TRIPURA UNIVERSITY

(A Central University)
Suryamaninagar

SYLLABUS

OF

Physics
(General & Major)

Semester-I

Year 2014

THREE-YEAR-DEGREE COURSE

PHYSICS (MAJOR)

First Semester:

Total Marks 100

Paper Name : H1 (Theory = 100)

Theory = 100, Practical = 00

(80 + 20 internal)

Four units : each unit has (20 + 5 marks internal)

First Semester:

Paper = H1

UNIT-I

MATHEMATICAL METHODS IN PHYSICS – I : (20 + 5 internal)

Scalar and vector fields, Differentiation of vectors, Gradient, Divergence and Curl - their physical meaning and applications. Vector integrations - Line, Surface and Volume integrations, Gauss Divergence theorem, Stoke's theorem, Green's theorem and their applications to simple problems.

Orthogonal curvilinear coordinate systems, unit vectors in such systems, gradient, divergence, curl and Laplacian in orthogonal curvilinear coordinates, illustration by spherical polar and cylindrical polar coordinate systems as special case.

Matrices: Hermitian matrices, Eigen value and eigen vectors of matrix, Cayley-Hamilton theorem, diagonalization of a matrix.

Beta and Gamma functions, their properties, interrelationship, their applications to simple problems.

Fourier series: Statement of Dirichlet's condition, Fourier series for the expansion of some simple functions. Analysis of different simple waveforms with Fourier series.

UNIT-II

MECHANICS – I: (20 + 5 internal)

Mechanics of a particle: Equation of motion of a particle under time dependent force, velocity dependent force (resistive force) and their applications.

Moment of inertia, Radius of gyration, parallel and perpendicular axes theorems, calculation of moments of inertia for sphere, cylinder, cone, ellipsoid, motion of a sphere and cylinder along an inclined plane.

Frames of reference, inertial and non-inertial reference frame, Rotating frames of references, transformations of operators, Corioli's and centrifugal force in a rotating frame of reference, explanation of some physical phenomena from the point of view of Corioli's force.

Plane .curvilinear motion: velocity and acceleration of particle in plane polar coordinate system (radial and transverse components of velocity and acceleration), tangential and normal components of velocity and acceleration.

Central force, conservative force and related theorems, central orbit, differential equation of motion of a particle moving under central force in plane polar coordinate system, nature of orbits in an inverse square attractive force field, areal velocity, Kepler's laws of planetary motion and their applications, proofs of Kepler's laws considering the inverse square law.

UNIT-III

GENERAL PROPERTIES OF MATTER:

(GRAVITATION, ELASTICITY, SURFACE TENSION AND VISCOSITY): (20 + 5 internal)

Gauss's theorem in gravitation and its application to spherical and cylindrical cases. Poisson's and Laplaces equations (derivation using divergence theorem).

Elastic moduli and their interrelations, bending moment, depression at the free end of a light cantilever, depressions of a beam supported at the two ends and loaded at the middle, bending of beam due to its own weight (fixed at one end & supported at the two ends), torsion of a cylinder, torsional oscillations, strain energy in all cases.

Fluid dynamics: Derivation of equation of continuity in differential form, rigorous derivation of Bernoulli's theorem, Applications of Bernoulli's theorem to venturimeter, pitot tube, Torricelli's theorem.

Motion of viscous fluid: Poiseuille's equation for the flow of an incompressible fluid with necessary corrections. Poiseuille's equation for the flow of a compressible fluid, Statement of Stoke's law, equation of motion of a body through viscous medium under gravity and it's solution, terminal velocity.

Surface tension: Calculation of excess pressure across a curved film with special cases. Determination of surface tension using Sessile drop, Surface wave in a liquid.

UNIT-IV

VIBRATION AND WAVES: (20 + 5 internal)

Simple Harmonic Motion (SHM): Differential equation of SHM and its solution (rigorous method). Compositions of SHM. Lissajou's figure, damped and forced vibrations, their differential equations and solutions, resonance and sharpness of resonance.

Differential equation of longitudinal plane progressive wave and its solution in one dimension, energy of waves, pressure distribution in longitudinal waves, dispersion in wave propagation, phase velocity and group velocity on the basis of consideration of superposition of two waves.

Differential equation for transverse wave in stretched string, Theories of plucked, struck and bowed string, basic principle underlying the production of combination tone.

Acoustics of building: Growth of sound intensity, reverberation time and Sabine's law. Chracteristics of a good Auditorium.

PHYSICS (GENERAL)
TRIPURA UNIVERSITY
Paper C-1
Full Marks - 100
Total Lecture 60
(Each lecture period = 1 hour)

Each unit

Unit – I: Vectors, Mechanics

15 lectures

Vectors: Differentiation of vectors, Gradient , Divergence and Curl-their meanings and applications. Vector integrations-Line, Surface and Volume integrations, Gauss's divergence theorem, Green's theorem and Stoke's theorem (Only their statements), their applications to simple problems.

Moment of inertia. Radius of gravitation, Parallel and perpendicular axes theorems (in two dimension), calculation of moments of inertia for uniform rod, uniform lamina, sphere, cylinder.

Velocity and acceleration in Cartesian and plane polar co-ordinate systems.

Degrees of freedom, Generalised co-ordinates, Lagranges and Hamilton's equations (only their statements), applications in simple pendulum, simple harmonic oscillator, and projectile, Cyclic corordinate and its importance.

Unit - II: Gravitation and elasticity and Fluid

15 lectures

Gravitational potential and intensity for spherical shell. Hollow and solid sphere, Kater's pendulum with Bessel's correction.

Elastic constants, modulli and heir interrelations, bending moment, depression at the free end of a light cantilever, depressions of a beam supported at the two ends and loaded at the middle, torsion of a cylinder and torsional constant, torsional escillations, strain energy of torsion.

Surface tension surface energy molecular theory of surface tension, Explanation of elevation and depression of a liquid in a capillary tube with calculation of rise. Jurin's law.

Viscosity and Newton's law, Poiseuille's equation for the flow of an incompressible fluid (Correction only qualitative), Statement of stoke's law terminal velocity.

Unit - III: THERMODYNAMICS AND RADIATION

15 lectures

Andrew's and Amagat,s experiment, Van der waal's equartion(Simple derivation), merits and demerits of van der waal's equation, critical constants, expression for Boyle temperature,.

Second law of thermodynamies. reversible and irreversible changes, Carnot's cycle and its efficiency. Carnot's theorem, thermodynamic scale of temperature..

its properties and physical significance, change of entropy in reversible and irreversible changes,

Porus plug experiment Joule-Thomson effect and inversion temperature.

Kirchoff's law and its simple derivation, pressure and energy density of diffused radiation(Expressions only).

Unit IV optics:

15 Lectures

Fermat's principles reflection and refraction at plane surfaces by Fermat's principle, Refraction at spherical surface, thin lenses and their combination, cardinal points, equivalent lens, Ramsden and Huygen's eyepiece.

Wave nature of light. Huygen's principle, explation of reflection, refraction and experiment. Fresnel's biprism experiment, Newtons ring experiment with theory.

Diffraction (Fresnel class): half period zone, explanation of rectilinear propagation of light, principle of zone plate and its behavior as convergent lens.

Diffraction (Fraunhoffer class): diffraction pattern of single slit, double slit and plane transmlssion grating (simple treatment), circular aperture(qualitative).. Polarisation: Double refraction , Huygen's construction for uniaxial crystal.

TRIPURA UNIVERSITY

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Syllabus

For

Semester – II

Physics (Major/General)

Year 2014

THREE-YEAR-DEGREE COURSE

PHYSICS (HONOURS)

Second Semester: PHYSICS (HONOURS), TRIPURA UNIVERSITY

Total Marks 100
Paper Name : 112
(Theory paper 112-A = 60 marks, Practical paper 112-B = 40 marks)
Each Lecture is of 1 hour duration.

Theory paper 112-A (60 marks)
Total Theory Marks 60
(48 + 12 internal)
Two units: each unit has (24 + 6 marks internal)

Second Semester: Theory Paper = 112-A

UNIT-I
Electrostatics and Magnetostatics: (24 + 6 internal)

Gauss's theorem in electrostatics and its applications. Coulomb's theorem, mechanical force on a charged surface, energy per unit volume. Poison's equation and Laplace's equation and their solutions in the case of spherical and cylindrical charge distribution.

Lecture Period: 08

Electrical images, use of electrical image to the field problems in the case of point charges near conducting plate and conducting sphere.

Lecture Period: 06

Capacitance of spherical capacitors and cylindrical capacitors, attracted disc electrometer and quadrant electrometer (only basic principle).

Lecture Period: 05

Dipole-dipole interaction, Dielectric medium, polarization and susceptibility, boundary conditions of D and E, dielectric spheres in uniform field.

Lecture Period: 05

Intensity of magnetization, permeability, susceptibility and their relations, Boundary conditions for B and H. Hysteresis and hysteresis loss, its importance, magnetic circuit: its theory and applications.

Lecture Period: 06

Second Semester: Theory Paper = H2-A

UNIT-II
Optics: (24 + 6 internal)

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 Huygen's eyepiece.

Lecture Period: 08

Interference of light: Young's experiment, Fresnel's biprism, Interference by Lloyd mirror, interference by thin films including wedge shaped film, Newton's ring; theory and experiment.

Lecture Period: 08

Diffraction (Fresnel class): half period zone, explanation of rectilinear propagation of light, principle of zone plate and its behavior as convergent lens.

Lecture Period: 04

Diffraction (Fraunhofer class): diffraction pattern of single slit, double slit and plane transmission grating (rigorous treatment), Rayleigh criterion of resolution: resolving power of grating. Prism, telescope and microscope.

Lecture Period: 04

Polarization: Nicol prism, polaroids and their uses, production and analysis of plane, circularly and elliptically polarized light by retardation plates and Babinet's compensator, optical activity, Fresnel's explanation of optical activity , Biquartz and half shade polarimeter.

Lecture Period: 06

Second Semester: Practical Paper = H2-B
(Total marks: 40)

Marks division:

12 marks = 30 minutes written examination of 12 short questions to be supplied by the Head Examiner

08 marks = Internal assessment including Laboratory Note Book

20 marks = performance of the experiment.

Total Practical Period: 60

Experiments on General Properties of Matter and Optics

1. Determination of thermal conductivity of material of disc by Lees and Chorlton's method (applying Bedford's correction)

2. Determination of dispersive power of material of a prism.

3. To draw $(\delta - \lambda)$ curve and to determine unknown wavelength by prism.

4. To determine unknown concentration of an optically active substance by a polarimeter and to find the specific rotation of the substance.

5. To find the slit width and the separation between slits of a double slit for Fraunhoffer diffraction.

6. To determine the coefficient of viscosity of a liquid by Poiseuillie's method.

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N.B. Out of six experiments, a minimum of five experiments has to be set up in the laboratory by the concerned Department and must be completed by the students. **Otherwise no practical marks will be given.**

TRIPURA UNIVERSITY

PHYSICS (General) Syllabus,

Second Semester Syllabus

Paper PH-201A (or 2A) (Theory)

Full marks: 50 (Internal Assessment: 10, Semester Exam: 40)

Lecture 40, (Each lecture period = 1 hour)

Unit I: Acoustic:Lecture Period: 20 (Total: 25 marks, Internal Assessment: 05, Semester Exam: 20)

Composition of SHMs. Lissajoe's Figure, Damped aand forced vibrations (Solutions are to assumed without derivations), resonance and sharpness of resonance.

Differential equation of longitudinal wave using pressure distribution, Stationary waves in strings with various modes, Charateristic features of plucked and struck strings, Young's law.

Acoustics of building: Reverberation, Sabine's law, live and dead rooms.

Unit II: Electrostatics, Magnetostatics, Magnetic effect of Current: Lecture Period: 20: (Total: 25 marks, Internal Assessment: 05, Semester Exam: 20)

Coulomb's theorem, mechanical force on a charges surface, energy density, Capacitance of spherical and cylindrical capacitors.

Use of Biot-Savart Law for the calculation of magnetic induction due to circular coil and solenoid (finite and infinite)

Magnetic shell and potential due to magnetic shell, equivalence of magnetic shell and current carrying loop.

Hysteresis and calculation of hysteresis loss, selection of material for core of electromagnet.

Theory of Ballistic galvanometer with damping correction.

PHYSICS (General) Syllabus
TRIPURA UNIVERSITY
Second Semester Syllabus
Paper PH-201B(or 2B) (Practical)
Full marks: 50 (Internal Assessment: 10, Semester Exam: 40)
Total Practical Period: 60 hours

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 by 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 the combination of concave and convex lens using optical bench.
8. Determination of 'g' by Kater's pendulum.
9. Viscosity of water by Poseuillie's method (diameter of the tube to be measured by microscope)

TRIPURA UNIVERSITY

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Syllabus
OF

Physics
(Major & General)

Semester – III

2014

Third Semester:
Total Marks 100
Paper Name : H3
(Theory paper H3-A = 60 marks,
Practical paper H3-B = 40 marks)

Theory paper H3-A (60 marks)
Total Theory Marks 60
(48 + 12 internal)
Two units : each unit has (24 + 6 marks internal)

Third Semester : Theory Paper = H3-A

UNIT-I

Current Electricity: (24 + 6 internal)

D.C. circuits: Kirchoff's laws, Thevenin's theorem, Norton's theorem, superposition theorem, maximum power transfer theorem, problems on current in complicated circuits, inadequacy of Wheatstone's bridge. Platinum resistance thermometer, Callender and Griffith bridge and measurement of high temperature by platinum resistance thermometer. Working principle of potentiometer and its applications.

Thermoelectricity: Thermo emf, laws of Thermoelectricity, Peltier and Thomson's coefficient, total emf developed in a thermocouple, thermoelectric curve and the concept of neutral temperature and temperature of inversion of a thermocouple, thermoelectric power, thermoelectric diagram and its applications, calculation of Peltier and Thomson's coefficients from thermodynamic considerations, uses of thermocouple.

Theory of moving coil dead-beat and ballistic galvanometer, corrections due to damping in ballistic galvanometer, applications of ballistic galvanometer: measurement of capacitance of a capacitor (principle only), measurement of high resistance by the method of leakage (principle only).

Electromagnetic induction: Self and mutual inductance and relation between them, coefficient of coupling, combination of inductances, self inductance of a circular coil and solenoid, mutual inductance between two circular coils and between two coaxial solenoids. Eddy current and its explanation.

Charging and discharging of condenser in L-C-R circuit considering various conditions.
Current in L-R, C-R and L-C-R circuits using operator and imaginary quantity method, resonance in series and parallel L-C-R circuits, power in AC circuits, power factor, wattless current, choke coil and by-pass capacitor, principle of ideal transformer, various transformer losses.

UNIT-II

Thermal Physics: (Thermodynamics, Radiation, Kinetic Theory of Gases, Transport Phenomena and Refrigeration)

(24 + 6 internal)

Limitation of first law of thermodynamics. Necessity of Second law of thermodynamics, Carnot's cycle and its efficiency. Carnot's theorem, thermodynamic scale of temperature. Clausius inequality. Entropy: its properties and physical significance, change of entropy in reversible and irreversible changes, entropy of a perfect gas, entropy of a mixture of N-number of gases, principle of degradation of entropy. Temperature-entropy (T-S) diagram and representation of Carnot's cycle with the help of T-S diagram.

State functions: exact and inexact differential. Thermodynamic functions. Maxwell's thermodynamic relations, their simple deductions and their applications. Clausius-Clapeyron equation. Thermodynamic potentials, enthalpy.

Porus plug experiment Joule-Thomson effect and inversion temperature.

Radiation: emissive power and absorptive power of a body, black body, black body radiation spectrum, , Kirchoff's law and its rigorous derivation, pressure and energy density of diffused radiation. Stefan-Boltzmann law. solar constant and solar temperature. Wien's law, Rayleigh-Jeans law, basic assumptions and statement of Planck's law.

Kinetic Theory of Gases: Basic assumptions of kinetic theory, Ideal gas approximation, Maxwell's distribution law (both in terms of velocity and energy), root mean square and most probable speeds. Collision probability, Distribution of free paths and mean free path from Maxwell's distribution. expression for pressure according to kinetic theory. Degrees of freedom, equipartition of energy (detailed derivation not required), Relation between γ and degree of freedom.

Transport Phenomena: Viscosity and Thermal conductivity and their relation in the case of gas. diffusion in gases. Brownian Motion: Einstein's theory and Perrin's work for determination of Avogardo number.

Refrigeration: Basic principle,

Third Semester: Practical Paper = H3-B
(Total marks: 40)

Marks division:

12 marks = 30 minutes written examination of 12 short questions to be supplied by the Head Examiner

08 marks = Internal assessment including Laboratory Note Book

20 marks = performance of the experiment.

Electrical Experiments:

Experiment No.	Name of Experiment
1	To construct an 1-Ohm coil and its comparison with standard 1-Ohm
2	To draw thermoelectric curve and to find thermoelectric power at 60^0C using thermocouple.
3	To determine the boiling point of a liquid by platinum resistance thermometer.
4	Determination of high resistance by the method of leakage.
5	Determination of mutual inductance between two coils.
6	Construction of a rectifier circuit and study of output using a CRO with filter and without filter.

N.B. Out of six experiments, a minimum of five experiments have to be set up in the laboratory by the concerned Department and must be completed by the students. **Otherwise no practical marks will be given.**

TRIPURA UNIVERSITY

PHYSICS (General) Syllabus, Third Semester Syllabus

Paper PH-301 (Theory)

Full marks: 50 (Internal Assessment: 10, Semester Exam: 40)

Total Lecture 40, (Each lecture period = 1 hour)

Unit I: Current Electricity I

Total Lecture Period: 20 (Total: 25 marks, Internal Assessment: 05, Semester Exam: 20)

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 inversion, thermoelectric power, thermoelectric diagram and its applications, calculation of Peltier and Thomson coefficient from thermodynamic considerations.

Electromagnetic Induction: Self inductance of Circular coil and solenoid; Mutual inductance due between two coaxial circular coils, Mutual inductance between a small coil and a solenoid on which the small coil is wound coaxially.

Growth and decay of current in LR circuit, Charging and discharging of capacitor through a resistance (CR circuit), Transient current in LCR circuit (qualitative considerations of different cases without mathematical analyses).

Unit II: Current Electricity II and Atomic Theory

Total Lecture Period: 20 (Total: 25 marks, Internal Assessment: 05, Semester Exam: 20)

Current Electricity II Alternating emf and alternating current: General expressions, their mean and rms values, Mean power and power factor, wattless current, R, L, C, LR, CR and LCR circuit under AC voltage (solution by any method), Reactance and impedance, Resonance in LCR circuit, rejector circuit, choke coil, principle of ideal transformer, various losses in real transformer.

Atomic Theory: Positive rays, analysis by parabola method, Limitation of Bohr's Theory, Extension of Bohr's model as Vector atom model, quantum numbers, normal Zeeman effect. statement of Pauli's exclusion principle.

X-Ray: Bragg's law and explanation, Crystalline and amorphous solids, elementary of crystal study: NaCl and KCl structure, Compton effect and calculation of Compton shift

Paper PH-301B (Practical)

Full marks: 50 (Internal Assessment: 10, Semester Exam: 40)

Total Practical Period: 60 hours

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 values of two resistance by ther fall of potential method with the help of Carey Foster'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 coefficient 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 flowing in a circuit by using a potentiometer (r should be supplied)
9. To determine the refractive index of material of prism by using spectrometer.

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Syllabus

OF

Physics
(General & Major)

Semester - IV

2014

Utkal University
Physics (general) Syllabus

Fourth Semester Syllabus
Paper PH-401 (T)
Full marks: 50 (Internal Assessment: 10, Semester Exam: 40)
Total Lecture 40, (Each lecture period = 1 hr.)

Unit I

ELECTRONICS: Total Lecture Period: 20
(Total: 25 marks, Internal Assessment: 05, Semester Exam: 20)
UNIT-VI:

Diode 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 : Γ and π filters.

Zener break down, zener voltage, zener diode and its use as a voltage regulator.

Transistor characteristics in CE mode, load line analysis, Q-point. Working of CE transistor amplifier and calculation of voltage gain (Preliminary method)

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 theorems: Thevenin, Norton, Superposition and Maximum power transfer.

Unit II

Relativity and Nuclear Physics: Total Lecture Period: 20
(Total: 25 marks, Internal Assessment: 05, Semester Exam: 20)

Gallilean 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.

Radioactivity: radioactivity, disintegration, [illegible]

[illegible] charged particles, Geiger-Nuttal rule.

β-ray spectrum and its natures, neutrino hypothesis (qualitative idea only), internal conversion, γ-rays, qualitative discussion on γ-ray absorption in matte electron-positron annihilation, [illegible]

Cosmic rays, primary and secondary cosmic rays, mesons, Van Allen belt.

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.

PHYSICS

TDC (ELECTIVE) SYLLABUS FOR PART-III

Full marks : 50 (Internal assessment :10, Semester Examination:40)

Total Practical Period: 60 Hours

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 and g_m.
3. Study of the characteristic response curve of a photodiode cell (or determination of plank's constant).
4. Zener diode reverse characteristics, reverse impendence 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.

Theory paper H4-A (96 marks)
Total Theory Marks = 72
(48 + 12 internal)
Two units : each unit has (24 + 6 marks internal)

Fourth Semester: Theory Paper = H4-A

UNIT-I
Mechanics – II and Relativity: (24 + 6 internal)

Mechanics – II

Rigid body, angular momentum of a rigid body, moment and product of inertia, kinetic energy of rotation of a rigid body, ellipsoid of inertia, inertia tensor, principal axes, principal planes and principal moment of inertia, setting up of principal axes in simple symmetric cases, Euler's angles.

Generalized coordinate, constraints, forces of constraints, degrees of freedom, application of generalized coordinate and concept of constraints in different cases, generalized velocity, generalized potential, generalized force

Lagrangian formulation and its superiority over Newtonian approach, Principle of virtual work, D'Alemberts principle. Lagrange's equation for a conservative system from D'Alembert's principle and its application to different cases (see appendix), cyclic coordinates and its applications.

Hamiltonian formulation and its superiority, Calculation of Hamiltonian in simple cases (see appendix).

Relativistic mechanics: Gallilean transformation and invariance, Michelson-Morley experiment: its outcomes and difficulties. Postulates of the special theory of relativity, simple derivation of Lorentz transformation formula, relativity of simultaneity, length contraction, time dilation, addition of velocities (velocities along same line), variation of mass with velocity (head-on and oblique collision), Equivalence of mass and energy.

Fourth Semester: Theory Paper = H4-A

UNIT-II
Electromagnetism and Electromagnetic Theory: (24 + 6 internal)

Applications of Biot-Savart law and Ampere's circuital law (see appendix), Lorentz force and concept of magnetic induction, non-existence of magnetic monopole, $\nabla.B=0$; magnetic vector potential, calculation of vector potential and magnetic induction in simple cases.

Displacement current, Maxwell's electromagnetic equations (using Divergence and Stokes theorem), propagation of plane electromagnetic waves in free space, transverse character and polarized electromagnetic wave, Poynting vector and Poynting theorem, energy density in electromagnetic field,, Hertz's experiment.

Reflection and refraction of plane wave at the boundary of two dielectrics (law in generalized case and calculation of intensity only for normal incidence), waves in conducting media – skin effect and skin depth.

Normal and anomalous dispersion, Cauchy and Sellemier equation and Lorentz modification.

Fourth Semester: Practical Paper = H4-B
(Total marks: 40)

Marks division:

10 marks = One flow chart (questions to be supplied by the Head Examiner)

10 marks = First program (questions to be supplied by the Head Examiner)

10 marks = Second program (questions to be supplied by the Head Examiner)

05 marks = Viva Voce

05 marks = Laboratory Note Book

Computer Programming in Basic / Fortran

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Syllabus

OF

Physics
(General & Major)

Semester – V

2014

Fifth Semester

HONS syllabus

Subject: Physics

Total Marks 100 + 100 = 200

Paper Name : Theory paper: H5 = 100 marks

Practical paper: H6 = 100 marks

Fifth Semester: Paper = H5
Theory = 100
(80 + 20 internal)
Four units : each unit has (20 + 5 marks internal)

UNIT-I
Mathematical Methods in Physics – II: [20 (Exam) + 5(internal)]

Partial differential equation: Laplace equation and wave equation and their solutions in Cartesian, spherical polar and cylindrical polar coordinates by the method of separation of variables.

Series solutions of Legendre, Hermite, and Laguerre's differential equations, orthogonality of the solutions and recurrence relations.

Complex Variable: Complex variable and function of a complex variable, continuity, differentiability, singular points, removable singularities, essential singularities, isolated singularities, poles, singularity at infinity, Branch points, Branch cuts, Riemanns' sheet and Riemann Surface, single and multi-valued function, idea about complex plane, analytic function and necessary and sufficient condition for a function to be analytic;- Cauchy Riemann Equations, harmonic functions, Cauchy Riemann Equations in polar co-ordinates.

Laplace transform, properties of Laplace transform, important formulae related to Laplace transform, Laplace transform of the derivative of $f(t)$, Laplace transform of the integral of $f(t)$, Laplace transform of t. $f(t)$, Laplace transform of $\frac{f(t)}{t}$, evaluation of integrals using Laplace transform,

UNIT-II
Atomic and Molecular Physics, Laser and Fiber Optics: [20 (Exam) + 5(internal)]

Spectrum of hydrogen atom with reduced mass correction, vector atom model, qualitative idea of Bohr-Sommerfeald model, space quantization, Stern-Gerlach experiment and intrinsic spin of electron, magnetic moment of electron, Bohr magneton.

Spectroscopic notations, L-S and J-J coupling, lande g-factor, spectra of alkali atoms, doublet structure of spectral lines, normal and anomalous Zeeman effect.

Basic ideas about molecular spectra, rotational and vibrational spectra of diatonic molecules (see appendix).

Compton effect and calculation of Compton shift.

Laser: Population inversion: Einstein's A & B; coeffients; feedback of energy in a resonator, 3-level and 4-level systems; Ruby, Helium-Neon and semiconductor lasers. Laser applications, holography (Basic principle).

Optical Fibre: Core and cladding, total internal reflection; optical fibre as waveguide; step index and graded index fiber, communication through optical fibres, energy loss, band width and channel capacity- a typical system, attenuation and dispersion, splicing and couplers, fibre sensor.

UNIT-III
Electronics (Analog): [20 (Exam) + 5(internal)]

Applications of PN junction diode: bridge rectifier, clipper and clamper.

Transistors, working of PNP and NPN transistor, current components in a junction transistor, CB, CE and CC configurations and their comparisons.

Transistor characteristics in CB, CE, and CC configurations, definition of α, β and their interrelations. Working of a CE transistor amplifier, hybrid parameters, analysis of small signal single stage low frequency CE transistor amplifier with hybrid parameters, calculation of current gain, input impedance, voltage gain and output conductance.

Transistor biasing, fixed bias and its disadvantage, self bias or emitter bias and its advantage with respect to stability, voltage divider method.

Field effect transistor (FET) and its difference from bipolar transistor, n and p-channel FET, FET operation, FET characteristics: static and dynamic characteristics, FET parameters and their relation, use of FET as a voltage amplifier and calculation of voltage gain.

Operational amplifier (ideal), concept of virtual ground, uses of OP-AMP as an inverter, phase shifter, adder, differentiator, integrator, solution of simultaneous equation, real OPAMP – input offset voltage, input offset current, common mode rejection ratio and slew rate square wave and triangular wave generator.

Feedback amplifiers; positive and negative feedback, voltage gain with feedback, Barkhausen criterion for oscillator, Hartley, Colpitt and Wien Bridge oscillators with transistors and FET, qualitative description and advantages of crystal oscillator.

Principle of radio transmission and reception using block diagram.

Ionosphere: different layers, their role in radio wave propagation.

UNIT-IV
Statistical Mechanics: [20 (Exam) + 5(internal)]

Systems and ensembles, microstates and macro-states, calculations of microstates and macro-states in different cases, postulate of equal apriori probability, concept of chemical potential, micro-canonical, canonical and grand canonical ensembles, few examples of different ensembles from the physical world, phase space and its features, dimension of elementary phase cell, thermodynamic probability and its calculation in various cases, partition function and its significance, calculations of partition functions in different cases, Planck-Boltzmann definition of entropy, entropy and probability, third law of thermodynamics and its consequences, most probable distribution, derivation of distribution function for Maxwell-Boltzmann for a system of non-interacting particles, equipartition of energy and Richardson-Dushman equation from classical statistical mechanics.

Spin angular momentum of identical and indistinguishable particles and their symmetry requirements, calculations of macrostates, microstates and wave functions in case of assemblies of identical and indistinguishable particles, Bose-Einstein and Fermi-Dirac statistics for a system of non-interacting particle,

Fifth Semester: Practical Paper = H6
(Total marks: 100)

Marks division:

40 marks = Two hour written examination of 40 short / MCQ practical based questions to be supplied by the Head Examiner

10 marks = Laboratory note book

50 marks = performance of the experiment.

Advance Practical

Experiment No.	Name of Experiment
1	Determination of wavelength by Fresnel's biprism.
2	Determination of wavelength of spectral line by plane transmission grating.
3	Determination of J by callender and Barnes method
4	Drawing of B-H loop and determination of hysteresis loss.
5	Measurement of self-inductance by Anderson's bridge.
6	Determination of the Q-factor for LCR resonant circuit for different frequencies.
7	Determination of susceptibility of a magnetic material.

N.B. Out of seven practical experiments, a minimum of six experiments have to be set up in the laboratory by the concerned department and must be completed by the students. **Otherwise no practical marks will be given.**

Fifth Semester

General Syllabus

Subject: Physics

Total Marks 50 + 50 = 100

Paper Name : Theory paper: 501(T) = 50 marks

Practical paper: 502(P) = 50 marks

Tripura University

Fifth Semester Syllabus

Paper PH-501 (T)

Full marks: 50 (Internal Assessment: 10, Semester Exam: 40)

Total Lecture 40, (Each lecture period = 1 hour)

Unit-I: Electromagnetic Theory and Laser & Computer Science, Programming and Digital Electronics
Total Lecture Period: 20
(Total: 25 marks, Internal Assessment: 05, Semester Exam: 20)

Electromagnetic Theory and Laser, Maxwell's electromagnetic equations, propagation of plane electromagnetic waves in free space, transverse character of an electromagnetic wave, , energy density in transverse field, Poynting Theorem.

Qualitative idea of co-axial cable, optical fibre: Structure, Step index fibre, graded index fibre, Single and Multimode Propagation, different losses in fibre, advantage of optical fibre over the co-axial cable media.

Temporal and spatial coherence, Einstein's A and B co-efficient, LASER as monochromatic source of light, spontaneous and stimulated emission, population inversion, optical pumping, Ruby LASER.

Computer Progamming and Digital Electronics

Essential parts of an electronic computer, CPU, INPUT, OUTPUT, Devices, RAM, ROM, CD-ROM, Familiarity with different operating systems with common use, Machine language, Assembly language (idea only), Characteristics and field applications of high level languages such as BASIC, FORTRAN, C and 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, LPRINT, NEW, PRINT, REM, RUN, SAVE, SCREEN, STOP, SYSTEM.

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

Unit II: **Quantum Mechanics I and Quantum Mechanics II**
Total Lecture Period: 20
(Total: 25 marks, Internal Assessment: 05, Semester Exam: 20)

Quantum Mechanics I

Black body radiation and discussion of the failure of classical theory with special mentioning of Wein'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.

Heisenberg uncertainty principle and time-energy uncertainty principle, experimental illustrations diffraction by a single slit, complementary principle.

Quantum Mechanics-II

Schrodinger's equation and its derivation, operator, eigen function and eigen values, representation of position, momentum and energy by quantum mechanical operator, Born's interpretation of wave function, required properties of wave function.

Solution of time independent Schrodinger Equation for a free particle in one dimensional box with infinite potential walls at x=0 and at x=l, normalization of wave function and '$|\Psi|^2$-x'graph, energy level diagram, zero point energy.

Tripura University

Fifth Semester Syllabus

Paper PH-502 (P)

Full marks: 50 (Internal Assessment: 10, Semester Exam: 40)

Total Practical Period: 60 hours

Programming in Basic

1. Write a program in Basic to find the largest side of a triangle where the three sides are given as input. First of all you have to check whether the three sides can form the triangle and then you have to find the largest side.

2. Write a program in Basic to find the area of a triangle using Hero's formula. The three sides are given as input. First of all you have to check whether the three sides can form a triangle and then you have to calculate the area of the triangle.

3. Write a program in Basic to check whether a right angle triangle is possible by the three sides given as input. First of all you have to check whether the three sides can form a triangle and then you have to check the condition for right angle triangle.

4. Write a program in BASIC to input an integer and print all its divisors at the output.

5. Write a program in BASIC to input 10 random numbers. Print all the odd numbers at the output.

6. Write a program in BASIC to input 10 random numbers. Print all the even numbers at the output.

7. Write a program in BASIC to find all the prime numbers from 1 to 100.

8. Write a program in BASIC to calculate the sum of 10 natural numbers.

9. Write a program in BASIC to calculate factorial of "N" where "N" is given as input.

10. Write a program in BASIC to input two numbers and calculate their L.C.M.

11. Write a program in BASIC to input two numbers and calculate their H.C.F.

12. Write a program in BASIC to input 10 numbers and print the numbers at the output in ascending order.

13. Write a program in BASIC to input 10 numbers and print the numbers at the output in descending order.

14. Write a program in BASIC to input 10 numbers and arrange the numbers in reverse order and print both the original order and reverse order in two columns at the output.

15. Write a program in BASIC to print 10 Fibonecci numbers at the output where $T(1) = 0$ and $T(2) = 1$.

16. Write a program in BASIC to input a temperature in Celsius scale and convert it into in Fahrenheit scale.

17. Write a program in BASIC to input a temperature in Fahrenheit scale and convert it into in Celsius scale.

18. Write a program in BASIC to input the radius of a sphere in centimetre and calculate its area and volume.

19. Write a program in BASIC to input a five digit number. Construct a new number where the digits are arranged in reverse order and print both five digit numbers at output.

20. Write a program in BASIC to input a five digit number. Construct a new number where the digits are arranged in ascending and descending order and print both five digit numbers at the output.

21. Write a program in BASIC to input the focal length of a convex lens. If the object distance is given, calculate the image distance.

22. Write a program in BASIC to input five resistances. Calculate the equivalent resistance when they are in parallel combintion.

23. Write a program in BASIC to print the first 10 terms of the following series.
0, 3, 8, 15, 24, 35.....

24. Write a program in BASIC to input the number of days and convert it into year, month and day.

25. Write a program in BASIC to find all the three digit numbers for which sum of the cube of the digits is equal to the number itself.
e.g. $153=1^3+5^3+3^3$ (Armstrong number)

TRIPURA UNIVERSITY

(A Central University)
Suryamaninagar-799022

Syllabus

OF

Physics (Major)
Semester – VI

2014

Sixth Semester:

Sub: PHYSICS (Honours)

Total Marks = 200 = 100 (Theory) + 100 (Practical)
Paper Name : H7 (Theory) and H8 (Practical)
H7 (Theory paper) = 100 marks = 80 + 20 internal)

Four units :

UNIT-I: NUCLEAR PHYSICS: (20 + 5 internal)
UNIT-II : Quantum Mechanics: (20 + 5 internal)
UNIT-III-:Condensed Matter Physics: (20 + 5 internal)
UNIT-IV: Digital Electronics and Computer: (20 + 5 internal)

H8 (Practical paper) = 100 marks

Sixth Semester: Paper = H7

UNIT-I

NUCLEAR PHYSICS: (20 + 5 internal)

Characteristics of nucleus: mass, charge, size, binding energy, spin, magnetic moment, packing fraction, atomic mass unit, isobars, isotopes, isotones.

Nuclear structure: Nature of nuclear force, nuclear stability and nuclear binding, binding energy curve and its significance, description of liquid drop model and Bethe- Weizsacker mass formula.

Radioactivity: Successive disintegration, secular and transient equilibrium.

α decay: Rutherford α-scattering experiment and formula (deduction not necessary) and its significance, range of α particles, Geiger-Nuttal law, α-ray spectrum, fine structure in α-ray spectrum, theory of α-disintegration.

β-decay: Different types of β-ray spectrum and their natures, neutrino hypothesis, β-disintegration energy, internal conversion, Curie plot, β-ray absorption (qualitative discussion).

γ-decay: γ-ray spectra and nuclear energy levels, qualitative discussion on γ-ray absorption in matter – photoelectric process, Compton Scattering and pair production, electron-positron annihilation (qualitative).

Nuclear reaction: conservation principles in nuclear reactions, Q-value and thresholds, exoergic and endoergic reactions, artificial radioactivity, nuclear reactions induced by α-particle, proton, deuteron, γ-rays, neutron, Bohr's postulates of compound nuclear reaction.

Spontaneous and induced fission, nuclear chain reaction and basic principle of nuclear reactor.

Four basic interactions in nature and their relative strengths, examples of different types of interactions.

Accelerators and detectors: Betatron, Synchrotron (principle only), Ionization chamber, Proportional counter, G.M. counter.

Sixth Semester: Paper = H7

UNIT-II
Quantum Mechanics: (20 + 5 internal)

Black body radiation and discussion of the failure of classical theory with special mentioning of Wien's and Rayleigh – Jeans formula, Plank's hypothesis and Planck's energy distribution law in black body radiation (Deduction Required).

Matter wave, wave function, physical significance of ψ, concept of wave packet associated with free particle. Schrödinger time independent equation from the classical differential wave equation in one and three dimension, one and three dimensional representation of position, momentum and energy by quantum mechanical operators, Schrödinger equation using idea of quantum mechanical operator and separation of one and three dimensional space part and time part, expectation value of an observable, probability current density, equation of continuity, Ehrenfest theorem, eigen functions and eigen values, stationary states, orthogonality of eigenfunctions, normalization, fundamental postulates of quantum mechanics.

Free particles in one dimensional box, three dimensional box normalization, energy level diagram, explanation of continuous energy ocean as a limiting case of discontinuous energy eigen value, degeneracy, zero point energy, momentum and wave function for a free particle in one dimensional box, particle in a finite one dimensional potential barrier, one dimensional harmonic oscillator, the hydrogen atom problem (see appendix).

Sixth Semester: Paper = H7

UNIT-III
Condensed Matter Physics: (20 + 5 internal)

Crystal physics: Distinction between crystalline and amorphous solids, Characteristics of a Crystal: Face, Form, Edges and Interfacial angles. Lattice, Basis and Crystal structure, translational and angular parameters, Unit cell and primitive cell, fundamental types of lattices, Different features of simple cubic, b.c.c. anf f.c.c. lattices, namely lattice point density, number of nearest neighbour, nearest neighbour distance, number of second nearest neighbour, second nearest neighbour distance, packing fraction. Miller indices, Laue and Bragg's equations, powder diffraction method, study of Nacl & KCl structure.

Different types and natures of bonding: ionic, covalent, molecular, metallic and Van der walls.

Lattice vibration (**only monatomic lattice**), concept of phonon (basic idea only), theory of specific heat of solid : Einstein & Debye model.

Classical Free electron theory of metals: drift velocity, mobility and conductivity, Boltzmann transport equation, calculation of thermal and electrical conductivities of metals; Wiedmann Franz law.

Band Theory and semiconductor: Modification of electronic energy levels of atoms in a crystalline solid, band structure of electronic states: Bloch Theorem, Kronig-Penny model, distinction between metals, insulators and semi conductors, qualitative discussion on n and p–type semi conductors, Hall effect in both conductor and in semi conductors.

Magnetic properties of materials: dia, para, and ferromagnetic properties of solid, Langevin's theory of diamagnetism, classical and quantum theory of paramagnetism, Curie's law, spontaneous magnetization and domain structure, temperature dependence of magnetic property, Curie-Wiess law and explanation of hysteresis.

Sixth Semester: Paper = H7

UNIT-IV
Digital Electronics and Computer: (20 + 5 internal)

Digital Electronics: Binary system, conversion of binary to decimal and vice versa, binary addition and substraction, Boolean expression, Logic gates (AND, OR, NOT), DDL, DTL, digital electronics-combinational circuits, circuit adder & subtractor, multiplexer, Sequential circuits – Flip – flop: RS, D & J – K.

Operating system: Familiarity with different operating systems in common use. Simple MS DOS Command. Simple Windows command.

Algorithm and Flow chart for solving simple problems.

Elementary idea about machine, assembly and high level languages, assembler, compiler, characteristics & field of application of high-level languages such as BASIC, FORTRAN, C. Development of simple programs BASIC language using commands listed : CLS, REM, INPUT, PRINT, assignment statement (LET), READ- DATA, arithmetic logic, DEFFN, GOSUB, IF – THEN, GOTO, FOR – NEXT, FILES (INPUT, OUTPUT, FILE open), DIM, PRINT USING, LPRINT, TAB, LOCATE, END, RUN, SAVE.

Sixth Semester: Practical Paper = H8
(Total marks: 100)

Marks division:

40 marks = Two hour written examination of 40 short practical based questions (to be supplied by the Head Examiner)

20 marks = Internal assessment including Laboratory note book

40 marks = performance of the experiment.

Electronics Practical

Expt. No.	Name of Experiment
1	To draw the dynamic characteristics of a triode and to determine the voltage gain of a triode amplifier.
2	To draw the input and output characteristics of a transistor amplifier in CE mode and calculation of α and hybrid parameters.
3	To draw the characteristics of Zener diode and study of line and load regulation.
4	To draw the static, dynamic and transfer characteristics of FET and calculation of voltage gain in FET amplifier.
5	Construction and study of half wave and full wave rectifier without and with R-C filter.
6	Study of operational amplifier (IC-741).
7	(a) Construction and study of OR, AND & NOT circuits using diode, transistor, resistances etc.
	(b) Boolean expressions and realization of relevant truth tables using digital IC 74**.

N.B. Out of seven experiments, a minimum of six experiments have to be set up in the laboratory by the concerned Department and must be completed by the students. **Otherwise no practical marks will be given.**