KURUKSHETRA UNIVERSITY, KURUKSHETRA

REVISED SCHEME OF EXAMS. & SYLLABI FOR B.SC. I (1ST AND 2ND SEM) EFFECTIVE FROM SESSION 2011-2012

Scheme of Examination:

Semester	Paper code and nomenclature of the papers	Marks Theory	Time
1st	PH-101 Classical Mechanics and theory of relativity	40+10* =50	3 Hours
	PH-102 Electricity Magnetism and Electromagnetic Theory	40+10* =50	3 Hours
2nd	PH-201 Properties of Matter and Kinetic Theory of Gases	40+10* =50	3 Hours
	PH -202 Semiconductor Devices	40+10* =50	3 Hours
	Practical	50+50=100	3 + 3 Hours
	Total Marks	300	

* Internal Assessment.

B.Sc.-1 (Physics)
Semester – I

Physics- PH-101

Paper – I: Classical Mechanics and Theory of Relativity

Max. Marks: 40
Internal Assessment: 10
Time: 3 hours

Note:-

1. Nine Questions will be set in total.
2. Question number 1 will be compulsory and will be based on the conceptual aspects of entire syllabus. This question may have five parts and the answer should be in brief but not in Yes/ No.
3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.
4. 20% numerical problems are to be set.
5. Use of scientific (non-programmable) calculator is allowed.

Unit 1: Basic concepts of Classical mechanics

Mechanics of single and system of particles, Conversion law of linear momentum, Angular momentum and mechanical energy for a particle and a system of particles, Centre of Mass and equation of motion, Constrained Motion.

Unit2: Generalized Notations

Degrees of freedom and Generalized coordinates, Transformation equations, Generalized Displacement, Velocity, Acceleration, Momentum, Force and Potential, Hamilton's variational principle, Lagrange's equation of motion from Hamilton's principle, Linear Harmonic oscillator, Simple pendulum, Atwood's machine.

Unit 3: Theory of relativity

Frame of reference, limitation of Newton's law of motion, Inertial frame of reference, Galilean transformation, Frame of reference with linear acceleration, Classical relativity-Galilean invariance, Transformation equation for a frame of reference- inclined to an

inertial frame and Rotating frame of reference, Non-inertial frames-The accelerated frame
of reference and rotating frame of reference , Effect of centrifugal and coriolis forces due to Earth's rotation, Fundamental frame of reference, Michelson- Morley's experiment, concept of Einstein's relativity.

Unit 4: Applications of theory of relativity

Special theory of relativity, Lorentz co-ordinate and physical significance of Lorentz invariance, Length Contraction, Time Dilation, Twin Paradox, Velocity addition theorem, Variation of mass with velocity, Mass energy equivalence, Transformation of relativistic momentum and energy, relation between relativistic momentum and energy, Mass, velocity, momentum and energy of zero rest mass.

Reference:

1. Classical Mechanics by H. Goldstien (2^{nd} Edition).
2. Berkely Physics Course. Vol. 1. Mechanics by E.M.Purcell
3. Concepts of Modern Physics by Arthur Beiser
4. Mechanics by D.S. Mathur

B.Sc.-1(Physics)

Semester – I

Physics- PH-102

Paper – II: Electricity, Magnetism and Electromagnetic theory

Max. Marks: 40
Internal Assessment: 10
Time: 3 hours

Note:-

1. Nine Questions will be set in total.
2. Question number 1 will be compulsory and will be based on the conceptual aspects of entire syllabus. This question may have five parts and the answer should be in brief but not in Yes/ No.
3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.
4. 20% numerical problems are to be set.
5. Use of scientific (non-programmable) calculator is allowed.

Unit I: Vector background and Electric field

Gradient of a scalar and its physical significance, Line, Surface and Volume integrals of a vector and their physical significance, Flux of a vector field, Divergence and curl of a vector and their physical significance, Gauss's divergence theorem, Stoke's theorem. Derivation of electric field E from potential as gradient, Derivation of Laplace and Poisson equations, Electric flux, Gauss's Law, Mechanical force of charged surface, Energy per unit volume.

Unit 2: Magnetism

Magnetic induction, Magnetic flux, Solenoidal nature of vector field of induction, properties of $\vec{B}$ (i) $\vec{\nabla}.\vec{B} = 0$, (ii) $\vec{\nabla} \times \vec{B} = \mu\vec{j}$, Electronic theory of dia and paramagnetism, Domain theory of ferromagnetism (Langevin's theory), Cycle of magnetization- hystresis loop (Energy dissipation, Hystresis loss and importance of Hystresis Curve)

Unit 3: Electromagnetism

Maxwell equations and their derivations, Displacement current, Vector and Scalar potentials, Boundary conditions at interface between two different media, Propagation of electromagnetic wave (Basic idea, no derivation), Poynting vector and Poynting theorem.

Unit 4: A. C. Analysis

A.C. circuit analysis using complex variable with (a) Capacitance and Resistance (CR) (b) Resistance and Inductance (LR) (c) Capacitance and Inductance (LC) and (d) Capacitance, Inductance and Resistance (LCR), Series and parallel resonance circuit, Quality factor (sharpness of resonance).

Reference:

1. Electricity and Magnetism by Reitz and Milford (Prentice Hall of India).
2. Electricity and Magnetism by A.S. Mahajan and A.A. Rangwala (Tata McGrawHill)

B.Sc.-1(Physics)
Semester – II

Physics- PH-201

Paper –III: Properties of Matter and Kinetic Theory of Gases

Max. Marks: 40
Internal Assessment: 10
Time: 3 hours

Note:-

1. Nine Questions will be set in total
2. Question number 1 will be compulsory and will be based on the conceptual aspects of entire syllabus. This question may have five parts and the answer should be in brief but not in Yes/ No.

3. For more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts
4. 20% numerical problems are to be set.
5. Use of scientific (non-programmable) calculator is allowed.

Unit I: Moment of inertia

Rotation of rigid body, Moment of inertial, Torque, angular momentum, Kinetic Energy of rotation. Theorem of perpendicular and parallel axes (with proof), Moment of inertia of solid sphere, hollow sphere, spherical shell, solid cylinder, hollow cylinder and solid bar of rectangular cross–section, Fly wheel, Moment of inertia of an irregular body, Acceleration of a body rolling down on an inclined plane.

Unit 2: Elasticity

Elasticity, Stress and Strain, Hook's law, Elastic constant and their relations, Poisson's ratio, Torsion of cylinder and twisting couple, Determination of coefficient of modulus of rigidity for the material of wire by Maxwell's needle, Bending of beam (Bending moment and its magnitude), Cantilever and Centrally loaded beam, Determination of Young's modulus for the material of the beam and Elastic constants for the material of the wire by Searle's method.

Unit 3: Kinetic theory of gases-I

Assumption of Kinetic theory of gases, pressure of an ideal gas (with derivation), Kinetic interpretation of Temperature, Ideal Gas equation, Degree of freedom, Law of equipartition of energy and its application for specific heat of gases, Real gases, Vander wall's equation, Brownian motion(Qualitative)

Unit 4: Kinetic theory of gases-II

Maxwell's distribution of speed and velocities (derivation required), Experimental verification of Maxwell's law of speed distribution: most probable speed, average and r.m.s. speed, Mean free path, Transport of energy and momentum, Diffusion of gases.

Reference:1. Properties of Matter by D.S. Mathur.

2. Heat and Thermodynamics (5^{th} Edition) by Mark W. Zermansky.

B.Sc.-1(Physics)
Semester – II

Physics-PH-202

Paper – IV: Semiconductor Devices

Max. Marks: 40
Internal Assessment: 10

Time: 3 hours

Note:-

1. Nine Questions will be set in total.
2. Question number 1 will be compulsory and will be based on the conceptual aspects of entire syllabus. This question may have five parts and the answer should be in brief but not in Yes/ No.
3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts.
4. 20% numerical problems are to be set.
5. Use of scientific (non-programmable) calculator is allowed.

Unit I: Semiconductors

Energy bands in solids, Intrinsic and extrinsic semiconductors, carrier mobility and electrical resistivity of semiconductors, Hall effect, p-n junction diode and their characteristics, Zener and Avalanche breakdown, Zener diode, Zener diode as a voltage regulator. Light emitting diodes (LED), Photoconduction in semiconductors, Photodiode, Solar Cell, p-n junction as a rectifier, half wave and full wave rectifiers (with derivation), filters (series inductor, shunt capacitance, L-section or choke, π and R.C. filter circuits).

Unit 2: Transistors

Junction transistors, Working of NPN and PNP transistors, Three configurations of transistor (C-B, C-E, C-C modes),Common base, common emitter and common collector characteristics of transistor, Constants of a transistor and their relation, Advantages and disadvantages of C-E configuration. D.C. load line .Transistor biasing; various methods of transistor biasing and stabilization.

Unit 3: Transistor Amplifiers

Amplifiers, Classification of amplifiers, common base and common emitter amplifiers, coupling of amplifiers, various methods of coupling, Resistance- Capacitance (RC) coupled amplifier (two stage, concept of band width, no derivation), Feedback in amplifiers, advantages of negative feedback, emitter follower, distortion in amplifiers.

Unit 4: Oscillators

Oscillators, Principle of oscillation, classification of oscillators, Condition for self sustained oscillation: Barkhausen criterion for oscillation, Tuned collector common emitter oscillator, Hartley oscillator, C.R.O. (Principle and Working).

Reference:

1. Basic Electronics and Linear Circuits by N.N.Bhargava. D.C. Kulshreshtha and S.C.Gupta (TITI CHD).
2. Solid State Electronics by J.P. Agarwal, Amit Agarwal (Pragati Prakashan Meerut).
3. Electronics Fundamentals and Applications by J.D. Ryder (Prentice Hall India)
4. Solid State Electronics by B.L.Theraja

B.Sc.-I (Physics)
Semester – II

Paper – : Physics lab Practicals

Max. Marks: 100
Time: 3 + 3 hours
(on two days)

Special Note:-

1. Do any eight experiments from each Section.
2. The students are required to calculate the error involved in a particular experiment.

Note:-

1. The Practical examination will be held in two sessions of 3 hours each (first session I the evening of first day and the second session in the morning of the next day).
2. Distribution of Marks:

Experiments	25+25	=	50 Marks
Viva-voce	15+15	=	30 Marks
Lab. Record			20 Marks
Total			**100 Marks**

For giving marks under Lab. Record each college will maintain practical assessment record by using the following procedure:-

I. Each student has to perform a minimum number of experiments prescribed in the syllabus.

II. After the completion of a practical the teacher concerned will check the note book and conduct the Viva – voce of each student to find out how much concepts related to the theoretical and experimental part of the experiment he/ she has understood. According to his/her performance marks will be recorded on their practical note-book. These marks will constitute the lab. Record.

III. To compute the final marks for lab. Record, a separate register will be maintained. Each student will be assigned separate page on this register. On this page the marks obtained by the student in different practical's will be entered. This record will be signed by the concerned teacher.

IV. The lab. Record register will be presented to eth external practical examiners fro Lab. Record marks. These external examiners will verify the record randomly.

Section: A

1. Moment of Inertia of a fly-wheel.
2. M.I. of an irregular body using a torsion pendulum.
3. Surface tension by Jeager's Method.
4. Young's Modulus by bending of beam.
5. Modulus of rigidity by Maxell's needle.
6. Elastic constant by Scarle's method.
7. Viscosity of water by its flow through a uniform capillary tube.
8. 'g' by Bar pendulum.
9. E.C.E. of hydrogen using an Ammeter.
10. Calibration of a thermocouple by Potentiometer.

Section: B

11. Low resistance by Carey Foster's bridge with calibration.
12. Determination of Impedance of an A.C. circuit and its verification.
13. Frequency of A.C. mains by Sonometer using an electromagnet.

14. Frequency of A. C. mains by Sonometer using an electromagnet.
15. High resistance by substitution method.
16. To draw forward and reverse bias characteristics of a semiconductor diode.
17. Zener Diode voltage regulation characteristics.
18. Verification of inverse square law by photo-cell.
19. To study the characteristics of a solar cell.

References:

1 Worshnop and Flint, Advanced Practical Physics
2 Nelkon M and Ogborn, Advanced Level Practical Physics, Heinemann Education Bookd Ltd, New Delhi
3 Srivastava S S and Gupta M K, Experiments in Electronics, Atma Ran & Sons, Delhi
4 Gupta S L and Kumar V, Practical Physics, Pragati Prakashan, Meerut.

KURUKSHETRA UNIVERSITY, KURUKSHETRA

REVISED SCHEME OF EXAMS. & SYLLABI FOR B.SC. II (3^{RD} AND 4^{TH} SEM)
EFFECTIVE FROM SESSION 2012-2013

Scheme of Examination:

Semester	Paper code and nomenclature of the papers	Marks Theory	Time
3rd	PH -301 Computer Programming and Thermodynamics	40+10* =50	3 Hours
	PH- 302 Wave and Optics -I	40+10* =50	3 Hours
4th	PH - 401 Statistical Physics	40+10* =50	3 Hours
	PH - 402 Wave and Optics II	40+10* =50	3 Hours
	Practical	50+50=100	3 + 3 Hours
	Total Marks	300	

* Internal Assessment.

B.Sc.-II(Physics)
Semester-III

Physics- PH-301

Paper V: Computer Programming and Thermodynamics

Max. Marks: 40
Internal Assessment: 10
Time: 3 Hours

Note:
1. The syllabus is divided into 4 units. 9 questions will be set.
2. Question no 1 will be compulsory, it contains 6 parts (form all the four units) and answer should be brief but not in yes / no.
3. Four more questions are to be attempted, selecting one question from each unit. Questions 2-9 may contain two or more parts. All questions carry equal marks
4. 20% numerical problems are to be set.
5. Use of scientific (non-programmable) calculator is allowed.

UNIT-1: Computer Programming

Computer organization, Binary representation, Algorithm development, Flow charts and their interpretation. FORTRAN Preliminaries: Integer and floating point arithmetic expression, built in functions, executable and non-executable statements, input and output statements, Formats, IF, DO and GO TO statements, Dimension arrays, statement function and function subprogram.

UNIT –2: Applications of FORTRAN programming

Algorithm, Flow Chart and Programming for Print out of natural numbers, Range of the set of given numbers, Ascending and descending order, Mean and standard deviation, Least square fitting of curve, Roots of quadratic equation, Product of two matrices, Numerical integration (Trapezoidal rule and Simpson 1/3 rule) .

UNIT-3: Thermodynamics-I

Thermodynamic system and Zeroth law of thermodynamics. First law of thermodynamics and its limitations, reversible and irreversible process. Second law of thermodynamics and its significance, Carnot theorem, Absolute scale of temperature, Absolute Zero and magnitude of each division on work scale and perfect gas scale, Joule's free expansion, , Joule Thomson effect, Joule-Thomson (Porous plug) experiment, conclusions and explanation, analytical treatment of Joule Thomson effect. Entropy, calculations of entropy of reversible and irreversible process , T-S diagram, entropy of a perfect gas, Nernst heat law(third law of thermodynamics), Liquefaction of gases, (oxygen, air, hydrogen and helium), Solidification of He below 4K, Cooling by adiabatic demagnetization.

UNIT-4: Thermodynamics-II

Derivation of Clausius-Clapeyron and Clausius latent heat equation and their significance,specific heat of saturated vapours,phase diagrame and triple point of a substance, development of Maxwell thermodynamical relations. Thermodynamical functions: Internal energy (U), Helmholtz function (F), Enthalpy (H), Gibbs function (G) and the relations between them, derivation of Maxwell thermodynamical relations from thermodynamical functions,Application of Maxwell relations: relations between two specific heats of gas, Derivation of Clausius-Clapeyron and Clausius equation,variation of intrinsic energy with volume for (i) perfect gas (ii)Vanderwall gas (iii)solids and liquids , derivation of Stefans law, adiabatic compression and expention of gas & deduction of theory of Joule Thomson effect.

References:

1 Ian C and Malcon C, Interactive FORTRAN 77, Affiliated East West Press Pvt Ltd, New Delhi
2 Rajaraman V, Computer Programming in FORTRAN 77, Prentice-Hall of India Pvt Ltd, New Delhi.
3 Suresh C, Computer Applications in Physics, Narosa ublishing House, New Delhi
4 Roy S K, Thermal Physics and Statistical Mechanics, New Age International Publishers, New Delhi
5 Sharma J K and Sarkar K K, Thermodynamics and Statistical Physics, Himalaya Publishing House, Bambay
6 Stowe Keith, Introduction to Thermodynamics and its Applications, University press (India) Pvt Ltd, Hyderabad

7 Infelta Pierre P. Introductory Thermodynamics Publisher: BrownWalker Press
8 Johnson J. K, Fundamentals of Thermodynamics University of Pittsburgh 2009
9 Jefferson Tester, Michael Modell, Thermodynamics and Its Applications 3rd Edition
10 Thomas Engel, Philip Reid, Thermodynamics, Statistical Thermodynamics, & Kinetics 2nd Edition

B.Sc. –II (Physics)
Semester-III

Physics- PH-302

Paper VI: Wave and optics I **Max. Marks: 40**
Iternal Assessment: 10
Time: 3 hours

Note:

1. The syllabus is divided into 4 units. 9 questions will be set.
2. Question no 1 will be compulsory, it contains 6 parts (form all the four units) and answer should be brief but not in yes / no.
3. Four more questions are to be attempted, selecting one question from each unit. Questions 2-9 may contain two or more parts .All questions carry equal marks.
4. 20% numerical problems are to be set.
5. Use of scientific (non-programmable) calculator is allowed.

Unit-1: Interference I

Interference by Division of Wave front: Young's double slit experiment, Coherence, Conditions of interference, Fresnel's biprism and its applications to determine the wavelength of sodium light and thickness of a mica sheet, Lloyd's mirror, Difference between Bi-prism and Llyod mirror fringes, phase change on reflection.

Unit 2: Interference II
Interference by Division of Amplitude: Plane parallel thin film, production of colors in thin films, classification of fringes in films, Interference due to transmitted light and reflected light, wedge shaped film, Newton's rings, Interferometer: Michelson's interferometer and its applications to (i) Standardization of a meter (ii) determination of wavelength.

Unit- 3: Diffraction I
Fresnel's diffraction: Fresnel's assumptions and half period zones, rectilinear propagation of light, zone plate, diffraction at a straight edge, rectangular slit and circular aperture, diffraction due to a narrow slit and wire.

Unit -4: Diffraction II
Fraunhoffer diffraction: single-slit diffraction, double-slit diffraction, N-slit diffraction, plane transmission granting spectrum, dispersive power of grating, limit of resolution, Rayleigh's criterion, resolving power of telescope and a grating. Differences between prism and grating spectra.

References

1 Hecht, Optics, Pearson Education, New Delhi
2 Brooker G, Modern Classical Optics, Ane Books Pvt Ltd, New Delhi
3 Chaudhuri R N, Waves and Oscillations, New Age International Publishers, New Delhi
4 Khandelwal D P, Text Book of Optics and Atomic Physics, Himalaya Publishing House, Bombay
5 Subrahmanyam N, Lal B, Avadhanulu M N, A Text Book of Optics, S Chand & Co, New Delhi
6 Barton A w, atext Book on Light, Longmans Green & Co London.
7 Longhurst R S, Geometrical and Physical Optics, University Press India Pvt.Ltd. Hyd.

B.Sc.- II (Physics)
Semester-IV

Physics- PH-401

Paper VII: Statistical Physics

Max.Marks:40
Internal assessment:10
Time:3 Hours

Note:
1. The syllabus is divided into 4 units. 9 questions will be set.
2. Question no 1 will be compulsory, it contains 6 parts (form all the four units) and answer should be brief but not in yes / no.
3. Four more questions are to be attempted, selecting one question from each unit.

Questions 2-9 may contain two or more parts. All questions carry equal marks.

4. 20% numerical problems are to be set.
5. Use of scientific (non-programmable) calculator is allowed.

Unit –I: Statistical Physics I

Microscopic and Macroscopic systems, events-mutually exclusive, dependent and independent. Probability, statistical probability, A- priori Probability and relation between them, probability theorems, some probability considerations, combinations possessing maximum probability, combination possessing minimum probability, Tossing of 2,3 and any number of Coins, Permutations and combinations, distributions of N (for N= 2,3,4) distinguishable and indistinguishable particles in two boxes of equal size, Micro and Macro states, Thermodynamical probability, Constraints and Accessible states, Statistical fluctuations, general distribution of distinguishable particles in compartments of different sizes, Condition of equilibrium between two systems in thermal contact-- β parameter, Entropy and Probability (Boltzman's relation).

Unit –II: Statistical Physics II

Postulates of statistical physics, Phase space, Division of Phase space into cells, three kinds of statistics, basic approach in three statistics. M. B. statistics applied to an ideal gas in equilibrium- energy distribution law (including evaluation of σ and β) , speed distribution law & velocity distribution law. Expression for average speed, r.m.s. speed, average velocity, r. m. s. velocity, most probable energy & mean energy for Maxwellian distribution.

Unit-III: Quantum Statistics

Need for Quantum Statistics: Bose-Einstein energy distribution law, Application of B.E. statistics to Planck's radiation law B.E. gas, Degeneracy and B.E. Condensation, Fermi-Dirac energy distribution law, F.D. gas and Degeneracy, Fermi energy and Fermi temperature, Fermi Dirac energy distribution law, Fermi Dirac gas and degeneracy, Fermi energy and Fermi temperature, Fermi Dirac energy distribution law for electron gas in metals, Zero point energy, Zero point pressure and average speed (at 0 K) of electron gas, Specific heat anomaly of metals and its solution. M.B. distribution as a limiting case of B.E. and F.D. distributions, Comparison of three statistics.

Unit-IV: Theory of Specific Heat of Solids

Dulong and Petit law. Derivation of Dulong and Petit law from classical physics. Specific heat at low temperature, Einstein theory of specific heat, Criticism of Einstein theory, Debye model of specific heat of solids, success and shortcomings of Debye theory, comparison of Einstein and Debye theories.

References:

1. Prakash S and Agarwal J P, Statistical Mechanics, Kedar Nath Ram Nath & co, Meerur
2. ReifF. statistical Physics, Berleley Physics Course Volume 5, Mc Graw Hill Book Co Ltd, New Delhi
3. Mc Quarrie D A. Statistical Mechanics, Viva Books Pvt Ltd, New Delhi.
4. Ashley Cmter (August 1999), Classical and Statistical Thermodynamics .

5.Richard Fitzpatrick, Thermodynamics and Statistical Mechanics: An intermediate level course Lulu.com,2007

B.Sc.-II
Semester-IV

Physics-PH- 402

Paper VIII: Wave and Optics II

Max. Marks:40
Internal Assessment: 10
Time: 3 Hours

Note:

1. The syllabus is divided into 4 units. 9 questions will be set.
2. Question no 1 will be compulsory, it contains 6 parts (form all the four units) and answer should be brief but not in yes / no.
3. Four more questions are to be attempted, selecting one question from each unit. Questions 2-9 may contain two or more parts. All questions carry equal marks.
4. 20% numerical problems are to be set.
5. Use of scientific (non-programmable) calculator is allowed.

Unit-1: Polarization

Polarization: Polarisation by reflection, refraction and scattering, Malus Law, Phenomenon of double refraction, Huygen's wave theory of double refraction (Normal and oblique incidence), Analysis of polarized Light. Nicol prism, Quarter wave plate and half wave plate, production and detection of (i) Plane polarized light (ii) Circularly polarized light and (iii) Elliptically polarized light. Optical activity, Fresnel's theory of optical rotation, Specific rotation, Polarimeters (half shade and Biquartz).

Unit-II: Fourier analysis

Fourier theorem and Fourier series, evaluation of Fourier coefficient, importance and limitations of Fourier theorem, even and odd functions, Fourier series of functions f(x) between (i) 0 to 2pi, (ii) –pi to pi, (iii) 0 to pi, (iv) –L to L, complex form of Fourier series, Application of Fourier theorem for analysis of complex waves: solution of triangular and rectangular waves , half and full wave rectifier outputs, Parseval identity for Fourier Series, Fourier integrals.

Unit III: Fourier transforms

Fourier transforms and its properties, Application of Fourier transform (i) for evaluation of integrals, (ii) for solution of ordinary differential equations, (iii) to the following functions:

1. $f(x)= e^{-x^2/2}$

2. $f(x) = \begin{cases} 1 & |X|<a \end{cases}$

0 |X |>a

Geometrical Optics I

Matrix methods in paraxial optics, effects of translation and refraction, derivation of thin lens and thick lens formulae, unit plane, nodal planes, system of thin lenses.

Unit-IV: Geometrical Optics II

Chromatic, spherical, coma, astigmatism and distortion aberrations and their remedies.

Fiber Optics

Optical fiber, Critical angle of propagation, Mode of Propagation, Acceptance angle, Fractional refractive index change, Numerical aperture, Types of optics fiber, Normalized frequency, Pulse dispersion, Attenuation, Applications, Fiber optic Communication, Advantages.

References

1 Born M and Wolf E, Principles of Optics, Pergaman Press
2 Jenkins and white, Fundamentals of Optics, McGraw Hill Book Co Ltd, New Delhi
3 Moller K D, Optics, University Science Books, Mill ally California
4 Tolansky, An Introduction to Interferometery, John Wiley & Sons, New Delhi
5 Shurcliff, Polarized Light Production and Use, Harward University Press, Cambridge, M A (USA)
6 Arora C L, Refresher Course in Physics Vol II, S Chand and Co, New Delhi.

B.Sc.-II

Physics Practicals
Paper- (Physics lab Practicals)

Max. Marks: 100 Time: 3 + 3 Hours (in two days)

SPECIAL NOTES

1. Do any eight experiments from each Section.
2. The students are required to calculate the error involved in a particular experiment.

Note:-

1 The Practical examination will be held in two sessions of 3 hours each (first session in the evening of first day and the second session in the morning of the next day).

2. Distribution of Marks:

Experiments (2):	25 + 25 =	50
Viva-voce	15 + 15 =	30
Lab. Record	10 + 10 =	20
Total		= 100

For giving marks under Lab. Record, each college will maintain practical assessment record by using the following procedure:-

I. Each student has to perform a minimum number of experiments prescribed in the syllabus.

II. After the completion of a practical, the teacher concerned will check the note-book and conduct the viva-voce of each student to find out how much concepts related to the theoretical and experimental part of the experiment he/she has understood. According to his/her performance marks will be recorded on their practical note-book. These marks will constitute the Lab. Record.

III. To complete the final marks for Lab. Record a separate register for each class of B.Sc. will be maintained. The student will be assigned a separate page on this register. On this page the marks obtained by the student in different practicals will be recorded. While taking the final average, the total marks obtained will be divided by the total number of required practicals, instead of the number of practicals performed by the student. This record will be signed by the concerned teacher.

IV. The Lab. record register will be presented to the external practical examiners for lab. record marks. The external examiners will verify the record randomly.

Section-A

1. To measure the (a) area of a window
   (b) height of an inaccessible object.
2. Refractive index and dispersive power of a prism material by spectrometer.
3. To draw a graph between wave length and minimum deviation for various lines from a Mercury discharge source.
4. Determination of wave length of Na light and the number of lines per centimeter using a diffraction grating.
5. Wave length by Newton's Rings.
6. Resolving power of a telescope.
7. Comparison of Illuminating Powers by a Photometer.
8. Measurement of (a) Specific rotation (b) concentration of sugar solution using polarimeter.
9. Ordinary and extra ordinary refractive indices for calcite or quartz.
10. To find the equivalent focal length of a lens system by nodal slide assembly.

Section -B

It will contain two parts (i) Electronics and (ii) Computer experiment.
Students have to perform a minimum of four experiments from each part.

(i) Electronics.

11. To draw common base and common emitter characteristics of a transistor and

calculate transistor characteristics parameters.

12. To study the ripple factor in a d.c. power supply.
13. Study of Hartley oscillator (calibration of gang condenser).
14. To find out the frequency of a tuning fork by Melde's experiment.
15. Study of series and parallel resonance circuits.
16. Electronic Voltmeter measurement of peak, average & R.M.S. value of signal.
17. Study of voltage doubler and trippler circuits.

(ii) Computer Experiments.

18. To print out all natural (even/odd) numbers between given limits using computer.
19. To find maximum, minimum and range of a given set of numbers using computer.
20 To evaluate sum of finite series.
21. Find the roots of a quadratic equation.
22. To find integration of a definite integral by trapezoidal rule.
23. To find the area of a triangle, sphere and cylinder.
24. Given values for a, b, c and d and a set of values for the variable x evaluate the function defined by.

$f(x) = ax2 + bx + c$ if $x < d$
$f(x) = 0$ if $x = d$
$f(x) = ax2 + bx - c$ if $x > d$

For each value of x and print the value of x and f(x). Write a program for an arbitrary number of x values.

References:

1 Worshnop and Flint, Advanced Practical Physics
2 Nelkon M and Ogborn, Advanced Level Practical Physics, Heinemann Education Bookd Ltd, New Delhi
3 Srivastava S S and Gupta M K, Experiments in Electronics, Atma Ran & Sons, Delhi
4 Gupta S L and Kumar V, Practical Physics, Pragati Prakashan, Meerut.

KURUKSHETRA UNIVERSITY, KURUKSHETRA
REVISED SCHEME OF EXAMS. & SYLLABI FOR
B.SC. III (5^{TH} AND 6^{TH} SEM)
EFFECTIVE FROM SESSION 2013-2014

Scheme of Examination

Semester	Paper code and nomenclature of the Papers	Marks	Time
5^{th}	PH - 501 Quantum and Laser Physics	40+10* =50	3 Hours
	PH -502 Nuclear Physics	40+10* =50	3 Hours
6^{th}	PH -601 Solid State and Nano Physics	40+10* =50	3 Hours
	PH - 602 Atomic and Molecular Spectroscopy	40+10* =50	3 Hours
	Physics Lab	50+50=100	3 + 3 Hours
	Total Marks	300	

*Internal assesment

B.Sc.-III (Physics)
Semester – V

Physics – PH-501

Paper – IX : Quantum and Laser Physics

Max. Marks: 40
Internal Assessment: 10
Time: 3 hours

Note:-

1. Nine Questions will be set in total
2. Question number 1 will be compulsory and will be based on the conceptual aspects of entire syllabus. This question may have five parts and the answer should be in brief but not in Yes/ No.
3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts.
4. 20% numerical problems are to be set.
5. Use of scientific (non-programmable) calculator is allowed.

Unit I: Origin quantum physics (Experimental basis)

Overview, scale of quantum physics, boundary between classical and quantum phenomena, Photon, Photoelectric effect, Compton effect (theory and result), Frank-Hertz experiment, de-Broglie hypothesis. Davisson and Germer experiment, ·G.P. Thomson experiment. Phase velocity, group velocity and their relation. Heisenberg's uncertainty principle. Time energy and angular momentum, position uncertainty. Uncertainty principle from de Broglie wave. (Wave-particle duality). Gamma Ray Microscope, Electron diffraction from a slit. Derivation of 1-D time-dependent Schrodinger wave equation (subject to force, free particle). Time-independent Schrodinger wave equation, eigen values, eigen functions, wave functions and its significance. Orthogonality and Normalization of function, concept of observer and operator. Expectation values of dynamical quantities, probability current density

Unit II: Application of Schrodinger wave equation:

(i) Free particle in one-dimensional box (solution of Schrodinger wave equation, eigen functions, eigen values, quantization of energy and momentum, nodes and anti nodes, zero point energy).

(ii) One dimensional step potential E > Vo (Reflection and Transmission coefficient)

(iii) One dimensional step potential E < Vo (penetration depth calculation).

(iv) One dimensional potential barrier, E > Vo (Reflection and Transmission coefficient)

(v) One-dimensional potential barrier, E < Vo (penetration or tunneling coefficient).

(vi) Solution of Schrodinger equation for harmonic oscillator (quantization of energy, Zero-point energy, wave equation for ground state and excited states).

Unit III: Laser Physics –I

Absorption and emission of radiation, Main features of a laser: Directionality, high intensity, high degree of coherence, spatial and temporal coherence, Einstein's coefficients and possibility of amplification, momentum transfer, life time of a level, kinetics of optical absorption ((two and three level rate equation, Fuchbauer landerburg formula).population inversion: A necessary condition for light amplification, resonance cavity, laser pumping, Threshold condition for laser emission, line broadening mechanism, homogeneous and inhomogeneous line broadening (natural, collision and Doppler broadening).

Unit IV: Laser Physics – II

He-Ne laser and RUBY laser (Principle, Construction and working), Optical properties of semiconductor, Semiconductor laser (Principle, Construction and working), Applications of lasers in the field of medicine and industry.

References:

1 L I Schiff, Quantum Mechanics
2 Bransden B H and Joachain C J, Quantum Mechanics (2000), Pearson Education, New Delhi
3 Liboff R L, Introductory Quantum Mechanics
4 Eisberg R M and Resnick R, Quantum Physics of Atoms Molecules, Solids, Nuclei and Particles, Wiley Eastern Ltd, New Delhi
5 Verdeyen J T, Laser Electronics PHI, New Delhi
6 Thorenton S T and Rex A, Modern Physics, (2007) Cengage Learning, New Delhi
7 Taylor J R, Zafiratos C D and Dubson M A, Modern Physics, 2nd Ed (2004), PHI, New Delhi
8 Laud B B, Laser Physics

B.Sc.-III (Physics)
Semester – V

Physics – PH-502

Paper – X : Nuclear Physics

Max. Marks: 40
Internal Assessment: 10
Time: 3 hours

Note:-

1. Nine Questions will be set in total.
2. Question number 1 will be compulsory and will be based on the conceptual aspects of entire syllabus. This question may have five parts and the answer should be in brief but not in Yes/ No.
3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.
4. 20% numerical problems are to be set.
5. Use of scientific (non-programmable) calculator is allowed.

Unit I: Nuclear Structure and Properties of Nuclei

Nuclear composition (p-e and p-n hypotheses), Nuclear properties; Nuclear size, spin, parity, statistics, magnetic dipole moment, quadruple moment (shape concept).

Determination of mass by Bain-Bridge, Bain-Bridge and Jordan mass spectrograph. Determination of charge by Mosley Law. Determination of size of nuclei by Rutherford Back Scattering. mass and binding energy, systematic of nuclear binding energy, nuclear stability

Unit II: Nuclear Radiation decay Processes

Alpha-disintegration and its theory. Energetics of alpha-decay, Origin of continuous beta spectrum (neutrino hypothesis), types of beta-decay and energetics of beta-decay. Nature of gamma rays, Energetics of gamma rays.

Radiation interaction

Interaction of heavy charged particles (Alpha particles); Energy loss of heavy charged particle (idea of Bethe formula, no derivation), Range and straggling of alpha particles. Geiger-Nuttal law. Interaction of light charged particle (Beta-particle), Energy loss of beta-particles (ionization), Range of electrons, absorption of beta-particles. Interaction of Gamma Ray; Passage of Gamma radiations through matter (Photoelectric, Compton and pair production effect) electron-positron annihilation. Absorption of Gamma rays (Mass attenuation coefficient) and its application.

Unit III: Nuclear Accelerators

Linear accelerator, Tendem accelerator, Cyclotron and Betatron accelerators.

Nuclear Radiation Detectors.

Gas filled counters; Ionization chamber, proportional counter, G.M. Counter (detailed study), Scintillation counter and semiconductor detector.

Unit IV:

Nuclear reactions.

Nuclear reactions, Elastic scattering, Inelastic scattering, Nuclear disintegration, Photonuclear reaction, Radiative capture, Direct reaction, Heavy ion reactions and spallation Reactions. Conservation laws, Q-value and reaction threshold**.**

Nuclear Reactors.

Nuclear Reactors, General aspects of Reactor Design. Nuclear fission and fusion reactors, (Principle, construction, working and use).

References:

1 Kaplan I, Nuclear Physics, 2nd Ed (1962), Oxford and IBH, New Delhi
2 Sriram K, Nuclear Measurement Techniques, (1986), AEWP, New Delhi
3 Tayal D C, Nuclear Physics (1994), HPH, Bombay

4 Ghoshal S N, Atomic and Nuclear Physics Vol II (1994), S Chand & Co New Delhi
5 Srivastava B N, Basic Nuclear Physics, (1993), Pragati Prakashan Meerut
6 Halliday, Introductory Nuclear Physics, Asia Publishing House, New Delhi
7 Sood D D, Ready A V R and Ramamoorthy, Fundamentals of Radiochemistry, IANCAS (2007), BARC, Bombay
8 Cohen B L, Comcepts of Nuclear Physics (1998), Tata Mc Graw Hill, New Delhi
9 Krane K S, Introductory Nuclear Physics (1988), John Wiley & Sons New Delhi
10 Patel S B, Nuclear Physics (1992), Wiley Eastern Ltd, New Delhi
11 Roy R R and Nigam B P, Nuclear Physics (1993), Wiley Eastern Ltd New Delhi.

B.Sc.-III (Physics)
Semester – VI

Physics – PH-601

Paper – XI : Solid State and Nano Physics

Max. Marks: 40
Internal Assessment: 10
Time: 3 hours

Note:-

1. Nine Questions will be set in total.
2. Question number 1 will be compulsory and will be based on the conceptual aspects of entire syllabus. This question may have five parts and the answer should be in brief but not in Yes/ No.
3. For more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.
4. 20% numerical problems are to be set.
5. Use of scientific (non-programmable) calculator is allowed.

Unit I: Crystal Structure I

Crystalline and glassy forms, liquid crystals, crystal structure, periodicity, lattice and basis, crystal translational vectors and axes. Unit cell and Primitive Cell, Winger Seitz primitive Cell, symmetry operations for a two dimensional crystal, Bravais lattices in two and three dimensions. Crystal planes and Miller indices, Interplaner spacing, Crystal structures of Zinc Sulphide, Sodium Chloride and Diamond.

Unit II: Crystal Structure II

X-ray diffraction, Bragg's Law and experimental X-ray diffraction methods. K-space and reciprocal lattice and its physical significance, reciprocal lattice vectors, reciprocal lattice to a simple cubic lattice, b.c.c. and f.c.c.

Unit III: Super conductivity

Historical introduction, Survey of superconductivity, Super conducting systems, High Tc Super conductors, Isotopic Effect, Critical Magnetic Field, Meissner Effect, London Theory and Pippards' equation, Classification of Superconductors (type I and Type II), BCS Theory of Superconductivity, Flux quantization, Josephson Effect (AC and DC), Practical Applications of superconductivity and their limitations, power application of superconductors.

Unit IV: Introduction to Nano Physics

Definition, Length scale, Importance of Nano-scale and technology, History of Nan-technology, Benefits and challenges in molecular manufacturing. Molecular assembler concept, Understanding advanced capabilities. Vision and objective of Nano-technology, Nanotechnology in different field, Automobile, Electronics, Nano-biotechnology, Materials, Medicine.

References:

1 C. Kittel, *Introduction to Solid State Physics*, 7th Ed (1996) John Wiley & Sons, New Delhi.

2 H. Ibach and H. Lüth, *Solid State Physics, An Introduction to Theory and Experiment*, Springer-Verlag, Berlin, 1991

3 Pillai O S, *Solid State Physics*, New Age International Publishers (2007) New Delhi

4 Mark R and Denial R, *Nano-tecnology* – A Gentle Introduction to the Next Big Idea (2002)

5 M. Tinkham, *Introduction to Superconductivity*, McGraw-Hill, New York, 1975

6 Dekkar A J, Solid State Physics (2000), Mc Millan India Ltd New Delhi

7 Ascroft N W and Mermin N D, Solid State Physics (2003) Harcourt Asia, Singapore

8 Keer H V, Solid State Physics (1993), Wiley Eastern Ltd, New Delhi

9 Kachhava C M, Solid State Physics (1990) Tata Mc Graw Hill Co Ltd, New Delhi

10 Gupta, Solid State Physics (1995) Vikas Publishing House Pvt Ltd, New Delhi

B.Sc.-III (Physics)

Semester – VI

Physics – PH-602

Paper – XII: Atomic and Molecular Spectroscopy

Max. Marks: 40

Internal Assessment: 10

Time: 3 hours

Note:-

1. Nine Questions will be set in total
2. Question number 1 will be compulsory and will be based on the conceptual aspects of entire syllabus. This question may have five parts and the answer should be in brief but not in Yes/ No.
3. For more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.
4. 20% numerical problems are to be set.
5. Use of scientific (non-programmable) calculator is allowed.

Unit – I: Historical background of atomic spectroscopy

Introduction of early observations, emission and absorption spectra, atomic spectra, wave number, spectrum of Hydrogen atom in Balmer series, Bohr atomic model(Bohr's postulates) , spectra of Hydrogen atom , explanation of spectral series in Hydrogen atom, un-quantized states and continuous spectra, spectral series in absorption spectra, effect of nuclear motion on line spectra (correction of finite nuclear mass), variation in Rydberg constant due to finite mass, short comings of Bohr's theory, Wilson sommerfeld quantization rule, de-Broglie interpretation of Bohr quantization law, Bohr's corresponding principle, Sommerfeld's extension of Bohr's model, Sommerfeld relativistic correction, Short comings of Bohr-Sommerfeld theory, Vector atom

model**;** space quantization, electron spin, coupling of orbital and spin angular momentum, spectroscopic terms and their notation, quantum numbers associated with vector atom model, transition probability and selection rules.

Unit –II: Vector Atom Model (single valance electron)

Orbital magnetic dipole moment (Bohr megnaton), behavior of magnetic dipole in external magnetic filed; Larmors' precession and theorem.

Penetrating and Non-penetrating orbits, Penetrating orbits on the classical model**;** Quantum defect, spin orbit interaction energy of the single valance electron, spin orbit interaction for penetrating and non-penetrating orbits. quantum mechanical relativity correction, Hydrogen fine spectra, Main features of Alkali Spectra and their theoretical interpretation, term series and limits, Rydeburg-Ritze combination principle, Absorption spectra of Alkali atoms. observed doublet fine structure in the spectra of alkali metals and its Interpretation, Intensity rules for doublets, comparison of Alkali spectra and Hydrogen spectrum .

UNIT-III: Vector Atom model (two valance electrons)

Essential features of spectra of Alkaline-earth elements, Vector model for two valance electron atom: application of spectra.

Coupling Schemes;LS or Russell – Saunders Coupling Scheme and JJ coupling scheme, Interaction energy in L-S coupling (sp, pd configuration), Lande interval rule, Pauli principal and periodic classification of the elements. Interaction energy in JJ Coupling (sp, pd configuration), equivalent and non-equivalent electrons, Two valance electron system-spectral terms of non-equivalent and equivalent electrons, comparison of spectral terms in L-S And J-J coupling. Hyperfine structure of spectral lines and its origin; isotope effect, nuclear spin.

Unit –IV: Atom in External Field

Zeeman Effect (normal and Anomalous),Experimental set-up for studying Zeeman effect, Explanation of normal Zeeman effect(classical and quantum mechanical), Explanation of anomalous Zeeman effect(Lande g-factor), Zeeman pattern of D1 and D2 lines of Na-atom, Paschen-Back effect of a single valence electron system. Weak field Stark effect of Hydrogen atom.

Molecular Physics

General Considerations, Electronic States of Diatomic Molecules, Rotational Spectra (Far IR and Microwave Region), Vibrational Spectra (IR Region), Rotator Model of Diatomic Molecule, Raman Effect, Electronic Spectra.

References

1 Beiser A, Concept of Modern Physics (1987), Mc Graw Hill Co Ltd, New Delhi
2 Rajab J B, Atomic Physics (2007), S Chand & Co, New Delhi
3 Fewkes J H and Yarwood J Atomic Physics Vol II (1991) Oxford University Press
4 Bransden B H and Joachain C J, Physics of Atoms and Molecules 2nd Ed (2009), Pearson Education, New Delhi.
5 Banwell, Molecular Spectroscopy
6 Ghoshal S N, Atomic and Nuclear Physics Vol I (1996) S Chand & Co, New Delhi
7 Gopalkrishnan K, Atomic and Nuclear Physics (1982), Mc Millan India New Delhi
8 Raj Kumar, Atomic and Moleculer Spectra:Laser , Kedarnath Ram nathpub.
9 S.L.Gupta, V.Kumar,R.C.Sharma, Elements of Spectroscopy,Pragati Prakashan.

B.Sc.-III (Physics)
Semester- VI

Paper: (Physics Lab Practicals)

Max. Marks: 100

Time: 3+3 hours (on two days)

Special Note:-

1. Do any eight experiments from each Section.
2. The students are required to calculate the error involved in a particular experiment.

Note:- The Practical examination will be held in two sessions of 3 hours each (first session in the evening of first day and the second session in the morning of the next day).

1. Distribution of Marks:

Experiments	25+25	50 marks
Viva- voce	15+15	30 marks
Lab. Record		20 marks
Tolal		100 marks

For giving marks under Lab. Record each college will maintain practical assessment record by using the following procedure:-

1. Each student has to perform a minimum number of experiments prescribed in the syllabus.
2. After the completion of a practical the teacher concerned will check the note book and conduct the Viva – voce of each student to find out how much concepts related to the theoretical and experimental part of the experiment he/ she has understood. According to his/her performance marks will be recorded on their practical note-book. These marks will constitute the lab. Record.
3. To compute the final marks for lab. Record, a separate register will be maintained. Each student will be assigned separate page on this register. On this page the marks obtained by the student in different practicals will be entered. This record will be signed by the concerned teacher.
4. The lab. Record register will be presented to the external practical examiners from Lab. Record marks. These external examiners will verify the record randomly.

Section A

(i) Electronics, Solid State and Nuclear Physics– 4 Experiments

1 Determine e/m by Thomson's method
2 Study the C B transistor amplifier
3 Study the C E transistor amplifier
4 Study the B H curve using oscilloscope
5 Study the Hall effect
6 Measurement of energy band gap of Ge/Si by four probe method
7 (a) Draw the plateau using G M counter (b) Determine the mass attenuation coefficient by G M counter
(ii) Computer experiments –4 Experiments
8 Compute the product of two matrices of different dimension using DO loop
9 Numerical integration by Simpson 1/3 rule
10 Fitting of a straight line using Least-Square method
11 Using array variable, find out the average and standard deviation
12 Compute the sum of a finite series up to correct three decimal place
13 With the help of a program arrange the marks in ascending of descending order
14 Write a program to evaluate the function $Y=1 / [C (1 + e \cos \theta)]$ and $V=\sqrt{ [C M G (e2 + e \cos \theta + 1)] }$ $e = 1.1$, $C = 3.0(E+08)$, $M = 5.893(E+24)$, $G = 6.67(E-11)$ for varying value of θ from 0 to π.

Section B

15 Determine the λ_{Na} by Fresnel Byprism
16 Determine the velocity of ultrasonic in the Kerosene oil
17 Diameter of a Lycopodium powder using corona rings
18 Study double slit interference by He-Ne laser
19 Determine the diameter of a wire using (He-Ne Laser) diffraction method
20 Determine the Young modulus 'Y' by Searl's interference method

21 Determine the resolving power of a prism
22 Thickness of a paper using interference fringes in an air wedge
23 Determine the resolving power of a transmission grating
24 Determine the R_H by grating and Hydrogen tube

References:

1 Worshnop and Flint, Advanced Practical Physics
2 Nelkon M and Ogborn, Advanced Level Practical Physics, Heinemann Education Books Ltd, New Delhi
3 Srivastava S S and Gupta M K, Experiments in Electronics, Atma Ran & Sons, Delhi
4 Gupta S L and Kumar V, Practical Physics, Pragati Prakashan, Meerut.