Approved in BOS meeting in the Subject of Physics held on 07.06.2013

Annexure-I of BOS Meeting

PHYSICS DEPARTMENT
HIMACHAL PRADESH UNIVERSITY

OUT LINES OF SYLLABI AND COURSES OF READING

IN THE SUBJECT OF PHYSICS FOR B. Sc. WITH MAJOR IN PHYSICS AND MINOR ELECTIVE IN PHYSICS (2013-2014 onwards)

(A) Structure Outline of Major in Physics (Minimum Credits to be Earned=56)

Semester	Course Code	Course Type	Course Name	Credit(s)	Cumulated Credits Category-wise
I (O dd)		Compulsory Course I	To be Selected from the list of Compulsory Courses	3	Compulsory – 6 **Core – 8** Elective – 8 GI & H – 1 Total – 23
		Compulsory Course II (Skill Based)	To be Selected from the list of Compulsory Courses (Skill Based)	3	
	BSCPHY0101	Major Core Course I	**Mechanics**	**3 ***	
	BSCPHY0102	Major Core Course II	**Computer Applications in Physics**	**3***	
		Minor Elective Course I (a)	To be Selected from the list for Minor Elective Subject other than Physics	3	
		Minor Elective Course I (b)	To be Selected from the list for Minor Elective Subject other than Physics	3	
	BSCPHY0101(P)	Major Core Lab Course I	**Physics Lab 1 Mechanics)**	**1***	
	BSCPHY0102(P)	Major Core Lab Course II	**Computational Physics Lab 1**	**1***	
		Minor Elective Lab Course I (a)	To be Selected from the list for Minor Elective Subject other than Physics	1	
		Minor Elective Lab Course I (b)	To be Selected from the list for Minor Elective Subject other than Physics	1	
		GI and H Course I	To be Selected from the list GI and Hobby Courses	1	

Semester	Course Code	Course Type	Course Name	Credit(s)	Cumulated Credits Category-wise
II (Even)		Compulsory Course III	To be Selected from the list of Compulsory Courses	3	Compulsory – 6 (12) **Core – 8 (16)** Elective – 8 (16) GI & H – 1 (2) Total 23 (46)
		Compulsory Course IV(Skill Based)	To be Selected from the list of Compulsory Courses (Skill Based)	3	
	BSCPHY0203	Major Core Course III	**Fundamentals of Quantum Mechanics**	**3***	
	BSCPHY0204	Major Core Course IV	**Optics**	**3***	
		Minor Elective Course II (a)	To be Selected from the list for Minor Elective Subject other than Physics	3	
		Minor Elective Course II (b)	To be Selected from the list for Minor Elective Subject other than Physics	3	
	BSCPHY0203(P)	Major Core Lab Course III	**Physics Lab II (Optics-I)**	**1***	
	BSCPHY0204(P)	Major Core Lab Course IV	**Physics Lab III (Optics-II)**	**1***	
		Minor Elective Lab Course II (a)	To be Selected from the list for Minor Elective Subject other than Physics	1	
		Minor Elective Lab Course II ()	To be Selected from the list for Minor Elective Subject other than Physics	1	
		GI and H Course II	To be Selected from the list GI and Hobby Courses	1	
III (Odd)		Compulsory Course V	To be Selected from the list of Compulsory Courses	3	Compulsory – 6 (18) (Complete) **Core – 8 (24)** Elective – 8 (24) GI & H – 1 (3) (Complete) Total 23 (69)
		Compulsory Course VI	To be Selected from the list of Compulsory Courses (Skill Based)	3	
	BSCPHY0305	Major Core Course V	**Vibrations and Waves**	**3***	
	BSCPHY0306	Major Core Course VI	**Laser Physics**	**3***	
		Minor Elective Course III (a)	To be Selected from the list for Minor Elective Subject other than Physics	3	

Semester	Course Code	Course Type	Course Name	Credit(s)	Cumulated Credits Category-wise
		Minor Elective Course III(b)	To be Selected from the list for Minor Elective Subject other than Physics	3	
	BSCPHY0305(P)	Major Core Lab Course V	**Physics Lab IV (Laser Lab)**	**1***	
	BSCPHY0306(P)	Major Core Lab Course VI	**Computational Physics Lab II**	**1***	
		Minor Elective Lab Course III(a)	To be Selected from the list for Minor Elective Subject other than Physics	1	
		Minor Elective Lab Course III(b)	To be Selected from the list for Minor Elective Subject other than Physics	1	
		GI and H Course III	To be Selected from the list GI and Hobby Courses	1	
IV (Even)	**BSCPHY0407**	Major Core Course VII	**Electricity & Magnetism**	3*	**Core – 12 (36)** Elective – 8 ((32) Core / Elective (additional) - 4 Total 24 (93)
	BSCPHY0408	Major Core Course VIII	**Nuclear Physics**	**3***	
	BSCPHY0409	Major Core Course IX	**Particle Physics**	**4***	
		Minor Elective Course IV (a)	To be Selected from the list for Minor Elective Subject other than Physics	4	
		Minor Elective Course IV (b)	To be Selected from the list for Minor Elective Subject other than Physics	4	
	BSCPHY0407(P)	Major Core Lab Course VII	**Physics Lab V (Electricity and Magnetism –I)**	**1***	
	BSCPHY0408(P)	Major Core Lab Course VIII	**Physics Lab VI (Electricity and Magnetism –II)**	**1***	
		Minor Elective Lab Course IV (a)	To be Selected from the list for Minor Elective Subject other than Physics	1	
		Minor Elective Lab Course IV(b)	To be Selected from the list for Minor Elective Subject other than Physics	1	

Semester	Course Code	Course Type	Course Name	Credit(s)	Cumulated Credits Category-wise
		Core / Elective Course (Additional)*		4	
V (O dd)	**BSCPHY0510**	Major Core Course X	**Statistical Mechanics and Thermodynamics**	**3***	**Core – 12 (48)** Elective – 8 (40) (Complete) Core / Elective (additional) - 4 Total 24 (117)
	BSCPHY0511	Major Core Course XI	**Solid State Physics**	**4***	
	BSCPHY0512	Major Core Course XII	**Electronics**	**3***	
		Minor Elective Course V(a)	To be Selected from the list for Minor Elective Subject other than Physics	3	
		Minor Elective Course V(b)	To be Selected from the list for Minor Elective Subject other than Physics	3	
	BSCPHY0510(P)	Major Core Lab Course X	**Physics Lab VII (Electronics)**	**1***	
	BSCPHY0511(P)	Major Core Lab Course XI	**Computational Physics Lab III**	**1***	
		Minor Elective Lab Course V (a)	To be Selected from the list for Minor Elective Subject other than Physics	1	
		Minor Elective Lab Course V (b)	To be Selected from the list for Minor Elective Subject other than Physics	1	
		Core / Elective Course (Additional)*	Any one of the Additional or open elective courses	4	
VI (Even)	**BSCPHY0513**	Major Core Course XIII	**Digital Electronics**	**3***	**Core – 8 (56)** Core / Elective (additional) – 20* Total 28 (145)
	BSCPHY0514	Major Core Course XIV	**Mathematical Physics**	**4***	
	BSCPHY0513(P)	Major Core lab Course XIII	**Physics Lab VIII (Digital Electronics Lab)**	1*	
	BSC(Or Other than Science) PHY(or other than Physics) 06**	Core / Elective Course (Additional)*	Any one of the Additional or open elective courses	4	
	BSC(Or Other than Science) PHY(or other than Physics) 06**	Core / Elective Course (Additional)*	Any one of the Additional or open elective courses	4	

Semester	Course Code	Course Type	Course Name	Credit(s)	Cumulated Credits Category-wise
	BSC(Or Other than Science) PHY(or other than Physics) 06**	Core / Elective Course (Additional)*	Any one of the Additional or open elective courses	4	
	BSC(Or Other than Science) PHY(or other than Physics) 06**	Core / Elective Course (Additional)*	Any one of the Additional or open elective courses	4	
	BSC(Or Other than Science) PHY(or other than Physics) 06**	Core / Elective Course (Additional)*	Any one of the Additional or open elective courses	4	

** For a course having a lab the 4 credits have been distributed as: L3+T0+P1

*Additional Elective Courses offered by Physics Department

Semester	Course Code	Course Type	Course Name	Credit(s)	Cumulated Credits Category-wise
V/VI	**BSCPHY05/0615**	Core / Elective Course (Additional)*	**Computer Simulations in Physics**	3*	
V/VI	**BSCPHY05/0615(P)**	Core / Elective lab Course (Additional)*	**Computer Simulations in Physics Lab**	1*	
V/VI	**BSCPHY05/0616**	Core / Elective Course (Additional)*	**Nano Technology**	4*	
V/VI	**BSCPHY05/0617**	Core / Elective Course (Additional)*	**Energy Studies**	4*	
V/VI	**BSCPHY05/0618**	Core / Elective Course (Additional)*	**Astronomy and Astrophysics**	4*	
V/VI	**BSCPHY05/0619**	Core / Elective Course (Additional)*	**Bio Physics**	4*	
V/VI	**BSCPHY05/0620**	Core / Elective Course (Additional)*	**Medical Physics** *	4*	

Semester	Course Code	Course Type	Course Name	Credit(s)	Cumulated Credits Category-wise
V/VI	**BSCPHY05/0621**	Core / Elective Course (Additional)*	**Introduction to Microprocessors**	4*	
V/VI	**BSCPHY05/0622**	Core / Elective Course (Additional)*	**Electronics Instrumentation and Measurement**	3*	
V/VI	**BSCPHY05/0622 (P)**	Core / Elective Course (Additional)*	**Electronics Instrumentation and Measurement Lab**	1*	

*Open Elective Courses offered by Physics Department

Semester	Course Code	Course Type	Course Name	Credit(s)	Cumulated Credits Category-wise
V/VI	**BSCPHY05/0623**	Open /Core Elective Course (Additional)*	**Renewable Sources of Energy**	4*	
V/VI	**BSCPHY05/0624**	Core / Elective Course (Additional)*	**Consumer Electronics**	3*	
V/VI	**BSCPHY05/0624(P)**	Core / Elective Course (Additional)*	**Consumer Electronics Lab**	1*	

General Interest Courses Offered by Physics Department

Semester	Course Code	Course Type	Course Name	Credit(s)	Cumulated Credits Category-wise
I/II/III	BSCPHY01/02/0325	GI/H	**History of Science**	1*	
I/II/III	BSCPHY01/02/0326	GI/H	**Science, Technology and Society**	1*	

Structure Outline of Minor Elective in Physics for other than Major Physics Students (Minimum Credits to be Earned=20)

Semester	Course Code	Course Name	Course Name	Credit(s)	Cumulated Credits Category-wise
I (Odd)		Compulsory Course I		3	Compulsory – 6 Core – 8 **Minor Elective 1(a) – 4(4)** Minor Elective 1(b)=4 Total Minor Electives – 8 (8) GI & H – 1 Total – 23
		Compulsory Course II (Skill Based)		3	
		Major Core Course I		3	
		Major Core Course II		3	
	BSCPHY0101	**Minor Elective Course I (a)**	**Mechanics**	3	
		Minor Elective Course I (b)		1	
		Major Core Lab Course I		1	
		Major Core Lab Course II		1	
	BSCPHY0101(P)	**Minor Elective Lab Course I (a)**	**Physics Lab 1 (Mechanics)**	**1**	
		Minor Elective Lab Course I (b)		1	
		GI and H Course I		1	
II (Even)		Compulsory Course III		3	Compulsory – 6 (12) Core – 8 (16) **Minor Elective 1I(a) – 4 (8)** Minor Elective 1I(b) – 4 (8) Total Minor Electives – 8 (16) GI & H – 1 (2) Total 23 (46)
		Compulsory Course IV(Skill Based)		3	
		Major Core Course III		3	
		Major Core Course IV Optics		3	
	BSCPHY0203	**Minor Elective Course II (a)**	**Fundamentals of Quantum Mechanics**	**3**	
		Minor Elective Course II (b)		3	
		Major Core Lab Course III		1	
		Major Core Lab Course IV		1	
	BSCPHY0203(P)	**Minor Elective Lab Course II (a)**	**Physics Lab II (Optics-I)**	**1**	
		Minor Elective Lab Course II ()		1	
		GI and H Course II		1	
III (Odd)		Compulsory Course V		3	Compulsory – 6 (18) (Complete) Core – 8 (24) **Minor**
		Compulsory Course VI		3	
		Major Core Course V		3	

Semester	Course Code	Course Name	Course Name	Credit(s)	Cumulated Credits Category-wise
		Major Core Course VI	------	3	**Elective III(a) – 4 (12)** Minor Elective III(b) – 4 (12) Elective – 8 (24) GI & H – 1 (3) (Complete) Total 23 (69)
	BSCPHY0305	**Minor Elective Course III (a)**	**Vibrations and Waves**	**3**	
		Minor Elective Course III(b)	------	3	
		Major Core Lab Course V	------	1	
		Major Core Lab Course VI	------	1	
	BSCPHY0305(P)	**Minor Elective Lab Course III(a)**	**Physics Lab IV (Laser Lab)**	**1**	
		Minor Elective Lab Course III(b)	------	1	
		GI and H Course III	------	1	
IV (Even)		Major Core Course VII	------	4	Core – 12 (36) **Minor Elective IV(a) – 4 (16)** Minor Elective IV(b) – 4 (16) Total Minor Electives – 8 (32) Core / Elective (additional) - 4 Total 24 (93)
		Major Core Course VIII Nuclear Physics	------	4	
		Major Core Course IX Particle Physics	------	4	
	BSCPHY0407	**Minor Elective Course IV (a)**	**Electricity & Magnetism**	**4**	
		Minor Elective Course IV (b)	------	4	
		Major Core Lab Course VII	------	1	
		Major Core Lab Course VIII	------	1	
	BSCPHY0407(P)	**Minor Elective Lab Course IV (a)**	**Physics Lab V (Electricity and Magnetism-I)**	**1**	
		Minor Elective Lab Course IV(b)	------	1	
		Core / Elective Course (Additional)*	------	4	
V (O dd)		Major Core Course X	------	3	Core – 12 (48) **Minor Elective V(a) – 4 (20)** Minor Elective V(b) – 4 (20) Total Minor Electives – 8 (40) (Complete)
		Major Core Course XI	------	3	
		Major Core Course XII	------	3	
	BSCPHY0510	**Minor Elective Course V(a)**	**Statistical Mechanics and Thermodynamics**	**3**	
		Minor Elective Course V(b)	------	3	
		Major Core Lab Course X	------	1	

Semester	Course Code	Course Name	Course Name	Credit(s)	Cumulated Credits Category-wise
		Major Core Lab Course XI	------	1	Core / Elective (additional) - 4 Total 24 (117)
		Major Core Lab Course XII *	------	1	
	BSCPHY0510(P)	**Minor Elective Lab Course V(a)**	**Physics Lab VII (Electronics)**	**1**	
		Minor Elective Lab Course V (b)	------	1	
		Core / Elective Course (Additional)*	------	4	
VI (Even)		Major Core Course XIII	------	4	Core – 8 (56) Core / Elective (additional) – 20* Total 28 (145)
		Major Core Course XIV	------	4	
		Core / Elective Course (Additional)*	------	4	
		Core / Elective Course (Additional)*	------	4	
		Core / Elective Course (Additional)*	------	4	
		Core / Elective Course (Additional)*	------	4	
		Core / Elective Course (Additional)*	------	4	

Syllabus

Semester I

Course Code 1	**BSCPHY0101**		
Credits=3	**L=2 , T=1 , P=0**		
Name of the course	**MECHANICS**		
Type of the course	**Major Core Course I and Minor Elective Course 1(a)**		
Number of hrs required for this course	**45 hrs.**		
Total Max Marks	**100**		
Semester Term End Examination	**Max Marks: 50**		**Maximum Time: 3 hrs.**
Continuous Comprehensive Assessment: Based on Minor Tests (2), class tests, Tutorials/ Assignments, Quiz, Seminar and Attendance. **Marks Attendance:** 5 marks to be given as per the regulations			**Max Marks: 50**

Instructions:

1. **For Paper Setters and candidates:** Question paper will consist of five sections: Sections A (Compulsory, Covering all the units), B(Unit-I), C (Unit-II), D (Unit-III) , E (Unit IV). Nine questions will be set in all. Section A will be Compulsory, consisting of a single question with 9 subparts of objective short answer/ multiple choice type, which will cover whole of the syllabus of the course and consist of the 36% of the maximum marks of the end term examination for the course. Sections B, C, D, and E will have two questions each from respective sub units and each question will carry 16% of maximum marks of the end term examination for the course. 20-30% questions should be problem based numericals.
2. **For Candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections: B,C,D and E of the end term question paper and all the subparts in section A. Use of nonprogrammble calculator and log tables is allowed.

Course of Study

Unit-1 (12 hrs.)

1.1 Co-ordinate Systems and Motion of a Particle : Volume, velocity and acceleration in Cartesian and Spherical co-ordinate systems. Solid angle.

1.2 Space Time Symmetry, Conservation Laws and Frames of Reference: Relationship of conservation laws and symmetries of space and time. Inertial frames of reference. Galilean transformation and Galilean invariance. Non-inertial frames, Coriolis force and its applications. Focault's pendulum.

Unit-II (12 hrs.)

2.1 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.

2.2 Effects of Relativity: 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.

Unit-III (10 hrs.)

3.1 Inverse Square Force Law: Various forces in nature (qualitative). Central forces, Centre of mass. Equivalent one body problem.

3.2 Equation of motion under a force law. Equation of orbit and turning points. Kepler's laws.

Unit-IV (11 hrs.)

4.1 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.

4.2 Classical Scattering: 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.
7. **Mechanics, DS Mathur, S Chand and Company**
8. **An Introduction to Mechanics, Kleppner, Tata Macgraw Hill**

Internet Resources: Walter Lewin's Video lectures (MIT Open Course Wares)

Course Code 2	**BSCPHY0102**		
Credits=3	**L=2 , T=1 , P=0**		
Name of the course	**COMPUTER APPLICATIONS IN PHYSICS**		
Type of the course	**(Major Core Course II)**		
Number of hrs required for this course	**45 hrs.**		
Total Maximum Marks	**100**		
Semester Term End Examination	**Max Marks: 50**		**Maximum Time: 3 hrs.**
Continuous Comprehensive smentAssessment: Based on Minor Tests (2), class tests, Tutorials/ Assignments, Quiz, Seminar and Attendance. **Marks Attendance:** 5 marks to be given as per the regulations			**Max Marks: 50**

Instructions:

1 **For Paper Setters and candidates:** Question paper will consist of five sections: Sections A(Compulsory, Covering all the units), B(Unit-I), C (Unit-II), D (Unit-III) , E (Unit IV). Nine questions will be set in all. Section A will be Compulsory, consisting of a single question with 9 subparts of objective short answer/ multiple choice type, which will cover whole of the syllabus of the course and consist of the 36% of the maximum marks of the end term examination for the course. Sections B, C, D, and E will have two questions each from respective sub units and each question will carry 16% of maximum marks of the end term examination for the course. 20-30% questions should be problem based numericals/algorithms.

2. **For Candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections: B,C,D and E of the end term question paper and all the subparts in section A. Use of nonprogrammble calculator and log tables is allowed.

Course of Study

Unit-1 (12 hrs.)

1.1 Physics and Computers: Importance of Computers in Physics as third way of doing physics, Formulation of a problem for solution on a computer, paradigm for solving physics problems for solution**. Algorithms and Flowcharts: Algorithm:** Definition, Properties and development **Flowchart:** Concept of flowchart, flowchart symbols, flowcharting guidelines, advantages and limitations of flowcharts, Types of flowcharts. **Examples of algorithms and flowcharts:** Cartesian to Spherical Polar Coordinates, Roots of Quadratic Equation, Sum of two matrices, Sum and Product of a finite series, calculation of sin x as a series, algorithm for plotting lissajous figures, algorithm for plotting trajectory of a projectile thrown at an angle with the horizontal. (4)

1.2 Fundamentals of Computer: Introduction to Computers: Definition, Characteristics, Advantages & Limitations. **Anatomy of Computers:** Components of Computer (Input, Output, Storage, ALU, CU CPU) and their functions. **Generations of Computer:** First to 5^{th} Generation **Overview of Input devices of Computer:** Keyboard, Mouse, **Scanners:** Image scanner, OCR, OMR, MICR. **Overview of Output devices of Computer**: Monitors: CRT, LCDs, **Printers:** Dot Matrix, Laser. **Memory:** Units and Types (Primary: RAM/ROM, Cache; Auxiliary Memory: Hard Disk, Memory Cards (SD/MMC), CDs, DVD, Flash Derive.)**Types of Software (System and Application)**: Operating System, **Translators:** Interpreter, Assembler, Compiler & **Programming languages**: Machine, Assembly and HLL **Operating System**: Concept and Functions of OS **Some fundamental Linux Commands:** Internal and External commands **Introduction to Windows:** features of windows, Brief history of Windows, Parts of window screen, types of windows (Application and document windows), and Anatomy of windows. (8)

Unit-II (11 hrs.)

2.1 **Scientific Programming**: Development of **FORTRAN**, **Basic elements of FORTRAN:** Character Set, Constants and their types, Variables and their types, Keywords, Variable Declaration and concept of instruction and program. **Operators:** Arithmetic, Relational, Logical and Assignment Operators. **Expressions:** Arithmetic, Relational, Logical, Character and Assignment Expressions. **Fortran Statements:** I/O Statements[unformatted/formatted], Executable and Non-Executable Statements, Layout of a Fortran Program, Format of writing a computer Program and concept of coding, Initialization and Replacement Logic. Examples from physics problems (5)

2.2 **Control Statements:** Types of Logic(Sequential, Selection, Repetition), Branching Statements (Logical **IF**, Arithmetic IF, Block IF, Nested Block IF, SELECT CASE and ELSE IF Ladder statements), Looping Statements (DO-CONTINUE, DO-ENDDO, DO-WHILE, Implied and Nested DO Loops), Jumping Statements (Unconditional GOTO, Computed GOTO, Assigned GOTO) Subscripted Variables (Arrays: Types of Arrays, DIMENSION Statement, Reading and Writing Arrays), Functions and Subroutines (Arithmetic Statement Function, Function Subprogram and Subroutine), RETURN, CALL, COMMON and EQUIVALENCE Statements), Structure, Disk I/O Statements, open a file, writing in a file, reading from a file. Examples from physics problems (6)

Unit-III (12 hrs.)

3.1 Scientific word processing: Introduction to LaTeX: TeX/LaTeX word processor, preparing a basic LaTeX file, Document classes, Preparing an input file for LaTeX, Compiling LaTeX File, LaTeX tags for creating different environments, Defining LaTeX commands and environments, Changing the type style, Symbols from other languages. **Mathematical Environment:** Mathematical formulae and equations, Figures and other floating bodies, Lining in columns-Tabbing and tabular environment, Generating table of contents, bibliography and citation, Making an index and glossary, List making environments, Fonts, Picture environment and colors, errors. (6)

3.2 Visualisation:What is graphical analysis, Why graphical analysis, limitations of graphical analysis, what **is gnuplot?** importance of visualization of computational and computational data, Introduction to Gnuplot, basic gnuplot commands: simple plots, plotting data from a file, saving and exporting, multiple data sets per file, physics with gnuplot (mathematical experssions, building functions, user defined variables and functions)

3.3 Understanding data with gnuplot**,** (6)

Unit-IV (10 hrs.)

4.1 Introduction to electronic spreadsheet, Brief history and applications, Features of MS Excel, Organization of spreadsheet, Building a spreadsheet, Entering data: Text data, numeric data, formulae, entering different functions (Mathematical, Statistical, Trigonometric, Logical, Text and Financial); Types of operators (Arithmetic, Comparison, Text Concatenation and Reference), Syntax and nesting of functions, Cell Addressing/Referencing (Absolute, Relative and Mixed). Charting using spreadsheets (6)

4.2 Basic introduction to VBA: Functions, module, macro, data types, declaration of variable, control and looping statements. (4)

References:

1. Computer Programming in Fortran 77" by V. Rajaraman (Publisher:PHI).
2. Computer Fundamentals" by Pradeep K Sinha and Priti Sinha (BPB Publications).
3. LaTeX – A Document Preparation System" by Leslie Lamport (Second Edition, Addison-Wesley, 1994).
4. Excel 2010-Power Programming with VBA" by John Walkenbach (Wiley India Pvt Ltd).

5. Gnuplot in action: understanding data with graphs, Philip K Janert, (Manning 2010)
6. Fundamentals of Computer, V. Rajaraman (PHI Ltd.).

Course Code 3	**BSCPHY0101(P)**		
Credits=1	**L=0 , T=0 , P=1**		
Name of the course	**Physics Lab 1 (Mechanics)**		
Type of the course	**(Major Core Lab Course I/ Minor Elective Lab Course 1(b))**		
Number of hrs required for this course	**30hrs.**		
Total Max Marks	**50**		
Semester Term End Examination	**50 % of total marks**		**Maximum Time: 3 hrs.**
Continuous Comprehensive Assessment: Based on performance in the laboratory, lab record, lab seminar and Attendance. **Marks Attendance:** 5% marks to be given as per the regulations			**Max Marks: 50% of the total marks**

Instructions for Paper Setters and candidates: Laboratory examination will consist of two parts: (i) Performing a practical exercise assigned by the examiner from Unit II or Unit III (50% of the total marks) (ii) Viva Voce Examination (50 % of the total marks) Viva Voce Examination will be related to the practical performed, seminar assignment done by the candidate related to the paper and lab skills (Unit I) learnt during the course of the semester.

Course of Study

Unit-I

The test of lab skills will be of the following test items:

i. Finding standard deviation.
ii. Least square fitting
iii. Units of measurements of different physical quantities and their dimensional formulae.
iv. Calculation of errors in the result of the experiments (including percentage error).
v. Knowledge of the fitting of experimental data to a curve, determination of standard deviation and probable error and expressing result in scientific manner.
vi. Least counts of various measuring instruments
vii. Setting up of an apparatus taking observation of any experimental activity within the scope of the syllabus
viii. Interpretation of graphical data

Unit-II

Laboratory Exercises

1. Conservation of momentum in two dimensions.
2. Momentum of Inertia of a flywheel.
3. Determination of Surface Tension by Traveling Microscope.
4. Modulus of Elasticity by Beam Bending method.
5. Searle's method for finding Y and σ.
6. g by Bar pendulum
7. g by Kater's Pendulum
8. Rutherford's Scattering Experiment **(Through Remotely Controlled Lab) http://rd-munich.informatik.unibw-muenchen.de/**
9. **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 to be decided by the teacher concerned.

10. 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.

Unit-III

Suggested Open ended Exercises:

1. Using tracker to study the rotational motion of a flywheel after capturing video of the rotational motion of a flywheel
2. Determination of c oefficient of Friction.
3. To find atmospheric pressure using Fortin's Barometer.

Books /References Suggested

1. A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi.
2. **http://rd-munich.informatik.unibw-muenchen.de/docs/Table of_worldwide_RCL's.pdf**
3. **Practical Physics, C.L. Arora (S.Chand).**

Course Code 4	**BSCPHY0102(P)**	
Credits=1	**L=0 , T=0 , P=1**	
Name of the course	**Computational Physics Lab I**	
Type of the course	**(Major Core Lab Course II)**	
Number of hrs required for this course	**30 hrs.**	
Total Max Marks	**50**	
Semester Term End Examination	**50 % of total marks**	**Maximum Time: 3 hrs**
Continuous Comprehensive Assessment: Based on performance in the laboratory, lab record, lab seminar and Attendance. **Marks Attendance:** 5% marks to be given as per the regulations		**Max Marks: 50% of the total marks**

Instructions for Paper Setters and candidates: Laboratory examination will consist of two parts: (i) Performing a practical exercise assigned by the examiner from Unit II or Unit III (50% of the total marks) (ii) Viva Voce Examination (50 % of the total marks) Viva Voce Examination will be related to the practical performed, seminar assignment done by the candidate related to the paper and lab skills (Unit I) learnt during the course of the semester.

Course of Study

Unit I (6hrs)

Learning Computational physics Lab skills

1. Usage of MS or any other editor GUI windows
2. DOS/windows/linux commands
3. Usage of Editor
4. Flow charts of the PC based experiments
5. Familiarity with programming language, FORTRAN

Unit II (8 hrs)

PC Based Experiments:

1. Exercises on syntax on usage of FORTRAN
2. Usage of GUI Windows, Linux Commands, familiarity with DOS commands and working in an editor to write sources codes in a programming language (FORTRAN).
3. To print out all natural even/ odd numbers between given limits
4. To find maximum, minimum and range of a given set of numbers
5. Calculating euler number using exp(x) series evaluated at x=1

Unit III (8 hrs)

PC Based Experiments:

1. To compile a frequency distribution and evaluate moments such as mean; standard deviation etc.
2. To evaluate sum of finite series and the area under a curve.
3. To find the product of two matrices
4. To find a set of prime numbers and Fibonacci series.
5. To write program to open a file and generate data for plotting the data using Gnuplot
6. Plotting trajectory of a projectile projected horizontally
7. Plotting trajectory of a projectile projected making an angle with the horizontally.
8. Creating an input gnuplot file for plotting a data and savin the output for seeing on the screen, saving it as an eps file and saving it as a pdf file.

Unit IV (8 hrs)

PC Based Experiments:

1. To find the roots of a quadratic equation.
2. Motion of a projectile using computer simulation and plotting the output for visualization
3. Numerical solution of equation of motion of SH.O and plotting the outputs for visualization.
4. Motion of particle in a central force field and plotting the output for visualization.

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 Computational Physics: An Introduction, R. C. Verma, etal. New Age International Publishers, New Delhi(1999)

4 Gnuplot in action: understanding data with graphs, Philip K Janert, (Manning 2010)

5 www.spokentutorial.org of IIT Bombay NMEICT project.

***Note*:** For conducting Computer based Experiments it is recommended that each Physics laboratory be provided with at least 5 intel PC's having dual Linux/Windows operating system and a laser printer. FORTRAN/ BASIC/C Compiler, A spreadsheet package (Excel), a word processing package such as open office/ latex package, a graphics package such as Gnu plot 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. Students may be exposed to spoken tutorials of Talk to a Teacher program to learn basic commands of Linux and windows operating systems.

Semester II

Course Code 5	**BSCPHY0203**	
Credits=3	**L=2 , T=1 , P=0**	
Name of the course	**FUNDAMENTALS OF QUANTUM MECHANICS**	
Type of the course	**Major Core Course III and Minor Elective Course II(a)**	
Number of hrs required for this course	**45 hrs.**	
Total Max Marks	**100**	
Semester Term End Examination	**Max Marks: 50**	**Maximum Time: 3 hrs.**
Continuous Comprehensive Assessment: Based on Minor Tests (2), class tests, Tutorials/ Assignments, Quiz, Seminar and Attendance. **Marks Attendance:** 5 marks to be given as per the regulations		**Max Marks: 50**

Instructions:

1. **For Paper Setters and candidates:** Question paper will consist of five sections: Sections A(Compulsory, Covering all the units), B(Unit-I), C (Unit-II), D (Unit-III) , E (Unit IV). Nine questions will be set in all. Section A will be Compulsory, consisting of a single question with 9 subparts of objective short answer/ multiple choice type, which will cover whole of the syllabus of the course and consist of the 36% of the maximum marks of the end term examination for the course. Sections B, C, D, and E will have two questions each from respective sub units and each question will carry 16% of maximum marks of the end term examination for the course. 20-30% questions should be problem based numericals.
2. **For Candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections: B,C,D and E of the end term question paper and all the subparts in section A. Use of nonprogrammble calculator and log tables is allowed.

Course of Study

Unit-I (12 hrs.)

1.1 Brief review of origin of quantum theory(review of photoelectric and Compton effect), Postulatory basis of Quantum Mechanics. Operators eigenfunctions and eigenvalues

1.2 Schrodinger's theory; Need for differential wave equation; time dependent and time independent forms of Schrodinger's wave equation, expectation values Born's interpretation of wave function, properties of wave function; Expectation values, Particle in a box (one, two and three dimensional) ; harmonic oscillator. Confining potentials. Operators: Position, Momentum, Angular Momentum and Total Energy (Hamiltonian)

Unit-II (12 hrs.)

2.1 Particle incident on an infinite potential step and a finite potential barrier; reflection and transmission by a barrier; the tunnel effect;

2.2 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.

Unit-III (10 hr.)

3.1 Atoms with one electron: Hydrogen atom and its spectrum, Frank – Hertz experiments, Quantization of angular momentum; vector atom model L-S, J-J coupling,

3.2 Zeeman effect (normal and anomalous). Fine structure of hydrogen spectrum; electron spin. The Stern - Gerlach experiment, spin-orbit coupling.

Unit-IV (11 hr.)

4.1 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.

4.2 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.

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, 6^{th} 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.

Course Code 6	**BSCPHY0204**	
Credits=3	**L=2 , T=1 , P=0**	
Name of the course	**OPTICS**	
Type of the course	**(Major Core Course IV)**	
Number of hrs required for this course	**45 hrs.**	
Total Max Marks	**100**	
Semester Term End Examination	**Max Marks: 50**	**Maximum Time: 3 hrs.**
Continuous Comprehensive Assessment: Based on Minor Tests (2), class tests, Tutorials/ Assignments, Quiz, Seminar and Attendance. **Marks Attendance:** 5 marks to be given as per the regulations		**Max Marks: 50**

Instructions:

1. **For Paper Setters and candidates:** Question paper will consist of five sections: Sections A(Compulsory, Covering all the units), B(Unit-I), C (Unit-II), D (Unit-III) , E (Unit IV). Nine questions will be set in all. Section A will be Compulsory, consisting of a single question with 9 subparts of objective short answer/ multiple choice type, which will cover whole of the syllabus of the course and consist of the 36% of the maximum marks of the end term examination for the course. Sections B, C, D, and E will have two questions each from respective sub units and each question will carry 16% of maximum marks of the end term examination for the course. 20-30% questions should be problem based numericals.
2. **For Candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections: B,C,D and E of the end term question paper and all the subparts in section A. Use of nonprogrammble calculator is allowed.

Course of Study

Unit-I (12 hrs.)

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

1.2 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.

Unit-II (12 hrs.)

2.1 **Interference:** Applications Interference of a light, Raleigh refract meter and other applications, Localized fringes; thin films, applications for precision measurements for displacements. Interference in uniform and wedge shaped films, Newton's rings and its applications.

2.2 **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.

Unit-III (11 hrs.)

3.1 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.

3.2 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.

Unit-IV (10 hrs.)

4.1 Polarization: Wire and grid polariser. Polarisation and double refraction, 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. Crystal polarizer, Nicol Prism

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. Optics, Born and Wolf
5. Optics, K.D. Moltev, Oxford University Press.

Course Code 7	**BSCPHY0203(P)**	
Credits=1	**L=0 , T=0 , P=1**	
Name of the course	**Physics Lab II (Optics -I)**	
Type of the course	**Major Core Lab Course II)/Minor Elective Lab course II (a)**	
Number of hrs required for this course	**30 hrs.**	
Total Max Marks	**50**	
Semester Term End Examination	**50 % of total marks**	**Maximum Time: 3 hrs**
Continuous Comprehensive Assessment: Based on performance in the laboratory, lab record, lab seminar and Attendance. **Marks Attendance:** 5% marks to be given as per the regulations		**Max Marks: 50% of the total marks**

Instructions for Paper Setters and candidates: Laboratory examination will consist of two parts: (i) Performing a practical exercise assigned by the examiner from Unit II or Unit III (50% of the total marks) (ii) Viva Voce Examination (50 % of the total marks) Viva Voce Examination will be related to the practical performed, seminar assignment done by the candidate related to the paper and lab skills (Unit I) learnt during the course of the semester.

Course of Study

Unit-I

The test of lab skills will be of the following test items:

i. Setting a spectrometer.
ii. Knowledge About Light Sources (mercury vapour lamp, Sodium Lamp)
iii. Setting of a travelling microscope

Unit-II

Laboratory Excercises:

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 incidence for a prism, measure angle of minimum deviation directly and compare with the value from I-D 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.

Projects on remotely controlled Laboratories (Through explorations on the internet):

6. Interference and diffraction **(Through Remotely Controlled Lab) http://rd-munich.informatk.unbw-muenchen.de/**
   (a) Diffraction at a single slit
   (b) Diffraction at a double slit
   (c) Diffraction at a grating

Unit-III

Suggested Open ended Exercises:

1. Study of **interference** fringes with wedge - shaped film.
2. To measure the numerical aperture of an optical fibre using a He-Ne Laser.

3. **Lab and household gadgets**.
   i) To study a camera.

Books /References Suggested

1. A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi.
2. Practical Physics, CL Arora (S.Chand).
3. Experiments with He-Ne Laser, R.S. Sirohi, New Age International Publishers, New Delhi.
4. **http://rd-munich.informatik.unibw-muenchen.de/docs/Table_____of_worldwide_RCL's.pdf**

Course Code 8	**BSCPHY0204(P)**	
Credits=1	**L=0 , T=0 , P=1**	
Name of the course	**Physics Lab III (Optics-II)**	
Type of the course	**(Major Core Lab Course II)**	
Number of hrs required for this course	**30 hrs.**	
Total Max Marks	**50**	
Semester Term End Examination	**50 % of total marks**	**Maximum Time: 3 hrs**
Continous Comprehensive Assesment: Based on performance in the laboratory, lab record, lab seminar and Attendance. **Marks Attendance:** 5% marks to be given as per the regulations		**Max Marks: 50% of the total marks**

Instructions for Paper Setters and candidates: Laboratory examination will consist of two parts: (i) Performing a practical exercise assigned by the examiner from Unit II and Unit III (50% of the total marks) (ii) Viva Voce Examination (50 % of the total marks) Viva Voce Examination will be related to the practical performed, seminar assignment done by the candidate related to the paper and lab skills (Unit I) learnt during the course of the semester.

Course of Study

Unit-I

The test of lab skills will be of the following test items:

a) Light sources
b) Setting a spectrometer.

Unit-II

1. Finding the height of an accessible and inaccessible object.
2. μ by traveling microscope method.
3. Linear magnification by slit method.
4. Linear magnification by linear scale method.
5. Study of Newton's rings
6. **Speed of Light (Through Remotely Controlled Lab) http://rd-munich.informatik.unibw-muenchen.de/**

Unit-III

Suggested Open ended Exercises:

1. To study phenomenon of interference and diffraction using a ripple tank
2. To determine the dielectric constant of a solid.

Books /References Suggested

1. A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi.
2. Practical Physics, CL Arora (S.Chand).
3. Experiments with He-Ne Laser, R.S. Sirohi, New Age International Publishers, New Delhi.

http://rd-munich.informatik.unibw-muenchen.de/docs/Table of worldwide RCL's.pdf

Semester III

Course Code 9	**BSCPHY0305**	
Credits=3	**L=2 , T=1 , P=0**	
Name of the course	**Vibrations and Waves**	
Type of the course	**Major Core Course I and Minor Elective Course III(a)**	
Number of hrs required for this course	**45 hrs.**	
Total Max Marks	**100**	
Semester Term End Examination	**Max Marks: 50**	**Max Time: 3hrs**
Continuous Comprehensive Assessment: Based on Minor Tests (2), class tests, Tutorials/ Assignments, Quiz, Seminar and Attendance. **Marks Attendance:** 5 marks to be given as per the regulations		**Max Marks: 50**

Instructions:

1. **For Paper Setters and candidates:** Question paper will consist of five sections: Sections A(Compulsory, Covering all the units), B(Unit-I), C (Unit-II), D (Unit-III) , E (Unit IV). Nine questions will be set in all. Section A will be Compulsory, consisting of a single question with 9 subparts of objective short answer/ multiple choice type, which will cover whole of the syllabus of the course and consist of the 36% of the maximum marks of the end term examination for the course. Sections B, C, D, and E will have two questions each from respective sub units and each question will carry 16% of maximum marks of the end term examination for the course. 20-30% questions should be problem based numericals.
2. **For Candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections: B,C,D and E of the end term question paper and all the subparts in section A. Use of nonprogrammble calculator is allowed.

Course of Study

Unit-I (12 hrs.)

1.1 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.

1.2 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.

Unit-II (12 hrs.)

2.1 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)

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

Unit-III (10 hrs.)

3.1 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.

3.2 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.

Unit-IV (11 hrs.)

4.1 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.

4.2 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. Vibration and Waves, AP French, CBS Publishers

Internet Resources: Walter Lewin's Video lectures (MIT Course Ware).

Course Code 10	**BSCPHY0306**	
Credits=3	**L=2 , T=1 , P=0**	
Name of the course	**LASER PHYSICS**	
Type of the course	**(Major Core Course VI)**	
Number of hrs required for this course	**45 hrs.**	
Total Max Marks	**100**	
Semester Term End Examination	**Max Marks: 50**	**Maximum Time: 3 hrs.**
Continuous Comprehensive Assessment: Based on Minor Tests (2), class tests, Tutorials/ Assignments, Quiz, Seminar and Attendance. **Marks Attendance:** 5 marks to be given as per the regulations		**Max Marks: 50**

Instructions:

1. **For Paper Setters and candidates:** Question paper will consist of five sections: Sections A(Compulsory, Covering all the units), B(Unit-I), C (Unit-II), D (Unit-III) , E (Unit IV). Nine questions will be set in all. Section A will be Compulsory, consisting of a single question with 9 subparts of objective short answer/ multiple choice type, which will cover whole of the syllabus of the course and consist of the 36% of the maximum marks of the end term examination for the course. Sections B, C, D, and E will have two questions each from respective sub units and each question will carry 16% of maximum marks of the end term examination for the course. 20-30% questions should be problem based numericals.
2. **For Candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections: B,C,D and E of the end term question paper and all the subparts in section A. Use of nonprogrammble calculator is allowed.

Course of Study

Unit-1 (12 hrs.)

1.1 Light waves and photons, optical directionality, interactivity, monochromacity and coherence, quantum transitions in absorption and Emission of light.

1.2 The active medium, creating population inversion, Laser oscillation in optical Resonant cavity (quality factor, losses) Basic laser characteristics (gain coefficient out put power).

Unit-II (12 hrs.)

2.1 Laser gain curve, Einstein's quantum theory of Radiation, Einstein coefficients and their relationship momentum transfer and possibility of amplification.

2.2 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,

Unit-III (10 hrs.)

3.1 Optical resonators of various kinds and their role in confinement of laser beam.

3.2 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.

Unit-IV (11 hrs.)

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

4.2 Holography: Principle of holography, principle identity, holography of point objects, holography of three dimensional objects

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.

Course Code 11	**BSCPHY0305(P)**	
Credits=1	**L=0 , T=0 , P=1**	
Name of the course	**Physics Lab IV (Laser and RCL)**	
Type of the course	**Major Core Lab Course V)/Minor Elective Lab course III (a)**	
Number of hrs required for this course	**30 hrs.**	
Total Max Marks	**50**	
Semester Term End Examination	**50 % of total marks**	**Maximum Time 3 hrs**
Continuous Comprehensive Assessment: Based on performance in the laboratory, lab record, lab seminar and Attendance. **Marks Attendance:** 5% marks to be given as per the regulations		**Max Marks: 50% of the total marks**

Instructions for Paper Setters and candidates: Laboratory examination will consist of two parts: (i) Performing a practical exercise assigned by the examiner from Unit II or Unit III (50% of the total marks) (ii) Viva Voce Examination (50 % of the total marks) Viva Voce Examination will be related to the practical performed, seminar assignment done by the candidate related to the paper and lab skills (Unit I) learnt during the course of the semester.

Course of Study

Physics Lab –IV Laser Lab and Internet Based Remotely Controlled Laboratories

Unit-I

The test of lab skills will be of the following test items:

a) Precautions to be taken in usage of Laser
b) Light sources

Unit-II

Laboratory Exercises:

1. **Lasers**

   Objective:

   1. To handle a low power He-N Laser to do optics experiments
   2. To see diffraction patterns of a single 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.

Projects on remotely controlled Laboratories (Through explorations on the internet):

1. **Electron Diffraction (Through Remotely Controlled Lab) http://rd-munich.informatk.unbw-muenchen.de/**

2. Interference and diffraction **(Through Remotely Controlled Lab) http://rd-munich.informatk.unbw-muenchen.de/**
   i. **Interference of waves**
   ii. **Constructive and destructive interference**
   iii. **Diffraction of light at periodically ordered slits**
   iv. **Maxima and minima of single slit and diffraction grating**
   v. **Intensity distribution of diffraction pattern**
   vi. **Asymmetric double slit**
   vii. **Babinet's principle**

Unit-III

Suggested Open ended Exercises:

i. To study the properties of the light of a laser pointer used in classrooms and conduct experiments to demonstrate wave nature of light

ii. Measuring variations of intensity of light in a room using photo voltaic cell.

Books /References Suggested

1. A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi.
2. Experiments with He-Ne Laser, R.S. Sirohi, New Age International Publishers, New Delhi. **http://rd-munich.informatik.unibw-muenchen.de/docs/Table of_worldwide_RCL's.pdf**
3. Experiments with He-Ne Laser, R.S. Sirohi, New Age International Publishers, New Delhi.

Course Code 12	**BSCPHY0306(P)**	
Credits=1	**L=0 , T=0 , P=1**	
Name of the course	**Computational Physics Lab II**	
Type of the course	**(Major Core Course)**	
Number of hrs required for this course	**30 hrs.**	
Total Max Marks	**50**	
Semester Term End Examination	**50 % of total marks**	**Maximum Time: 3 hrs**
Continuous Comprehensive Assessment: Based on performance in the laboratory, lab record, lab seminar and Attendance. **Marks Attendance:** 5% marks to be given as per the regulations		**Max Marks: 50% of the total marks**

Instructions for Paper Setters and candidates: Laboratory examination will consist of two parts: (i) Performing a practical exercise assigned by the examiner from Unit II or Unit III (50% of the total marks) (ii) Viva Voce Examination (50 % of the total marks) Viva Voce Examination will be related to the practical performed, seminar assignment done by the candidate related to the paper and lab skills (Unit I) learnt during the course of the semester.

Course of Study

Unit I

Learning Computational physics Lab skills

1. Usage of Spreadsheets
2. Scientific Word Processing
3. Usage of Editor
4. Flow charts/algorithms of the problems being implemented
5. Familiarity with programming language (FORTRAN), Spread sheets and Latex Word processor.

Unit II

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)

Unit III

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

1. Verification of stirrings formula (SS/ FORTRAN)
2. Compute Numinous efficiency of a back body radiation
3. Plot wave function of a particle in a box.
4. Plot wave function of one dimensional Harmonic Oscillator.

Unit IV

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

1. Creating a document in LATEX involving plain text.
2. Creating a document in LATEX with mathematical formulae, differentials, integral, gradient divergence and curl etc. using equation environment.
3. Creating a document in LATEX using table environment and lists.
4. Creating a document in LATEX having title page, table of contents, bibliography using sectioning and sub sectioning.
5. Creating LATEX document involving matrices and line diagrams.

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. Computational Physics: An Introduction, R.C. Verma, etal. New Age International Publishers, New Delhi(1999)
4. www.spokentutorial.org of IIT Bombay NMEICT project.
5. LaTeX – A Document Preparation System" by Leslie Lamport (Second Edition, Addison-Wesley, 1994).

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.

Semester IV

Course Code 13	**BSCPHY0407**	
Credits=3	**L=2 , T=1 , P=0**	
Name of the course	**ELECTRICITY AND MAGNETISM**	
Type of the course	**Major Core Course VII and Minor Elective Course IV(a)**	
Number of hrs required for this course	**45 hrs.**	
Total Max Marks	**100**	
Semester Term End Examination	**Max Marks: 50**	**Maximum Time: 3 hrs**
Continuous Comprehensive Assessment: Based on Minor Tests (2), class tests, Tutorials/ Assignments, Quiz, Seminar and Attendance. **Marks Attendance:** 5 marks to be given as per the regulations		**Max Marks: 50**

Instructions:

1. **For Paper Setters and candidates:** Question paper will consist of five sections: Sections A(Compulsory, Covering all the units), B(Unit-I), C (Unit-II), D (Unit-III) , E (Unit IV). Nine questions will be set in all. Section A will be Compulsory, consisting of a single question with 9 subparts of objective short answer/ multiple choice type, which will cover whole of the syllabus of the course and consist of the 36% of the maximum marks of the end term examination for the course. Sections B, C, D, and E will have two questions each from respective sub units and each question will carry 16% of maximum marks of the end term examination for the course. 20-30% questions should be problem based numericals.
2. **For Candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections: B,C,D and E of the end term question paper and all the subparts in section A. Use of nonprogrammble calculator is allowed.

Course of Study

Unit-I (12 hrs.)

1.1 Ideas of Vector Calculus: 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).

1.2 Electric Potential: 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).

Unit-II (12 hrs.)

2.1 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.

2.2 Field of Moving Charges: 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.

Unit-III (11 hrs.)

3.1 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.

3.2 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**.**

Unit-IV (10 hrs.)

4.1 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.

4.2 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.

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. Electricity and Magnetism, Brij Lal and Subramanium, S Chand & Co.
7. Applied Mathematics for Engineers and Physicists by Pipes.
8. Mathematical methods for Physicists by G. Arfken

Internet Resources: Walter Lewin's Video lectures (MIT Open Course Wares)

Course Code 14	**BSCPHY0408**	
Credits=3	**L=2 , T=1 , P=0**	
Name of the course	**NUCLEAR PHYSICS**	
Type of the course	**(Major Core Course VIII)**	
Number of hrs required for this course	**45 hrs.**	
Total Max Marks	**100**	
Semester Term End Examination	**Max Marks: 50**	**Maximum Time: 3 hrs.**
Continuous Comprehensive Assessment: Based on Minor Tests (2), class tests, Tutorials/ Assignments, Quiz, Seminar and Attendance. **Marks Attendance:** 5 marks to be given as per the regulations		**Max Marks: 50**

Instructions:

1. **For Paper Setters and candidates:** Question paper will consist of five sections: Sections A(Compulsory, Covering all the units), B(Unit-I), C (Unit-II), D (Unit-III) , E (Unit IV). Nine questions will be set in all. Section A will be Compulsory, consisting of a single question with 9 subparts of objective short answer/ multiple choice type, which will cover whole of the syllabus of the course and consist of the 36% of the maximum marks of the end term examination for the course. Sections B, C, D, and E will have two questions each from respective sub units and each question will carry 16% of maximum marks of the end term examination for the course. 20-30% questions should be problem based numericals.
2. **For Candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections: B,C,D and E of the end term question paper and all the subparts in section A. Use of nonprogrammble calculator is allowed.

Course of Study

Unit-I (12 hrs.)

1.1 **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.

1.2 **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.

Unit-II (12 hrs.)

2.1 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,

2.2 **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.

Unit-III (11 hrs.)

3.1 Nuclear Reactions**:**Types of Nuclear reactions, Nuclear reaction cross section, nuclear reaction cross section, conservation laws nuclear reactions, Kinematics of nuclear reactions, compound nucleus, nuclear fission, nuclear fusion.

3.2 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.

Unit IV (10 hrs)

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

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

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**

Course Code 15	**BSCPHY0409**	
Credits=4	**L=3 , T=1 , P=0**	
Name of the course	**PARTICLE PHYSICS**	
Type of the course	**(Major Core Course IX)**	
Number of hrs required for this course	**60 hrs.**	
Total Max Marks	**100**	
Semester Term End Examination	**Max Marks: 50**	**Maximum Time: 3 hrs.**
Continuous Comprehensive Assessment: Based on Minor Tests (2), class tests, Tutorials/ Assignments, Quiz, Seminar and Attendance. **Marks Attendance:** 5 marks to be given as per the regulations		**Max Marks: 50**

Instructions:

1 **For Paper Setters and candidates:** Question paper will consist of five sections: Sections A(Compulsory, Covering all the units), B(Unit-I), C (Unit-II), D (Unit-III) , E (Unit IV). Nine questions will be set in all. Section A will be Compulsory, consisting of a single question with 9 subparts of objective short answer/ multiple choice type, which will cover whole of the syllabus of the course and consist of the 36% of the maximum marks of the end term examination for the course. Sections B, C, D, and E will have two questions each from respective sub units and each question will carry 16% of maximum marks of the end term examination for the course. 20-30% questions should be problem based numericals.

2 **For Candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections: B,C,D and E of the end term question paper and all the subparts in section A. Use of nonprogrammble calculator is allowed.

Course of Study

Unit-I (15 hrs)

1.1 Introduction to particle physics: Equivalence of mass and energy, collision in lab and center of mass frames, production of elementary particles, particle colliders, and multi-layer particle detectors, calorimeter. **Types of interactions:** basic features of Gravitational interactions, Electromagnetic Interactions, strong interactions, and weak interactions

1.2 Classification of elementary particles: quanta of forces, matter particles, antiparticles, observation and production of anti matter, Observation of tau lepton, associated production, observation of strange particles and heavy flavour hadrons. **Mass spectra and major decays of elementary particle:** leptons, mesons, baryons, Positronium and its decays, Weak and electromagnetic Decays of Strange mesons and Hyperons. Classification of weak decays and selection rules. Properties and strong decays of Resonances.

Unit-II (15 hrs)

2.1 Quantum numbers of Elementary particles: Spin (S), Charge (Q), Parity (P), Lepton number (L), Baryon Number (B), Isospin and its 3rd component (I, I_3), Strangeness (S), Hypercharge (Y), Charm (C), bottom (b), and top (t), Extended Gell-Mann-Nishijima Scheme. **Conservation Laws:** Conservation of Charge, Conservation of lepton number, Conservation of Baryon Number, conservation of Isospin (I), Conservation of 3rd component of Isospin (I_3), Conservation of Hypercharge, Charm and bottom quantum numbers.

2.2 Discrete Conservation Laws: Conservation of Parity (P), Conservation of Charge Conjugation Parity (C), Time Reversal (T) Symmetry, Permutation Symmetry, Parity violation in weak interaction, weak decay of strange particles, CP violation, CPT Theorem (statement only) and its consequences (qualitatively),

Unit-III (15 hrs)

3.1 Particle Symmetries: Brief introduction to Group postulates, SU(2) and SU(3) groups of unitary matrices, nonstrange and strange baryon and meson multiplets under SU(2) and SU(3), prediction of omega-hyperon, Higher Symmetries, charm and bottom hadrons (qualitatively), **Quarks**: Need for quark structure, search for quarks, Prediction of Charm, top quark, quantum numbers of quarks, Observation of quarks in electron-nucleon scattering experiments.

3.2 Quark Model of Hadrons: Quark structure of non strange and strange hadrons, Mesons and baryons containing charm and Bottom quarks, explanation of their quantum numbers in terms of their constituents quarks, Quark wave function of Mesons and nucleons, need of color quantum number, Mass relations and Hyperfine interaction, baryon magnetic moments (qualitative ideas).

Unit-IV (15 hrs)

4.1 Qualitative ideas of Gauge **Theories of basic interactions**: Quantum Field Theory of interactions (basic ideas only), Gauge Invariance, Quantum Electrodynamics (QED), and Feynman diagrams involving electron and photons, basic features of Glashow-Weinberg-Salam theory and QCD. **Qualitative ideas of Unification of fundamental forces**: Introduction of Standard Model, Higgs particle and its observation in Large Hadron Collider (LHC), Recent developments and basic ideas of string theory. Superunification, Planck length, Planck Time and Planck energy.

4.2 Cosmic Rays: Introduction, discovery of cosmic rays, the latitude effect, east west asymmetry effect, the altitude effect, Primary and secondary cosmic rays, Cosmic ray showers, Origin of cosmic radiations: solar cosmic radiations, Galactic cosmic radiations, extragalactic cosmic radiations

Recommended books

1. Introduction to Nuclear and Particle Physics, V.K. Mittal, R.C. Verma, S.C.Gupta, Prentice Hall of India (N.Delhi)
2. Introduction to Particle Physics, M.P. Khanna, Prentice Hall of India (N.Delhi)
3. Introduction to High Energy Physics, D.H. Perkins, Cambridge Univ. Press
4. In search of the ultimate Building Blocks, G t'Hooft, Cambridge University Press
5. Introduction to Elementary Particles, D. Griffith, John Wiley & Sons
6. Quarks and Leptons, F. Halzen and A.D.Martin, Wiley India, New Delhi

Course Code 16	**BSCPHY0407(P)**	
Credits=1	**L=0 , T=0 , P=1**	
Name of the course	**Physics Lab V (Electricity & Magnetism-I)**	
Type of the course	**Major Core Lab Course VII /Minor Elective Lab course IV (a)**	
Number of hrs required for this course	**30 hrs.**	
Total Max Marks	**50**	
Semester Term End Examination	**50 % of total marks**	**Maximum Time: 3 hrs**
Continuous Comprehensive Assessment: Based on performance in the laboratory, lab record, lab seminar and Attendance. **Marks Attendance:** 5% marks to be given as per the regulations		**Max Marks: 50% of the total marks**

Instructions for Paper Setters and candidates: Laboratory examination will consist of two parts: (i) Performing a practical exercise assigned by the examiner from Unit II or Unit III (50% of the total marks) (ii) Viva Voce Examination (50 % of the total marks) Viva Voce Examination will be related to the practical performed, seminar assignment done by the candidate related to the paper and lab skills (Unit I) learnt during the course of the semester.

Course of Study

Unit I

The test of lab skills will be of the following test items:

c) Setting a ballistic Galvanometer.
d) Balancing of bridges.
e) Use of multimeter.
f) Conversion of a galvanometer in to ammeter of a specific range
g) Conversion of Galvanometer into a specific range.
h) Working of a function generator (producing signals of different shape frequency and amplitude

Unit II

Laboratory Excercises

1. 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 bulb.

2. CR Circuit:

Objective:

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

Activity:

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

3. 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.

4. 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.

5. Self and Mutual Inductance:

Objective:

1. Knowledge of ac bridges.

Concept of self and mutual inductance.

Activity:

1. To determine L using Anderson method.

6. To determine M using B.G. To determine the temperature coefficient of resistance using platinum resistance thermometer
7. To determine self inductance by Rayleigh's method.
8. To **find** angle of dip using earth inductor.
9. To **compare** the capacitance of two capacitors by deflection method.
10. To **find** the frequency of ac supply by electrical vibrator .
11. Compare the **frequency** of oscillations using C.R.O and generating Lissazous figures

Unit III

Suggested Open ended Exercises:

1. To open and reassemble a galvanometer.
2. To find the resistance using color code.

Books /References Suggested

1. A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi.
2. **Practical Physics, CL Arora (S.Chand)**
3. Experiments with He-Ne Laser, R.S. Sirohi, New Age International Publishers, New Delhi.
4. **http://rd-munich.informatik.unibw-muenchen.de/docs/Table of_worldwide_RCL's.pdf**
5. Internet Resources: Walter Lewin's Video lectures (MIT Open Course Wares)

6.

Course Code 17	**BSCPHY0408(P)**	
Credits=1	**L=0 , T=0 , P=1**	
Name of the course	**Physics Lab VI (Electricity & Magnetism-II)**	
Type of the course	**(Major Core Lab Course)**	
Number of hrs required for this course	**30 hrs.**	
Total Max Marks	**50**	
Semester Term End Examination	**50 % of total marks**	**Maximum Time: 3 hrs**
Continuous Comprehensive Assessment: Based on performance in the laboratory, lab record, lab seminar and Attendance. **Marks Attendance:** 5% marks to be given as per the regulations		**Max Marks: 50% of the total marks**

Instructions for Paper Setters and candidates: Laboratory examination will consist of two parts: (i) Performing a practical exercise assigned by the examiner from Unit II or Unit III (50% of the total marks) (ii) Viva Voce Examination (50 % of the total marks) Viva Voce Examination will be related to the practical performed, seminar assignment done by the candidate related to the paper and lab skills (Unit I) learnt during the course of the semester.

Course of Study

Physics Lab – VI Electricity and Magnetism-II

Unit I

The test of lab skills will be of the following test items:

i) Setting a ballistic Galvanometer.
j) Balancing of bridges.
k) Use of multimeter.
l) Conversion of a galvanometer in to ammeter of a specific range
m) Conversion of Galvanometer into a specific range.

Unit II

Laboratory Excercises

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

2. **C. R. O.**:
   Objective:
   I. Further practice with CRO
   Activity:
   1. Calibration of CRO vertical and horizontal sensitivities

3. **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

4. **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.

5. **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.

6. **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.

7. To determine the **frequency** of an electrically maintained tuning fork by Melde 's experiment.
8. To compare the **capacitance** using electrical vibrator.
9. To plot a graph between thermo emf and temperature for a given thermocouple.
10. To **study** the variation of **magnetic** field along the axis of a circular coil using Stewart and Gee galvano meter .
11. To determine H & M **using** deflection and vibration magnetometer.

Unit III

Suggested Open ended Exercises:

1. Frequency of AC using electrical vibrator and CRO.
2. Study of Thermocouple.
3. ECE of copper.

Books /References Suggested

1. A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi.
2. Experiments with He-Ne Laser, R.S. Sirohi, New Age International Publishers, New Delhi.
   http://rd-munich.informatik.unibw-muenchen.de/docs/Table of_worldwide_RCL's.pdf
3. **Practical Physics, CL Arora (S.Chand)**
4. Internet Resources: Walter Lewin's Video lectures (MIT Open Course Wares)

5. Semester V

Course Code 18	**BSCPHY0510**	
Credits=3	**L=2 , T=1 , P=0**	
Name of the course	**Statistical Mechanics and Thermodynamics**	
Type of the course	**Major Core Course X and Minor Elective Course V(a)**	
Number of hrs required for this course	**45 hrs.**	
Total Max Marks	**100**	
Semester Term End Examination	**Max Marks: 50**	**Maximum Time: 3 hrs.**
Continuous Comprehensive Assessment: Based on Minor Tests (2), class tests, Tutorials/ Assignments, Quiz, Seminar and Attendance. **Marks Attendance:** 5 marks to be given as per the regulations		**Max Marks: 50**

Instructions:

1 **For Paper Setters and candidates:** Question paper will consist of five sections: Sections A(Compulsory, Covering all the units), B(Unit-I), C (Unit-II), D (Unit-III) , E (Unit IV). Nine questions will be set in all. Section A will be Compulsory, consisting of a single question with 9 subparts of objective short answer/ multiple choice type, which will cover whole of the syllabus of the course and consist of the 36% of the maximum marks of the end term examination for the course. Sections B, C, D, and E will have two questions each from respective sub units and each question will carry 16% of maximum marks of the end term examination for the course. 20-30% questions should be problem based numericals.

2 **For Candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections: B,C,D and E of the end term question paper and all the subparts in section A. Use of nonprogrammble calculator is allowed.

Course of Study

Unit-I (12 hrs.)

1.1 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.

1.2 Distribution of Particles in Compartments: 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.

Unit-II (12 hrs.)

2.1 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,

2.2 Bose Einstein and Fermi Dirac 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

Unit-III (11 hrs.)

5.1 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.

5.2 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.

Unit-IV (10 hrs.)

4.1 Maxwell's Thermodynamic Relations and Their Applications: Derivation of Maxwell's thermodynamic relations.

4.2 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.

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.

Course Code 19	**BSCPHY0511**	
Credits=4	**L=3 , T=1 , P=0**	
Name of the course	**SOLID STATE PHYSICS**	
Type of the course	**(Major Core Course XI)**	
Number of hrs required for this course	**60 hrs.**	
Total Max Marks	**100**	
Semester Term End Examination	**Max Marks: 50**	**Maximum Time: 3 hrs.**
Continuous Comprehensive Assessment: Based on Minor Tests (2), class tests, Tutorials/ Assignments, Quiz, Seminar and Attendance. **Marks Attendance:** 5 marks to be given as per the regulations		**Max Marks: 50**

Instructions:

1 **For Paper Setters and candidates:** Question paper will consist of five sections: Sections A(Compulsory, Covering all the units), B(Unit-I), C (Unit-II), D (Unit-III) , E (Unit IV). Nine questions will be set in all. Section A will be Compulsory, consisting of a single question with 9 subparts of objective short answer/ multiple choice type, which will cover whole of the syllabus of the course and consist of the 36% of the maximum marks of the end term examination for the course. Sections B, C, D, and E will have two questions each from respective sub units and each question will carry 16% of maximum marks of the end term examination for the course. 20-30% questions should be problem based numericals.

2 **For Candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections: B,C,D and E of the end term question paper and all the subparts in section A. Use of nonprogrammble calculator is allowed.

Course of Study

Unit-I (15 hrs.)

1.1 **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.

1.2 **Diffraction Methods:** Bragg's Law, experimental arrangements, Laue pattern, Laue equation, reciprocal lattice, atomic scattering factor, geometrical structure factors.

Unit-1I (15 hrs.)

2.1 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.

2.2 **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.

Unit-III (15 hrs)

3.1 Free electron theory of metals: Classical picture, Fermi gas, density of states, Fermi energy and fermi velocity, electronic contribution to specific heat of metals.

3.2 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

Unit-IV (15 hrs)

4.1 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,

4.2 BCS theory (Brief idea, Existence of energy gap. High Tc superconductor, 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

Course Code 20	**BSCPHY0512**	
Credits=3	**L=2 , T=1 , P=0**	
Name of the course	**Electronics**	
Type of the course	**(Major Core Course XII)**	
Number of hrs required for this course	**45 hrs.**	
Total Max Marks	**100**	
Semester Term End Examination	**Max Marks: 50**	**Maximum Time: 3 hrs.**
Continuous Comprehensive Assessment: Based on Minor Tests (2), class tests, Tutorials/ Assignments, Quiz, Seminar and Attendance. **Marks Attendance:** 5 marks to be given as per the regulations		**Max Marks: 50**

Instructions:

1 **For Paper Setters and candidates:** Question paper will consist of five sections: Sections A(Compulsory, Covering all the units), B(Unit-I), C (Unit-II), D (Unit-III) , E (Unit IV). Nine questions will be set in all. Section A will be Compulsory, consisting of a single question with 9 subparts of objective short answer/ multiple choice type, which will cover whole of the syllabus of the course and consist of the 36% of the maximum marks of the end term examination for the course. Sections B, C, D, and E will have two questions each from respective sub units and each question will carry 16% of maximum marks of the end term examination for the course. 20-30% questions should be problem based numericals.

2 **For Candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections: B,C,D and E of the end term question paper and all the subparts in section A. Use of nonprogrammble calculator is allowed.

Course of Study

Unit-I (11 hrs.)

1.1 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.

1.2 Rectifiers: Half wave and full wave rectifiers, efficiency and ripple factor, filter circuits, Voltage regulation (Zener and IC).

Unit-II (12 hrs.)

2.1 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

2.2 **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.

Unit-III (12 hrs.)

3.1 Amplifiers: Small signal amplifiers: General principles of operation, classification, distortion, RC coupled amplifier, gain frequency response, input and output impedance,

3.2 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

Unit-IV (10 hrs.)

4.1 Oscillators: 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

4.2 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. Radio communication, Optical Fiber Communication.

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.
8 Principle of Electronics, VK Mehta, S Chand and Company

Course Code 21	**BSCPHY0510(P)**	
Credits=1	**L=0 , T=0 , P=1**	
Name of the course	**Physics Lab VII (Electronics Lab)**	
Type of the course	**Major Core Lab Course X /Minor Elective Lab course V (b)**	
Number of hrs required for this course	**30 hrs.**	
Total Max Marks	**50**	
Semester Term End Examination	**50 % of total marks**	**Maximum Time: 3 hrs**
Continuous Comprehensive Assessment: Based on performance in the laboratory, lab record, lab seminar and Attendance. **Marks Attendance:** 5% marks to be given as per the regulations		**Max Marks: 50% of the total marks**

Instructions for Paper Setters and candidates: Laboratory examination will consist of two parts: (i) Performing a practical exercise assigned by the examiner from Unit II or Unit III (50% of the total marks) (ii) Viva Voce Examination (50 % of the total marks) Viva Voce Examination will be related to the practical performed, seminar assignment done by the candidate related to the paper and lab skills (Unit I) learnt during the course of the semester.

Course of Study

Unit I

The test of lab skills will be of the following test items:

i. Use of an oscilloscope.
ii. CRO as a versatile measuring device.
iii. Soldering.
iv. Circuit tracing of Laboratory electronic equipment,
v. Use of Digital multimeter/ VTVM for measuring voltages
vi. Color codes for resistor and capacitors.
vii. Testing a diode BJT and FET.
viii. Winding a coil / transformer.
ix. To test a microphone/ speaker.
x. To test a radio-receiver.
xi. Study the layout of receiver circuit.
xii. Interfacing of a computer with the measuring instruments
xiii. Trouble shooting a circuit

Unit II

Laboratory Exercise:

1. **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.

2. 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.

3. 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.

4. 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.

5. 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.

6. **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.

7. 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.

8. **LC Oscillators**:

Objective: Conditions for oscillation, LC and RC oscillators.

Activity: To set up an LC-Oscillator and study its output.

9. Thermistor:

Objective: Principle of an thermistor : use of a thermistor.

Activity: To study the characteristics of a thermostat and find its parameters.

10. **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.

11. 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.

12. 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.

13. **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.

14. Semiconductor Characteristics (Through Remotely Controlled Lab) http://rd-munich.informatk.unbw-muenchen.de/

Unit III

Suggested Open ended Exercises:

Design one of the following gadgets

1. Fabrication of battery eliminator

2. Regulated power supply
3. Public address system
4. Radio- receiver.

Books Suggested

1. A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi.
2. Art of Electtronics, Paul Horowitz, Cambridge University Press, New Delhi
3. Practical Physics, CL Arora (S.Chand)

Course Code 22	**BSCPHY0511(P)**	
Credits=1	**L=0 , T=0 , P=1**	
Name of the course	**Computational Physics Lab III**	
Type of the course	**(Major Core Lab CourseXI)**	
Number of hrs required for this course	**30 hrs.**	
Total Max Marks	**50**	
Semester Term End Examination	**50 % of total marks**	**Maximum Time: 3 hrs**
Continuous Comprehensive Assessment: Based on performance in the laboratory, lab record, lab seminar and Attendance. **Marks Attendance:** 5% marks to be given as per the regulations		**Max Marks: 50% of the total marks**

Instructions for Paper Setters and candidates: Laboratory examination will consist of two parts: (i) Performing a practical exercise assigned by the examiner from Unit II and Unit III (50% of the total marks) (ii) Viva Voce Examination (50 % of the total marks) Viva Voce Examination will be related to the practical performed, seminar assignment done by the candidate related to the paper and lab skills (Unit I) learnt during the course of the semester.

Unit I

Learning Computational physics Lab skills:

a) Usage of GUI windows and advanced linux commands
b) DOS commands
c) Usage of Editor
d) Flow charts of the PC based experiments
e) Familiarity with programming language (FORTRAN).

Unit II

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

Unit III

PC based experiments (With FORTRAN)

1. Towers Of Hanoi
2. Finding of Four perfect numbers.
3. Quadratic interpolation using Newton's forward difference formula of degree 2.
4. Find the solution of equation of motion.
5. Motion of projectile using computer simulation.

Unit III

PC based experiments (With FORTRAN)

1. Motion of particle in a central force field.
2. Computer generation of phase space of SHO
3. Numerical solution of wave function of SHO.
4. Simulation study of variation of mass with velocity.
5. Simulation of radioactivity.
6. Calculatin the value of pi

Books Suggested

1. Schism's Outline of Theory and Problems of Programming with Fortran, S Lipsdutz and A Poe, 1986Mc-Graw Hill Book Co. I
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. Computational Physics: An Introduction, R. C. Verma, etal, New Age International Publishers, New Delhi(1999)
4. www.spokentutorial.org of IIT Bombay NMEICT project.

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.

Semester VI

Course Code 23	**BSCPHY0613**	
Credits=3	**L=2 , T=1 , P=0**	
Name of the course	**Digital Electronics**	
Type of the course	**Major Core Course XIII**	
Number of hrs required for this course	**45 hrs.**	
Total Max Marks	**100**	
Semester Term End Examination	**Max Marks: 50**	**Maximum Time: 3 hrs.**
Continous Comprehensive Assesment: Based on Minor Tests (2), class tests, Tutorials/ Assignments, Quiz, Seminar and Attendance. **Marks Attendance:** 5 marks to be given as per the regulations		**Max Marks: 50**

Instructions:

1 **For Paper Setters and candidates:** Question paper will consist of five sections: Sections A(Compulsory, Covering all the units), B(Unit-I), C (Unit-II), D (Unit-III) , E (Unit IV). Nine questions will be set in all. Section A will be Compulsory, consisting of a single question with 9 subparts of objective short answer/ multiple choice type, which will cover whole of the syllabus of the course and consist of the 36% of the maximum marks of the end term examination for the course. Sections B, C, D, and E will have two questions each from respective sub units and each question will carry 16% of maximum marks of the end term examination for the course. 20-30% questions should be problem based numericals.

2 **For Candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections: B,C,D and E of the end term question paper and all the subparts in section A. Use of nonprogrammble calculator is allowed.

Course of Study

Unit-I (12 hrs.)

1.1 Digital Fundamentals: Binary, Octal and Hexadecimal number systems and their inter conversion, Binary arithmetic (addition, subtraction, multiplication and division 1's and 2's complements,

1.2 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. code (straight Binary code, BCD code, Gray code) Error detection, correction and Hamming codes.

Unit-II (12 hrs.)

2.1 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.

2.2 Simplification 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

Unit-III (10 hrs.)

3.1 Flip Flop circuits: 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,

3.2 Counters: Clock waveforms, 555 timer as astable multivibrator, shift registers: Serial out, parallel in, parallel out; synchronous counters, Alynchronous counters, Ring counters.

Unit IV (11 hrs)

4.1 Converter Circuits: D/A converters, A/D Counters, clipping and Clamping, astable, Monostable and bistable multivibrators using transistors.

4.2 Logic Families: 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.

Course Code 24	**BSCPHY0614**	
Credits=4	**L=3 , T=1 , P=0**	
Name of the course	**Mathematical Physics**	
Type of the course	**(Major Core Course XIV)**	
Number of hrs required for this course	**60 hrs.**	
Total Max Marks	**100**	
Semester Term End Examination	**Max Marks: 50**	**Maximum Time: 3 hrs.**
Continuous Comprehensive Assessment: Based on Minor Tests (2), class tests, Tutorials/ Assignments, Quiz, Seminar and Attendance. **Marks Attendance:** 5 marks to be given as per the regulations		**Max Marks: 50**

Instructions:

1 **For Paper Setters and candidates:** Question paper will consist of five sections: Sections A(Compulsory, Covering all the units), B(Unit-I), C (Unit-II), D (Unit-III) , E (Unit IV). Nine questions will be set in all. Section A will be Compulsory, consisting of a single question with 9 subparts of objective short answer/ multiple choice type, which will cover whole of the syllabus of the course and consist of the 36% of the maximum marks of the end term examination for the course. Sections B, C, D, and E will have two questions each from respective sub units and each question will carry 16% of maximum marks of the end term examination for the course. 20-30% questions should be problem based numericals.

2 **For Candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections: B,C,D and E of the end term question paper and all the subparts in section A. Use of nonprogrammble calculator is allowed.

Course of Study

Unit-I (15 hrs.)

1.1 Function of complex variables. Cauchy- Riemann conditions. Analytic functions. Singularities.

1.2 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 ResidueTheorem, contour integration and its application to evaluation of integrals and series (simple excercises).

Unit-II (15 hrs.)

2.1 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.

2.2 Integral Transform: Fourier Integral theorem, Fourier integral transform, sine and cosines transform conservation theorem conservation theorem.

Unit-III (15 hrs.)

3.1 Laplace Transforms: 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.

3.2 Special functions: Dirac Delta function and its properties.

Unit-IV (15 hrs.)

4.1 Legendre, Bessel, Hermite and laguerre functions, Generating function. Recurrence relations.

4.2 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

Course Code 25	**BSCPHY0613(P)**	
Credits=3	**L=0 , T=0 , P=1**	
Name of the course	**Physics Lab VIII (Digital Electronics, Solid State Physics, Nuclear Physics)**	
Type of the course	**Major Core Lab Course XIII**	
Number of hrs required for this course	**30 hrs.**	
Total Max Marks	**50**	
Semester Term End Examination	**50 % of total marks**	**Maximum Time: 3 hrs**
Continuous Comprehensive Assessment: Based on performance in the laboratory, lab record, lab seminar and Attendance. **Marks Attendance:** 5% marks to be given as per the regulations		**Max Marks: 50% of the total marks**

Instructions for Paper Setters and candidates: Laboratory examination will consist of two parts: (i) Performing a practical exercise assigned by the examiner from Unit II or Unit III (50% of the total marks) (ii) Viva Voce Examination (50 % of the total marks) Viva Voce Examination will be related to the practical performed, seminar assignment done by the candidate related to the paper and lab skills (Unit I) learnt during the course of the semester.

Course of Study

Unit I

The test of lab skills will be of the following test items:

i. Use of an oscilloscope.
ii. CRO as a versatile measuring device.
iii. Soldering.
iv. Circuit tracing of Laboratory electronic equipment,
v. Use of Digital multimeter/ VTVM for measuring voltages
vi. Color codes for resistor and capacitors.
vii. Testing a diode BJT and FET.
viii. Circuit tracing of Laboratory electronic equipment,
ix. Winding a coil / transformer.
x. To test a microphone/ speaker.
xi. To test a radio-receiver.
xii. Study the layout of receiver circuit.
xiii. Interfacing of a computer with the measuring instruments
xiv. Trouble shooting a circuit

Unit II

Laboratory Excercises:

1. Verify the truth tables of (a) AND (b) OR, (c) NOT, (d) NAND (e) NOR (f) XOR (g) EXTOR gates)
2. Implementation of half adder using AND- OR gates.
3. Implementation of full adder using AND –OR-gates.
4. Implementation of half subtraction using AND-OR & NOT gates
5. Implementation of full Subtractor using AND- OR and NOT gates
6. Verify truth tables of RS& JK flip flops
7. Using 555 timer as astable multivibrator.

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

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. 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.

12. 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.

13. **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.

14. 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.

15. **Millikan's** Experiment **(Through Remotely Controlled Lab) http://rd-munich.informatk.unbw-muenchen.de/**

16. **Photoelectric** Effect **(Through Remotely Controlled Lab) http://rd-munich.informatk.unbw-muenchen.de/**

17. Radioactivity **(Through Remotely Controlled Lab) http://rd-munich.informatk.unbw-muenchen.de/**

Unit III

Suggested Open ended Exercises:

1. **Design and Fabrication**:

i) Fabrication and design of simple electronic gadget or a toy involving principles of physics.

(ii) Design an LED display screen

Books Suggested

1. A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi.
2. Art of Electtronics, Paul Horowitz, Cambridge University Press, New Delhi
3. Practical Physics, CL Arora (S.Chand)

Additional Elective Courses (V/VI):

Course Code 26	**BSCPHY05/0615**	
Credits=3	**L=2 , T=1 , P=0**	
Name of the course	**Computer Simulations in Physics**	
Type of the course	**Core/Elective Course (Additional)**	
Number of hrs required for this course	**45 hrs.**	
Total Max Marks	**100**	
Semester Term End Examination	**Max Marks: 50**	**Maximum Time: 3 hrs.**
Continuous Comprehensive Assessment: Based on Minor Tests (2), class tests, Tutorials/ Assignments, Quiz, Seminar and Attendance. **Marks Attendance:** 5 marks to be given as per the regulations		**Max Marks: 50**

Instructions:

1 **For Paper Setters and candidates:** Question paper will consist of five sections: Sections A(Compulsory, Covering all the units), B(Unit-I), C (Unit-II), D (Unit-III) , E (Unit IV). Nine questions will be set in all. Section A will be Compulsory, consisting of a single question with 9 subparts of objective short answer/ multiple choice type, which will cover whole of the syllabus of the course and consist of the 36% of the maximum marks of the end term examination for the course. Sections B, C, D, and E will have two questions each from respective sub units and each question will carry 16% of maximum marks of the end term examination for the course. 20-30% questions should be problem based numericals.

2 **For Candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections: B,C,D and E of the end term question paper and all the subparts in section A. Use of nonprogrammble calculator is allowed.

Course of Study

Unit-I (12 hrs.)

1.1 Nature of Computer Simulations, analogy between a computer simulation and laboratory experiments, impotance of visualization, choosing a programming language, errors and uncertainities in computers, types of errors, errors in algorithms

1.2 Numerical Methods –I: **Curve Fitting:** Least Square Fitting. **Root Finding**: Newton-**Raphson** Method, Bisection Method, Secant Method and False Position Method. **Matrix and Linear Algebra:** Introduction to Matrix, Matrix Inversion Method, Gauss Elimination Method (with and without pivoting), LU Method, Gauss Jordan and Gauss Siedel Methods.

1.3 True **Random** Numbers, Pseudorandom numbers, Pseudorandomnumber generators(Multiplicative congruential). Testing of random number generators. Simulating the value of π.

Unit-II (12 hrs.)

2.1 Interpolation: Concept, Newton's Forward and Backward Formulae derivation (equal and unequal intervals), Lagrange's Formula derivation for unequal intervals.

2.2 Numerical Integration and Differentiation: Derivatives using Newton's Forward and Backward interpolation formulae, Trapezoidal Rule/Prismoidal Rule, Simpson 1/3 and 3/8 Rules.

2.3 Ordinary Differential Equations: Introduction, Taylor's Method, Euler's Methods (Basic, Improved, Modified), Ranga-Kutta Methods (order 1,2,3, 4), Predictor-Corrector Method (Milne's Method).Integral Transform: Fourier Integral theorem, Fourier integral transform, sine and cosines transform conservation theorem conservation theorem.

Unit-III (10 hrs.)

3.1 **1-D Motion:** Motion of Free Fall and Fall in Viscous Medium. (using euler method)
3.2 2-D Motion: Motion of Projectile and Satellites. (using …….)
5.3 Oscillatory Motion: Simple Pendulum Description (Differential Equation and its solution).
5.4 Newton's Law of Cooling: Concept and Analytical & Numerical Solutions.
5.5 Nuclear Radioactivity: Derivation and Analytical &Numerical Solutions
3.6 **Relativistic Mass Simulation:** Derivation of Formula and Simulation.

Unit-IV (11 hrs.)

4.1 Electrical Analysis: Kirchoff's Laws, Wheatstone Bridge, RL Circuit (Growth of Current),RC Circuit (Growth and Decay of Charge), LCR (Damped and Driven) Circuits.
4.2 Motion of Charge Particle in Electric and Magnetic Fields: Motion in Electric Field, Magnetic Field and Electromagnetic field.
4.3 Numerical Solution of Schrodinger Equation: Solution of Time independent SE.
4.4 Fourier series: Concept, **Definition** and mathematical description, Triangular, Saw tooth and Square wave generation using simulation.

Note: Algorithms and flowcharts along with computer programs (FORTRAN 77) are part of syllabus

Books Suggested:

1. An Introduction to Computational Physics, Tao Pang, Cambridge University Press
2. Computational Physics – An Introduction, RC Verma, PK Ahluwalia and KC Sharma, New Age International Publishers.
3. Numerical Methods, Dr. P. Kandasamy et al, S.Chand & Company
4. Computer Based Numerical and Statistical Techniques, Dr. Santosh Kumar, S.Chand & Company.
5. Computational Physics: Problem Solving with computers, Rubin H. Landau, Manual J Paez, John Wiley and Company, New york

Course Code 27	**BSCPHY05/0615 (P)**	
Credits=1	**L=0 , T=0 , P=1**	
Name of the course	**Computer Simulations in Physics Lab**	
Type of the course	**Core/Elective Course (Additional)**	
Number of hrs required for this course	**30 hrs.**	
Total Max Marks	**50**	
Semester Term End Examination	**50 % of total marks**	**Maximum Time: 3 hrs**
Continous Comprehensive Assesment: Based on performance in the laboratory, lab record, lab seminar and Attendance. **Marks Attendance:** 5% marks to be given as per the regulations		**Max Marks: 50% of the total marks**

Instructions for Paper Setters and candidates: Laboratory examination will consist of two parts: (i) Performing a practical exercise assigned by the examiner from Unit II or Unit III (50% of the total marks) (ii) Viva Voce Examination (50 % of the total marks) Viva Voce Examination will be related to the practical performed, seminar assignment done by the candidate related to the paper and lab skills (Unit I) learnt during the course of the semester.

Course of Study

Unit-I

Learning Computational physics Lab skills:

a) Usage of GUI windows and advanced linux commands
b) Linux commands
c) Usage of Editor
d) Flow charts of the PC based experiments
e) Familiarity with programming language (FORTRAN)
f) Usage of plotting package
g) Knowledge of propagation of errors

Unit II

List of Computational Physics Experiments:

1. Root of equation-Bisection method, Newton Raphson method, False Position Method, graphical method
2. Newton's quadratic interpolation.
3. Numerical integration- Trapezoidal, Simpson's 1/3rd rule and 3/8 Rule
4. Least square curve fitting (Data for ohm's law may be used)
5. Inverse and determinant of square matrix.
6. Solution of N-simultaneous equation in N- variables (Matrix inversion and Gauss elimination methods).
7. Solution of equation of motion (1D).
8. Simulation of Projectile motion.
9. Simulating Value of
10. Simulation of Nuclear Radioactivity and Relativistic mass variation.
11. Motion of an object in central force.
12. Phase space curve of S.H.O.
13. Wave functions of S.H.O.
14. Logistic maps
15. Bifurcation diagram of a logistic map

Unit III

Suggested open ended experiments:

(i) Plotting of mathematical functions of physics using recurrence relations
(ii) Probing errors in differentiation algorithms

Books Suggested:

1. An Introduction to Computational Physics, Tao Pang, Cambridge University Press

2. Computational Physics – An Introduction, RC Verma, PK Ahluwalia and KC Sharma, New Age International Publishers.
3. Numerical Methods, Dr. P. Kandasamy et al, S.Chand & Company
4. Computer Based Numerical and Statistical Techniques, Dr. Santosh Kumar, S.Chand & Company.
5. Computational Physics: Problem Solving with computers, Rubin H. Landau, Manual J Paez, John Wiley and Company, New york

Course Code 28	**BSCPHY05/0616**	
Credits=4	**L=3 , T=1 , P=0**	
Name of the course	**Nano Technology**	
Type of the course	**Core/Elective Course (Additional)**	
Number of hrs required for this course	**60 hrs.**	
Total Max Marks	**100**	
Semester Term End Examination	**Max Marks: 50**	**Maximum Time: 3 hrs.**
Continous Comprehensive Assesment: Based on Minor Tests (2), class tests, Tutorials/ Assignments, Quiz, Seminar and Attendance. **Marks Attendance:** 5 marks to be given as per the regulations		**Max Marks: 50**

Instructions:

1 **For Paper Setters and candidates:** Question paper will consist of five sections: Sections A(Compulsory, Covering all the units), B(Unit-I), C (Unit-II), D (Unit-III) , E (Unit IV). Nine questions will be set in all. Section A will be Compulsory, consisting of a single question with 9 subparts of objective short answer/ multiple choice type, which will cover whole of the syllabus of the course and consist of the 36% of the maximum marks of the end term examination for the course. Sections B, C, D, and E will have two questions each from respective sub units and each question will carry 16% of maximum marks of the end term examination for the course. 20-30% questions should be problem based numericals.

2 **For Candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections: B,C,D and E of the end term question paper and all the subparts in section A. Use of nonprogrammble calculator is allowed.

Course of Study

Unit I (15 hrs.)

1.1 Basics of Nanotechnology: Structure: size dependences of properties, Crystal structure, Face centered cubic nanoparticles, tetrahedral bonded semiconductor structures, Lattice vibrations, Energy bands: insulator, semiconductor and conductors, reciprocal space, energy bonds and gaps of semiconductors, effective masses, fermi surfaces, localized particles: donors, acceptors and deep traps, mobility and exactions.

1.2 Method of measuring properties at nanoscale: Introduction, structure: atomic structure, crystallography, particle size determination, surface structure, microscopy: transmission electron microscopy, field ion microscopy. Scanning microscopy, Spectroscopy: infrared and Raman spectroscopy, Photoemission and X-Ray spectroscopy, Magnetic resonance.

Unit II (15 hrs.)

2.1 Properties of individual **nanoparticle:** Metal nanoclusters, magic numbers, theoretical modeling of nanoparticles, geometric structure, electronic structure, reactivity , fluctuations, magnetic clusters.

2.2 Bulk to Nanotranstion: semiconducting nanoparticles, optical properties, photo fragmentation, columbic explosion, rare gas and molecular clusters inert gas clusters, superfluid clusters, molecular clusters. Method of synthesis: RF plasma, chemical method, thermolysis and pulse laser methods.

Unit III (15 hrs.)

3.1 Carbon nanostructure: Introduction, carbon molecules, nature of carbon bond, new carbon structures, carbon clusters, small carbon clusters, discovery of C_{60}, structure of C_{60} and its crystal, alkali-doped C_{60}, superconductivity in C_{60}, large and smaller fullerenes, other bucky balls

3.2 Carbon Nanotubes: Carbon nanotubes, fabrication, structure, electrical properties, vibrational properties, mechanical properties, application of carbon nanotubes, field emission and shielding, computers, fuel cells, chemical sensors, catalysis, mechanical reinforcement.

Unit IV (15 hrs.)

4.1 Bulk nanostructured materials: solid disordered nanostructures, method of synthesis, failure mechanisms of conventional grain sized materials, mechanical properties, nanostructured multilayer's, electrical properties, other properties, metal nanoclusters, composite glasses, porous silicon, nanostructured crystals, natural nanocrystal, computational prediction of cluster lattices, arrays of nanoparticles in zeolites, crystal of metal nanoparticles, nanoparticle lattices in colloidal suspensions, photonic crystals.

4.2 Application: electronics, energy, automobiles, sports and toys, textiles, cosmetics, domestic application, biotechnology and medical field, space and defense, nanotechnology environment.

Books Recommended:

1. Charles P. Poole, Jr. Frank J. Owens: Introduction to Nanotechnology (Wiley India Pvt. Ltd.)
2. Sulabha K. Kulkarni: Nanotechnology: Principles and Practices (Capital Publishing Company)
3. K. K. Chattopadhyay and A. N. Banerjee, Introduction to Nanoscience and Technology (PHI Learning Private Limited
4. Nanotechnology: A gentle Introduction to Next Big Idea, Mark Ratner, Daniel Ratner, Pearsion Education, 2003
5. Nanotechnology, Richard Booker, Earl Boysen, John Wiley and Sons.

Course Code 29	**BSCPHY05/0617**	
Credits=4	**L=3 , T=1 , P=0**	
Name of the course	**Energy Studies**	
Type of the course	**Core/Elective Course (Additional)**	
Number of hrs required for this course	**60 hrs.**	
Total Max Marks	**100**	
Semester Term End Examination	**Max Marks: 50**	**Maximum Time: 3 hrs.**
Continous Comprehensive Assesment: Based on Minor Tests (2), class tests, Tutorials/ Assignments, Quiz, Seminar and Attendance. **Marks Attendance:** 5 marks to be given as per the regulations		**Max Marks: 50**

Instructions:

1 **For Paper Setters and candidates:** Question paper will consist of five sections: Sections A(Compulsory, Covering all the units), B(Unit-I), C (Unit-II), D (Unit-III) , E (Unit IV). Nine questions will be set in all. Section A will be Compulsory, consisting of a single question with 9 subparts of objective short answer/ multiple choice type, which will cover whole of the syllabus of the course and consist of the 36% of the maximum marks of the end term examination for the course. Sections B, C, D, and E will have two questions each from respective sub units and each question will carry 16% of maximum marks of the end term examination for the course. 20-30% questions should be problem based numericals.

2 **For Candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections: B,C,D and E of the end term question paper and all the subparts in section A. Use of nonprogrammble calculator is allowed.

Course of Study

Unit-I (15 hrs)

1.1 Energy and its Uses: Units and scales of energy use, Mechanical energy and transport, Heat energy: Conversion between heat and mechanical energy, Electromagnetic energy: Storage, conversion, transmission and radiation, Quantum mechanics I: Intro to the quantum, energy quantization, Energy in chemical systems and processes, flow of CO2, Entropy and temperature, Heat engines.

1.2 Conversion I: Phase change energy conversion, refrigeration and heat pumps, Internal combustion engines, Conversion II: Steam and gas power cycles, the physics of power plants

Unit-II (12 hrs)

2.1 Sources of Energy: Fundamental forces in the universe, Quantum mechanics relevant for nuclear physics,

2.2 Nuclear forces, energy scales and structure, Nuclear binding energy systematics, reactions and decays, Nuclear fusion, Nuclear fission and fission reactor physics, Nuclear fission reactor design, safety, operation and fuel cycles

Unit-III (15 hrs)

3.1 Solar Energy: The flow of energy in the universe, Solar radiation, Absorption and thermal utilization, Solar-thermal electricity, Photovoltaics, Advanced PV an overview, Biological energy sources and fossil fuels

3.2 Wind Energy: Fluid dynamics and power in the wind, available resources, More about fluids, viscosity, types of fluid flow, lift, Wind turbine dynamics and design, wind farms,

Unit-IV (15 hrs)

4.1 Geothermal power and ocean thermal energy conversion, Tidal/wave/hydro power.
4.2 Systems and Synthesis: Nuclear radiation, fuel cycles, waste and proliferation, Climate change and energy, Energy storage, Energy conservation

Suggested books:

1. Sustainable energy without Hot Air, David MacKay, WWW.withouthotair.com
2. http://ocw.mit.edu/courses/physics/8-21-the-physics-of-energy-fall-2009/lecture-notes/

Course Code 30	**BSCPHY05/0618**	
Credits=4	**L=3 , T=1 , P=0**	
Name of the course	**Astronomy and Astrophysics**	
Type of the course	**Core/Elective Course (Additional)**	
Number of hrs required for this course	**60 hrs.**	
Total Max Marks	**100**	
Semester Term End Examination	**Max Marks: 50**	**Maximum Time: 3 hrs.**
Continous Comprehensive Assesment: Based on Minor Tests (2), class tests, Tutorials/ Assignments, Quiz, Seminar and Attendance. **Marks Attendance:** 5 marks to be given as per the regulations		**Max Marks: 50**

Instructions:

1 **For Paper Setters and candidates:** Question paper will consist of five sections: Sections A(Compulsory, Covering all the units), B(Unit-I), C (Unit-II), D (Unit-III) , E (Unit IV). Nine questions will be set in all. Section A will be Compulsory, consisting of a single question with 9 subparts of objective short answer/ multiple choice type, which will cover whole of the syllabus of the course and consist of the 36% of the maximum marks of the end term examination for the course. Sections B, C, D, and E will have two questions each from respective sub units and each question will carry 16% of maximum marks of the end term examination for the course. 20-30% questions should be problem based numericals.

2 **For Candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections: B,C,D and E of the end term question paper and all the subparts in section A. Use of nonprogrammble calculator is allowed.

Course of Study

Unit 1 (15 hrs.)

1.1Astronomical Scales: Astronomical Distance, Mass and Time, Scales, Brightness, Radiant Flux and Luminosity, Measurement of Astronomical Quantities Astronomical Distances, Stellar Radii, Masses of Stars, Stellar Temperature. **Basic concepts of positional astronomy:** Celestial Sphere, Geometry of a Sphere, Spherical Triangle, Astronomical Coordinate Systems, Geographical Coordinate Systems, Horizon System, Equatorial System, Diurnal Motion of the Stars, Conversion of Coordinates. Measurement of Time, Sidereal Time, Apparent Solar Time, Mean Solar Time, Equation of Time, Calendar. (6)

1.2 **Astronomical techniques**: Basic Optical Definitions for Astronomy (Magnification Light Gathering Power , Resolving Power and Diffraction Limit, Atmospheric Windows), Optical Telescopes (Types of Reflecting Telescopes, Telescope Mountings, Space Telescopes, Detectors and Their Use with Telescopes (Types of Detectors, etection Limits with Telescopes). **Physical principles:** Gravitation in Astrophysics(Virial Theorem, Newton versus Einstein), Systems in Thermodynamic Equilibrium, Theory of Radiative Transfer (Radiation Field, Radiative Transfer Equation, Optical Depth; Solution of Radiative Transfer Equation, Local Thermodynamic Equilibrium (6)

Unit 2 (15 hrs.)

2.1 The sun (Solar Parameters, Solar Photosphere, Solar Atmosphere, Chromosphere. Corona, Solar Activity , Basics of Solar Magnetohydrodynamics. Helioseismology). **The solar family** (Solar System: Facts and Figures, Origin of the Solar System: The Nebular Model, Tidal Forces and Planetary Rings, Extra-Solar Planets . **Stellar spectra and classification Structure (**Atomic Spectra Revisited, Stellar Spectra, Spectral Types and Their Temperature Dependence, Black Body Approximation, H R Diagram, Luminosity Classification) (6)

2.2 **Stellar structure: H**ydrostatic Equilibrium of a Star,, Some Insight into a Star: Virial Theorem, Sources of Stellar Energy, Modes of Energy Transport, Simple Stellar Model, Polytropic Stellar Model. **Star formation: B**asic Composition of Interstellar Medium, Interstellar Gas, Interstellar Dust,

Formation of Protostar, Jeans Criterion, Fragmentation of Collapsing Clouds, From Protostar to Pre-Main Sequence, Hayashi Line (6)

Unit 3 (15 hrs.)

3.1 Nucleosynthesis and stellar evolution: Cosmic Abundances, Stellar Nucleosynthesis, Evolution of Stars (Evolution on the Main Sequence, Evolution beyond the Main Sequence), Supernovae. **Compact stars:** Basic Familiarity with Compact Stars, Equation of State and Degenerate Gas of Fermions, Theory of White Dwarf, Chandrasekhar Limit, Neutron Star (Gravitational Red-shift of Neutron Star, Detection of Neutron Star: Pulsars), Black Hole. **The milky way**: Basic Structure and Properties of the Milky Way, Nature of Rotation of the Milky Way (Differential Rotation of the Galaxy and Oort Constant, Rotation Curve of the Galaxy and the Dark Matter , Nature of the Spiral Arms), Stars and Star Clusters of the Milky Way, Properties of and Around the Galactic Nucleus (8)

3.2 Galaxies: Galaxy Morphology, Hubble's Classification of Galaxies, Elliptical Galaxies (The Intrinsic Shapes of Ellipticals, de Vaucouleurs Law, Stars and Gas). Spiral and Lenticular Galaxies (Bulges, Disks, Galactic Halo) The Milky Way Galaxy, Gas and Dust in the Galaxy, Spiral Arms, Active Galaxies (4)

Unit 4 (15 hrs.)

4.1 Active galaxies: 'Activities' of Active Galaxies, How 'Active' are the Active Galaxies? Classification of the Active Galaxies, Some Emmission Mechanisms Related to the Study of Active Galaxies, Behaviour of Active Galaxies (Quasars and Radio Galaxies, Seyferts, BL Lac Objects and Optically Violent Variables), The Nature of the Central Engine, Unified Model of the Various Active Galaxies (6)

4.2 Large scale structure and the expanding universe: Cosmic Distance Ladder (An Example from Terrestrial Physics, Distance Measurement using Cepheid Variables), Hubble's Law (Distance-Velocity Relation), Clusters of Galaxies (The Virial Theorem and Dark Matter), Friedmann Equation and its Solutions, Early Universe and Nucleosynthesis (Cosmic Background Radiation, Evolving vs. Steady State Universe) (6)

Books Suggested:

1. Astronomy and Astrophysics, Course Material (PHE-15), Indira Gandhi National Open University, School of Sciences.
2. K.S. Krishnasamy, 'Astro Physics a modern perspective,' Reprint, New Age International (p) Ltd, New Delhi,2002.
3. 2. Baidyanath Basu, 'An introduction to Astro physics', second printing, prentice - Hall of India Private limited, New Delhi,2001.
4. Textbook of Astronomy and Astrophysics with elements of cosmology, V.B. Bhatia, Narosa Pub.

Course Code 31	**BSCPHY05/0619**	
Credits=4	**L=3 , T=1 , P=0**	
Name of the course	**Bio-Physics**	
Type of the course	**Core/Elective Course (Additional)**	
Number of hrs required for this course	**60 hrs.**	
Total Max Marks	**100**	
Semester Term End Examination	**Max Marks: 50**	**Maximum Time: 3 hrs.**
Continuous Comprehensive Assessment: Based on Minor Tests (2), class tests, Tutorials/ Assignments, Quiz, Seminar and Attendance. **Marks Attendance:** 5 marks to be given as per the regulations		**Max Marks: 50**

Instructions:

1 **For Paper Setters and candidates:** Question paper will consist of five sections: Sections A(Compulsory, Covering all the units), B(Unit-I), C (Unit-II), D (Unit-III) , E (Unit IV). Nine questions will be set in all. Section A will be Compulsory, consisting of a single question with 9 subparts of objective short answer/ multiple choice type, which will cover whole of the syllabus of the course and consist of the 36% of the maximum marks of the end term examination for the course. Sections B, C, D, and E will have two questions each from respective sub units and each question will carry 16% of maximum marks of the end term examination for the course. 20-30% questions should be problem based numericals.

2 **For Candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections: B,C,D and E of the end term question paper and all the subparts in section A. Use of nonprogrammble calculator is allowed.

Course of Study

Unit-1 (15 hrs.)

1.1 Building Blocks and Structure of Living State: Atoms and ions, molecules essential for life, what is life.

1.2 Living state interactions: Forces and molecular bonds, electric and thermal interactions, electric dipoles, casiimir interactions, domains of physics in biology.

Unit-II (15 hrs.)

2.1 Heat Transfer in biomaterials: Heat Transfer Mechanism, The Heat equation, Joule heating of tissue.

2.2 Living State Thermodynamics: Thermodynamic equilibrium, fIrst law of thermodynamics and conservation of energy. Entropy and second law of thermodynamics, Physics of many particle systems, Two state systems, continuous energy distribution, Composite systems, Casimir contribution of free energy, Protein folding and unfolding.

Unit-III (15 hrs.)

3.1 Open systems and chimcal thermodynamics: Enthalpy, Gibbs Free Energy and chemical potential, activation energy and rate constants, enzymatic reactions, ATP hydrolysis and synthesis, Entropy of mixing, The grand canonical ensemble, Haeoglobin

3.2 Diffusion and transport. Maxwell-Boltzmann statistics, Fick's law of diffusion, sedimentation of Cell Cultures, diffusion in a centrifuge, diffusion in an electric field, Lateral diffusion in membranes, Navier stokes equation, low Reynold's Number Transport, Active and passive membrane transport.

Unit-IV (15 hrs.)

4.1 Fluids: Laminar and turbulent fluid flow, Bernoulli's equation, equation of continuity, venture effect, Fluid dynamics of circulatory systems, capillary action

4.2 Bioenergetics and Molecular motors: Kinesins, Dyneins, and microtubule dynamics, Brownian motion, ATP synthesis in Mitochondria, Photosynthesis in Chloroplasts, Light absorption in biomolecules, vibrational spectra of bio-biomolecules.

Books Suggested:

1. **Introductory Biophysics, J Claycomb, JQP Tran, Jones & Bartelett Publishers**
2. Aspects of Biophysics, Hughe S W, John Willy and Sons.
3. Introduction of Biophysics by Pranab Kumar Banargy, S Chand and Co.
4. Essentials of Biophysics by P Narayanan, New Age International

Course Code 32	**BSCPHY05/0620**	
Credits=4	**L=3 , T=1 , P=0**	
Name of the course	**Medical Physics**	
Type of the course	**Core/Elective Course (Additional)**	
Number of hrs required for this course	**60 hrs.**	
Total Max Marks	**100**	
Semester Term End Examination	**Max Marks: 50**	**Maximum Time: 3 hrs.**
Continous Comprehensive Assesment: Based on Minor Tests (2), class tests, Tutorials/ Assignments, Quiz, Seminar and Attendance. **Marks Attendance:** 5 marks to be given as per the regulations		**Max Marks: 50**

Instructions:

1 **For Paper Setters and candidates:** Question paper will consist of five sections: Sections A(Compulsory, Covering all the units), B(Unit-I), C (Unit-II), D (Unit-III) , E (Unit IV). Nine questions will be set in all. Section A will be Compulsory, consisting of a single question with 9 subparts of objective short answer/ multiple choice type, which will cover whole of the syllabus of the course and consist of the 36% of the maximum marks of the end term examination for the course. Sections B, C, D, and E will have two questions each from respective sub units and each question will carry 16% of maximum marks of the end term examination for the course. 20-30% questions should be problem based numericals..

2 **For Candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections: B,C,D and E of the end term question paper and all the subparts in section A. Use of nonprogrammble calculator is allowed.

Course of Study

Unit I (15 hrs)

PHYSICS OF THE BODY-I

1.1 Mechanics of the body: Skeleton, forces, and body stability Muscles and the dynamics of body movement Physics of body crashing

1.2 Energy household of the body: Energy balance in the body, **Energy** consumption of the body, Heat losses of the body , **Pressure system of the body:** Physics of breathing, Physics of the cardiovascular system

UNIT II (15 hrs)

PHYSICS OF THE BODY-II

2.1 Acoustics of the **body:** Nature and characteristics of sound, Production of speech, Physics of the ear, Diagnostics **with** sound and ultrasound

2.2 Optical **system** of the body: Physics of the eye.

2.3 Electrical system of the body: Physics of the nervous system, Electrical signals and information transfer

UNIT III (15 hrs)

PHYSICS OF DIAGNOSTIC AND THERAPEUTIC SYSTEMS-I

3.1 Radiation **and radiation protection:** Radiation dosimetry, Natural radioactivity, Biological **effects** of radiation,, Radiation monitors**.**

3.2 Diagnostic **radiology:** Production and characteristics of X-rays, X-ray diagnostics and imaging, Physics of nuclear magnetic resonance (NMR) NMR imaging – MRI

Unit IV (15hrs)

Physics of diagnostic and therapeutic systems:

4.1 Diagnostic **nuclear medicine:** Radiopharmaceuticals for radioisotope imaging, Radioisotope imaging equipment, Single photon and positron emission tomography

4.2 Therapeutic **nuclear medicine:** Interaction between radiation and matter Dose and isodose in radiation treatment

Books Suggested:

1. Medical Physics, J.B.Cameron
2. Basic Radiological Physics Dr. K. Thayalan - Jayapee Brothers Medical Publishing Pvt. Ltd. New Delhi (2003)

Course Code 33	**BSCPHY05/0621**	
Credits=4	**L=3 , T=1 , P=0**	
Name of the course	**Introduction to Microprocessors**	
Type of the course	**Core/Elective Course (Additional)**	
Number of hrs required for this course	**60 hrs.**	
Total Max Marks	**100**	
Semester Term End Examination	**Max Marks: 50**	**Maximum Time: 3 hrs.**
Continous Comprehensive Assesment: Based on Minor Tests (2), class tests, Tutorials/ Assignments, Quiz, Seminar and Attendance. **Marks Attendance:** 5 marks to be given as per the regulations		**Max Marks: 50**

Instructions:

1 **For Paper Setters and candidates:** Question paper will consist of five sections: Sections A(Compulsory, Covering all the units), B(Unit-I), C (Unit-II), D (Unit-III) , E (Unit IV). Nine questions will be set in all. Section A will be Compulsory, consisting of a single question with 9 subparts of objective short answer/ multiple choice type, which will cover whole of the syllabus of the course and consist of the 36% of the maximum marks of the end term examination for the course. Sections B, C, D, and E will have two questions each from respective sub units and each question will carry 16% of maximum marks of the end term examination for the course. 20-30% questions should be problem based numericals.

2 **For Candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections: B,C,D and E of the end term question paper and all the subparts in section A. Use of nonprogrammble calculator is allowed.

Course of Study

Unit-1 (15 hrs.)

1.1 Number systems and Computer Math: Binary number system, decimal binary conversion, binary fractions, hexadecimal, binary arithmetic, carrys and overflow, fixed length binary numbers, 2's complement number, signed overflow, sign extension, representing character in binary, logical functions

1.2 Microprocessors, Microcomputers, and assembly language: microprocessors, microprocessor indtructionset and computer languages, from large computers to single chip microcontrollers, applications: microprocessor controlled temperatire systemsUn

Unit-II (15 hrs.)

2.1 8085 assembly language programming: The 8085 programming model, instruction classification, instruction, data format and storage, writing, assemblying and executing a simple program, overview of the 8085 instruction set, writing and hand assembling a program.

2.2 Microprocessor architecture and microcomputer systems: Microprocessor architecture and operations, memory, input output devices, example of a microcomputer system, logic devices for interfacing, microcomputer based system applications: MCTS

Unit-III (15 hrs.)

3.1 8085 Microprocessor architecture and memory interfacing: The 8085 MPU, example of an 8085 based microcomputer, memory interfacing, interfacing the 8155 memory segment, designing memory for the MCTS, testing and trouble shooting memory interfacing circuits, working of a single board microcomputer

3.2 Interfacing I/O Devices: Basic interfacing concepts, interfacing output displays, interfacing output displays, interfacing input devices, memory mapped I/O, , Testing and Troublr shooting I/O interfacing circuits

Unit-IV (15 hrs.)

4.1 Introduction to 8o85 instructions: Data transfer (copy) operations, arithmetic operations, logic operations, branch **operations**, writing assembly language program.

4.2 Programming techniques and instructions: Programming techniques: looping, counting and indexing, additional data transfer and 16 bit arithmetic instructions, arithmetic operations related to memory, logic operations: rotate, logic operations: compare, dynamic debugging.

Books Suggested:

1. Micrprocessors **architecture, programming and applications with the 8085, Ramesh Gaonkar, penram interational publishing (india) private ltd.**
2. **Microprocessor X86 Programming, Venugopal (BPB Publication).**
3. **8085 Microprocessor Fundamentals & Application, Vol-1, Boyet H (BPB Publication).**

Course Code 34	**BSCPHY05/0622**	
Credits=3	**L=2 , T=1 , P=0**	
Name of the course	**Electronics Instrumentation and Measurement**	
Type of the course	**Core/Elective Course (Additional)**	
Number of hrs required for this course	**45 hrs.**	
Total Max Marks	**100**	
Semester Term End Examination	**Max Marks: 50**	**Maximum Time: 3 hrs.**
Continuous Comprehensive Assessment: Based on Minor Tests (2), class tests, Tutorials/ Assignments, Quiz, Seminar and Attendance. **Marks Attendance:** 5 marks to be given as per the regulations		**Max Marks: 50**

Instructions:

1 **For Paper Setters and candidates:** Question paper will consist of five sections: Sections A(Compulsory, Covering all the units), B(Unit-I), C (Unit-II), D (Unit-III) , E (Unit IV). Nine questions will be set in all. Section A will be Compulsory, consisting of a single question with 9 subparts of objective short answer/ multiple choice type, which will cover whole of the syllabus of the course and consist of the 36% of the maximum marks of the end term examination for the course. Sections B, C, D, and E will have two questions each from respective sub units and each question will carry 16% of maximum marks of the end term examination for the course. 20-30% questions should be problem based numericals.

2 **For Candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections: B,C,D and E of the end term question paper and all the subparts in section A. Use of nonprogrammble calculator is allowed.

Course of Study

Unit-I (12 hrs.)

1.1 Basic of Measurement: Review of performance specifications of instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects. **Multimeter:** Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance in multimeter. Specifications of a multimeter and their significance.

1.2 Electronic Voltmeter: Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity. Principles of voltage, current and resistance measurement (block diagram only). Specifications of an electronic Voltmeter/ Multimeter and their significance. **AC millivoltmeter:** Type of AC millivoltmeters: Amplifier- rectifier, and rectifier- amplifier. Block diagram and explanation of the above type of ac millivoltmeter**.** Type of specifications and their significance.

Unit-II (12 hrs.)

2.1 Cathode Ray **Oscilloscope:** Construction of CRT, Electron gun, electrostatic focuning and acceleration (Explanation only – no mathematical treatment)Deflection sensitivity, brief mention of screen phosphor for CRT in relation to their visual persistence and chemical composition. Explanation of time base operation and need for blanking during fly back, synchronization. Block diagram explanation of a basic CRO and a triggered sweep oscilloscope, front panel controls. Specifications of a CRO and their significance.

2.2 Use of CRO for the measurement of voltage (dc and ac frequency, time period, and phase angles. Special features of dual trace, delayed sweep and storage CROs (brief mention only); introduction to digital CROs. CRO probes, including current probes. Digital storage Oscilloscope: Block diagram and principle of working. CRO, Block diagram, working of CRO and its various controls application of CRO.

Unit-III (11 hrs.)

3.1 Signal Generators and Analysis Instruments: Block diagram, explanation and specifications of Laboratory type low frequency and RF signal generators. pulse generator, and function generator. Brief idea for testing, specifications for the above instruments. Distortion factor meter, wave analysis and spectrum analysis

3.2 Impedance Bridges and Q-Meters: Block diagram explanation of working principles of a laboratory type (balancing type) RLC bridge. Specifications of a RLC bridge. Block diagram and working principles of a Q- Meter. Digital LCR bridges

Unit IV (10 hrs.)

4.1 Digital Instruments: Principle and working of digital meters for measuring meters. Comparison of analog and digital instruments. Characteristics of a digital meter. Working principles of lamp, dual slope and integrating type of digital voltmeter.

4.2 Digital Multimeter: Block diagram and working of a digital multimeter. Working principle of time interval, frequency and period measurement using universal counter/ frequency counter, time- base stability, accuracy and resolution. Principles of working and specifications of logic probes.

Course Code 35	**BSCPHY05/0622(P)**	
Credits=1	**L=0 , T=0 , P=1**	
Name of the course	**Electronics Instrumentation and Measurement Lab**	
Type of the course	**Core/Elective Course (Additional)**	
Number of hrs required for this course	**30 hrs.**	
Total Max Marks	**50**	
Semester Term End Examination	**50 % of total marks**	**Maximum Time: 3 hrs**
Continous Comprehensive Assesment: Based on performance in the laboratory, lab record, lab seminar and Attendance. **Marks Attendance:** 5% marks to be given as per the regulations		**Max Marks: 50% of the total marks**

Instructions for Paper Setters and candidates: Laboratory examination will consist of two parts: (i) Performing a practical exercise assigned by the examiner from Unit II or Unit III (50% of the total marks) (ii) Viva Voce Examination (50 % of the total marks) Viva Voce Examination will be related to the practical performed, seminar assignment done by the candidate related to the paper and lab skills (Unit I) learnt during the course of the semester.

Course of Study

Unit-I

The test of lab skills will be of the following test items:

xv. Use of an oscilloscope.
xvi. CRO as a versatile measuring device.
xvii. Circuit tracing of Laboratory electronic equipment,
xviii. Use of Digital multimeter/ VTVM for measuring voltages
xix. Circuit tracing of Laboratory electronic equipment,
xx. Winding a coil / transformer.
xxi. Study the layout of receiver circuit.
xxii. Trouble shooting a circuit
xxiii. Balancing of bridges

Unit-II

Laboratory Excercises:

1. (a) To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance
   (b) To observe the limitations of a multimeter for measuring high frequency voltage and currents.
2. To measure Q of a coil and observe its dependence on frequency, using a Q- meter.
3. Measurement of voltage, frequency, time period and phase angle using CRO.
4. Measurement of time period, frequency, average period using universal counter/ frequency counter.
5. Measurement of rise, fall and delay times using a CRO.
6. Measurement of distortion of a RF signal generator using distortion factor meter.
7. Measurement of R,L and C using a LCR bridge/ universal bridge.

Unit-III

Open Ended Experiments:

1. Using a Dual Trace Oscilloscope
2. Converting the range of a given measuring instrument (such as voltmeter, ammeter)

Note: Computer Wallats.

Open Elective Courses(Offered by Physics Department):

Course Code 36	**BSCPHY05/0623**	
Credits=4	**L=3 , T=1 , P=0**	
Name of the course	**Renewable Sources of Energy**	
Type of the course	**Core/Elective Course (Additional)Open Elective**	
Number of hrs required for this course	**60 hrs.**	
Total Max Marks	**100**	
Semester Term End Examination	**Max Marks: 50**	**Maximum Time: 3 hrs.**
Continous Comprehensive Assesment: Based on Minor Tests (2), class tests, Tutorials/ Assignments, Quiz, Seminar and Attendance. **Marks Attendance:** 5 marks to be given as per the regulations		**Max Marks: 50**

Instructions:

1 **For Paper Setters and candidates:** Question paper will consist of five sections: Sections A(Compulsory, Covering all the units), B(Unit-I), C (Unit-II), D (Unit-III) , E (Unit IV). Nine questions will be set in all. Section A will be Compulsory, consisting of a single question with 9 subparts of objective short answer/ multiple choice type, which will cover whole of the syllabus of the course and consist of the 36% of the maximum marks of the end term examination for the course. Sections B, C, D, and E will have two questions each from respective sub units and each question will carry 16% of maximum marks of the end term examination for the course. 20-30% questions should be problem based numericals.

2 **For Candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections: B,C,D and E of the end term question paper and all the subparts in section A. Use of nonprogrammble calculator is allowed.

Course of Study

Unit-I (15hrs)

1.1 Energy: Past, Today, and Future. A brief history of energy consumption, Energy & Environment,
1.2 Non-renewable energies, Solar Energy: Sun and its Energy (Basics of Solar Energy), Solar Energy in the Past, Solar Thermal Energy, Solar Photovoltaic

Unit-II (15 hrs)

2.1 Wind Energy: Historical Background, Wind Resources,
2.2 Wind Turbines, Environmental Impact

Unit-III (15 hrs)

3.1 Ocean Energy: Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices.
3.2 Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass

Unit-IV (15 hrs)

4.1 Geothermal Energy: Geothermal Resources, Geothermal Technologies
4.2 Hydro Energy: Hydropower resources, hydropower technologies, environmental impact of hydro power sources
4.3 Environmental issues and Renewable sources of energy, sustainability and renewable sources of energy

Recommended Books:

1. Godfrey Boyle, " Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University.
2. Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009
3. John Balfour, Micael Shaw and Sharlene Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
4. http://en.wikipedia.org/wiki/Renewable_energy

Course Code 37	**BSCPHY05/0624**	
Credits=3	**L=3 , T=1 , P=0**	
Name of the course	**Consumer Electronics**	
Type of the course	**Core/Elective Course (Additional)Open Elective**	
Number of hrs required for this course	**45 hrs.**	
Total Max Marks	**100**	
Semester Term End Examination	**Max Marks: 50**	**Maximum Time: 3 hrs.**
Continuous Comprehensive Assessment: Based on Minor Tests (2), class tests, Tutorials/ Assignments, Quiz, Seminar and Attendance. **Marks Attendance:** 5 marks to be given as per the regulations		**Max Marks: 50**

Instructions:

1 **For Paper Setters and candidates:** Question paper will consist of five sections: Sections A(Compulsory, Covering all the units), B(Unit-I), C (Unit-II), D (Unit-III) , E (Unit IV). Nine questions will be set in all. Section A will be Compulsory, consisting of a single question with 9 subparts of objective short answer/ multiple choice type, which will cover whole of the syllabus of the course and consist of the 36% of the maximum marks of the end term examination for the course. Sections B, C, D, and E will have two questions each from respective sub units and each question will carry 16% of maximum marks of the end term examination for the course. 20-30% questions should be problem based numericals.

2 **For Candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections: B,C,D and E of the end term question paper and all the subparts in section A. Use of nonprogrammble calculator is allowed.

Course of Study

Unit-I (11 hrs)

1.1 Audio System: M Microphones: construction , working principles and applications of microphones, their types viz: a) Carbon b) moving coil, c) velocity, d) crystal, e) condenser, f) cordless etc. Loud Speaker: Direct radiating, horn loaded woofer , tweeter , mid range, multi-speaker system, baffles and enclosures.

1.2 Sound Recording: Sound recording on magnetic tape, its principles, block diagram, and tape transport mechanism. Digital sound recording on tap and disc. CD System- Hi –Fi system, pre-amplifier , amplifier and equalizer system, stereo amplifier.

Unit-II (12 hrs)

2.1 Television : Elements of TV communication system. Scanning – its need for picture transmission. Need for synchronizing and blanking pulses. Progressive scanning- Gross structure, interlaced scanning, resolution and band width requirement, tonal gradation , Composite Video Signal (CVS) at the end of even and odd fields , Equalizing pulses and their need. Monochrome picture tube-construction and working , comparison of magnetic and electric deflection of beam .

2.2 Construction and working of camera tube: vidicon and plumbicon, Block diagram of TV camera and the transmitter chain. Block diagram of a TV receiver: function of each block and waveform at the input and output of each block. Concept of appositive and negative modulation VSB Transmission Tuner.

Unit-III (10 hrs)

3.1 Colour TV: Primary colours, tristimulus values, trichromatic coefficients, concepts of additive and subtracting mixing of colours, concepts of luminance, Hue and Saturation, representation of a colour in colour triangle, non spectral colour, visibility curve Compatibility of colour TV system with monochrome system. Block diagramof colour TV camera.

3.2 Colour Schemes: Introduction to PAL, NTSC, SECAM system Advantages and disadvantages, block diagram of video camera and its explanation, Construction and woking principles of trintron and PIL types of colour picture tubes, Concept of convergence, purity of beam shifting, Block diagram of PAL TV receiver, explanation and working.

Unit-IV (11 hrs)

4.2 Cable Television: Block diagram and principles of working of cable TV and DTH , Cable TV using internet. **Tape Recorder, VCD and DVD** :Working Principles of Tape recorder, VCD and DVD recording and playback.**Basic Block Diagram, Working**

4.3 Principle and Application: Cordless Telephone, Photostat M/C, Electronic lgnition System for Automobiles. Automatic Washing Machine, Microwave Oven, Fax Machine, Mobile Phone

Suggested books:

I. *Colour Television- principles & practice R.R. Gulati by Wiley Eastern Limited, New Delhi*
II. *Complete Satellite & cable Television R.R. Gulati New age International Publisher, New Delhi*
III. *Colour television Servicing by RC Vijay BPB Publicatin, New Delhi*
IV. *Colour Television & Video Technoloty by A.K. MINI CSB Publishers*
V. *Colour TV by A. Dhake*
VI. *Service Manuals, BPB Publication, New Delhi*

Course Code 38	**BSCPHY05/0624(P)**	
Credits=1	**L=0 , T=0 , P=1**	
Name of the course	**Consumer Electronics Lab**	
Type of the course	**Core/Elective Course (Additional)Open Elective**	
Number of hrs required for this course	**30 hrs.**	
Total Max Marks	**50**	
Semester Term End Examination	**50 % of total marks**	**Maximum Time: 3 hrs**
Continous Comprehensive Assesment: Based on performance in the laboratory, lab record, lab seminar and Attendance. **Marks Attendance:** 5% marks to be given as per the regulations		**Max Marks: 50% of the total marks**

Instructions for Paper Setters and candidates: Laboratory examination will consist of two parts: (i) Performing a practical exercise assigned by the examiner from Unit II and Unit III (50% of the total marks) (ii) Viva Voce Examination (50 % of the total marks) Viva Voce Examination will be related to the practical performed, seminar assignment done by the candidate related to the paper and lab skills (Unit I) learnt during the course of the semester.

Course of Study

Unit-I

The test of lab skills will be of the following test items:

xxiv. Use of an oscilloscope.
xxv. CRO as a versatile measuring device.
xxvi. Soldering.
xxvii. Circuit tracing of Laboratory electronic equipment,
xxviii. Use of Digital multimeter/ VTVM for measuring voltages
xxix. Color codes for resistor and capacitors.
xxx. Elements of a microprocessor
xxxi. To test a microphone/ speaker.
xxxii. To test a radio-receiver.
xxxiii. To test a TV =reciever
xxxiv. Study the layout of receiver circuit
xxxv. Study the layout of receiver circuit.
xxxvi. Interfacing of a computer with the measuring instruments
xxxvii. Trouble shooting a circuit

Unit-II

Laboratory Exercises:

1. To plot the frequency response of a microphone
2. To plot the frequency response of a loud speaker
3. Trouble shooting of tape-recorder systems
4. To observe the wave forms and voltage B/W and colour T.V receiver.
5. Fault finding of colour T.V.
6. Trouble shooting of C.D. Player
7. Demonstration of DVD Player.
8. Demonstration and study to VCD especially its transport mechanism
9. Study of a TV cable network system

Unit III

1. Demonstration of Microwave oven

2. Demonstration of Photostat M/c

3. Demonstration of Automatic Washing Machine

Suggested books:

I. *Colour Television- principles & practice R.R. Gulati by Wiley Eastern Limited, New Delhi*
II. *Complete Satellite & cable Television R.R. Gulati New age International Publisher, New Delhi*
III. *Colour television Servicing by RC Vijay BPB Publicatin, New Delhi*
IV. *Colour Television & Video Technoloty by A.K. MINI CSB Publishers*
V. *Colour TV by A. Dhake*
VI. *Service Manuals, BPB Publication, New Delhi*

General Interest Courses (Offered by Physics Department I/II/III):

Course Code 39	**BSCPHY01/02/0325**	
Credits=1	**L=1 , T=0 , P=0**	
Name of the course	**History of Science**	
Type of the course	**General Interest/Hobby Course**	
Number of hrs required for this course	**15 hrs.**	
Total Max Marks	**50**	
Semester Term End Examination	**Max Marks: 25**	**Maximum Time: 3 hrs.**
Continuous Comprehensive Assessment: Based on Minor Tests (2), class tests, Tutorials/ Assignments, Quiz, Seminar and Attendance. **Marks Attendance:** 5 marks to be given as per the regulations		**Max Marks: 25**

Instructions:

1 **For Paper Setters and candidates:** Question paper will consist of five sections: Sections A(Compulsory, Covering all the units), B(Unit-I), C (Unit-II), D (Unit-III) , E (Unit IV). Nine questions will be set in all. Section A will be Compulsory, consisting of a single question with 9 subparts of objective short answer/ multiple choice type, which will cover whole of the syllabus of the course and consist of the 36% of the maximum marks of the end term examination for the course. Sections B, C, D, and E will have two questions each from respective sub units and each question will carry 16% of maximum marks of the end term examination for the course.

2 **For Candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections: B,C,D and E of the end term question paper and all the subparts in section A. Use of nonprogrammble calculator is allowed.

Course of Study

Unit 1 (4 hr)

1.1 **Science as a human endeavor:** Linking Past with Present, why search the past, What is History of Science, Some Aspects of Science: The Institution of Science, The Method of Science, The Tradition of Science, The Social Function of Science

1.2 Science in the ancient world: Primitive Human Society, Food Gathering and Hunting, The Material Basis of Primitive Life, Social Basis of Primitive Life , The Origins of Science, End of Stone Age, Agriculture and Civilization, The Origin of Agriculture and Civilization, Scientific and Technical Achievements of Bronze Age, Indus Valley Civilization.

Unit 2 (3 hr)

2.1 Iron Age: Science in Iron Age India, Search for Agricultural Land and Minerals, Emergence of Urban Societies, Emergence of Science, Developments in Medicine. Science in Iron Age Greece, Development in Some Areas of Science, Atomic Theory in Antiquity Decline of European Science

2.2 The golden age of science in india Second Urban Civilization in India, The Indian State, Developments in Technology in the Mauryan Empire, Developments in South India, The Gupta Period Social Organization, Improvement of Techniques and Crafts, Development in Mathematics, Development in Astronomy, Decline of the Gupta Empire, Age of Conflict

Unit 3 (4 hr)

3.1 Science in medivial times: The Arab Renaissance, Arab Science, Decay of Arab Culture and Science, Science and Technology in Medieval India, Achievements in Science Technical innovations and Inventions, Impediments to the Growth of Science in India

3.2 Renaissance, the industrial revolution and after: Science and Technique in Medieval Europe. The Feudal Society, The Transformation of Medieval Economy, The Renaissance (1440-1540), Science

and Technology during Renaissance, Science in the Post Renaissance period (1540-1760), Why Science Grew in Europe, The Industrial Revolution (1760-1830)

3.3 Science in colonial and modern india: Science in Colonial India, Scientific esearch in Colonial India, Impact of Freedom Movement, Science in Post- Independence India

Unit 4 (4hr.)

4.1 Method of Science and nature of Scientific knowledge: Science – Its Many Facets, The Method of Science, Observations, Hypothesis, Experiments, Laws, Models and Theories, Some Example, The nature of Scientific Knowledge, Scientific Approach to Problem Solving, A Reflection about Science.

4.2 Origin and Evolution of Life: Origin of Life on the Earth, Special Creation, Spontaneous Generation, Chemical Evaluation, Miller's Experiment, Biological Evolution, Systems View of Life, Life Cycle, Aging, Extra – terrestrial Life. Information Age: Mass Communication, A Historical Perspective, Media of Mass Communication Today. Technological Advances in Mass Communication. State of Communication in the Past. Communication Revolution: Internet, world wide web, Social and Economic Impact of Modern Communication Technology, New World Information and Communication Order

Books Suggested:

1. Foundation Course in Science and Technology, Indira Gandhi National Open University, New Delhi
2. What is Science?, Sunder Sarukkai, National Book Trust, India
3. Barger, Bernard 1952. Science and the social order New York: Free Press.
4. Krishna, V.V. 1993. S.S. Bhatangar on science, technology, and development, 1938-54 New Delhi: Wiley Eastern.
5. Rahman, A. 1972. Trimuti: Science, technology and society- A collection of essays New Delhi: Peoples Publishing House.
6. MacLeod, Roy and Deepak Kumar. 1995. Technology and the raj: Western technology and technical transfers to India, 1700-1947 New Delhi: Sage.
7. Merton, Robert K. 1938. " Science, technology and society in seventeenth – century England", Osiris (Bruges, Belgium), 14, Pp.360-632.

Course Code 40	**BSCPHY01/02/0326**	
Credits=1	**L=1 , T=0 , P=0**	
Name of the course	**Science, Technology and Society**	
Type of the course	**General Interest/Hobby Course**	
Number of hrs required for this course	**15 hrs.**	
Total Max Marks	**50**	
Semester Term End Examination	**Max Marks: 25**	**Maximum Time: 3 hrs.**
Continuous Comprehensive Assessment: Based on Minor Tests (2), class tests, Tutorials/ Assignments, Quiz, Seminar and Attendance. **Marks Attendance:** 5 marks to be given as per the regulations		**Max Marks: 25**

Instructions:

1 **For Paper Setters and candidates:** Question paper will consist of five sections: Sections A(Compulsory, Covering all the units), B(Unit-I), C (Unit-II), D (Unit-III) , E (Unit IV). Nine questions will be set in all. Section A will be Compulsory, consisting of a single question with 9 subparts of objective short answer/ multiple choice type, which will cover whole of the syllabus of the course and consist of the 36% of the maximum marks of the end term examination for the course. Sections B, C, D, and E will have two questions each from respective sub units and each question will carry 16% of maximum marks of the end term examination for the course.

2 **For Candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections: B,C,D and E of the end term question paper and all the subparts in section A. Use of nonprogrammble calculator is allowed.

Course of Study

Unit-I (4 hrs.)

1.1 Science and technology in industry: The Indian Context, Technology in Industry, Economic Development and Self-reliance, Research and Development in Industry

1.2 Technology and economic development: Technology Policy, Technology Transfer, Import of Technology, Lab to Field, Export of Technology, Current Technological Developments: Energy Sector, Some Key Industries. Limited Access to Technology

Unit-II (4 hrs.)

2.1 Laser: Putting Light to Work, Fibre Optics, Applications of Optical Fibres. Space Technology: Dividends from Space.

2.2 Fission and Fusion Energy: Nuclear Fission: Splitting the Atom, Nuclear Reactor, Nuclear Fusion: The Ultimate Source of Energy, The Other Side of the Coin. What is Biotechnology: Genetic Engineering, Enzyme Immobilization

Unit-III (3 hrs.)

3.1 Semiconductors: What is a Semiconductor, Semiconductor Devices and their Uses. Computer Technology: Computers at Work, Micros, Minis, Mainframes, 'Monsters' and their Uses, Artificial Intelligence.

3.2 Robotics: An Insight into Robotics and Robots, Where Robots Star, Getting Ready for Robots. Materials Science and Technology. Technology Forecasting

Unit-IV (4 hrs.)

4.1 Perceptions and aspirations: Science and Society Interaction : Science Influences Entire Social Edifice, Society Influences Scientific Development. Need for a System Approach: Primacy of Social Objectives, Evolution of Science and Some Social Ideas. Relevance of Past to Present, Science and the Creation of New Vision. New Perceptions and Aspirations

4.2 Science – the road to development: Quest of Prosperity For All, Technology as a Tool of Domination, New International Economic Order, Exploded Myths. Self- reliance: Science and Technology for National Development

References:

1. Science & Technology, Ashok Kumar Singh (Tata McGraw Hill).
2. Foundation Course in Science and Technology, Indira Gandhi National Open University, New Delhi (with special focus on History of Science)