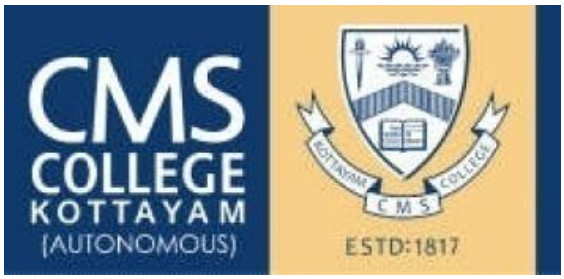

CMS COLLEGE KOTTAYAM

(AUTONOMOUS)

Affiliated to the Mahatma Gandhi University, Kottayam, Kerala

CURRICULUM FOR

UNDER GRADUATE PROGRAMME

BACHELOR OF SCIENCE IN PHYSICS

UNDER CHOICE BASED CREDIT SYSTEM 2018

(with effect from 2018)

Approved by the Board of Studies on 22-03-2018

CONTENTS

BOARD OF STUDIES

1. Dr. P. Rajagopal, Head of the Department, Dept of Physics, CMS College, Kottayam (Chairman)
2. Dr. Pragash R, Head of the Department, Dept of Physics, Government College, Kottayam. (Member)
3. Dr. C. Sudarsanakumar, Professor and Head of the Department, SPAP, M G University, Kottayam. (Member)
4. Mr. Preman D. Ninan, Country Manager, Molex Pvt . Ltd , Bangalore (Member)
5. Mr. Dr. Sreelatha K.S, Dept of Physics, Government College, Kottayam. (Member)
6. Dr. Ravikumar C., Assistant Professor, Department of Physics , CMS College (Member)
7. Dr. P. Nuja S. John, Assistant Professor, Department of Physics , CMS College (Member)
8. Dr. Seema R. Assistant Professor, Department of Physics , CMS College (Member)
9. Dr. Arunkumar K V, Assistant Professor, Department of Physics , CMS College (Member)
10. Dr. Preema C. Thomas, Assistant Professor, Department of Physics , CMS College (Member Secretary)

ACKNOWLEDGEMENT

The Board of Studies in Physics (Under Graduate), Department of Physics, CMS Colleges takes this opportunity to express our deep sense of gratitude to all academicians and representatives from the industry who participated in the numerous meetings that were arranged during the year, held at CMS College.

Our heartfelt gratitude to Dr. N. J. Rao, Former Professor, Indian Institute of Science for the 2 day workshop on curriculum designing and to Dr. T P Sasikumar, Former Space Scientist ISRO for the 2 day curriculum workshop, and to Dr. C James, Associate Professor in Physics, Scott Christian College for the workshop on question bank design.

Chairman

Board of Studies

PREFACE

Making every student significantly "smarter" having a more accurate understanding of nature or of anything in it is the one aim in teaching and learning physics. The curriculum is framed to equip students to grasp the basic concepts of physics and in addition have a broader vision. A dynamic curriculum accommodates fast faced developments in the knowledge of the subject concerned by introducing innovative concepts, multidisciplinary profile and standard education. The syllabus should, as already mentioned have a thrust on real time needs at the same time should aspire to gather information from resources and use them.

The programme also aims to provide an intellectually stimulating environment to develop skills and enthusiasm of students to the best of their potential. It also helps in giving need based education in physics of the highest quality at the undergraduate level and generate graduates of the caliber sought by industries and public service including academic teachers and researchers of the future.

In this programme, we aim to provide a solid foundation in all aspects of physics and to show a broad spectrum of modern trends in physics and to develop experimental, computational and mathematical skills of students. The syllabus is framed in such a way that it bridges the gap between the plus two and the post graduate level of physics by providing a more complete and logical framework in almost all areas of basic physics.

CURRICULUM

GRADUATE PROGRAMME OUTCOMES (GPO)

At the completion of the under graduate programme, the student will be able to accomplish the following programme outcomes.

GPO No.	Graduate Programme Outcomes
GPO.1	**Critical Thinking**: Take an informed and analytical approach to learning and demonstrate in-depth knowledge of the subject and give opinion(s) supported by logical reasoning that one have judged to be appropriate and understanding different approaches and using them
GPO.2	**Effective Communication:** Demonstrate proficiency in communicating competently in groups and organizations, competence in interpersonal communication; possess skills to effectively deliver formal and informal presentations to a variety of audiences in multiple contexts
GPO.3	**Social Interaction:** Foster social skills and peer interaction enabling them to make all people feel valued and respect their differences by being responsible citizens for creating a socially inclusive society
GPO.4	**Ethical Standards:** Recognize values such as justice, trust, equity, fairness, kindness and develop a commitment to meeting and upholding standards of ethical behaviour in all walks of life and comprehending the moral dimensions of decisions and actions
GPO.5	**Environmental Consciousness:** Discern the issues of environmental contexts and engages in promoting values and attitudes that claim coexistence and sustainable living with reduced, minimal, or no harm upon ecosystems
GPO.6	**Lifelong Learning:** Acquire the skill to be an independent lifelong learner embracing real-time changes in the socio-technological context, promoting continuous development and improvement of the knowledge and skills needed for employment and personal fulfilment.

PROGRAMME SPECIFIC OUTCOMES (PSO)

Sl.No.	PSO No.	Intended Programme Specific Outcomes ***Upon completion of B.Sc. Physics Degree Programme, the graduates will be able to:***	GPO No.
1	PSO-1	Develop deep understanding of the basics of subjects like mechanics, optics, properties of matter, e-m theory, environmental issues related to physics so that they can pursue higher studies.	1,3,6
2	PSO-2	Enhance mathematical skills to go to the grass root level of understanding Physics	1,6
3	PSO-3	Improve practical skills to implement the basic principles of the subject.	4
4	PSO-4	Design new devices and systems that correlate with the fundamental for innovative research program.	3
5	PSO-5	Use constructive knowledge and communication skill at an international standard.	5
6	PSO-6	Use the knowledge in mathematics and statistics as an essential tool for solving problems in physics.	6
7	PSO- LG	Organize and deliver relevant applications of knowledge through effective written, verbal, graphical/virtual communications and interact productively with people from diverse backgrounds.	2

PROGRAMME DESIGN

B.Sc. PHYSICS PROGRAMME

The U.G. programme in Physics includes (a) Common courses, (b) Core courses, (c) Complementary courses, (d) Choice based course, (e) Open course (f) Project and (g) Industrial visit. No course shall carry more than 4 credits. The student shall select any one Open course in Semester 5 offered by the various departments depending on the availability of infrastructure facilities in the institution. The number of Courses for the 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 and industrial visit in the area of core and 8 complementary courses from the relevant subjects for complementing the core of study. There should be 10 common courses, which includes English and Additional language of study. For the successful completion of this UG programme, a student shall acquire minimum 120 credits.

Sl. No.	**Course type**	**No. of courses**	**Total credits**
1	Common course I-English	**6**	**22**
3	Common course II– Additional language	**4**	**16**
4	Core	**12**	**35**
5	Core Practical	**12**	**12**
6	Complementary I	**4**	**14**
7	Complementary II	**4**	**14**
8	Choice Based Open course	**1**	**3**
9	Choice Based Elective Course	**1**	**3**
10	Project work and Industrial Visit	**1**	**1**
Total		**45**	**120**

PROGRAMME STRUCTURE – B.Sc.Physics
(Semester wise)

Course Code	Title of the Course	Course Category	Hours / week	Total hours	Credits
SEMESTER I					
EN1811501	**Fine-tune Your English**	**Common I - English 1**	**5**	**90**	**4**
EN1811502	Pearls from the Deep	Common I - English 2	4	72	3
	Additional Language	Common Course	4	72	4
HN1811501	Prose and One Act Plays	Common II - Hindi 1			
ML1811501	*Kathasahithyam*	Common II - Malayalam 1			
SC1811501	Poetry/ Grammar & History of Syriac Language & Literature	Common II –Syriac 1			
PH1811101	Methodology and Perspectives in Physics	Core 1	2	36	2
PH1811601	Mechanics and Properties of Matter 1	Core Practical 1	2	36	1
ST1811201	Descriptive statistics	Complementary I Statistics 1	4	72	3
MT1811201	Partial Differentiation, Matrices, Trigonometry	Complementary II Mathematics 1	4	72	3
		Total	**25**	**450**	**20**
SEMESTER II					
Course Code	**Title of the Course**	**Course Category**	**Hours / week**	**Total hours**	**Credits**
EN1812503	Issues That matter	Common I -English 3	5	90	4
EN1812504	Savouring the Classics	Common I - English 4	4	72	3
	Additional Language	Common Course	4	72	4
HN1812503	Short stories and Novel	Common II - Hindi 2			
ML1812504	*Kavitha*	Common II- Malayalam 2			
SC1812503	Poetry/ Grammar & History of Syriac Literature	Common II –Syriac 2			
PH1812102	Mechanics and Properties of Matter	Core 2	2	36	2

PH1812602	Mechanics and Properties of Matter 2	Core Practical 2	2	36	1
ST1812203	Probability Theory	Complementary I Statistics 2	4	72	3
MT1812203	Integral calculus and Differential Equations	Complementary II Mathematics 2	4	72	3
		Total	**25**	**450**	**20**
SEMESTER III					
Course Code	**Title of the Course**	**Course Category**	**Hours / week**	**Total hours**	**Credits**
EN1813505	Literature and/ as Identity	Common I-English 5	5	90	4
	Additional Language	Common Course	5	90	4
HN1813505	Poetry/Grammar and Translation	Common II -Hindi 3			
ML1813507	*Drishyakalasahithyam*	Common II-Malayalam 3			
SC1813505	Prose, Grammar & Literature	Common II- Syriac 3			
PH1813103	Optics, Laser and Fibre Optics	Core 3	3	54	3
PH1813603	Optics and Semiconductor Physics 1	Core Practical 3	2	36	1
ST1813204	Probability Distribution	Complementary I Statistics 3	5	90	4
MT1813205	Vector Calculus, analytic Geometry and Abstract Algebra	Complementary II Mathematics 3	5	90	4
		Total	**25**	**450**	**20**
SEMESTER IV					
Course Code	**Title of the Course**	**Course Category**	**Hours / week**	**Total hours**	**Credits**
EN1814507	Illuminations	Common I -English 6	5	90	4
	Additional Language	Common Course	5	90	4
HN1814506	Drama and Long Poem	Common II- Hindi 4			
ML1814508	*Malayala Gadyarachanakal*	Common II-Malayalam 4			
SC1814506	Poetry, Grammar & Syriac Heritage in India	Common II- Syriac 4			
PH1814104	Semiconductor Physics	Core 4	3	54	3
PH1814604	Optics and Semiconductor Physics 2	Core Practical 4	2	36	1
ST1814206	Statistical Inference	Complementary I Statistics 4	5	90	4
MT1814206	Fourier Series, Laplace Transform and Complex Analysis	Complementary II Mathematics 4	5	90	4
		Total	**25**	**450**	**20**

SEMESTER V					
Course Code	**Title of the Course**	**Course Category**	**Hours / week**	**Total hours**	**Credits**
PH1815105	Thermal and Statistical physics	Core 5	3	54	3
PH1815106	Classical and Quantum Mechanics	Core 6	3	54	3
PH1815107	Digital Electronics and Programming	Core 7	3	54	3
PH1815108	Environmental Physics and Human Rights	Core 8	4	72	4
PH1815605	Electricity, Magnetism and Laser 1	Core Practical 5	2	36	1
PH1815606	Digital Electronics 1	Core Practical 6	2	36	1
PH1815607	Thermal Physics, Spectroscopy and C++ programming 1	Core Practical 7	2	36	1
PH1815608	Acoustics, Photonics and Advanced Semiconductor physics 1	Core Practical 8	2	36	1
PH1815401	Our Universe	Open Course	4	72	3
PH1815402	Physics in Daily Life				
PH1815403	Computer Hardware and Networking				
		Total	**25**	**450**	**20**
SEMESTER VI					
PH1816109	Electricity and Electrodynamics	Core 9	3	54	3
PH1816110	Relativity and Spectroscopy	Core 10	4	72	3
PH1816111	Nuclear Particle and Astrophysics	Core 11	3	54	3
PH1816112	Solid State Physics	Core 12	4	72	3
PH1816609	Electricity, Magnetism and Laser 2	Core Practical 9	2	36	1
PH1816610	Digital Electronics 2	Core Practical 10	2	36	1
PH1816611	Thermal Physics, Spectroscopy and C++ programming 2	Core Practical 11	2	36	1
PH1816612	Acoustics, Photonics and Advanced Semiconductor physics 2	Core Practical 12	2	36	1
PH1816301	Information Technology	Choice Based Course (Elective)	3	54	3
PH1816302	Material Science				
PH1816303	Instrumentation				
PH1816304	Computational Physics				
PH1816305	Astronomy and Astrophysics				
PH1816801	Project & Industrial Visit				1
		Total	**25**	**450**	**20**

PROGRAMME STRUCTURE – B.Sc.Physics
(Category wise)
COMMON COURSES

Sl.No	Course Name		Credit	Hrs/W	Semester
1	Common I -English 1 Fine-tune Your English		4	5	1
2	Common I- English 2 Pearls from the Deep		3	4	1
3	Common I -English 3 Issues that Matter		4	5	2
4	Common I- English 4 Savouring the Classics		3	4	2
5	Common I – English 5 Literature and/ as Identity		4	5	3
6	Common I – English 6 Illuminations		4	5	4
7	Additional language –1		4	4	1
	Prose and One Act Plays	Common II - Hindi 1			
	Kathasahithyam	Common II - Malayalam 1			
	Poetry/ Grammar & History of Syriac Language & Literature	Common II –Syriac 1			
8	Additional language –1		4	4	2
	Short stories and Novel	Common II - Hindi 2			
	Kavitha	Common II- Malayalam 2			
	Poetry/ Grammar & History of Syriac Literature	Common II –Syriac 2			
9	Additional Language - 1		4	4	3
	Poetry Grammar and Translation	Common II -Hindi 3			
	Drishyakalasahithyam	Common II-Malayalam 3			
	Prose, Grammar & Literature	Common II- Syriac 3			
10	Additional Language – 1		4	4	4
	Drama and Long Poem	Common II- Hindi 4			
	Malayala Gadyarachanakal	Common II-Malayalam 4			
	Poetry, Grammar & Syriac Heritage in India	Common II- Syriac 4			
Total			**38**		

CORE COURSES

Sl.No	Course Name	Credit	Hrs/Week	Semester
1	Methodology and Perspectives in Physics	2	2	1
2	Mechanics and Properties of Matter	2	2	2
3	Optics, Laser and Fiber Optics	3	3	3
4	Semiconductor Physics	3	3	4
5	Thermal and Statistical physics	3	3	5
6	Classical and Quantum Mechanics	3	3	5
7	Digital Electronics and Programming	3	3	5
8	Environmental Physics and Human Rights	4	4	5
9	Electricity and Electrodynamics	3	3	6
10	Relativity and Spectroscopy	3	4	6
11	Nuclear Particle and Astrophysics	3	3	6
12	Solid State Physics	3	4	6
26	Project and Industrial visit	1	-	6
Total		**36**		

CORE PRACTICAL COURSES

Sl.No	Course Name	Credit	Hrs/W	Semester
1	Mechanics and Properties of Matter 1	1	2	1
2	Mechanics and Properties of Matter 2	1	2	2
3	Optics and Semiconductor Physics 1	1	2	3
4	Optics and Semiconductor Physics 2	1	2	4
5	Electricity, Magnetism and Laser 1	1	2	5
6	Digital Electronics 1	1	2	5
7	Thermal Physics, Spectroscopy and C++ programming 1	1	2	5
8	Acoustics, Photonics and Advanced Semiconductor physics 1	1	2	5
9	Electricity, Magnetism and Laser 2	1	2	6
10	Digital Electronics 2	1	2	6
11	Thermal Physics, Spectroscopy and C++ programming 2	1	2	6
12	Acoustics, Photonics and Advanced Semiconductor physics 2	1	2	6
Total		**12**		

COMPLEMENTARY COURSES

Sl.No	Course Name	Credits	Hrs/W	Semester
1	Complementary I - Descriptive statistics	3	4	1
2	Complementary I - Probability Theory	3	4	2
3	Complementary I - Probability Distribution	4	5	3
4	Complementary I - Statistical Inference	4	5	4
5	Complementary II - Partial Differentiation, Matrices, Trigonometry	3	4	1
6	Complementary II - Integral calculus and Differential Equations	3	4	2
7	Complementary II - Vector Calculus, analytic Geometry and Abstract Algebra	4	5	3
8	Complementary II - Fourier Series, Laplace Transform and Complex Analysis	4	5	4
Total		**28**		

CHOICE BASED OPEN COURSE

Sl.No	Course Name	Credits	Hrs/Wk	Semester
1	Our Universe	**3**	4	5
2	Physics in Daily Life			
3	Computer Hardware and Networking			

CHOICE BASED ELECTIVE COURSE

Sl.No	Course Name	Credits	Hrs/Wk	Semester
1	Information Technology	3	3	6
2	Material Science			
3	Computational Physics			
4	Instrumentation			
5	Astronomy and Astrophysics			

EXTRA CREDIT COURSES

Sl. No	Course Name	Credits
1	Basic Instrumental Skills And Electrical Circuits	2
2	Scientific Computational Physics	2

ADD ON COURSES

Sl. No	Course Name
1	Optics of Photography

DETAILED SYLLABUS OF THE COURSES

Offered by the Department

SEMESTER I				
Course Code	**Title of the Course**	**Course Category**	**Hours/ week**	**Credits**
EN1811501	Fine-tune Your English	Common I - English 1	5	4
EN1811502	Pearls from the Deep	Common I - English 2	4	3
	Additional Language	Common Course	4	4
HN1811501	Prose and One Act Plays	Common II - Hindi 1		
ML1811501	*Kathasahithyam*	Common II - Malayalam 1		
SC1811501	Poetry/ Grammar & History of Syriac Language & Literature	Common II –Syriac 1		
PH1811101	Methodology and Perspectives in Physics	Core 1	2	2
PH1811601	Mechanics and Properties of Matter 1	Core Practical 1	2	1
ST1811201	Descriptive statistics	Complementary I Statistics 1	4	3
MT1811201	Partial Differentiation, Matrices, Trigonometry	Complementary II Mathematics 1	4	3
		Total	**25**	**20**

Course	Details				
Code	**PH1811101**				
Title	**METHODOLOGY AND PERSPECTIVES OF PHYSICS**				
Degree	B.Sc.				
Branch(s)	Physics				
Year/Semester	I/I				
Type	Core				
Credits	2	Hrs/Week	2	Total hours	36

CO No.	*Expected Course Outcomes* *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Evaluate earlier experiments and observations on celestial mechanics, Optics, Electricity and Magnetism	U	1
2	Examine Contributions by the Great Scientists In Physics.	An	2
3	Application of binary numbers in Computers.	Ap	3
4	Application of vectors in Physics.	Ap	3
5	Understand different co-ordinate systems.	U	2
6	Understand different types of errors.	U	2
7	Calculate errors in different computing methods	C	3

PSO-Program Specific outcome; CO-Course Outcome; Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO.No.
1.0	**CONCEPTS AND DEVELOPMENT PHYSICS**		
1.1	Evolution of Celestial mechanics	1	1
1.2	Galileo and his emphasis on experiments and observations, Kepler's laws.	1	1
1.3	Newton's contributions to Mechanics and Optics,	1	1
1.4	Maxwell – Unification of Electricity, Magnetism and Optics, Rayleigh's scattering. Planck's Hypothesis.	1	1
1.5	Quantum concepts- Black body radiation, Photoelectric effect, Compton effect and De Broglie waves.	2	1
1.6	Einstein and his theories of relativity.	1	2
1.7	Contributions by the Great Indian Scientists - S. N. Bose, M. N. Saha, C. V. Raman, Chandrasekhar.(Topics in this part require qualitative study only)	1	2
2.0	**NUMBER SYSTEMS, INTRODUCTORY VECTOR ANALYSIS AND CO-ORDINATE SYSTEMS**		
2.1	Decimal, hexadecimal and Binary Conversions	1	3
2.2	Binary arithmetic addition, subtraction and multiplication.	2	3
2.3	1's and 2's complement subtraction	1	3
2.4	Signed binary numbers	1	3
2.5	Signed binary arithmetic	1	3
2.6	BCD code, ASCII code	1	3
2.7	Significance of binary number system in computers	1	3
2.8	Applications of vectors in Physics	1	4
2.9	Vector operations. Position, Displacement and Separation vectors	1	4
2.10	Transformation of vectors under co-ordinate rotation	1	4
2.11	Differential vector calculus: – The operator ∇	1	4
2.12	Physical significance of Gradient, Divergence and Curl	1	4
2.13	Product rules , Second derivatives	1	4
2.14	Cartesian Co-ordinate system	1	5
2.15	Plane polar and spherical polar coordinates	1	5
2.16	Cylindrical coordinates (Basic ideas with examples in physics)	2	5
3.0	**EXPERIMENTAL METHODS AND ERROR ANALYSIS**		
3.1	Experimental methods	1	6
3.2	Least count of instruments, Length measurement– verniers, screw gauges-travelling microscope	1	6
3.3	Laser range finder- sonar. Angle measurement	1	6
3.4	Spectrometer - scale and telescope- measurement	1	6

	of stellar parallaxes.		
3.5	Electrical measurement - Working principle of voltmeter and ammeter	1	6
3.6	Source of error in measurements, necessity of estimating errors	1	6
3.7	Types of errors- gross error, random error, systematic error.	1	6
3.8	Significant digits, order of magnitude and rounding of numbers, rounding error, absolute and relative errors	1	6
3.9	Errors of computation- addition, subtraction, multiplication, division, error in power and roots	2	7

Text Books for Reference

1. Feynman lectures on Physics,Richard P. Feynman, Robert B. Leighton, and Matthew Sands,Volume I, II and III, Addison-Wesley Pub. Co., 2005
2. Concepts of Modern Physics, ArtherBeisser, VI Ed. McGraw-Hill Publications, 2003
3. Modern Physics, Kenneth S Krane, II Ed.Wiley Publishers, 2012
4. Modern Physics, R Murugeshan, S. Chand Publishing, 2016
5. https://www.nobelprize.org/nobel_prizes/physics/laureates/
6. Introduction to Electrodynamics, David J. Griffiths, Prentice Hall India Pvt. Ltd., Chapter 1
7. Mathematical Physics, Charlie Harper,Hugh D Young, Roger A Freedman, University Physics, 14th edition
8. Digital electronics, Albert Paul Malvino
9. Digital logic and computer design, M. Morris Mano, PHI
10. Advanced course in Practical Physics, D Chattopadhyay
11. Practical Physics, G L Squires, Third edn. Cambridge University Press
12. Instrumentation Devices & Systems, C. S. Rangan, G. R. Sarma, V. S. V. Mani, - McGraw-Hill
13. An Introduction to Error Analysis, The Study of Uncertainties in Physical Measurements, John R. Taylor - Univ. Science Books
14. The theory of Errors in Physical Measurements, J C Pal - New Central Book Agency- 2010

Course	Details				
Code	**PH1811601**				
Title	**MECHANICS AND PROPERTIES OF MATTER 1**				
Degree	BSc				
Branch(s)	Physics				
Year/Semester	I/I				
Type	Core Practical				
Credits	1	Hours/week	2	Total hours	36

CO No.	*Expected Course Outcomes* *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Examine the basic principles of Mechanics	An	1
2	Analyse the measurement methods and rules in conducting experiments	An	3,4
3	Evaluate the properties of matter.	Ev	1

PSO-Program Specific outcome; CO-Course Outcome; Cognitive Level: R-Remember;
U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Section	Course Description	Hrs	CO.No.
	MECHANICS AND PROPERTIES OF MATTER		
1	Symmetric Compound Pendulum – Determination of acceleration due to gravity (g).	2	1
2	Symmetric Compound Pendulum – Determination of radius of gyration(K) and moment of inertia (I).	2	1
3	Torsion Pendulum – Determination of rigidity modulus (n).	2	1
4	Torsion Pendulum – Determination of moment of inertia (I).	2	1
5	Verify the parallel axis theorem using torsional pendulum.	2	1
6	Verify the parallel axis theorem using torsional pendulum.	2	1
7	Measurement of density of a solid –using screw gauge for dimension measurements (mass of the solid given).	2	2
8	Measurement of density of a solid – venire callipers for dimension measurements (mass of the solid given).	2	2
9	Uniform bending – Pin and Microscope – Determination of Young's modulus.	2	3
10	Compare the young's modulus of two materials by uniform bending – Pin and Microscope method.	2	3
11	Uniform bending – Optic Lever – Determination of Young's modulus.	2	3
12	Non Uniform bending – Optic Lever – Determination of Young's modulus	2	3

13	Cantilever – Pin and Microscope – Determination of Young's modulus.	2	3
14	Compare the young's modulus of two materials using a cantilever by Pin and Microscope method.	2	3
15	Vertical oscillations of a spring – Determination of Young's modulus.	2	3
16	One dimensional elastic collision – Hanging sphere method – Law of conservation of energy and momentum.	2	1
17	Determination of radius of a capillary tube using travelling microscope.	2	2
18	Stokes's method – Determination of viscosity of a liquid.	2	3

Text Books for Reference.

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.

SEMESTER II				
Course Code	**Title of the Course**	**Course Category**	**Hours / week**	**Credits**
EN1812503	Issues that Matter	Common I -English 3	5	4
EN1812504	Savouring the Classics	Common I - English 4	4	3
	Additional Language	Common Course	4	4
HN1812503	Short stories and Novel	Common II - Hindi 2		
ML1812504	*Kavitha*	Common II- Malayalam 2		
SC1812503	Poetry/ Grammar & History of Syriac Literature	Common II –Syriac 2		
PH1812102	Mechanics and Properties of Matter	Core 2	2	2
PH1812602	Mechanics and Properties of Matter 2	Core Practical 2	2	1
ST1812203	Probability Theory	Complementary I Statistics 2	4	3
MT1812203	Integral calculus and Differential Equations	Complementary II Mathematics 2	4	3
		Total	25	20

Course	Details				
Code	**PH1812102**				
Title	**MECHANICS AND PROPERTIES OF MATTER**				
Degree	BSc				
Branch(s)	Physics				
Year/Semester	I/II				
Type	Core				
Credits	2	Hours /week	2	Total Hours	36

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Understand superposition of waves.	U	1
2	Analyse the theory of oscillations.	An	3,4
3	Define the basic concepts of angular velocity- angular acceleration- angular momentum.	R	1
4	State parallel and perpendicular axes theorems	R	1
5	Calculate the moment of Inertia of different bodies	C	2
6	Analyse the basic concepts of elasticity	An	2
7	Determine coefficient of viscosity by Poiseuille's method	C	2
8	Evaluate factors affecting surface tension	E	4
9	Examine the basic principles of Mechanics and Properties of Matter	An	1

PSO-Program Specific outcome; CO-Course Outcome; Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO.No.
1.0	**WAVE MOTION AND OSCILLATIONS**		
1.1	General equation of wave motion, plane progressive harmonic wave.	1	1
1.2	Energy density, intensity of a wave,	1	1
1.3	Superposition of waves, beats, transverse waves in stretched strings.	2	1
1.4	Periodic motion, simple harmonic motion and harmonic oscillator.	2	2
1.5	Energy of a harmonic oscillator.	1	2
1.6	Examples of harmonic oscillator – simple and compound pendulum.	2	2
1.7	Theory of damped harmonic oscillator.	1	2
1.8	Theory of forced oscillator, resonance, applications.	2	2
2.0	**ROTATIONAL MECHANICS**		
2.1	Angular velocity- angular acceleration- angular momentum- conservation	1	3
2.2	Torque and moment of inertia	1	9
2.3	Parallel and perpendicular axes theorems	1	4
2.4	Calculation of moment of inertia-rod, ring and disc.	1	5
2.5	Calculation of moment of inertia- cylinder and sphere.	1	5
2.6	Theory of flywheel.	2	9
3.0	**ELASTICITY AND HYDRODYNAMICS**		
3.1	Basic ideas on elasticity – Young's modulus, bulk modulus, rigidity modulus.	1	6
3.2	Poisson's ratio, relations connecting various elastic constants.	1	6
3.3	Work done per unit volume in a strain	1	6
3.4	Bending of beams.	1	6
3.5	Bending moment, flexural rigidity.	1	6
3.6	Young's modulus – uniform bending.	1	6
3.7	Young's modulus –non-uniform bending, cantilever.	1	6
3.8	I –section girders.	1	6
3.9	Determination of rigidity modulus using Static methods	1	6
3.10	Determination of rigidity modulus using Dynamic methods.	1	6
3.11	Streamline and turbulent flows	1	9
3.12	Coefficient of Viscosity – Determination of viscosity by Poiseuille's method.	1	7

3.13	Equation of continuity, energy possessed by a liquid.	1	9
3.14	Bernoulli's theorem.	1	9
3.15	Surface tension, surface energy	1	8
3.16	Excess pressure in a liquid drop and bubble	1	8
3.17	Factors affecting surface tension and its applications	1	8

Text Books for Reference

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

Text Books for Enrichment

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

Course	Details				
Code	**PH1812602**				
Title	**MECHANICS AND PROPERTIES OF MATTER 2**				
Degree	BSc				
Branch(s)	Physics				
Year/Semester	I/II				
Type	Core Practical				
Credits	1	Hours/week	2	Total hours	36

CO No.	*Expected Course Outcomes* *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Examine the basic principles of Mechanics	An	1
2	Analyse the measurement methods and rules in	An	3,4
3	Evaluate the properties of matter.	Ev	1

PSO-Program Specific outcome; CO-Course Outcome; Cognitive Level: R-Remember;

Section	Course Description	Hrs	CO.No.
	MECHANICS AND PROPERTIES OF MATTER		
1	Asymmetric Compound Pendulum – Determination of acceleration due to gravity (g).	2	1
2	Asymmetric Compound Pendulum – Determination of radius of gyration(K) and moment of inertia (I).	2	1
3	Kater's pendulum – Determination of acceleration due to gravity (g)	2	1
4	Comparing the periods of oscillation of two bodies having the same mass and the same body shape, but different dimensions using a torsional pendulum	2	1
5	Torsion Pendulum (Method of equal masses) – Determination of rigidity modulus (n).	2	1
6	Torsion Pendulum (Method of equal masses) – Determination of moment of inertia (I).	2	1
7	Measurement of density of a solid – Sensibility method to find mass using beam balance and screw gauge / vernier callipers for dimension measurements	2	2
8	Non Uniform bending – Pin and Microscope – Determination of Young's modulus.	2	3
9	Compare the young's modulus of two materials by non uniform bending – Pin and Microscope method	2	3
10	Cantilever – Scale and telescope – Determination of Young's modulus	2	3
11	Static Torsion – Determination of rigidity modulus	2	3
12	Comparison of rigidity modulus of two materials by	2	3

	static torsion method.		
13	Flywheel – Determination of moment of inertia.	2	1
14	Flywheel – Determination of radius of gyration where mass of flywheel is given.	2	1
15	Constant pressure head – Determination of viscosity of a liquid	2	3
16	Variable pressure head – Determination of viscosity of a liquid	2	3
17	Capillary rise method – Determination of surface tension	2	3
18	Quincke's method – Determination of surface tension	2	3

Text Books for Reference.

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.

SEMESTER III				
Course Code	**Title of the Course**	**Course Category**	**Hours/ week**	**Credits**
EN1813505	Literature and/ as Identity	Common I-English 5	5	4
	Additional Language	Common Course	5	4
HN1813505	Poetry/Grammar and Translation	Common II -Hindi 3	3	3
ML1813507	*Drishyakalasahithyam*	Common II-Malayalam 3		
SC1813505	Prose, Grammar & Literature	Common II-Syriac 3		
PH1813103	Optics, Laser and Fibre Optics	Core 3		
PH1813603	Optics and Semiconductor Physics 1	Core Practical 3	2	1
ST1813204	Probability Distribution	Complementary I Statistics 3	5	4
MT1813205	Vector Calculus, analytic Geometry and Abstract Algebra	Complementary II Mathematics 3	5	4
		Total	**25**	**20**

Course	Details				
Code	**PH1813103**				
Title	**OPTICS, LASER AND FIBER OPTICS**				
Degree	BSc				
Branch(s)	Physics				
Year/Semester	II/III				
Type	Core				
Credits	3	Hours/week	3	Total hours	54

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Discuss the important and fascinating areas of interference with many experiments associated with it.	U	1
2	Differentiate between Fraunhofer and Fresnel diffraction	An	1
3	Apply skill to find the wavelength of spectral lines using Plane diffraction grating	Ap	2
4	Distinguish the methods of polarisation by reflection, refraction and scattering	U	1
5	Explain the Brewsters law and Malus law	U	2
6	Describe the different types of lasers, its principle, properties of laser beam	U	1
7	Classify the different types of fibre	Ap	3

PSO-Program Specific outcome; CO-Course Outcome; Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO.No.
1.0	**INTERFERENCE OF LIGHT**		
1.1	Review of basic ideas of interference	1	1
1.2	Coherent waves-Optical path and phase change	1	1
1.3	Principle of superposition	1	1
1.4	Theory of interference-intensity distribution	1	1
1.5	Young's double slit experiment	1	1
1.6	Coherence , Conditions for interference	1	1
1.7	Thin films-plane parallel film, interference due to reflected light, conditions for brightness and darkness	1	1
1.8	Interference due to transmitted light	1	1
1.9	Haidinger fringes	1	1
1.10	Interference in wedge shaped film	1	1
1.11	Colours in thin films	1	1
1.12	Newton's rings-applications	1	1
1.13	Michelson interferometer -working	1	1

2.0	**DIFFRACTION AND POLARIZATION**		
2.1	Fresnel Diffraction	1	2
2.2	Huygens- Fresnel theory, zone plate	1	2
2.3	Difference between zone plate and convex lens, comparison between interference and diffraction	1	2
2.4	Diffraction pattern due to a straight edge	1	2
2.5	Diffraction pattern due to a single silt	1	2
2.6	Fraunhoffer diffraction at a single slit	1	2
2.7	Fraunhoffer diffraction at a double slit	1	2
2.8	Fraunhoffer diffraction at N slits	1	2
2.9	Theory of plane transmission grating	1	3
2.10	Dispersive power and resolving power of grating	1	3
2.11	Concept of polarization	1	4
2.12	Plane of polarization, types of polarized light	1	4
2.13	Production of plane polarized light by reflection, refraction	1	4
2.14	Malu's law	1	5
2.15	Polarization by double refraction calcite crystal	1	4
2.16	Anisotropic crystals-optic axis	1	4
2.17	Double refraction-Huygens explanation of double refraction	2	4
2.18	Retarders - Quarter wave plate and Half wave plate	1	4
2.19	Production and Detection of plane	1	4
2.20	Elliptically and circularly polarized light	2	4
3.0	**LASER AND FIBRE OPTICS**		
3.1	Absorption and emission of light	1	6
3.2	Absorption-spontaneous emission and stimulated emission	1	6
3.3	Einstein relations	1	6
3.4	Population inversion, Active medium	1	6
3.5	Pumping, different pumping methods	1	6
3.6	Resonators – plane mirror and confocal resonators, metastable state	2	6
3.7	Three level and Four level Laser systems	1	6
3.8	Semiconductor Laser, Laser beam Characteristics	1	6
3.9	Applications of Laser, Holography (qualitative study only)	1	6
3.10	Propagation of light in a fibre	2	7
3.11	Acceptance angle, numerical aperture	1	7
3.12	V-number	1	7
3.13	Single mode and multimode	1	7
3.14	Step index fibre , graded index fibre	1	7
3.15	Attenuation, application of fibre	1	7
3.16	Optical fibre communication	1	7
3.17	Advantages	1	7

Books for Reference

1. Optics by N.Subramanayam, Brijlal, M.N.Avadhanulu-Chapter 14, 15, 17,18, , and 19
2. Optics by N.Subramanayam, Brijlal, M.N.Avadhanulu-Chapter 20, 22 and 23.

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

Books for Enrichment

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.

Course	Details				
Code	**PH1813603**				
Title	**OPTICS AND SEMICONDUCTOR PHYSICS 1**				
Degree	B.Sc.				
Branch(s)	Physics				
Year/Semester	II/ IV				
Type	Core Practical				
Credits	1	Hours/week	2	Total hours	36

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Demonstrate experiments related to the fields of optics and semiconductorelectronics	Ap	3
2	Analyse the input and output characteristics of various electronic devices	An	3
3	Determine important optical parameters experimentally	E	2
4	Familiarize with different configurations and circuits containing diodes, transistors and rectifiers	U	3

PSO-Program Specific outcome; CO-Course Outcome; Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Section	Description	Hrs	CO.No.
1.1	Liquid Lens – Determination of optical constants of a convex lens using water	2	3
1.2	Liquid Lens – Determination of optical constants of a convex lens using mercury	2	3
1.3	Liquid Lens – Determination of refractive index of a liquid using water	2	3
1.4	Liquid Lens – Determination of refractive index of a liquid using an unknown liquid	2	3
1.5	Spectrometer – Prism – Determination of refractive index of material of the prism	2	3
1.6	Spectrometer – Hollow Prism – Determination of refractive index of liquid	2	3
1.7	Spectrometer – Small angled Prism –Normal incidence- Determination of refractive index of material of the prism	2	3
1.8	Spectrometer – i-d curve – Determination of refractive index of material of the prism	2	3
1.9	Newton’s rings – Determination of wavelength of	2	1

	sodium light		
1.10	The air wedge – Determination of diameter of thin wire	2	1
1.11	Zener characteristics – forward – Study of dynamic and static properties	2	2
1.12	Zener characteristics – reverse – Study of dynamic and static properties	2	2
1.13	Transistor characteristics – Common Emitter configuration	2	2
1.14	Half wave rectifier – Study of ripple factor and load regulation with filter circuit	2	4
1.15	Half wave rectifier – Study of ripple factor and load regulation without filter circuit	2	4
1.16	Full wave rectifier – (center tap) - Study of ripple factor and load regulation with filter circuit	2	4
1.17	Full wave rectifier – (center tap) - Study of ripple factor and load regulation without filter circuit	2	4
1.18	Full wave rectifier – (bridge) - Study of ripple factor and load regulation with filter circuit	2	4

References:

1. B.Sc. Practical Physics, C L Arora, S. Chand & Company Ltd, New Delhi, India,2010.
2. Practical Physics, Harnam Singh,S. Chand Limited, New Delhi, India,2000.
3. Electronics lab Manual Vol 1 & 2, K A Navas.,PHI Learning Pvt. Ltd, New Delhi, India, 2015.
4. A Text Book of Optics, N. Subrahmanyam, Brij Lal, M. N. Avadhanulu,S. Chand Limited, 2015.
5. Optics, AjoyGhatak, Tata McGrawHill Education Pvt. Ltd., New Delhi, India, 2012.

SEMESTER IV				
Course Code	**Title of the Course**	**Course Category**	**Hours / week**	**Credits**
EN1814507	Illuminations	Common I -English 6	5	4
	Additional Language	Common Course	5	4
HN1814506	Drama and Long Poem	Common II- Hindi 4	3	3
ML1814508	*Malayala Gadyarachanakal*	Common II-Malayalam 4		
SC1814506	Poetry, Grammar & Syriac Heritage in India	Common II- Syriac 4		
PH1814104	Semiconductor Physics	Core 4		
PH1814604	Optics and Semiconductor Physics 2	Core Practical 4	2	1
ST1814206	Statistical Inference	Complementary I Statistics 4	5	4
MT1814206	Fourier Series, Laplace Transform and Complex Analysis	Complementary II Mathematics 4	5	4
		Total	**25**	**20**

Course	Details				
Code	**PH1814104**				
Title	**SEMICONDUCTOR PHYSICS**				
Degree	B.Sc.				
Branch(s)	Physics				
Year/Semester	II/IV				
Type	Core				
Credits	3	Hours/week	3	Total Hours	54

CO No.	*Expected Course Outcomes* *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Discuss basic idea of doping , p-n junction diode and its V-I characteristics using graphical and mathematical methods	U	1
2	Explain wave shaping circuits and voltage multipliers in electronics and its responses	U	1
3	Illustrate various biasing circuits of a transistor	Ap	2
4	Analyse various transistor amplifier circuits	An	2
5	Design simple oscillator circuits	C	3
6	Apply the concept of feedback in operational amplifiers	Ap	3
7	identify the need for modulation with AM techniques in detail	E	1

PSO-Program Specific outcome; CO-Course Outcome; Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO.No.
1.0	**SEMICONDUCTING DIODES AND APPLICATIONS**		
1.1	PN Junction, Depletion layer, Barrier potential, Biasing-forward and reverse, Reverse breakdown	1	1
1.2	Junction capacitance and diffusion capacitance- PN Junction diode – V-I characteristics–Diode parameters	1	1
1.3	Diode current Equation, Ideal diode, Thermistors	1	1
1.4	Zener diode and its reverse characteristics.	1	1
1.5	Rectification - Half wave,Full wave-Centre tapped	2	1
1.6	Full wave- Bridge rectifier circuits - Nature of rectified output, Efficiency & Ripple factor	2	1
1.7	Filter circuits – Inductor Filter, Capacitor Filter, LC Filter, πFilter	2	2
1.8	Regulated Power supplies - Zener diode voltage regulator	1	2
1.9	Voltage multipliers – Doubler& Tripler	1	2

1.10	Wave shaping circuits - Clipper-Positive, negative and biased – Clampers- Positive, negative and biased.	2	2
2.0	**TRANSISTORS CONFIGURATIONS AND FEED BACK , AMPLIFIERS AND OSCILLATORS**		
2.1	Bipolar junction transistors, Transistor biasing	1	3
2.2	CB, CC, CE configurations and their characteristics- Active, saturation and cut-off regions	3	3
2.3	Current gain α, β, γ and their relationships	1	3
2.4	Leakage currents- Thermal runaway	1	3
2.5	DC operating point and AC and DC Load line, Q-Point	2	3
2.6	Basic principles of feedback, positive & negative feedback	2	3
2.7	Advantages of negative feedback	1	3
2.8	negative feedback circuits – voltage series & shunt, current series & shunt	1	3
2.9	Need for biasing-Stabilization	1	3
2.10	Voltage divider bias	2	4
2.11	Single stage transistor Amplifiers-CE amplifier	2	4
2.12	Amplification factors. Decibel system, Variations in Amplifier gain with frequency	1	4
2.13	Oscillatory Circuits	1	5
2.14	LC oscillators	1	5
2.15	Hartley Oscillator	1	5
2.16	Colpit's Oscillator	1	5
2.17	RC oscillators -Phase shift Oscillator	1	5
2.18	Astable and monostablemultivibrator (basic idea only)	1	5
3.0	**FET, OPERATIONAL AMPLIFIER & MODULATION**		
3.1	FET -characteristics, FET- Parameters	2	3
3.2	Comparison between FET and BJT.MOSFET(basic idea only)	1	3
3.3	OP-amp- Symbol and terminals	1	6
3.4	Characteristics of ideal OP-amp, CMRR	2	6
3.5	Inverting OP-amp	1	6
3.6	Non-inverting OP-amp	1	6
3.7	Unity follower, Summing amplifiers	1	6
3.8	Types of modulation – AM, FM, Pulse modulation and Phase modulation (qualitative study only)	2	7
3.9	Amplitude modulation- modulation index	1	7
3.10	Analysis of AM wave-– Sidebands–bandwidth	3	7
3.11	AM Demodulation	1	7

Text Books for Reference

1. Basic Electronics, B.L.Theraja,S.chand& Company
2. A Text Book of Applied Electronics,R.S.Sedha ,S.chand& Company

Text Books for Enrichment

1. ,Principles of electronics,VK Mehta,S.chand& Company
2. Basic Electronics, 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, PrenticeHall
6. Basic Electronics, DebashisDe , Pearson
7. Basic Electronics, SantiramKal, PHI

Course	Details				
Code	**PH1814604**				
Title	**OPTICS AND SEMICONDUCTOR PHYSICS 2**				
Degree	B.Sc.				
Branch(s)	Physics				
Year/Semester	II/ IV				
Type	Core Practical				
Credits	1	Hours/week	2	Total hours	36

CO No.	*Expected Course Outcomes* *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Apply the theoretical concepts of semiconductor physics	Ap	3
2	Analyse the input and output characteristics of various electronic devices	An	3
3	Determine important transistor parameters experimentally	E	2
4	Familiarize with different configurations and circuits containing diodes, transistors and rectifiers	U	3

PSO-Program Specific outcome; CO-Course Outcome; Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Section	Description	Hrs	CO.No.
1.1	Full wave rectifier – (bridge) - Study of ripple factor and load regulation without filter circuit	2	1,2
1.2	FET – characteristics	2	1
1.3	FET – Determination of parameters	2	3
1.4	Voltage regulator using zener diode – Study of line regulation	2	2
1.5	Voltage regulator using zener diode – Study of load regulation	2	2
1.6	Clippers – positive – Study of output waveforms	2	2
1.7	Clippers – negative – Study of output waveforms	2	2
1.8	Clippers – biased – Study of output waveforms	2	2
1.9	Clampers – positive – Study of output waveforms	2	2
1.10	Clampers – negative – Study of output waveforms	2	2
1.11	Clampers – biased – Study of output waveforms	2	2
1.12	OP AMP characteristics- Study of CMRR	2	3
1.13	OP AMP characteristics- Study of open loop gain	2	1,4
1.14	OP AMP – inverter - Study of gain	2	1,4
1.15	OP AMP – non-inverter - Study of gain	2	1,4
1.16	OP AMP – buffer- Study of gain	2	1,4
1.17	LC Oscillator – Colpit's/ Hartley – using transistor	2	4
1.18	Phase Shift Oscillator - using transistor	2	4

References:

1. B.Sc. Practical Physics, C L Arora, S. Chand & Company Ltd, New Delhi, India, 2010.
2. Practical Physics, Harnam Singh, S. Chand Limited, New Delhi, India, 2000.
3. Electronics lab Manual Vol 1 & 2, K A Navas., PHI Learning Pvt. Ltd, New Delhi, India, 2015.
4. A Text Book of Optics, N. Subrahmanyam, Brij Lal, M. N. Avadhanulu,S. Chand Limited, 2015.
5. Optics, AjoyGhatak, Tata McGrawHill Education Pvt. Ltd., New Delhi, India, 2012.

SEMESTER V				
Course Code	**Title of the Course**	**Course Category**	**Hours / week**	**Credits**
PH1815105	Thermal and Statistical physics	Core 5	3	3
PH1815106	Classical and Quantum Mechanics	Core 6	3	3
PH1815107	Digital Electronics and Programming	Core 7	3	3
PH1815108	Environmental Physics and Human Rights	Core 8	4	4
PH1815605	Electricity, Magnetism and Laser 1	Core Practical 5	2	1
PH1815606	Digital Electronics 1	Core Practical 6	2	1
PH1815607	Thermal Physics, Spectroscopy and C++ programming 1	Core Practical 7	2	1
PH1815608	Acoustics, Photonics and Advanced Semiconductor physics 1	Core Practical 8	2	1
PH1815401	Our Universe	Open Course	4	3
PH1815402	Physics in Daily Life			
PH1815403	Computer Hardware and Networking			
		Total	**25**	**20**

Course	Details				
Code	**PH1815105**				
Title	**THERMAL AND STATISTICAL PHYSICS**				
Degree	B.Sc.				
Branch(s)	Physics				
Year/Semester	III/V				
Type	Core				
Credits	3	Hours/week	3	Total Hours	54

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	State the laws of thermodynamics.	R	1
2`	Describe the working of heat engines such as Carnot engine,Petrol engine,Diesel engine.	U	5
3	Define the concept of entropy and explain its physical significance.	R	2
4	Explain Lees Disc experiment and can calculate the thermal conductivity by experimentally also	U	1,5
5	Derive Maxwells thermodynamic relations	Ap	2
6	Explain the significance of Clausius-Clapeyron equation	U	1
7	Explain fundamental concepts of statistical mechanics	U	1
8	Compute the thermodynamics of an ideal monoatomic gas.	Ap	2
9	Derive Maxwell-Boltzmann,Bose-Einstien and Fermi-Dirac distribution laws and compare the laws.	Ap	2

PSO-Program Specific outcome; CO-Course Outcome; Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO.No.
1.0	**LAWS OF THERMODYNAMICS AND HEAT ENGINES**		
1.1	Thermodynamic system, surroundings, variables, thermal equilibrium	1	1
1.2	Zeroth law, thermodynamic equilibrium, thermodynamic processes,	2	1
1.3	Reversible and irreversible processes, equation of state	1	1
1.4	Expansivity and Compressibility	1	1
1.5	Internal energy, heat, work, cyclic processes	1	1
1.6	First law, heat capacity, energy equation	2	1
1.7	Difference of specific heat capacities	1	1
1.8	Indicator diagram, work done in reversible isothermal expansion of ideal gas	2	1
1.9	Work done in reversible adiabatic expansion of ideal gas.	1	1
1.10	Second law statement, heat engine, efficiency.	1	2

1.11	Carnot's ideal heat engine, work done by the engine per cycle, reversibility	2	2
1.12	Carnot refrigerator, heat pump, Carnot theorem	2	2
1.13	Absolute scale of temperature	1	2
1.14	Third law of thermodynamics	1	1
2.0	**ENTROPY,THERMODYNAMIC RELATIONS, CONDUCTION AND RADIATION**		
2.1	Definition of entropy, principle of increase of entropy,	1	3
2.2	Entropy and unavailable energy, change in entropy in heat conduction	1	3
2.3	Change in entropy in reversible and irreversible process,	1	3
2.4	Efficiency of Carnot cycle from TS diagram	2	3
2.5	Entropy of an ideal gas, entropy and disorder.	1	3
2.6	Maxwell's thermodynamic relations	2	5
2.7	TdS equations	1	3
2.8	Energy equation, heat capacity equations	2	3
2.9	Thermodynamic functions	1	5
2.10	ClausiusClapeyron latent heat equation.	2	6
2.11	Conduction, thermal conductivity.	1	4
2.12	Thermal conductivity of bad conductor Lee's disc experiment -thermal resistance	1	4
2.13	Thermal radiation and its properties, fundamental definitions of energy flux, intensity and radiant emittance	1	4
2.14	Stefan's law, Stefan-Boltzmann law	1	4
3.0	**STATISTICAL MECHANICS AND STATISTICAL DISTRIBUTIONS**		
3.1	Microstates and macrostates	1	7
3.2	Thermodynamic probability , density of states	1	7
3.3	Phase Space	1	7
3.4	Principle of equal a priori probability	1	7
3.5	Concept of entropy and thermodynamic probability, ensembles.	1	7
3.6	Classical Statistics:Maxwell Boltzmann Distribution law and its distribution laws.	3	9
3.7	Thermodynamics of an ideal monoatomic gas	3	8
3.8	Gibbs Paradox	1	8
3.9	Quantum Statistics:Need of quantum statistics	1	9
3.10	Fermi-Dirac Statistics - Distribution laws	2	9
3.11	Bose-Einstein statistics – Distribution laws	2	9

Text Books for Study

1. Thermodynamics and Statistical physics BrijLal, N.Subrahmanyam and P S Hemne, S. Chand &Co,

Text book forReference:

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. Thermal and Statistical Physics, R.B. Singh.
5. Berkeley Physics Course Volume 5; Statistical Physics; Frederick Reif. McGraw Hill.
6. Statistical Mechanics, R.K. Pathria, Pergamon press, Oxford

Course	Details				
Code	**PH1815106**				
Title	**CLASSICAL AND QUANTUM MECHANICS**				
Degree	B.Sc.				
Branch(s)	Physics				
Year/Semester	III/V				
Type	Core				
Credits	3	Hours/week	3	Total Hours	54

CO No.	*Expected Course Outcomes* *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Identify the various types of constraints involved in motion of a system.	U	1
2	Apply concept of constraints to represent certain dynamics.	Ap	1
3	Solve problems in classical dynamics,quantum mechanics	Ap	2
4	Explain quantum mechanical phenomena such as photoelectric effect and Compton effect.	An	1
5	Explain how the wave nature of particle leads to the understanding of quantum mechanics.	U	1
6	Apply general formalism of quantum mechanics to various problems.	Ap	5
7	To analyze quantum mechanical system by finding eigenvalues and eigenvectors.	Ap	2
8	Define the probability density and the probability current density	U	1
9	Compute the Ehrenfest theorem and its extension to three dimensions	Ap	2
10	Solve the Schrodinger equation for a particle in a box and square potential barrier	Ap	2

PSO-Program Specific outcome; CO-Course Outcome; Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO.No.
1.0	**LAGRANGIAN AND HAMILTONIAN FORMULATIONS OF CLASSICAL MECHANICS**		
1.1	Constraints, degrees of freedom and generalized co-ordinates	1	1
1.2	Principle of virtual work and D'Alembert's principle	2	2
1.3	Lagrange's equations (no derivation)	1	3
1.4	Application of Lagrangian (Linear Harmonic oscillator and Planetary motion only	2	3
1.5	Hamilton's Canonical equations of motion and Advantages of Hamilton's method	2	3
1.6	Applications of Hamilton's method -Linear Harmonic oscillator	1	3
1.7	Applications of Hamilton's method -Planetary motion	1	3
1.8	Hamilton's Principle of Least Action.	1	3
1.9	Derivation of Lagrange's equation from Hamilton's Principle	1	3

2.0	**ORIGIN OF QUANTUM THEORY, WAVE NATURE OF PARTICLES AND GENERAL FORMALISM OF QUANTUM MECHANICS**		
2.1	Limitations of classical physics- Black Body radiation	1	4
2.2	Optical spectra, Photoelectric effect, specific heat of solids.	1	4
2.3	Planck's radiation law	1	4
2.4	Einstein's explanation of photoelectric effect	1	4
2.5	Compton effect, Quantum theory of specific heat	1	4
2.6	Bohr's model of hydrogen atom, Stern- Gerlach Experiment.	1	4
2.7	De Broglie hypothesis, Davisson-Germer Experiment	1	5
2.8	Statement of uncertainty principle and its illustrations	1	5
2.9	Wave packet, Group and phase velocities.	1	5
2.10	Linear vector space- Hilbert space	3	6
2.11	Orthogonality- Linear operator- Hermitian operator	3	6
2.12	Eigen functions and eigen values	3	7
2.13	Postulates of Quantum Mechanics- wave function, Operators, Expectation value, Eigen value	4	7
2.14	Time development- Simultaneous measurability	2	6
3.0	**SCHRÖDINGER EQUATION AND ITS APPLICATIONS**		
3.1	Time dependent Schrödinger equation	1	6
3.2	Interpretation of wave function and Probability density	1	6
3.3	Probability current density, Ehrenfest theorem	2	8
3.4	Ehrenfest theorem Extension to three dimensions	2	8
3.5	Time independent Schrödinger equation- Stationary states	1	10
3.6	Admissibility conditions of wave function- general properties of one dimensional Schrödinger equation.	2	6
3.7	Particle in a box	3	10
3.8	Square potential barrier	3	10

Text Books for Study

1. Classical Mechanics , J.C. Upadhyaya
2. Classical Mechanics , G. Aruldhas
3. Modern Physics – R. Murugesan

Text Books for Reference

1. Concepts of Modern Physics- Arthur Beiser, TMH
2. Classical Mechanics-Takwale and Puranik, TMH.
3. Classical mechanics- K.SankaraRao, PHI.
4. Introductory Quantum Mechanics- RI Liboff, Pearson
5. Quantum Physics- Gasiorowicz, John Wiely
6. Quantum Mechanics- Griffith, Pearson

Course	Details				
Code	**PH1815107**				
Title	DIGITAL ELECTRONICS AND PROGRAMMING				
Degree	B.Sc.				
Branch(s)	Physics				
Year/Semester	III/IV				
Type	Core				
Credits	3	Hours/week	3	Total Hours	54

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Explain the basic logic operations of NOT, AND, OR, NAND, NOR, and XOR gates	U	1
2	Describe the functionality and applications of logic circuits	U	1
3	Simplify circuits and Boolean expressions using the Boolean laws	Ap	3
4	Explain the logic behind the operation of registers and counters	U	2
5	Design basic combinational andsequential logic circuits.	C	4
6	Use the methods of systematic reduction of Boolean algebra expressions including Karnaugh maps	Ap	3
7	Outline the basic concepts of OOPs	U	1
8	List out the tokens used in C++ programming language	R	1
9	Explain aboutconditional statements and loops	U	1
10	Discuss the concept of object and classes	U	2
11	Design OOPs concepts through C++ programs for solving simple problems (sorting, matrix multiplication, Prime number, etc.)	C	2

PSO-Program Specific outcome; CO-Course Outcome; Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO.No.
1.0	**Boolean algebra and logic gates**		
1.1	Basic gates NOT, OR, AND	0.5	1
1.2	Universal Logic Gates- NOR, NAND	0.5	1
1.3	XOR and XNOR Gates	0.5	1
1.4	Rules and Laws of Boolean algebra	0.5	2
1.5	Duality theorem	0.5	2
1.6	De Morgan's Theorems	0.5	2
1.7	Analysis and simplification of logic circuits	0.5	2,5
1.8	Boolean equation and truth table	0.5	2
1.9	SOP and POS	0.5	2
1.10	Minterms and Maxterms	0.5	3
1.11	Standard SOP and Standard POS	1	3
1.12	Conversion between Standard SOP & Standard POS	1	3
1.13	Karnaugh Map (up to four variables)	1	3
1.14	K map SOP minimization	1	6
2.0	**Combinational logic and Sequential logic**		
2.1	Half Adder and Full Adder	1	5
2.2	Half and Full subtractor	1	5
2.3	4-bit parallel Adder/Subtractor	1	5
2.4	Multiplexer	1	5
2.5	De-multiplexer	1	5
2.6	Encoder	0.5	5
2.7	Decoder	0.5	3
2.8	Flip-flops	0.5	3
2.9	RS FF	1	2
2.10	Clocked RS FF	1	2
2.11	Master Slave JK FF	1	2
2.12	T Flip-flop	1	2
2.13	DFF	1	2
2.14	Buffer registers	1	6
2.15	Shift register	1	6
2.16	SISO and SIPO	2	6
2.17	Counters- Binary ripple counter	1.5	6
2.18	D/A converters (Ladder type)	1	6
2.19	A/D Converter (Counter type)	1	6
3.0	**Programming in C++**		
3.1	Basic C++ program structure	1	7
3.2	Comments	1	7
3.3	Data types	2	8
3.4	Variable types	2	8
3.5	Constants	2	8
3.6	Operators(arithmetic, relational, logical and assignment operators)	2	8

3.7	If, if-else and else if, do while	2	9
3.8	Case – loops(while, do-while, and for)	2	9
3.9	Nested loops	1	9
3.10	Arrays(Defining Arrays, Accessing Array Elements, Initializing Arrays)	3	9
3.11	Basic ideas of functions(qualitative idea)	3	9
3.12	Object and classes	2	10
3.13	Programs using loops	3	11

Text Books for Reference

1., Digital fundamentals, Thomas l. Floyd PearsonEducationInc., New Jersey, 2006.
2. Digital Principles and Applications ,D. P. Leach, A. P. Malvino and G. Saha, ,
3. Tata McGraw Hill Education Private limited, New Delhi, 2011.
4. Digital Electronics S. Salivahanan and S. Arivazhagan, , VIKAS Publishing Ltd., Noida, 2011.
5. Digital Design,Morris Mano and M. D. Ciletti, Pearson, New York, 2013.
6. Object Oriented Programming With C++, E. Balagurusamy, Tata McGraw-
7. Hill Education, New Delhi, 2008.

Text Books for Enrichment

1 Digital Logic and Computer Design ,M. Morris Mano , Pearson, New York, 2016.
2 Digital Electronics, William H Gothmann, Prentice Hall, New Delhi, 1982.
3 Digital Circuits and Design, S.Salivahanan and S. Pravin Kumar, Vikas Publishing House, Noida,2012.
4 A Textbook of Digital Electronics, R S Sedha, S. Chand Publishing, New Delhi, 2013.
5 Digital Computer Electronics, A. P. Malvinoand J.A. Brown, McGraw-Hill Higher Education, New Delhi, 2001.
6 Object Oriented Programming in Turbo C++, Robert Lafore, Galgotia Publications Pvt Ltd, New Delhi, 1991.

Course	Details				
Code	**PH1815108**				
Title	**ENVIRONMENTAL PHYSICS AND HUMAN RIGHTS**				
Degree	B. Sc				
Branch(s)	Physics				
Year/Semester	III/ V				
Type	Core				
Credits	4	Hours/week	4	Total Hours	72

CO No.	*Expected Course Outcomes* *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Identify various types of natural resources, human impact on these resources, and common resource management practices	R	1
2	Develop skills and a commitment to act independently and collectively to sustain and enrich the environment.	U	1
3	Understand the multidisciplinary nature, important theories and concepts of environmental science, ecosystems, natural resources and conservation	U	1
4	Describe environmental hazards and risks and the social and economic ramifications	E	1
5	Familiarize with the major environmental problems its causes and potential solutions	U	1
6	Explain Non-renewable energy sources:-Coal, Oil, Natural gas; Nuclear fission energy; Merits and demerits of non-renewable energy and different Renewable energy sources	Ap	1
7	Identify the environmental aspects of solar energy resources. In Comparison with various conventional energy systems, their prospects and limitations.	An	1
8	Identify issues and problems relating to the human rights.	U	1
9	Analyse country's situation or international situation in terms of human rights.	An	1
10	Create awareness on various environmental acts in India	C	1

Module	Course Description	Hrs	CO.No.
1.0	**Module I**		
1.1	**Multidisciplinary nature of environmental studies** Definition, scope and importance. Need for public awareness	2	3
1.2	**Natural Resources and associate problems -** Introduction, renewable and non-renewable resources	1	1,3
1.2.1	**Forest resources**: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.	1	1
1.2.2	**Water resources:** Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.	1	1
1.2.3	**Mineral resources:** Use and exploitation, environmental effects of extracting and using mineral resources, case studies.	2	1
1.2.4	**Food resources:** World food problems, changes caused by agriculture and over grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.	2	1
1.2.5	**Energy resources:** Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, case studies.	1	1
1.2.6	**Land resources:** Land as a resource, land degradation, man induced landslides, soil erosion and desertification	1	1
1.2.7	Role of individual in conservation of natural resources. Equitable use of resources for sustainable life styles	1	2
1.3	**Ecosystems** - Concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in the ecosystem	1	3
1.3.1	Food chains, food webs and ecological pyramids. Ecological succession, climax community	1	3
1.3.2	Introduction, types, characteristic features, structure and function of the given ecosystem- Forest ecosystem, grassland, desert	1	3
1.3.3	Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries.	1	3
1.3.4	Concept of limiting factors- Liebig's and Shelford's laws of limiting factors. Biogeochemical cycles- concept.	1	3
1.3.5	Gaseous and sedimentary cycles, carbon cycle, nitrogen cycle	1	3
2.0	**Module 2**		
2.1.1	**Biodiversity and its conservation-** Introduction to biodiversity: Types of biodiversity- Alpha, beta and gamma diversity. Concept and importance of biodiversity.	1	3
2.12	Biogeograhical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values	1	4
2.13	Biodiversity at global and local levels, India as a mega-diversity nation	1	3
2.14	Wild life conservation in India	1	3

2.15	Hot-spots of biodiversity	1	3
2.16	Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India.	1	5
2.17	Conservation of biodiversity: In situ and Ex situ conservation of biodiversity	1	1
2.18	Conservation of indigenous cattle breeds of India (any 4)	1	1
2.2.1	**Pollution and social issues:** Introduction and types of pollution	1	4,5
2.2.2	Causes, effects and control measures of: - Air pollution**,** Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards and Municipal solid waste	3	4,5
2.2.3	Pollution case studies (Local and National). Role of an individual in prevention of pollution.	2	4,5
2.2.4	Disaster management: floods, earthquake, cyclone and landslides.	2	4,5
2.2.5	Environmental ethics: Consumerism, sustainable development	1	2
2.2.6	Water conservation, rain water harvesting, watershed management: its problems and concerns. Ramsar sites in Kerala	2	5,2
2.2.7	Climate change, global warming	1	5
2.2.8	Acid rain, ozone layer depletion	1	5
2.2.9	Environment Protection Act (1986) Air (Prevention and Control of Pollution) Act (1981)	2	8
2.2.10	Water (Prevention and control of Pollution) Act (1974), Wildlife Protection Act (1972).	1	8
2.2.11	Forest Conservation Act (1980). Issues involved in enforcement of environmental legislation. Biodiversity Act (2002)	2	8
3.0	**Non-renewable and Renewable Energy Sources**		
3.1	Non-renewable energy sources:-Coal, Oil, Natural gas; Nuclear fission energy; Merits and demerits of non-renewable energy.	3	6
3.2	Renewable energy sources: Biomass energy- Biogas plant - Fixed dome type and moving dome type	3	6
3.3	Wind energy; Wave energy; Tidal energy;	2	6
3.4	Hydroelectricity; Geothermal energy conversion;	1	6
3.5	Ocean thermal energy conversion;	1	6
3.6	Fusion energy; Hydrogen energy- Production (electrolysis) and storage; Merits and demerits of each renewable energy sources;	1	6
3.7	Storage of intermittently generated renewable energy (qualitative)	1	6
4.0	**Solar energy**		
4.1	Sun as a source of energy- Solar radiation, Solar Constant, Spectral distribution;	1	7
4.2	Solar pond - Convective and salt gradient types;.	1	7
4.3	Flat plate collector; Solar water heater - Direct and indirect systems- Passive and active systems;	1	7
4.4	Optical concentrator - Parabolic trough reflector - Mirror strip reflector - Fresnel lens collector;		7
4.5	Solar desalination; Solar dryer - Direct and indirect type;	2	7

	Solar cooker; Solar heating of buildings;		
4.6	Solar green houses; Need and characteristics of photovoltaic (PV) systems;	2	7
4.7	Solar cells - Principle, Equivalent circuits,	2	7
4.8	V-I characteristics, fill factor, conversion efficiency;	1	7
4.9	PV Sun tracking systems; Merits and demerits of solar energy	1	7
5.0	**Human Rights**		
5.1	An introduction to human rights, meaning, concept and development.	1	8
5.2	Three Generations of human rights (civil and political rights; economic, social and cultural rights).	1	8
5.3	Human Rights and United Nations Contributions, main human rights related organizations- UNESCO, UNICEF, WHO, ILO	1	8
5.4	Mechanisms for checking violations of Human rights, National human right commission	1	8,9
5.5	Human rights in India – fundamental rights and Indian constitution, rights for children and women, Euthanasia, scheduled castes, scheduled tribes, other backward castes and minorities	2	8,9

Text Books for Reference

1. BharuchaErach, Text Book of Environmental Studies for undergraduate Courses. University Press, IInd Edition 2013 (TB)
2. Clark.R.S., Marine Pollution, Clanderson Press Oxford (Ref)
3. Cunningham, W.P.Cooper, T.H.Gorhani, E & Hepworth, M.T.2001 Environmental Encyclopedia, Jaico Publ. House. Mumbai.1196p .(Ref)
4. Dc A.K.Enviornmental Chemistry, Wiley Eastern Ltd.(Ref)
5. Down to Earth, Centre for Science and Environment (Ref)
6. Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment, Cambridge University Press 1140pb (Ref)
7. Jadhav.H&Bhosale.V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p (Ref)
8. Mekinney, M.L &Schock.R.M. 1996 Environmental Science Systems & Solutions. Web enhanced edition 639p (Ref)
9. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. (TB)
10. Odum.E.P 1971. Fundamentals of Ecology. W.B. Saunders Co. USA 574p (Ref)
11. Rao.M.N&Datta.A.K. 1987 Waste Water treatment Oxford & IBII Publication Co.Pvt.Ltd.345p (Ref)
12. Rajagopalan. R, Environmental Studies from crisis and cure, Oxford University Press, Published: 2016 (TB)
13. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut (Ref)
14. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (Ref)

15. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Stadards, Vol I and II, Enviro Media (Ref)
16. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (Ref)
17. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p (Ref) (M) Magazine (R) Reference (TB) Textbook
18. Renewable Energy Sources and Emerging Technologies: Edition 2, D.P. Kothari K. C. Singal Rakesh Ranjan - PHI Learning Pvt. Ltd, 2011.
19. Solar energy - M P Agarwal - S Chand and Co. Ltd.
20. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.
21. Amartya Sen, The Idea Justice, New Delhi: Penguin Books, 2009.
22. Chatrath, K. J.S., (ed.), Education for Human Rights and Democracy (Shimla: Indian Institute of Advanced Studies, 1998)
23. Law Relating to Human Rights, Asia Law House, 2001.
24. Shireesh Pal Singh, Human Rights Education in 21st Century, Discovery Publishing House Pvt.Ltd, New Delhi,
25. S.K.Khanna, Children andthe Human Rights, Common Wealth Publishers, 1998. 2011.
26. Sudhir Kapoor, Human Rights in 21st Century, Mangal Deep Publications, Jaipur, 2001.
27. United Nations Development Programme, Human Development Report 2004: Cultural Liberty in Today's Diverse World, New Delhi: Oxford University Press, 2004

Course	Details				
Code	**PH1815605**				
Title	**ELECTRICITY, MAGNETISM AND LASER 1**				
Degree	B.Sc.				
Branch(s)	Physics				
Year/Semester	III/V				
Type	Core practical				
Credits	1	Hours/week	2	Total hrs	36

CO No.	*Expected Course Outcomes* *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Analyse the electrical parameters	E	3
2	Apply the theoretical concepts of magnetism	Ap	1
3	Determine the optical properties and laser parameters	E	1
4	Construct and verify various electronic circuits	C	4

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Section	Course Description	Hrs	CO.No.
1.0	Potentiometer – Measurement of resistance of wire	2	1
1.1	Potentiometer – Calibration of low range voltmeter	2	4
1.2	Potentiometer – Calibration of high range voltmeter	2	4
1.3	Laser – Grating – Determination of wavelength	2	3
1.4	Tangent galvanometer – Calibration of ammeter	2	4
1.5	Tangent galvanometer – reduction factor	2	4
1.6	Potentiometer – Measurement of resistance of wire	2	1
1.7	Moving coil galvanometer – determine the resistance of the galvanometer	2	1
1.8	Moving coil galvanometer – figure of merit	2	1
1.9	Conversion of galvanometer into voltmeter- determine the internal resistance and galvanometer current	2	1
1.10	Conversion of galvanometer into voltmeter- determine the series	2	1
1.11	Conversion of galvanometer into ammeter- determine the shunt resistance	2	1
1.12	Conversion of galvanometer into ammeter-using known resistance	2	1
1.13	Field along the axis of a circular coil – m	2	2
1.14	Field along the axis of a circular coil – Bh	2	2
1.15	Searle's vibration magnetometer – magnetic moment by Tan A position	2	2

1.16	Searle's vibration magnetometer – magnetic moment by Tan B position	2	2
1.17	Deflection and vibration magnetometer – m	2	2
1.18	Deflection and vibration magnetometer – Bh	2	2

.

Books for Reference

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

Course	Details				
Code	**PH1815606**				
Title	DIGITAL ELECTRONICS 1				
Degree	B.Sc.				
Branch(s)	Physics				
Year/Semester	III/5				
Type	Core Practical				
Credits	1	Hours/week	2	Total hours	36

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Examine the performance of logic gates using IC's and discrete components and to measure the output	Ap	3
2	Verify D'morgan's theorems using logic Gates	E	3
3	Analyse the working of 7 segment display with BCD input and BCD with decimal input	An	3
4	Design circuits for digital arithmetic	C	3,4
5	Verify the working of flip flop, Counters, shift registers, Multivibrators, encoders, MUX and DeMUX	E	3
6	Design and explain the Analog to Digital conversion operation and vice versa.	C	3,4
7	Compare sine wave, square wave and triangular wave generator using IC 741	C	3,4

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Section	Course Description	Hrs	CO.No.
1	Realization of logic gates – AND, OR and NOT – Using diodes, transistors etc.	2	1
2	Verification of truth table of NAND, NOR, XOR and XNOR gates	2	1
3	BCD to 7 segment decoder	2	3
4	Realization of Half adder using gates – Verification of truth table	2	4
5	Astable Multivibrator using Transistor	2	5
6	Astable Multivibrator using IC 555	2	5
7	D/A converter using IC 741 – Using binary weighed resistor / R – 2R ladder type	2	6
8	A/D converter using IC 741	2	6
9	SR Flip Flops using IC 7400 – Verification of truth table	2	5
10	Digital counter using IC 7490 / 7495 / 74194 / 74151 –	2	5

	Verification of truth table		
11	Schmitt trigger using IC 741	2	5
12	Multiplexer using gates	2	5
13	Shift register – SISO	2	5
14	Sine wave generator using IC 741	2	7
15	Square wave generator using IC 741	2	7
16	Triangular wave generator using IC 741	2	7
17	Realization of Full Adder	2	4
18	Johnson Counter using IC7476	2	2

Text Books for Reference

1. Abraham Michelen, Digital Electronics Laboratory Manuel, Prentice Hall, New Delhi, 2000.
2. Vance Venable, Michael Wiesner, Laboratory Manuel, Digital Electronics, Prentice Hall, New Delhi, 2005.
3. D. Chattopadhyay, P.C. Rakshit, B. Saha, Advanced courses in practical physics, Books and Allied. Ltd., Calcutta, 2005.
4. Geeta Sanon, BSc Practical Physics, 1st Edition, Chand & Co., New Delhi, 2007.
5. K. A. Navas, Electronics Lab Manual, Volume I, PHI, 5th Edition, 2015.

Course	Details				
Code	**PH1811607**				
Title	**THERMAL PHYSICS, SPECTROSCOPY AND C++ PROGRAMMING 1**				
Degree	B.Sc.				
Branch(s)	Physics				
Year/Semester	III/V				
Type	Core practical				
Credits	1	Hours/week	2	Total hrs	36

CO No.	*Expected Course Outcomes* *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Construct various experimental set ups to study the different thermal properties	C	5
2	Determine the e/k of a transistor and chemical equivalent of copper	Ap	4
3	Determine the various optical parameters of prism and grating using spectrometer	Ap	4
4	Design and study the output of various c++ programs	C	5
5	Construct amplitude modulated wave and study its properties	C	5

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Section	Course Description	Hrs	CO.No.
1.1	Thermistor – Resistance - Temperature characteristics and temperature co-efficient of resistance.	2	1
1.2	Newton's law of cooling – Specific heat capacity of a liquid 1	2	1
1.3	Newton's law of cooling – Specific heat capacity of a liquid 2	2	1
1.4	Carey Foster's bridge – To find the resistance of the given coil at different temperatures	2	1
1.5	Study of Seeback effect/Peltier effect.	2	1
1.6	To determine e/k using transistor	2	2
1.7	Spectrometer – Resolving power of a prism.	2	3
1.8	Spectrometer – Resolving power of a prism(prism made of another material)	2	3
1.9	Spectrometer – Dispersive power of prism	2	3
1.10	. Spectrometer – Dispersive power of prism(prism made of another material)	2	3
1.11	Computer programming in C++ – Conversion of temperature scale.	2	4
1.12	Computer programming in C++ – Simple Pendulum –	2	4

	Calculation of ‘g’ from experimental data.		
1.13	Computer programming in C++ – sorting the numbers in ascending and descending order.	2	4
1.14	Computer programming in C++ – Generation of Fibonacci numbers	2	4
1.15	Computer programming in C++ – write the program using bisection method.	2	4
1.16	Computer programming in C++ – Resistance colour code to numerical value conversion.	2	4
1.17	Generate an amplitude modulated wave.	2	5
1.18	Generate square wave from sine wave using Fourier analysis	2	5

References:

1. Advanced course in Practical Physics, D Chattopadhyay, New Central Book Agency , Calcutta, India,2011
2. Practical Physics, Harnam Singh , S. Chand Limited, New Delhi, India, 2000
3. B.Sc. Practical Physics, C L Arora , S. Chand & Company Ltd 0, New Delhi, India,2010.
4. A Text Book of Optics, N. Subrahmanyam, Brij Lal, M. N. Avadhanulu, S. Chand Limited, 2006.
5. Optics, Ajoy Ghatak, Tata McGrawHill Education Pvt. Ltd., New Delhi, India, 2012.
6. Object oriented programming in C ++, Robert Lafore, Pearson, 2002.
7. Object oriented programming in C ++, E. Balagurusamy, Tata McGrawHill Education Pvt. Ltd., New Delhi, India, 2013.
9. Thermodynamics and Statistical Physics, J. K. Sharma, K. K . Sarkar, HPH, 2015.

Course	Details				
Code	**PH1815608**				
Title	**Acoustics, Photonics and Advanced Semiconductor Physics 1**				
Degree	B.Sc.				
Branch(s)	Physics				
Year/Semester	III/ V				
Type	Core Practical				
Credits	1	Hours/week	2	Total hours	36

CO No.	*Expected Course Outcomes* *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Determine the frequency of AC and tuning fork, velocity of sound using various apparatus.	E	4
2	Determine the refractive indices of quartz using spectrometer.	E	5
3	Construct and study various electronic circuits.	C	5

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Section	Course Description	Hrs	CO.No.
1.1	Sonometer – Determination of frequency of given turning fork, unknown mass and verification of laws of strings	2	1
1.2	Sonometer – Determination of another frequency of given turning fork, unknown mass and verification of laws of strings	2	1
1.3	Spectrometer – Quartz prism – Refractive indices of quartz	2	2
1.4	Characteristics of solar cell / photodiode V-I characteristics	2	3
1.5	Planck's constant using LED	2	3
1.6	Planck's constant using another(color) LED's	2	3
1.7	Sweep wave generator using transistor	2	3
1.8	Regulated power supply using IC 78XX– Study of line and load regulations	2	3
1.9	Regulated power supply using IC 79XX etc – Study of line and load regulations	2	3
1.10	Voltage regulator using zener diode and transistor – Study of line regulations	2	3
1.11	Voltage regulator using zener diode and transistor – Study of load regulations	2	3
1.12	RC coupled common emitter amplifier – Study of frequency response	2	3
1.13	RC coupled common emitter amplifier – Study of bandwidth	2	3
1.14	Wave shaping R C circuits – Integrator	2	3
1.15	Wave shaping R C circuits –differentiator	2	3
1.16	OPAMP – adder	2	3
1.17	OPAMP –subtractor	2	3
1.18	Pulse Width Modulation using IC 555	2	3

Text Books for Reference -

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

Course	Details				
Code	**PH1815401**				
Title	**OUR UNIVERSE**				
Degree	B.Sc.				
Branch(s)	Physics				
Year/Semester	III/V				
Type	Open Course				
Credits	3	Hours/week	4	Total Hours	72

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Discuss the early models of universe	U	1
2	Explain the origin and evolution of universe	U	1
3	Explain contemporary methods to find the distance to sun	R	1
4	Explain solar system, meteroids, comets	U	1
5	Explain the fundamental concepts of observational astronomy	U	1
6	Explain Optical telescopes	U	5

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO.No.
1.0	**OUR UNIVERSE**		
1.1	Early models of universe- Geo centric model- Ptolemy-Aristotle	2	1
1.2	Copernican model - Sun at the centre.	2	1
1.3	Galileo and his observations	2	1
1.4	Planetary paths-Kepler's laws(No need of derivation).Galaxies	2	1
1.5	Hubble's classification – Spiral, elliptical & irregular galaxies. Milky way galaxy (qualitative)	2	1
2.0	**COSMOLOGY**		
2.1	Origin of the universe - Big bang theory	2	2
2.2	Expansion of the universe – Hubble's law	2	2
2.3	Age of the universe.	1	2

2.4	Doppler effect and red shift(qualitative).	2	2
2.5	Stellar evolution – birth - red giant- death of a star	2	2
2.6	White dwarf- Chandrasekhar limit	2	2
2.7	Super novae- neutron star.	2	2
2.8	Black hole	1	2
3.0	**OBSERVATIONAL ASTRONOMY AND SOLAR SYSTEM**		
3.1	Celestial sphere- cardinal points, celestial equator, ecliptic, equinoxes.	3	5
3.2	Celestial co-ordinate systems-equatorial co-ordinate system-Right ascension & declination	3	5
3.3	Ecliptic and galactic co-ordinate systems	3	5
3.4	Diurnal motion of sun - Summer solstice and winter solstice	2	5
3.5	Time - apparent and mean solar time	2	5
3.6	International date line	2	5
3.7	Constellations-zodiacal constellations	2	5
3.8	Astronomical distance scales – AU, Parsec and light year. Stellar Parallax and distance to stars from parallax	4	3
3.9	Optical Telescopes - Light gathering power, visual angle, angular magnification	3	6
3.10	Types of telescopes-refracting and reflecting – Newtonian and Cassegrain telescopes (No need of derivation for magnification)	4	6
3.11	HST, Radio telescopes, GMRT (India)	5	6
3.12	The sun- solar atmosphere - Photosphere, chromospheres and corona.Sun spots.	4	4
3.13	Definition of a planet- terrestrial planets & Jovian planets, Comparison of planets	4	4
3.14	Minor members of solar system- Asteroids, comets, meteors	3	4
3.15	Universal law of gravitation, Earth's orbital motion-day to day changes-seasonal changes	4	4

Text Books for Study

1. Architecture of the universe, NeciaH.Apfel and Allen Hynek-Benjamin Cummins Publishing Company.
2. AstronomyA Beginners guide to the universe sixth edition-ChaissonMcMillan
3. Cosmic vistas-A popular history of astronomyBimanBasu-national book trust,India
4. Astronomy; A Self Teaching Guide -Dinah L Moche
5. The Great Universe G.K Sasidharan-S.Chand

Text Books for Reference

1.Joy of Star watching - BimanBasu- National Book Trust, India
2.A textbook of Optics , N.Subrahmanyan, Brijlal and M.N Avadhanulu

Course	Details				
Code	**PH1815402**				
Title	**PHYSICS IN DAILY LIFE**				
Degree	B.Sc.				
Branch(s)	Physics				
Year/Semester	III/V				
Type	Open Course				
Credits	3	Hours/week	4	Total Hours	72

CO No.	*Expected Course Outcomes* *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	List the units and dimensions of fundamental and derived quantities.	R	1
2	Explain the concepts of reflection, refraction, diffraction, interference, scattering and total internal reflection.	U	1
3	Interpret the various defects of the eye.	U	1
4	Apply the fundamental concepts of motion in everyday life.	Ap	3
5	Distinguish between the different methods of power generation.	An	3
6	Generalize the physics behind matter and energy.	U	2
7	Illustrate the different phenomenon occurring in the universe.	U	1

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO.No.
1.0	**UNITS AND LIGHT**		
1.1	Fundamental and derived quantities.	2	1
1.2	Units and dimensions.	2	1
1.3	Dimensional analysis.	1	1
1.4	Order of magnitude.	1	1
1.5	Significant figures.	1	1
1.6	Errors.	1	1
1.7	Reflection, refraction.	1	2
1.8	Diffraction, interference.	2	2
1.9	Scattering (elementary ideas only) – examples from daily life – apparent depth, blue color of sky, twinkling of stars.	1	2
1.10	Total internal reflection, mirage, sparkling of diamond.	1	2
1.11	Primary and secondary rainbow	1	2
1.12	Optical fibers.	1	2
1.13	Concave and convex mirrors	1	2
1.14	Lenses – focal length, power of a lens	1	2
1.15	Refractive index, prism, dispersion.	1	2

1.16	Human eye	1	3
1.17	Defects of the eye – myopia, hypermetropia, presbyopia and astigmatism and their correction by lens.	1	3
2.0	**MOTION, ELECTRICITY**		
2.1	Velocity, acceleration	1	4
2.2	Momentum, Idea of inertia	1	4
2.3	Force - laws of motion.	2	4
2.4	Newton's law of gravitation	1	4
2.5	Acceleration due to gravity, mass and weight	1	4
2.6	Apparent weight, weightlessness.	2	4
2.7	Rotational motion, Moment of inertia, torque	1	4
2.8	Centripetal and centrifugal acceleration-examples-banking of curves	2	4
2.9	Centrifugal pump, roller coasters.	1	4
2.10	Voltage and current, ohms law	1	5
2.11	Electric energy, electric power	1	5
2.12	Calculation of energy requirement of electric appliances	2	5
2.13	Transformer	1	5
2.14	Generator	1	5
2.15	Hydroelectric power generation	1	5
2.16	Wind power	1	5
2.17	Solar power	1	5
2.18	Nuclear power	1	5
3.0	**MATTER AND ENERGY, UNIVERSE**		
3.1	Different phases of matter	1	6
3.2	Fluids - surface tension	1	6
3.3	Viscosity- capillary rise	1	6
3.4	Bernoulli's theorem and applications	1	6
3.5	Heat energy, temperature	1	6
3.6	Different temperature scales – degree Celsius, Fahrenheit and Kelvin	1	6
3.7	Waves – transverse and longitudinal waves	1	6
3.8	Sound waves, Doppler Effect	1	6
3.9	Lasers, fluorescence, phosphorescence	1	6
3.10	Electromagnetic waves – applications	1	6
3.11	Microwave oven, radar	1	6
3.12	Super conductivity	1	6
3.13	Planets, solar system	1	7
3.14	Moon- faces of moon	2	7
3.15	Lunar and solar eclipses	1	7
3.16	Constellations	1	7
3.17	Different types of stars	2	7
3.18	Galaxies, black hole.	1	7

3.19	Satellites, Artificial satellites	1	7
3.20	Global positioning system.	2	7
3.21	Geo stationary satellite.	1	7

Text Books for Study

1. Fundamentals of Physics with Applications by Arthur Beiser

2.Conceptual Physics by Paul G Hewitt

Course	Details				
Code	**PH1815403**				
Title	**COMPUTER HARDWARE AND NETWORKING**				
Degree	B.Sc.				
Branch(s)	Physics				
Year/Semester	III/V				
Type	Open Course				
Credits	4	Hours/week	4	Total Hours	72

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Discuss basic idea of computer, its components ,microprocessor and advancement in chip technology	U	1
2	Explain working of simple input/output and memory devices and processors	U	1
3	Illustrate methods to install devices , software and upgrade memory	Ap	2
4	Analyse Trouble shooting of various devices connected to systems to solve software and hardware problems	An	2
5	Explain networking methods, modems and multimedia to control systems in administrator level	U	3
6	Compare various software packages	An	3
7	Discuss basic anti- virus packages	E	1

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO.No.
1.0	**MODULE I**		
1.1	Microprocessors	2	1
1.2	Basic concepts of Intel 80186	1	1
1.3	Basic concepts of Intel 80286	1	1
1.4	Basic concepts of Intel 80386.	1	1
1.5	Basic concepts of Intel 80486.	1	1
1.6	Basic concepts of Pentium processors	2	1
1.7	Motherboard	2	2
1.8	Expansion buses	2	2
1.9	Memory, upgrading / adding memory	3	2
1.10	BIOS Motherboard.	1	2
1.11	BIOS Motherboard	1	
1.12	BIOS Motherboard – removing, installing / configuring motherboards	3	2
1.13	BIOS set up	2	2
1.14	troubleshooting memory	2	2
2	**Module II**		
2.1	Data storage devices	2	2
2.2	IDE and SCSI controllers.	2	2
2.3	Hard disk	1	3
2.4	Installing / upgrading CD ROM drives.	2	3
2.5	Installing / upgrading DVD, Optical storage, Tape back – ups	2	3
2.6	Printers	2	4
2.7	Keyboards	2	4
2.8	Pointing and positioning devices	1	4
2.9	Digital camera	1	4
2.10	Scanners	1	2
2.11	Monitors	1	2
2.12	Hard disks- installing / upgrading	2	4
2.13	Troubleshooting, formatting, Error codes	3	4
2.14	BIOS disk routines	2	4
3.0	**Module III**		
3.1	Multimedia	1	5
3.2	Graphical accelerators	2	5
3.3	Modems	1	5
3.4	I/E add on	2	5
3.5	Networks	2	5
3.6	Power supplies	1	2
3.7	UPSPrinter installation	2	5
3.8	Software installation – DOS, Windows 95, 98	2	6
3.9	Linux	1	6
3.10	WindowsNT – installation,Administration	2	6
3.11	Installing PASCAL, C, ORACLE, VISUAL BASIC	2	7
3.12	Software diagnostics – PC tools	2	7
3.13	Norton utilities, XT/AT diagnostics	2	7
3.14	Viruses and anti-viruses	2	7

Text Books for Reference

1. IBM PC and CLONES- Hardware, troubleshooting and maintenance –B Govindarajalu, TMH
2.PC Hardware, a beginners guide – Ron Gilster,McGraw-Hill Education
2.All about Motheroard: - ManaharLotia, Pradeep Nair, BPB publications

Text Books for Enrichment

1. A+ Guide to PC Hardware Maintenance and Repair, Volume 1, Michael W. Graves,Thomson Delmar learning
2.Complex hardware and networking Kit, Vikas Gupta, Dreamtech Press\

SEMESTER VI				
Course Code	**Title of the Course**	**Course Category**	**Hours / week**	**Credits**
PH1816109	Electricity and Electrodynamics	Core 9	3	3
PH1816110	Relativity and Spectroscopy	Core 10	4	3
PH1816111	Nuclear Particle and Astrophysics	Core 11	3	3
PH1816112	Solid State Physics	Core 12	4	3
PH1816609	Electricity, Magnetism and Laser 2	Core Practical 9	2	1
PH1816610	Digital Electronics 2	Core Practical 10	2	1
PH1816611	Thermal Physics, Spectroscopy and C++ programming 2	Core Practical 11	2	1
PH1816612	Acoustics, Photonics and Advanced Semiconductor physics 2	Core Practical 12	2	1
PH1816301	Information Technology	Choice Based Course (Elective)	3	3
PH1816302	Material Science			
PH1816303	Instrumentation			
PH1816304	Computational Physics			
PH1816305	Astronomy and Astrophysics			
PH1816801	Project & Industrial Visit			1
		Total	**25**	**20**

Course	Details				
Code	**PH1816109**				
Title	**ELECTRICITY AND ELECTRODYNAMICS**				
Degree	B. Sc.				
Branch(s)	Physics				
Year/Semester	III/VI				
Type	Core				
Credits	3	Hours/week	3	Total Hours	54

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Define the fundamental concepts of Wattless current, choke coil, transformer on no load- skin effect.	R	1
2	Explain the theorems related to ideal voltage source and current source.	U	1
3	Explain the basics Thermocouple effects	U	1, 4
4	Explain the Gauss's law, Poisson's and Laplace's equations .Lorentz Force law- Biot- Savart law, Faraday's law	U	1
5	Apply the principles of algebra and trigonometry to Gaussian surface and Amperian loop.	Ap	1, 2
6	Explain the Maxwell's equations, Continuity equations- Poynting's theorem, Energy of electromagnetic waves	U	1, 2

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs.	CO.No.
1.0	**ALTERNATING CURRENT AND NETWORK THEOREMS, TRANSIENT CURRENT AND THERMO ELECTRICITY**		
1.1	EMF induced in a coil rotating in a magnetic field	1	1
1.2	AC applied to resistive, inductive and capacitance circuits	1	1
1.3	AC applied to LR and RC circuits	2	1
1.4	Analysis of LCR series circuits	1	1
1.5	LCR parallel resonant circuit. Comparison of all circuits	1	1
1.6	Power in ac circuits	1	1
1.7	Wattless current choke coil	1	1
1.8	Transformer on no load	1	1
1.9	Skin effect	1	1
1.10	Ideal voltage source and current source	1	2
1.11	Superposition theorem, Reciprocity theorem	1	2
1.12	Thevenin's theorem, Norton's theorem	2	2
1.13	Maximum power transfer theorem.	1	2
1.14	Growth and decay of current in an LR circuit-	1	3
1.15	Charging and discharging of a capacitor through a resistor -	1	2
1.16	Growth and decay of charge in an LCR circuit.	1	2
1.17	Seebeck effect, Laws of thermoemf	1	2
1.18	Peltier effect, Thomson effect	1	2

1.19	Thermoelectric diagrams	1	2
1.20	Thermocouple (qualitative study)	1	2
1.21	Explanation of thermoelectric effects based on electron theory.	1	3
2.0	**ELECTROSTATICS AND MAGNETOSTATICS**		
2.1	Fundamental theorems of divergence and curl (physical concepts)	2	4
2.2	Electric field -Continuous charge distribution- Divergence and curl of electrostatic field	2	4
2.3	Gauss's law and applications: solid sphere, infinite wire, infinite plane sheet	2	5
2.4	Electric potential -Poisson's and Laplace's equations	2	4
2.5	Potential of a localized charge distribution –Electrostatic boundary conditions- work and energy in electrostatics	2	4
2.6	The work done to move a charge – Energy of a point charge distribution and continuous charge distribution-Basic properties a conductor	2	4
2.7	Lorentz Force law, Biot- Savart law, Divergence and curl of B	2	4
2.8	Applications of Ampere's law: long straight wire, infinite plane, solenoid, Comparison of electrostatics and magnetostatics	2	5
2.9	Magnetic vector potential – Magnetostatics boundary conditions	2	4
2.10	Electromagnetic induction- Faraday's law	2	4
3.0	**MAXWELL'S EQUATIONS AND ELECTROMAGNETIC WAVE PROPAGATION**		
3.1	Maxwell's equations	2	6
3.2	Boundary conditions for free space	1	6
3.3	Continuity equations	1	6
3.4	Poynting's theorem	1	6
3.5	Wave equations (general idea on reflection at boundary and polarization)	1	6
3.6	Electromagnetic wave in vacuum	1	6
3.7	Wave equation for E and B	2	6
3.8	Monochromatic plane waves	1	6
3.9	Energy of electromagnetic waves	1	6

Text Books for Reference

4. Electricity and Magnetism, R. Murugeshan
5. Introduction to Electrodynamics, David J Griffiths

Text Books for Enrichment

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- PragatiPrakashan
5. Classical Electromagnetism, Jerrold Franklin- Pearson
6. Electromagnetic Fields and Waves, KD Prasad- SatyaPrakashan
7. Field and wave Electromagnetics, David K Cheng- Pearson.

Course	Details				
Code	**PH1816110**				
Title	**RELATIVITY AND SPECTROSCOPY**				
Degree	B.Sc.				
Branch(s)	Physics				
Year/Semester	III/VI				
Type	Core				
Credits	3	Hours/week	4	Total Hours	72

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Explain the significance of Michelson –Morley experiment	U	1
2	State the postulates of special theory of relativity-introductory concept of GTR	R	1
3	Derive Lorentz transformation equation and Einstein mass - energy relation	Ap	2
4	Analyze the consequence of Lorentz transformation	An	2
5	Describe atom models- Bohr atom model and vector atom model	R	1
6	Interpret the spin of electron using Stern-Gerlach experiment	U	1
7	Define the rotational and vibrational spectra of molecules and electronic energy levels of atom	R	1
8	Explain the Raman effect classically and quantum mechanically,Zeeman effect and Paschen Back effect,NMR,ESR	U	1
9	Explain IR and microwave spectroscopes with instrumentation	U	2,5

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO. No.
1.0	**SPECIAL THEORY OF RELATIVITY**		
1.1	Inertial and non inertial frames of reference	1	1
1.2	Galilean transformation	2	1
1.3	Significance of Michelson-Morley experiment	2	1
1.4	Postulates of Special Theory of Relativity	1	2
1.5	Lorentz transformation	2	2
1.6	Spatial contraction	2	4
1.7	Time dilation	2	4
1.8	Composition of velocities	2	4
1.9	Mass of moving particle	2	4
1.10	Equivalence of mass and energy	1	3
1.11	Introductory concept of general theory of relativity	1	2
2.0	**ATOMIC SPECTROSCOPY**		

2.1	Electromagneticspectrum.Types of spectra. Absorption and emission of light by atoms, quantum theory.	2	5
2.2	Early atom models – Bohr model	3	5
2.3	Electron spin and magnetic moment	1	6
2.4	Exclusion principle	1	6
2.5	Stern-Gerlach experiment	2	6
2.6	Vector atom model, quantum numbers associated with vector atom models	3	5
2.7	Total angular momentum and LS coupling	2	5
2.8	Fine structure of Sodium D lines	1	8
2.9	Zeeman effect, quantum mechanical explanation for anomalous Zeeman effect	4	8
2.10	Paschen-Back effect(qualitative).	2	8
3.0	**MOLECULAR SPECTROSCOPY, NMR AND ESR SPECTROSCOPY**		
3.1	Molecular energy levels, Electronic, rotational and vibrational energies.	2	7
3.2	Rotational spectra, rigid rotator model	3	7
3.3	Vibrational energy levels, harmonic oscillator	3	7
3.4	Electronic energy levels of atoms	1	7
3.5	Raman effect – experimental arrangement and result	2	8
3.6	Classical theory and its failure	3	8
3.7	Quantum theory of Raman effect	3	8
3.8	IR and Microwave spectroscopes-instrumentation	4	9
3.9	NMR Spectroscopy	3	8
3.10	Basic principles and instrumentation	3	8
3.11	Medical applications of NMR	2	8
3.12	ESR Spectroscopy	2	8
3.13	Basic principles and instrumentation	2	8

Text Books for Study

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.

Text Books for 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 (PragathiPrakash)
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.

Course	Details				
Code	**PH1816111**				
Title	**NUCLEAR, PARTICLE PHYSICS AND ASTROPHYSICS**				
Degree	B.Sc.				
Branch(s)	Physics				
Year/Semester	III/VI				
Type	Core				
Credits	3	Hours/week	3	Total Hours	54

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Identify the various properties of nucleus and the nuclear forces	U	1
2	Explain the nuclear reaction counters and particle accelerators	U	1
3	Discuss the concept of radioactivity	U	1,2
4	Explain the theory of α, β and ϒ-decay in radioactivity	U	2
5	Compute the half-lifetime of radioactive materials	Ap	2
6	Differentiates the different types of reactors and Cosmic showers	Ap	1
7	Explain the properties of elementary particles and their interactions	U	1
8	Explain the explosive nature of Supernova and the subsequent productions of elements	U	1
9	Identify different stages in the evolution of stars	U	1

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO.No.
1.0	**NUCLEAR STRUCTURE, NUCLEAR DETECTORS, COUNTERS AND PARTICLE ACCELERATORS**		
1.1	Nuclear Composition	1	1
1.2	Discovery of neutron	1	1
1.3	Nuclear electrons	1	1
1.4	Nuclear properties	0.5	1
1.5	Nuclear radii	0.5	1
1.6	Spin and magnetic moment	0.5	1
1.7	Stable nuclei	0.5	1
1.8	Binding energy	0.5	1
1.9	Binding energy curve	0.5	1
1.10	Liquid drop model	1	1
1.11	Semi empirical binding energy formula with correction factors	1	1
1.12	Shell model	1	1
1.13	Meson theory of nuclear forces	1	1
1.14	Discovery of Pions	0.5	1
1.15	Virtual photons	1	1
1.16	Interactions between particles and matter(basic concepts only)	1	1
1.17	Ionization chamber	0.5	2

1.18	Solid state detectors	0.5	2
1.19	Proportional Counter	0.5	2
1.20	Geiger Muller Counter	0.5	2
1.21	The Wilson Cloud chamber	0.5	2
1.22	Bubble Chamber	0.5	2
1.23	Scintillation Counters	0.5	2
1.24	Van de Graff generator	0.5	2
1.25	Linear accelerator	0.5	2
1.26	Cyclotron	0.5	2
1.27	Betatron	0.5	2
2.0	**NUCLEAR TRANSFORMATIONS AND COSMIC RAYS**		
2.1	Radioactive decay	0.5	3
2.2	Radiation hazards	0.5	3
2.3	Half life	1	5
2.4	Radiometric dating	0.5	3
2.5	Radioactive series	0.5	3
2.6	Alpha decay	0.5	4
2.7	Tunnel theory of alpha decay	1	4
2.8	Derivation of alpha decay constant	1	4
2.9	Beta decay	1	4
2.10	Positron emission	0.5	4
2.11	Electron capture	0.5	4
2.12	Inverse beta decay	0.5	4
2.13	Gamma decay	0.5	4
2.14	The concept of interaction cross section	0.5	6
2.15	Reaction rate	0.5	6
2.16	Resonance	0.5	6
2.17	Centre of mass coordinate system	0.5	6
2.18	Q value of nuclear reaction	0.5	6
2.19	Nuclear fission	0.5	6
2.20	Nuclear reactors	0.5	6
2.21	Breeder reactors	0.5	6
2.22	Nuclear fusion in stars	0.5	6
2.23	Fusion reactors	1	6
2.24	Lattitude effect	0.5	6
2.25	Azimuth effect	0.5	6
2.26	Altitude effect	0.5	6
2.27	Cosmic rays	0.5	6
2.28	Discovery of positron	1	6
2.29	Mesons Van Allen belts	1	6
2.30	Origin of cosmic rays	1	6
3.0	**PARTICLE PHYSICS AND ASTRO PHYSICS**		
3.1	Interactions and particles	0.5	7
3.2	Leptons	0.5	7
3.3	Neutrinos and antineutrinos	0.5	7
3.4	Hadrons	0.5	7
3.5	Resonance Particles	0.5	7
3.6	Elementary particle Quantum numbers	1	7
3.7	Basic concepts of Symmetries and Conservation principle	1	7
3.8	Basic concepts of Quarks-color,flavor	1	7
3.9	Quark confinement	1	7
3.10	Higgs boson	1	8

3.11	Classification of stars	1	8
3.12	Hertzsprung- Russel diagram	1	8
3.13	Luminosity of a star	1	9
3.14	Stellar Evolution	0.5	9
3.15	White Dwarfs	0.5	9
3.16	Chandrasekhar limit	0.5	9
3.17	Neutron star	1	9
3.18	Black holes	1	9
3.19	Supernova Explosion	1	9
3.20	Photon diffusion time	1	9

Text Books for study

1. Modern Physics, R. Murugeshan and Kiruthiga Siva Prakash, S.Chand& Company Ltd., Ram Nager, New Delhi, 2007.
2. Modern Physics, Arthur Beiser, S. Chand and Co., New Delhi, 2007.

TextBooks for for Reference

1. Atomic and Nuclear Physics, S N Ghosal, S Chand.
2. Nuclear and Particle Physics, SL Kakani and Subra Kakani-Viva Books 2008.
3. Mordern Physic, Kenneth Kranne,2nd Edition, Wiley India (Pvt) Ltd.
4. Mordern Physics, G Aruldas and P Rajagopal, Printice Hall India

Course	Details				
Code	**PH1816112**				
Title	**SOLID STATE PHYSICS**				
Degree	B.Sc.				
Branch(s)	Physics				
Year/Semester	III/VI				
Type	Core				
Credits	3	Hours/week	4	Total Hours	72

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Define crystal lattice, unit cell and lattice parameters	R	1
2	Compute the crystal structures of SC, BCC, FCC and HCP	Ap	1
3	Explain the Bragg's law and crystal diffraction methods.	U	1
4	Interpret the bonding in solids	U	1
5	Explain the basic concepts of free electron theory and band theory of solids	U	1
6	Explain the basic concept of semiconductor, hall effect, the principles of LED and photodiodes	U	1,4
7	Explain the basic concepts of polarization	U	1
8	Analyze the theories related to dielectric polarizability	An	1
9	Classify magnetic materials and their properties	A	1,5
10	Solve problems related to coherence length, penetration depth, isotopic mass, in superconductivity.	Ap	1,2

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO.No.
1.0	**CRYSTAL STRUCTURE**		
1.1	Solid state, crystalline, polycrystalline and amorphous materials	1	1
1.2	Crystal lattice, periodicity, translation vectors, unit cell, basis	1	1
1.3	Symmetry operations	1	1
1.4	Bravaislattice in two and three dimensions	2	2
1.5	Miller indices, interplanar spacing	2	2
1.6	Simple crystal structures-fcc, bcc and simple cubic	3	2
1.7	Simple crystal structures- hcp	3	2
1.8	Structures of NaCl, Diamond and ZnS	2	2
1.9	X-ray diffraction from crystals-Bragg's law, powder method	2	3
1.10	Reciprocal lattice-properties.	1	3
2.0	**BONDING IN SOLIDS, FREE ELECTRON THEORY AND ELEMENTARY BAND THEORY AND SEMICONDUCTING PROPERTIES OF MATERIALS**		
2.1	Inter-atomic forces and types of bonding	2	4
2.2	Bond dissociation and cohesive energy	1	4
2.3	Ionic bonding - Madelung energy	2	4
2.4	Covalent bonding, metallic bonding, hydrogen bonding, van der waalsbonding (basic ideas only).	2	4
2.5	Free electron gas in one dimension, three dimension	2	5
2.6	Electronic specific heat	1	5
2.7	Band theory	1	5
2.8	Bloch theorem	1	5
2.9	Kronig-Penney model (derivation not expected)	1	5
2.10	Energy-wave vector relations	1	5
2.11	Different zone schemes	3	5
2.12	Velocity and effective mass of electron.	1	5
2.13	Distinction between metals, insulators and semiconductors	1	5
2.14	Intrinsic and extrinsic semiconductors	2	6
2.15	Drift velocity, mobility and conductivity of intrinsic semiconductors	1	6
2.16	Carrier concentration and Fermi level for intrinsic semiconductor	1	6
2.17	Carrier concentration	1	6
2.18	Conductivity and Fermi level for extrinsic semiconductor	1	6
2.19	Hall Effect	1	6
2.20	Direct and Indirect band gap	2	6
2.21	Principles of LED	1	6
2.22	Principles of Photodiodes	1	6
3.0	**DIELECTRIC AND MAGNETIC PROPERTIES OF MATERIALS, SUPERCONDUCTIVITY**		
3.1	Polarization and susceptibility	1	7
3.2	Local filed, dielectric constant and polarizability	1	7
3.3	Sources of polarizability	1	7

3.4	Clausius-Mossoti relation	1	8
3.5	Piezoelectricity	1	8
3.6	Response of materials to magnetic field.	1	9
3.7	Classification of magnetic materials.	1	9
3.8	Langevin's classical theory of diamagnetism and paramagnetism	2	9
3.9	Ferromagnetism	1	9
3.10	Weiss theory, domain theory	1	9
3.11	Antiferromagnetism and ferrimagnetism	1	9
3.12	Origin of superconductivity, electrical resistivity	1	10
3.13	Meissner effect	1	10
3.14	Type-I and type–II superconductors, critical field and critical temperature	1	10
3.15	thermodynamics of superconducting transitions	1	10
3.16	origin of energy gap, isotope effect	1	10
3.17	Super currents and penetration depth	1	10
3.18	BCS theory-Cooper pairs	1	10
3.19	Normal tunneling and Josephson effect	1	10
3.20	Applications of Superconductivity	1	10
3.21	SQUIDs	1	10

Text Books for Study

1.Solid State Physics,M.A.Wahab,(2nd Edition),Narosa.
2. Solid State Physics,SO Pillai, Newage.

Text Books for Reference

1. Solid State Physics by Puri and Babbar, S Chand
2. Introduction to solid State Physics, Charles Kittel (7th Edition), Wiley.
3. Solid state Physics, A J Dekker, Macmillian.
4. Solid state Physics, N W Ashcroft, N D Mermin, Cengage Learning.
5. Elementary Solid State Physics, M Ali Omer, Pearson.

Course	Details				
Code	**PH1816609**				
Title	**ELECTRICITY, MAGNETISM AND LASER 2**				
Degree	B.Sc.				
Branch(s)	Physics				
Year/Semester	III/VI				
Type	Core practical				
Credits	1	Hours/week	2	Total hrs	36

CO No.	*Expected Course Outcomes* *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Analyse the electrical parameters	E	3
2	Apply the theoretical concepts of magnetism	Ap	1
3	Determine the optical properties and laser parameters	E	1
4	Construct and verify various electronic circuits	C	4

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Section	Course Description	Hrs	CO.No.
1.1	Field along the axis of a circular coil – magnetic flux variation	2	2
1.2	Carey Foster's bridge – Measurement of unknown resistance of wire	2	1
1.3	Carey Foster's bridge – Measurement of resistivity of wire	2	1
1.4	LCR series circuit analysis	2	4
1.5	LCR parallel resonant circuit analysis	2	4
1.6	Verification of Thevenin's theorems	2	4
1.7	Verification of Norton's theorems	2	4
1.8	Verification of Superposition theorems.	2	4
1.9	Verification of Maximum power transfer theorems.	2	4
1.10	Potentiometer – Calibration of ammeter	2	4
1.11	Laser – Determination of spot size	2	3
1.12	Laser – Determination of divergence	2	3
1.13	Optical fiber – Determination of numerical aperture	2	3
1.14	Single slit diffraction using laser – Determination of slit width	2	3
1.15	e/m – Thomson's apparatus – Bar magnet/magnetic focusing	2	2
1.16	Determination of Dielectric constant of a thin sheet/ a liquid	2	1
1.17	Hall Effect-determine the Hall Voltage	2	2
1.18	Hall Effect-determine the Hall coefficient and charge concentration	2	2

.

Books for Reference

1. Electronics lab manual Vol 1 & 2, K A Navas.
2. Advanced course in Practical Physics by D Chattopadhyay
3. Electronics lab manual Vol 1 & 2, Kuryachan T D and Shyam Mohan S, Ayodhya pub.
4. Practical Physics – Joseph Ittiavirah, Premnath and Abraham(2005)
5. Practical Physics, CL Arora, S.Chand
6. Practical Physics, Harnam Singh , S Chand
7. A course of Experiments with He –Ne Laser – R.S Sirohi (2nd Edition) Wiley Eastern Ltd.
8. Electronics lab manual Vol 1 & 2, Kuryachan T D and Shyam Mohan S, Ayodhya pub.
9.
10.

Course	Details				
Code	**PH1816610**				
Title	DIGITAL ELECTRONICS 2				
Degree	B.Sc.				
Branch(s)	Physics				
Year/Semester	III/6				
Type	Core Practical				
Credits	1	Hours/week	2	Total hours	36

CO No.	*Expected Course Outcomes* *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Examine the performance of logic gates using IC's and discrete components and to measure the output	Ap	3
2	Verify D'morgan's theorems using logic Gates	E	3
3	Design circuits for digital arithmetic	C	3,4
4	Verify the working of flip flop, Counters, shift registers, Multivibrators, encoders, MUX and DeMUX	E	3
5	Design and explain the Analog to Digital conversion operation and vice versa.	C	3,4

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Section	Course Description	Hrs	CO.No.
1	Realization of logic gates – AND, OR and NOT – Using universal gates	2	1
2	Verification of De Morgan's theorems – Using IC 7400	2	2
3	Monostable Multivibrator using Transistor	2	4
4	Monostable Multivibrator using IC 555	2	4
5	JK Flip Flops using IC 7400 & 7410 – Verification of truth table	2	4
6	Bistable multivibrator using IC 555	2	4
7	Demultiplexer using gates	2	4
8	Shift register – SIPO	2	4
9	4-Bit Binary to Gray conversion	2	5
10	4-Bit Gray to Binary conversion	2	5
11	Implementation of Half subtractor using basic logic gates	2	3
12	Implementation of Full subtractor using basic logic gates	2	3
13	4-bit Binary Adder	2	3
14	Verification of state tables of T flip –flop	2	3
15	Verification of state tables of D flip –flop	2	3
16	Implementation of the given Boolean function using logic gates in both SOP and POS forms	2	2
17	Decimal to BCD encoder	2	4
18	Ring counter using 74194 and 74151	2	4

Text Books for Reference

1. Abraham Michelen, Digital Electronics Laboratory Manuel, Prentice Hall, New Delhi, 2000.
2. Vance Venable, Michael Wiesner, Laboratory Manuel, Digital Electronics, Prentice Hall, New Delhi, 2005.
3. D. Chattopadhyay, P.C. Rakshit, B. Saha, Advanced courses in practical physics, Books and Allied. Ltd., Calcutta, 2005.
4. Geeta Sanon, BSc Practical Physics, 1st Edition, Chand & Co., New Delhi, 2007.
5. K. A. Navas, Electronics Lab Manual, Volume I, PHI, 5th Edition, 2015.

Course	**Details**				
Code	**PH1816611**				
Title	**THERMAL PHYSICS, SPECTROSCOPY AND C++ PROGRAMMING 2**				
Degree	B.Sc.				
Branch(s)	Physics				
Year/Semester	III/V				
Type	Core practical				
Credits	1	Hours/week	2	Total hrs	36

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	**Cognitive Level**	**PSO No.**
1	Construct various experimental set ups to study the different thermal properties	C	5
2	Determine the e/k of a transistor and chemical equivalent of copper	Ap	4
3	Determine the various optical parameters of prism and grating using spectrometer	Ap	4
4	Design and study the output of various c++ programs	C	5
5	Construct amplitude modulated wave and study its properties	C	5

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Section	Course Description	Hrs	CO. No.
1.1	Thermistor – Temperature co-efficient of resistance.	2	1
1.2	Thermal conductivity of bad conductor – Lee's disc	2	1
1.3	Carey Foster's bridge – Temperature co-efficient of resistance.	2	1
1.4	Electrochemical equivalent of Copper.	2	2
1.5	Spectrometer – Cauchy's constants-Angle of minimum deviation(D) and refractive index	2	3
1.6	. Spectrometer – Resolving power of grating.	2	3
1.7	Spectrometer – Cauchy's constants-Find constants 'A' and 'B' from calculation and graph.	2	3
1.8	Spectrometer – Dispersive power of grating	2	3
1.9	Computer programming in C++ – Solving a quadratic equation.	2	4
1.10	Computer programming in C++ – Conversion of a decimal number into binary number.	2	4
1.11	Computer programming in C++ – For different initial velocity and angle of projection, find out time of flight, horizontal range, Maximum height of a Projectile	2	4
1.12	Computer programming in C++ – multiplication of two matrices.	2	4
1.13	Computer programming in C++ –R K second order method	2	4
1.14	Computer programming in C++ –R K second order method solve several differential equations.	2	4
1.15	Computer programming in C++ – Generation of set of prime numbers	2	4
1.16	Computer programming in C++ – Solve linear equations using bisection method	2	4
1.17	Generate an amplitude modulated wave- Study the effect of varying signal frequency and modulation index.	2	5
1.18	Generate triangular wave from sine wave using Fourier analysis	2	5

References:

1. Advanced course in Practical Physics, D Chattopadhyay, New Central Book Agency , Calcutta, India,2011
2.Practical Physics, Harnam Singh , S. Chand Limited, New Delhi, India, 2000
3. B.Sc. Practical Physics, C L Arora , S. Chand & Company Ltd 0, New Delhi, India,2010.
4. A Text Book of Optics, N. Subrahmanyam, Brij Lal, M. N. Avadhanulu, S. Chand Limited, 2006.
5. Optics, Ajoy Ghatak, Tata McGrawHill Education Pvt. Ltd., New Delhi, India, 2012.
6. Object oriented programming in C ++, Robert Lafore, Pearson, 2002.
7. Object oriented programming in C ++, E. Balagurusamy, Tata McGrawHill Education Pvt. Ltd., New Delhi, India, 2013.
8. Thermodynamics and Statistical Physics, J. K. Sharma, K. K . Sarkar, HPH, 2015.

Course	Details				
Code	**PH1816612**				
Title	**ACOUSTICS, PHOTONICS AND ADVANCED SEMICONDUCTOR PHYSICS 2**				
Degree	B.Sc.				
Branch(s)	Physics				
Year/Semester	III/VI				
Type	Core Practical				
Credits	1	Hours/week	2	Total hours	36

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Determine the frequency of AC and tuning fork, velocity of sound using various apparatus.	E	4
2	Determine the refractive indices of quartz using spectrometer.	E	5
3	Construct and study various electronic circuits.	C	5

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Section	Course Description	Hrs	CO.No.
1.1	Melde's string – Determination of frequency of given tuning fork.	2	1
1.2	Melde's string – Determination of frequency of another tuning fork.	2	1
1.3	Sonometer – Determination of frequency of AC.	2	1
1.4	Kundt's tube - Determination of velocity of sound.	2	1
1.5	Spectrometer – Quartz prism – Refractive indices of quartz for the ordinary rays.	2	2
1.6	Spectrometer – Quartz prism – Refractive indices of quartz for the extra ordinary.	2	2
1.7	Characteristics of LED- V-I characteristic .	2	3
1.8	Characteristics of LED- V-I characteristic for different colors.	2	3
1.9	Characteristics of Light Dependent Resistors.	2	3
1.10	Weinbridge Oscillator using IC 741.	2	3
1.11	Weinbridge Oscillator using IC 741 for different frequency.	2	3
1.12	Realization of XOR using transistor.	2	3
1.13	Realization of Ex NOR using transistor.	2	3
1.14	Regulated power supply using zener diode and IC 741 – Study of line regulations	2	3

1.15	Regulated power supply using zener diode and IC 741 – Study of load regulations	2	3
1.16	Voltage multipliers – doubler	2	3
1.17	Voltage multipliers – tripler	2	3
1.18	Amplitude modulation using transistor	2	3

.

Text Books for Reference -

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

Course	Details				
Code	**PH1816301**				
Title	**INFORMATION TECHNOLOGY**				
Degree	B.Sc.				
Branch(s)	Physics				
Year/Semester	III/VI				
Type	Choice Based				
Credits	3	Hours/week	3	Total Hours	54

CO No.	*Expected Course Outcomes* *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Discuss basic idea of information ,its storage and transfer	U	1
2	Discuss systems used for handling information electronically	U	1
3	Examine various circuits for networking with practical considerations	Ap	2
4	Analyse various networking models and protocols	An	2
5	Explain various internet protocols and structure of servers	U	3
6	Demonstrate basic tags in HTML using computer	U	1
7	Discuss basic ideas of database	U	1
8	Use some of office packages such as MS office or open office to develop documentation and presentation skills	R	1

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO.No.
1.0	**MODULE I**		
1.1	Information Technology, Quality of information, Message transmission	1	1
1.2	Electronic Office, E mail, Document storage	1	1
1.3	Computers in Industry ,Different types	1	2
1.4	Graphical user interface	1	2
1.5	Computer Networks: Importance of Networks, Components of Networks	2	3
1.6	Classification of Networks: Broad cast networks-Switched networks, Switching Techniques	2	3
1.7	Types of Networks – LAN – MAN – WAN	2	3
1.8	Networking Models – OSI reference model – TCP/IP reference model	2	4
1.9	Comparison between the OSI and TCP/IP models	2	4
1.10	Network Topology – Bus- Star-Ring-Tree-Mesh-Cellular.	2	4
1.11	Internet Protocol (IP)-Transmission Control Protocol (TCP)	1	5
1.12	Internet Address – Structure of Internet Servers Address-Address Space- Services on Internet	1	5
1.13	Domain Name System-SMTP and Electronic mail – Http and World Wide Web-Usenet and News groups-FTP-Telnet-Network Security	1	5
1.14	Digital Signature-E-mail Privacy-Internet Tools – Search	1	5

	Engines-Web browsers-Internet explorer, Netscape Navigator, Mozilla Firefox		
2	**Module II**		
2.1	What is HTML	1	6
2.2	Basic Tags of HTML – HTML-TITLE-BODY.	2	6
2.3	Starting an HTML document – The <!DOCTYPE>declaration	1	6
2.4	Setting boundaries with <HTML>-the HEAD element-the BODY element	2	6
2.5	The STYLE element and the SCRIPT element	2	6
2.6	Formatting of text– Headers-Formatting Tags-PRE tag-FONT tag-Special Characters	2	6
2.7	Working with Images- META tag -Links – Anchor Tag - Lists	2	6
2.8	Lists – Unordered Lists-Ordered Lists-Definition Lists	2	6
2.9	Tables –TABLE, TR and TD Tags-Cell Spacing and Cell Padding-Colspan and Rowspan	2	6
2.10	Frames –Frameset-FRAME Tag-NOFRAMES Tag	2	6
2.11	Forms – FORM and INPUT Tag-Text Box-Radio Button-Checkbox-SELECT Tag and Pull Down Lists-Hidden-Submit and Reset	2	6
3.0	**Module III**		
3.1	Basic Idea of DBMS	1	7
3.2	Need for Data Base	1	7
3.3	Database Systems versus File systems	1	7
3.4	View of Data - Data Abstraction	1	7
3.5	View of Data -Instances and Schemas	1	7
3.6	Data Models	1	7
3.7	ER Model-Relational Model	3	7
3.8	Hierarchical Model	3	7
3.9	Basic ideas about Structured Query Language.	4	7
3.10	MS – OFFICE/OPEN OFFICE: Word processors	2	8
3.11	PowerPoint - Spreadsheets – Databases	2	8

Text Books for Reference

1. "Information Technology – The Breaking Wave", D.Curtin, K.Sen and K.Morin, Tata McGraw Hill,
2. 2. Computer Networks, A.S. Tanenbaum - Prentice Hall of India,
3. Computer Fundamentals, P.K. Sinha , BPB Publications,
4. Computer Networks, A.S.Tanenbaum - Prentice Hall of India
5. Computer Fundamentals, P.K. Sinha . BPB Publications,
6. Text book: HTML4 – 2nd Edn. Rick Darnell, Techmedia,

Text Books for Enrichment

1. "Information Technology – The Breaking Wave", D.Curtin, K.Sen and K.Morin,Tata McGraw Hill
2. Computer Networks – A.S. Tanenbaum - Prentice Hall of India
3. Computer Fundamentals – P.K. Sinha 3rd Edn. BPB Publicati

Course	Details				
Code	**PH1816302**				
Title	MATERIAL SCIENCE				
Degree	B Sc				
Branch(s)	Physics				
Year/Semester	III/VI				
Type	Choice Based Course				
Credits	3	Hours/week	3	Total Hours	54

CO No.	*Expected Course Outcomes* *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Memorize the Materials and classification	U	1
2	Discuss the mechanical properties Materials	A	1
3	Summarise the optical properties of materials	An	1
4	Implementation of advanced materials in the modern engineering applications.	A	4
5	Identify the purpose of the nano materials and applications	C	5
6	Investigate the importance of carbon nanostructures	A	3
7	Significance of modern characterisation techniques	E	2

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO.No.
1.0	**Structure and Properties of Materials**		
1.1	Classification of materials	1	1
1.2	Advanced materials	2	1
1.3	Semiconductors, biomaterials, materials of future	2	1,2
1.4	Imperfections in solids- Point defects-Vacancies and self-interstitials, impurities in solids , dislocations, interfacial and bulk defects	3	2
1.5	Diffusion Mechanisms- Fick's first and second laws	2	1,2
1.6	Mechanical Properties-Elastic deformation stress-strain relationship, plastic deformation	2	2
1.7	Basic ideas of tensile properties- ductility, toughness, resilience, hardness	2	2
1.8	Thermal properties, Thermal stresses	2	2
1.9	Electrical properties- Dielectric behaviour	2	2
2.0	**Optical Properties of Materials and Modern Engineering Materials**		
2.1	Absorption processes	1	3
2.2	Fundamental absorption	1	3
2.3	Exciton absorption	1	3
2.4	Free –carrier absorption	1	3
2.5	Photoconductivity	1	3

2.6	Photoelectric effect	1	3
2.7	Photovoltaic effect	1	3
2.8	Photoluminescence-colour centres-Generation of colour centres	2	3
2.9	Display devices- active and passive	2	4
2.10	Liquid crystals- Types of Liquid crystals- Nematic liquid crystals, Cholesteric liquid crystals- Smectic liquid crystals	3	4
2.11	General features of liquid crystals	1	4
2.12	Numeric display using LCD Metallic glasses	1	4
2.13	Metallic glasses; Shape memory alloy; lead free solders	2	4
3.0	**Nano science**		
3.1	Metal nano clusters	2	5
3.2	Magic numbers	1	5
3.3	Theoretical modelling, geometric and electronic structure magnetic clusters	3	5
3.4	Semiconducting nano particles	2	5
3.5	Rare gas and molecular clusters	2	5
3.6	Carbon nanostructures- Carbon clusters	2	6
3.7	CNT preparation, properties and applications	3	5
3.8	Quantum wells, wires and dots preparation, Size and dimensionality effects, applications	3	5,7

Text Books for Reference

1. Text Book: Callister's Material Science and Engineering-Adapted by R Balasubramaniam, Wiley
2. Solid State Physics (2nd ed.), M.A. Wahab, Narosa pub.
3. Nanotechnology-The science of small, MA Shah and KA Shah, Wiley.
4. Text Book: Modern Physics by Murugeshan
5. Semiconductor Physics and Optoelectronics, V.Rajendran et al., VikasPublishingHouse.
6. Crystallography applied to solid state Physics, A.R Verma, O.N Srivastava, Newage
7. Nanotechnology, L.E Foster, Pearson.
8. Nanotechnology: Principles and Practices, 2nd edition, Sulabha K Kulkarni,Springer.
9. Introduction to Nanotechnology, C.P Poole, F.J Owens –Wiley
10. Textbook of Nanoscience and Nanotechnology, BS Murthy, P Shankar, BaldevRaj,BBRath and J Murday- Universities Press-IIM.

Course	Details				
Code	**PH1816303**				
Title	INSTRUMENTATION				
Degree	B.Sc.				
Branch(s)	Physics				
Year/Semester	III/VI				
Type	Choice based				
Credits	3	Hours/week	3	Total Hours	54

CO No.	*Expected Course Outcomes* *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
CO1	Identify the different instruments and measuring systems.	U	1
CO2	Evaluate the different technological possibilities and the limitations of the system.	An	3
CO3	Define the classification of the transducers and their characteristics.	U	1
CO4	Understand the theory of potentiometers, strain gauges.	U	4
CO5	Define the design, construction and provision of instruments for measurement, control etc.	Ap	4,5
CO6	Describe the use of light dependent transducers.	U	1
CO7	Sketch and interpret the response curves for thermistors.	An	2
CO8	Understand different types of transformer.	U	1

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO. No.
1.0	**MEASUREMENTS AND MEASUREMENT SYSTEMS**		
1.1	Measurements-Method of measurements.	1	1
1.2	Instruments and measurement systems-Mechanical	1	1
1.3	Instruments and measurement systems -Electrical	1	1
1.4	Instruments and measurement systems -Electronic instruments	1	1
1.5	Classification of instruments	1	1
1.6	Applications of measurement systems.	1	5
1.7	Elements of generalized measurement systems	2	2
2.0	**PRIMARY SENSING ELEMENTS AND TRANSDUCERS**		
2.1	Mechanical Devices as Primary Detectors.	1	1
2.2	Mechanical Spring Devices	2	1
2.3	Pressure Sensitive Primary Devices	1	1
2.4	Flow Rate Sensing Elements	1	1
2.5	Transducers-Classification	2	3
2.6	Transducers -Characteristics (Static)	1	3

2.7	Transducers -Characteristics (Dynamic)	1	3
2.8	Choice of Transducers	1	3
2.9	Characterization	1	3
3.0	**RESISTIVE, INDUCTIVE AND CAPACITIVE TRANSDUCERS, MISCELLANEOUS TRANSDUCERS**		
3.1	Potentiometers	1	4
3.2	Strain gauges (Theory, types)	1	4
3.3	Rosettes	1	4
3.4	Resistance thermometer	1	4
3.5	Thermistors (materials, Constructions,)	1	7
3.6	Thermistors (Characteristics)	1	7
3.7	Thermocouples	1	5
3.8	Self inductive transducer	1	3
3.9	Mutual inductive transducers	1	3
3.10	Linear Variable Differential Transformer	1	8
3.11	LVDT Accelerometer	1	8
3.12	RVDT	1	8
3.13	Synchros	1	8
3.14	Capacitive transducer- Variable Area Type	1	3
3.15	Capacitive transducer – Variable Air Gap type	1	3
3.16	Capacitive transducer -Variable Permittivity type	1	3
3.17	Capacitor microphone	1	3
3.18	Linear Variable Differential Transformer	2	8
3.19	Light transducers (photo conductive)	1	6
3.20	Light transducers (photo emissive)	1	6
3.21	Light transducers (photo voltaic)	1	6
3.22	Light transducers(semiconductor, LDR)	1	6
3.23	Piezoelectric transducer	1	3
3.24	Hall Effect transducers	1	3
3.25	Digital Encoding transducers	1	3

Text Books for Reference

1. A Course in Electrical and Electronics Measurements and Instrumentation, Sawhney. A.K.
2. Sensors and Transducers, Patranabis D, 2nd edition, PHI, 2015.

Text Books for Enrichment

1. Measurement Systems-Applications and Design, Doebelin. E.A, Tata McGraw Hill.

2 .Principles of Measurement Systems John. P, Bentley, III Edition, Pearson.

3.Transducers and Instrumentation, Murthy.D.V.S,Prentice Hall of India.

4.Instrumentation- Devices and Systems, Rangan, Sarma, and Mani, Tata-McGrawHill.

5.Electronic Instrumentation by H.S Kalsi, McGrawHill.

6.Instrumentation measurements and analysis, Nakra& Choudhary, Tata-McGrawHill.

7.Mechanical and industrial measurement by R.K. Jain, Khanna Publishers, New Delhi.

Course	Details				
Code	**PH1816304**				
Title	**COMPUTATIONAL PHYSICS**				
Degree	B.Sc.				
Branch(s)	Physics				
Year/Semester	III/VI				
Type	Choice Based				
Credits	3	Hours/week	3	Total Hours	54

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Discuss the methods to solve algebraic and transcendental equations	U	1
2	Compare the methods to solve algebraic and transcendental equations	An	2
3	Discuss the methods to solve linear systems	U	1
4	Solve problems of nonlinear equations by numerical methods	Ap	3
5	Explain the methods for curve –fitting and interpolation	U	1
6	Solve the problems of curve fitting and interpolation	Ap	3
7	Discuss various numerical integration and differentiation methods	U	1
8	Solve the problems of numerical integration and differentiation methods	Ap	3

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO.No.
1.0	**SOLUTIONS OF NONLINEAR EQUATIONS**		
1.1	Bisection Method	2	1,4
1.2	Newton Raphson method (two equation solution)	2	1,4
1.3	Regula-Falsi Method	2	1,4
1.4	Secant method - Fixed point iteration method	2	1,4
1.5	Rate of convergence and comparisons of these Methods	1	2
1.6	Solution of system of linear algebraic equations	1	3,4
1.7	Gauss elimination method	2	3,4
1.8	Gauss-Jordan method-LU Factorization	2	3,4
1.9	Jacobi method	2	3,4
1.10	Gauss-Seidel method	2	3,4
2	**Module II**		
2.1	Least squares Regression	1	5,6
2.2	Fitting a straight line.	2	5,6
2.3	Fitting a parabola,	2	5,6

2.4	Fitting polynomial and	2	5,6
2.5	Fitting exponential curve	2	5,6
2.6	Finite difference operators-forward differences, divided difference	3	5,6
2.7	Newton's forward difference interpolation formula	2	5,6
2.8	Lagrange interpolation polynomial	2	5,6
2.9	Newton's divided difference interpolation polynomial	2	5,6
3.0	**Module III**		
3.1	Numerical Differentiation	1	7,8
3.2	Newton's forward difference formulae	2	7,8
3.3	Maxima and minima of a tabulated function	1	7,8
3.4	Newton Cote general quadrature formula	1	7,8
3.5	Trapezoidal rule	2	7,8
3.6	Simpson's 1/3 rule	1	7,8
3.7	Simpson's 3/8 rule	1	7,8
3.8	Solution of ordinary differential equations	1	7,8
3.9	Taylor Series Method.	2	7,8
3.10	Euler's and modified Euler's method	3	7,8
3.11	RungeKutta methods for 1st and 2nd order	3	7,8

Text Books for Reference

1. Numerical Methods for Scientists and Engineers- K Sankara Rao- PHI
2. Introductory Numerical Methods, S SSastry, PHI.
3.Numerical Methods Dr. P. Kandasamy, Dr.PThilagavathy, Dr. K Gunavathi.,S Chand publishing

Text Books for Enrichment

1. Numerical Methods, Balagurusamy, TMH
2. Numerical Methods,GHaribaskaran,University Science Press

Course	Details				
Code	**PH1816305**				
Title	**ASTRONOMY AND ASTROPHYSICS**				
Degree	B. Sc.				
Branch(s)	Physics				
Year/Semester	III/VI				
Type	Choice- Based				
Credits	3	Hours/week	3	Total Hours	54

CO No.	*Expected Course Outcomes* *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Demonstrate an understanding of astronomical coordinate systems, stellar types	U	1
2	Examine principles and working of various telescopes	An	4
3	Define the main features of a HR diagram of stars in general, and in cluster	R	5
4	Demonstrate knowledge of the structure and main processes operating in the Sun	U	5
5	Explain the types of galaxies, their evolution and the various concepts related to the universe	U	1
6	Apply Hubble's law to determine distances to remote galaxies and determine the age of the universe	Ap	2

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO.No.
1.0	**OBSERVATIONAL ASTRONOMY**		
1.1	Astronomical distance scales – AU, Parsec and light year	1	1
1.2	Stellar parallax and distance to stars from parallax	1	1
1.3	Magnitude scale – Apparent and absolute magnitudes	1	1
1.4	Variable stars as distance indicators	1	1
1.5	Cepheid variables	1	1
1.6	Astronomy in different bands of electromagnetic radiation – optical, radio and X-ray astronomies	1	1
1.7	Radiation laws	1	1
1.8	Optical telescopes	1	2
1.9	Types of telescopes – refracting and reflecting, Newtonian and Cassegrain telescopes	1	2
1.10	Magnification and f number	1	2
1.11	Resolving Power	1	2
1.12	Telescope mounts – alt-azimuth and equatorial mounts	1	2

2.0	**CELESTIAL SPHERE, SUN, GALAXIES**		
2.1	Concept of celestial sphere - cardinal points, celestial equator, ecliptic, equinoxes	1	4
2.2	Diurnal motion of sun	1	4
2.3	Summer solstice and winter solstice	1	4
2.4	Celestial co-ordinate systems: – Horizon system – Azimuth & Altitude, Equatorial system-Right ascension & declination, Ecliptic coordinate system.	2	1
2.5	Time - apparent and mean solar time, sidereal time	1	4
2.6	Twilight, Seasons- causes of seasons (qualitative ideas)	1	4
2.7	International Date Line	1	4
2.8	Sun - solar atmosphere and internal structure – Photosphere, chromosphere and corona	1	4
2.9	Radiation zone & Convection Zone	2	4
2.10	Sun spots, Activity Cycles, flares, prominences, coronal holes, Solar wind	2	4
2.11	Galaxies - our galaxy, galaxy types & turning fork diagram	2	5
2.12	Structure on the largest scale-clusters, super clusters and voids	1	3
3.0	**ASTROPHYSICS, COSMOLOGY**		
3.1	Gravitational contraction	1	3
3.2	Virial theorem, Jeans mass	1	1
3.3	Energy production inside stars	1	1
3.4	Thermonuclear fusion	1	1
3.5	Hydrogen burning	1	1
3.6	p-p chain	1	1
3.7	CNO cycle	1	1
3.8	Evolution of stars – birth	1	1
3.9	Protostar, hydrostatic equilibrium, red giant	1	1
3.10	Late stages of evolution - white dwarfs & Chandrasekhar limit, Neutron stars, Supernovae, Pulsars, Black holes	2	1
3.11	Stellar Classification	1	1
3.12	H-R diagram	1	3
3.13	Main sequence stars	1	3
3.14	Large scale structure of the universe	1	5
3.15	Isotropy and homogeneity	1	5
3.16	Cosmological principle	1	5

3.17	Standard big bang model	1	5
3.18	GUT, Planck Epoch, Inflation and nucleosynthesis	2	5
3.19	Recombination & CMBR	1	5
3.20	Expanding universe - red shift	1	6
3.21	Hubble's law and Hubble parameter	2	6
3.22	Age of universe and its determination	1	6
3.23	Dark energy and Dark Matter (qualitative idea)	1	5

Text Books for Reference:

1. Astrophysics: Stars and Galaxies- K D Abhyankar
2. Introduction to Astronomy and Cosmology, Ian Morison, John Wiley & Sons, Inc
3. ASTRONOMY, A Self-Teaching Guide, Dinah L. Moché, John Wiley & Sons, Inc

Text Books for Enrichment:

1. A short history of the Universe – Joseph Silk
2. Introduction to cosmology- J V Narlikar

urse	Details		
Code	**PHX1801**		
Title	**BASIC INSTRUMENTAL SKILLS AND ELECTRICAL CIRCUITS**		
Degree	BSc		
Branch(s)	Physics		
Year/Semester	I/II		
Type	Extra Credit Course		
Credits	2	Total Hours	36

CO No.	*Expected Course Outcomes* *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Discuss the basics of measurement and electricity principles	U	1
2	Discuss the electrical circuits, generators and transformers	Ap	1
3	Explain about the solid state devices, electrical wiring and electrical protection	Ap	1
4	Discuss about oscilloscopes signal and pulse generators	Ap	2
5	Summarise the core knowledge and applications in digital multimeter	Ap	3

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO.No.
1.0	**Basic Electricity Principles**		
1.1	Voltage, Current, Resistance and Power, Ohm's law Series, parallel, and series-parallel combinations	1	1
1.2	AC and DC Electricity.	1	1
1.3	Familiarization with multimeter, voltmeter and ammeter	1	1`
	Basics of Measurement		1
1.4	Instruments accuracy, precision, sensitivity, resolution range	1	1
1.5	Errors in measurements	1	1
	Multimeter		
1.6	Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. and their significance	1	1
1.7	Specifications of a multimeter	1	1
2.0	**Electrical Circuits**		
2.1	Basic electric circuit elements and their combination.	1	2
2.2	Rules to analyze DC sourced electrical circuits.	1	2
2.3	Current and voltage drop across the DC circuit elements	1	2
2.4	Single-phase and three-phase alternating current sources	2	2
2.5	Rules to analyze AC 50 sourced electrical circuits.	1	2
	Generators and Transformers		
2.6	DC Power sources	1	2
2.7	AC/DC generators, Inductance, capacitance and impedance	1	2
2.8	Operation of transformers	1	2
	Electric Motors		
2.9	Single-phase, three-phase & DC motors -Basic design	1	2
2.10	Interfacing DC or AC sources to control heaters & motors	1	2
	Solid-State Devices		
2.11	Resistors, inductors and capacitors, diode and rectifiers	1	3
2.12	Components in Series or in shunt	1	3
2.13	Response of inductors and capacitors with DC or AC sources	1	3
2.14	**Electrical Protection**		
2.15	Relays, Fuses and disconnect switches	2	3
2.16	Circuit breakers, Overload	2	3
	Electrical Wiring		
2.17	Different types of conductors and cables	1	3

2.18	Basics of wiring-Star and delta connection	1	3
3.0	**Oscilloscope**		
3.1	CRO	1	4
3.2	CRT- Block diagram, construction, electrostatic focusing and acceleration (Explanation only– no mathematical treatment)	1	4
3.3	Brief discussion on screen phosphor, Specifications of CRO and their significance	1	4
3.4	Use of CRO for the measurement of voltage (dc and ac), frequency and time period	1	4
3.5	Special features of dual trace, introduction to digital oscilloscope, probes	1	4
	Signal and pulse Generators		
3.6	Block diagram, explanation and specifications of low frequency signal generator and pulse generator	1	4
3.7	Brief idea for testing, specifications, wave analysis	1	4
	Digital Multimeter		
3.8	Block diagram and working of a digital multimeter	1	5
3.9	Working principle of time interval, frequency and period measurement, accuracy and resolution	1	5

Text Books for Reference

1. A text book in Electrical Technology -. B L Theraja - S Chand & Co
2. Electrical Technology – Edward Hughes
3.Electronics Lab Manual Vol 1 K A Navas

Course	Details		
Code	**PHX1802**		
Title	**SCIENTIFIC COMPUTATIONAL PHYSICS**		
Degree	B.Sc.		
Branch(s)	Physics		
Year/Semester	II/IV		
Type	Extra Credit Course		
Credits	2	Total hours	36

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Discuss basic idea of operating systems, file systems, scripting	U	1
2	Explain the methods to set environment and also various modes of operation	U	1
3	Illustrate concept of basic shell programing	Ap	2
4	Discuss basic idea of word processor, Latex and document classes	U	2
5	Design simple Latex document	C	3
6	Discuss various options of Latex to improve quality of presentation	U	1
7	Use Linux scripting commands in simple scripting programs and latex commands in designing small documents	Ap	3
8	Design a small project using Latex	Ap	3

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO.No.
1.0	**Linux**		
1.1	Different operating systems, Linux, kernel – shell - file system – commands, file security, file permissions, *man* pages, alias, copying files,	2	1
1.2	Environmental files, *vi* text editor, command mode, input mode, last line mode	2	2
1.3	C-shell scripting, invoking a C shell, C-shell example,	1	3
1.4	Looping, shell variables, filename modifiers,logical operators, conditionals.	1	3
1.5	Conditionals, file inquiry operators, communication commands, tcp/ip, secure shell, sftp	1	3
2.0	**LaTex**		
2.1	TeX/LaTex word processor, preparing a basic LaTex file, document classes,	1	4
2.2	Preparing an input file for LaTex, compiling LaTex file, LaTex tags for creating different environments	1	5
2.3	Defining LaTex commands and environments, changing the type style, symbols from other languages	1	6
2.4	Formulae and equations, figures and floating bodies, lining in columns	1	6
2.5	Tabbing and tabular environment, generating table of contents, bibliography and citation	1	6
2.6	Making an index and glossary, list making environments, fonts, picture environment and colours, errors	2	6
3.0	**Hands on: Linux and LaTex**		
3.1	Install Linux from scratch	2	7
3.2	Create a “test file” directory, Move and copy test files within and outside parent directory	3	7
3.3	Find your IP address, change permissions onseveral of your test files	2	7
3.4	Get help on the LS command, explore the file system “cd /, ls, cd ~, pwd”	3	7
3.5	Invoke a C shell, edit and exit	2	7
3.6	Setting a LaTex document, typesetting text	2	7
3.7	Application of different document classes, handling of LaTeX errors, typesetting equations	2	7
3.8	Tabular columns and environment, writing a bibliography, preparing a glossary	2	7
3.9	Write a LaTeX report including introduction, section, subsection, figure, table and bibiliography	4	8

Text Books for Reference

1. The Linux Command Line: A Complete Introduction, William E. Shotts, Jr., William Pollock,2012
2. LaTeX-A Document preparation system, Leslie Lamport, Second edition, Addison-Wesley,1994

Text Books& tutorials for Enrichment

A practical guide to ubuntu Linux , Mark Sobell's
1. Point & click Linux ,Robin Roblimo miller
3 http://tldp.org/LDP/intro-linux/html/index.html
4 http://coffee.ncat.edu:8080/Flurchick/Lectures/linuxIntroduction/syllabus.html
5. http://www.freeos.com/guides/lsst/
6. https://en.wikibooks.org/wiki/LaTeX
7. https://www.latex-tutorial.com/tutorials/first-document/

Course	Details		
Code	**PHA1801**		
Title	**Optics of Photography**		
Degree	B.Sc.		
Branch(s)	Physics		
Year/Semester	-		
Type	Add On Course		
Credits	2	Total hours	36

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Discuss the basics of photography	U	1
2	Discuss the various types of cameras	U	1
3	Explain about the physics of light	U	1
4	Analyse examples of photographic art	An	2
5	Demonstrate an understanding of advanced techniques and methods specific to the practice of photography	Ap	3

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO.No.
1.1	Invention Of Photography	1	1
1.2	Camera ,Choosing A Camera	1	2
1.3	Lenses: Type Of Lenses	1	2
1.4	Focusing ,Focal Length, Aperture	1	2
1.5	Depth Of Field , Shutter Speeds	1	2
1.6	DSLR Camera	2	2
1.7	Image Sensor	1	2
1.8	ISO, Aspect Ratio	1	2
1.9	Full Frame, APS Sensors.	1	2
1.10	Working With Tripod And Other Supporting Accessories.	2	2
2.1	Light- What Is Light?	1	3
2.2	Physics Of Light, Properties Of Light	1	3
2.3	Lighting Aesthetics, Colour Temperature, Direction	1	3
2.4	Quality Of Light	1	3
2.5	Light Sources: Natural Light	1	3
2.6	Artificial Light-Hard And Soft Light, Key Light	2	3

2.7	Fill Light, Rim Light ,Front Lighting, Side Lighting	2	3
2.8	Three Point Lighting- Studio Lighting And Light Modifiers:-Flash Diffusers	2	4
2.9	Gels And Filters.	2	4
3.1	Photographic Projects: Product Photography (Advertisement Photography)	5	5
3.2	Photography for Stop Motion Animation.	6	5

Text Books for Reference

1.Photography, the art of composition by Bert Krages
2.Photographic lighting Simplified by Susan McCartney
3.Creative composition by Harold Davis
4.The 3d photography book by Jeffrey L. Cooper
5.Focal Encyclopaedia of Photography by Focal Press Team
6.3D Storytelling: How Stereoscopic 3D Works and How to Use It by Bruce Block
7. Optics by N. Subramanian Brijlal, M N Avadhanulu

Complementary Course for B.Sc. Mathematics (MAT)

Course	Details				
Code	**PH1811201**				
Title	**PROPERTIES OF MATTER & ERROR ANALYSIS**				
Degree	B. Sc.				
Branch(s)	Physical Science				
Year/Semester	I/I				
Type	Complementary Physics for Mathematics				
Credits	2	Hours/week	2	Total hours	36

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Define the basic concepts related to modulus of elasticity	R	MAT 8
2	Illustrate the different examples of elasticity	A	MAT 8
3	Explain the molecular theory of surface tension	U	MAT 8
4	Categorize the factors affecting the surface tension	An	MAT 8
5	Discuss the theories related to viscosity	E	MAT 8
6	List different types of errors	R	MAT 8
7	Interpret the errors in instruments	A	MAT 8

PSO-Program Specific outcome; CO-Course Outcome; Cognitive Level: R-Remember;
U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO. No.
1.0	**ELASTICITY**		
1.1	Stress- strain- Hooke's law	1	1
1.2	Elastic moduli- Poisson's ratio	1	2
1.3	Twisting couple	1	2
1.4	Determination of rigidity modulus static and dynamic methods	1	1,2
1.5	Static torsion	1	2
1.6	Torsion pendulum	1	2
1.7	Bending of beams	1	2
1.8	Cantilever	1	2
1.9	Uniform bending	2	2

1.10	Non-uniform bending	2	2
1.11	I-section girder	1	1,2
2.0	**SURFACE TENSION AND HYDRODYNAMICS**		
2.1	Molecular theory of surface tension	1	3
2.2	Surface energy - excess pressure in a liquid drop	1	3
2.3	Factors affecting surface tension - applications	1	4
2.4	Streamline and turbulent flow, critical velocity	1	5
2.5	Coefficient of viscosity	1	5
2.6	Derivation of Poiseuille's equation	1	5
2.7	Stokes equation	1	5
2.8	Determination of viscosity by Poiseuille's method	1	5
2.9	Brownian motion , Viscosity of gases	1	5
2.10	Bernoulli's theorem	1	5
3.0	**ERROR ANALYSIS**		
3.1	Error Analysis-Basic ideas, uncertainties of measurement	1	6
3.2	Importance of estimating errors	1	6
3.3	Dominant errors – random errors – systematic errors	1	6
3.4	Rejection of spurious measurements	1	7
3.5	Estimating and reporting errors	1	6,7
3.6	Errors with reading scales	1	7
3.7	Errors of digital instruments	1	7
3.8	Number of significant digits	1	7
3.9	Absolute and relative errors – standard deviation	1	7
3.10	Propagation of errors- sum and differences	1	7
3.11	Propagation of errors -products and quotients	1	7
3.12	Multiplying by constants	1	7
3.13	Powers	1	7

Text Books for Reference

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 Measurements, John R. Taylor - Univ.
Science Books

Course	Details				
Code	**PH1811701**				
Title	**PROPERTIES OF MATTER & ERROR ANALYSIS (P)**				
Degree	B. Sc.				
Branch(s)	Physical Science				
Year/Semester	I/I				
Type	**Complementary Practical Physics For Mathematics**				
Credits	1	Hours/week	2	Total hours	36

CO No.	*Expected Course Outcomes* *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Create basic ideas of measuring instruments	C	MAT 8
2	Verify Modulus of elasticity of different bodies	E	MAT 8
3	Analyze various physical parameters related to mechanics	An	MAT 8
4	Understand the importance of light experiments	U	MAT 8
5	Understand the basic ideas of Conducting/ Semiconducting materials	U	MAT 8

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Section	Course Description	Hrs	CO.No.
1.1	Vernier Calipers - Volume of cylinder	2	1
1.2	Vernier Calipers - Volume of solid & hollow sphere	2	1
1.3	Screw gauge – Thickness of glass sheet, volume of glass piece	2	1
1.4	Beam balance - Mass of a solid (sensibility method)	2	1
1.5	Spectrometer – Angle of Prism & Minimum Deviation	2	1,4
1.6	Coefficient of viscosity of the liquid – Constant pressure head method	2	3
1.7	Determination of Young's Modulus- Cantilever (Scale and Telescope)	2	2
1.8	Determination of Young's Modulus - Uniform bending (Optic lever method)	2	2
1.9	Symmetric Compound Pendulum- Acceleration due to gravity (g)	2	3
1.10	Symmetric Compound Pendulum - Determination of Radius of gyration	2	3
1.11	Fly wheel – Moment of Inertia	2	3
1.12	Determination of moment of inertia of rotationally symmetric body-solid sphere- from their period of oscillation on a torsion axle	2	3
1.13	Spring constant - Hooke's law - oscillation	2	3

1.14	Resistivity of the material of the wire- Ohm's law and verification by multimeter	2	5
1.15	Construction of half wave rectifier without filter – Ripple factor	2	5
1.16	Laser- Transmission Grating- Determination of wavelength	2	4
1.17	Temperature dependence of capacitance- polymer capacitors	2	2
1.18	Resistance of a galvanometer	2	5

Text Books for Reference

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

Course	Details				
Code	**PH1812203**				
Title	**MECHANICS AND ASTROPHYSICS**				
Degree	B.Sc.				
Branch(s)	Physical Science				
Year/Semester	I/II				
Type	Complementary Physics for mathematics				
Credits	2	Hours/week	2	Total Hours	36

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Recall the basic ideas of gravity	R	MAT 8
2	illustrate the experiments related to gravity	A	MAT 8
3	Recognize the ideas of rotational dynamics	R	MAT 8
4	Determine the moment of inertia of different bodies	E	MAT 8
5	Differentiate periodic and oscillatory motion	An	MAT 8
6	Explain the theories related to progressive waves	An	MAT 8
7	Explain various physical parameters that affecting the star.	U	MAT 8
8	Discuss various theories of evolution of stars	An	MAT 8

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO. No.
1.0	**MOTION UNDER GRAVITY & ROTATIONAL DYNAMICS**		
1.1	Velocity- acceleration	1	1
1.2	Force – acceleration due to gravity	1	1
1.3	Compound pendulum (symmetric and asymmetric) radius of gyration	1	2
1.4	Kater's Pendulum	1	2
1.5	Centripetal acceleration and force - centrifugal force	1	1
1.6	Angular velocity- angular momentum	1	3
1.7	Torque- conservation of angular momentum	1	3
1.8	Angular acceleration	1	3
1.9	Moment of inertia- parallel and perpendicular axes theorems	1	3,4
1.10	Moment of inertia of rod	1	4
1.11	Moment of inertia of ring	1	4
1.12	Moment of inertia of disc	1	4
1.13	Moment of inertia of cylinder	1	4
1.14	Moment of inertia of sphere	1	4
1.15	Flywheel	1	4
2.0	**OSCILLATIONS AND WAVES**		
2.1	Periodic and oscillatory motion	1	5
2.2	Simple harmonic motion	1	5
2.3	Differential equation	1	5
2.4	Expression for displacement, velocity and acceleration	1	5
2.5	Graphical representation- energy of a particle executing simple harmonic motion	1	5
2.6	Damped oscillation	1	
2.7	Forced oscillation	2	5
2.8	Resonance	1	5
2.9	Waves-classifications	1	6
2.10	Progressive wave- energy of progressive wave	1	6
2.11	Superposition of waves, Theory of beats	1	6
2.12	Doppler Effect	1	6
3.0	**ASTROPHYSICS**		

3.1	Temperature and color of a star	1	7
3.2	Elements present in stellar atmosphere	1	7
3.3	Mass of star	1	7
3.4	Life time of a star	1	7
3.5	Main sequence stars-HR diagram	2	8
3.6	Evolution of stars- white dwarf, supernova explosion	2	8
3.7	Neutron star- black hole	1	8
3.8	Temperature and color of a star	1	8

Text Books for Reference

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. KirthigaSivaprasad
4. A text book on oscillations waves and acoustics, M.Ghosh , D Bhattacharya
5. Introduction to Astrophysics-BaidyanathBasu.
6. Mechanics by D.S. Mathur and P.S. Hemne, S. Chand.
7. Waves, Mechanics & Oscillations- S B Puri

Course	Details				
Code	**PH1812703**				
Title	**MECHANICS AND ASTROPHYSICS (P)**				
Degree	B. Sc.				
Branch(s)	Physical Science				
Year/Semester	I/II				
Type	**Complementary Practical Physics For Mathematics**				
Credits	1	Hours/week	2	Total hours	36

CO No.	*Expected Course Outcomes* *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Create basic ideas of measuring instruments	C	MAT 8
2	Verify Modulus of elasticity of different bodies	E	MAT 8
3	Analyze various physical parameters related to mechanics	An	MAT 8
4	Understand the importance of light experiments	U	MAT 8
5	Understand the basic ideas of Conducting/ Semiconducting materials	U	MAT 8

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Section	Course Description	Hrs	CO. No.
1.1	Vernier Calipers - Volume of beaker	2	1
1.2	Screw gauge – Radius of wire, volume of sphere	2	1
1.3	Spectrometer - Refractive Index of material of prism.	2	1,4
1.4	Diode characteristics- ac and dc resistance	2	3
1.5	Coefficient of viscosity of the liquid –Variable pressure head method	2	3
1.6	Surface Tension – Capillary rise method	2	3
1.7	Determination of Young's Modulus - Non-uniform bending (Pin and Microscope method	2	2
1.8	Acceleration due to gravity (g)- Kater's pendulum	2	3
1.9	Symmetric Compound Pendulum - Determination of moment of inertia		
1.10	Torsion pendulum -Rigidity modulus	2	3

1.11	Determination of moment of inertia of rotationally symmetric body- cylinder - from their period of oscillation on a torsion axle	2	3
1.12	Determination of moment of inertia of rotationally symmetric body -Disc- from their period of oscillation on a torsion axle	2	3
1.13	Construction of half wave rectifier with filter – Ripple factor		5
1.14	Laser- Reflection Grating- Determination of wavelength		4
1.15	Liquid lens - Refractive Index of glass using a liquid of known refractive index.	2	4
1.16	Poisson's ratio of rubber	2	2
1.17	Temperature dependence of capacitance- ceramic capacitors		2
1.18	Figure of merit of a galvanometer	2	5

Text Books for Reference

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

Course	Details				
Code	**PH1813205**				
Title	MODERN PHYSICS AND ELECTRONICS				
Degree	B.Sc.				
Branch(s)	Physical Science				
Year/Semester	II/III				
Type	Complementary Physics for Mathematics				
Credits	3	Hours/week	3	Total Hours	54

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Explain the different atom models	U	MAT 8
2	Compute the binding energy of nucleus	Ap	MAT 8
3	Interprets the theory of radioactivity	An	MAT 8
4	Explain the physical concepts of quantum mechanics	U	MAT 8
5	Summarise the Schrödinger equation (time dependent and time independent) for a particle in a potential box.	An	MAT 8
6	Explain the quantum theory of Raman Effect	U	MAT 8
7	Explain the physics of semiconductors	U	MAT 8
8	Evaluate the working of diodes and rectifiers	Ap	MAT 8
9	Recognize different types of number systems as they relate to computers	R	MAT 8
10	Describe the operation of the logic gates	R	MAT 8
11	Construct and understand the working principles of half adder and full adder	Ap	MAT 8

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO.No.
1.0	**Modern Physics**		
1.1	Basic features of Bohr atom model	1	1
1.2	Formula for energy	1	1
1.3	Vector atom model	1	1
1.4	Various quantum numbers	1	1
1.5	Coupling schemes-LS &JJ	1	1
1.6	Pauli's exclusion principle	0.5	1
1.7	Magnetic moments of orbital electrons	1	1
1.8	Atomic nucleus	1	1
1.9	Basic properties of nucleus-charge, mass, spin,magnetic moment, binding energy and packing fraction	1	2
1.10	Nuclear forces-Salient features	1	2
1.11	Radioactivity	1	3
1.12	Properties of alpha, beta and gamma	0.5	3
1.13	Soddy Fajan's displacement law	1	3
1.14	Law of radioactive disintegration	1	3
1.15	Decay constant	1	3
1.16	Half-life and mean life	1	3
1.17	Radioactive equilibrium	1	3
1.18	Measurement of radioactivity	1	3
1.19	Radiocarbon dating	1	3
2.0	**Quantum Mechanics and Spectroscopy**		
2.1	Inadequacies of classical physics	1	4
2.2	Experimental evidences	2	4
2.3	Evidences for quantum theory	1	4
2.4	Planck's hypothesis	1	4
2.5	Foundation of quantum mechanics	1	4
2.6	Wave function and probability density	2	4
2.7	Schrodinger equation	2	5
2.8	Time dependent and time independent particle in a box	2	5
2.9	Optical Spectra	0.25	5
2.10	Spectral terms	0.25	6
2.11	Selection rules	0.25	6
2.12	Hyperfine structure	0.25	6
2.13	Molecular spectra	0.5	6
2.14	Rotational, vibrational and electronic spectra	1	6
2.15	Raman effect	0.5	6
2.16	Experimental study	0.5	6

2.17	Quantum theory	0.5	6
2.18	Fluoresence and phosphorescence	0.5	6
2.19	Comparison of Raman	0.5	6
2.20	Fluroscence of IR spectra	0.5	6
2.21	NMR	0.5	6
3.0	**Electronics and Digital electronics**		
3.1	Current-voltage characteristics of a diode	0.25	7
3.2	Forward and reverse bias	0.5	7
3.3	Breakdown mechanism of p-n junction diode	0.5	7
3.4	Zener diode and its characteristics	0.5	7
3.5	Halfwave and full wave rectifiers	0.5	8
3.6	Bridge rectifier	1	8
3.7	Ripple factor	0.5	8
3.8	Efficiency	0.5	8
3.9	Bipolar junction transistor	0.75	8
3.10	Construction and operation	1	8
3.11	Different number systems - Decimal, binary, octal, hexa decimal number systems	1	9
3.12	Conversion between different number systems	1	9
3.13	Binary mathematics - Addition, subtraction (1's complement and 2's complement methods)	1	9
3.14	Basic theorems of Boolean algebra	1	10
3.15	de Morgan's theorem	1	10
3.16	Simplification of Boolean equations	1	10
3.17	AND. OR, NOT, NAND, NOR, XOR gates	1	10
3.18	Truth tables	1	10
3.19	Half adder	1	11
3.20	Full adder	1	11

Text Books for Reference

1 Modern Physics,R.Murugeshan and KiruthigaSivaprasath, S. Chand Publishing, New Delhi, 2016.

2 Principles of Electronics, V K Mehta and Rohit Mehta, S. Chand Publishing, New Delhi, 1980.

3 Digital Principles and Applications, D. P. Leach, A. P. Malvino and G. Saha, Tata McGraw Hill Education
Private limited, New Delhi, 2011.

4 Concepts of Modern Physics, Arthur Beiser, The McGraw-Hill Companies, Inc., New York, 2003.

Text Books for Enrichment

1 Basic Electronics, B L Theraja, S. Chand Publishing, New Delhi, 2005.

2 Digital Design,Morris Mano and M. D. Ciletti, Pearson, New York, 2013.

Course	Details				
Code	**PH1813705**				
Title	**MODERN PHYSICS AND ELECTRONICS (P)**				
Degree	BSc				
Branch(s)	Physical Science				
Year/Semester	II/III				
Type	COMPLEMENTARY PHYSICS FOR MATHEMATICS				
Credits	1	Hours/week	2	Total hours	36

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Determine the Young's Modulus of material using Pin & Microscope	E	MAT 8
2	Determine the moment of inertia using asymmetric compound Pendulum and torsion pendulum	E	MAT 8
3	Determine the dispersive power of prism and grating using spectrometer	E	MAT 8
4	Determine the wave length of light using Newton's rings	E	MAT 8
5	Verify the calibration of low range ammeter using potentiometer	E	MAT 8
6	Construct the full wave rectifier and find the ripple factor with and without filter	C	MAT 8

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Section	Course Description	Hrs	CO.No.
1	Determination of Young's Modulus- Cantilever (Pin& Microscope)	2	1
2	Determination of Young's Modulus -Uniform bending (pin and microscope)	2	1
3	Determination of Young's Modulus -Non-uniform bending (optic lever)	2	1
4	Asymmetric Compound Pendulum- Determination of moment of inertia	2	2
5	Asymmetric Compound Pendulum- Determination of acceleration due to gravity (g)	2	2
6	Torsion pendulum (Equal mass method) - Determination of moment of Inertia	2	2
7	Torsion pendulum (Equal mass method) - Determination of rigidity modulus	2	2
8	Spectrometer– Dispersive power of prism	2	3
9	Spectrometer –Refractive index of prism	2	3
10	Spectrometer – Dispersive power of grating	2	3
11	Newton's rings - Determination of wavelength	2	4
12	Newton's rings- Determination of refractive index	2	4
13	Characteristics of Zener diode - Determination of break down voltage	2	6
14	Characteristics of Zener diode- ac and dc resistance	2	6
15	Conversion of galvanometer into voltmeter	2	5
16	Carey Foster's Bridge -Measurement of unknown resistance	2	5
17	Carey Foster's Bridge -Measurement of resistivity	2	5
18	Tangent Galvanometer – Ammeter calibration	2	5

Books for Reference

1. Practical Physics – C L Arora, S Chand
2. Properties of Matter -D.S. Mathur, S Chand
3. Optics –Subrahmanyam & Brijlal, S Chand
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

Course	Details				
Code	**PH1814207**				
Title	OPTICS AND ELECTRICITY				
Degree	B.Sc.				
Branch(s)	Physical Science				
Year/Semester	II/IV				
Type	Complementary Physics for Mathematics				
Credits	3	Hours/week	3	Total Hours	54

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Explain the phenomenon of interference	U	MAT 8
2	Analyze Newton's ring experiment	An	MAT 8
3	Differentiates the different types of Diffraction	Ap	MAT 8
4	Compute the resolving power of grating	Ap	MAT 8
5	Explains the concept of Polarization	U	MAT 8
6	State and analyze Brewster's law	R	MAT 8
7	Explains the e-ray and o-ray	U	MAT 8
8	Describe the different types of lasers, its principle, properties	An	MAT 8
9	Recognize and classify the structures of Optical fiber and types	R	MAT 8
10	Explain the electrical behaviour of dielectric materials	U	MAT 8
11	Illustrate the theory related to Gauss's law in dielectrics	Ap	MAT 8
12	DescribeRC, LC, LR and LCR Series Circuits at resonance	An	MAT 8
13	Explain the significance of the resonant frequency	U	MAT 8

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO.No.
1.0	**Interference, Diffraction and Polarization**		
1.1	Light waves	0.5	1
1.2	Phase difference and coherence	0.5	1
1.3	Optical path and phase change	0.5	1
1.4	Principle pf superposition	1	1
1.5	Analytical treatment of interference	1	1
1.6	Young's double slit experiment	1	1
1.7	Conditions for interference	0.5	1
1.8	Band width	0.5	1

1.9	Interference in thin films	0.5	1
1.10	Reflected system	0.5	1
1.11	Colour of thin films	0.5	1
1.12	Fringes of equal inclination and equal thickness	0.5	1
1.13	Newton's rings	1	2
1.14	Reflected system	0.5	2
1.15	Measurement of wavelength	0.5	2
1.16	Fresnel and Fraunhofer diffraction	1	3
1.17	Fresnel's theory of approximate propagation of light Fraunhofer diffraction	1	3
1.18	Theory of plane transmission grating	1	3
1.19	Determination of wavelength	0.5	4
1.20	Dispersive power of grating	0.5	4
1.21	Prism and grating spectra	0.5	4
1.22	Resolving power	0.5	4
1.23	Rayleigh criterion	0.5	4
1.24	Resolving power of grating	0.5	4
1.25	Polarization	1	5
1.26	Types of polarization	0.5	5
1.27	Brewster's law	1	6
1.28	Dichorism	0.5	6
1.29	Birefringence	0.5	6
1.30	e-ray and o-ray	1	7
1.31	Polariser and analyser	1	7
1.32	Malu's law	0.5	7
1.33	Optical activity	0.5	7
2.0	**Laser and Fiber optics**		
2.1	Principle of operation of laser	1	8
2.2	Population inversion, metastable states	1	8
2.3	Optical resonator	1	8
2.4	Components of laser- active medium, pump, optical resonant cavity	1	8
2.5	Principal pumping schemes - three level and four level	1	8
2.6	Laser beam characteristics applications of lasers	1	8
2.7	Light propagation in optical fibers	1	9
2.8	Acceptance angle, numerical aperture	1	9
2.9	Step index fiber	1	9
2.10	Graded index fiber	1	9
3.0	**Dielectrics and Varying Currents**		
3.1	Dielectrics	1	10
3.2	Polar and non-polar dielectrics	1	10
3.3	Polarization	1	10
3.4	Sources of polarization	1	10
3.5	Gauss's law in dielectrics	1	11
3.6	Permittivity	1	10
3.7	Dielectric displacement vector	1	10

3.8	Dielectric constant	1	10
3.9	Susceptibility	1	10
3.10	Ferro-electricity	1	10
3.11	Transient currents	1	10
3.12	Growth and decay of current in an inductive circuit	2	12
3.13	Charging and discharging of a capacitor through a resistance	2	12
3.14	Peak, mean, rms and effective values of a.c, Ac circuits	2	12
3.15	AC through RC, LC, LR and LCR series circuits resonance	3	12
3.16	Sharpness of resonance	1	13
3.17	Power factor	1	13

Text Books for Reference

1 A Text Book of Optics, Brij Lal, M N Avadhanulu and N Subrahmanyam, S. Chand Publishing, New Delhi, 2012.
2 Electricity and Magnetism, D.C. Tayal, Himalaya Publishing House, New Delhi, 2015.
3 Electricity and Magnetism, R. Murugeshan, Electricity and Magnetism, S. Chand Publishing, New Delhi, 2017.
4 Lasers: Theory and Applications K. Thyagarajan and A. Ghatak, Lasers: Theory and Applications, Springer,New York, 2010.
5 Concepts of Modern Physics, Arthur Beiser, The McGraw-Hill Companies, Inc., New York, 2003.
6 Optical Fiber Communications, John M Senior, Prentice Hall, New Delhi, 2009.

Text Books for Enrichment

1 Modern Physics, R. Murugeshan and KiruthigaSivaprasath, S. Chand Publishing, New Delhi, 2016.
2 Electricity and Magnetism,J.H.Fewkes and John Yarwood, University Tutorial Press,London, 1965.
3 Laser Systems and Applications, V. K. Jain, Alpha Science International Ltd., Oxford, United Kingdom, 2013.

Course	Details				
Code	**PH1814707**				
Title	**OPTICS & ELECTRICITY (P)**				
Degree	BSc				
Branch(s)	Physical Science				
Year/Semester	II/ IV				
Type	COMPLEMENTARY PHYSICS FOR MATHEMATICS				
Credits	1	Hours/week	2	Total hours	36

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Determine the moment of inertia using torsion pendulum	E	MAT 8
2	Determine the dispersive power of prism and grating using spectrometer	E	MAT 8
3	Determination of B_h along the axis of circular coil	E	MAT 8
4	Determine the thickness of wire using air wedge	E	MAT 8
5	Verify the calibration of low range ammeter using potentiometer	E	MAT 8
6	Construct the full wave rectifier and find the ripple factor with and without filter	C	MAT 8
7	Construct the Gates – AND, OR, NOT and verify the truth tables	C	MAT 8
8	Determine the width of single slit using Laser diffraction	E	MAT 8

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Section	Course Description	Hrs	CO.No.
1	Potentiometer-Calibration of low range ammeter	2	5
2	Potentiometer-Calibration of low range voltmeter	2	5
3	Construction of full wave rectifier -center-tap-with and without filter Ripple factor	2	6
4	Construction of full wave rectifier –bridge rectifier- with and without filter Ripple factor	2	6
5	Construction of regulated power supply using Zener diode-line and load regulation	2	6
6	Laser diffraction- width of single slit	2	8
7	Laser diffraction- thickness of wire	2	8
8	Refractive index of liquid- Liquid Lens	2	2
9	Refractive index of material of prism- Spectrometer	2	2
10	Refractive index of liquid- Hollow Prism	2	2
11	Air wedge-thickness of wire	2	4
12	Static Torsion - Determination of rigidity modulus	2	1
13	Deflection and Vibration Magnetometer- Determination of magnetic moment	2	3
14	Deflection and Vibration Magnetometer- Determination of B_h	2	3
15	Field along the axis of circular coil- Determination of B_h	2	3
16	Searle's Vibration Magnetometer - Determination of magnetic moment	2	3
17	Gates – AND, OR- Verification of truth tables	2	7
18	Gates – NOT- Verification of truth table	2	7

Books for Reference

1. Practical Physics – C L Arora, S Chand
2. Properties of Matter -D.S. Mathur, S Chand
3. Optics –Subrahmanyam & Brijlal, S Chand
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

Complementary course for BSc Chemistry (CH)

Course	Details				
Code	**PH1811202**				
Title	**PROPERTIES OF MATTER & THERMODYNAMICS**				
Degree	B.Sc.				
Branch(s)	Physical Science				
Year/Semester	I/I				
Type	Complementary Physics for Chemistry				
Credits	2	Hours/week	2	Total Hours	36

CO No.	*Expected Course Outcomes* *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Define the basic concepts related to modulus of elasticity	R	CH 7
2	Illustrate different examples of elasticity	A	CH 7
3	Explain the molecular theory of surface tension	U	CH 7
4	Categorize the factors affecting the surface tension	An	CH 7
5	Discuss the theories related to viscosity	E	CH 7
6	Classify different thermodynamic systems	A	CH 7
7	Explain the theories of thermodynamics	A	CH 7

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO.No.
1.0	**Elasticity**		
1.1	Stress- strain- Hooke's law	1	1
1.2	Elastic moduli- Poisson's ratio	1	2
1.3	Twisting couple	1	2
1.4	Determination of rigidity modulus static and dynamic methods	1	1,2
1.5	Static torsion	1	2
1.6	Torsion pendulum	1	2
1.7	Bending of beams	1	2
1.8	Cantilever	1	2
1.9	Uniform bending	2	2
1.10	Non-uniform bending	2	2
1.11	I section girder	1	1,2
2.0	**Surface tension and Hydrodynamics**		
2.1	Molecular theory of surface tension	1	3
2.2	Surface energy excess pressure in a liquid drop	1	3
2.3	Factors affecting surface tension applications	1	4
2.4	Streamline and turbulent flow, critical velocity	1	5
2.5	Coefficient of viscosity	1	5
2.6	Derivation of Poiseuille's equation	1	5
2.7	Stokes equation	1	5
2.8	Determination of viscosity by Poiseuille's method	1	5
2.9	Brownian motion Viscosity of gases	1	5
2.10	Bernoulli's theorem	1	5
3.0	**Thermodynamics**		
3.1	Thermodynamic systems- thermodynamic equilibrium	1	6
3.2	Thermodynamic processes	1	6
3.3	Isothermal process- adiabatic process	1	6
3.4	Zeroth law of thermodynamics	1	7
3.5	First law of thermodynamics	1	7
3.6	Heat engine	1	7
3.7	The Carnot engine	2	7
3.8	Refrigerator	1	7
3.9	Concept of entropy	1	7
3.10	Second law of thermodynamics	1	7
3.11	Third law of thermodynamics	1	7
3.12	Maxwell's thermodynamic relations	1	7

Text Books for Reference

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

Course	Details				
Code	**PH1811702**				
Title	**PROPERTIES OF MATTER AND THERMODYNAMICS(P)**				
Degree	B. Sc.				
Branch(s)	Physical Science				
Year/Semester	I/I				
Type	**Complementary Practical Physics For Chemistry**				
Credits	1	Hours/week	2	Total Hours	36

CO No.	*Expected Course Outcomes* *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Create basic ideas of measuring instruments	C	CH 7
2	Verify Modulus of elasticity of different bodies	E	CH 7
3	Analyze various physical parameters related to mechanics	An	CH 7
4	Understand the importance of light experiments	U	CH 7
5	Understand the basic ideas of Conducting/ Semiconducting materials	U	CH 7

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Section	Course Description	Hrs	CO.No.
1.1	Vernier Calipers - Volume of cylinder	2	1
1.2	Vernier Calipers - Volume of solid & hollow sphere	2	1
1.3	Screw gauge – Thickness of glass sheet, volume of glass piece	2	1
1.4	Beam balance - Mass of a solid (sensibility method)	2	1
1.5	Spectrometer – Angle of Prism & Minimum Deviation	2	1,4
1.6	Coefficient of viscosity of the liquid – Constant pressure head method	2	3
1.7	Determination of Young's Modulus- Cantilever (Scale and Telescope)	2	2
1.8	Determination of Young's Modulus - Uniform bending (Optic lever method)	2	2
1.9	Symmetric Compound Pendulum- Acceleration due to gravity (g)	2	3
1.10	Symmetric Compound Pendulum - Determination of Radius of gyration	2	3
1.11	Fly wheel – Moment of Inertia	2	3
1.12	Determination of moment of inertia of rotationally symmetric body-solid sphere- from their period of oscillation on a torsion axle	2	3
1.13	Spring constant - Hooke's law - oscillation	2	3
1.14	Resistivity of the material of the wire- Ohm's law and verification by multimeter	2	5
1.15	Construction of half wave rectifier without filter – Ripple factor	2	5
1.16	Laser- Transmission Grating- Determination of wavelength	2	4
1.17	Temperature dependence of capacitance- polymer capacitors	2	2
1.18	Resistance of a galvanometer	2	5

Text Books for Reference

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

Course	Details				
Code	**PH1812204**				
Title	**MECHANICS AND SUPERCONDUCTIVITY**				
Degree	B. Sc.				
Branch(s)	Physical Science				
Year/Semester	I/II				
Type	Complementary Physics for Chemistry				
Credits	2	Hours/week	2	Total Hours	36

CO No.	*Expected Course Outcomes* *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Recall the basic ideas of Gravity	R	CH 7
2	illustrate the experiments related to gravity	A	CH 7
3	Recognize the ideas of rotational dynamics	R	CH 7
4	Determine the moment of inertia of different bodies	E	CH 7
5	Differentiate periodic and oscillatory motion	An	CH 7
6	Explan the theories related to progressive waves	An	CH 7
7	Describe different theories related to superconductivity	U	CH 7
8	Explain types of superconductivity and their applications	An	CH 7

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO.No.
1.0	**Motion under gravity & Rotational dynamics**		
1.1	Velocity- acceleration	1	1
1.2	Force – acceleration due to gravity	1	1
1.3	Compound pendulum (symmetric and asymmetric) radius of gyration	1	2
1.4	Kater's Pendulum	1	2
1.5	Centripetal acceleration and force - centrifugal force	1	1
1.6	Angular velocity- angular momentum	1	3
1.7	Torque- conservation of angular momentum	1	3
1.8	Angular acceleration	1	3
1.9	Moment of inertia- parallel and perpendicular axes theorems,	1	3,4
1.10	Moment of inertia of rod	1	4
1.11	Moment of inertia of ring	1	4
1.12	Moment of inertia of disc	1	4
1.13	Moment of inertia of cylinder	1	4
1.14	Moment of inertia of sphere	1	4
1.15	Flywheel	1	4
2.0	**Oscillations and Waves**		
2.1	Periodic and oscillatory motion	1	5
2.2	Simple harmonic motion	1	5
2.3	Differential equation,	1	5
2.4	Expression for displacement, velocity and acceleration	1	5

2.5	Graphical representation- energy of a particle executing simple harmonic motion	1	5
2.6	Damped oscillation	1	5
2.7	Forced oscillation	2	5
2.8	Resonance.	1	5
2.9	Waves-classifications.	1	6
2.10	Progressive wave- energy of progressive wave	1	6
2.11	Superposition of waves, theory of beats	1	6
2.12	Doppler Effect	1	6
3.0	**Superconductivity**		
3.1	Super conducting phenomenon- Occurrence	1	7
3.2	BCS theory (qualitative) , Meissner Effect	2	7
3.3	Type I and Type II superconductors	2	8
3.4	Josephson effects (qualitative)	1	8
3.5	High temperature superconductors	2	7,8
3.6	Applications of Superconductivity	2	8

Text Books for Reference

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

Course	Details				
Code	**PH1812704**				
Title	**MECHANICS AND SUPERCONDUCTIVITY(P)**				
Degree	B. Sc.				
Branch(s)	Physical Science				
Year/Semester	I/II				
Type	**Complementary Practical Physics For Chemistry**				
Credits	1	Hours/week	2	Total hours	36

CO No.	*Expected Course Outcomes* *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Create basic ideas of measuring instruments	C	CH 7
2	Verify Modulus of elasticity of different bodies	E	CH 7
3	Analyze various physical parameters related to mechanics	An	CH 7
4	Understand the importance of light experiments	U	CH 7
5	Understand the basic ideas of Conducting/ Semiconducting materials	U	CH 7

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Section	Course Description	Hrs	CO. No.
1.1	Vernier Calipers - Volume of beaker	2	1
1.2	Screw gauge – Radius of wire, volume of sphere	2	1
1.3	Spectrometer - Refractive Index of material of prism.	2	1,4
1.4	Diode characteristics- ac and dc resistance	2	3
1.5	Coefficient of viscosity of the liquid –Variable pressure head method	2	3
1.6	Surface Tension – Capillary rise method	2	3
1.7	Determination of Young's Modulus - Non-uniform bending (Pin and Microscope method	2	2
1.8	Acceleration due to gravity (g)- Kater's pendulum	2	3
1.9	Symmetric Compound Pendulum - Determination of moment of inertia		
1.10	Torsion pendulum -Rigidity modulus	2	3
1.11	Determination of moment of inertia of rotationally symmetric body- cylinder - from their period of oscillation on a torsion axle	2	3
1.12	Determination of moment of inertia of rotationally symmetric body - Disc- from their period of oscillation on a torsion axle	2	3
1.13	Construction of half wave rectifier with filter – Ripple factor		5
1.14	Laser- Reflection Grating- Determination of wavelength		4
1.15	Liquid lens - Refractive Index of glass using a liquid of known refractive index.	2	4
1.16	Poisson's ratio of rubber	2	2
1.17	Temperature dependence of capacitance- ceramic capacitors		2
1.18	Figure of merit of a galvanometer	2	5

Text Books for Reference

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

Course	Details				
Code	**PH1813206**				
Title	**MODERN PHYSICS AND MAGNETISM**				
Degree	BSc				
Branch(s)	Physical Science				
Year/Semester	II/III				
Type	Complementary Physics for Chemistry				
Credits	3	Hours/week	3	Total Hours	54

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Discuss the basic features of Bohr atom model and vector atom model	U	CH 7
2	Differentiate between the molecular spectra, rotational, vibrational and electronic spectra	U	CH 7
3	Explain the basic properties of nucleus and salient features of nuclear forces	An	CH 7
4	Explain radioactivity, its applications and properties of alpha, beta and gamma	U	CH 7
5	Summarise the Schrödinger equation (time dependent and time independent) for a particle in a potential box.	An	CH 7
6	Discuss about magnetism, different magnetic materials and its properties	U	CH 7
7	Summarise the core knowledge and applications in semiconductor, diodes and transistor.	Ap	CH 7

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO.No.
1.0	**MODERN PHYSICS**		
1.1	Basic features of Bohr atom model, formula for energy	2	1
1.2	Vector atom model	2	1
1.3	Various quantum numbers	1	1
1.4	Coupling schemes-LS and JJ coupling	1	1
1.5	Pauli's exclusion principle	1	1
1.6	Magnetic moment of orbital electrons	1	1
1.7	Optical spectra, spectral terms, selection rules	1	2
1.8	Hyperfine structure	1	2
1.9	Molecular spectra, rotational, vibrational and electronic spectra	1	2
1.10	Raman effect- experimental study and quantum theory	1	2
1.11	Fluorescence and phosphorescence	1	2
1.12	Comparison of Raman, fluorescence and IR spectra	1	2
1.13	NMR	1	2
1.14	Atomic nucleus classification	1	3
1.15	Basic properties of nucleus, charge, mass, spin, magnetic moment binding energy and packing fraction	1	3
1.16	Nuclear forces, salient features	1	3
1.17	Radioactivity, properties of alpha, beta and gamma	1	4
1.18	Soddy Fajan's displacement law, law of radioactive disintegration -decay constant	2	4
1.19	Half life and mean life-radioactive equilibrium	2	4
1.20	Measurement of radioactivity, Radio carbon dating	1	4
2.0	**QUANTUM MECHANICS AND MAGNETISM**		
2.1	Inadequacies of classical physics, experimental evidences	2	5
2.2	Evidences for quantum theory, Planck's hypothesis	2	5
2.3	Foundation of quantum mechanics	2	5
2.4	Wave function & probability density	2	5
2.5	Time dependent Schrödinger equation for a particle in a potential box	2	5
2.6	Time independent Schrödinger equation for a particle in a potential box	2	5
2.7	Properties of magnetic materials	2	6
2.8	Paramagnetism, Diamagnetism, Ferromagnetism	2	6
2.9	Ferrites, Magnetostriction	2	6
2.10	Earth's magnetism-elements of earth's magnetism-dip, declination, horizontal and vertical components	2	6
2.11	Magnetic maps and magnetographs	1	6
2.12	Cause of earth's magnetism	1	6
3.0	**ELECTRONICS**		
3.1	Current-voltage characteristics of a diode	1	7

3.2	Forward and reverse bias-breakdown mechanism of p-n junction diode	1	7
3.3	Zener diode and its characteristics	1	7
3.4	Half wave and full wave rectifiers	2	7
3.5	Bridge rectifier ripple factor, efficiency	1	7
3.6	Construction and operation of a bipolar junction transistor	2	7

Text Books for Reference

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

Text Books for Enrichment

1.Functional Electronics, Ramanan (Tata McGraw-Hill)
2.Electricity and magnetism - Brijlal and N. Subrahmanyam (S. Chand and Co.)

Course	Details				
Code	**PH1813706**				
Title	**MODERN PHYSICS AND MAGNETISM (P)**				
Degree	BSc				
Branch(s)	Physical Science				
Year/Semester	II/III				
Type	COMPLEMENTARY PRACTICAL FOR CHEMISTRY				
Credits	1	Hours/week	2	Total Hours	36

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Determine the Young's Modulus of material using Pin & Microscope	E	CH 7
2	Determine the moment of inertia using asymmetric compound Pendulum and torsion pendulum	E	CH 7
3	Determine the dispersive power of prism and grating using spectrometer	E	CH 7
4	Determine the wave length of light using Newton's rings	E	CH 7
5	Verify the calibration of low range ammeter using potentiometer	E	CH 7
6	Construct the full wave rectifier and find the ripple factor with and without filter	C	CH 7

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Section	Course Description	Hrs	CO.No.
1	Determination of Young's Modulus- Cantilever (Pin& Microscope)	2	1
2	Determination of Young's Modulus -Uniform bending (pin and microscope)	2	1
3	Determination of Young's Modulus -Non-uniform bending (optic lever)	2	1
4	Asymmetric Compound Pendulum- Determination of moment of inertia	2	2
5	Asymmetric Compound Pendulum- Determination of acceleration due to gravity (g)	2	2
6	Torsion pendulum (Equal mass method) - Determination of moment of Inertia	2	2
7	Torsion pendulum (Equal mass method) - Determination of rigidity modulus	2	2
8	Spectrometer– Dispersive power of prism	2	3
9	Spectrometer –Refractive index of prism	2	3

10	Spectrometer – Dispersive power of grating	2	3
11	Newton's rings - Determination of wavelength	2	4
12	Newton's rings- Determination of refractive index	2	4
13	Characteristics of Zener diode - Determination of break down voltage	2	6
14	Characteristics of Zener diode- ac and dc resistance	2	6
15	Conversion of galvanometer into voltmeter	2	5
16	Carey Foster's Bridge -Measurement of unknown resistance	2	5
17	Carey Foster's Bridge -Measurement of resistivity	2	5
18	Tangent Galvanometer – Ammeter calibration	2	5

Books for Reference

1. Practical Physics – C L Arora, S Chand
2. Properties of Matter -D.S. Mathur, S Chand
3. Optics –Subrahmanyam & Brijlal, S Chand
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

Course	Details				
Code	**PH1814208**				
Title	**OPTICS AND SOLID STATE PHYSICS**				
Degree	BSc				
Branch(s)	Physical Science				
Year/Semester	II/IV				
Type	Complementary Physics for Chemistry				
Credits	3	Hours/week	3	Total Hours	54

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Discuss the important and fascinating areas of interference diffraction and polarization with many experiments associated with it	U	CH 7
2	Differentiate between Fraunhofer and Fresnel diffraction	An	CH 7
3	Apply skill to find the wavelength of spectral lines using Plane diffraction grating	Ap	CH 7
4	Distinguish the methods of polarisation by reflection, refraction and scattering	An	CH 7
5	Explain Brewsters law and Malus law	U	CH 7
6	Describe the different types of lasers, its principle, properties	An	CH 7
7	Explain about the crystal structure and Bragg's law of x-ray diffraction	Ap	CH 7
8	Illustrate the theory related to Gauss's law in dielectrics	Ap	CH 7

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Module	Course Description	Hrs	CO.No.
1.0	**INTERFERENCE, DIFFRACTION AND POLARIZATION**		
1.1	Light waves, phase difference and coherence, optical path and phase change	1	1
1.2	Principle of superposition, Analytical treatment of interference	2	1
1.3	Young's double slit experiment, conditions for interference, bandwidth	1	1
1.4	Interference in thin films, reflected system, colour of thin films	2	1
1.5	Newton's rings, reflected system, measurement of wavelength	2	1
1.6	Fresnel and Fraunhofer diffractions	1	2
1.7	Fresnel's theory of approximate rectilinear propagation of light	2	2
1.8	Theory of Plane transmission grating-determination of wavelength	2	3
1.9	Dispersive power of grating, Prism and grating spectra	1	3
1.10	Polarization, types of polarization	2	4
1.11	Brewster's law, dichroism, birefringence	2	5
1.12	E- ray and o-ray, polarizer and analyzer	2	4
1.13	Malu's law	1	5
1.14	Optical activity	1	4
2.0	**LASER AND FIBER OPTICS**		
2.1	Principle of operation of laser-population inversion, metastable states	2	6
2.2	Optical resonant cavity	1	6
2.3	Principal pumping schemes- three level and four level lasers	2	6
2.4	Laser beam characteristics	1	6
2.5	Applications of lasers	1	6
2.6	Light propagation in optical fibers	1	6
2.7	Acceptance angle, numerical aperture	1	6
2.8	Step index fiber - graded index fiber	1	6
3.0	**CRYSTALLOGRAPHY AND DIELECTRICS**		
3.1	Crystal structure-crystal lattice and translation vectors	2	7
3.2	Unit cell-types of lattices	1	7
3.3	Miller indices	1	7
3.4	lattice directions and planes interplanar spacing	1	7
3.5	Simple crystal structures	1	7
3.6	Sc, fcc, bcc, hcp close packed structures	2	7
3.7	Sodium chloride structure	1	7

3.8	X-ray crystallography	1	7
3.9	Diffraction of x-rays	1	7
3.10	Bragg's law	1	7
3.11	Dielectrics- polar and non-polar dielectrics	1	8
3.12	Polarization and sources of polarization	1	8
3.13	Gauss's law in dielectrics	2	8
3.14	Permittivity- dielectric displacement vector	1	8
3.15	Dielectric constant-susceptibility	1	8
3.16	Ferro-electricity	2	8
3.17	Peak, mean, rms and effective values of A.C	2	8

Text Books for Reference

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

Text Books for Enrichment

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

Course	Details				
Code	**PH1814708**				
Title	**OPTICS AND SOLID STATE PHYSICS (P)**				
Degree	BSc				
Branch(s)	Physical Science				
Year/Semester	II/ IV				
Type	COMPLEMENTARY PRACTICAL for Chemistry				
Credits	1	Hours/week	2	Total hours	36

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Determine the moment of inertia using torsion pendulum	E	CH 7
2	Determine the dispersive power of prism and grating using spectrometer	E	CH 7
3	Determination of B_h along the axis of circular coil	E	CH 7
4	Determine the thickness of wire using air wedge	E	CH 7
5	Verify the calibration of low range ammeter using potentiometer	E	CH 7
6	Construct the full wave rectifier and find the ripple factor with and without filter	C	CH 7
7	Construct the Gates – AND, OR, NOT and verify the truth tables	C	CH 7
8	Determine the width of single slit using Laser diffraction	E	CH 7

PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create.

Section	Course Description	Hrs	CO.No.
1	Potentiometer-Calibration of low range ammeter	2	5
2	Potentiometer-Calibration of low range voltmeter	2	5
3	Construction of full wave rectifier -center-tap-with and without filter Ripple factor	2	6
4	Construction of full wave rectifier –bridge rectifier- with and without filter Ripple factor	2	6
5	Construction of regulated power supply using Zener diode-line and load regulation	2	6
6	Laser diffraction- width of single slit	2	8
7	Laser diffraction- thickness of wire	2	8
8	Refractive index of liquid- Liquid Lens	2	2
9	Refractive index of material of prism- Spectrometer	2	2
10	Refractive index of liquid- Hollow Prism	2	2
11	Air wedge-thickness of wire	2	4
12	Static Torsion - Determination of rigidity modulus	2	1
13	Deflection and Vibration Magnetometer- Determination of magnetic moment	2	3
14	Deflection and Vibration Magnetometer- Determination of B_h	2	3
15	Field along the axis of circular coil- Determination of B_h	2	3
16	Searle's Vibration Magnetometer - Determination of magnetic moment	2	3
17	Gates – AND, OR- Verification of truth tables	2	7
18	Gates – NOT- Verification of truth table	2	7

Books for Reference

1. Practical Physics – C L Arora, S Chand
2. Properties of Matter -D.S. Mathur, S Chand
3. Optics –Subrahmanyam & Brijlal, S Chand
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