OUTLINES OF TESTS, SYLLABI AND COURSES OF READING FOR B. Sc. (HONS. SCHOOL) IN PHYSICS AND ELECTRONICS – FIRST AND SECOND SEMESTER EXAMINATION 2009 AND ONWARDS

B.Sc. (H. S.) FIRST SEMESTER		***MARKS***	***CREDITS***
Major			
PHYE 111	Mechanics	75	3
PHYE 112	Electricity and Magnetism	75	3
PHYE 113	Laboratory	50	2

B.Sc. (H. S.) SECOND SEMESTER		***MARKS***	***CREDITS***
Major			
PHYE 121	Special theory of relativity	75	3
PHYE 122	Electricity, Magnetism and Circuit Theory	75	3
PHYE 123	Laboratory	50	2

Subsidiary courses for B. Sc. (Hons. School) in Physics and Electronics First year will be same as that for B. Sc. (Hons. School) in Physics for the examination 2009 and onwards. the syllabi will also be the same.

The students of B.Sc (Hons. School) have also to study the subject of "Environment Education". This is a compulsory qualifying paper which the students are required to qualify in the $1^{st}/2^{nd}/3^{rd}$ year of the course. The examination will be conducted by the University.

Internal assessment and end semester examination will be of 20% and 80%, respectively. of the total marks.

PHYSICS SYLLABUS FOR B.SC. (HONS. SCHOOL) FIRST SEMESTER FOR STUDENTS OF PHYSICS and ELECTRONICS MAJOR FOR THE EXAMINATION, NOV./DEC. 2009 ONWARD

PHYE 111 MECHANICS (40 hrs.) Max. Marks: 75

Objective: This course has been so framed that the students are first exposed to the mathematical tools needed in Mechanics and Special Relativity. Students are then taught the topics of conservation laws, elastic and inelastic scattering, dynamics of rigid bodies and inverse-square law of forces in the framework of Newtonian Mechanics.

Note:

1. The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt **five** questions in all including compulsory question. All Questions will carry equal marks viz. 12.
2. The question paper is expected to contain problems with a weightage of 25 to 40%.
3. The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

Mathematical Tools: Differentiation : Basic ideas, the chain rule, implicit differentiation, special points of a function. Differential Equations: First degree first order equations, exact differentials, integrating factor, second order homogeneous and non-homogeneous differential equations with constant coefficients, complementary solutions and particular integral. Integration : As area under the curve and inverse of differentiation, simple examples, integration by substitution and by parts, reduction formulae, integration in plane polar coordinates. Vectors : Basics, vector addition, products of vectors (Scalar and Vector), reciprocal vectors, vector derivatives, circular motion, vectors and spherical polar coordinates, invariants. (Ch 1 & 6 of Book 1, Ch. II of Book 2, Ch. 2 and 3 of Book 3).

C**onservation Laws:** Conservation of Energy, Conservative forces, Internal forces and conservation of linear momentum, Centre of mass, systems with variable mass, Space-Vehicle Problem. Conservation of Angular Momentum, Internal torques, Angular Momentum about the Centre of mass, Rotational invariance, Shape of Galaxy. (Chs. V and VI of Book 2, Ch. 5 of Book 3).

Elastic and Inelastic Scattering : Types of scattering and conservation laws, Laboratory and centre of mass systems, collision of particles which stick together, General elastic collision of particles of different mass, Cross-section of elastic scattering, Rutherford scattering. (Ch. VI of Book 1, Ch. 7 of Book 2).

Dynamics of Rigid Bodies : Equation of motion, angular momentum and kinetic energy of a Rotating Body, Moment of Inertia and Radius of Gyration, Rotation of about fixed axes - time dependence of motion, cylinder on an accelerated rough plane, Behaviour of angular momentum vector, Principal axes and Euler's equations. Elementary Gyroscope, Symmetrical Top. (Ch. VIII of Book 2, Ch. 8 of Book 3).

Inverse-Square-Law of Forces : Force between a Point Mass and Spherical shell. Force between a Point Mass and Solid Sphere, Gravitational and Electrostatic self-energy. Gravitational energy of the Galaxy and of uniform sphere; Orbits and their eccentricity, Two-body problem - reduced mass. (Ch. IX of Book 2, Ch. 6 of Book 3).

TUTORIALS : Relevant problems given at the end of a chapter in books 1, 2 and 3.

Books :

1. Mathematical Methods for Physics and Engineering : K.F. Riley, M.P. Hobson and S.J.Bence (Cambridge University Press) (1998).
2. Mechanics (Berkeley) Physics Course I : Charles Kittle, Walter D. Knight, M. Alvin and A. Ruderman (Tata McGraw Hill) (1981).
3. Mechanics : H.S. Hans and S.P. Puri (Tata McGraw Hill) (2003).
4. Introduction to Classical Mechanics : R.G. Takwale & P.S.Puranik (Tata-McGraw-Hill) (2000)

PHYE 112 ELECTRICITY AND MAGETISM (40 hrs.) Max. Marks: 75

Objective: This course has been designed to teach the students the basics of electronics, electric current and circuit theory after exposing them to the mathematical tools like complex variable, trigonometric functions and vector calculus.

Note:

1. The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt **five** questions in all including compulsory question. All Questions will carry equal marks viz. 12.
2. The question paper is expected to contain problems with a weightage of 25 to 40%.
3. The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

Mathematical Tools : Complex Numbers : Real and imaginary parts, complex plane, polar representation, conjugation, algebraic operations, Euler's formula, power and roots of complex numbers, exponential and trigonometric functions, hyperbolic functions, logarithms, inverse functions. Vector Calculus : Differentiation of vectors, scalar and vector fields, conservative fields and potentials, line integrals, gradient of a scalar field, divergence of a vector field and divergence theorem, curl of a vector field and its physical significance, Stokes' theorem, combination of grad, div and curl. (Ch 2, 6, 8 of Book 1; Ch 1,3,5 of Book 2, Ch 1, 2 of Book 3)

Electric Charges and Fields : Conservation and quantization of charge, Coulomb's Law, Energy of a system of charges. Flux and Gauss's law. Brief review of electric fields of a spherical charge distribution, a line charge and an infinite flat charged sheet. (Ch. 1 of Book 3).

Electric Potential : Potential as line integral of field, potential difference, Gradient of a scalar function, Derivation of the field from the potential, potential of a charge distribution, Uniformly charged disc. Force on a surface charge, energy associated with an electric field, Gauss's theorem and differential form of Gauss's law, Laplacian and Laplace's equation, Poisson's equation. (Ch. 2 of Book 3).

Electric Fields Around Conductors : Conductors and insulators, General electrostatic problem. Boundary conditions, Uniqueness theorem, some simple system of conductors; capacitors and capacitance, Energy stored in a capacitor. (Ch. 3 of Book 3).

Electric Currents : Charge transport and current density, Stationary currents, Ohm's law, Electrical conduction model, Failure of Ohm's law, Circuits and circuit elements, Energy dissipation in current flow, variable currents in capacitors and resistors. (Ch. 4 of Book3).

Circuit Theory: Basic definitions, KCL and KVL, Mesh and Node analysis, Principle of duality, Superposition theorem, the reciprocity theorem, Thevenin's theorem, Norton's theorem. (Book 7)

Tutorials : Relevant problems given at the end of each chapter in books 1,2 and 3.

Books :

1. Mathematical Methods in the Physical Sciences : M.L.Boas (Wiley) (2002).
2. Introduction to Mathematical Physics : C. Harper (Prentice Hall of India) (2004).
3. Electricity and Magnetism (Berkley, Phys. Course 2) : E.M. Purcell (Tata McGraw Hill) (1981).
4. Elements of Electromagnetics : M.N.O.sadiku (Oxford University Press) (2001).
5. Electricity and Magnetism : A.S. Mahajan & A.A. Rangwala (Tata- McGraw Hill) (1988).
6. Electricity and Magnetism : A.N. Matveev (Mir) (1986).
7. Linear and Non-linear Circuits : Chua, Desoer and Kuh.

PHYE 113 LABORATORY (90 hrs.) Max. Marks: 50

Objective: The laboratory exercises have been so designed that the students learn to verify some of the concepts learnt in the theory courses. They are trained in carrying out precise measurements and handling sensitive equipments.

Note:

1. Examination time will be 3½ hours. Internal assessment will be based on day to day performance of the students in the laboratory, viva voice of each experiment, regularity in the class, number of experiments performed etc.
2. Eight to ten experiments are to be performed in each Semester. Experiments performed in odd semester can not be repeated in even semester. Experiment number 1 is compulsory for I semester.

1. Analysis of experimental data by:
   (i) Fitting of given data to a straight line.
   (ii) Calculation of probable error. Use of Vernier callipers, screw gauge and spherometer.
2. To study the variation of time period with distance between centre of suspension and centre of gravity for a bar pendulum and to determine:
   (i) Radius of gyration of the bar about an axis through its C.G. and perpendicular to its length.
   (ii) The value of g in the laboratory.
3. To determine the Young's modulus by bending of beam.
4. To determine the coefficient of rigidity of a wire by static method or Maxwell's needle.
5. To study one dimensional collision using two hanging spheres of different materials.
6. Dependence of scattering angle on kinetic energy and impact parameter in Rutherford scattering (mechanical analogue).
7. To measure the coefficient of linear expansion.
8. Determination of E.C.E. of hydrogen and evaluation of Faraday and Avogadro constants.
9. To study the magnetic field produced by a current carrying solenoid using a pick-up coil and to find the value of permeability of air.
10. To determine the frequency of a.c. main using sonometer.
11. To study given source of electrical energy and verify the maximum power theorem.
12. To determine the resistance of an electrolyte for a.c current and study its concentration dependence.
13. To study the dependence of resistance on temperature.
14. To measure thermo e.m.f. using potentiometer.
15. To study C.R.O. as display and measuring device by recording sines and square waves, output from a rectifier, verification (qualitative) of law of electromagnetic induction and frequency of a.c. mains.
16. To plot the Lissajous figures and determine the phase angle by C.R.O.
17. To study B-H curves for different ferromagnetic materials using C.R.O.
18. Determination of given inductance by Anderson's bridge.
19. To determine the value of an air capacitance by de-Sauty Method and to find permittivity of air. Also to determine the dielectric constant of a liquid.
20. Study of R.C. circuit with varying e.m.f. using it as an integrating circuit.
21. Study of R.C. circuit with a low frequency a.c. source.
22. Studies based on LCR Board: Impedance of LCR circuit and the phase angle between voltage and current.
23. To determine the wavelength of LASER using diffraction grating and use it for the determination of the grating element of another grating.

PHYSICS SYLLABUS FOR B.SC. (HONS. SCHOOL) SECOND SEMESTER FOR STUDENTS OF PHYSICS and ELECTRONICS MAJOR FOR THE EXAMINATION, NOV./DEC. 2009 AND ONWARD

PHYE 121 SPECIAL THEORY OF RELATIVITY (40 hrs.) Max. Marks: 75

Objective: This course aims at exposing the students to Newton's law of motion, the Galilean transformations and Einstein's special theory of relativity in proper perspective so that they can use its formulation in later courses.

Note:

1. The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt **five** questions in all including compulsory question. All Questions will carry equal marks viz. 12.
2. The question paper is expected to contain problems with a weightage of 25 to 40%.
3. The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

Newton's Laws of Motion: Forces and equations of motion, Lorentz force, Motion of a charged particle in a uniform constant magnetic field, charged particle in a uniform alternating electric field. (Ch. III of Book 2, Ch. 4 of Book 3).

Galilean Transformation: Inertial reference frames, absolute and relative accelerations and velocity, Galilean Transformation, Conservation of Momentum, Fictitious Forces, Collisions, Velocity and Acceleration in Rotating coordinate systems. (Ch. IV of Book 2, Ch. 10 of Book 3).

Lorentz Transformations: Michelson-Morley Experiment, Basic postulates of special relativity, Lorentz transformations, Simultaneity and causality in relativity. Length contraction, Time dilation, Velocity Transformation, Space-like and time-like intervals, Aberration of light, Doppler effect. (Ch. XI of Book 2, Ch. 11 of Book 3).

Relativistic Dynamics: Conservation of Momentum, Relativistic momentum, Relativistic Energy, Transformation of Momentum and Energy, Equivalence of Mass and Energy. Particles with zero Rest-mass. Transformation of force, Four vectors. (Ch. XII of Book 2, Ch. 12 of Book 3).

Problems in Relativistic Dynamics: Acceleration of Charged Particle by constant longitudinal electric field, Acceleration by a Transverse Electric field, charged particle in a magnetic field, centre of mass system and Threshold Energy. Energy available from Moving charge, Antiproton Threshold, Photoproduction of mesons. (Ch. XIII of Book 2, Ch. 12 of Book 3).

Principle of Equivalence : Inertial and Gravitational Mass, Gravitational Mass of photons, Gravitational Red-Shift, Equivalence. (Ch. XIV of Book 2).

TUTORIALS : Relevant problems given at the end of a chapter in books 1, 2 and 3.

Books :

1. Mechanics (Berkeley) Physics Course I : Charles Kittle, Walter D. Knight, M. Alvin and A. Ruderman (Tata McGraw Hill) (1981).
2. Mechanics : H.S. Hans and S.P. Puri (Tata McGraw Hill) (2003).
3. Introduction to Classical Mechanics : R.G. Takwale & P.S.Puranik (Tata-McGraw-Hill) (2000)

PHYE 122 ELECTRICITY, MAGNETISM AND CIRCUIT THEORY 40 hrs.

Max. Marks: 75

Objective: The content of this course has been so arranged that the students are taught about electric and magnetic fields in matter, the field of moving charges, essentials of electromagnetic induction , alternating currents and the elements of circuit theory so that they can use later this knowledge in the analysis of electronic circuits.

Note:

1. The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt **five** questions in all including compulsory question. All Questions will carry equal marks viz. 12.
2. The question paper is expected to contain problems with a weightage of 25 to 40%.
3. The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

Electric Fields in Matter : Dielectrics, Moments of a charge distribution, Potential and field of a dipole, Atomic and molecular dipoles, Induced dipole moments, Permanent dipole moments, electric field caused by polarized matter, field of a polarized sphere, dielectric sphere in a uniform field, Gauss's law and a dielectric medium, Electrical susceptibility and atomic polarizability, Energy changes in polarization, Polarization in changing fields. (Ch. 10 of Book 3).

The Fields of Moving Charges : Magnetic forces, Measurement of a charge in motion, invariance of charge, Electric field measured in different frames of reference, Field of a point charge moving with constant velocity, Field of a charge that starts or stops, Force on a moving charge, Interaction between a moving charge and other moving charges. (Ch. 5 of Book 3).

Magnetic Field : Definition, some properties of the magnetic field, Vector potential, Field of current carrying wire and solenoid, change in **B** at a current sheet; Transformations of electric and magnetic fields. Rowland's experiment, Hall effect. (Ch 6 of Book 3).

E**lectromagnetic Induction :** Universal law of induction, Mutual inductance, Reciprocity theorem, Self inductance, Energy stored in a Magnetic field. A circuit containing self inductance, Displacement current and Maxwell's equations. (Ch. 7 and 9 of Book 3).

Alternating Current Circuits: A resonance circuit, Alternating current, A.C. networks, Admittance and impedance, skin effect, power and energy in A.C. circuits, Anderson's Bridge, Q factor for series resonance. (Ch. 8 of Book 3).

Magnetic Fields in Matter : Response of various substances to magnetic field, Force on a dipole in an external field, Electric currents in Atoms, Electron spin and Magnetic moment, types of magnetic materials, Magnetic susceptibility. (Ch. 11 of Book 3).

Circuit Theory: Linear Resistive Two-ports, Z, Y, T, T', H and H' representations, Interconnection of two-ports, T and π networks, Reduction of complicated network, the compensation theorem, Maximum power transfer theorem, driving point impedance, Miller's theorem.(Book 7)

Tutorials : Relevant problems given at the end of each chapter in books 1,2 and 3.

Books :

1. Mathematical Methods in the Physical Sciences : M.L.Boas (Wiley) (2002)
2. Introduction to Mathematical Physics : C. Harper (Prentice Hall of India) (2004).
3. Electricity and Magnetism (Berkley, Phys. Course 2) : E.M. Purcell (Tata McGraw Hill) (1981).
4. Elements of Electromagnetics : M.N.O. Sadiku (Oxford University Press) (2001).
5. Electricity and Magnetism : A.S. Mahajan & A.A. Rangwala (Tata- McGraw Hill) (1988).
6 Electricity and Magnetism : A.N. Matveev (Mir) (1986).
7. Linear and Non-linear Circuits : Chua, Desoer and Kuh.

PHYE 123 LABORATORY (90 hrs.) Max. Marks: 40 + 10 (PROJECT) = 50

Objective: The laboratory exercises have been so designed that the students learn to verify some of the concepts learnt in the theory courses. They are trained in carrying out precise measurements and handling sensitive equipments.

Note:

1. Examination time will be 3½ hours. Internal assessment will be based on day to day performance of the students in the laboratory, viva voice of each experiment, regularity in the class, number of experiments performed etc.
2. Eight to ten experiments are to be performed in each Semester. Experiments performed in odd semester can not be repeated in even semester. **Students will also carry out minor project work in this semester.**

1. To study the variation of time period with distance between centre of suspension and centre of gravity for a bar pendulum and to determine:
   (i) Radius of gyration of the bar about an axis through its C.G. and perpendicular to its length.
   (ii) The value of g in the laboratory.
2. To determine the Young's modulus by bending of beam.
3. To determine the coefficient of rigidity of a wire by static method or Maxwell's needle.
4. To study one dimensional collision using two hanging spheres of different materials.
5. Dependence of scattering angle on kinetic energy and impact parameter in Rutherford scattering (mechanical analogue).
6. To measure the coefficient of linear expansion.
7. Determination of E.C.E. of hydrogen and evaluation of Faraday and Avogadro constants.
8. To study the magnetic field produced by a current carrying solenoid using a pick-up coil and to find the value of permeability of air.
9. To determine the frequency of a.c. main using sonometer.
10. To study given source of electrical energy and verify the maximum power theorem.
11. To determine the resistance of an electrolyte for a.c current and study its concentration dependence.
12. To study the dependence of resistance on temperature.
13. To measure thermo e.m.f. using potentiometer.
14. To study C.R.O. as display and measuring device by recording sines and square waves, output from a rectifier, verification (qualitative) of law of electromagnetic induction & frequency of a.c. mains.
15. To plot the Lissajous figures and determine the phase angle by C.R.O.
16. To study B-H curves for different ferromagnetic materials using C.R.O.
17. Determination of given inductance by Anderson's bridge.
18. To determine the value of an air capacitance by de-Sauty Method and to find permittivity of air. Also to determine the dielectric constant of a liquid.
19. Study of R.C. circuit with varying e.m.f. using it as an integrating circuit.
20. Study of R.C. circuit with a low frequency a.c. source.
21. Studies based on LCR Board: Impedance of LCR circuit and the phase angle between voltage and current.
22. To determine the wavelength of LASER using diffraction grating and use it for the determination of the grating element of another grating.

OUTLINES OF TESTS, SYLLABI AND COURSES OF READING FOR B. Sc. (HONS SCHOOL) IN PHYSICS AND ELECTRONICS – THIRD AND FOURTH SEMESTER EXAMINATION 2010 AND ONWARDS

B.Sc. (H. S.) THIRD SEMESTER	MARKS	CREDITS
PHYE 211 Vibrations and Waves	75	3
PHYE 212 Quantum Mechanics and Statistical Physics	75	3
PHYE 213 Electronics and Network Theory -I	75	3
PHYE 214 Physics and Electronics Laboratory	75	3

B.Sc. (H. S.) FOURTH SEMESTER	MARKS	CREDITS
PHYE 221 Electromagnetic Theory	75	3
PHYE 222 Thermodynamics	75	3
PHYE 223 Electronics and Network Theory-II	75	3
PHYE 224 Physics and Electronics Laboratory	75	3

Internal assessment and end semester examination will be of 20% and 80%, respectively. of the total marks.

SYLLABUS FOR B.Sc. (HONS. SCHOOL) IN PHYSICS AND ELECTRONICS THIRD SEMESTER (MAJOR) FOR THE EXAMINATION 2010 AND ONWARD

PHYE 211 : VIBRATIONS AND WAVES (40 hrs.)

Max. Marks: 75

Note:

1. The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt **five** questions in all including compulsory question. All Questions will carry equal marks viz. 12.
2. The question paper is expected to contain problems with a weightage of 25 to 40%.
3. The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

I Simple Harmonic Free Vibrations : Simple harmonic motion, energy of a SHO, Compound pendulum, Electrical Oscillations, Plasma Vibrations, Lattice Vibrations, Transverse Vibrations of a mass on a string, composition of two perpendicular SHMs of same period and of periods in ratio 1:2, Anharmonic Oscillations.

II Damped Simple Harmonic Vibrations: Decay of free Vibrations due to damping, types of damping, Determination of damping coefficients – Logarithmic decrement, relaxation time and Q-factor. Electromagnetic damping, collision damping – Ionosphere and metals.

III Forced Vibrations and Resonance: A forced oscillator, Transient and Steady State Oscillations, velocity versus driving force frequency, Resonance, power supplied to forced oscillator by the driving force. Q-factor of a forced oscillator, Electrical, nuclear and nuclear-magnetic resonances.

IV Coupled Oscillations: Stiffness coupled oscillators, Normal coordinates and modes of vibrations. Normal frequencies, Forced vibrations and resonance for coupled oscillators, Masses on string-coupled oscillators.

V Waves in Physical Media: Wave motion in one dimension, Transverse and longitudinal waves, progressive harmonic waves and their energy, Transverse waves on a string, longitudinal waves on a rod, Electrical transmission lines, characteristic impedance of a string and a transmission line, waves in an absorbing medium, spherical waves.

VI Reflection and Transmission: Reflection and transmission of transverse waves on a string at the discontinuity, Energy considerations of reflected and transmitted waves, Impedance matching, eigenfrequencies and eigenfunctions for stationary waves on a string. Normal modes in three dimensions, Planck's Law, Debye's T^3 Law, Conduction electrons in a metal, transmission of non-monochromatic waves, Bandwidth Theorem.

TUTORIALS : Relevant Problems on the topics covered in the course.

Books :

Text Book of Vibrations and Waves : S.P. Puri (Macmillan India) (2004)
The Physics of Vibrations and Waves : H.J. Pain (Wiley and ELBS, 1976)

PHYE 212: QUANTUM MECHANICS AND STATISTICAL PHYSICS (40 hrs.)

Max. Marks: 75

Note:

1. The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt **five** questions in all including compulsory question. All Questions will carry equal marks viz. 12.
2. The question paper is expected to contain problems with a weightage of 25 to 40%.
3. The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

I Mathematical Tools : Partial differentiation : Definition of partial derivative, total differentiation, exact and inexact differentials, useful theorems, the chain rule, change of variables, stationary values under constraints, Lagrange multipliers, differentiation of integrals.

II Origin of the Quantum Theory : Blackbody radiation, the photoelectric effect, the Franck-Hertz experiment, the correspondence principle, the Bohr atom, quantization of the phase integral, the particle in a box, the rigid rotator, the harmonic oscillator.

III Foundations of Wave Mechanics : Photons as particles: the Compton effect, particle diffraction, elements of Fourier Analysis, Parseval's formula and the Fourier integral theorem, examples of Fourier transforms, superposition of plane waves and time dependence, wavepackets and the Einstein-de Broglie relations, wave functions for a free particle and the Schrodinger equation, physical interpretation of the Schrodinger wave function.

IV Basic Ideas of Statistical Physics : Introduction, Basic ideas of probability and their applications, Macrostates and microstates, Effect of constraints on the system. Distribution of n particles in two compartments, deviation from the state of maximum probability, Equilibrium state of a dynamic system, distribution of N distinguishable particles in unequal compartments, Division into cells.

V Maxwell-Boltzmann Statistics : Phase space and its division into cells. Three kinds of statistics and their basic approach. Maxwell-Boltzmann Statistics for an ideal gas: Volume in phase space, values of α and β. Experimental verification and graphical depiction of Maxwell-Boltzmann distribution of molecular speeds.

VI Bose-Einstein and Fermi-Dirac Statistics : Need for quantum statistics, Bose-Einstein statistics and its application to photon gas, deductions from Planck's law, Fermi-Dirac statistics and its application to electron gas, Fermi energy, comparison of M.B., B.E. and F.D. statistics.

TUTORIALS : Relevant Problems given at the end of chapters in books 1 - 4.

Books

1. Mathematical Methods for Physics and Engineering : K.F. Riley, M.P. Hobson and S.J.Bence (Cambridge University Press) (1998).

2. Mathematical Methods in the Physical Sciences : M.L.Boas (Wiley) (2002)

3. Quantum Mechanics : J.L. Powell, B. Crasemann (Narosa Publishing House).
4. Statistical Physics, Thermodynamics and Kinetic Theory : V.S. Bhatia (Vishal Pub. Co., Jalandhar,) (2003).

PHYE 213: ELECTRONICS AND NETWORK THEORY -I (40 hrs.)

Max. Marks: 75

Note:

1. The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt **five** questions in all including compulsory question. All Questions will carry equal marks viz. 12.
2. The question paper is expected to contain problems with a weightage of 25 to 40%.
3. The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

Circuit Theory: Series and parallel addition of V-I characteristics, KCL and KVL, Mesh and Node analysis, Superposition theorem, Thevenin's and Norton's theorem, reciprocity theorem, Linear resistive 2-ports and interconnections, Z, Y, T, T', H and H' representations**,** T and π networks.

Semiconductor Materials and Diode Junctions: Band diagram, Mobility and conductivity, generation and recombination of charges, Diffusion, Continuity equation Diode equation, V-I characteristics, temperature dependence, Transition and diffusion capacitance, Zener diode, Light emitting diode, various kinds of Transducers

Transistors : pnp and npn junction transistors, transistor current components, CB, CC and CE configurations, transfer characteristics, Transistor as switch and applications, Transistor biasing, fixed bias, emitter-stabilised biasing, Voltage-divider biasing, Junction FET, v-i Characteristics.

Waveshaping Circuits: Clipping and Clamping circuits, Diode and transistor clippers, Clamping circuits, Clamping circuit theorem.

Power Supplies : Characteristics, Rectifiers, Filter circuits, efficiency, Ripple factor, voltage multiplying circuits, Regulation, Shunt and Series regulators, Monolithic regulators (Introduction)

TUTORIALS: Relevant problems given at the end of chapters in the books.

Books

1. Pulse, Digital and Switching Waveforms : J. Millman and H. Taub (Tata Mcgraw Hill)
2. Integrated Electronics : J. Millman and C.C.Halkias(Tata Mcgraw Hill)
3. Linear and Non-linear Circuits : Chua, Desoer and Kuh.
4. Network lines and Fields : J.D. Ryder (Prentice Hall) (1988).
5. Electronic Devices and Circuits : A. Mottershead (Prentice Hall) (1977)

PHYE 214 PHYSICS AND ELECTRONICS LABORATORY (90 hrs.)

Max. Marks: 75

Note:

1. Examination time will be 4 hours. Internal assessment will be based on day to day performance of the students in the laboratory, viva voice of each experiment, regularity in the class, number of experiments performed etc.
2. Students are expected to perform at least 4 experiments each from the sections A and B in each Semester. Experiments performed in odd semester can not be repeated in even semester.

SECTION A

1. To determine Cauchy's constant and resolving power of a given prism.
2. To find the refractive index of a given liquid using a prism spectrometer.
3. To determine the wavelength of sodium light using Newton's rings method.
4. To find the resolving power of a given diffraction grating and Telescope.
5. To determine the wavelength of LASER using diffraction grating and study the diffraction pattern using photodiode.
6. To study the variation of specific rotation of sugar solution with concentration.
7. Determination of mechanical equivalent of heat by Calendar and Barne's constant flow method.
8. To determine the value of Stefan's Constant.
9. To determine thermal conductivity of a bad conductor disc by Lees and Chorlton method.
10. To draw the characteristics of a given triode and to determine the tube parameters.
11. To measure low resistance by Kelvin's double bridge/Carey Foster's bridge. To study the induced emf as a function of the velocity of magnet and to study the phenomenon of electromagnetic damping.
12. To study the variation of magnetic field with distance along the axis of a circular coil-realization of Helmholtz's coils.
13. To determine charge to mass ratio (e/m) of an electron by helical method using CRT.
14. Verification of laws of probability and radioactivity (mechanical analogue).
15. To find the first ionisation potential of mercury.

SECTION B

1. To measure resistivity of insulators by two probe method at different temperatures.
2. To study I-V characteristics of different diodes - Ge, Si, LED and Zener.
3. To study voltage regulation and ripple factor for a half-wave and a full-wave rectifier without and with different filters. Use of Zener diode and IC regulators.

4. To study common emitter and common base characteristics of a given transistor and to determine various parameters.
5. To study the frequency response of CE amplifiers.
6. To study characteristics of a given FET.
7. Use of LDR, LVDT transducers along with electromagnetic switching.
8. Precision timing measurements in Physics experiments using PC based kits.
9. To study response of the RC circuits for different waveforms.
10. To study Amplitude modulation and demodulation
11. Combinational logic: Verification and design of AND, OR, NOT and XOR gates using NAND gates.

Compulsory exercises on fabrication etc. utilizing workshop facility-Wood/Metal/Electronics (Students will submit the report on these exercises which are equivalent to one experiment)

SYLLABUS FOR B.Sc. (HONS. SCHOOL) IN PHYSICS AND ELECTRONICS FOURTH SEMESTER (MAJOR) FOR THE EXAMINATION 2010 AND ONWARD

PHYE 221 : ELECTROMAGNETIC THEORY (40 hrs.)

Max. Marks: 75

Objective: This course has been framed keeping in mind the requirements of the students with respect to the concepts of electromagnetic theory and its applications in physical optics.

Note:

1. The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt **five** questions in all including compulsory question. All Questions will carry equal marks viz. 12.
2. The question paper is expected to contain problems with a weightage of 25 to 40%.
3. The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

I Electromagnetic Waves: Maxwell's equations, wave equation, e.m. waves in a medium with finite ε and μ. Plane waves, Energy flux due to a plane e.m. wave, Wave-impedance of a medium to e.m. waves, e.m. waves in a conducting medium – skin depth and impedance of a conductor. Reflection and Transmission of e.m. waves at the boundary of two dielectric media - impedance and refractive index, e.m. theory of dispersion.

II Polarization: Polarization of plane harmonic waves, linear, circular and elliptical polarization, natural light, production of polarized light, Malus' law, polarization by scattering, Birefringence, quarter-wave and half-wave plates. Double refraction, Nicol prism, analysis of circularly and elliptically polarized light.

III Interference: Light vector, coherence, theory of interference. Young's double slit experiment, Fresnel's Biprism, displacement of fringes, fringes with white light, Stoke's law, interference in thin films, non-reflecting films, Newton's rings and applications, Michelson's interferometer—principle, theory and applications, Fabry-Perot interferometer and etalon, Interference filters.

IV Diffraction: Introduction: Helmholtz Kirchhoff's integral, scalar diffraction theory, Fraunhoffer diffraction: single slit, circular aperture, diffraction grating, Rayleigh's criterion for resolution, resolving power of a diffraction grating, a telescope and a microscope, Fresnel diffraction at a single slit and circular aperture, Cornu spiral, Fresnel's half period zones, zone plate. Explanation of rectilinear propagation.

TUTORIALS : Relevant Problems on the topics covered in the course.

Books :

Text Book of Vibrations and Waves : S.P. Puri (Macmillan India) (2004)
The Physics of Vibrations and Waves : H.J. Pain (Wiley and ELBS, 1976)
Optics : A.K. Ghatak (Tata-McGraw Hill, 1992)
Fundamentals of Optics : F.A. Jenkins and H.E. White (McGraw Hill, 1981)

PHYE 222 THERMODYNAMICS (40 hrs.)

Max. Marks: 75

Note:

1. The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt **five** questions in all including compulsory question. All Questions will carry equal marks viz. 12.
2. The question paper is expected to contain problems with a weightage of 25 to 40%.
3. The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

I Statistical Basis of Entropy : Definition of entropy, change of entropy of a system, third law of thermodynamics. Additive nature of entropy, law of increase of entropy, reversible and irreversible processes and their examples, work done in a reversible process, Increase of entropy in some natural processes, entropy and disorder.

II Entropy and Carnot's Engine : Review of terms used in thermodynamics and of Carnot's Heat Engine, Entropy changes in Carnot's cycle, Carnot's theorem, Thermodynamic temperature scale, Third law, Thermoelectric effect and its thermodynamical analysis, change of entropy along a reversible path in P-V diagram, entropy of a perfect gas, equation of state of an ideal gas, Heat death of Universe.

III Maxwell's Thermodynamic Relations : Perfect differentials in Thermodynamics, Maxwell Relationships, cooling produced by adiabatic expansion, adiabatic compression, adiabatic stretching of wires and thin films, change of internal energy with volume, C_p-C_v, variation of C_v with volume, Clapeyron's equation. Second-order phase transitions. Thermodynamic equilibrium of a heterogeneous system. Application of phase rule to systems with one or more components.

IV Production of Low Temperature : Joule-Thomson effect and its thermodynamic treatment, Joule-Thomson effect for a Vander Waal's gas, Production of very low temperatures by adiabatic demagnetization, Measurement of very low temperatures.

V Specific Heat of Gases : Specific Heats of monoatomic and diatomic gases, Energy due to rotation and its variation, quantization of rotational motion, contribution of rotational energy to specific heat, quantization of vibrational motion, contribution of vibrational energy to specific heat, specific heat of diatomic gases.

TUTORIALS : Relevant Problems given at the end of chapters in books 1 and 2.

Books

1. Statistical Physics, Thermodynamics and Kinetic Theory : V.S. Bhatia (Vishal Pub. Co., Jalandhar,) (2003).
2. A Treatise on Heat : M.N. Saha and B.N. Srivastava (Indian Press, Allahabad, 1972).Thermal Physics : C. Kittel & H. Kroemer (CBS Pub.) (1987).
3. Thermal Physics : S.C. Garg, R.M.Bansal & C.K.Ghosh (Tata McGraw Hill) (2000).

PHYE 223 ELECTRONICS AND NETWORK THEORY-II (40 hrs.)

Max. Marks: 75

Note:

1. The question paper for the final examination will consist of 7 questions including one compulsory question covering the whole syllabus. There will be no choice in the compulsory question. The candidate will attempt **five** questions in all including compulsory question. All Questions will carry equal marks viz. 12.
2. The question paper is expected to contain problems with a weightage of 25 to 40%.
3. The books indicated as recommended books are suggestive of the level of coverage. However, other books may be followed.

Circuit Theory : Miller's theorem, Maximum Power Transfer Theorem, Series and parallel connection of mutually coupled coil, Equivalent circuit of transformer, Impedance transformer and power relationship.

Transistor Amplifiers and Oscillators:

Transistor hybrid model, Analysis of Transistor amplifier circuit using h-parameters, Comparison of transistor amplifier configurations, Simplified common-emitter hybrid model, Common emitter amplifier with an emitter resistance, Classification of amplifiers, distortion in amplifiers, RC-coupled amplifier, Feedback in amplifiers, different types, voltage gain, advantages, emitter follower as –ve feedback circuit, FET amplifier configurations, operational amplifier characteristics and applications.

Barkhausen criterion of sustained oscillations, LC oscillator, Hartley oscillator, RC oscillators, Phase-shift and Wein bridge oscillators.

Logic Circuits: Logic systems, Circuits for OR, AND, NOT gates, transistor switching times, Exclusive OR gate, De Morgan's laws.

Communication: Modulation and detection, AM, FM, Radio wave propagation, Radio transmitter and receiver, TV receiver, Pulse Modulation, Modem.

TUTORIALS: Relevant problems given at the end of chapters in the books.

Books

1. Pulse, Digital and Switching Waveforms : J. Millman and H. Taub (Tata Mcgraw Hill)
2. Integrated Electronics : J. Millman and C.C.Halkias(Tata Mcgraw Hill)
3. Linear and Non-linear Circuits : Chua, Desoer and Kuh.
4. Network lines and Fields : J.D. Ryder (Prentice Hall) (1988).
5. Electronic Devices and Circuits : A. Mottershead (Prentice Hall) (1977)

PHYE 224 PHYSICS AND ELECTRONICS LABORATORY (90 hrs.)

Max. Marks: 10 (Internal)+ 40 (final) + 25 (summer project) = 75

Note:

1. Examination time will be 4 hours. Internal assessment will be based on day to day performance of the students in the laboratory, viva voice of each experiment, regularity in the class, number of experiments performed etc.
2. Students are expected to perform at least 4 experiments each from the sections A and B in each Semester. Experiments performed in odd semester can not be repeated in even semester.
3. Summer project will be based on electronics gadgets and each student will be give seminar on the project work. Seminar and project work will be of 25 marks.

SECTION A

1. To determine Cauchy's constant and resolving power of a given prism.
2. To find the refractive index of a given liquid using a prism spectrometer.
3. To determine the wavelength of sodium light using Newton's rings method.
4. To find the resolving power of a given diffraction grating and Telescope.
5. To determine the wavelength of LASER using diffraction grating and study the diffraction pattern using photodiode.
6. To study the variation of specific rotation of sugar solution with concentration.
7. Determination of mechanical equivalent of heat by Calendar and Barne's constant flow method.
8. To determine the value of Stefan's Constant.
9. To determine thermal conductivity of a bad conductor disc by Lees and Chorlton method.
10. To draw the characteristics of a given triode and to determine the tube parameters.

11. To measure low resistance by Kelvin's double bridge/Carey Foster's bridge. To study the induced emf as a function of the velocity of magnet and to study the phenomenon of electromagnetic damping.
12. To study the variation of magnetic field with distance along the axis of a circular coil-realization of Helmholtz's coils.
13. To determine charge to mass ratio (e/m) of an electron by helical method using CRT.
14. Verification of laws of probability and radioactivity (mechanical analogue).
15. To find the first ionisation potential of mercury.

SECTION B

1. To measure resistivity of insulators by two probe method at different temperatures.
2. To study I-V characteristics of different diodes - Ge, Si, LED and Zener.
3. To study voltage regulation and ripple factor for a half-wave and a full-wave rectifier without and with different filters. Use of Zener diode and IC regulators.
4. To study common emitter and common base characteristics of a given transistor and to determine various parameters.
5. To study the frequency response of CE amplifiers.
6. To study characteristics of a given FET.
7. Use of LDR, LVDT transducers along with electromagnetic switching.
8. Precision timing measurements in Physics experiments using PC based kits.
9. To study response of the RC circuits for different waveforms.
10. To study Amplitude modulation and demodulation
11. Combinational logic: Verification and design of AND, OR, NOT and XOR gates using NAND gates.

Compulsory exercises on fabrication etc. utilizing workshop facility-Wood/Metal/Electronics (Students will submit the report on these exercises which are equivalent to one experiment)