielectric (Lorentiz field), electronic, atomic, ionic and Orientation polarization, Relation between dielectric constant and polarizability.

AC Bridges: Balance and sensitivity conditions For AC Bridges. Andersons, Wien's and Robinson's Bridges.

Unit-II: Electrical Circuit

Circuit parameter, Kirchoff's law for a loop and junction, T and π network, Network's theorem, "Norton's theorem, Thevenin's theorem and Maximum power transfer theorem".

Magnetism:

Magnetic field due to straight wire. Variation of Magnetic field on the axis of a circular loop current, helmoholtz Galvanometer, Field on the axis of solenoid and Toroid.

Until-III Power Supply:

Rectifier Filtering by RC and LC Circuit, Regulation: Voltage regulations by using zenor diode.

Basic Semiconductor Electronics:

Conduction in Solid: Conductor, insulator, Semiconductor, intrinsic and extrinsic semiconductor, Conductivity and Mobility.

Unit IV: PN Junction:

Diode Characteristics, Depletion region, Break down voltage. Forward and Revers Biasing, Zenor diode: its Characteristics.

Transistor:

NPN and PNP transistor action, its configuration, Hybrid parameter and equivalent circuit RC coupled Amplifier.

Oscillator:

Principle of feed back, Barkhausen criteria for sustained oscillation, Circuit of Hartley and colpits Oscillator.

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B. Sc. – Second Year

Paper-I: Thermal Physics

Maximum Marks: 50

Theory

Unit-1: Thermodynamics:

Thermodynamics Systems, Macroscopic and Microscopic Variables, Thermodynamical Equilibrium, Thermodynamical state, Zeroth law of thermodynamics and concept of Temperature. Heat and work and their path-dependence, Thermal processes, First law of Thermodynamics and internal energy, Joule's law, applications of first law.

Unit-II: Carnot cycle

Carnot Engine and Refrigerator, Reversible and irreversible processes, Carnot's Theorem, Thernodynamical scale of temperature. Clausius-Clapeyron's equation, specific head of saturated vapor, Clasius theorem, Clausius inequality, entropy, Calculation of entropy in various processes, Entropy and unavailable energy, Physical significance of entropy, second Law of thermodynamics.

Conditions for natural changes, Thermodynamic potentials and Maxwell's equation, Applications of Maxwell's equations, Joule-Thomson effect, Inversion Temperature.

Change of phase, First and second order phase transitions and Ehrenfest's equations.

Unit-III- Kinetic Theory of Gases:

Maxwell-Boltzmann Law of distribution of molecular velocities, Evaluation of R.M.S. Velocity and average and most probable speeds, Mead free path, transport phenomenon.

Conduction of Heat: Fourier equation for one-Dimensional flow of head and its steady-state solution, periodic flow of head (only sinusoidal heat current)

Unit-IV: Radiation:

Radiation as electromagnetic Waves, Emissive and absorptive powers, Radiation in a hollow enclosure, Black-body radiation, Kirchoff's Law Intensity and energy density, Pressure and energy density, Stefan-Boltzmann Law, Solar constant and temperature of sun, Temperature of Non-black Bodies, Distribution of energy in the spectrum of black body radiation, Adiabatic expansion of black-body radiation, Law, Wein's displacement law, Wein's formula, Rayleigh-jean's law, Planck's law.

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Paper-II: Optics

Maximum Marks: 50

Theory

Unit-I

Cardinal Points of coaxial optical systems. Simple problems on combination of thin lenses, Eyepieces, Aplantic points. Chromatic aberration.

Unit-II

Conditions for observing interference, Degree of coherence and disability of fringes, Production of interference fringes and determination of wave length, Michelson interferometer and its uses, Colour of thin films, Newton's Rings. Theory of Multiple Reflections, EP. Etalon.

Temporal and Spatial Coherence. Stimulated emission, Basic ideas about laser emission, Ruby and He-Ne lesser as examples.

Unit-III

Fresnel's theory of diffraction, Half-period elements. Diffraction from circular obstacle and aperture (Elementary theory), Zone Plate, Comu's Spiral, Fresnel diffraction by straight edge and single slit.

Fraunhofer's diffraction by single slit and double slit. Theory of plane grating, Width of principal maxima. Rayleigh's criterion of resolution for telescope and grating Concave fretting (Elementary theory), and its mountings.

Unit-IV

Unpolarised, polarized and partially polarized lights. Polarization by reflection and regration Double refraction by uni-axial crystals, Polaroids, Huygens's theory of double refraction. Half and quarter wave plates. Production of elliptically and circularity polarized light.

Bobbinet compensator, Analysis of elliptically polarized light by using a Nicol and quarter wave plate and by using Bobbinet compensator. Optical activity. Fresnel's theory of optical rotation. Specific rotation, Biquartz and Laurent's half-shade polarimeters.

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Paper-III: Atomic and Nuclear Physics

Maximum Marks: 50

Theory

Unit-I-Bohr-Summerfield Model

Historical developments, Bohr model and the spectra of hydrogen atoms, Critical resonance and the lionization potentials. Frank-Hertz experiment. Characteristic and continuous S-rays, Moseley's law, Bragg's Law.

space Quantization, Vector atom model and quantum Numbers, Magnetic moment of electrons Larmor Precession, Electron Spin, Stem-Gerlach experiment, Pauli's exclusion principle and electronic configuration of atoms, Zeeman effect, Raman effect.

Unit-III: Quantum Concepts:

Particle nature of radiation, Photoelectric effect and Compton Effect. Wave nature off particles. De-Broglie Waves, Davission-Germer Experiment, Wave Packets, Phase velocity and group velocity, Heisenberg's Uncertainty Principle and applications, One dimensional Schrödinger's Wave Equation and concept of probabilistic, amplitude.

Unit-III- Nuclear Physics

Natural radioactivity, Law of radioactive disintegration, radioactive series, Detection of radiation, GM Counter and Bubble Chamber Scintillation Counter.
Kinematics of nuclear reactions, artificial nuclear transmutation, Discovery of neutron, radioactive tracers, transuranic elements.

Cyclotron.

Constitution of nucleus, Binding energy, Liquid drop model and the semiempirical mass formula, Elementary theory of α – decay, β -Decay and discover pf neutrino Magic numbers and the shell model.

Unit-IV

Classification of Elementary Particles, Leptons, mesons and baryons and their quantum numbers, conservation Laws.

Relativity: _ Relativistic addition of velocities; variation of mass with velocity, Mass energy relation.

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Physics
B. Sc. – Third Year

Paper-I:
Quantum Mechanics

Maximum Marks: 50

Theory

Unit-I

Need of Quantum Mechanics, Schrödinger Equation and interpretation of wave function. Applications of Schrödinger Equations.

Unit-II

Observable and Operators, Hermitian operator, Parity operator, Parity operator, Commutation relations. Eigen values and Eigen values and Eigen functions, orthonormality and completeness. Dirace Delta function.

Non-Commutability, Uncertainty, Expectation values, Ehrenfest's Theorem.

Unit-III

Separation of variables in Time-Dependent Schrödinger Equation. Density of state, one-dimensional Potential Barrier problems. Tunneling throught square well potential, One-dimensional Harmonic Oscillator, Hermite Polynomials, Zero-point energy, Correspondence with classical theory.

Unit-IV

Angular Momentum, Commutation Relations, Eigen Values and Eigen Functions of ladder ( ) operators.

Spherically symmetric potential, complete solution of the Hydrogen-Atom Problem, Hydrogen spectrum.

Elementary concept of spin, Pauli Matrices and spin Wave functions, Total angular momentum.

Time independent, non-degenerate, First-order Perturbation Theory, Spin-Orbit coupling.

Identical Particles, Symmetric and Antisymmetric wave functions. Pauli's Exclusion Principle.

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Paper-II:
Statistical Mechanics and Solid State Physics.

Maximum Marks: 50

Theory

Unit-I

Microscopic and Macroscopic systems, Phase space representation Division of phase space into cells, Liouvillle theorem and its consequences, Statistical ensembles, Equilibrium and fluctuations, Distribution probability, Equilibrium between two macroscopic systems in thermal diffusive and mechanical contacts, Postulates of quantum statistical mechanics, Entropy and probability, entropy of a perfect gas using the concepts of micro canonical ensemble.

Unit-II

Distribution function for two types of quantum statistics (Bose-Einstein and Fermi-Direct): Simple applications (Black-body radiations).

Unit-III: Solid State Physics

Crystalline amorphous and glassy state of solids, Lattices translation vector, Crystal lattices, Primitive lattice cell, Miller indices, interplaner spacing, Brivais lattices, Crystal structures of s.c.,b,c,c,f,c,c, diamond and h.c.p. Reciprocal lattices: s.c.,b.c.c, and f.c.c. lattices, Brillouin Diffraction conditions in reprocal lattice, Bragg's law.

Unit-IV: Free electron Theory

Free electron gasin one dimension: Energy levels and density of states, Fermi Energy, Electrical conductivity, Hass effect.

Band Theory of solids: Energy Bands; kroning-penny model in one dimension, Energy gap, Number of state in a branch, Distinction between metal, semi-conductor and insulator, Intrinsic semi-conductors, Variation of Fermi level with temperature. Effective mass.

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Paper-III:
Basic Digital Electronics and Photonic Devices

Maximum Marks: 50

Theory

Unit-I

Review of characteristics of a semi-conductor diode; cut in voltage, explanation of storage and transition capacitances.

BJ transistor as a switch, Analytic expression using Ebers-Moll Mode, saturation properties for normal, inverse and emitter follower mode and their comparisons. Switching speed of a diode, Storage and transition time, switching speed of BJT. Metal-semi-conductor junction, Schottky diode and transistor.

Unit-II

Field effect transistor, Principle of operation, a practical FET structure, MOSfet, enhancement and depletion modes, their representations, the MOS switch. Logic Circuits. AND, OR, NOT, NAND and Ex-OR operation, truth tables, their representations, Venn diagrams.

Unit-III

Binary notation Boolean algebra, Karnaugh mapping. The Resistance transistor logic, RTL nor gates, pull up resistors, fanout, I/O Characterstics, noise margin, rise time, RTL ex-or gate,

Unit-IV

The diode transistor gate, fan out, I/O Characterstics. The Transistor- transistor logic, comparision between TTL and DTL., The active pull up, I?O Charactersitcs.

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Paper-IV:
Electromagnetic theory, Laser, Holography

Maximum Marks: 50

Theory

Unit-I: Electromagnetic theory

Electrostatics potential due to a charge distribution, Multipoles and their interaction with electrostatics field. Solution of Laplace Equation by separation of variables in Cartesian Sperical and Polar Cooridnates.

Polynting's Theorem, Conservation of energy and momentum for a system of charged particles and electromagnetic fields, Maxwell,s stress tensor.

Unit-II

Plane wave solution of Maxwell's equations in source free space and simple dielectrics.

Polarization of electromagnetic waves, plane wave propagation in metal and plasma.

Elementary theory of dispersion.

Boundary condition at a discontinuity, Fresne's formula. Total internal reflection, Metallic reflection and skin depth.

Unit-III: Laser and Holography

Stimulated and spontaneous emission Einstein's coefficients, relative contribution of stimulated and spontaneous emission population inversion. Laser emission, Characteristics of Laser light (including temporal)

Unit-IV

Amplification on an inverted medium, threshold condition for lasing, Basic principles of Holography, Recording and Viewing of a hologram.

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List for Experiments of B.Sc. III

Electronics

1. Band gap and Bias Stabilization
2. DTL and TTl (switching and Fan Out)
3. RTL (switching and Fan Out)
4. FET characteristics and FET as an amplifier
5. Common Emitter Amplifier.
6. Verification of Richard Dushman Equation
7. Inter stage Audio Transformer.
8. High/Low pass passive pitter.

Optica Power Supply

9. Refractive index of material of Prism and of water by spectrometer.
10. Diffraction of light by Ultrasonic.
11. Plane Reflection Grating using laser.
12. Fraunhoffer diffraction at double silt using laser.
13. Calibration of constant deviation spectrometer.
14. Photocell and Planck Constant.
15. Cornu's Fringes and Elastics constants.
16. Youngs Modulus by Newton's Ring (Selarle's Apparatus)
17. Photodiode and Photo transistor
18. e/m of the clectron by kenotron/helical method.
19. Magnetic susceptibility by Quincke's Tuybe.

Special Recommendation

In View of the importance of applications of comuters in science, it is recommentded that in addition to the above experiments. Computers may also used in analysis of the experimental data and in projects.