TRIPURA UNIVERSITY

(A Central University)

Suryamaninagar

Syllabus

For

Three Year Degree Course

(Under 1+1+1 Examination System)

Part – I , Part – II, Part – III

(Elective)

COURSE STRUCTURE WITH DISTRIBUTION OF MARKS FOR B.Sc GENERAL EXAMINATION
TOTAL MARKS: 1350
DURATION: 3 YEARS

Part-I Examination (at the end of 1st year)	**Part-II Examination** (at the end of 2nd year)	**Part-III Examination** (at the end of 3rd year)
a) Elective Subjects: Three For each Elective Subject: Paper-I(Theoretical): 100 Marks b) Language Group Paper-I (Theoretical) : 100 Marks Group A(English) : 50 Marks Group B(Bengali/Hindi/ Kokbarak) : 30 Marks Group C (Indian Heritage & Culture) : 20 Marks	a) Elective subjects: Three 1st Elective Subject : Paper-II(Theoretical) : 100 Marks Paper-III(Practical) : 100 Marks 2nd Elective Subject : Paper-II(Theoretical) : 100 Marks Paper-III(Practical) : 100 Marks 3rd Elective Subject : Paper-II(Theoretical):100 Marks Paper-III(Theoretical/ Practical) : 100 Marks b) Language Group- Nil	a) Elective Subjects: Three 1st Elective Subject: Paper IVA(Theoretical): 70 Marks Paper IVB(Practical) : 30 Marks 2nd Elective Subject: Paper IVA(Theoretical): 70 Marks Paper IVB(Practical) : 30 Marks 3rd Elective Subject: Paper IV(Theoretical) :100 Marks b) Environmental studies: Paper-I: 50 Marks
Total Marks : 400	**: 600**	**:350**

B.Sc PHYSICS (ELECTIVE) PART-I SYLLABUS

PAPER-I (THEORY) : 100 MARKS

UNIT – I **MATHEMATICAL METHODS & MECHANICS**
UNIT – II **GENERAL PROPERTIES OF MATTER-I**
UNIT – III **GENERAL PROPERTIES OF MATTER-II**
UNIT – IV **HEAT AND THERMODYNAMICS**
UNIT – V **OPTICS**
UNIT – VI **ACOUSTICS**

Question Pattern

- One Compulsory question (Q.No.1) is to be set with Ten (short/ multiple choice/ both) questions of 1 mark each from six units, all are to be answered.

- Two questions of 15 marks each are to be set from each unit, out of which one question is to be answered. Each question of 15 marks may be divided into three or more parts having a maximum of 8 marks for a part.

UNIT-I : MATHEMATICAL METHODS & MECHANICS

Vectors : Scalar and vector products, Product of three vectors, Gradient, Divergence and Curl & their meanings; Differentiation of vectors, line integral, surface and volume integral of vectors; Gauss' divergence theorem, stoke's theorem.

Rotational Motion : Rotational motion under constant angular acceleration, K.E of rotating body, rigid body as a system of particles, idea of center of mass and its motion, moment of inertia, radius of gyration; theorems of M.I (2D), Calculation of M.I(uniform rod, uniform lamina, cylinder, sphere), motion of sphere along an inclined plane.

Plane curvilinear motion : Velocity and acceleration in Cartesian and plane polar coordinates system.

Mechanics : Generalized coordinates , degrees of freedom, application of generalized coordinates in simple harmonic oscillator, simple pendulum, projectiles, cyclic coordinates, Lagrange's & Hamilton's equations(deduction not necessary) and their applications to simple cases.

UNIT-II : GENERAL PROPERTIES OF MATTER-I

Gravitation : Gravitational potential and intensity for shells, hollow and solid sphere; keter's pendulum with Bessel's correction.
Elasticity : Elastic constants, elastic moduli and their inter relations; bending moment, cantilever, depression at the free end, depression of beam supported at two ends and loaded at the middle; torsion of cylinder, torsional oscillations, strain energy.

UNIT-III : GENERAL PROPERTIES OF MATTER-II

Surface tension : Surface tension and surface energy, molecular theory, angle of contact, factors affecting surface tension, capillarity, excess pressure inside a spherical bubble and liquid drop, excess pressure across a curved film with special cases, explanation of elevation and depression of liquid in a capillary tube with calculation of rise, jurin's law.
Fluid Dynamics : Streamline and turbulent motion, equation of continuity, Bernoulli's theorem(simple derivation), application, venturimeter, pitot tube, Torichelli's theorem.
Viscosity : Newtonian and non-Newtonian fluids, Viscosity and Newton's law, Critical velocity and Renold's number, effect of temperature on viscosity, Poiseuille's equation for the flow of an incompressible fluid, terminal velocity, statement of Stoke's law, calculation of coefficient of viscosity of a liquid by Stoke's law(experiment not necessary)

UNIT-IV : HEAT AND THERMODYNAMICS

Degrees of freedom, statement of equi-partition of energy, R.M.S velocity, mean free path (simple deduction), failure of classical theory of sp. Heat. Result of Andrew's and Amagat's experiments, simple derivation of Vander Wall's equation, its merit and demerits, evaluation of the critical constants, expression for Boyle temperature, law of corresponding state. Thermal conductivity and diffusivity, Fourier equation(1D), radial flow of heat, First law of thermodynamics, Isothermal and adiabatic changes, adiabatic relations, work done in isothermal and adiabatic changes, indicator diagram, reversible, irreversible and cyclic process, second law of thermodynamics, Carnot's cycle, Carnot's theorem, Thermodynamic scale of temperature, Entropy-it's property and significance, change of entropy in reversible and irreversible changes. Porus Plug experiment, Joule-Thomson cooling, inversion temperature.

UNIT-V : OPTICS

Geometrical : Fermat's principle, reflection and refraction at plane surface by Fermat's principle, dispersion and dispersive power in case of prism, refraction at spherical surface, thin lenses and their combination, cardinal points, equivalent lens, chromatic and spherical aberration, qualitative and quantitative study of their remedies with reference to the construction of Ramsden and Huygens eyepiece.

Physical : Wave nature of light, Huygen's principle, explanation of reflection, refraction and rectilinear propagation of light on the basis of wave theory. **Interference :** Young's experiment, Fresnel's bi-prism, Newton's ring. **Diffraction (Frenel's class) :** Half period zone, explanations of rectilinear propagation of light, principle of zone plate, and its behavior as convergent lens. **Diffraction(Fraunhoffer class):** diffraction pattern of single slit and double slit, spectrum formed by a plane transmission grating.

UNIT-VI : ACOUSTICS

S.H.M : Differential equation of S.H.M and its solution, composition of S.H.M (analytical), Lissajous figures, Free, damped & forced vibration, resonance and sharpness of resonance.

Differential equation of waves and its solution, pressure distribution of longitudinal waves in a gas, energy of sound waves, interference, stationary waves, beats, Transverse waves in a string, stationary waves in a string, characteristics of plucked & struck string (qualitative). Doppler's effect in sound, velocity of sound waves, longitudinal waves in solid and gas, velocity of sound wave in air with correction, intensity of sound, decibel. Reverberation of sound, Sabine law, time of reverberation, live and dead rooms.

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PHYSICS : ELECTIVE

PART – II

PAPER – II (THEOTY) : 100

PAPER – III (PRACTICAL) : 100

B.Sc PHYSICS (ELECTIVE) PART-II SYLLABUS

(According to 1+1+1 system implemented in 2008)

PAPER-II (THEORY) : 100 MARKS

UNIT – I **ELECTROSTATIC**
UNIT – II **MEGNETOSTATICS**
UNIT – III **CURRENT ELECTRICITY-I**
UNIT – IV **CURRENT ELECTRICITY-II**
UNIT – V **ATOMIC PHYSICS**
UNIT – VI **ELECTRONICS**

Question Pattern

- One Compulsory question (Q.No.1) is to be set with Ten (short/ multiple choice/ both) questions of 1 mark each from six units, all are to be answered.

- Two questions of 15 marks each are to be set from each unit, out of which one question is to be answered. Each question of 15 marks may be divided into three or more parts having a maximum of 8 marks for a part.

UNIT-I : ELECTROSTATIC

Electrostatics: Electrostatics field and potentials, Gauss theorem of normal induction and its applications, intensity due to charged spherical and cylindrical bodies. Coulomb's theorem, mechanical force on a charged surface, energy per unit volume in an electrostatic field.
Dielectric medium, polarization, dipole and dipole moment, (simple and composite dielectric). Capacity of parallel plate and cylindrical condenser, capacity of spherical condenser(two concentric sphere). Energy of a charged conductor, loss of energy due to sharing of charging between two conductors.

UNIT-II : MEGNETOSTATICS

Biot-Savart's law, Ampere's circuital law, calculation of magnetic field due to straight current carrying conductor, circular current carrying conductor, due to solenoid.
Magnetic field due to small current carrying loop- concept of magnetic dipole moment; Lorentz force; force on current carrying conductor placed in magnetic field, force between two long parallel current carrying conduction. Magnetic and intensity at any point due to a short magnet magnetic shell. Effect of

magnet on magnet: Gauss's Tangent-A and Tangent-B positions. Deflection and vibration magnetometer, determination of Earth's horizontal field and moment of a magnet.
Permeability, intensity of magnetization susceptibility and their relations. Cycle of magnetization, Hysteresis, calculation of hysteresis loss of energy and its importance for electromagnet and permanent magnets.

UNIT-III : CURRENT ELECTRICITY-I

D.C. circuits, Kirchoff's laws, Wheatstone bridge principle by Kirchoff's laws, problems on current in complicated circuits.
Meter bridge, Carey Foster's bridge: Working principle and their applications, concept of end corrections in case of meter bridge.
Working principle of Potentiometer and its applications, inadequacy of Wheatstone bridge.
Thermoelectricity: Seebeck, Peltier and Thomson's effect, Peltier and Thomson's coefficient, laws of thermoelectricity, total e.m.f. developed in a thermocouple, thermoelectric curve and concept of neutral temperature and temperature of invention, thermoelectric diagram and its applications, calculation of Peltier and Thomson coefficient from thermodynamic considerations.
Moving magnet type galvanometers: Tangent galvanometer and its application.
Moving coil galvanometers: working principle and its application in determining the galvanometer constant, figure of merit and current sensitivity.
Theory of ballistic galvanometer (damping correction is not required).

UNIT-IV: CURRENT ELECTRICITY-II

Electromagnetic induction: self and mutual inductance due to a circular coil and solenoid, mutual inductance between two circular coils and between two coaxial solenoid.
Growth and decay of current in LR circuit, charging and discharging in CR circuit, time constant.
Mean and r.m.s. value of ac current and e.m.f., current in L-R, C-R and L-C-R circuit by operator method. Series and parallel resonant circuit, vector impedance diagram and its applications in analyzing different AC circuits, Q-factor, LC oscillation (qualitative idea only) power factor, power in a AC circuit, wattles current choke coil and by-pass condenser, skin effect, principle of an ideal transformer, transformer losses.

UNIT-V: ATOMIC PHYSICS

Measurement of e/m of electron by Thomson's method, Measurement of change of an electron by Millikan's oil drop experiment, positive rays. Parabola method, Isotopes. Atomic weight, atomic number, atomic mass unit, mass energy equivalence.
Bohr-Rutherford atom model, Bohr's theory of hydrogen spectra, quantum numbers, statement of Pauli exclusion principle.

X-rays production and properties, continuous and characteristic spectra, Mosley's law and its explanation from Bohr's theory.
Bragg's law and explanation.
Compton effect and calculation of Compton shift.
Photo electricity: definition, features, explanation and uses.
Vector atom model, space quantization ,atomic magnetism, normal Zeeman effects.

UNIT –VI : ELECTRONICS

PN junction diode and its use as a half wave and full wave bridge rectifier. Calculation of average current and voltage, r.m.s. current and voltage, ripple factor and efficiency of half wave and full wave rectifier, removal of ripples : T and π filters.
Zener break down, zener voltage, zener diode and its use as a voltage regulator.
Junction transistor: structure, types and operations, CB, CE & CC configurations, their comparison.
Transistor characteristics in CE mode, load line analysis, Q-point, Working of CE transistor amplifier.
Field effect transistor (FET) and its differences from bipolar transistor, n and p channel FET, FET operations, static and dynamic characteristics, FET parameters and their relation, use of FET as a voltage amplifier.
Operational amplifier (ideal), concept of virtual ground, basic equation of an ideal OP-AMP, use of OP-AMP as inverter, phase shifter, adder, differentiator and integrator.
Network theorem: Thevenin, Norton, Superposition and Maximum power transfer theorem and their simple applications.

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PHYSICS

TDC (ELECTIVE) SYLLABUS FOR PART – II

(According to 1+1+1 system implemented in 2008)

PAPER – III

(PRACTICAL)

MARKS-100

GROUP-A: (Marks : 50)

Experiment No.	Name of the Experiments.
1	Determination of Young's modulus of the material of a beam by the method of flexure (single length only).
2	Determination of modulus of rigidity by statical method or dynamical method.
3	Determination of moment of inertia of a body about an axis passing through its centre of gravity.
4	To determine frequency of tuning fork by Melde's Experiment.
5	To determine the refractive index of the given liquid with the help of traveling microscope.
6	To determine the refractive index of the given liquid with the help of a plane mirror and a convex lens (radius of curvature is to be determined with the help of spherometer
7	To determine the focal length of a concave lens by combination of concave and convex lens using an optical bench.
8	Determination of 'g' by Kater's pendulum.
9	Viscosity of water by Poiseuillie's method (diameter of the tube to be measured by microscope).

GROUP – B : (MARKS : 50)

Experiment No.	Name of the Experiments.
1	Determination of H and M by deflection magnetometer and vibration magnetometer.
2	Determination of the end-correction of a meter-bridge wire and to find the specific resistance of the material of the given wire.
3	Determination of resistance per unit length of the meter bridge wire by Carey Foster's method and determination of unknown resistance.
4	Comparison of the value of two resistance by the fall of potential method with the help of Carey Forster's bridge.
5	Determination of the reduction factor of a tangent galvanometer with the help of copper voltameter and hence find the value of H.
6	To determine temperature coefficients of resistance of material of a given wire by meter bridge.
7	To determine the resistance of a suspended coil galvanometer by half-deflection method and hence to find its *Figure of merit*
8	To determine the current flow in a circuit by using a potentiometer (R supplied)
9	To determine the refractive index of material of prism by using spectrometer.

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PHYSICS : ELECTIVE

PART – III

PAPER – IV A (THEOTY) : 70

PAPER – IV B (PRACTICAL) : 30

PHYSICS

TDC (ELECTIVE) SYLLABUS FOR PART-III

(According to 1+1+1 system implemented in 2008)

PAPER – IV (A)

MARKS – 70

UNIT – I : RELATIVITY

UNIT – II : NUCLEAR PHYSICS

UNIT – III : ELECTROMAGNETIC THEORY

UNIT – IV : COMPUTER SCIENCE , PROGRAMING & DIGITAL ELECTRONICS

UNIT – V : QUANTUM PHYSICS – I

UNIT – VI : QUANTUM PHYSICS – II

Question Pattern

- One Compulsory question (Q.No.1) is to be set with Ten (short/ multiple choice/ both) questions of 1 mark each from six units, all are to be answered.
- Two questions of 10 marks each are to be set from each unit, out of which one question is to be answered. Each question of 10 marks may be divided into three or more parts.

UNIT – I : RELATIVITY

Galilean invariance , inertial and non – inertial frames , pseudo force , apparent weight in accelerated frame . Concept of space , time and mass according to Newtonian Mechanics . Michelson–Morley experiment – its difficulties . Postulates of special theory of relativity , simple derivation of Lorentz transformation formula , length contraction , time dilation , addition of velocities (velocity along the same line) , variation of mass with velocity (deduction on the basis of head-on-collision) , equivalence of mass and energy .

UNIT – II : NUCLEAR PHYSICS

Radio activity : Decay laws , mean life , half life , successive disintegration , secular and transient equilibrium , application of radioactivity in determining the age of a sample .

Properties of nuclei : Nuclear mass , charge , size , packing fraction , atomic mass unit , isobars , isotopes , isotones , binding energy , binding energy curve and its significance .

Nuclear reaction : Nuclear reaction , conservation principles in nuclear reactions , Q – value and thresholds , exoergic and endoergic reactions , artificial radioactivity .

Nuclear fission and fusion : Nuclear fission , general characteristics , simple explanation by liquid drop model , energy released in nuclear fission , nuclear chain reaction and basic mechanism of energy generation in stars .

α-rays , Rutherford α-scattering experiment and formula (deduction not necessary) and its significance , range of alpha particles , Geiger Nuttal rule .

β-rays , different types of β-ray spectrum and their natures , neutrino hypothesis (qualitative idea only) , internal conversion .

γ-rays , qualitative discussion on γ-ray absorption in matter , photoelectric process , Compton scattering and pair production , electron-positron annihilation (qualitative) .

Cosmic ray , primary and secondary cosmic ray , muons , Van Allen belt .

UNIT – III : ELECTROMAGNETIC THEORY

Maxwell's electromagnetic equations , propagation of plane electromagnetic waves in free space , transverse character of an electromagnetic wave and polarization , Poynting vector , energy density in electromagnetic field , Hertz's experiment .

Qualitative idea of co-axial cable , optical fibre (numerical aperture and time dispersion) . Step index fibre , graded index fibre , different losses in fibre , advantage of optical fibre over the communicating media .

Temporal and spatial coherence , Einstein's A & B coefficient , LASER as monochromatic source of light , spontaneous and stimulated emission , population inversion , optical pumping , Ruby LASER , elementary idea of holography .

UNIT – IV : COMPUTER SCIENCE , PROGRAMING & DIGITAL ELECTRONICS

Essential parts of an electronic computer , CPU , INPUT , OUTPUT Devices , RAM , ROM , CD-ROM. Familiarity with different operating systems in common use , Machine language , Assembly language (idea only) , Characteristics & field of applications of high level languages such as BASIC , FORTRAN , C & C^{++} . Algorithm and flow chart for solving simple problems . Simple MS-DOS Commands , Development of simple programs in BASIC language using commands listed – AUTO , CLOSE , CLS , DATA-READ , DAE , DEFFN , DELETE , DIM, END , FILES , FOR-NEXT , GOSUB-RETURN , GOTO , IF-THEN , IF-THEN-ELSE , INPUT , KILL , LET , LINE , LIST , LOAD , LPRINT , NEW , PRINT , REM , RUN , SAVE , SCREEN , STOP , SYSTEM .

Binary system , binary numbers , binary to decimal and decimal to binary conversion , AND , OR , NOT , NAND , NOR , XOR , XNOR gates , circuits with discrete components . De Morgan's theorem and applications , Half adder & Full adder , RS flip-flop and D flip-flop .

UNIT – V : QUANTUM PHYSICS – I

Nature of radiant heat . Kirchoff's law – simple deduction , Black body radiation , black body in practice , application of Kirchoff's law , Black body radiation and discussion of the failure of classical theory with special mentioning of Wien's law and Rayleigh-Jean's formula , Plank's hypothesis and plank's energy distribution law in black body radiation . Dual character of radiation , de Broglie hypothesis of matter wave , de Broglie wavelength , Davisson - Germer's experiment and G P Thomson's experiment .

Heisenberg's uncertainty principle , and the time-energy uncertainty principle , experimental illustrations , experiment with microscope and diffraction by a single slit , complementary principle .

UNIT – VI : QUANTUM PHYSICS – II

Schrödinger's time independent equation from the classical differential equation of wave (one dimensional) , operator , eigen function and eigen values , representation of position , momentum and energy by quantum mechanical operator , Hermitian operators and their properties ; solution of time-dependent Schrödinger's equation using idea of separation of variables , the time independent Schrödinger's equation , Born's interpretations of wave function , required properties of wave function .

Free particle in one dimensional box and box normalization , energy level diagram , explanation of continuous energy ocean as a limiting case of discontinuous energy eigen values , zero point energy .

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PHYSICS

TDC (ELECTIVE) SYLLABUS FOR PART-III

(According to 1+1+1 system implemented in 2008)

PAPER – IV (B)

MARKS – 30

Group A : (Marks 15)

Experiment No. **Name of the experiments**

1. To draw the characteristic curves of PN-junction diode for both forward and reverse bias and hence to determine the AC and DC resistance of the diode .
2. To draw static characteristic curves (only mutual characteristics) of a triode and to find μ , r_p , g_m .
3. Study of the characteristic response curve of a photo diode cell (or determination of Plank's constant) .
4. Zener diode reverse characteristics , reverse impedance and break down voltage .
5. Input characteristics of common emitter (CE) transistor .
6. Output characteristics of common emitter (CE) transistor .
7. Drawing characteristics of FET & to determine FET parameters .
8. To construct 2-input OR & AND gates using diodes and to verify the truth table .

Group B : (Marks 10)

Computer programming in BASIC using commands as mentioned in the syllabus .

Group C : (Marks 05)

Independent project work .

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