MAHATMA GANDHI UNIVERSITY, KOTTAYAM

CURRICULUM FOR UNDER GRADUATE PROGRAMMES IN

PHYSICS

UNDER CHOICE BASED CREDIT SYSTEM (UG CBCS) 2017

2017 ADMISSIONS ONWARDS

CONTENTS

1. ACKNOWLEDGEMENT

There are many profound personalities whose relentless support and guidance made this syllabus restructuring 2017 a success. We take this opportunity to express our sincere appreciation to all those who were part of this endeavour for restructuring the syllabus of U G course in Physics under Mahatma Gandhi University, Kottayam.

We express profound gratitude to the Honourable Vice-Chancellor, Pro-Vice Chancellor, Registrar, Members of the Syndicate and Academic Council for their sincere co-operation and guidance for completion of this work. We place on record my wholehearted gratitude to the members of Faculty of Science and Board of Studies for their untiring efforts. We also appreciate the efforts of members of University Academic Section and other staff.

Special thanks are due to the representatives of the colleges affiliated to M. G. University, who have actively participated and contributed in the workshops. The enthusiasm and sincerity shown by the teachers from various colleges in the context of syllabus restructuring is highly appreciated.

Prepared by BOS and Faculty of Science,

Kottayam

02-05-2017

2. TITLE

B. Sc. PHYSICS PROGRAMME – Under Graduate Programmes under Choice Based Credit System, 2017 (UG CBCS 2017).

3. AIMS AND OBJECTIVES OF THE PROGRAMME

Aims:

The Board of Studies in Physics (UG) recognizes that curriculum, course content and assessment of scholastic achievement play complementary roles in shaping education. The committee is of the view that assessment should support and encourage the broad instructional goals such as basic knowledge of the discipline of Physics including phenomenology, theories and techniques, concepts and general principles. This should also support the ability to ask physical questions and to obtain solutions to physical questions by use of qualitative and quantitative reasoning and by experimental investigation. The important student attributes including appreciation of the physical world and the discipline of Physics, curiosity, creativity and reasoned skepticism and understanding links of Physics to other disciplines and to societal issues should gave encouragement. With this in mind, we aim to provide a firm foundation in every aspect of Physics and to explain a broad spectrum of modern trends in physics and to develop experimental, computational and mathematics skills ofstudents.

The programme also aims to develop the following abilities:

1. Read, understand and interpret physical information – verbal, mathematical and graphical.
2. Impart skills required to gather information from resources and use them.
3. To give need based education in physics of the highest quality at the undergraduate level.
4. Offer courses to the choice of the students.
5. Perform experiments and interpret the results of observation, including making an assessment of experimental uncertainties.
6. Provide an intellectually stimulating environment to develop skills and enthusiasms of students to the best of their potential.

7. Use Information Communication Technology to gather knowledge at will.
8. Attract outstanding students from all backgrounds.

Objectives:

The syllabi are framed in such a way that it bridges the gap between the plus two and post graduate levels of Physics by providing amore complete and logical framework in almost all areas of basic Physics.

By the end of the first year (2^{nd} semester), the students should have attained a common level in basic mechanics, a secure foundation in mathematics, Chemistry(otherwise specified), Languages and other relevant subjects to complement the core for their future courses and developed their experimental and data analysis skills through experiments at laboratories.

By the end of the second year(4^{th}semester), the students should have been introduced to powerful tools for tackling a wide range of topics in Optics, Laser, Fiber optics, Semiconductor devices and circuits. Along with Languages, they should have been familiar with additional relevant techniques in mathematics, Chemistry or Electronics/Computer application and developed their experimental and data analysis skills through a wide range of experiments through practical at laboratories.

By the end of the third year (6^{th} semester)r, the students should have developed their understanding of core Physics by covering a range of topics in almost all areas of physics including Classical and Quantum Mechanics, Electricity and Electrodynamics, Relativity and spectroscopy, Thermal and Statistical Physics, Nuclear and Particle physics, Solid State Physics, Digital Electronics etc. along with one choice based courses, Open course and had experience of independent work such as projects; seminars etc. and thereby developing their experimental skills through a series of experiments which also illustrate major themes of the lecture courses.

4. COURSE DESIGN - B. Sc. PROGRAMMES IN PHYSICS

The U.G. programme in Physics must include (a) Common courses, (b) Core courses, (c) Complementary courses, (d) Choice based courses, (e) Open courses and (f) Project. No course shall carry more than 4 credits. The student shall select any one Open course in Semester 5 offered

by the various Departments which offers the core courses or physical education department, depending on the availability of infrastructure facilities, in the institution. The number of Courses for the restructured programme should contain 12 compulsory core courses, 1 open course, 1 choice based course from the frontier area of the core courses, 6 core practicals, 1 project in the area of core, 8 complementary courses, 2 complementary practicals otherwise specified, from the relevant subjects for complementing the core of study. There should be 10 common courses, or otherwise specified, which includes the first and second language of study.

5. PROGRAMME STRUCTURE

5.1. Programme structure

Model- I B. Sc

A	Programme Duration	6 Semesters
B	Total Credits required for successful completion of the Programme	120
C	Credits required from Common Course I	22
D	Credits required from Common Course II	16
E	Credits required from Core course (including Project) and Complementarycourses	79
F	Open course	3
G	Minimum attendance required	75%

5.2. Courses:

There shall be three different types (models) of courses in Physics programme. The programme (Model I) consists of common courses with 38 credits, core, Choice based course, Open course & complementary courses with 82 credits. The programme (Vocational -Model II) consists of common courses with 24 credits, core, Choice based courses, Open course & complementary courses with 96 credits. The programme (Model III) consists of common courses with 8 credits, core, Choice based course, Open course & complementary courses with 112 credits.

The Physics core subject will be the same in all respect in Model-I, Model-II and Model-III. Therefore B.Sc. Physics programme in all these three models will be treated equally for considering higher education in Physics and for Physical Science B.Ed.

5.3. Scheme of Courses:

The different types of courses and its number are as the following:

Model- I		Model- II		Model- III	
Courses	No.	Courses	No.	Courses	No.
Common Courses	10	Common Courses	6	Common Courses	2
Core Courses	12	Core Courses	12	First Core Courses	12
Project	1	Project	1	Project	1
Core Practicals	6	Core Practicals	6	First Core Practicals	6
Open Course	1	Open Course	1	Open Course	1
Choice based Course	1	Choice based Course	1	Choice based Course	1
-		Vocational courses	8	Second Core Courses	8
		Vocational Practicals	3	Second Core Practicals	3
		-	-	OJT	2
Complementary Courses	8	Complementary Courses	4	Complementary Courses	8
Complementary Practicals	2	-		Complementary Practicals	2
Total	41	Total	42	Total	46

5.4. Course Code:

Every course is coded using an eight digit alpha numeric code that gives a brief description on the following details.

A. Subject Code (2 characters)

Composed of two characters, which gives a meaningful abbreviation of the subject to which the paper belongs to.

The abbreviations used here are PH – Physics, AE – Applied Electronics, CA – Computer Application, EM – Electronic Equipment Maintenance, and EL - Electronics

B. Semester to which course belongs to (1 digit)

Composed of single digit number which indicates the semester to which the paper belongs to (1 to 6). In case of Practicals the number indicates the semester in which the exam in conducted.

C. Course type as per syllabus (2 characters)

Composed of two characters which give meaningful abbreviation of type of the course. The abbreviations used here are CM – Complementary Course, CB – Choice Based Core, CR – Core Course, OJ – On Job Training, PR – Project, OP – Open Course and VO – Vocational Course

D. Whether 'Theory' or 'Practical' or 'Other' (1 character)

Letter 'T' is used to denote Theory papers, the letter 'P' for Practical papers and the letter 'O' to denote other papers like Project, On Job Training, etc.

E. Serial number of the course in continuous series (2 digits)

Composed of two digits to indicate the paper's relative position in the programme.

Eg. 01 indicates 1stpaper, 05 indicates 5th paper, etc.

Sample Course Code

The Course code "PH1CRT01" indicates that the paper is "Physics – 1st

Semester – Core Course – Theory – 1st paper"

5.5. Courses with Credits:

Courses with Credits of different courses and scheme of examinations of the programme is the following

Courses	Model I		Model II		Model III	
	Credits	Total	Credits	Total	Credits	Total
Core Courses	47		47		47	
Open Course	3		3		3	
Choice Based Core	3		3		3	

Project	1		1		1	
Vocational Courses	Nil		28		Nil	
2nd Core Courses	Nil		Nil		30	
Total		54		82		84
Complementary Courses I	14		14		14	
Complementary Courses II	14		Nil		14	
Total		28		14		28
Common Courses	38		24		8	
Total		38		24		8
Grand Total		120		120		120

5.6. Scheme of Distribution of Instructional hours for Core courses:

Semester	Model I		Model II		Model III	
	Theory	Practical	Theory	Practical	Theory	Practical
First semester	2	2	6	4	8	4
Second semester	2	2	6	4	6	4
Third semester	3	2	9	6	9	6
Fourth semester	3	2	9	6	9	6
Fifth semester	17	8	17	8	17	8
Sixth Semester	17	8	17	8	17	8

6. MARKS DISTRIBUTION FOR PROJECT AND INDUSTRIAL VISIT

All students are to do a project in the area of core course. This project can be done individually or in groups (not more than three students). The projects are to be identified and its work must be started during the V semester of the programme with the help of the supervising teacher. The report of the project in duplicate is to be submitted to the department at the sixth semester and are to be produced before the examiners appointed by the University. External Project evaluation and Viva / Presentation are compulsory for all subjects and will be conducted at the end of theprogramme.

An industrial visit is also included in the program. The entire student must visit an industry during 5th or 6th semester and submit a report in duplicate along with the project report. This industrial visit and the report will be evaluated internally and externally along with the project evaluation.

a) Marks of External Examination : 80

Components of Evaluation (External)	Marks
Dissertation - Project (External)	45
Viva-Voce– Project(External)	27
Industrial Visit Report	5
Viva-Voce – Industrial Visit	3
Total	80

b) Marks of internal evaluation: 20 (All the five components of the internal assessment are mandatory)

Components of Internal Evaluation	Marks
Punctuality	4
Experimentation/Data Collection	5
Knowledge	5
Report	4
Industrial Visit	2

Total	20

c) OJT Evaluation (Internal evaluation: 100 marks)

Components of Internal Evaluation	Marks
Punctuality	20
Knowledge	20
Experimentation	20
Report	25
Presentation & Viva Voce	15
Total	100

7. CONSOLIDATED SCHEME FOR I TO VI SEMESTERS

7.1. B. Sc. Physics Programme – (Model I)

Semester	Title of the Course	Hours/week	Credits	Total hrs	University Exam duration	Marks	
						IA	EA
1	English I	5	4	90	3	20	80
	English II/ Common Course I	4	3	72	3	20	80
	Second Language I	4	4	72	3	20	80
	PH1CRT01 - Methodology and Perspectives of Physics	2	2	36	3	15	60
	Complementary I: Mathematics I	4	3	72	3	20	80
	Complementary II: Chemistry I	2	2	36	3	15	60

	Core Practical I: PH2CRP01 Mechanicsand Properties of Matter	2	-	36	-	-	-
	Complementary II Practical I	2	-	36	-	-	-
2	English II	5	4	90	3	20	80
	English III/ Common Course II	4	3	72	3	20	80
	Second Language II	4	4	72	3	20	80
	PH2CRT02 – Mechanics and Properties of Matter	2	2	36	3	15	60
	Complementary I: Mathematics II	4	3	72	3	20	80
	Complementary II: Chemistry II	2	2	36	3	15	60
	Core Practical I: PH2CRP01 Mechanics and Properties of Matter	2	2	36	3	10	40
	Complementary II Practical I	2	2	36	3	10	40
3	English III	5	4	90	3	20	80
	II Lang/Common Course I	5	4	90	3	20	80
	PH3CRT03 – Optics, Laser and Fiber Optics	3	3	54	3	15	60
	Complementary I: Mathematics III	5	4	90	3	20	80
	Complementary II: Chemistry III	3	3	54	3	15	60
	Core Practical II: PH4CRP02 Optics and Semiconductor Physics	2	-	36	-	-	-
	Complementary II Practical II	2	-	36	-	-	-

4	English IV	5	4	90	3	20	80
	II Lang/ Common Course II	5	4	90	3	20	80
	PH4CRT04- Semiconductor Physics	3	3	54	3	15	60
	Complementary I: Mathematics IV	5	4	90	3	20	80
	Complementary II: Chemistry IV	3	3	54	3	15	60
	Core Practical II: PH4CRP02 Optics and Semiconductor Physics	2	2	36	3	10	40
	Complementary II Practical II	2	2	36	3	10	40
5	PH5CRT05 – Electricity and Electrodynamics	3	3	54	3	15	60
	PH5CRT06 – Classical and Quantum Mechanics	3	3	54	3	15	60
	PH5CRT07 –Digital Electronics and Programming	3	3	54	3	15	60

	PH5CRT08 – Environmental Physics and Human Rights	4	4	72	3	15	60
	PH5OPT0X* -Open Course	4	3	72	3	20	80
	Core Practical III: PH6CRP03 Electricity, Magnetism and Laser	2	-	36	-	-	-
	Core Practical IV: PH6CRP04 Digital Electronics	2	-	36	-	-	-
	Core Practical V: PH6CRP05 Thermal Physics, Spectroscopy and C++ programming	2	-	36	-	-	-
	Core Practical VI: PH6CRP06 Acoustics, Photonics and Advanced Semiconductor Physics	2	-	36	-	-	-
6	PH6CRT09- Thermal and Statistical Physics	3	3	54	3	15	60
	PH6CRT10 --Relativity and Spectroscopy	4	3	72	3	15	60
	PH6CRT11 – Nuclear, Particle and Astrophysics	3	3	54	3	15	60
	PH6CRT12- Solid State Physics	4	3	72	3	15	60
	PH6CBT0X *-Choice BasedCourse	3	3	54	3	20	80
	Core Practical III: PH6CRP03 Electricity, Magnetism and Laser	2	2	36	3	10	40
	Core Practical IV: PH6CRP04 Digital Electronics	2	2	36	3	10	40
	Core Practical V: PH6CRP05 Thermal Physics, Spectroscopy and C++ programming	2	2	36	3	10	40
	Core Practical VI: PH6CRP06 Acoustics, Photonics and Advanced	2	2	36	3	10	40
	Semiconductor Physics						
	PH6PRO01 – Project and Industrial Visit	-	1	-	-	20	80

*- X Stands for 1, 2, 3, … depending upon Open course and Choice based course

Choice Based Course

Sl. No.	Paper Code	Semester	Paper Title
1	PH6CBT01	VI	IT
2	PH6CBT02	VI	Material Science
3	PH6CBT03	VI	Computational Physics
4	PH6CBT04	VI	Instrumentation
5	PH6CBT05	VI	Astronomy & Astrophysics

Open Course

Sl. No.	Paper Code	Semester	Paper Title
1	PH5OPT01	V	Our Universe
2	PH5OPT02	V	Physics in Daily Life
3	PH5OPT03	V	Computer Hardware and Networking

8. SYLLABUS CORE PHYSICS

B.Sc. Physics Programme (Model – I, II &III)

Semester-I

Core Course: I Credit – 2 (36 hours)

PH1CRT01: METHODOLOGY AND PERSPECTIVES OF PHYSICS

Module I

Concepts and Development Physics: (8hours)

Development of physics in the last century and the birth of new scientific concepts with reference to scientific contributions of Galileo, Newton, Einstein, J J Thomson, Curies,
Rayleigh, Max Plank, Heisenberg and Schrodinger (qualitative understanding).
Contributions of Indian physicists -C V Raman, H J Babha, J C Bose, S N Bose, M Saha, S Chandrasekhar, Vikram Sarabhai, (Topics in this part require qualitative study only) References:

1. Feynman lectures of Physics
2. Concepts of Modern Physics: ArtherBeisser,
3. Modern Physics: Kenneth Krane
4. Modern Physics: R Murugeshan
5. https://www.nobelprize.org/nobel_prizes/physics/laureates/

Module II (18 hours)

Number systems- Decimal, hexadecimal and Binary. Conversions, Binary arithmetic addition, subtraction and multiplication. 1's and 2's complement subtraction –signed binary numbers. Signed binary arithmetic, BCD code, ASCII code, Significance of binary number system in digital electronics, microprocessors and in computers,

Introductory Vector Analysis - Applications of vectors in Physics. Differential and integral vector calculus: – The operator □- physical significance of Gradient, Divergence and Curl, Line integral, surface integral and volume integral of vectors

Co-ordinate systems:Cartesian Co-ordinate system, plane polar and spherical polar coordinates, cylindricalcoordinates (Basic ideas with examples in physics), References:

6. Introduction to Electrodynamics, David J. Griffiths, Prentice Hall India Pvt. Ltd., Chapter 1
7. Mathematical Physics: Charlie Harper
8. University Physics, Roger A Freedman, Hugh D Young 14th edition
9. Digital electronics: Albert Paul Malvino
10. Digital logic and computer design – M. Morris Mano, PHI.

Module III

Experimental methods and error analysis (10 hrs)

Experimental methods, least count of instruments, Instruments for measuring mass, length, time, angle , current, voltage. Fundamental units. Precision and accuracy of measurements, source of error in measurements, necessity of estimating errors , types of errors, reading error of instrument, calibration error, random error, systematic error, significant digits, order of magnitude and rounding of numbers, rounding error, absolute and relative errors, Errors of computation-addition, subtraction, multiplication, division, error in power and roots, Propagation of errors, analysis of data, standard deviation, calculation of mean value.

References:

1. Text book: Advanced course in Practical Physics by D Chattopadhyay- Chapter-1
2. Practical Physics, G L Squires, Third edn. Cambridge University Press.
3. The theory of Errors in Physical Measurements- J C Pal- New Central Book Agency- 2010

Semester-II

Core Course: II Credit – 2 (36 hours)

PH2CRT02: MECHANICS AND PROPERTIES OF MATTER

Module I

Wave motion (4 hours)

General equation of wave motion, plane progressive harmonic wave, energy density, intensity of a wave, superposition of waves, beats, transverse waves in stretched strings, modes.

Text Book: Mechanics by D.S. Mathur – Chapter 9.

Oscillations (8 hours)

Periodic motion, simple harmonic motion and harmonic oscillator, energy of a harmonic oscillator, examples of harmonic oscillator – simple and compound pendulum. Theory of Damped harmonic oscillator. Theory of forced oscillator, resonance, applications.

Text Book: Mechanics by D.S. Mathur – Chapter 7, 8.

Module -II

Rotational mechanics (7 Hours)

Angular velocity- angular acceleration- angular momentum- conservation- torque-moment of inertia- Parallel and perpendicular axes theorems - calculation of moment of inertia- (rod, ring, disc, cylinder, and sphere). Theory of flywheel.

Text Book: Mechanics by D.S. Mathur – Chapter 10.

Module III

Elasticity (10 hours)

Basic ideas on elasticity – Young’s modulus, bulk modulus, rigidity modulus, Poisson’s ratio, relations connecting various elastic constants. Work done per unit volume in a strain. Bending of beams, bending moment, flexural rigidity. Young's modulus – uniform and non-uniform bending, cantilever. I –section girders. Determination of rigidity modulus using Static and Dynamic methods.

Text Book: Mechanics by D.S. Mathur – Chapter 12, 13.

Hydrodynamics (7 hours)

Streamline and turbulent flows, coefficient of Viscosity – Determination of viscosity by Poiseuille's method. Equation of continuity, energy possessed by a liquid, Bernoulli's theorem.

Surface tension, surface energy, excess pressure in a liquid drop and bubble, factors affecting surface tension, applications.

Text Book: Mechanics by D.S. Mathur – Chapter 14.

Text books:

1. Mechanics by J.C. Upadhayaya, Ramprasad Pub.
2. Mechanics -D.S.Mathur, S.Chand.
3. Advanced course in Practical Physics by D Chattopadhyay, Central Book
4. Properties of Matter and Acoustics by Murugeshan and K. Sivaprasath, S. Chand

References:

1. Mechanics- Hans and Puri, TMH
2. Classical Mechanics by J.C. Upadhyaya, Himalaya Pub.
3. Classical Mechanics-Takwale and Puranik, TMH.
4. Classical mechanics- K.SankaraRao, PHI.
5. Properties of Matter by Mathur, S. Chand,
6. Mechanics by Somnath Datta, Pearson
7. Mechanics by H.D Young and R.A Freedman, Pearson.

Semester-III

Core Course: III Credit – 3 (54 hours)

PH3CRT03: OPTICS, LASER AND FIBER OPTICS

Module I

Interference (13 hours)

Review of basic ideas of interference, Coherent waves-Optical path and phase changesuperposition of waves-theory of interference-intensity distribution. Young's double slit experiment, Coherence-Conditions for interference.

Thin films-plane parallel film- interference due to reflected light-conditions for brightness and darkness-interference due to transmitted light-Haidinger fringes-interference in wedge shaped film-colours in thin films-Newton's rings-applications. Michelson interferometer-construction, working and just mention the applications.

Text book: Optics by N.Subramanayam, Brijlal, M.N.Avadhanulu-Chapter 14 and 15.

Module II

Diffraction (10 hours)

Fresnel Diffraction – Huygens- Fresnel theory –zone plate –Difference between zone plate and convex lens. Comparison between interference and diffraction –diffraction pattern due to a straight edge, single silt. Fraunhoffer diffraction at a single slit, double slit,N slits, theory of plane transmission grating. Dispersive power and resolving power of grating.

Text book: Optics by N.Subramanayam, Brijlal, M.N.Avadhanulu-Chapter 17, 18 and 19.

Polarization (12hours)

Concept of polarization – plane of polarization- Types of polarized light-production of plane polarized light by reflection-refraction. Malu's law-Polarization by double refraction- calcite crystal. Anisotropic crystals-optic axis-Double refraction-Huygens explanation of double refraction. Retarders - Quarter wave plate and Half wave plate. Production and Detection of plane, elliptically and circularly polarized light-Optical Activity- specific rotation.

Text book: Optics by N.Subramanayam, Brijlal, M.N.Avadhanulu-Chapter 20.

Module III

Laser (10 hours)

Absorption and emission of light-Absorption-spontaneous emission and stimulatedemission, Einstein relations, Population inversion- Active medium-Pumping, different pumping methods, Resonators – plane mirror and confocal resonators – Metastable state, Three level and Four level Laser systems. Ruby Laser, He-Ne laser, Semiconductor Laser, Laser beam Characteristics, coherence. Applications of Laser, Holography (qualitative study only).

Text book: Optics by N.Subramanayam, Brijlal, M.N.Avadhanulu-Chapter 22 and 23.

Fiber Optics (9 hours)

Propagation of light in a fiber -acceptance angle, numerical aperture, V-number, single mode and multimode step index fiber –graded index fiber- attenuation- application of fiber-optical fiber communication – advantages.

Text book: Semiconductor physics and optoelectronics- V.Rajendran, J.Hemaletha and M.S.M.Gibson, Unit IV-Chapter 1.

References

1. Optics, E Hecht and AR Ganesan, Pearson
2. Optics, 3rd edition, AjoyGhatak, TMH
3. Optical Electronics, AjoyGhatak and K Thyagarajan, Cambridge
4. Optics and Atomic Physics, D P Khandelwal, Himalaya Pub. House
5. Optics, S K Srivastava, CBS Pub. N Delhi
6. A Text book of Optics, S L Kakani, K L Bhandari, S Chand.
7. Optics N.Subramanayam, Brijlal, M.N Avadhanulu S Chand.
8. Semiconductor optoelectronic devices: Pallab Bhattacharya, PHI 2009.
9. Lasers and Non linear Optics, BB Laud, New Age Int Pub. 2013
10. Laser Fundamentals, William T Silfvast, Cambridge Univ Press. 2012.
11. Optoelectronics an Introduction, J Wilson & JFB Hawkes, PHI 1999.
12. Fiber Optics and Optoelectronics, R P Khare, Oxford 2012..
13. Introduction to Optics, Frank L Pedrotti, Leno M Pedrotti& Leno S Pefrotti, Pearson 2014.
14. Optical fiber and fiber optic communication system (4th edition) Subir Kumar Sarkar, S Chand.

Semester-IV

Core Course: IV

PH4CRT04: SEMICONDUCTOR PHYSICS

Module I

Semiconducting diodes and applications (14 hours)

PN Junction, Depletion layer, Barrier potential, Biasing- forward and reverse, Reverse breakdown, Junction capacitance and diffusion capacitance- PN Junction diode – V-I characteristics–Diode parameters, Diode current Equation, Diode testing, Ideal diode. Zener diode and its reverse characteristics. Thermistors.

Rectification - Half wave, Full wave, Centre tapped, Bridge rectifier circuits - Nature of rectified output, Efficiency & Ripple factor-Filter circuits – Inductor Filter, Capacitor Filter, LC Filter, π Filter-Regulated Power supplies - Zener diode voltage regulatorVoltage multipliers – Doubler & Tripler- Wave shaping circuits - Clipper-Positive, negative and biased – Clampers- Positive, negative and biased.

Text Book: Basic Electronics- B.L.Theraja Chapters 13,14,15,17

A Text Book of Applied Electronics- R.S.Sedha Chapters-11, 12, 19, 20, 33

Module II

Transistors Configurations and Feed back (12 hours)

Bipolar junction transistors, Transistor biasing, CB, CC, CE configurations and their characteristics-Active, saturation and cut-off regions. Current gain α, β, γ and their relationships. Leakage currents-Thermal runaway. DC operating point and AC and DC Load line, Q-Point.

Basic principles of feedback, positive & negative feedback, Advantages of negative feedback, negative feedback circuits – voltage series & shunt, current series & shunt.

Amplifiers and Oscillators (12 hours)

Need for biasing-Stabilization- Voltage divider bias. Single stage transistor Amplifiers-CE amplifier - amplification factors. Decibel system, Variations in Amplifier gain with frequency.

Oscillatory Circuits, LC oscillators – Hartley Oscillator, Colpit's Oscillator, RC oscillators - Phase shift Oscillator. Astable and monostable multivibrator (basic idea only)

Text Book: Basic Electronics-B.L.Theraja-Chapters 18, 19, 20, 22, 24, 25, 28, 29.

A Text Book of Applied Electronics-R.S.Sedha Chapters 14, 15, 22,24, 29, 31, 32

Module III

FET, Operational Amplifier & Modulation (16 hours)

FET -characteristics, FET- Parameters. Comparison between FET and BJT. MOSFET (basic idea only)

OP-amp- Symbol and terminals. Characteristics of ideal OP-amp, CMRR, Applications - inverting, Non-inverting, Unity follower and Summing amplifiers.

Types of modulation – AM, FM, Pulse modulation and Phase modulation (qualitative study only). Amplitude modulation- modulation index - Analysis of AM wave – Sidebands –bandwidth- AM Demodulation.

Text Book: Basic Electronics-B. L. Theraja - Chapters 26, 30, 31

A Text Book of Applied Electronics-R.S.Sedha-Chapter-16, 35

References:

1. Principles of electronics, VK Mehta, S Chand
2. Basic Electronics(7^{th}Edition), Malvino and Bates, TMH
3. Electronics Fundamentals and Applications- D. Chattopadhyay and P.G.Rakshit, New Age International Publishers.
4. Electronics: Fundamentals of Analog circuits, Thomas L. Floyd, David Buchla, Prentice Hall
5. Electronic Devices and Circuit Theory, Robert Boylestad, Louis Nashelsky, Prentice Hall
6. Basic Electronics, Debashis De , Pearson 2010
7. Basic Electronics, Santiram Kal, PHI 2010

Semester-V

Core Course: V

PH5CRT05: ELECTRICITY AND ELECTRODYNAMICS

Module I

Alternating Current and Network Theorems (15 hours)

EMF induced in a coil rotating in a magnetic field - AC applied to resistive, inductive and capacitance circuits - AC applied to LR and RC circuits - Analysis of LCR series circuits - LCR parallel resonant circuit – comparison - Power in ac circuits - Wattless current - choke coil - transformer on no load- skin effect.

Ideal voltage source and current source - Superposition theorem - Reciprocity theorem - Thevenin's theorem - Norton's theorem - Maximum power transfer theorem.

Text Book:Electricity and Magnetism, R. Murugeshan- Chapters 13, 30 and 18

Module II

Transient Current and Thermo electricity (8 hours)

Growth and decay of current in an LR circuit- Charging and discharging of a capacitor through a resistor - Growth and decay of charge in an LCR circuit.

Seebeck effect - Laws of thermo emf - Peltier effect- Thomson effect- Thermoelectric diagrams - Thermocouple (qualitative study) - Explanation of thermoelectric effects based on electron theory.

Text Book: Electricity and Magnetism, R. Murugeshan- Chapters 12, 8 and 32.

Module III

Electrostatics and Magnetostatics (20 hours)

Fundamental theorems of divergence and curl (physical concepts) - Electric field - Continuous charge distribution- Divergence and curl of electrostatic field- Gauss's law and applications: solid sphere, infinite wire, infinite plane sheet - Electric potential - Poisson's and Laplace's equations - Potential of a localized charge distribution – Electrostatic boundary conditions- work and energy in electrostatics – The work done to move a charge – Energy of a point charge distribution and continuous charge distribution- Basic properties a conductor .

Lorentz Force law- Biot- Savart law- Divergence and curl of B- Applications of Amperes' law: long straight wire, infinite plane, solenoid – Comparison of electrostatics and magnetostatics- Magnetic vector potential – Magnetostatics boundary conditions

Electromagnetic induction- Faraday's law

Text Book:Introduction to Electrodynamics, David J Griffiths, Chapters 1, 2, 5 and 7

Module IV

Maxwell's Equations and Electromagnetic wave propagation (11 hours)

Maxwell's equations - Boundary conditions for free space - Continuity equations- Poynting's theorem

Wave equations (general idea on reflection at boundary and polarization) - Electromagnetic wave in vacuum - Wave equation for E and B - Monochromatic plane waves- Energy of electromagnetic waves

Text Book: Introduction to Electrodynamics, David J Griffiths-Chapters 7,8 and 9

References:

1. Fundamentals of Magnetism and Electricity, D.N Vasudeva - S Chand
2. Principles of Electromagnetics, Mathew N.O Sadiku- 4th Ed. , Oxford
3. Electricity and Magnetism, KK Tewari- S Chand
4. Electricity and Electronics, Saxena, Arora and Prakash- Pragati Prakashan
5. Classical Electromagnetism, Jerrold Franklin- Pearson
6. Electromagnetic Fields and Waves, KD Prasad- Satya Prakashan
7. Field and wave Electromagnetics, David K Cheng- Pearson.

Core Course: VI

PH5CRT06: CLASSICAL AND QUANTUM MECHANICS

Module I

Lagrangian and Hamiltonian Formulations of Classical Mechanics (15 hours)

Constraints, degrees of freedom, generalized co-ordinates, principle of virtual work, D'Alembert's principle, Lagrange's equations(no derivation required), Application of
Lagrangian (Linear Harmonic oscillator, Planetary motion and Simple Pendulum only),
Hamilton's Canonical equations of motion, Advantages of Hamilton's method, Applications of Hamilton's method (Linear Harmonic oscillator and Simple pendulum only).Hamilton's Principle of Least Action. Derivation of Lagrange's equation from Hamilton's Principle.

Text book: Classical Mechanics by J.C. Upadhyaya-Chapter 2 & 3.

Classical Mechanics by G. Aruldhas

Module II

Historical development and origin of quantum theory (9 hours)

Failure of classical physics- Black Body radiation-Planck's radiation law, Photoelectric effect-Einstein's explanation, Compton effect, Bohr's correspondence principle-Wave particle Dualism, Dual nature of matter- De Broglie hypothesis, Davisson-Germer Experiment, De Broglie waves, Wave packet, Group and phase velocities

Text Book: A Textbook of Quantum Mechanics- G Aruldhas-Chapter 1

General Formalism of Quantum Mechanics (15 hours)

Linear vector space- Hilbert space- Orthogonality- Linear operator-Eigen functions and eigen values-Hermitian operator- Postulates of Quantum Mechanics- wave function, Operators, Expectation value, Eigen value, Time development- Simultaneous measurability- General uncertainty relation.

Text Book: A Textbook of Quantum Mechanics- G Aruldhas-Chapter 3 and 8

Module III

Schrödinger equation and its applications (15 hours)

Time dependent Schrödinger equation- interpretation of wave function, Probability density, Probability current density, Ehrenfest theorem- Extension to three dimensions- Time independent Schrödinger equation- Stationary states- Admissibility conditions of wave function-general properties of one dimensional Schrödinger equation, particle in a box, one dimensional barrier problem- square potential barrier.

Text Book: A Textbook of Quantum Mechanics- G Aruldhas.

Text Book:

1. Classical Mechanics by J.C. Upadhyaya. Himalaya Pub.
2. Concepts of Modern Physics- Arthur Beiser, TMH

References:

1. Concepts of Modern Physics- Arthur Beiser, TMH
2. A Textbook of Quantum Mechanics- G Aruldhas- (2^{nd} Edition)- PHI
3. Classical Mechanics-Takwale and Puranik, TMH.
4. Classical mechanics- K.SankaraRao, PHI.
5. Introductory Quantum Mechanics- RI Liboff, Pearson
6. Quantum Physics- Gasiorowicz,John Wiely
7. Quantum Mechanics- Griffith, Pearson

Core Course: VII Credit-3 (54 hours)

PH5CRT07: DIGITAL ELECTRONICS AND PROGRAMMING

Module I

Boolean algebra and logic gates (9 hours)

Basic gates NOT, OR, AND. Universal Logic Gates- NOR, NAND. XOR and XNOR Gates. Rules and Laws of Boolean algebra. Duality theorem -De Morgan's Theorems. analysis and simplification of logic circuits. Boolean equation and truth table - SOP and POS. Minterms and Maxterms. Standard SOP and Standard POS- Conversion between Standard SOP & Standard POS. Karnaugh Map (up to four variables). K map SOP minimization.

Module II

Combinational logic (6 hours)

Half Adder and Full Adder, Half and Full subtractor, 4-bit parallel Adder/Subtractor. Multiplexer, De-multiplexer, Encoder & Decoder.

Sequential logic (13 hours)

Flip-flops, RS, Clocked RS, Master Slave JK FF, DFF, T Flip-flop, Buffer registers- Shift register- SISO and SIPO, Counters- Binary ripple counter. D/A converters (Ladder type), A/D Converter (Counter type).

Module III

Programming in C++ (26 hours)

Basic C++ program structure –comments-data types-variable types-constants-operators(arithmetic, relational, logical and assignment operators)- if, if-else and else if, do while - case – loops(while, do-while, and for)-nested loops- arrays(Defining Arrays, Accessing Array Elements, Initializing Arrays)- basic ideas of functions(qualitative idea), object and classes. Programs using loops.

Text book: Object oriented programming in Turbo C++ - Robert Lafore (Galgotia Pub.) Chapter 2, 3 and 7.

Text books:

1. Digital fundamentals, Thomas L. Floyed (10^{th} edition), Pearson
2. Digital principles and applications, Malvino, Leach and Saha (6th Edition) TMH
3. Digital electronics, S Salivahanan & S Arivazhagan VPH (2010)
4. Digital design, M Morris Mano, PHI

References:

1. Digital logic and computer design - M Morris Mano, PHI
2. Digital Electronics- William H Gothmann, PHI
3. Digital circuits and design- S Salivahanan and S Arivazhakan, PHI
4. Digital Electronics- Sedha, S Chand

5. Digital computer electronics- Malvino, Brown, TMH
6. Object oriented programming in Turbo C++ - Robert Lafore (Galgotia Pub.)

Core Course: VIII Credit-4 (72 hours)

Semester-V

Core Course: VIII Credit-4 (72 hours)

PH5CRT08: ENVIRONMENTAL PHYSICS AND HUMAN RIGHTS

Vision

The importance of environmental science and environmental studies cannot be disputed. The need for sustainable development is a key to the future of mankind. Continuing problems of pollution, solid waste disposal, degradation of environment, issues like economic productivity and national security, Global warming, the depletion of ozone layer and loss of biodiversity have made everyone aware of environmental issues. The United Nations Conference on Environment and Development held in Rio de Janerio in 1992 and World Summit on Sustainable Development at Johannesburg in 2002 have drawn the attention of people around the globe to the deteriorating condition of our environment. It is clear that no citizen of the earth can afford to be ignorant of environment issues.

India is rich in biodiversity which provides various resources for people. Only about 1.7 million living organisms have been described and named globally. Still many more remain to be identified and described. Attempts are made to conserve them in ex-situ and in-situ situations. Intellectual property rights (IPRs) have become important in a biodiversity-rich country like India to protect microbes, plants and animals that have useful genetic properties. Destruction of habitats, over-use of energy resource and environmental pollution has been found to be responsible for the loss of a large number of life-forms. It is feared that a large proportion of life on earth may get wiped out in the near future.

In spite of the deteriorating status of the environment, study of environment has so far not received adequate attention in our academic programme. Recognizing this, the Hon'ble Supreme Court directed the UGC to introduce a basic course on environment at every level in college education. Accordingly, the matter was considered by UGC and it was decided that a six months compulsory core module course in environmental studies may be prepared and compulsorily implemented in all the University/Colleges of India.

The syllabus of environmental studies includes five modules including human rights. The first two modules are purely environmental studies according to the UGC directions. The second two modules are strictly related with the core subject and fifth module is for human rights.

Objectives

- • Environmental Education encourages students to research, investigate how and why things happen, and make their own decisions about complex environmental issues by developing and enhancing critical and creative thinking skills. It helps to foster a new generation of informed consumers, workers, as well as policy or decision makers.
- • Environmental Education helps students to understand how their decisions and actions affect the environment, builds knowledge and skills necessary to address complex environmental issues, as well as

ways we can take action to keep our environment healthy and sustainable for the future. It encourages character building, and develops positive attitudes and values.

• • To develop the sense of awareness among the students about the environment and its various problems and to help the students in realizing the inter-relationship between man and environment and helps to protect the nature and natural resources.

• To help the students in acquiring the basic knowledge about environment and the social norms that provides unity with environmental characteristics and create positive attitude about the environment.

Module I (15 Hours)

Water Resources and Its Management (3 Hours)

Water resources: Use and over-utilization of surface and ground water, floods, drought, dams-benefits and problems. Water harvesting-Importance of rain water harvesting in Kerala.

Remote sensing (3 Hours)

Remote sensing-principles, spectral reflectance of earth's surface features, Remote sensing satellites and sensors, aerial photography, Applications of Remote Sensing in environmental monitoring and assessment.

Environmental Pollution (9 Hours)

Environment and human health; Environmental pollution- Primary and secondary pollutants; Air pollution- Sources, Effects and Control/Treatment methods; Acid Rain; Ozone layer depletion; Green house gases; Global warming - Climatic effects; Water pollution- Sources, Effects and Control/Treatment methods; Groundwater pollution; Marine pollution; Soil pollution; Noise pollution- Sources and measurement indices of noise pollution, Noise exposure level and standards, Noise control measures, Impact of noise on human health, ; Environmental pollution due to environmental disasters; Consumerism and waste products; E-waste-an emerging environmental threat. Disaster management: floods, earthquake, cyclone and landslides.

Module II (12 Hours)

Waste Management (8Hours)

Waste minimization and resource conservation:- Source reduction, Recycling, Value-added products; Waste minimization promotional methods- awareness generation, control methods and economic benefits; Benefits of waste minimization; Management of solid wastes- Municipal solid wastes, Hazardous solid waste-characteristics and management of HSW, Waste treatment and disposal methods- physical, biological and chemical process.

Environment Impact Assessment and Control (4 Hours)

Basic ideas of environment impact assessment; Environment ethics; Environmental laws and constitutional provisions to control pollutions in India-The general acts; Air (prevention and control of pollution) act; Water (prevention and control of pollution) act; Wild life protection act; Forest conservation act; Environment protection acts.

Module III (13 Hours)

Non-renewable and Renewable Energy Sources (13 Hours)

Non-renewable energy sources:-Coal, Oil, Natural gas; Nuclear fission energy; Merits and demerits of non-renewable energy.

Renewable energy sources: Biomass energy- Biofuels, Biogas plant - Fixed dome type and moving drum type; Wind energy; Wave energy; Tidal energy; Hydroelectricity; Geothermal

energy conversion; Ocean thermal energy conversion; Fusion energy; Hydrogen energy- Production and storage; Merits and demerits of each renewable energy sources; Storage of intermittently generated renewable energy.

Module IV (14 Hours)

Solar energy (14 Hours)

Sun as a source of energy- Solar radiation, Solar Constant, Spectral distribution; Solar pond - Convective and salt gradient types; Flat plate collector; Solar water heater - Direct and indirect systems- Passive and active systems; Optical concentrator - Parabolic trough reflector - Mirror strip reflector - Fresnel lens collector; Solar desalination; Solar dryer - Direct and indirect type; Solar cooker; Solar heating of buildings; Solar green houses; Need and characteristics of photovoltaic (PV) systems; Solar cells - Principle, Equivalent circuits, V-I characteristics, fill factor, conversion efficiency; PV Sun tracking systems; Merits and demerits of solar energy.

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Module - V (18 Hours)

Unit 1 - Human Rights

An Introduction to Human Rights, Meaning, concept and development –History of Human Rights- Different Generations of Human Rights- Universality of Human Rights- Basic International Human Rights Documents - UDHR ,ICCPR,ICESCR.-Value dimensions of Human Rights

Unit 2 - Human Rights and United Nations

Human Rights co-ordination within UN system- Role of UN secretariat- The Economic and Social Council- The Commission Human Rights-The Security Council and Human rights- The Committee on the Elimination of Racial Discrimination- The Committee on the Elimination of Discrimination Against Women- the Committee on Economic, Social and Cultural Rights- The Human Rights Committee- Critical Appraisal of UN Human Rights Regime.

Unit 3- Human Rights National Perspective

Human Rights in Indian Constitution – Fundamental Rights- The Constitutional Context of Human Rights- directive Principles of State Policy and Human Rights- Human Rights of Women-children –minorities- Prisoners- Science Technology and Human Rights- National Human Rights Commission- State Human Rights Commission- Human Rights Awareness in Education.

Reference Books:

1. Non-conventional energy sources - G.D Rai- Khanna Publishers, New Delhi
2. A textbook of Environmental Studies- E Bharucha - University Grants Commission, 2004
3. Environmental Science: Principles and Practice- R.C. Das and D.K. Behera - PHI Learning Pvt. Ltd
4. Renewable Energy Sources and Emerging Technologies: Edition 2, D.P. Kothari K. C. Singal, Rakesh Ranjan - PHI Learning Pvt. Ltd, 2011.

5. Solar energy - M P Agarwal - S Chand and Co. Ltd.
6. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.
7. Renewable Energy, Power for a sustainable future, Edited by Godfrey Boyle, Oxford University Press, 2012.
8. Solar Energy: Resource Assesment Handbook- Dr. P Jayakumar APCTT 2009
9. A textbook of Environmental Studies- S.Satyanarayan, S.Zade, S.Sitre and P.Meshram - Allied Publishers, New Delhi, 2009
10. Remote Sensing: Principles and Interpretation, Floyd F. Sabins, Waveland Pr Inc; 3 edition (2007) 1. Amartya Sen, The Idea Justice, New Delhi: Penguin Books, 2009.

2. Chatrath, K. J.S., (ed.), Education for Human Rights and Democracy (Shimla: Indian Institute of Advanced Studies, 1998)

3. Law Relating to Human Rights, Asia Law House, 2001.

4. Shireesh Pal Singh, Human Rights Education in 21st Century, Discovery Publishing House Pvt.Ltd, New Delhi,

5. S.K.Khanna, Children and the Human Rights, Common Wealth Publishers, 1998. 2011.

6. Sudhir Kapoor, Human Rights in 21st Century, Mangal Deep Publications, Jaipur, 2001.

7. United Nations Development Programme, Human Development Report 2004: Cultural Liberty in Today's Diverse World, New Delhi: Oxford University Press, 2004

Human Rights

1. Amartya Sen, The Idea Justice, New Delhi: Penguin Books, 2009.

2. Chatrath, K. J.S., (ed.), Education for Human Rights and Democracy (Shimla: Indian Institute of Advanced Studies, 1998)

3. Law Relating to Human Rights, Asia Law House, 2001.

4. Shireesh Pal Singh, Human Rights Education in 21st Century, Discovery Publishing House Pvt.Ltd, New Delhi,

5. S.K.Khanna, Children and the Human Rights, Common Wealth Publishers, 1998. 2011.

6. Sudhir Kapoor, Human Rights in 21st Century, Mangal Deep Publications, Jaipur, 2001.

7. United Nations Development Programme, Human Development Report 2004: Cultural Liberty in Today's Diverse World, New Delhi: Oxford University Press, 2004.

Open Course: Credits-3 (72 Hrs)

PH5OPT02: Physics in Daily Life

Module I

Unit 1 (8 hours)

Fundamental and derived quantities. Units and dimensions,dimensional analysis, order of magnitude, significant figures, errors.

Unit 2 Light (12 Hours)

Reflection, refraction, diffraction,interference, scattering(elementary ideas only) – examples from daily life – apparent depth, blue color of sky, twinkling of stars.

Total internal reflection, mirage, sparkling of diamond, primary and secondary rainbow – optical fibers. Concave and convex mirrors, lenses – focal length, power of a lens, refractive index, prism, dispersion. Human eye, defects of the eye – myopia, hypermetropia, presbyopia and astigmatism and their correction by lens.

Module II

Unit 3 Motion (12 Hours)

Velocity, acceleration, momentum, Idea of inertia, force - laws of motion. Newton's law of gravitation, acceleration due to gravity, mass and weight, apparent weight, weightlessness.

Rotational motion, Moment of inertia, torque, centripetal and centrifugal acceleration- examples- banking of curves, centrifugal pump, roller coasters.

Unit 4 Electricity 10 Hours)

Voltage and current, ohms law. Electric energy, electric power, calculation of energy requirement of electric appliances – transformer, generator, hydroelectric power generation – wind power – solar power – nuclear power

Module III

Unit 5 Matter and energy (18 Hours)

Different phases of matter, fluids - surface tension, viscosity- capillary rise, Bernoulli's theorem and applications.

Heat energy, temperature, different temperature scales – degree Celsius, Fahrenheit and Kelvin.

Waves – transverse and longitudinal waves, sound waves, Doppler Effect.

Lasers, fluorescence, phosphorescence, electromagnetic waves – applications – microwave oven, radar, super conductivity.

Unit 6 Universe (12 hours)

Planets, – solar system, moon- faces of moon, lunar and solar eclipses, constellations, Different types of stars, Galaxies, black hole. Satellites, Artificial satellites, Global positioning system. Geo stationary satellite.

Reference Texts

1. Fundamentals of Physics with Applications by Arthur Beiser
2. Conceptual Physics by Paul G Hewitt

Semester-VI

Semester-VI

Core Course: IX Credit-3 (54 hours)

PH6CRT09: THERMAL AND STATISTICAL PHYSICS

Module I

Equation of state for gases (5 hours)

Equation of an ideal gas, behavior of real gases, Andrew's experiment on carbon dioxide, critical state, two phase region, intermolecular forces, van der Waals equation of state, van der Waals isotherms, critical constants, limitation of van der Waals equation.

Zeroth law of thermodynamics (4 hours)

Thermodynamic system, surroundings, variables, thermal equilibrium: zeroth law, thermodynamic equilibrium, thermodynamic processes, reversible and irreversible processes, equation of state, expansivity and compressibility.

First laws of thermodynamics (7 hours)

Internal energy, heat, work, cyclic processes, first law, heat capacity, energy equation and difference of specific heat capacities, indicator diagram work done in reversible isothermal expansion of ideal gas, work done in reversible adiabatic expansion of ideal gas.

Heat engines and second law of thermodynamics (5 hours)

Second law statements, heat engine, efficiency, Carnot's ideal heat engine, work done by the engine per cycle, reversibility, Carnot refrigerator, heat pump, Carnot theorem, absolute scale of temperature, Clausius- Clapeyron latent heat equation.

Text Book: Thermal and Statistical Physics, R.B. Singh, part-1 chapter 3, 4, 5 and6

Module II

Entropy (5 hours)

Definition of entropy, principle of increase of entropy, entropy and unavailable energy, change in entropy in heat conduction, change in entropy in reversible and irreversible process, efficiency of Carnot cycle from TS diagram, entropy of an ideal gas, entropy and disorder.

Thermodynamic relations (8hours)

Maxwell's thermodynamic relations, TdS equations, energy equation, heat capacity equations, thermodynamic functions, third law of thermodynamics.

Conduction and radiation (4 hours)

Conduction, thermal conductivity, thermal conductivity of bad conductor Lee's disc experiment - thermal resistance, thermal radiation and its properties, fundamental definitions of energy flux, intensity and radiant emittance, Stefan's law, Stefan-Boltzmann law.

Text Book: Thermal and Statistical Physics, R.B. Singh, part-1 chapter7,8,10 and 11.

Module III

Statistical mechanics (8 hours)

Microstates and macrostates, Phase space, density of states, mu space and Gamma space, principle of equal a priori probability, ergodic hypothesis, statistical equilibrium, ensemble,ensemble formulation of statistical mechanics, microcanonical, canonical and grand canonical ensemble, partition function, average energy of particle, equipartition theorem.

Statistical distributions (8 hours)

Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics, distribution laws, MaxwellBoltzmann, Fermi-Dirac and Bose-Einstein distribution.

Text Book: Thermal and Statistical Physics, R.B. Singh, part-2, Chapters 2, 3,4 and 5.

Text Book:

1. Thermal and Statistical Physics, R.B. Singh, New Age Pub. (2010)

References:

1. An introduction to thermodynamics by Y.V.C. Rao (New Age Pub.)
2. An introduction to Thermal Physics by D.V. Schroeder (Pearson Pub.)
3. Heat and thermodynamics by Mark W Zemansky, Richard H Dittman & Amit K Chattopadhyay. MCH New Delhi.
4. Thermodynamics and Statistical physics Brij Lal, N.Subrahmanyam and P S Hemne (S. Chand &Co, Multi colour edition 2007).
5. Berkeley Physics Course Volume 5; Statistical Physics; Frederick Reif. McGraw Hill.
6. Statistical Mechanics, R.K. Pathria, Pergamon press, Oxford

Semester-VI

Core Course: X Credit-3 (72 hours)

PH6CRT10: RELATIVITY AND SPECTROSCOPY

Module I

Special Theory of Relativity (18 hours)

Inertial and non inertial frames of reference- Galilean transformation, Significance of Michelson-Morley experiment, Postulates of Special Theory of Relativity, Lorentz transformation, Spatial contraction, Time dilation, composition of velocities, mass of moving particle, Equivalence of mass and energy. Introductory concept of general theory of relativity.

Text Book: Modern Physics, Kenneth S Krane.

Concepts of modern Physics, Arthur Beiser

Module II

Atomic Spectroscopy (21 hours)

Historical introduction. Electrostatic spectrum. Types of spectra. Absorption and emission of light by atoms, quantum theory, early atom models – Bohr model, electron spin and magnetic moment, Exclusion principle, Stern-Gerlach experiment, Vector atom model, quantum numbers associated with vector atom models, Total angular momentum and LS coupling, fine structure of Sodium D lines, Zeeman effect, quantum mechanical explanation for anomalous Zeeman effect, Paschen-Back effect.

Text Book: Molecular structure and Spectroscopy, G Aruldas.

Concepts of modern Physics, Arthur Beiser

Module III

Molecular Spectroscopy (21 hours)

Molecular energy levels. Electronic, rotational and vibrational energies, rotational spectra, explanation in terms of rigid rotator model, vibrational energy levels, explanation in terms of harmonic oscillator.

Electronic energy levels of atoms, Fluorescence and phosphorescence, Raman effect – experimental arrangement and result, classical theory and its failure, quantum theory of Raman effect.

IR and Microwave spectroscopes.

Text Book: Fundamentals olf Molecular Spectroscopy, C.Banwell and E. Mccash.

Semester-VI

Molecular structure and Spectroscopy, G Aruldas.

NMR and ESR Spectroscopy (12 hours)

NMR Spectroscopy- Basic principles and instrumentation- Medical applications of NMR.

Text Book: Molecular structure and Spectroscopy, G Aruldas – Chapter 10 (Sections 10.1, 10.2,10.3 and 10.19).

ESR Spectroscopy- Basic principles and instrumentation.

Text Book: Molecular structure and Spectroscopy, G Aruldas – Chapter 11 (Sections 11.1, 11.2 and 11.3).

Text Books:

1. Molecular structure and spectroscopy, Aruldas 2nd ed. EEE.
2. Modern Physics, Kenneth S Krane (2nd Edition) -Wiley.
3. Concepts of modern Physics, Arthur Beiser (6th Edition) - SIE.

References:

1. Spectroscopy: Straughan and Walker –(Vol.1) John Wiley
2. Fundamentals of Molecular Spectroscopy: CN Banwell –(4th edition) TMH .
3. Introduction to Atomic Spectra, HE White, TMH
4. Elements of spectroscopy, Guptha, Kumar and Sharma (Pragathi Prakash)
5. Special Relativity- Resnick, (Wiley)
6. Mechanics – D.S.Mathur (S.Chand).
7. Mechanics by J.C. Upadhayaya (Ramprasad)
8. Semiconductor physics and optoelectronics- V Rajendran, J Hemaletha and M S M Gibson.

Core Course: XI Credit - 3 (54 hours)

PH6CRT11: NUCLEAR, PARTICLE PHYSICS AND ASTROPHYSICS

Module I

Nuclear structure (10 hours)

Nuclear composition – Discovery of neutron – Nuclear electrons - Nuclear properties: Nuclear radii – Spin and magnetic moment - Stable nuclei - Binding energy- Binding energy curve, Liquid drop model - Semi empirical binding energy formula with correction factors - Shell model - Nuclear forces- Meson theory of nuclear forces – Discovery of pion – Virtual Photons

Nuclear Radiation Detectors, Counters and Particle Accelerators (8 Hours)

Interactions between energetic particles and matter (basic concepts only) - Ionization chamber - Solid state detectors - Proportional counter - Geiger-Muller counter - The Wilson cloud chamber - Bubble chamber - Scintillation counters - Van de Graaff generator - Linear accelerator - Cyclotron - Betatron

Module II

Nuclear Transformations (15 hours)

Radioactive decay – Radiation hazards – Half life – Radiometric dating – Radioactive series - Alpha decay, tunnel theory of alpha decay, derivation for alpha decay constant - Beta decay, positron emission, electron capture, inverse beta decay – Gamma decay - The concept of interaction cross section, reaction rate – Nuclear reactions, Resonance, Center of mass coordinate system, Q value of nuclear reaction – Nuclear fission – Nuclear reactors – Breeder reactors - Nuclear fusion in stars – Formation of heavier elements – Fusion reactors – Confinement methods

Cosmic rays (4 hours)

Latitude effect – Azimuth effect – Altitude effect - Primary cosmic rays – Secondary cosmic rays – Cosmic ray showers – Discovery of Positron – Mesons Van Allen belts –
Origin of cosmic rays

Module III

Particle Physics (10 hours)

Interactions and Particles – Leptons – Neutrinos and Antineutrinos, other leptons – Hadrons – Resonance particles – Elementary particle quantum numbers – Basic concepts of symmetries and conservation principles – Basic concepts of Quarks – color, flavor, Quark confinement –Higgs boson

Astrophysics (7 hours)

Semester-VI

Classification of stars – Hertzsprung - Russel diagram – Luminosity of a star – Stellar evolution - White Dwarfs - Chandrasekhar limit - Neutron stars - Black holes - Supernova explosion – Photon diffusion time.

Text Book:

1. Concepts of Modern Physics, Arthur Beiser, 6th Edition, Tata McGraw-Hill publishing company
2. Modern Physics, R Murugeshan and K. Sivaprasath, 15th Edition (Revised) (2010), S.Chand

References:

1. Atomic and Nuclear Physics, S N Ghoshal, S.Chand.
2. Nuclear and Particle Physics S L Kakani and Subhra Kakani -Viva Books 2008
3. Elements of Nuclear Physics, M L Pandya and R P S Yadav, Kedar Nath Ram Nath
4. Modern Physics, Kennth Krane, 2nd Edition, Wiley India (Pvt) Ltd.
5. Modern Physics , G. Aruldhas and P. Rajagopal, Prentice-Hall India
6. An Introduction to Astrophysics, Baidyanath Basu, 2nd Edition, Prentice-Hall India

Core Course: XII Credit-3 (72 hours)

PH6CRT12: SOLID STATE PHYSICS

Module I

Crystal structure (18 hours)

Solid state, crystalline, polycrystalline and amorphous materials, crystal lattice, periodicity, translation vectors, unit cell, basis, symmetry operations, bravais lattice in two and three dimensions, miller indices, interplanar spacing, simple crystal structures-hcp, fcc, bcc and simple cubic, Structures of NaCl, Diamond and ZnS, X-ray diffraction from crystals- Bragg's law, powder method, reciprocal lattice-properties, reciprocal lattice to sc, bcc and fcc, Bragg's law in reciprocal lattice.

Text book: Solid State Physics by Puri and Babbar- Chapter 1 & 2

Module II

Bonding in solids (7 hours)

Inter-atomic forces, ionic bonding, bond dissociation and cohesive energy, madelung energy, covalent bonding, metallic bonding, hydrogen bonding, van derwaals bonding (basic ideas only).

Text book: Solid State Physics by Puri and Babbar

Free electron theory and elementary band theory (12 hours)

Free electron gas in one dimension, three dimension, electronic specific heat, band theory, Bloch theorem, Kronig-Penney model (derivation not expected), energy-wave vector relations, different zone schemes, velocity and effective mass of electron, distinction between metals, insulators and semiconductors.

Semiconducting properties of materials (12 hours)

Intrinsic and extrinsic semiconductors, drift velocity, mobility and conductivity of intrinsic semiconductors, carrier concentration and Fermi level for intrinsic semiconductor, carrier concentration, conductivity and Fermi level for extrinsic semiconductor. Hall Effect, Direct and Indirect band gap, Principles of LED and Photodiodes.

Text book: Solid State Physics by Puri and Babbar Chapter 5, 6 and 7

Module III

Dielectric properties of materials (5 hours)

Polarization and susceptibility, local filed, dielectric constant and polarizability, sources of polarizability, Clausius-Mossoti relation, piezoelectricity.

Semester-VI

Magnetic properties of materials (7 hours)

Response of materials to magnetic field, classification of magnetic materials, Langevin's classical theory of diamagnetism and paramagnetism, ferromagnetism, Weiss theory, domain theory, antiferromagnetism and ferrimagnetism.

Superconductivity (10 hours)

Origin of superconductivity, response of magnetic field, Meissner effect, super current and penetration depth, critical field and critical temperature, type-I and type –II superconductors, thermodynamic and optical properties, isotope effect, Josephson effect and tunneling- SQUID BCS theory-Cooper pairs-Existence of bandgap.

Text book: Solid State Physics by Puri and Babbar Chapter 5, 6 and 7

Text book:

1. Solid State Physics by Puri and Babbar (S.Chand)

References:

1. Solid State Physics, M.A. Wahab, (2^{nd} Edition), Narosa
2. Introduction to Solid State Physics, Charles Kittel, (7^{th} Edition), Wiley
3. Crystallography applied to solid state Physics, AR Verma, ON Srivastava, New age
4. Solid State Physics, AJ Dekker- Macmillian.
5. Solid State Physics, NW Ashcroft, ND Mermin – Cengage Learning.
6. Elementary Solid State Physics, M. Ali Omer, Pearson.
7. Solid state physics, R L Singal, KNRN &Co.
8. Solid state physics, S O Pillai, New age

Choice Based Course – XIV-1 Credit – 3 (54 hours)

PH6CBT01: INFORMATION TECHNOLOGY

Scope: To learn about the fascinating world of information technology and to use the tools available in Internet and the World Wide Web for a deep study of the subjects related to physics in better way by the students themselves.

Prerequisites: Awareness of basic computer operations.

Module I (20 hours)

Information and its Use : Information Technology – Quality of information – Message transmission – Electronic Office – E mail – Document storage – Computers in Industry – Different types – Graphical user interface

Text book: "Information Technology – The Breaking Wave", D.Curtin, K.Sen and K.Morin, Tata McGraw Hill, 1999. Chapter – 1, 2

Computer Networks: Importance of Networks. Components of Networks. Classification of Networks: Broad cast networks-Switched networks. Switching Techniques. Types of Networks – LAN – MAN – WAN. Networking Models – OSI reference model – TCP/IP reference model-Comparison between the OSI and TCP/IP models. Network Topology – Bus- Star-Ring-Tree-Mesh-Cellular.

Text book: Computer Networks, A.S. Tanenbaum - Prentice Hall of India, Chapter - 1

Computer Fundamentals, P.K. Sinha 3rd Edn. BPB Publications, Chapter – 17

THE INTERNET: Internet Protocols – Internet Protocol (IP)-Transmission Control Protocol (TCP) -Internet Address – Structure of Internet Servers Address-Address Space- Services on Internet – Domain Name System-SMTP and Electronic mail – Http and World Wide Web-Usenet and News groups-FTP-Telnet-Network Security

-Digital Signature-E-mail Privacy-Internet Tools – Search Engines-Web browsers- Internet explorer, Netscape Navigator, Mozilla Firefox(Working Knowledge)

Text book: Computer Networks, A.S.Tanenbaum - Prentice Hall of India, Chapter –5, 6, 7

Computer Fundamentals, P.K. Sinha 3rd Edn. BPB Publications, Chapter – 18

Module – II (20 hours)

THE HTML: What is HTML? Basic Tags of HTML – HTML-TITLE-BODY - Starting an HTML document – The <!DOCTYPE>declaration-setting boundaries with <HTML>-the

Semester-VI

HEAD element-the BODY element-the STYLE element and the SCRIPT element. Formatting of text– Headers-Formatting Tags-PRE tag-FONT tag-Special Characters. Working with Images-META tag -Links – Anchor Tag -Lists – Unordered Lists-Ordered Lists-Definition Lists -Tables – TABLE, TR and TD Tags-Cell Spacing and Cell PaddingColspan and Rowspan -Frames – Frameset-FRAME Tag-NOFRAMES Tag - Forms – FORM and INPUT Tag-Text Box-Radio Button-Checkbox-SELECT Tag and Pull Down Lists-Hidden-Submit and Reset

Text book: HTML4 – 2nd Edn. Rick Darnell, Techmedia, Chapter – 1, 2,3,4,5

Module – III (14 hours)

Basic Idea of DBMS: Need for Data Base – Database Systems versus File systems -
View of Data - Data Abstraction-Instances and Schemas - Data Models – ER ModelRelational Model- Network Model-Hierarchical Model (general ideas) -Basic ideas about Structured Query Language.

Text book: Fundaments of Database System – Elmasri, Ramez and Navathe Shamkant B. 4th Edn.Person Education, India, 2004. Chapter – 1

MS – OFFICE/OPEN OFFICE (Working Knowledge): Word processors – PowerPoint Spreadsheets – Databases

(No specific text book is preferred. MS office (97, 98, 2000, /Open Office which is installed in the lab can be used. Working practice must be given)

References

1. “Information Technology – The Breaking Wave”, D.Curtin, K.Sen and K.Morin,Tata McGraw Hill, 1999.
2. Computer Networks – A.S. Tanenbaum - Prentice Hall of India
3. Computer Fundamentals – P.K. Sinha 3rd Edn. BPB Publications
4. Internet and World Wide Web – Deitel
5. HTML4 – 2nd Edn. Rick Darnell, Techmedia
6. Database System Concepts – Silberschatz-Korth-Sudarshan 4th Edn – TataMac Graw Hill
7. “Information Technology and systems”, Green, B.C., Longman Scientific

&Technical Publishers, England, 1994.

8. Networks – Tirothy S. Ramteke – 2nd Edn. Pearson Edn – New Delhi, 2004
9. Data and Computer Communucation, William Stalling, PHI, New Delhi.
10. Mastering HTML4 – Ray D.S. and Ray E.J. – BPB
11. HTML – The Complete Reference – Tata Mc Graw Hill
12. Fundaments of Database System – Elmasri, Ramez and Navathe Shamkant B. 4thEdn.v Pearson Education, India, 2004.

B. Sc. PHYSICS PRACTICAL

Minimum of experiments to be done in each paper is 14.

Minimum number of experiments for appearing practical examination is 8.

Maximum possible number of repetitions must be done to reduce error in a measuring quantity.

Do calculation of percentage error for all experiments.

The S.I. units must be specified along with the results.

Division of internal marks for record (maximum 4 marks)

No. of Experiments	Marks
14 and above	4
12 & 13	3
10 & 11	2
8, 9 & 10	1
Less than 8	0

SEMESTER	PAPER	PAPER CODE	TITLE
1 & 2	01	PH2CRP01	Mechanics and Properties of Matter
3 & 4	02	PH4CRP02	Optics and Semiconductor Physics
5 & 6	03	PH6CRP03	Electricity, Magnetism and LASER
5 & 6	04	PH6CRP04	Digital Electronics
5 & 6	05	PH6CRP05	Thermal Physics, Spectroscopy and C++ Programming

5 & 6	06	PH6CRP06	Acoustics, Photonics and Advanced Semiconductor Physics

SEMESTER 1&2 (First Year)

Core Practical 1: PH2CRP01 – Mechanics and Properties of Matter

1. Symmetric Compound Pendulum – Determination of acceleration due to gravity (g), radius of gyration(K) and moment of inertia (I)
2. Asymmetric Compound Pendulum – Determination of acceleration due to gravity (g), radius of gyration(K) and moment of inertia (I)
3. Kater's pendulum – Determination of acceleration due to gravity (g)
4. Torsion Pendulum – Determination of rigidity modulus (n) and moment of inertia (I)
5. Torsion Pendulum (Method of equal masses) – Determination of rigidity modulus (n) and moment of inertia (I)
6. Measurement of density of a solid – Sensibility method to find mass using beam balance and screw gauge / venier calipers for dimension measurements
7. Uniform bending – Pin and Microscope – Determination of Young's modulus
8. Non Uniform bending – Pin and Microscope – Determination of Young's modulus
9. Uniform bending – Optic Lever – Determination of Young's modulus
10. Non Uniform bending – Optic Lever – Determination of Young's modulus
11. Cantilever – Scale and telescope – Determination of Young's modulus
12. Cantilever – Pin and Microscope – Determination of Young's modulus
13. Vertical oscillations of a spring – Determination of Young's modulus
14. One dimensional elastic collision – Hanging sphere method – Law of conservation of energy and momentum
15. Static Torsion – Determination of rigidity modulus
16. Flywheel – Determination of moment of inertia
17. Constant pressure head – Determination of viscosity of a liquid
18. Variable pressure head – Determination of viscosity of a liquid
19. Stokes's method – Determination of viscosity of a liquid

20. Capillary rise method – Determination of surface tension
21. Quincke's method – Determination of surface tension

SEMESTER 3&4 (Second Year)

Core Practical 02: PH4CRP02 –Optics and Semiconductor Physics

1. Liquid Lens – Determination of optical constants of a convex lens – water and mercury given
2. Liquid Lens – Determination of refractive index of a liquid – water and unknown liquid
3. Spectrometer – Prism – Determination of refractive index of material of the prism
4. Spectrometer – Hollow Prism – Determination of refractive index of liquid
5. Spectrometer – Small angled prism – Normal incidence – Determination of refractive index of material of the prism
6. Spectrometer – i – d curve – Determination of refractive index of material of the prism
7. Newton's rings – Determination of wavelength of sodium light
8. The air wedge – Determination of diameter of thin wire
9. Zener characteristics – forward and reverse – Study of dynamic and static properties
10. Transistor characteristics – Common Emitter Configuration
11. Half wave rectifier – Study of ripple factor and load regulation with and without filter circuit
12. Full wave rectifier – (center tap) – Study of ripple factor and load regulation with and without filter circuit
13. Full wave rectifier – (bridge) – Study of ripple factor and load regulation with and without filter circuit
14. FET – characteristics – Determination of parameters
15. Voltage regulator using zener diode – Study of line and load regulations
16. Clippers – positive, negative and biased – Study of output waveforms
17. Clampers – positive, negative and biased – Study of output waveforms
18. OPAMP characteristics – Study of CMRR and open loop gain
19. OPAMP – inverter, non inverter and buffer – Study of gain
20. LC Oscillator – Colpit's /Hartley – using transistor

21. Phase shift oscillator – using transistor

SEMESTER 5&6 (Third Year)

Core Practical 03: PH6CRP03 – Electricity, Magnetism and LASER

1. Potentiometer – Measurement of resistance of wire
2. Potentiometer – Calibration of low range voltmeter
3. Potentiometer – Calibration of high range voltmeter
4. Potentiometer – Calibration of ammeter
5. Tangent galvanometer – Calibration of ammeter
6. Moving coil galvanometer – figure of merit
7. Conversion of galvanometer into voltmeter
8. Conversion of galvanometer into ammeter
9. Field along the axis of a circular coil – magnetic flux variation
10. Field along the axis of a circular coil – m and B_h
11. Searle's vibration magnetometer – magnetic moment
12. Deflection and vibration magnetometer – m and B_h
13. Carey Foster's bridge – Measurement of resistivity of wire
14. LCR seriesand parallel resonant circuit analysis
15. Verification of Thevenin's and Norton's theorems
16. Verification of Superposition and Maximum power transfer theorems.
17. Laser – Grating – Determination of wavelength
18. Laser – Determination of spot size and divergence
19. Optical fiber – Determination of numerical aperture
20. Single slit diffraction using laser – Determination of slit width
21. e/m – Thomson's apparatus – Bar magnet/magnetic focusing
22. Determination of Dielectric constant of a thin sheet/ a liquid

SEMESTER 5&6 (Third Year)

Core Practical 04: PH6CRP04 – Digital Electronics

1. Realization of logic gates – AND, OR and NOT – Using diodes, transistors etc.
2. Realization of logic gates – AND, OR and NOT – Using universal gates
3. Verification of truth table of NAND, NOR, XOR and XNOR gates
4. Verification of De Morgan's theorems – Using IC 7400
5. BCD to 7 segment decoder
6. Realization of Half adder/ Full adder using gates – Verification of truth table
7. Astable Multivibrator using Transistor
8. Astable Multivibrator using IC 555
9. Monostable Multivibrator using Transistor
10. Monostable Multivibrator using IC 555
11. D/A converter using IC 741 – Using binary weighed resistor / R – 2R ladder type
12. A/D converter using IC 741
13. SR Flip Flops using IC 7400 – Verification of truth table
14. JK Flip Flops using IC 7400 & 7410 – Verification of truth table
15. Digital counter using IC 7490 / 7495 / 74194 / 74151 – Verification of truth table
16. Schmitt trigger using IC 741
17. Bistable multivibrator using IC 555
18. Multiplexer using gates
19. Demultiplexer using gates
20. Shift register – SISO
21. Shift register – SIPO
22. 4-Bit Binary to Gray conversion
23. 4-Bit Gray to Binary conversion

SEMESTER 5&6 (Third Year)

Core Practical 05: PH6CRP05 – Thermal Physics, Spectroscopy and C++ Programming

1. Thermistor – Resistance - Temperature characteristics and temperature coefficient of resistance
2. Newton's law of cooling – Specific heat capacity of a liquid
3. Thermal conductivity of bad conductor – Lee's disc
4. Carey Foster's bridge – Temperature co-efficient of resistance
5. Study of Seeback effect/Peltier effect
6. Electrochemical equivalent of Copper
7. To determine e/k using transistor
8. Spectrometer – Cauchy's constants 9. Spectrometer – Resolving power of a prism.
10. Spectrometer – Resolving power of grating.
11. Spectrometer – Dispersive power of grating
12. Spectrometer – Dispersive power of prism
13. Computer programming in C++ – Conversion of temperature scale
14. Computer programming in C++ – Solving a quadratic equation
15. Computer programming in C++ – Generation of Fibonacci series
16. Computer programming in C++ – Conversion of a decimal number into binary number
17. Computer programming in C++ – Simple Pendulum – Calculation of 'g' from experimental data
18. Computer programming in C++ – Resistance colour code to numerical value conversion
19. Computer programming in C++ – For different initial velocity and angle of projection, find out time of flight, horizontal range, Maximum height of a Projectile
20. Computer programming in C++ – sorting the numbers in ascending and descending order
21. Computer programming in C++ – multiplication of two matrices

Core Practical 06: PH6CRP06 – Acoustics, Photonics and Advanced Semiconductor Physics

1. Melde's string – Determination of frequency of given tuning fork

SEMESTER 5&6 (Third Year)

2. Sonometer – Determination of frequency of AC
3. Sonometer – Determination of frequency of given tuning fork, unknown mass and verification of laws of strings
4. Kundt's tube – Determination of velocity of sound
5. Spectrometer – Quartz prism – Refractive indices of quartz for the ordinary and extra – ordinary rays
6. Characteristics of LED – V- I characteristic for different colors
7. Characteristics of solar cell / photodiode – V- I characteristics
8. Characteristics of Light Depend Resistors
9. Planck's constant using LED's of at least 3 different colours
10. Weinbridge Oscillator using IC 741
11. Realization of XOR and Ex NOR using transistor
12. Sweep wave generator using transistor
13. Regulated power supply using zener diode and IC 741 – Study of line and load regulations
14. Regulated power supply using IC 78XX/79XX etc – Study of line and load regulations
15. Voltage regulator using zener diode and transistor – Study of line and load regulations
16. RC coupled common emitter amplifier – Study of frequency response and bandwidth
17. Voltage multipliers – doubler & tripler
18. Wave shaping R C circuits – Integrator and differentiator
19. OPAMP – adder and subtractor
20. Amplitude modulation using transistor
21. Pulse Width Modulation using IC 555

References:

1. Advanced course in Practical Physics by D Chattopadhyay
2. Practical Physics – Joseph Ittiavirah, Premnath and Abraham(2005)
3. Practical Physics, CL Arora, S.Chand
4. Practical Physics, Harnam Singh , S Chand
5. Electronics lab manual Vol 1 & 2, K A Navas.
6. A course of Experiments with He –Ne Laser – R.S Sirohi (2nd Edition) Wiley Eastern Ltd.
7. Electronics lab manual Vol 1 & 2, Kuryachan T D and Shyam Mohan S, Ayodhya pub.

9. COMPLEMENTARY PHYSICS FOR MATHEMATICS AND STATISTICS

Semester I 2 credits (36 hours)

PH1CMT01: PROPERTIES OF MATTER & ERROR ANALYSIS

Module I

Elasticity (13 hours)

Stress- strain- Hooke's law- Elastic moduli- Poisson's ratio- twisting couple- determination of rigidity modulus- static and dynamic methods- static torsion- torsion pendulum, bending of beams- cantilever, uniform and non-uniform bending, I section girder.

Module II

Surface tension (3 hours)

Molecular theory of surface tension - surface energy - excess pressure in a liquid drop, factors affecting surface tension - applications

Hydrodynamics (7 hours)

Streamline and turbulent flow - critical velocity - Coefficient of viscosity - Derivation of Poiseuille's equation, Stokes equation-Determination of viscosity by Poiseuille's method Brownian motion – Viscosity of gases – Bernoulli's theorem.

Module III (13 hours)

Error Analysis

Basic ideas – uncertainties of measurement – importance of estimating errors – dominant errors – random errors – systematic errors - rejection of spurious measurements. Estimating and reporting errors – errors with reading scales, errors of digital instruments – number of significant digits – absolute and relative errors – standard deviation. Propagation of errors – sum and differences – products and quotients – multiplying by constants – powers

References:

1. Elements of properties of matter, D S Mathur
2. Advanced course in Practical Physics by D Chattopadhyay
3. Properties of Matter- Brijlal and N. Subrahmanyam (S. Chand and Co.)
4. Concepts of Modern Physics- A. Beiser (Tata McGraw-Hill, 5th Edn.)
5. Modern Physics- G. Aruldas and P. Rajagopal (PHI Pub)
6. Physics- Resnick and Halliday

7. An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements, John R. Taylor - Univ. Science Books

Semester II 2 credits (36 hours)

PH2CMT01: MECHANICS AND ASTROPHYSICS

Module I

Motion under Gravity (5 hours)

Velocity- acceleration- force – acceleration due to gravity - compound pendulum (symmetric and asymmetric) radius of gyration – Kater's Pendulum- centripetal acceleration and force - centrifugal force

Rotational Dynamics (10 hours)

Angular velocity- angular momentum- torque- conservation of angular momentum- angular acceleration- moment of inertia- parallel and perpendicular axes theorems- moment of inertia of rod, ring, disc, cylinder and sphere- flywheel

Module II

Oscillations (9 hours)

Periodic and oscillatory motion- simple harmonic motion- differential equation, expression for displacement, velocity and acceleration- graphical representation- energy of a particle executing simple harmonic motion - damped oscillation- forced oscillation and resonance.

Waves (4 hours)

Waves-classifications- progressive wave- energy of progressive wave- superposition of waves- theory of beats- Doppler Effect.

Module III

Astrophysics (8 hours)

Temperature and color of a star- elements present in a stellar atmosphere- mass of star- life time of a star- main sequence stars-HR diagram- evolution of stars- white dwarf- supernova explosion- neutron star- black hole- (all topics to be treated qualitatively)

References

1. Elements of properties of matter, D S Mathur Mechanics- H.S.Hans and S.P.Puri. (TMH)
2. Mechanics, D S Mathur

3. Modern Physics- R. Murugeshan, Er. Kirthiga Sivaprasad
4. A text book on oscillations waves and acoustics, M.Ghosh , D Bhattacharya
5. Introduction to Astrophysics-Baidyanath Basu.
6. Mechanics by D.S. Mathur and P.S. Hemne, S. Chand.
7. Waves, Mechanics & Oscillations- S B Puri

Semester III 3 credits (54 hours)

PH3CMT01: MODERN PHYSICS AND ELECTRONICS

Module I

Modern Physics (18 hours)

Basic features of Bohr atom model-formula for energy- vector atom model- various quantum numbers-coupling schemes – LS & JJ-Pauli's exclusion principle- magnetic moments of orbital electrons

Atomic nucleus-classification-basic properties of nucleus-charge, mass, spin, magnetic moment binding energy and packing fraction-nuclear forces-salient features

Radioactivity- properties of alpha, beta and gamma-Soddy Fajan's displacement law, law of radioactive disintegration-decay constant-half life and mean life-radioactive equilibrium - measurement of radioactivity-radio carbon dating

Module II

Quantum Mechanics (12 hours)

Inadequacies of classical physics-experimental evidences-evidences for quantum theory- Planck's hypothesis-foundation of quantum mechanics-wave function & probability density- Schrödinger equation-time dependent and time independent particle in a potential box.

Spectroscopy (6 hours)

Optical spectra- spectral terms, selection rules, hyperfine structure; molecular spectra- rotational, vibrational and electronic spectra; Raman effect- experimental study, quantum theory; fluorescence and phosphorescence; comparison of Raman, fluorescence and IR spectra; NMR

Module III

Electronics (8 hours)

Current-voltage characteristics of a diode-forward and reverse bias-breakdown mechanism of p-n junction diode-Zener diode and its characteristics-half wave and full wave rectifiers- bridge rectifier-ripple factor, efficiency. Bipolar junction transistorConstruction and operation.

Module IV

Digital Electronics (10 hours)

Different number systems – decimal, binary, octal, hexa decimal number systems- conversion between different number systems- binary mathematics – addition, subtraction (1's compliment and 2's compliment methods) - basic theorems of Boolean algebra- de Morgan's theorems – Simplification of Boolean equations - AND, OR, NOT, NAND, NOR, XOR gates- truth tables- half adder- full adder

References

1. Modern Physics- R. Murugeshan, Er. Kirthiga Sivaprasad
2. Principles of electronics, V K Mehta
3. Digital principles and applications- A. P. Malvino and P. Leach
4. Concepts of Modern Physics: Arthur Beiser (TMH).
5. Basic Electronics , B L Thereja (S. Chand)

Semester IV 3 credits (54 hours)

PH4CMT01: OPTICS & ELECTRICITY

Module I

Interference, Diffraction and Polarization (22 hours)

Light waves- phase difference and coherence, optical path and phase change, principle of superposition, Analytical treatment of interference-young's double slit experiment, conditions for interference, bandwidth - Interference in thin films-reflected system-colour of thin films-fringes of equal inclination and equal thickness. Newton's rings-reflected system-measurement of wavelength

Fresnel and Fraunhofer diffractions. Fresnel's theory of approximate rectilinear propagation of light-. Fraunhofer diffraction. Theory of Plane transmission gratingdetermination of wavelength-

dispersive power of grating. Prism and grating spectra, resolving power, Rayleigh criterion, resolving power of grating,

Polarization, types of polarization, Brewster's law, dichroism, birefringence – e ray and oray, polarizer and analyser, Malu's law, optical activity

Module II

Laser and Fiber Optics (10 hours)

Principle of operation of laser-population inversion, metastable states, optical resonator-components of laser- active medium, pump, optical resonant cavity- principal pumping schemes-three level and four level- laser beam characteristics applications of lasers. Light propagation in optical fibers, acceptance angle, numerical aperture-step index fiber - graded index fiber.

Module III

Dielectrics (10 hours)

Dielectrics- polar and non-polar dielectrics- polarization- sources of polarization-Gauss's law in dielectrics- permittivity- dielectric displacement vector- dielectric constantsusceptibility- ferro-electricity.

Module IV

Varying Currents (12 hours)

Transient currents – Growth and decay of current in an inductive circuit – charging and discharging of a capacitor through a resistance - Peak, mean, rms and effective values of a.c, Ac circuits-AC through RC, LC, LR and LCR series circuits resonance-sharpness of resonance-power factor.

References:

1. Optics - Brijlal and N. Subrahmanyam, S Chand-2015
2. Electricity and Magnetism , D C Tayal
3. Electricity and Magnetism- J. H. Fewkes & John Yarwood
4. Electricity and Magnetism – R. Murugeshan
5. Nuclear physics –Irvin Kaplan
6. Lasers – theory & applications- Thyagarajan & Ghatak
7. Concepts of Modern Physics- A. Beiser

8. Laser Physics and Applications, V K Jain (Narosa Publication)
9. Optical Fiber Communications, John M Senior

10. COMPLEMENTARY PHYSICS FOR CHEMISTRY AND GEOLOGY

Semester 1

PH1CMT02: PROPERTIES OF MATTER AND THERMODYNAMICS

Module I

Elasticity (13 hours)

Stress- strain- Hooke's law- Elastic moduli- Poisson's ratio- twisting couple- determination of rigidity modulus- static and dynamic methods- static torsion- torsion pendulum, bending of beams- cantilever, uniform and non-uniform bending, I section girder.

Module II

Surface tension (3 hours)

Molecular theory of surface tension - surface energy - excess pressure in a liquid drop, factors affecting surface tension - applications

Hydrodynamics (7 hours)

Streamline and turbulent flow - critical velocity - Coefficient of viscosity - Derivation of Poiseuille's equation, Stokes equation-Determination of viscosity by Poiseuille's method Brownian motion – Viscosity of gases- Bernoulli's theorem.

Text Book: Elements of properties of matter, D S Mathur, Chapter- 14

Module III

Thermodynamics (13 hours)

Thermodynamic systems- thermodynamic equilibrium- thermodynamic processes- isothermal process- adiabatic process- zeroth law of thermodynamics, first law of thermodynamics- heat

engine- the Carnot engine- refrigerator, concept of entropy- second law of thermodynamics- third law of thermodynamics- Maxwell's thermodynamic relations

Text Books:

1. Elements of properties of matter, D S Mathur- S Chand
2. Heat and Thermodynamics-Brijlal & Subrahmanyam (S.Chand)

References

1. Mechanics - H.S.Hans and S.P.Puri. (Tata McGraw-Hill)
2. Properties of Matter - Brijlal and N. Subrahmanyam (S. Chand and Co.)
3. Mechanics - J.C. Upadhyaya (Ram Prasad and sons)
4. Heat and Thermodynamics – Mark W Zemanski (Tata McGraw-Hill)

Semester 2

PH2CMT02: MECHANICS AND SUPERCONDUCTIVITY

Module I

Motion under gravity (5 hours)

Velocity- acceleration- force – acceleration due to gravity - compound pendulum (symmetric and asymmetric) radius of gyration –centripetal acceleration and force - centrifugal force

Rotational dynamics (10 hours)

Angular velocity- angular momentum- torque- conservation of angular momentum- angular acceleration- moment of inertia- parallel and perpendicular axes theorems- moment of inertia of rod, ring, disc, cylinder and sphere- flywheel

Module II

Oscillations (9 hours)

Periodic and oscillatory motion- simple harmonic motion- differential equation, expression for displacement, velocity and acceleration- graphical representation- energy of a particle executing simple harmonic motion damped oscillation- forced oscillation and resonance.

Waves (4 hours)

Waves-classifications- progressive wave- energy of progressive wave- superposition of waves- theory of beats- Doppler effect.

Module III

Superconductivity (8 hours)

Super conducting phenomenon- Occurrence- BCS theory (qualitative) Meissner Effect- Type I and Type II superconductors- Josephson effects (qualitative) - High temperature superconductors- Applications of Superconductivity Text Books:

1. Elements of properties of matter, D S Mathur- S Chand
2. Mechanics- D S Mathur- S Chand
3. Solid State Physics- P K Palanisamy- Scitech

References

1. Properties of Matter- Brijlal and N. Subrahmanyam (S. Chand and Co.)
2. A text book on oscillations waves and acoustics, M.Ghosh , D Bhattacharya
3. Solid State Physics- R. K. Puri and V.K. Babbar (S. Chand and Co.)
4. Elementary Solid State Physics,Ali Omar
5. Modern Physics- Murugeshan- S Chand

Semester III

PH3CMT02: MODERN PHYSICS AND MAGNETISM

Module I

Modern Physics (18 hours)

Basic features of Bohr atom model-formula for energy-vector atom model- various quantum numbers- Coupling schemes-LS and JJ coupling-Pauli’s exclusion principle- magnetic moment of orbital electrons,

Atomic nucleus classification-basic properties of nucleus-charge, mass, spin, magnetic moment binding energy and packing fraction-nuclear forces-salient features

Radioactivity- properties of alpha, beta and gamma- Soddy Fajan's displacement law, law of radioactive disintegration -decay constant-half life and mean life-radioactive equilibrium
- measurement of radioactivity-.Radio carbon dating

Module II

Quantum Mechanics (12 hours)

Inadequacies of classical physics-experimental evidences-evidences for quantum theory- Planck's hypothesis-foundation of quantum mechanics-wave function & probability density- Schrödinger equation-time dependent and time independent particle in a potential box.

Spectroscopy (6 hours)

Optical spectra- spectral terms, selection rules, hyperfine structure; molecular spectra- rotational, vibrational and electronic spectra; Raman effect- experimental study, quantum theory; fluorescence and phosphorescence; comparison of Raman, fluorescence and IR spectra; NMR

Module III

Electronics (8 hours)

Current-voltage characteristics of a diode-forward and reverse bias-breakdown mechanism of p-n junction diode-Zener diode and its characteristics-half wave and full wave rectifiers- bridge rectifier-ripple factor, efficiency. Construction and operation of a bipolar junction transistor

Module IV

Magnetism (10 hours)

Properties of magnetic materials, Paramagnetism, Diamagnetism, Ferromagnetism, Hysteresis, Ferrites, Magnetostriction, Earth's magnetism-elements of earth's magnetism-dip, declination, horizontal and vertical components-magnetic mapsmagnetographs-cause of earth's magnetism
Text Books:

1. Modern Physics- R. Murugeshan, Er. Kirthiga Sivaprasad . S Chand
2. Principles of electronics, V K Mehta, S Chand
3. Electricity and magnetism, D C Tayal,

References

1. Functional Electronics, Ramanan (Tata McGraw-Hill)

2. Electricity and magnetism - Brijlal and N. Subrahmanyam (S. Chand and Co.) Semester IV

PH4CMT02: OPTICS AND SOLID STATE PHYSICS

Module I

Interference, Diffraction and Polarization (22 hours)

Light waves- phase difference and coherence, optical path and phase change, principle of superposition, Analytical treatment of interference-- young's double slit experiment, conditions for interference, bandwidth Interference in thin films-reflected system-colour of thin films-fringes of equal inclination and equal thickness. Newton's rings-reflected system-measurement of wavelength

Fresnel and Fraunhofer diffractions. Fresnel's theory of approximate rectilinear propagation of light. Fraunhofer diffraction. Theory of Plane transmission gratingdetermination of wavelength-dispersive power of grating. Prism and grating spectra, resolving power, Rayleigh criterion, resolving power of grating,

Polarization, types of polarization, Brewster's law, dichroism, birefringence – e ray and oray, polarizer and analyzer, Malu's law, optical activity

Module II

Laser and Fiber Optics (10 hours)

Principle of operation of laser-population inversion, metastable states, optical resonator-components of laser- active medium, pump, optical resonant cavity- principal pumping schemes-three level and four level- laser beam characteristics, applications of lasers. Light propagation in optical fibers, acceptance angle, numerical aperture-step index fiber - graded index fiber.

Module III

Dielectrics (10 hours)

Dielectrics- polar and non-polar dielectrics- polarization- sources of polarization-Gauss's law in dielectrics- permittivity- dielectric displacement vector- dielectric constantsusceptibility- ferro-electricity. Peak, mean, rms and effective values of A.C

Module IV

Crystallography (12 hours)

Crystal structure-crystal lattice and translation vectors-unit cell-types of lattices- Miller indices-lattice directions and planes interplanar spacing-simple crystal structures- sc, fcc, bcc, hcp close packed structures- -sodium chloride structure. X-ray crystallography- diffraction of x-rays-Bragg's law Text Books:

1. Optics - Brijlal and N. Subrahmanyam - S Chand-2015
2. Electricity and Magnetism , D C Tayal
3. Solid State Physics, S O Pillai

References:

1. A text book of Applied Physics – A .K Jha
2. Electricity and Magnetism – R. Murugeshan (S Chand & Co.)
3. Solid state physics, P. K Palanisami
4. Lasers – theory & applications- Thyagarajan &Ghatak

COMPLEMENTARY PHYSICS PRACTICALS

Semester I & II

Complementary Physics Practical 1: PH2CMP01

1. Vernier Calipers -- Volume of cylinder (solid and hollow), sphere and beaker
2. Screw gauge – Radius of wire, volume of sphere and glass piece
3. Beam balance - Mass of a solid (sensibility method)
4. Spectrometer - Refractive Index of material of prism.
5. Diode characteristics- ac and dc resistance
6. Coefficient of viscosity of the liquid – Constant OR Variable pressure head method
7. Surface Tension – Capillary rise method
8. Determination of Young's Modulus- Cantilever (Scale and Telescope)
   OR - Uniform bending (Optic lever method)
   OR- Non-uniform bending (Pin and Microscope method)
9. Acceleration due to gravity (g)- Symmetric Compound Pendulum
   OR Kater's pendulum
10. Symmetric Compound Pendulum - Determination of Radius of gyration and moment of inertia
11. Fly wheel – Moment of Inertia
12. Torsion pendulum -Rigidity modulus
13. Determination of moment of inertia of rotationally symmetric body (solid sphere OR cylinder OR disc) from their period of oscillation on a torsion axle
14. Spring constant - Hooke's law - oscillation
15. Resistivity of the material of the wire- Ohm's law and verification by multimeter
16. Construction of half wave rectifier with and without filter – Ripple factor
17. Laser- Transmission OR Reflection Grating- Determination of wavelength
18. Liquid lens - Refractive Index of glass using a liquid of known refractive index
19. Poisson's ratio of rubber
20. Temperature dependence of capacitance- polymer and ceramic capacitors
21. Resistance of a galvanometer and its figure of merit.

Semester III & IV: Complementary Physics Practical 2: PH4CMP02

1. Determination of Young's Modulus- Cantilever (Pin & Microscope)
   OR Uniform bending (pin and microscope)OR Non-uniform bending (optic lever)
2. Asymmetric Compound Pendulum- Determination of moment of inertia and Acceleration due to gravity (g)
3. Torsion pendulum (Equal mass method) - Rigidity modulus and Moment of Inertia
4. Spectrometer – Dispersive power of prism
5. Spectrometer – Dispersive power of a Grating
6. Newton's rings -Wave length
7. Characteristics of Zener diode- ac and dc resistance
8. Conversion of Galvanometer into voltmeter
9. Carey Foster's Bridge -Measurement of resistivity
10. Tangent Galvanometer – Ammeter calibration
11. Potentiometer-Calibration of low range ammeter OR voltmeter
12. Construction of full wave rectifier (center-tap OR bridge) with and without filter – Ripple factor
13. Construction of regulated power supply using Zener diode- line and load regulation
14. Laser diffraction- width of single slit OR thickness of wire
15. Refractive index of liquid- Liquid Lens OR Spectrometer and Hollow Prism
16. Air wedge-thickness of wire
17. Static Torsion - Rigidity modulus
18. Deflection and Vibration Magnetometer-m & Bh
19. Field along the axis of circular coil- determination of Bh
20. Searle's Vibration Magnetometer - magnetic moment
21. Gates – AND, OR, NOT- verification of truth tables

References

1. Practical Physics – C L Arora- S Chand
2. Properties of Matter -D.S. Mathur
3. Optics -Subrahmanyam& Brijlal
4. Electricity &Magnetism -Sreevastava
5. Electronics Lab Manual (Vol.1) -K. A. Navas
6. Laboratory manual for electronic devices and circuits-David A Bell 7. Practical Physics-Joseph Ittiavirah, Premnath and Abraham