on 16.7.2007

PHYSICS DEPARTMENT
HIMACHAL PRADESH UNIVERSITY

New Syllabus w.e.f March 2008 session

OUT LINES OF SYLLABI AND COURSES OF READING

IN THE SUBJECT OF PHYSICS FOR B. Sc. General (Pass) and Honours Course

B. Sc. General (Pass) & Honours Course 1st Year (2007-2008 onwards)

	Max. Marks	Max Marks for Int. Assessment	Time	No. of hrs requ for each course
Paper – I **Mechanics**	40	10	3 hrs.	60 hrs.
Paper – II **Statistical Physics and Thermodynamics**	40	10	3 hrs.	60 hrs.
Paper – III **Electricity and Magnetism**	40	10	3 hrs.	60 hrs.
Paper – IV **Practical**	40	10	3 hrs.	90 hrs.

(**Practical** - Three sessions of 2hrs. duration one session per week for Physics apparatus based experiments and one session per week for computer based lab.)

Additional Paper for Honours Students

Paper- V **Mathematical Physics**	40	10	3 hrs.	60 hrs.

B. Sc. General (Pass) & Honours Course 2nd Year (2008-2009 onwards)

Paper – VI **Vibrations and Waves**	40	10	3 hrs.	60 hrs.
Paper – VII **Optics**	40	10	3 hrs.	60 hrs.
Paper – VIII **Atomic and Molecular Physics**	40	10	3 hrs.	60 hrs.
Paper – IX **Practical**	40	10	3 hrs.	90 hrs.

(**Practical** - Three sessions of 2hrs. duration one session per week for Physics apparatus based experiments and one session per week for computer based lab.)

Additional Paper for Honours Students

Paper-- X **Laser Physics**	40	10	3 hrs.	60 hrs.

B. Sc. General (Pass) & Honours Course 3rd Year (2009-2010 onwards)

Paper –XI **Solid State Physics**	40	10	3 hrs.	60 hrs.
Paper –XII **Electronics**	40	10	3 hrs.	60 hrs.
Paper –XIII **Nuclear Physics**	40	10	3 hrs.	60 hrs.
Paper –XIV **Practical**	40	10	3 hrs.	90 hrs.

(**Practical** - Two sessions of 2hrs. duration one session per week for Physics apparatus based experiments and one session per week for computer based lab.)

Additional Paper for Honours Students

Paper- XV **Digital Electronics**	40	10	3 hrs.	60 hrs.

B.Sc. 1st year

Syllabus

PAPER - I MECHANICS

Course Code	**Paper-I**	**Examination Wing Code**	
Name of the course	**MECHANICS**		
Number of hrs required for this course	**60 hrs.**		
Annual Term End Examination	**Max Marks 40**	**Min. Pass Marks 16**	**Maximum Time:3 hrs.**
Internal Assessment based on one house test on the pattern of Annual Examination : 7.5 marks **Marks Attendance: 2.5 marks** (75%-79%=0.5, 80%-84%=1, 85%-89%=1.5, 90%-94% =2, 95%-100%= 2.5)			**Max Marks 10**

Instructions

1. **For Paper Setters and candidates:** Nine questions will be set in all; three from section A, three from section B and two from section C and one objective type question covering whole of the course. Candidates will be required to attempt five questions in all, taking at least one from each section. The objective type question shall be *compulsory* and will have 10 parts and may contain questions of short answer type and multiple choice type. The numerical component may be up to 30% marks covering whole of the syllabus.
2. **For internal assessment:** Internal assessment is an integral part of the evaluation process. Internal assessment will be based on house examination score and attendance in the class. Distribution of marks is 20 percent of the total marks i.e. 50 marks (i.e. 10 marks split as shown in the box above separately for House examination and attendance).

Course of Study

SECTION - A (20 hrs.)

1. **Ideas of Vector Algebra and Calculus:**

   Scalar and vector products, polar and axial vectors their examples from physics, triple and quadruple products.

   Scalar and vector fields, Differentiation of vector with respect to scalars, gradient, divergence, curl operations and their meaning. Idea of line, surface and volume integrals, Gauss, Stokes and Green's theorems, General orthogonal coordinates, expressions for gradient, div and curl in Cartesian, spherical and cylindrical co-ordinates (no derivation).

2. **Co-ordinate Systems and Motion of a Particle :**

   Volume, velocity and acceleration in Cartesian and Spherical co-ordinate systems. Solid angle.

3. **Space Time Symmetry and Conservation Laws:** Relationship of conservation laws and symmetries of space and time.

SECTION – B (20 hrs.)

1. **Frames of Reference:**

   Inertial frames of reference. Galilean transformation and Galilean invariance. Non-inertial frames, Coriolis force and its applications. Focault's pendulum.

Special Theory of Relativity:

Concept of stationary universal frame of reference and search for ether. Michelson- Morley experiment, postulates of special theory of relativity. Lorentz transformations. Observer in relativity. Relativity of simultaneity. Length contraction. Time dilation. Relativistic addition of velocities. Relativistic Doppler effect. Variation of mass with velocity and mass energy equivalence. Increase of mass in an inelastic collision, Relativistic momentum and energies. Transformation of momentum , energy. Minkowsky space.

SECTION – C (20 hrs.)

1 **Inverse Square Force Law:**

Various forces in nature (qualitative). Central forces, Centre of mass. Equivalent one body problem. Equation of motion under a force law. Equation of orbit and turning points. Kepler's laws.

2. **Kinematics of Elastic and Inelastic Collisions:**

Elastic and inelastic collisions, coefficient of restitution. Elastic collisions in laboratory and C.M.systems. Velocities, angle and energies in elastic collisions in C.M.and lab. Systems. Cross- section for elastic scattering. Rutherford scattering (with derivation).

Books Suggested:

1. Mechanics, H. S Hans and S. P. Puri, First Reprint (1988), Tata Mc Graw Hill, New Delhi.
2. Mechanics, Berkley Physics Course Vol. 1, 2nd Edition, C. Kittle, Walter D. Knight, Malvin A. Ruderman, Revised by A. Carl Helmholtz, Burton J Moyer, Mc Graw-Hill Company.
3. University Physics, Francis W Sears, Mark W. Zemanasky, Hugh D. Young, 6th Edition, Addison Wesley, Indian Student Edition Available with Narosa Publishing House, N. Delhi.
4. The Feynman Lectures in Physics, Vol 1, R.P. Feynman, R.B. Lighton and M sands, Indian Reprint available with BI Publications, Bombay.
5. Applied Mathematics for Engineers and Physicists by Pipes.
6. Mathematical Methods for Physicists by G. Arfken.

C

PAPER – II STATISTICAL PHYSICS AND THERMODYNAMICS

Course Code	Paper-II	Examination Wing Code	
Name of the course	STATISTICAL PHYSICS AND THERMODYNAMICS		
Number of hrs required for this course	60 hrs.		
Annual Term End Examination	Max Marks 40	Min. Pass Marks 16	Maximum Time:3 hrs.
Internal Assessment based on one house test on the pattern of Annual Examination : 7.5 marks Marks Attendance: 2.5 marks (75%-79%=0.5, 80%-84%=1, 85%-89%=1.5, 90%-94% =2, 95%-100%= 2.5)			Max Marks 10

Instructions

1. **For Paper Setters and candidates:** Nine questions will be set in all; three from section A, three from section B and two from section C and one objective type question covering whole of the course. Candidates will be required to attempt five questions in all, taking at least one from each section. The objective type question shall be *compulsory* and will have 10 parts and may contain questions of short answer type and multiple choice type. The numerical component may be up to 30% marks covering whole of the syllabus.
2. **For internal assessment:** Internal assessment is an integral part of the evaluation process. Internal assessment will be based on house examination score and attendance in the class. Distribution of marks is 20 percent of the total marks i.e. 50 marks (i.e. 10 marks split as shown in the box above separately for House examination and attendance).

Course of Study

SECTION – A (20 hrs.)

1. **Basic Ideas of Statistical Physics:**

Scope of statistical physics, basic ideas about probability, distribution of four distinguishable particles in two compartments of equal sizes. Concept of macro-states, micro-states, thermodynamic probability, 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 k compartments of unequal sizes.

2. **Different Statistics in Physics:**

Phase space and division into elementary cells. Three kinds of statistics. The basic approach in the three statistics. M-B. Statistics applied to an ideal gas in equilibrium, experimental verification of the Maxwell Boltzmann's law of distribution of molecular speeds. Need for quantum statistics, h as a natural constant and its implications, Indistinguishability of particles and its implications. B-E statistics, derivation of Planck's law of radiation, deduction of Wien's distribution law and Stefan's law from plank's law. Fermi-Dirac statistics. Applications to liquid helium, free electrons gas (Fermi level and Fermi Energy), Comparison of M-B, B-E, F-D statistics

3. **Entropy and Laws of Thermodynamics:**

Application of thermodynamics to the thermoelectric effect, change of entropy along a reversible path in a p-v diagram, entropy of a perfect gas, equation of state of ideal gas from simple statistical considerations, heat death of the universe.

SECTION: B (20 hrs.)

1. **Statistical Interpretation of entropy:**

   Statistical definition of entropy, change of entropy of system, additive nature of entropy, law of increase of entropy . Reversible and irreversible processes, example of reversible and irreversible processes. Work done in a reversible process, example of entropy in natural process, entropy and disorder.

2. **Maxwell's Thermodynamic Relations and Their Applications:**

   Derivation of Maxwell's thermodynamic relations. Applications of thermodynamics relations. Cooling produced by adiabatic stretching, adiabatic compression, adiabatic Stretching of a wire, stretching of thin films, change of internal energy with volume. Thermo dynamical treatment of Joule-Thomson effect for liquification of Helium. Production of very low temperatures by adiabatic demagnetization.

SECTION – C (20 hrs.)

1. **Computer Organisation:**
   PC Family, Computer Hardware: Memory and Auxiliary Storage Devices, Disk Drives, Input/Output Devices, Video Display Unit. Standard Typewriting Keys: Cursor Control Arrow Keys, Editing Keys, Scrolling Keys, Enter Key, Special Keys, Function Keys. Powering on PC: Cold Boot and Power on Self-Test (POST) Hot/Warm Boot and System Reset. Computer Software: Program, Different Types of Software's. Interpreter, Compiler, File and Filename conventions.

2. **Windows Operating System:**
   An Overview of Windows as an operating System, Typical Windows Desktop, System Folders, Taskbar, Mouse, Start Button. Window Components, Moving, Sizing and Scrolling a Window, Menu Commands, Dialog box control for Commands, Using Help, Accessories, Running Multiple Programs, Clip boards, Managing Files, Folders and Disks, Windows Explorer: Tree pane, Tool bar, Creating Folders, Copying, Moving, Renaming and Deleting Files, Restoring deleted objects, Emptying the Recycle bin, Sorting and Finding Documents, MSDOS Application : Run, DOS Commands, Shutdown Command., EDIT (MS Editor)

Books Suggested:

1. Statistical Physics and Thermodynamics, V.S.Bhatia, Sohan Lal Nagin Chand & Co, 1986, Jalandhar.
2. A Treatise of Heat, M.N. Saha and B.N. Srivastva, Twelfth Reprint(1988), The Indian Press (Publication) Pvt. Ltd., Allahabad.
3. Introduction to Statistical Mechanics, B. B. Laud,(1988), Macmillan India Limited
4. Thermodynamics and Statistical Mechanics Greiner, Springer.
5. Advanced Mathematics for Engineers by H.W.Reddik and F.H. Miller , Asia Publishing house, New Delhi.
6. Statistical Physics, Berkley Physics Course, Vol. 5, F. Rief, Mc-Graw Hill Book Company.
7. Fortran 77(Programming and Applications (with elements of PC, DOS, Windows and Graphics, (2007) RC Verma etal., Allied Publishers, New Delhi

PAPER -III ELECTRICITY AND MAGNETISM

Course Code	Paper-III	Examination Wing Code	
Name of the course	ELECTRICITY AND MAGNETISM		
Number of hrs required for this course	60 hrs.		
Annual Term End Examination	Max Marks 40	Min. Pass Marks 16	Maximum Time:3 hrs.
Internal Assessment based on one house test on the pattern of Annual Examination : 7.5 marks Marks Attendance: 2.5 marks (75%-79%=0.5, 80%-84%=1, 85%-89%=1.5, 90%-94% =2, 95%-100%= 2.5)			Max Marks 10

Instructions

1. **For Paper Setters and candidates:** Nine questions will be set in all; three from section A, three from section B and two from section C and one objective type question covering whole of the course. Candidates will be required to attempt five questions in all, taking at least one from each section. The objective type question shall be *compulsory* and will have 10 parts and may contain questions of short answer type and multiple choice type. The numerical component may be up to 30% marks covering whole of the syllabus.
2. **For internal assessment:** Internal assessment is an integral part of the evaluation process. Internal assessment will be based on house examination score and attendance in the class. Distribution of marks is 20 percent of the total marks i.e. 50 marks (i.e. 10 marks split as shown in the box above separately for House examination and attendance).

Course of Study

SECTION - A

1. **Electric Potential: (20 hrs.)**

Electric potential due to a dipole and quadrupole, long uniformly changed wire, charged disc. Electric potential energy. Curl of a vector field, stokes theorem (with proof) and its application to electrostatic field (Curl E = zero). Electric field as gradient of a scalar potential, calculation of electric field due to a point charge and a dipole from potential. Potential due to charge distribution and multiple moments. Method of Electrical images, Calculation of electric potential and field due to point charge placed near an infinite conducting sheet. Poisson and Laplace Equations (Derivation only).

2. **Electric Current and Fields of Moving charges:**

Current and current density. Continuity equation, $\nabla . J + \frac{\partial \rho}{\partial t} = 0$. Microscopic form of Ohm's law (J α E) and conductivity. Failure of Ohms law and its explanation. Invariance of charge. E in different frames of reference. Field of a point charge moving with constant velocity. Field of charge that starts or stops (qualitative). Interaction between moving charge and force between parallel currents.

3. **Magnetic Fields:**

Ampere circuital law and its applications Hall Effect, Expression for Hall constant and its significance. Divergence and curl of magnetic field **B**. Vector potential: Definition of vector potential **A** and

derivation of its expression. Surface current density: Definition. and its use in calculation of change in magnetic field at a current sheet. Transformation equations of E and B from one frame of reference to another. Dielectrics, parallel plate capacitor with a dielectric, dielectric constant, polarization and polarization vector, displacement vector **D**, molecular interpretation of Claussius - Mossotti equation, boundary conditions satisfied by **E** and **D** at the interface between two homogenous dielectrics, illustration through a simple example.

SECTION – B (20 hrs.)

1. **Electrostatic Fields in Dielectrics:**

Polarization of matter. Atomic and molecular dipoles, induced. Dipole moment and atomic polarizability. Electric susceptibility and polarization vector Capacity of a capacitor filled with Dielectrics. Dielectrics and Gauss's law Displacement vector-Establishment of relation $\nabla.D = \rho_{free}$.

Energy stored in a dielectric medium.

2. **Magnetic Fields in Matter**:

Behavior of various substances in magnetic fields. Definition of M and H and their relation to free and bound currents. Magnetic permeability and susceptibility and their interrelation. Orbital motion of electrons and diamagnetism. Electron spin and paramagnetic. Ferromagnetism. Domain theory of ferromagnetism, magnetization curve, hysterics loss, ferrites.

SECTION- C (20 hrs.)

Flow Charting and FORTRAN Programming

1. **Flow Charting and Algorithms:**
Algorithm development, flow charts and their interpretation., Algorithm and Flow Charts for
   (a) Finding the roots of a quadratic equation
   (b) Summing a series of numbers.
   (c) Motion of a Projectile
   (d) Motion of a particle in a central force field.
   (e) Finding factorial natural number.
   (f) Addition & multiplication of two matrices.
   (g) Simpson rule of integration.
2. **FORTRAN PROGRAMMING:**
Basic elements of FORTRAN, Layout of a Program (Executable and Non-executable statements).Arithmetic operations, Built-in functions, Essential commands: Fortran statements, Classes of variable and type specifications, input and Output statements, Stop and End, Sequential structure, Helping the user with comments, Integer division and Mod, Assigning a variable from keyboard. Reading data, replacement (an important updating trick), Mathematical function and Fortran, Statement functions, Repetitive Structure (Doloops and insplied loops), Nested loop's, transfer of control (Branching in a program), Unconditional (GO TO), Computed GO TO , Arithmetic IF Statement , Relational Statements of conditional jumping, Nested Block IF structures, Multiple IF structures, Logical operators, Dealing with Arrays (Subscripted variable) Formatting the output.
Useful commands: Declaring variables, Data file operations, Dividing the work(subprogram), PROGRAM Statement, Halting Execution of Program Temporarily, Equivalence Statement common statement. Other types of variables: Double precision variables, complex variables, character variables, logical variables.

Books Suggested:

1. Fundamentals of Electricity and Magnetism, Arthur F. Kip, International Student Edition, McGraw-Hill, Kogakusha Ltd.
2. Introduction to Electrodynamics, D.J. Griffth, 3rd Edition, Prentice Hall of India.
3. Electricity and Magnetism, Berkeley Physics course Vol. II, by E. M. Purcell, Mc-Graw Hill Book Company.
4. Electricity and Magnetism, M. L. Narchal, Panjab University Publication Bureau Chandigarh.
5. Electricity and Magnetism, A S Mahajan and A A Rangwala, Tata Mc-Graw Hill Company.
6. Applied Mathematics for Engineers and Physicists by Pipes.

7. Mathematical methods for Physicists by G. Arfken.
8. Fortran 77(Programming and Applications (with elements of PC, DOS, Windows and Graphics, (2007) RC Verma etal., Allied Publishers, New Delhi

PAPER – IV PHYSICS PRACTICAL (B.Sc. 1st year)

Course Code	**Paper-IV**	**Examination Wing Code**	
Name of the course	**PHYSICS PRACTICAL (B.Sc. 1st year)**		
Number of hrs required for this course	**90 hrs. Two sessions of Two hrs. each per group, per week**		
Annual Term End Examination to be conducted in two sessions	**Max Marks 40**	**Min. Pass Marks 16**	**Maximum Time:3 hrs. for each session**
Internal Assessment based on one house test on the pattern of Annual Examination : 7.5 marks **Marks Attendance: 2.5 marks** (75%-79%=0.5, 80%-84%=1, 85%-89%=1.5, 90%-94% =2, 95%-100%= 2.5)			**Max Marks 10**

Instructions

For Paper Setters and candidates: The Practical examination will consists of the following components:

i) One full experiment requiring the students to take some data, analyse it and draw conclusions. (10 Marks)

ii) PC based Experiment (10 marks)

iii) Written test of ½ hour duration. This part will consist of short questions on various experiments of lab included in the course. (5 marks)

iv) Test of lab skills and viva-voce (10 Marks)

v) Record of laboratory activities (note book & Project report if any). (5 Marks)

Note: (1) *There will be two sessions, each of three hours duration, one in the afternoon & the other in the morning next day. In the first session, half the candidates will be examined in components No. (I) and (iv) while the other half components No. (ii), (iii) and (v). In the second session, the components will interchange.*

(2) *Test in components (i) and (ii) will be conducted according to paper set separately for each session and will consist of three sections.*

Section - A: There will be 10 short questions for components No. (ii) on various aspects of laboratory work to be set on the spot by the external examiner.

Section - B: There will be eight experiments; students will mark six and one will be allotted

Section –C: There will be eight PC based Experiment, students will mark Six and one will be allotted.

For internal assessment: Internal assessment is an integral part of the evaluation process. Internal assessment will be based on house examination score and attendance in the class. Distribution of marks is 20 percent of the total marks i.e. 50 marks (i.e. 10 marks split as shown in the box above separately for laboratory based house examination and attendance).

SECTION- A:

1. The test of lab skills will be of the following test items:
   a) Finding standard deviation.
   b) Least square fitting.
   c) Setting a ballistic Galvanometer.
   d) Use of Oscilloscope.
   e) Soldering.

f) Setting up of an apparatus taking observation of any experimental activity within the scope of the syllabus.
g) Calculation of errors in the result of the experiments.
h) Usage of MS or any other editor GUI windows
i) DOS commands
j) Usage of Editor
k) Flow charts of the PC based experiments
l) Familiarity with programming language, FORTRAN.

SECTION- B:

LABORATORY EXERCISES

1. **Analysis of Experimental Data**
Objectives:
i) Familiarity with the method of least squares for fitting of experimental data to a curve.
ii) Knowledge of straight line fitting of the experimental data.
iii) Practical determination of standard deviation and probable error, and their use in expressing the experimental result.
Activity: To achieve above three objectives on a sample data of some experiment.

2. **Thermal Conductivity**
Objectives:
i) Attainment of steady state.
ii) Application of radiation correction.
iii) Magnitude of thermal conductivity of bad conductors.
Activity: To determine the coefficient of thermal conductivity of a disc of bad conductor using method of lees.

3. **Introduction of Probability**
Objectives:
i) Basic idea of equal apriori probability.
ii) Law of two independent events.
iii) Probability distribution of identical particles in two compartments.
Activity: Experimental study of probability distribution for a two option system using coloured dice.

4. **Ballistic Galvanometer**
Objectives:
i) Knowledge of ballistic galvanometers as a device to measure quantity of charge.
ii) Calibration of a ballistic galvanometer.
iii) Use of ballistic galvanometer in measurement of resistance.
Activity: To determine the value of high resistance by leakage using a ballistic galvanometer.

5. **Low Resistance**
Objectives:
i) Inadequacy of whetstone bridge to measure low resistance.
ii) Acquaintance with a method of measuring low resistance.
Activity: To determine the value of given low resistance using kelvin bridge/ Carey Foster's bridge

6. **Magnetic Field**
Objectives:
i) Familiarity with the magnetic field produced by a solenoid.
ii) Dependence of solenoid field on number of turns and currents.
iii) Permeability of air.
Activity: To study the magnetic field produced by a current carrying solenoid using a search coil.

7. **Cathode Ray Oscilloscope**
Objectives:
i) Introduction to CRO as a display device.

ii) Handling of CRO.

Activity: Use of CRO for measurement of phase angle and frequency of a. c. mains.

8. **Magnetic materials**

Objectives:

Knowledge of (i) hysteresis loop, (ii) coercivity and retentivity.

Activity: Tracing of hysterisis loop of a number of magnetic materials and qualitatively discussing their distinguishing features.

Additional Experiments:

9. Conservation of momentum in two dimensions.
10. Momentum of Inertia of a flywheel.
11. Determination of Surface Tension by Traveling Microscope.
12. Modulus of Elasticity by Beam Bending method.
13. Searle's method for finding Y and σ.
14. g by Bar pendulum
15. g by Kater's Pendulum
16. Conversion of a Galvanometer to an Ammeter and a Voltmeter.

SECTION- C:

PC Based Experiments:

1. Usage of GUI Windows, familiarity with DOS commands and working in an editor to write sources codes in a programming language (FORTRAN).
2. To print out all natural even/ odd numbers between given limits
3. To find maximum, minimum and range of a given set of numbers
4. To compile a frequency distribution and evaluate moments such as mean; standard deviation etc.
5. To evaluate sum of finite series and the area under a curve.
6. To find the product of two matrices
7. To find a set of prime numbers and Fibonacci series.
8. Motion of a projectile using computer simulation
9. Numerical solution of equation of motion of SH.O
10. Motion of particle in a central force field.
11. To find the roots of a quadratic equation.

Note: For conducting Computer based Experiments it is recommended that each Physics laboratory be provided with at least 3 Pentium 4 PC's having Windows operating system, FORTRAN/ BASIC Compiler, A spreadsheet package(Excel), a word processing package, a graphics package such as Gnu plot and a DOT matrix Printer/ Ink jet printer.

Students are to maintain a record of each PC based experiment in the form of a flow chart, source code in a programming language and output, both numerical and graphics, of the runs of the compiled programs.

Books Suggested

1. Schaum's Outline of Theory and Problems of Programming with Fortran, S Lipsdutz and A Poe, 1986Mc-Graw Hill Book Co.
2. Introduction to PC's, DOS and Computing with Applications, U.N. Khosla, etal., 1998, Allied Publishers, New Delhi.
3. A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi.
4. Computational Physics: An Introduction, R. C. Verma, etal. New Age International Publishers, New Delhi(1999)

PAPER - V MATHEMATICAL PHYSICS (Additional Paper for Honours Students)

Course Code	**Paper-V**	**Examination Wing Code**	
Name of the course	**MATHEMATICAL PHYSICS**		
Number of hrs required for this course	**60 hrs.**		
Annual Term End Examination	**Max Marks 40**	**Min. Pass Marks 16**	**Maximum Time:3 hrs.**
Internal Assessment based on one house test on the pattern of Annual Examination : 7.5 marks **Marks Attendance: 2.5 marks** (75%-79%=0.5, 80%-84%=1, 85%-89%=1.5, 90%-94% =2, 95%-100%= 2.5)			**Max Marks 10**

Instructions

1. **For Paper Setters and candidates:** Nine questions will be set in all; three from section A, three from section B and two from section C and one objective type question covering whole of the course. Candidates will be required to attempt five questions in all, taking at least one from each section. The objective type question shall be *compulsory* and will have 10 parts and may contain questions of short answer type and multiple choice type. The numerical component may be up to 30% marks covering whole of the syllabus.
2. **For internal assessment:** Internal assessment is an integral part of the evaluation process. Internal assessment will be based on house examination score and attendance in the class. Distribution of marks is 20 percent of the total marks i.e. 50 marks (i.e. 10 marks split as shown in the box above separately for House examination and attendance).

Course of Study

SECTION –A: (20 hrs.)

1. Complex Variables, Evolution of the number system complex number. Graphical representation of complex number. De Moiver's theorem. Roots of complex numbers. Euler's formula, Function of complex variables. Cauchy- Riemann conditions. Analytic functions. Singularities.

2. Differentiation and intergration of a complex variable. Cauchy's theorem. Cauchy's integral formula. Morera's theorem of algebra. The argument theorem, Power series of a complex variable, absolute and uniform convergence tests. Tayler and Laurant's series, residue and Residue, Theorem, contour integration and its application to evaluation of integrals and series.

SECTION-B: (20 hrs.)

1. **Fourier Series**: Fourier series, Dirichlet conditions (Statement only) sine and cosine series and their ortheogojality and complete Distinctive features of Fourier expansions Applications: Square wave triangular wave output of full wave rectifier. Summing of infinite series Gibb's phenomenon.

2. **Integral Transform:**
Fourier Integral theorem, Fourier integral transform, sine and cosines transform conservation theorem conservation theorem. Laplace transform of elementary function of derivative integrals and unit step function and of periodie functions, translation, substitution and convolution theorem, laplace inverse

transform, Application of Laplace transform for solving first and second order differential equations with constant coefficients.

SECTION-C: (20 hrs)

1. Special functionsDirac Delta function and its properties.
2. Legendre, Bessel, Hermite and laguerre functions, Generating function. Recurrence relations. Legendre, Bessel and Hermite differntial equations. Orthogonality. Gamma functions and their properties.

Books Suggested:

1. Applied Mathematics for Engineers and Physicists – Pipes
2. Advanced Engineering Mathematics – Kryszig
3. Mathematical Physics- E.Bulkov (Addison Wosley)
4. Mathematical Methods of Physicists – Arfken
5. Mathematical Methods in Physics – Mathews and Walker.
6. Advanced Engineering Mathematics, Erwin Kreyszing, John Wiley & Sons, Inc
7. Schaum outline series (Vector analysis, complex variable, Fourier Analysis), tata Mc Graw- Hill.
8. Mathematical Physics; a modern introduction to its foundation, Sadri Hassani, Springer- Verlag.
9. Advance Engineering Mathematics, C. Ray Wylie and Louis C. Barrett, Tata McGraw- Hill Edition.
10. Mathematical Physics, A.K.Ghatak, I.C. Goyal, S.C.Chua.Macmillan India Ltd., 1995

B.Sc. 2nd year Syllabus

PAPER - VI VIBRATIONS AND WAVES

Course Code	Paper-VI	Examination Wing Code	
Name of the course	VIBRATIONS AND WAVES		
Number of hrs required for this course	60 hrs.		
Annual Term End Examination	Max Marks 40	Min. Pass Marks 16	Maximum Time:3 hrs.
Internal Assessment based on one house test on the pattern of Annual Examination : 7.5 marks Marks Attendance: 2.5 marks (75%-79%=0.5, 80%-84%=1, 85%-89%=1.5, 90%-94% =2, 95%-100%= 2.5)			Max Marks 10

Instructions

1. **For Paper Setters and candidates:** Nine questions will be set in all; three from section A, three from section B and two from section C and one objective type question covering whole of the course. Candidates will be required to attempt five questions in all, taking at least one from each section. The objective type question shall be *compulsory* and will have 10 parts and may contain questions of short answer type and multiple choice type. The numerical component may be up to 30% marks covering whole of the syllabus.
2. **For internal assessment:** Internal assessment is an integral part of the evaluation process. Internal assessment will be based on house examination score and attendance in the class. Distribution of marks is 20 percent of the total marks i.e. 50 marks (i.e. 10 marks split as shown in the box above separately for House examination and attendance).

Course of Study

SECTION - A (20 hrs.)

1. Damped Harmonic Motion and Superposition of Harmonic Motions

Damped S.H.M. Logarithmic decrement. Relaxation time. The quality factor, q value of a simple harmonic oscillator. Superposition of two simple harmonic motions of the same frequency along the same line, interference, superposition of two mutually perpendicular simple harmonic vibrations of the same frequency, Lissajous figures, case of different frequencies.

2. **The Forced Oscillator:**

Transient and steady behaviour of forced oscillator. Displacement and velocity variation with driving force frequency. Variation of phase with frequency. Power supplied to an oscillator and its variation with frequency. Q- value and band width. Q-value as an amplification factor (Phasor treatment to be followed)

SECTION – B: (20 hrs.)

1. Coupled Oscillators:

Stiffness coupled pendulums. Normal co-ordinates and normal modes of vibration. Inductance coupling of electrical oscillators.

2. **Wave Motion:**

The type of waves. The wave equation and its solution. Characteristic impedance of a string. Impedance matching. Reflection and transmission of energy. Reflected and transmitted energy coefficients. Standing waves on a string of fixed length. Energy of a vibrating string. Wave and group velocity their measurements.

SECTION- C: (20 hrs.)

1. **Time Varying Fields:**

Integral and differential forms of Faraday's law mutual and self inductance, energy in a static magnetic field. Maxwell's displacement current, Maxwell's equations, electromagnetic field energy density.

2. **Electromagnetic waves:**

Electromagnetic waves in a medium having finite permeability and permittivity but with conductivity= 0. The wave equation for electromagnetic waves. Poynting vector. Impedance of a dielectric to electromagnetic waves. Electromagnetic waves in a medium of properties. Skin depth. E.M waves in a conductor and anomalous dispersion. Response of conducting medium to E.M.waves, reflection and transmission of waves at a boundary for normal incidence. reflection and refraction by the ionosphere.

Books Suggested:

1. The Physics of Vibrations and Waves by H.J.Pain (English Language Book Society)/ John Wiley and Sons.
2. Fundamentals of Vibration and Waves, S.P.Puri, Low Cost Student Edition, Tata Mc-Graw Hill Company, New Delhi.
3. Waves, Berkeley Physics course Vol. III, Frank S. Crawford Jr., Mc-Graw Hill Book Company.
4. University Physics, Francis W Sears, Mark W. Zemanasky, Hugh D. Young, 6th Edition, Addison Wesley, Indian Student Edition Available with Narosa Publishing House, N. Delhi.
5. Vibrations and Waves, I.J. Main, Cambridge University Press.
6. Acoustics.

PAPER - VII OPTICS

Course Code	Paper-VII	Examination Wing Code	
Name of the course	OPTICS		
Number of hrs required for this course	60 hrs.		
Annual Term End Examination	Max Marks 40	Min. Pass Marks 16	Maximum Time:3 hrs.
Internal Assessment based on one house test on the pattern of Annual Examination : 7.5 marks Marks Attendance: 2.5 marks (75%-79%=0.5, 80%-84%=1, 85%-89%=1.5, 90%-94% =2, 95%-100%= 2.5)			Max Marks 10

Instructions

1. **For Paper Setters and candidates:** Nine questions will be set in all; three from section A, three from section B and two from section C and one objective type question covering whole of the course. Candidates will be required to attempt five questions in all, taking at least one from each section. The objective type question shall be *compulsory* and will have 10 parts and may contain questions of short answer type and multiple choice type. The numerical component may be up to 30% marks covering whole of the syllabus.
2. **For internal assessment:** Internal assessment is an integral part of the evaluation process. Internal assessment will be based on house examination score and attendance in the class. Distribution of marks is 20 percent of the total marks i.e. 50 marks (i.e. 10 marks split as shown in the box above separately for House examination and attendance).

Course of Study

SECTION – A: (20 hrs.)

1. **Geometrical Optics:**

Fermat's principle: Principle of extremum path, the aplantic points of a sphere and other applications.

General theory of image formation: Matrix methods in optics. Translation, reflection and refraction matrix. The system matrix. Cardinal points of an optical system, general relationships, thick lens combinations, Lagrange equation of magnification, telescopic combinations, telephoto lenses and Ramsden and Huygen's eye pieces.

2. **Polarisation:**

Wire and grid polariser. crystal polariser. Applications Interference of a light, Raleigh refract meter and other applications, Localized fringes; thin films, applications for precision measurements for displacements.

Haidinger fringes: Fringes of equal inclination, Michelson interferometer, its application for precision determination of wavelength, wavelength difference and the width of spectral lines, Intensity distribution in multiple beam interference, Fabry-Perot interferometer.

SECTION- B: (20 hrs.)

1. **Diffraction:**

Huygen's principle. Huygen's Fresnel theory. Kirchoff's diffraction integral. Fresnel and Fraunhaufer diffraction. Fraunhoffer diffraction at single slit. Rectangular and circular apertures. Fraunhaufer diffraction at n slits. Diffraction grating. Concept of resolving power of optical instruments. Fresnel diffraction: Fresnel half-period zones, plates, straight edge, rectilinear propagation.Diffraction

gratings: Diffraction at N parallel slits, intensity distribution, plane diffraction grating, reflection grating and blazed gratings, Concave grating and different mountings, Resolving power of a grating and comparison with resolving powers of prism and of a Fabry-Perot etalon.

2. **Double refraction and optical rotation:** Refraction, in uniaxial crystals, its electromagnetic theory, Phase retardation plates, double image prism, Rotation of plane of polarization, origin of optical rotation in liquids and in crystals.

3. **Laser system and its Applications**: Purity of a spectra line, coherence length and coherence time, spatial coherence of a source, Einstein's A and B coefficients, Spontaneous and induced emissions, conditions for laser action, population inversion. Application of lasers: Pulsed lasers and tunable lasers, spatial coherence and directionality, estimates of beam intensity, temporal coherence and spectral energy density.

SECTION- C: (20 hrs.)

Spreadsheets

1. Introduction to an electronic spread sheet, brief history and applications.Building a spread sheet: Elements of a typical spread sheet (EXCEL), MSEXCEL, worksheet specifications, calculation specifications, menus in Excel: Edit, View, Insert, Format, Tool, Data, Financial Manager, Window Manager, Help. Noninterfering block structure of a work sheet, cell referencing (relative and absolute), naming for cell referencing, Function Keys. Visual basic function module in EXCEL.
2. Programming versus spreadsheets. Discussion about creating spreadsheets on following problems
   (a) Root finding through conditional formatting on spreadsheet
   (b) Plotting mathematical functions.
   (c) Motion of a projectile.
   (d) Verification of starlings Formula.
   (e) Compute the luminous efficiency of a black body radiator.
   (f) Plot wave function of particle in a box.
   (g) Plot the wave function of one dimensional Harmonic oscillator.

Books Suggested:

1. An Introduction to Modern Optics, Ajay K Ghatak, Tata Mc-Graw Hill Co., New Delhi .
2. Advanced Engineering Mathematics, Kreyszig.
3. A Text book of Light, D.N. Vasudeva, Atma Ram and Sons, New Delhi.
4. Lasers and Non-Linear Optics, B.B. Laud, Wiley Eastern Limited (1985).
5. Optics, Born and Wolf
6. Optics, K.D. Moltev, Oxford University Press.
7. Spreadsheet Tools for Engineers using Excel, Gottfried, McGraw-Hill International Edition, 3rd edition, 2007 (New York

PAPER - VIII ATOMIC AND MOLECULAR PHYSICS

Course Code	Paper-VIII	Examination Wing Code	
Name of the course	ATOMIC AND MOLECULAR PHYSICS		
Number of hrs required for this course	60 hrs.		
Annual Term End Examination	Max Marks 40	Min. Pass Marks 16	Maximum Time:3 hrs.
Internal Assessment based on one house test on the pattern of Annual Examination : 7.5 marks Marks Attendance: 2.5 marks (75%-79%=0.5, 80%-84%=1, 85%-89%=1.5, 90%-94% =2, 95%-100%= 2.5)			Max Marks 10

Instructions

1. **For Paper Setters and candidates:** Nine questions will be set in all; three from section A, three from section B and two from section C and one objective type question covering whole of the course. Candidates will be required to attempt five questions in all, taking at least one from each section. The objective type question shall be *compulsory* and will have 10 parts and may contain questions of short answer type and multiple choice type. The numerical component may be up to 30% marks covering whole of the syllabus.
2. **For internal assessment:** Internal assessment is an integral part of the evaluation process. Internal assessment will be based on house examination score and attendance in the class. Distribution of marks is 20 percent of the total marks i.e. 50 marks (i.e. 10 marks split as shown in the box above separately for House examination and attendance).

Course of Study

SECTION – A: (20 hrs.)

1. **Introductory Quantum Mechanics:**
Brief review of origin of quantum theory, Postulatory basis of Quantum Mechanics. Schrodinger's theory; Need for differential wave equation; time dependent and time independent forms of Schrodinger's wave equation, Born's interpretation of wave function, properties of wave function; Expectation values, particle in a box; particle incident on an infinite potential step and a finite potential barrier; reflection and transmission by a barrier; the tunnel effect; harmonic oscillator.

2. **Quantum theory of Hydrogen atom:**
Schrodinger's equation of hydrogen atom, separation of variables; solution of equation, physical significance of 'n', 'l' and 'm' quantum numbers, probability densities of electrons and shapes of H - atom orbitals. Qualitative discussion of transition probabilities and selection rules.

SECTION – B: (20 hrs.)

1. **Atoms with one electron**:
Hydrogen atom and its spectrum, Frank – Hertz experiments, Quantization of angular momentum; vector atom model L-S, J-J coupling, Zeeman effect (normal and anomalous). Fine structure of hydrogen spectrum; electron spin. The Stern - Gerlach experiment, spin-orbit coupling.

2. **Atoms with many electrons**:
Helium atom, symmetric and anti-symmetric wave functions, the exclusion principle, electronic structure of atoms, L – S coupling, Spectroscopic terms for S^2, P, P^2, P^3, D, D^2, D^4, D^5, electron configurations, Spectra of alkali and alkaline earth atoms only qualitative discussion.

3. **Molecules:**
Brief review of spectra of molecules Raman effect, Stokes and anti stokes lines, complimentary character of Raman and Infrared spectra, experimental arrangements for Raman spectroscopy.

SECTION – C: (20 hrs.)

Scientific Word Processing

1. Introduction to word processing, special needs of scientific word processing, Latex as Scientific word processor and its development as open source software.
2. Tex/Latex word processor,: Preparing a basic Tex file or Latex file, Document classes preparing an input file for latex., Latex tags for creating different environments, Defining Commands and Environments compiling latex files, Changing the type style, symbols from other languages, Mathematical formulas and equations, Figures and other Floating Bodies, Lining in Columns (tabbing environment, tabular environment), Generating the table of contents, bibliography and citation, making an index or glossary, key board input and screen output, , list making environments, fonts, pictures and colors, errors.
3. Discussion about following sample .tex files for creating simle text, mathematical formulae and equations (Integrals, derivatives and partial derivatives, matrix arrays, tables and figures). Converting latex outputs into ps, pdf and eps files.

Books Suggested:

1. Modern Physics Vol. 1 Vishwamittar and S.P.Puri, ULP (PUC).
2. Fundamental University Physics – Vol III (M. Alonso and E.J.Finn).
3. University Physics, Francis W Sears, Mark W. Zemanasky, Hugh D. Young, 6th Edition, Addison Wesley, Indian Student Edition Available with Narosa Publishing House, N. Delhi.
4. Elements of Modern Physics, Patil, Tata Mcgraw Hill.
5. Modern Physics, Arthur Beiser, Mc-Graw Hill Company.
6. Modern Physics, HS Mani and G.K.Mehta., Tata Mc-Graw Hll Company, New Delhi
7. Atomic Spectra, White.
8. Spectra of Diatomic Molecules, Dunford.
9. Latex: A Document Preperation System, Leslie Lamport, Pearson Education, 1994.

PAPER IX PHYSICS PRACTICAL (B. Sc. IInd Year)

Course Code	**Paper-IX**	**Examination Wing Code**	
Name of the course	**PHYSICS PRACTICAL (B.Sc. I1 year)**		
Number of hrs required for this course	**90 hrs. Two sessions of Two hrs. each per group, per week**		
Annual Term End Examination to be conducted in two sessions	**Max Marks 40**	**Min. Pass Marks 16**	**Maximum Time:3 hrs. for each session**
Internal Assessment based on one house test on the pattern of Annual Examination : 7.5 marks **Marks Attendance: 2.5 marks** (75%-79%=0.5, 80%-84%=1, 85%-89%=1.5, 90%-94% =2, 95%-100%= 2.5)			**Max Marks 10**

Instructions

For Paper Setters and candidates: The Practical examination will consists of the following components:

i) One full experiment requiring the students to take some data, analyse it and draw conclusions. (10 Marks)

ii) PC based Experiment (10 marks)

iii) Written test of ½ hour duration. This part will consist of short questions on various experiments of lab included in the course. (5 marks)

iv) Test of lab skills and viva-voce (10 Marks)

v) Record of laboratory activities (note book, Project report and pen ended experiment). (5 Marks)

Note: (1) *There will be two sessions, each of three hours duration, one in the afternoon & the other in the morning next day. In the first session, half the candidates will be examined in components No. (I) and (iv) while the other half components No. (ii), (iii) and (v). In the second session, the components will interchange.*

(2) *Test in components (i) and (ii) will be conducted according to paper set separately for each session and will consist of three sections.*

Section- A: There will be eight experiments; students will mark six and one will be allotted

Section- B: There will be 10 short questions for components No. (ii) on various aspects of laboratory work.

Section -C: PC based Experiment

1. **For internal assessment:** Internal assessment is an integral part of the evaluation process. Internal assessment will be based on house examination score and attendance in the class. Distribution of marks is 20 percent of the total marks i.e. 50 marks (i.e. 10 marks split as shown in the box above separately for laboratory based house examination and attendance).

SECTION- A:

1. The test of lab skills will be of the following test items:
   a) Setting a spectrometer.
   b) Least square fitting.
   c) Balancing of bridges.
   d) CRO as a versatile measuring device.
   e) Precautions to betaken in usage of Laser.
   f) Setting up of an apparatus taking observation of any experimental activity within the scope of the syllabus.
   g) Usage of Spreadsheets
   h) Scientific Word Processing

i) Usage of Editor
j) Flow charts of the PC based experiments
k) Familiarity with programming language (FORTRAN/ BASIC),Spread sheets and Latex Work processor.

2. Students are required to calculate errors in the result of the experiments.

SECTION-B:

Laboratory Exercises:

Desirable:

i) Knowledge of the fitting of experimental data to a curve, determination of standard deviation probable error and expressing result in scientific manner.

ii) Use of Digital multimeter/ VTVM for measuring voltages, where ever desirable.

1. **Spectrometer:**
   1. Use of spectrometer
   2. Concepts of minimum deviation and pure spectrum.

   Activity:
   1. To set up a spectrometer and study variation of angle of deviation with angle of incidenc a prism, measure angle of minimum deviation directly and compare with the value from curve.
   2. Refractive index of a liquid
   3. Determination of Cauchy's constants

2. **Polarization:**
   Objectives:
   Familiarity with concepts of double refraction and rotation of plane of polarization.
   Activity:
   1. Refractive indices of a doubly refracting prism.
   2. Study of rotation of plane of polarization with a polarimeter.

3. **Interference:**
   Objectives:
   1. Study of interference of thin films.
   2. Use of interference method for determining wave length.

   Activity:
   1. Set of interference methods for determining wave length using sodium light.
   2. Wave length using bi - prism.

4. **Diffraction**
   Objectives:
   1. Study of Fraunhofer's diffraction.

   Activities:
   1. Wave length using plane diffraction grating using Hg - source, also dispersive power.

5. **Resolving Power:**
   Objectives:
   1. Concept of resolving power.

   Activity:
   1. Resolving power of a telescope.
   2. Resolving power of a grating.

6. **Charge and Discharge of a Capacitor:**
   Objectives:
   1. Concepts of time constant and time base circuit.

Activity:

1. To determine capacitance using flashing and quenching of neon bul

7. **CR Circuit**:

Objective:

1. Study of phase relationship between currents and voltages in ac / ci
2. Concepts of resonance and q – value.

Activity:

1. Study of phase relationships using impedance triangle for LCR circ
2. Resonance in a series LCR circuit.
3. Response in a parallel LCR circuit and Q-value.

8. **Self and Mutual Inductance**:

Objective:

1. Knowledge of ac bridges.
2. concept of self and mutual inductance.

Activity:

1. To determine L using Anderson method.
2. To determine M using B.G.

9. **Ionization Potential of Hg**:

Objective:

1. Concept of ionization potential.

Activity:

1. To measure ionization potential of mercury.

10. **Photoelectric effect**:

Objective:

1. Study of Photoelectric effect.

Activity:

1. Measure of stopping potential
2. Calculation of Planck's constant.

11. **C. R. O.**:

Objective:

1. Further practice with CRO

Activity:

1. Calibration of CRO vertical and horizontal sensitivities.

12. **Lasers**

Objective:

1. To handle a low power He-N Laser to do optics experiments
2. To see diffraction patterns of a singl slit, a hair, a comb.

Activity:

1. Study the beam parameters of a laser beam
2. To study the divergence of a laser beam
3. Study of Raman Spectrum using laser as an excitation source.

Additional Experiments:

13. Finding the height of an accessible and inaccessible object.

14 μ by traveling microscope method.

15. Linear magnification by slit method.

16. Linear magnification by linear scale method.

17. Study of Newton's rings.

SECTION- C:

18. **PC Based Experiments (To be done using spread sheets/ Fortran)**

1. Calculation of days between two dates of a year (SS)
2. To check if triangle exists and the type of the triangle (SS)
3. To find the sum of the sine and cosine series and print out the curve (SS)
4. To solve simultaneous equations by elimination method (SS)
5. To prepare a mark-list of students in Class (CS)
6. Fitting a straight line or a simple curve a given data (SS/Fortran)
7. Convert a given integer into binary and octal systems and vice versa (Fortran)
8. Inverse of a matrix ((Fortran)
9. Spiral array (Fortran)
10. Verification of stirrings formula (SS/ FORTRAN)
11. Compute Numinous efficiency of a back body radiation
12. Plot wave function of a particle in a box.
13. Plot wave function of one dimensional Harmonic Oscillator.
14. Creating a document in LATEX involving plain text.
15. Creating a document in LATEX with mathematical formulae, differentials, integral, gradient divergence and curl etc. using equation environment.
16. Creating a document in LATEX using table environment and lists.
17. Creating a document in LATEX having title page, table of contents, bibliography using sectioning and sub sectioning.
18. Creating LATEX document involving matrices and line diagrams.

Suggested Open ended Exercises:

1. **Lab and household gadgets.**
   - i) To open and reassemble a galvanometer.
   - ii) To study a camera.
2. **Design and Fabrication:**
   - i) Fabrication and design of simple electronic gadget or a toy involving principles of physics.
3. **Investigative (Laboratory Situation) one of the following:**
   - i) Study of lissajous figures with CRO.
   - ii) Study of interference fringes with wedge - shaped film.
   - iii) e / m of electron.
   - iv) Measurement of magnetic field of an electron net.
4. **Investigative (real life situation):**
   - i) Measuring variations of intensity of light in a room using photo voltaic cell.

Note: For conducting Computer based Experiments it is recommended that each Physics laboratory be provided with at least 5 Pentium 4 PC's having Windows operating system, MS Office, FORTRAN/ Compiler, a word processing package, a graphics package such as Gnuplot and a DOT matrix Printer/ Ink (Latex) jet printer. Students are to maintain a record of each PC based experiment in the form of a flow chart, source code in a programming language and output, both numerical and graphics, of the runs of the compiled programs.

Books Suggested:

1. Schaum's Outline of Theory and Problems of Programming with Fortran, S Lipsdutz and A Poe, 1986Mc-Graw Hill Book Co.
2. Introduction to PC's, DOS and Computing with Applications, U.N. Khosla, P.K. Ahluwalia, R.C. Verma, 1998, Allied Publishers, New Delhi.
3. A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi.
4. Computational Physics: An Introduction, R.C. Verma, etal. New Age International Publishers, New Delhi(1999)
5. Experiments with He-Ne Laser, R.S. Sirohi, New Age International Publishers, New Delhi.

PAPER- X LASER PHYSICS

(Additional Paper for Honours Students)

Course Code	**Paper-X**	**Examination Wing Code**	
Name of the course	**LASER PHYSICS**		
Number of hrs required for this course	**60 hrs.**		
Annual Term End Examination	**Max Marks 40**	**Min. Pass Marks 16**	**Maximum Time:3 hrs.**
Internal Assessment based on one house test on the pattern of Annual Examination : 7.5 marks **Marks Attendance: 2.5 marks** (75%-79%=0.5, 80%-84%=1, 85%-89%=1.5, 90%-94% =2, 95%-100%= 2.5)			**Max Marks 10**

Instructions

1. **For Paper Setters and candidates:** Nine questions will be set in all; three from section A, three from section B and two from section C and one objective type question covering whole of the course. Candidates will be required to attempt five questions in all, taking at least one from each section. The objective type question shall be *compulsory* and will have 10 parts and may contain questions of short answer type and multiple choice type. The numerical component may be up to 30% marks covering whole of the syllabus.
2. **For internal assessment:** Internal assessment is an integral part of the evaluation process. Internal assessment will be based on house examination score and attendance in the class. Distribution of marks is 20 percent of the total marks i.e. 50 marks (i.e. 10 marks split as shown in the box above separately for House examination and attendance).

Course of Study

SECTION- A: (20 hrs)

1. Light waves and photons, optical Directionality interactivity monochromacity and coherence, quantum transitions in absorption and Emission of light. The active medium, creating population inversion, Laser oscillation in optical Resonant cavity (quality factor, losses) Basic laser characteristics (gain coefficient out put power.
2. Laser gain curve, Einstein's quantum theory of Radiation, Einstein coefficients and their relationship momentum transfer and possibility of amplification.

SECTION- B: (20 hrs)

1. Type of Lasers on the basis of pumping methods: solid state laser, organic dye laser, photo dissociation lasers, Ion and Atomic lasers, Molecular Lasers , Electro ionization Lasers, Gas Dynamic Lasers, Chemical Lasers, Plasma Lasers, Semiconductor Lasers, Optical resonators of various kinds and their role in confinement of laser beam.
2. Control of laser out put: Interactivity, control of spectral characteristics, method of Q switching, Pulsed Lasing , mode locking for ultra short pulses, modifying the spatial structure of laser output, Frequency transformations in non-linear media, wave front correction of laser output, Light beam manipulation.

SECTION-C: (20 hrs)

Applications of Lasers : Material working, Lasers in medicine isotope separation, holography, optical communications by laser, ranging and measurement; environmental measurements, quality control, thermonuclear fusion.

Books Suggested:

1. Lasers and Non-Linear optics, B.B. Laud, Second edition , New Age International (P) Limted , New Delhi-2005.
2. Lasers: Theory and Applications, K. Thyagarajan, A.K.Ghatack, Macmillan India Ltd, 1981.
3. Laser Physics, L.V. Tarasov, Mir Publishers, Moscow, 1983.
4. Laser Age in Optics, L.V. Tarasov Mir Publishers, Moscow, 1981.
5. Essentials of Lasers, L. Allen, Pergamon Press, Oxford 1969
6. Laser Physics and Applications, L Tarasov, Mir Publishers, Moscow, 1986.
7. Lasers and Holography, Winston E. Kock, Dover Publications, New York,1981.

B.Sc. 3rd Year Syllabus

PAPER - XI SOLID STATE PHYSICS

Course Code	Paper-XI	Examination Wing Code	
Name of the course	SOLID STATE PHYSICS		
Number of hrs required for this course	60 hrs.		
Annual Term End Examination	Max Marks 40	Min. Pass Marks 16	Maximum Time:3 hrs.
Internal Assessment based on one house test on the pattern of Annual Examination : 7.5 marks Marks Attendance: 2.5 marks (75%-79%=0.5, 80%-84%=1, 85%-89%=1.5, 90%-94% =2, 95%-100%= 2.5)			Max Marks 10

Instructions

1. **For Paper Setters and candidates:** Nine questions will be set in all; three from section A, three from section B and two from section C and one objective type question covering whole of the course. Candidates will be required to attempt five questions in all, taking at least one from each section. The objective type question shall be *compulsory* and will have 10 parts and may contain questions of short answer type and multiple choice type. The numerical component may be up to 30% marks covering whole of the syllabus.
2. **For internal assessment:** Internal assessment is an integral part of the evaluation process. Internal assessment will be based on house examination score and attendance in the class. Distribution of marks is 20 percent of the total marks i.e. 50 marks (i.e. 10 marks split as shown in the box above separately for House examination and attendance).

Course of Study

SECTION – A: (20 hrs)

1. **Crystal Structure:**

Periodicity, Lattice and basis, Fundamental translation vectors, transnational symmetry, unit cell, primitive cell, Wigner Seitz cell, allowed rotations, lattice types, packing fraction, Miller indices and lattice planes , simple structures NaCl, diamond.

2. **Diffraction Methods:**

Bragg's Law, experimental arrangements, Laue pattern, Laue equation, reciprocal lattice, atomic scattering factor, geometrical structure factors.

3. **Crystal bonding:**

Potential between a pair of atoms, Lennard-Jones potential, Ionic, Covalent, Vander - Waal's. Calculation of cohesive energy for ionic and inert gas system.

SECTION – B: (20 hrs)

1. **Lattice Vibration:**

Vibrations of one dimensional monoatomic chain under haromonic and nearest neighbour interaction approximation, Concept of phonons, density of modes (1-D), specific heat Einstein and Debye's models of specific heat. Extension to 3-D conceptual.

2. **Free electron theory of metals:**

Classical picture, Fermi gas, density of states, Fermi energy and fermi velocity, electronic contribution to specific heat of metals.

3. **Band Theory of Metals:**

Kronig Penny model, Brillouin zones, electrons in periodic structure, energy bands, energy gaps, effective mass of electrons and holes, metals, insulators, semiconductors.

SECTION – C: (20 hrs)

1. **Nano Science:**Introduction to the world of nano materials, size dependence of properties, tools for synthesis for nano structures. Tools for nano sciences (microcopy) Transmission electron microscopy (TEM), Field ion microscopy (FIM) scanning microscopy (Scanning transmission electron microscopy(SE, Scanning Tunneling microscope (STM). Atomic from microscope (AFM) (Basic principle and applications). Introduction to fullereners Carbon nano tubes and nano structures.

2. **Superconductivity:** Resistance to currents, occurrence of super conductivity, idea of critical field, Meissner effect, type I and type II superconductors, isotope effect, penetration of Magnetic field, thermodynamic effect, Flux quantization, BCS theory (Brief idea, Existence of energy gap. High Tc superconduct or Application of super of conductors

Books Suggested:

1 Introduction to Solid State Physics, C. Kittle, 7th Edition, John Wiley and Sons.
2 Introduction to Solids, L .V. Azaroff, Tata Mc-Graw Hill Co. New Delhi(1977)
3 Solid State Physics, C.M. Kachhava, 2nd Reprint(1993), Tata Mc-Graw Hill Co., New Delhi.
4 Solid State Physics, J.S. Blackmore, 2nd Edition, Cambridge University press, Cambridge.
5 Solid State Physics, N.W. Ashcroft and N.D. Mermin, Holt, Rinehart and Winston, New York
6 Nanotechnology: A gentle Introduction to Next Big Idea, Mark Ratner, Daniel Ratner, Pearsion Education, 2003
7 Introduction to Nanotechnology, Charles P. Poole Jr., Frank J Owens, John Wiley and Sons, 2006
8 Nanotechnology, Richard Booker, Earl Boysen, John Wiley and Sons, 2005

PAPER - XII ELECTRONICS

Course Code	Paper-XII	Examination Wing Code	
Name of the course	ELECTRONICS		
Number of hrs required for this course	60 hrs.		
Annual Term End Examination	Max Marks 40	Min. Pass Marks 16	Maximum Time:3 hrs.
Internal Assessment based on one house test on the pattern of Annual Examination : 7.5 marks Marks Attendance: 2.5 marks (75%-79%=0.5, 80%-84%=1, 85%-89%=1.5, 90%-94% =2, 95%-100%= 2.5)			Max Marks 10

Instructions

1. **For Paper Setters and candidates:** Nine questions will be set in all; three from section A, three from section B and two from section C and one objective type question covering whole of the course. Candidates will be required to attempt five questions in all, taking at least one from each section. The objective type question shall be *compulsory* and will have 10 parts and may contain questions of short answer type and multiple choice type. The numerical component may be up to 30% marks covering whole of the syllabus.
2. **For internal assessment:** Internal assessment is an integral part of the evaluation process. Internal assessment will be based on house examination score and attendance in the class. Distribution of marks is 20 percent of the total marks i.e. 50 marks (i.e. 10 marks split as shown in the box above separately for House examination and attendance).

Course of Study

SECTION – A: (20 hrs)

1. **Junctions Diodes:**

p-n junctions, biased junction , V-A characteristics, Zener diode, tunnel diode, LED and LCD, Solar cell. Diode as circuit element, load line concept, Half wave and full wave rectifiers, efficiency and ripple factor, filter circuits, Voltage regulation (Zener and IC).

2. **Transistors:**

Characteristics of a transistor in CB, CE and CC mode, graphical analysis of the CE configuration, Thevnin's Theorem, Norton Theorem, Constant Voltage and current generator, idea of equivalent circuits, low frequency equivalent circuits, h-parameters, bias stability, thermal runaway.

SECTION – B: (20 hrs)

1. **BJT, FET's and MOSFETS:**

Structure and working, α and β of BJT, characteristics, common emitter amplifier, Field effect transistor, JFET volt ampere curves, biasing JFET, ac operation of JFET, source follower, depletion and enhancement mode, MOSFET, biasing a MOSFET, FET as a variable voltage resister, digital MOSFET circuits, FET amplifier.

2. **Amplifiers:**

Small signal amplifiers: General principles of operation, classification, distortion, RC coupled amplifier, gain frequency response, input and output impedance, multistage amplifiers, transformer coupled amplifiers, Equivalent circuits at low, medium and high frequencies; emitter follower, low frequency common-source and common-drain amplifier, Noise in electronic circuits. Feed back in

amplifiers; Negative feed back and stability Braukhausen Criteria for oscillations; Tuned Collector, Hartley and Colpitts oscillators, phase shift oscillators. Operational Amplifier, inverting noninverty amplifier, OP-Amp as adder, subtractor, comparator, integrator and differentiator,

SECTION – C: (20 hrs)

1. **Modulation and detection:**

   AM and FM (Mathematical treatment included), poser in AM and generation of AM. Detector, radio transmitter, radio wave propagation. Ionosphere. Radio receivers.

2. **Digital Fundamentals**: Basic logic gates (OR, AND, NOT, NAND, NOR, XOR, XNOR), positive and negative logic, Boolean algebra theorems, De Morgan's Theorem examples of IC gates. Binary, Octal and Hexadecimal number systems and their inter conversion, Binary arithmetic (addition, subtraction, multiplication and division 1's and 2's complements, code (straight Binary code, BCD code, Gray code) Error detection, correction and Hamming codes.

Books Suggested:

1 Basic Electronics, D.C. Tayal, Himalya Publishing House.
2 Physics of Semiconductor Devices, Dilip K. Roy (1992), Universites Press, Distributed by Orient Longman Limited.
3 The Art of Electronics, Paul Horowitz, Win Field Hill, Foundation Books, New Delhi.
4 Solid State Electronic Devices, Ben G. Streetman, 2nd Edtion(1986), Prentice Hall Of India New Delhi-110001.
5 Electronic Devices, Circuits and Applications, K.N. Lakshminarayan, University Leadership Project, Panjab University, Chandigarh.
6 Electronic Principles, A.P. Malvino, 3rd Edition(1984), Tata Mcgraw Hill Edition, New Delhi.
7 Electronics Fundamentals and Applications, 2nd Edition, Prentice Hall of India Limited, New Delhi.

PAPER -XIII NUCLEAR PHYSICS

Course Code	**Paper-XIII**	**Examination Wing Code**	
Name of the course	**NUCLEAR PHYSICS**		
Number of hrs required for this course	**60 hrs.**		
Annual Term End Examination	**Max Marks 40**	**Min. Pass Marks 16**	**Maximum Time:3 hrs.**
Internal Assessment based on one house test on the pattern of Annual Examination : 7.5 marks **Marks Attendance: 2.5 marks** (75%-79%=0.5, 80%-84%=1, 85%-89%=1.5, 90%-94% =2, 95%-100%= 2.5)			**Max Marks 10**

Instructions

1. **For Paper Setters and candidates:** Nine questions will be set in all; three from section A, three from section B and two from section C and one objective type question covering whole of the course. Candidates will be required to attempt five questions in all, taking at least one from each section. The objective type question shall be *compulsory* and will have 10 parts and may contain questions of short answer type and multiple choice type. The numerical component may be up to 30% marks covering whole of the syllabus.
2. **For internal assessment:** Internal assessment is an integral part of the evaluation process. Internal assessment will be based on house examination score and attendance in the class. Distribution of marks is 20 percent of the total marks i.e. 50 marks (i.e. 10 marks split as shown in the box above separately for House examination and attendance).

Course of Study

SECTION – A: (20 hrs)

1. **General Properties of Nuclei:**
Constituents of nucleus and their Intrinsic properties, quantitative facts about size, mass, density, energy, charge, binding, energy, angular momentum magnetic and moment electric quadrupole moment of nucleus, wave mechanical properties of nucleus, parity and statistics. Average binding energy and its variation with mass number, main features of binding energy versus mass number curve. Qualitative discussion of main properties of nuclear forces. Reasons for the non existence of electrons in nucleus and acceptability of neutron proton model.

2. **Nuclear Models:**
Assumptions of liquid drop model of nucleus, semi empirical mass formula and significance of various terms, condition of nuclear stability. Experimental evidence for nuclear magic numbers, elementary accounts of nuclear shell model, Nuclear energy level scheme and explanations of magic numbers, predictions of shell model.

3. **Radioactivity:**
Models of decay, description of the processes of alpha emission, electron emission, positron emission, electron – capture, gamma ray emission and internal conversion, law of decay, disintegration constant, half life and mean life, unit of radioactivity. Radioactive dating, Radio- active tracers, Qualitative discussion of alpha, beta and gamma ray spectra, Geiger nuttal law, alpha decay : qualitative account of the theory of alpha decay. Neutrino hypothesis of beta decay, evidence for the existence of neutrino, qualitative discussion of the theory of beta decay.

SECTION – B: (20 hrs)

1. **Interaction of Nuclear Radiation with matter**:
Energy loss due to ionization (Bethe- Block formula) t energy loss of electrons, Cerenkov radiation, Rutherford scattering multiple coulomb scattering, passage of gamma- rays through matter, Compton scattering, pair production radiation loss by fast electrons, Radiation length and electron- gamma showers, position a annihilation, Relativistic Kinematics.

2. **Particles Accelerators and Detectors**:
Cockeroft Walton machine, Van de-Graaff generator (quantitative), Cyclotron, Synchrotron, Synchro-cyclotron, Betatron, Linear accelerators.

3. **Detectors**:
Ionization chamber, proportional counter, G. M. Counter. Scintillation counter, nuclear emulsions, bubble chamber.

SECTION – C: (20 hrs)

1. **Cosmic Rays and Elementary particles**:
Nature of cosmic rays, primary and secondary cosmic rays, discovery of elementary particles in cosmic ray studies, masses, life times, decay modes and classification of particle states (Factual information only), types of interactions, quantum numbers conservation laws, isospin, parity, parity violation in beta decay, charge conjugation, discovery of antiproton, discovery of strange particles and their decay modes. Associated production, Gell- Mann-Nishijima scheme, Introduction to leptonic, semileptonic and non-leptonic weak interaction and their selection rules, Introduction to quarks and qualitative description of quark model.

Books Suggested:

1. Nuclear Physics, Irving Kaplan, 2nd Edition, Addition- Wesley publishing Company Inc/ Narosa Publishing House, New Delhi.
2. An Introduction to Nuclear Physics by M.R. Bhiday & V.A.Joshi (Orient- Longman)
3. Introductory Nuclear Physics, R.K. Puri, V.K. Babbar(1996), Narosa Publishing House, New Delhi.
4. Introduction to Modern Physics, H.S. Mani, G. K. Mehta, Affliated East West Press, 1969.
5. Quantum Physics of Atoms Molecules, Solids, Nuclei and Particles, Eisenberg amnd Resnick, John Wiley and sons.
6. Modern Physics, Arthur Beiser, Edition, John Wiley and sons

PAPER - XIV PHYSICS PRACTICAL (B. Sc. 3rd YEAR)

Course Code	**Paper-XIV**	**Examination Wing Code**	
Name of the course	**PHYSICS PRACTICAL (B. Sc. 3rd YEAR)**		
Number of hrs required for this course	**90 hrs. Two sessions of two hrs. each per group, per week**		
Annual Term End Examination to be conducted in two sessions.	**Max Marks 40**	**Min. Pass Marks 16**	**Maximum Time:3 hrs. for each session**
Internal Assessment based on one house test on the pattern of Annual Examination : 7.5 marks **Marks Attendance: 2.5 marks** (75%-79%=0.5, 80%-84%=1, 85%-89%=1.5, 90%-94% =2, 95%-100%= 2.5)			**Max Marks 10**

Instructions

For Paper Setters and candidates: The Practical examination will consists of the following components:

i) One full experiment requiring the students to take some data, analyse it and draw conclusions. (10 Marks)

ii) PC based Experiment (10 marks)

iii) Written test of ½ hour duration. This part will consist of short questions on various experiments of lab included in the course. (5 marks)

iv) Test of lab skills and viva-voce (10 Marks)

v) Record of laboratory activities (note book & Project report). (5 Marks)

Note: (1) *There will be two sessions, each of three hours duration, one in the afternoon & the other in the morning next day. In the first session, half the candidates will be examined in components No. (I) and (iv) while the other half components No. (ii), (iii) and (v). In the second session, the components will interchange.*

(2) *Test in components (i) and (ii) will be conducted according to paper set separately for each session and will consist of three sections.*

Section - A: There will be eight experiments; students will mark six and one will be allotted

Section--B: There will be 10 short questions for components No. (ii) on various aspects of laboratory work.

Section –C: PC based Experiment

2. **For internal assessment:** Internal assessment is an integral part of the evaluation process. Internal assessment will be based on house examination score and attendance in the class. Distribution of marks is 20 percent of the total marks i.e. 50 marks (i.e. 10 marks split as shown in the box above separately for laboratory based house examination and attendance).

SECTION- A:

1) The test of lab skills will be the following test items:
   a) Finding standard deviation.
   b) Least Square fitting.
   c) Use of multimeter.
   d) Use of Oscilloscope.
   e) Circuit tracing of Laboratory electronic equipment,
   f) Setting up of an apparatus taking observation of any experimental activity within the scope of the syllabus.
   g) Usage of GUI windows
   h) DOS commands
   i) Usage of Editor

j) Flow charts of the PC based experiments
k) Familiarity with programming language (FORTRAN).

2) Students are required to calculate errors in the result of the experiments.

SECTION – B:

LABORATORY EXERCISES:
Desirable: i) Knowledge of the fitting of experimental data to a curve, determination of standard deviation and probable error and expressing results in scientific manner. ii) Use of a digital multimetre for measuring voltages and resistance is desirable where needed.

1. **Work Function:**
Objective: Idea of work functions; methods for determination of work function.
Activity: Work function of material of filament of a directly heated diode.

2. **e/m of an electron.**
Objective: e/m of an electron and other charged particles methods for measurement of e/m.
Activities: 1. e/m by long solenoid focusing method.
2. e/m by short solenoid focusing method.

3. **Charge of an electron.**
Objective: Unit charge: methods for measurement of charge of an electron.
Activity: Millikan Oil Drop Apparatus; setting of the apparatus and determination of charge of an electron.

4. **C.R.O.**
Objective: To learn the use of C.R.O.
Activity: Measurement of phase shift in a C.R.O.

5. **RC- Circuits:**
Objective: 1. RC- circuit as a filter network.
2. Wave shaping properties.
Activity: 1. to study the response of RC- circuit at different frequencies.
2. Wave-shaping properties using non sinusoidal wave forms; low pass and high pass circuits.

6. **PN- Junction Diode**:
Objective: 1. Forward and reverse bias characteristics of a junction diode.
2. Diode as a circuit element .
Activities: 1. To draw forward and reverse bias characteristics for a PN-junction diode and draw a load line.
2. Study of a diode as a clipping element.

7. **Energy gap:**
Objective: Intrinsic and extrinsic semi-conductors, band model, energy gap, diode equation.
Activity: Measurement of reverse saturation current to a PN-junction diode at various temperatures and to find the approximate value of energy gap.

8. **Half Wave and Full wave rectifier circuits:**
Objective: Rectification, efficiency and ripple factor Half wave full wave and bridge rectifier circuits.
Activity: To measure the efficiency and ripple factors for: a) Half wave b) full wave and c) bridge rectifier circuits.

9. **Filter Circuits**:
Objective: Ripple in rectified out put, filter circuits with R. L. and C elements.
Activity: RC, LC and PI filter circuits study to reduce ripple.

10. **Voltage Regulation:**

Objective: Variation of out put of an un –regulated power supply with charge in input voltage and load Principle of voltage regulation.
Activity: Study of stabilization of out put voltage of a supply with Zener diode.

11. **BJT Characteristics**:
Objective: 1. PNP and NPN Ge and Si transistors.
2. Characteristics of transistors
3. Transistor parameter.
Activity: 1. To measure and plot common emitter common base characteristics of a transistors.
2. To determine the h- parameters of a BJT.

12. **FET Characteristics:**
Objective:
1. N-channel and P-channel FET.
2. Characteristics of an FET.
3. Parameters of an FET.
Activity: To draw output and mutual characteristics for an FET and determine its parameters.

13. **Biasing of a Transistor**:
Objective: Idea of biasing, need for biasing, different types of biasing.
Activity: Biasing of BJT for normal class A operation and test the output wave from.

14. **Common- Emitter Amplifier:**
Objective: Class A, B, C and AB operation of an amplifier, frequency response of class amplifier.
Activity: To study the gain of an amplifier at different frequencies and to find band width and gain band width product.

15. **LC Oscillators**:
Objective: Conditions for oscillation, LC and RC oscillators.
Activity: To set up an LC-Oscillator and study its output.

16. **Thermistor:**
Objective: Principle of an thermistor : use of a thermistor.
Activity: To study the characteristics of a thermostat and find its parameters.

17. **Photo- Voltaic Cell**:
Objective: Principle, structure and uses of a photo voltaic cell.
Activity: To study the current voltage, power load, areal, azimuthal and spectral characteristics of a photo voltaic cell.

18. **Operational Amplifier:**
Objective: Properties of an ideal OP AMP; uses of an OP AMP.
Activities: Study of; an inverting and non-inverting of OP AMP.

19. **GM Counter:**
Objective: Principles, construction, working and use of a GM-counter.
Activities:
1. Plateau and dead time of a GM counter.
2. Absorption of beta particles in aluminum.

20. **Magnetic Susceptibility:**
Objective: Magnetic properties of materials measurement of magnetic susceptibility of a substance.
Activity: To measure magnetic susceptibility of FeCl , solution by Quincke's method.

21. Verify the truth tales of (a) AND (b) OR, (c) NOT, (d) NAND (e) NOR (f) XOR (g) EXTOR gates)
22. Implementation of half adder using AND- OR gates.
23. Implementation of full adder using AND –OR-gates.
24. Implementation of half subtraction using AND-OR & NOT gates
25. Implementation of full Subtractor using AND- OR and NOT gates
26. Verify truth tales of RS& JK flip flops
27. Using 555 timer as astable multivibrator.

SECTION – C:

PC based experiments (With FORTRAN)

1. Find roots of F (x)=0 using bisection / newton Raphson/ secant method.
2. Find factorials
3. Integration by Simpson Rule
4. Eight Queens Problem
5. Magic Squares
6. String Manipulations
7. Towers Of Hanoi
8. Finding of Four perfect numbers.
9. Quadratic interpolation using Newton's forward difference formula of degree 2.
10. Find the solution of equation of motion.
11. Motion of projectile using computer simulation.
12. Motion of particle in a central force field.
13. Computer generation of phase space of SHO
14. Numerical solution of wave function of SHO.
15. Simulation study of variation of mass with velocity.
16. Simulation of radioactivity.

Suggested Open ended Exercises:

1. Color codes for resistor and capacitors.
2. Testing a diode BJT and FET.
3. Winding a coil / transformer.
4. To test a microphone/ speaker.
5. To test a radio-receiver.
6. Study the layout of receiver circuit.
7. Fabrication of battery eliminator/ regulated power supply public address system/ radio- received.

Additional list of Experiments for B.Sc. Part-III (Physics)

i) To determine the temperature coefficient of resistance using platinum resistance thermometer
i) To plot a graph between thermo emf and temperature for a given thermocouple.
ii) To determine self inductance by Rayleigh's method.
iii) To find angle of dip using earth inductor.
iv) To compare the capacitance of two capacitors by deflection method.
v) To find the frequency of ac supply by electrical vibrator .
vii) To study the variation of magnetic field along the axis of a circular coil using Stewart and Gee galvanometer .
viii) To determine H & M using deflection and vibration magnetometer.
ix) To determine the frequency of an electrically maintained tuning fork by Melde 's experiment.
x) Compare the frequency of oscillations using C.R.O and generating Lissazous figures
xi) To compare the capacitance using electrical vibrator.

Note: For conducting Computer based Experiments it is recommended that each Physics laboratory be provided with at least 3 Pentium 4 PC's with dual booting and linex operating system Windows operating system, FORTRAN / BASIC Compiler, a word processing package, a graphics package such as Gnu plot and a DOT matrix Printer/ Ink jet printer. Students are to maintain a record of each PC based experiment in the form of a flow chart, source code in a programming language and output, both numerical and graphics, of the runs of the compiled programs.

Books Suggested

1. Schism's Outline of Theory and Problems of Programming with Fortran, S Lipsdutz and A Poe, 1986Mc-Graw Hill Book Co.
2. Introduction to PC's, DOS and Computing with Applications, U. N. Khosla, P. K. Ahluwalia, R. C. Verma, 1998, Allied Publishers, New Delhi.
3. A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi.
4. Computational Physics: An Introduction, R. C. Verma, etal, New Age International Publishers, New Delhi(1999)

PAPER- XV DIGITAL ELECTRONICS

(Additional paper for Honours Students)

Course Code	**Paper-XV**	**Examination Wing Code**	
Name of the course	**DIGITAL ELECTRONICS**		
Number of hrs required for this course	**60 hrs.**		
Annual Term End Examination	**Max Marks 40**	**Min. Pass Marks 16**	**Maximum Time:3 hrs.**
Internal Assessment based on one house test on the pattern of Annual Examination : 7.5 marks **Marks Attendance: 2.5 marks** (75%-79%=0.5, 80%-84%=1, 85%-89%=1.5, 90%-94% =2, 95%-100%= 2.5)			**Max Marks 10**

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2. **For internal assessment:** Internal assessment is an integral part of the evaluation process. Internal assessment will be based on house examination score and attendance in the class. Distribution of marks is 20 percent of the total marks i.e. 50 marks (i.e. 10 marks split as shown in the box above separately for House examination and attendance).

Course of Study

SECTION- A: (20 hrs)

Basic Idea about fundamental Products and derivation of through sum of product methods, sum of product equation. Minterms and Maxterms, Karnaugh mapping, k-map representation of logical functions for 2-4 variable, simlification of Boolean Equation with the help of k-map, Various minmiztion techniques, Quinne's Methods and quinnel Mc- Cluskey method, Difference between combinational & sequential ckts, Half adder, Full adder, Half subtractor, Full subtractor, Serial and parallel Binary adder,

SECTION- B: (20hrs)

Various kind of Flip Flops, clocked RS flip, Flop, Edge Triggered, D Flip Flop, Flip Flop, twitching time, JK Flip Flop, JK Master slave. Flip Flop, Clock waveforms, 555 timer as astable multivibrator, shift registers: Serial out, parallel in, parallel out; synchronous counters, Alynchronous counters, Ring counters ,D/A counverters, A/D Counters, clipping and Clamping, astable, Monostable and bistable multivibrators using transistors.

SECTION- C: (20 hrs)

Introduction and performance criteria for logic families, Various logic families: DCTL, RTL, DTL, TTL & ECL, working and characteristics in priew, Saturated and non-saturated , fan in and fan out, MOS gates and CMOS gate, comparison of various logic families.

Books Suggested:

1. Malvino and Leach, Digital Principle and application
2. Taub and Schilling, Digital Integrated Electronics
3. Samuel C Lee, Digital Circuits and Logic Design 4. Pulse, Digital and Switching Waveforms, Millman and Taub.
4. Lionel Warnes, Macmillan Press Limited Analogue and Digital Electronics, London, 1998.
5. Digital fundamentals by Floyd & Jain, Pearson Eduction.