DEPARTMENT OF PHYSICS

MADRAS CHRISTIAN COLLEGE (AUTONOMOUS)

Revised Syllabus

(with effect from 2019 onwards)

DEPARTMENT OF PHYSICS

(SELF- FINANCED STREAM)

MADRAS CHRISTIAN COLLEGE (AUTONOMOUS)

Revised Curriculum for B.Sc Physics under Choice Based Credit System (with effect from 2019 onwards)

SEM	Subject	Code	Hrs /wk	Credits	Dept. offering the course
I	Part I:Language		4	3	Language
	Part II: English		4	3	English
	Part III: Major				
	Mechanics and properties of matter	19 PHY - M - 101	6	5	Physics
	Physics practical I	19 PHY - M - 1P1	4	- -	Physics
	Part III: allied: Allied mathematics		6	5	Mathematics
	Part IV: Basic Tamil or advance Tamil or general course		4	2	Other departments
	Part IV: value education		2	1	- -
	Total		30	19	
II	Part I:Language		4	3	Language
	Part II: English		4	3	English
	Part III: Major				
	Heat and thermodynamics	19 PHY - M – 201	6	5	Physics
	Physics Practical 1	19 PHY - M - 1P1	4	6	Physics
	Part III:Allied :Allied Mathematics 2		6	5	Mathematics
	Part IV :basic Tamil or Advance Tamil or General course		4	2	Other departments
	Part IV: Value education		2	1	- -
	Total		30	25	

SEM	Subject	Code	Hrs /wk	Credits	Dept. offerings the course
III	**Part I:Language**		4	**3**	**Language**
	Part II: English		**4**	**3**	**English**
	Part III: Major				
	Electricity and Magnetism	**19 PHY - M - 301**	**6**	**5**	**Physics**
	Physics practical II	**19 PHY - M - 2P1**	**2**	**- -**	**Physics**
	Physics of Appliances and devices	**19 PHY - M - 302**	**2**	**- -**	**Physics**
	Part III: allied:				
	Allied chemistry - I or Allied Computer Science–I	**PHY - M - 1P1**	**4**	**5**	**Chemistry/Computer Science**
	Allied Lab		**2**	**- -**	**- - -do - -**
	Part –IV: Skilled based course: personality Development				
	Part - IV: Elective Course: Inter Disciplinary	**19 PHY – I- 301**	**4**	**3**	**All Departments**
Total			**30**	**19**	
IV	**Part I:Language**		4	**3**	**Language**
	Part II: English		**4**	**3**	**English**
	Part III: Major				
	Wave Physics and Mathematical Methods	**19 PHY - M - 401**	**6**	**5**	**Physics**
	Physics practical II	**19 PHY - M - 2P1**	**2**	**- -**	**Physics**
	Physics of Appliances and devices	**19 PHY - M - 302**	**2**	**- -**	**Physics**
	Part III: allied:				
	Allied chemistry - II or Allied Computer Science - II	**PHY - M - 1P1**	**4**	**3**	**Chemistry/Computer Science**
	Allied Lab		**2**	**2**	**- - -do - -**
	Part –IV: Skilled based course: personality Development		**2**	**3**	**- -**
	Part - IV: Elective Course: Inter Disciplinary		**4**	**2**	**- -**
Total			**30**	**26**	

SEM	SUBJECT	CODE	HRS/WK	CREDIT	DEPT. OFFERING THE COURSE
V	PART - III: Major				
	Electronics Circuits & Communications	19 PHY - M - 501	5	4	Physics
	Electronics Instrumentation & Measurement Techniques	19 PHY - M - 502	5	4	Physics
	Atomic Physics & Spectroscopy	19 PHY - M - 503	4	3	Physics
	Optics	19 PHY - M - 504	4	4	Physics
	Physics Practical III	19 PHY - M - 3P1	6	- -	Physics
	Part - IV(b):Skill based computer training: Python	19 PHY - C – 501	2	3	Physics
	Part - IV:(b):Skill based General Elective	19 PHY – E – 501	4	3	All Departments
Total			30	21	
VI	Part III: Major				
	Digital & Analog Circuits	19 PHY - M – 601	5	3	Physics
	Quantum Mechanics & Relativity	19 PHY - M – 602	5	4	Physics
	Nuclear Physics	19 PHY - M – 603	4	3	Physics
	Physics Practical III	19 PHY - M - 3P1	6	9	Physics
	Special Paper–Microprocessors and its applications	19 PHY - S – 601	5	4	Physics
	Special Paper -Materials Science	19 PHY - S – 602	5	4	Physics
	Project Work		- - -	2	Physics
Total			30	29	
	Part V:Extension Activities		--	1	
Grand total			180	140	

Part I (12), Part II (12), Part III (75+20), Part IV (4+12+2+2), part V (1) total =140

Major Semester: I + II + III + IV + V + VI

Major credits:5 +11+5+10+15+29=75

Allied credits: 20

ICA: 50 Marks ESE: 50 marks

Courses offered by the Department of Physics to students of other Departments

SEM	SUBJECT	CODE	HOURS/WEEK	CREDITS
I	Allied Physics- I (for Mathematics students)	19 PHY - A - 101	4	2
	Allied Physics lab (for Mathematics students)	19 PHY – A-1P1	2	- -
	General course – Everyday Physics (for students of other departments)	19 PHY - G - 101	4	2
II	Allied Physics- II (for Mathematics students)	19 PHY - A - 201	4	2
	Allied Physics lab (for Mathematics students)	19 PHY - A - 2P1	2	2
	General course – Everyday Physics (for students of other departments)	19 PHY - G - 201	4	2
III, IV	Inter disciplinary course Biophysics (For All students)	19 PHY - I - 401	4	3
V	General elective Astrophysics (for all students)	19 PHY–E- 501	4	3

PROGRAMME OUTCOME

1. Appreciate the role of science in society and the historical development of physics in the ongoing quest to discover the structure of the universe.

2. Gain an understanding of the basic principles and the experimental basis of the various fields of physics and the logical relationships of the various fields.

3. Become capable problem solvers using techniques that require mathematical skills, conceptual and mathematical models, order-of-magnitude estimates and an understanding of limiting cases.

4. Develop competence in designing, constructing and using laboratory instruments and to draw valid conclusions from experimental data.

5. Students will have at least one 'hands-on' out-of-class experimental learning component, related to their choice of specialty in their chosen topic. The impact of physics and science on society can be demonstrated by the students effectively.

6. Improves written and oral technical communication skills.

Current goals 1–3 are broad, foundational goals related to the fundamental nature of physics, and all courses are build on these themes. Goals 4-5 are typically reached through courses with an experimental or laboratory component in particular. Goal 6, which is often required in these laboratory courses, is also addressed in courses with a particular emphasis on presentation.

MECHANICS AND PROPERTIES OF MATTER

Objectives:
To develop knowledge and understanding in mechanics and mechanical properties of matter to relate for technological advances.

Semester: I Code: 19 PHY - M - 101 Hours / Week: 6 Credits: 5

UNIT 1: KINEMATICS

Projectile Motion – range up and down an inclined plane – MI of hollow sphere, solid cone, solid sphere and solid cylinder.

Impulse and impact – direct and oblique impacts – loss of kinetic energy – problems.

UNIT 2: GRAVITATION

Newton's law of gravitation – Determination of G – Cavendish – Boys' methods – Gravitational Potential and field due to (1) a spherical shell (2) a solid sphere (3) a hollow sphere - Problems.

UNIT 3: LAGRANGIAN FORMALISM

Conservation of linear and angular momentum – Degrees of Freedom – Constraints – Generalized coordinates – Principle of virtual work – D' Alembert's principle – Lagrange's equation – Atwood's machine – Bead sliding on a uniformly rotating wire – Problems.

UNIT 4: ELASTICITY

Basics of elasticity – Bending of Beams – Expression of Bending moment – Experiment with theory of cantilever, uniform and non-uniform bending – Work done in bending – Expression for couple per unit twist – Experiment with the theory of torsion pendulum and static torsion – Searle's method of finding q, η and σ- Problems.

UNIT 5: FLUID DYNAMICS AND LOW PRESSURE PHYSICS

Introduction – Relation between excess of pressure, radii of curvature and ST – Determination of ST by drop weight and Quickie's method with respective theories – Variation of ST with temperature – Jaeger's method – Surfactants – Problems – Viscosity – Determination of coefficient of viscosity by Poiseuille's method – Oswald viscometer – Viscosity of gases – Rankine's Method – Problems.

Production of low pressure – Rotary pump – Waran's pump – McLeod gauge

BOOKS FOR STUDY:

1. Prof. D.S. Mathur and Dr.P.S.Hemne, MECHANICS, (Revised edision), S.Chand & Company Ltd, NewDelhi.(2013).

2. M.Narayanamurthi and N.Nagaratnam, DYNAMICS, The National Publishing Company, Chennai . (2002).
3. J.C.Upadhyaya, CLASSICAL MECHANICS, Himalaya Publishing House,Mumbai.(2003).
4. R.Murugeshan, PROPERTIES OF MATTER, S.Chand & Company Ltd, Newdelhi.(2010).
5. D. S Mathur, ELEMENTS OF PROPERTIES OF MATTER, S Chand & Co. Pvt.Ltd, New Delhi (2001).
6. M. Narayanamurti and N Nagarathinam, STATISTICS, HYDROSTATICS AND HYDRODYNAMICS, National Publishing co. Chennai, (1989).

BOOK FOR REFERENCE

1. Robert Resnick , David Halliday, Kenneth K,Krane, PHYSICS –VOL-1,5th edition, John Wiley & Sons Inc,NewYork.(2002).
2. Ralhul Sardana, ADVANCED JEE PHYSICS FOR BOTH MAIN AND ADVANCED LEVELS OF JEE MECHANICS, Elsevier, India. (2013).
3. Michel Nelkon, Philip Parker, ADVANCED LEVEL PHYSICS, 7th Edition, CBSC Publishers & Distributors, NewDelhi.(1995).
4. K Sankara Rao, CLASSICAL MECHANICS, Prentice Hall of India Pvt Ltd, New Delhi (2005).
5. PK Chakrabarti, MECHANICS AND GENERAL PROPERTIES OF MATTER, Books and Allied (P) Ltd., Kolkata, (2009).
6. Subramania Iyer, Jayaraman, Rengarajan, Properties of Matter, S Viswanathan (Printers and Publishers), P.Ltd,. (1992).
7. C.J. Smith, GENERAL PROPERTIES OF MATTER, ORIENT LONGMAN PUBLISHERS, London. (1960).
8. https://nptel.ac.in/courses/105106172/41

COURSE OUTCOME

1. Understanding the basic of motion of any body, moment of inertia and apply to solve numerical problems.
2. Recollect the basic concepts of gravitation and employ the concepts for various geometrical shapes.
3. Recalling the basics ideas about conservation of momentum and apply for Lagrangian Formalism.
4. Apply knowledge of the elasticity, to explain natural physical processes and related mathematical derivation for modulus of elasticity.
5. Use an understanding of elementary mathematics along with physical principles of surface tension and viscosity to effectively solve problems encountered in everyday life.
6. Explore the physical principles of hydrostatics and effectively apply for Low pressure physics related studies.

EVERYDAY PHYSICS

Objectives:

To develop knowledge and understanding in the basic concepts of physics and the knowhow of its applications in everyday life.

Semesters: I & II Code: 19 PHY -G - 101/201 Hours per week: 4 Credits: 2

UNIT 1: MECHANICS AND HEAT

Force - weight – work – energy – power – horsepower – centrifuge - washing machine - variation of boiling point with pressure - pressure cooker - cooling by expansion - refrigerator - air conditioner - working principle of Otto and diesel engines - Bernoulli principle – Bunsen burner, aeroplane.

UNIT 2: SOUND AND OPTICS

Sound waves – Doppler Effect - power of lens – long sight and short sight – microscope – telescope – binocular – camera.

UNIT 3: ELECTRICAL AND ELECTRONIC APPLIANCES

Working of the tube light and fan - kilowatt hour - fuse and heating elements – microwave oven - electric heater - photoelectric effect - video camera.

UNIT 4: GEOPHYSICS AND MEDICAL PHYSICS

Earthquake – Richter scale – rainfall unit – lightning arrestors – cosmic showers – Coolidge tube – X - rays – ultrasound scan – CAT.

UNIT 5: ENERGY SOURCES

Fission – energy release – principle of Nuclear reactor – radiation doismetry – hazards and protection – solar energy – photovoltaic cell.

MATERIALS FOR STUDY

1. D. Halliday, R.Rensick and J. Walker, “FUNDAMENTALS OF PHYSICS”, 6th edition, Wiley, NY (2001).
2. Raymond A. Serway and Jerry S.Faughn, COLLEGE PHYSICS, Thomson learning (2003) California.

BOOKS FOR REFERENCE

1. THE HINDU SPEAKS ON SCIENTIFIC FACTS – Compiled by the editor – Kasturi and sons Limited, Chennai (June 2003)
2. Frederick J. Bueche and Eugene Hecht, “COLLEGE PHYSICS”, Schaum’s outline, McGraw Hill, New York(1977)
3. http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
4. https://onlinecourses.nptel.ac.in/

COURSE OUTCOME

A student who completes the course is expected to acquire

1. Elementary understanding of the mechanical concepts and application in various engines, Sound wave and optics
2. Working of few electrical and electronically appliances.
3. Basic understanding in Geophysics, nuclear physics and space sciences concepts and its applications connected to our daily life.

HEAT AND THERMODYNAMICS

Objective:
To enable the student to inquire the importance of temperature, Appreciate the thermodynamic concepts in real life and Understand statistical thermodynamics concepts.

Semesters: II Code: 19 PHY -M - 201 Hours per week: 6 Credits: 5

UNIT 1: REAL GASES

Andrew's experiment - Equation of state for real gases – Van der Waals' equation - Critical constants - Critical coefficient - Boyles temperature in terms of critical constants - inter molecular force of attraction- Drawbacks of Van der Waals' equation –Problems.

UNIT 2: LOW TEMPERATURE PHYSICS

Porous plug experiment - Results - Joule Kelvin effect for ideal gas and real gases - expression for the temperature of inversion - Relation between T_B, T_C and T_i – Liquefaction of gases - Linde's process - K Onnes method - Liquefaction of Helium - Helium I - Helium II – Practical application of low temperatures – Refrigerator and air conditioning machines - Problems.

UNIT 3: TRANSMISSION OF HEAT

Conduction - Thermal conductivity - Unit - Conduction along a uniform bar - determination of thermal conductivity - Forbe's method - thermal conductivity of a poor conductor - Lee's disc method - Radiation - Laws of radiation (qualitative analysis) - Problems.

UNIT 4: THERMODYNAMICS

Law of thermodynamics - Heat engines - Petrol engine - Diesel engine - efficiency – Second Law of Thermodynamics -Kelvin's thermo dynamical scale of temperature - Entropy of state - Properties of entropy – Change in Entropy reversible process and irreversible process - Change in entropy of a perfect gas in terms of TP, TV and PV – Entropy diagram- Problems.

UNIT 5: MAXWELL'S THERMODYNAMICAL RELATIONS & STATISTICS

Maxwell's thermo dynamical relations - Applications of Maxwell's thermo dynamical relations - Clausius Clapeyron's equation - Derivations of $C_P - C_V$ and C_P/C_V relations

Basic Concepts of Statistical Mechanics

Microscopic and macroscopic system - Calculation probabilities - Phase space - entropy - Perfect gas law - Maxwell - Boltzmann law - MB distribution of velocities - rms velocity - average velocity - most probable velocity - difficulties of classical statistics - Problems.

BOOKS FOR STUDY

1. Brijlal, Subramanian & P.S. Hemne, HEAT THERMODYNAMICS & STATISTICAL PHYSICS, S. Chand & Co. New Delhi (2014).
2. D.S. Mathur, HEAT AND THERMODYNAMICS, (Revised by M.N. Bapat) Sultan Chans & Sons (2008).
3. Kamal Singh and R. P Singh, ELEMENTS OF STATISTICAL MECHANICS, S. Chand & Co (1999)

BOOKS FOR REFERENCE

1. Francis W Sears and Gerhard L Salinger, THERMODYNAMICS, KINETIC THEORY AND STATISTICAL THERMODYNAMICS 3rd Edition, Narosa Publishing House, New Delhi (1975).
2. Mark W Zemansky and Richard H. Dittman, HEAT AND THERMODYNAMICS,7th edition, McGraw Hill Book Co., New York.(1981)
3. Robert Resnick , David Halliday, Kenneth K,Krane, PHYSICS –Vol-1,5th edition, John Wiley & Sons Inc,NewYork.(2002).
4. https://nptel.ac.in/courses/112105123/

COURSE OUTCOME

- Apply thermodynamic concepts in using thermal devices.
- Identify appropriate thermal equipment for various applications.
- Explain statistically the micro thermodynamic system.

ELECTRICITY AND MAGNETISM

Objective:

To enable the student to get a strong foundation in electricity and magnetism, understand resistance network circuits and appreciate the connections between the thermodynamics and electricity. To obtain knowledge about magnetic field and the laws associated with it and their applications.

Semester: III Code: 19 PHY - M - 301 Hours Per Week:6 Credits:4

UNIT 1: ELECTRIC FIELD AND ELECTRIC POTENTIAL

Coulomb's law - electric field strength - lines of forces - flux of the electric field - Gauss theorem - derivation of Coulomb's law from Gauss theorem - applications of Gauss theorem to determine the field due to (i) a point charge (ii) an infinite cylindrical charge and (iii) uniformly charged hollow sphere – problems.

Electric potential - zero potential - equipotential surfaces - potential due to (i) a point charge, (ii) a group of point charges, (iii) a long charged wire, (iv) charged circular ring, (v) a uniformly charged disc (vi) a charged non - conducting sphere.

Capacitance: Calculation of capacitance of a spherical, cylindrical and parallel plate capacitors - energy of a charged capacitor - energy associated with an electric field – problems.

UNIT 2: CURRENT ELECTRICITY

Current and current density - equation of continuity - Ohm's law - electrical conductivity - Kirchoff's laws and applications - current through a galvanometer in Wheatstone's bridge for slight imbalance - Thevenin and Norton's theorems.

Chemical effects of electric current - Faraday's law of electrolysis - Calculation and experimental determination of ionic mobility.

Thermoelectricity - Peltier effect - Thomson coefficient and its experimental determination – problems.

UNIT 3: MAGNETIC FIELD

Magnetic effect of steady current: Magnetic induction and definition of B - Biot - Savart experiments - Laplace's law - surface and line integrals of magnetic induction - Ampere's circuital theorem - field at any point in between two infinite wires.

Moving charges in a magnetic field - Force on a current carrying conductor in a uniform magnetic field - theory of a moving coil galvanometer - theory of a ballistic galvanometer - Lorentz force – problems.

UNIT 4: ELECTROMAGNETIC INDUCTION

Faraday's laws of e. m. induction - Lenz's law - induced current and charge - eddy currents - self inductance - energy associated with an inductor - experimental determination of L of a solenoid and toroid - mutual inductance - coefficient of coupling - combination of inductances - DC generator and motor – problems.

Transient Phenomena: Growth and decay of current in an inductive circuit - charge, and discharge of a capacitor through a resistance by leakage - LCR circuits - logarithmic decrement of a circuit – problems.

UNIT 5: ALTERNATING CURRENTS

Definition - AC voltages applied to resistors, inductors and capacitors — phase diagram - series LCR circuits - parallel LCR circuits - resonance - power in AC circuits - filter circuits - transformers - AC generators - Single phase and three phase distributions.

Electromagnetic theory: Basic equations - displacement current - Maxwell's equations - e.m. waves in free space - energy density of e. m. wave - Poynting theorem – problems.

BOOKS FOR STUDY

1. R. Murugeshan, ELECTRICITY AND MAGNETISM, S. Chand & Co., New Delhi.(2017).
2. M.Nagaratnam and N.Lakshminarayan, ELECTRICITY AND MAGNETISM, National Publication company, Chennai.(1994).
3. D. Griffiths, ELECTRODYNAMICS, Prentice Hall of India Pvt. Ltd., 3rd edition, New Delhi. (2003).

BOOKS FOR REFERENCE

1. Robert Resnick , David Halliday, Kenneth K,Krane, PHYSICS –VOL-2,5th edition, John Wiley & Sons Inc, New York.(2002).
2. Arthur Kip, FUNDAMENTALS OF ELECTRICITY AND MAGNETISM, 2nd edition, Mc Graw-Hill Inc, US .(1969).
3. Richard P Feynman , Robert B. Leighton and Matthew Sands , THE FEYNMAN LECTURES ON PHYSICS – VOL I & II, Narosa Narosa Publishing House, New Delhi. (2002).

COURSE OUTCOME

On the successful completion of this course the student will be able to

- Solve numerical problems related to electricity and magnetism.
- Identify and sort out the problems in the electrical devices.

PRINCIPLES OF PHYSICS IN APPLIANCES

(Qualitative analysis of principles and concepts only)

OBJECTIVE:

To develop knowledge and understanding of physics in designing appliances and devices for the societal needs in various technical fields.

Semesters: I & II Code: 19 PHY -M - 202 Hours per week: 4 Credits: 2

Unit I: MECHANICS AND HEAT

Centrifuges - Washing machine dinriers - heat engines - comparison of two stroke engines and four stroke engines –efficiency of heat engine - engine capacity - Power HP - BHP - Calculation of BHP of Engines - Pressure cooker.

Unit 2: SOUNDS AND OPTICS

Sound Waves – db - Ultra &Infra sounds - Supersonics - Applications of RADAR – Doppler effect of light - Red Shift - Spectral broadening - power of lens - Electron Microscope –Telescope –Binocular –Digital camera –pixels – resolution.

Unit 3: ELECTRICAL AND ELECTRONIC DEVICES

Principle, Working and Parts of Tube light –AC and DC fans - fuse –heating elements –applications – microwave ovens –photocopying principles - CD and its types –LCD display and LCD projector

Unit 4: MEDICAL PHYSICS AND COMMUNICATIONS

Diagnosis, principles of X - rays – Basic principles and qualitative analysis: Ultrasound, CAT, PET and MRI –Endoscopy - Angiogram –ECG –BP monitor & radiation therapy – IR based devices – Glucose monitor, blood glucose.

Satellite Communication –Indian satellites –Cell phone communication – Communication Network –Internet

Unit 5: RENEWABLE ENERGY SOURCES

Solar energy –photovoltaic cell –Calculation of Voltage and Current - principles of energy production from wind and tide.

BOOKS FOR REFERENCE

1. Brijlal, Subramanian and P.S.Hemne, HEAT AND THERMODYNAMICS AND STATISTICAL PHYSICS, S. Chand & Company Pvt. Ltd,. New Delhi. (2014).
2. N.Subramanyam , Brijlal, WAVES AND OSCILLATIONS, 2nd revised edition, Vikas Publishing House Pvt., Ltd. India.(2013).

3. R.Murugeshan , Er.Kiruthiga Sivaprasath , MODERN PHYSICS, Revised Edition, S.Chand Company Pvt., Ltd.,NewDelhi.(2013).
4. http://www.explainthastuff.com
5. http://www.howstuffworks.com
6. Dr.M.Arumugam, BIOMEDICAL INSTRUMENTATION, Anuratha Publications, Chennai. (1994).
7. Dennis Roddy, SATELLITE COMMUNICATIONS, 4th edition, The McGraw – Hill companies, NewYork.(2006).
8. D.P.Kothari, K.G.Singal and Rakesh Rajan, RENEWABLE ENERGY SOURCES AND EMERGING TECNOLOGIES, 2nd edition, PHI Learning Private Limited, NewDelhi.(2011).

COURSE OUTCOME

1. Understanding the basics of heat and mechanics explain the physical processes of various home appliances
2. Recollect the basic concepts of sound and optics and employ to astronomical devices used for various calculation.
3. Recalling the basics ideas of electrical and electronics apply to explain the working of electrical and electronic devices.
4. Explore physical principles, effectively communicate results, and critically evaluate related studies of medical instruments.
5. Effective communication network can be designed with the knowledge of physics of satellite.
6. Develop the skills of various energy sources and devices utilized for energy production**.**

WAVE PHYSICS AND MATHEMATICAL METHODS

OBJECTIVES: To understand the phenomenon of waves and to understand solving, generating various functions numerically.

Semester: IV Code: 19 PHY - M - 401 Hours per week:6 Credits:5

Unit 1: **WAVE MOTION AND VIBRATIONS**

Free vibrations –damped vibrations –damped oscillator with one degree of freedom–logarithmic decrement –relaxation time-(example)moving coil galvanometer –forced vibration of one dimensional harmonic oscillator –resonance –sharpness of resonance and quality factor .

Transverse and longitudinal waves –wave equation –transverse waves in a stretched string –characteristics impedance –longitudinal waves in gas –Newton's formula –Laplace's equation –longitudinal waves in a uniform rod - acoustic impedance.

Unit 2: **ACOUSTICS**

Relative motions of source - observer medium – applications of Doppler Effect in –medical and radars.

Reverberation time –absorption coefficient –Sabine's reverberation formula – architectural acoustics

Production of ultrasonic sound by piezo - electric oscillator –Galton whistle and Magnetostriction oscillator –detection and applications (qualitative study).

Unit 3**: PARTIAL DIFFERENTIAL EQUATIONS**

PDE for transverse vibrations in elastic strings (one dimensional wave equation) –one dimensional heat flow equation –solutions to these PDE's by the method of separation of variables –problems.

Unit 4: **NUMERICAL SOLUTION OF ALGEBRAIC EQUATIONS**

Bisection method – Method of successive approximation – Newton- Raphson method – Runge- Kutta method.

FINITE DIFFERENCE METHODS

Finite differences –forward ( ) and backward difference operators (no central difference) – shifting (E) –differential (D) operators –differences of polynomial – factorial polynomial.

Unit 5: **INTERPOLATION**

Gregory - Newton forward and backward interpolation formulas –Lagrange's interpolation formula –equidistant terms with one or more missing values.

NUMERICAL DIFFERENTIATION AND INTEGRATION

Derivatives using Newton's forward and backward difference formulas,

Numerical Integration: Trapezoidal rule –Romberg's method –Simpson's 1/3 rule.

BOOKS FOR STUDY

1. N.K.Bajaj, PHYSICS OF WAVES AND OSCILLATIONS, Tata Mc Graw Hill, New Delhi (2009).
2. Brij Lal and N.Subramaniam, WAVES AND OSCILLATIONS, S.Chand &Co; New Delhi (2005).
3. D.A.Murray, INTRODUCTORY COURSE IN DIFFERENTIAL EQUATIONS , Orient Longman (1967)
4. M.K.Venkataraman, NUMERICAL METHOD IN SCIENCE AND ENGINEERING, National Publication Co, Chennai(2001)
5. S. S. Sastry, INTRODUCTORY METHODS OF NUMERICAL ANALYSIS, third edition, Prentice Hall of India Pvt. Ltd., Delhi, (2003)
6. S. Arumugam, A. Thangapandi Isaac, A. Somasundaram, NUMERICAL METHODS, SCITECH Publications Pvt. Ltd., Chennai, (2001).

BOOKS FOR REFERENCE

1. V.Rajaraman, COMPUTER ORIENTED NUMERICAL METHODS, Prentice, Hall of India Pvt.Ltd., New Delhi. (1971).
2. Robert Resnick and David Halliday, PHYSICS PART I AND II, Willey Eastern Private Limited, NewDelhi (1969).
3. Erwin Kreyzsig, ADVANCE ENGINEERING MATHEMATICS Wiley India Edition (2010)
4. M.K.Venkataraman, ENGINEERING MATHEMATICS, National Publications , Chennai (2009)
5. P.Kandaswamy, K. Thilagavathy, K.Gunavathi, NUMERICAL METHODS, First Edition, S.Chand&Company LTD, New Delhi, 1997.
6. http://ndl.iitkgp.ac.in, http://ocw.mit.edu, http://mathforum.org

COURSE OUTCOME

Students will be able to

- ❖ derive and solve the equations for a forced oscillator
- ❖ understand the concept of resonance and the response of a system (amplitude and phase, power dissipation) as a function of driving frequency and the effects of transients
- ❖ solve an algebraic or transcendental equation using an appropriate numerical method and perform an error analysis for a given numerical method
- ❖ solve a linear system of equations using an appropriate numerical method

BIOPHYSICS
(Inter Disciplinary)

Objective:

To enable the student to get a knowledge about the physical forces exemplified in human body, understand the importance of heat transfer and fluid flow in human body and appreciate the acoustic and radiation therapy.

Semester: V Code: 19 PHY - E - 501 Hours per week: 4 Credits: 3

UNIT I: PHYSICAL FORCES EXEMPILIFIED IN MAN

Introduction – mechanical forces – osmotic force – electric forces – bioelectric potentials – colloids – inter molecular forces – electromagnetic forces – generalized force.

UNIT II: HEAT ENERGY AND BIO - ENERGETICS

Heat transfer – heat loss by the human body to the ambient air – radioactive heat transfer from the human body – Stefan – Boltzmann law – counter current heat exchange – applications to vasculature of the human arm – whale flippers – active transport system – Maximum amount of work tuned out by human adult.

Entropy – standard entropy – Gibb's free energy – concept of entropy in biological systems – fundamentals of energy cycle – activation energy – living body as a thermo dynamical system.

UNIT III: WAVES: SOUND AND ULTRASOUND

Absorption – principle mechanism of absorption of matter waves – frictional resistance and elastic reactance of bulk tissue – Weber – Fechner law – physiological effects of intense matter waves and ultra sonic therapy - applications.

UNIT IV: FLUID FLOW

Flow of frictionless fluids: Bernoulli's law – fluid flow in constricted tube – blood flow through a blood vessel with a partial blockage – angioplasty.

Flow of viscous fluids: Analogy between fluid flow and electric current flow – fluid friction – problem of scaling in fluid friction

UNIT V: RADIATION

Isotopes as tracers – labeling with isotopes – stable and radioactive isotopes – biological effects of radiation – internal radiation hazards – radiation units – dosimetry – relative biological effectiveness (RBE) – DNA mutation – genetic effects of radiation – radiation shielding.

BOOKS FOR STUDY: -

1. E.J.Casey , BIOPHYSICS – CONCEPTS AND MECHANISM, Reinhold Publishing Corporation, NewYork.(1962).
2. Harold J Metacalf , TOPICS IN CLASSICAL BIOPHYSICS, Prentice –Hall Pvt.Ltd.,India (1980).
3. Vasntha Pattabhi and N.Gautham , BIOPHYSICS, Narosa Publishing House, New Delhi. (2002) .

BOOKS FOR REFERENCE: -

1. Paul Davidovits, PHYSICS IN BIOLOGY AND MEDICINE, 3rd Edition, Academic Press, London. (2008).
2. Donald T.Hynie, BIOLOGICAL THERMODYNAMICS, 2nd Edition, Cambridge University Press, Cambridge. (2008).
3. B.R.Puri, L.R.Sharma and Madan S.Pathania, PRINCIPLES OF PHYSICAL CHEMISTRY, Shoban Lal Nagin Channd and Co.,Jalandar. (1987).

COURSE OUTCOME

The student will be able to

- Apply the knowledge in analyzing their own body.
- Identify the necessity of diagnosis and therapy for various devices.

ELECTRONICS CIRCUITS AND COMMUNICATION

Objectives

To enable the students to acquire knowledge about the basics of semiconductors and to understand the working of different diodes and transistors and also to gain an insight about the communication systems.

Semester:V code : 19 PHY - M - 501 Hours per week :5 Credits:4

UNIT 1: SEMICONDUCTOR DEVICES

BJT – construction-basic configurations - LED - LCD – Varactor diode - Zener diode - Zener & Avalanche breakdown - Micro diodes: PIN diodes - IMPATT diode - LASER diode

UNIT 2: APPLICATIONS OF SEMICONDUCTOR DEVICES

Construction and Mechanism of current conduction - V-I characteristics: JFET-MOSFET-CMOS, NMOS, VMOS -SCR-TRIAC-UJT.

JFET-Common source and common drain Amplifier-Sample and Hold amplifier-peak detector-UJT-Relaxation oscillator-SCR-Power Regulation.

UNIT 3: RECTIFIERS AND AMPLIFIERS

Bridge rectifier circuits - ripple factor - zener - regulator - voltage feedback regulation - current limiting - three terminal IC regulators 7805, 7905

AF AMPLIFIERS**:** classification - interstage coupling - frequency response - dB gain - Power amplifiers

Feedback in amplifiers: Basic concepts - types of feedback - effect on amplifier performance - negative feedback - emitter follower - Darlington pair - source follower Positive feedback and instability - RC oscillators – Wien Bridge oscillator and Phase shift oscillator-LC oscillators-Hartley oscillator and Colpitt oscillator

UNIT 4: COMMUNICATION SYSTEMS

Modulation and Demodulation- Amplitude Modulation - Analysis of Am wave – Power of AM wave- production of AM wave - AM demodulation.

Frequency modulation- Analysis of FM wave - Production of FM wave by Reactance Tube method - frequency discriminator -ratio tube.

Pulsed coded modulation-Pulse with modulation (PWM)

UNIT 5: ANTENNA AND RADAR

Antenna: Antenna action - short electric doublet - Radiated field strength -Radiation resistance - Radiated power - types of antenna.

RADAR**:** Principle of RADAR - Basic RADAR system - RADAR equations - Plana Position indicator - Duplexer - Air craft landing system.

BOOKS FOR STUDY

1. Dr. R.S.Sedha, A TEXTBOOK OF APPLIED ELECTRONICS, S.Chand& Company PVT. LTD, New Delhi(2016)
2. Murugeshan and Kiruthiga Sivaprasath, MODERN PHYSICS, S.Chand& Company PVT. LTD, New Delhi(2016))
3. V.K Mehta, PRINCIPLES OF ELECTRONICS, S.Chand & Company PVT. LTD, New Delhi(2016).
4. D.Chattotadhyay et al., FOUNDATIONS OF ELECTRONICS, Wiley Eastern Ltd., New Delhi 1(988).
5. G.Kennedy, ELECTRONICS COMMUNICATION SYSTEM, Mc GRAW Hill Book Co., New York.

BOOKS FOR REFERENCE

1. Allen Mottershead,'ELECTRONICS DEVICES AND CIRCUITS', Prentice-Hall of India, New Delhi 1989R.
2. J.Millman and Grabel, MICROELECTRONICS, McGraw -Hill Book Co. Singapore 1987.
3. Dennis lee croisette, TRANSISTORS, Prentice -Hall of India, New Delhi (1975).
4. Dr. R.S.Sedha, A TEXTBOOK OF ELECTRONIC DEVICES AND CIRCUITS, S.Chand & Company PVT. LTD, New Delhi(2010))

COURSE OUTCOME

The students will be able to

- Identify the devices and select them based on the needed application
- Design and fabricate new devices
- Apply their gained knowledge in modifying the needful changes in the communication system

ELECTRONIC INSTRUMENTATION AND MEASUREMENT TECHNIQUES

Objectives

To provide knowledge to design and create novel products and solutions for real life problems.

Semester: V Code: 19 PHY - M - 502 Hours per week: 5 Credits: 4

UNIT 1: MEASUREMENT AND ERROR

Definition - accuracy and precision - significant figures - types of errors - statistical analysis - probability of errors - limiting errors.

UNIT 2: ELECTROMAGNETIC METERS AND DC & AC INSTRUMENTS

PMMC - galvanometer sensitivity - dc ammeters and voltmeters - voltmeter sensitivity - resistance measurement by voltmeter - ammeter method, series type ohmmeter, shunt type ohmmeter - calibration of dc instruments. AC measurements - rectifier type instruments - electro dynamic instruments - AC power measurements, Multimeter.

UNIT 3: DC AND AC BRIDGES

Wheatstone's bridge - loop tests - guarded Wheatstone's bridge. AC bridge theory - Maxwell, Hay and Schering & Wien Bridges - Universal Impedance Bridge.

UNIT 4: OSCILLOSCOPES

Basic oscilloscopes - CRT - deflection systems - delay line - CRO probes - oscilloscope controls - Dual trace oscilloscope - special oscilloscopes overview - CRP techniques.

UNIT 5: TRANSDUCERS AND INTERFACING

Selecting a Transducer - strain gauges - transducers for displacements, temperature& magnetic measurements - photosensitive devices - digital data acquisition system - D/A & A/D multiplexing.

BOOKS FOR STUDY

1. A. D. Helfrick and W.D. Cooper, MODERN ELECTRONIC INSTRUMENTATION AND MEASUREMENT TECHNIQUES, Prentice - Hall of India, New Delhi(1990)

2. David A. Bell, ELECTRONIC INSTRUMENTATION AND MEASUREMENTS, II edn., Prentice - Hall of India, New Delhi(1997)

BOOKS FOR REFERENCE

1. H.S. Kalsi, ELECTRONIC INSTRUMENTATION , 3E, Tata Mc Graw Hill Education Pvt., Ltd, New Delhi, (1995)

2. A.V. Bakshi, U.A. Bakshi and A.P. Godse, MEASUREMENTS & INSTRUMENTATION, Technical Publication, (2007).

COURSE OUTCOME

1. Ability to measure the values without error and accuracy.
2. Measurement of R,L,C ,Voltage, Current, Power factor , Power, Energy
3. Ability to balance Bridges to find unknown values.
4. Ability to measure frequency, phase with Oscilloscope
5. Ability to measure the voltage by digital instruments and understand the basics of display instruments.
6. Ability to measure strain, displacement, Velocity, Angular Velocity, temperature, Pressure ,Vacuum, and Flow

ATOMIC PHYSICS AND SPECTROSCOPY

Objective: Aims to apply quantum principles in the study and design of atoms and spectra**.**

Semester: 5 code: 19 PHY - M - 503 Hours per week: 4 credits: 3

Unit 1: POSITIVE RAY ANALYSIS

Thomson's Parabola Method –isotopes –mass spectrograph studies –Aston's Bainbridge and Dempster's Mass Spectrographs

Unit 2: ATOMIC MODELS

Rutherford's Atom model –large scale scattering of Alpha rays–Hydrogen spectrum– Empirical results–Bohr's Theory of Hydrogen atom–isotope effect–the spectrum of sodium atom–selection rules–quantum defects–excitation potentials.

X-ray spectra–continuous and characteristics of spectra–Mosley's work – interpretation of X-ray spectra.

Unit 3: FINE STRUCTURE AND ELECTRON SPIN

Fine structure of alkali spectra –vector atom model - special quantization –electron spin - quantum numbers associated with vector atom model –magnetic moments – Stern Gerlach Experiment –coupling schemes.
Pauli's Exclusion Principle –statement –electronic structure of an elements and periodic table –empirical rules –hyperfine structure and nuclear spin angular momentum.

Unit 4: ZEEMAN AND STARK EFFECTS

Normal Zeeman effect - explanation in terms of vector atom model –Anomalous Zeeman Effect –Lande's Splitting Factor –Paschen Back effect –Stark effect.

Unit 5: MOLECULAR AND RESONANCE SPECTROSCOPY

Diatomic molecules –rotation spectra rigid rotator non - rigid rotator –isotope effect in rotation spectra –vibration spectra –microwave and IR Spectroscopy –linear harmonic oscillator –Raman Effect –Stokes and Anti-stokes lines scattering of light – experimental study of Raman Effect –classical and quantum theories of Raman effect –instrumentation and applications. NMR, ESR, Mossbauer spectroscopy–Overview theory of instrumentation and application.

BOOKS FOR STUDY:

1. T.A.Little Field and N.Thorley, ATOMIC AND NUCLEAR PHYSICS, ELBS and Van Nostrand Reinhold Co.,Ltd.,London
2. R.Murughesan, MODERN PHYSICS, S.ChandCo.,New Delhi

3. Colin. N. Banwell, FUNDAMENTALS OF MOLECULAR SPECTROSCOPY. Tata McGraw Hill, New Delhi

BOOKS FOR REFERENCE

1. Arthur Beiser, CONCEPTS OF MODERN PHYSICS, McGraw - Hill, New York
2. J. B.Rajam, ATOMIC PHYSICS, S. Chand &Co., New Delhi
3. Samuel Glasstone, SOURCE BOOK ON ATOMIC ENERGY, Affilidated Fast West Press Ltd., New Delhi.
4. R. P. Feynman,, et al, THE FEYNMAN LECTURES ON PHYSICS VOLUME II, Narosa Publishing House (1989)
5. Robert Resnick and David Halliday, PHYSICS PART I & II, Wiley Eastern Private Limited, New Delhi
6. Charles. D.Hodgman. Robert. C.Weast and Amuel. M. Selby. HAND BOOK OF CHEMISTRY AND PHYSICS. The Chemical Rubber Publishing Co. Cleveland

COURSE OUTCOME

- Understand the concepts of a good quantum number and simultaneous observability.
- Understand the origin of line widths and shapes in atomic spectra.
- Understand the quantum numbers, including their physical significance, and quantum mechanical states of the hydrogen atom.
- Know about the origins of fine structure in atomic spectra.
- Understand the exchange degeneracy and how this affects the excited states of helium.
- Understand the Periodic table from the viewpoint of the electronic structure.
- Understand the derivation of and be able to apply the selection rules for the interaction of electric dipole radiation and atoms.

OPTICS

OBJECTIVES:

To realize the fundamental properties of light propagation and applications Develop a perceptive understanding of the working principles of light.

Semester: V Code: 19 PHY - M - 504 Hours per week: 4 Credits:4

UNIT 1: **GEOMETRICAL OPTICS**

Basics of lenses - Spherical aberration - methods of minimizing spherical aberration - condition for minimum spherical aberration in case of two lenses separated by a distance - chromatic aberration in lenses – condition for achromatism of two thin lenses(in and out of contact) – dispersion produced by a thin prism – achromatic prisms – condition for prisms to produce dispersion without deviation and deviation without dispersion.

UNIT 2: **INTERFERENCE**

Coherent sources - path difference - phase difference – analytical treatment of interference – expression for fringe width – testing planeness of surfaces – Michelson's interferometer, determination of wavelength of light – temporal and spatial coherence.

UNIT 3: **DIFFRACTION**

Fresnel and Fraunhofer diffractions – Fraunhofer diffraction at a single slit – theory of plane transmission grating – determination of wavelength of spectral lines using a transmission grating – Fraunhofer diffraction at a circular aperture – Fresnel diffraction circular aperture and opaque circular disc – zone plate.

Resolving power of optical instruments: Lord Rayleigh's criterion for resolution of spectral lines – resolving power of telescope, prism and grating

UNIT 4: **POLARISATION**

Transverse nature of light waves – plane of vibration – polarization by reflection – Brewster's law - double refraction – Nicol prism – elliptically and circularly polarized light – theory of quarter wave plate – half wave plate - production and detection of plane, elliptically and circularly polarized light – polaroids and their uses – optical activity – Fresnel's explanation of specific rotation.

UNIT 5: **PRINCIPLES AND APPLICATIONS OF LASER**

Basic principle of Lasers -Laser optics: Resonators – modes for resonator cavity and open planar resonators – mode selection – Q switching – mode locking - Types of lasers - Ruby, He Ne, CO_2, Semiconductor Lasers.

Application of Lasers in medical (retinal surgery) communication (Basics and construction of Optical fibers) and material science (laser welding, drilling, cutting – LIDAR — LDV – holography).

BOOKS FOR STUDY: -

1. Brij Lal, M N Avadhanulu & N Subrahmanyam 'A TEXT BOOK OF OPTICS'. S.Chand& Co., New Delhi (2012)
2. B B Laud 'LASERS AND NON LINEAR OPTICS'. Wiley Eastern Ltd., New Delhi, Published by John Wiley & Sons (1992)
3. K. Thyagarajan and A K Ghatak 'LASERS: FUNDAMENTAL AND APPLICATIONS'. McMillan India Ltd., New Delhi (2011)

BOOKS FOR REFERENCE: -

1. Jenkins and White 'FUNDAMENTALS OF OPTICS' .McGraw Hill., New York (1975)
2. Grant R. Fowles, 'INTRODUCTION TO MODERN OPTICS', Dover publication, New York, (1975)
3. Eugene Hecht, 'OPTICS' (fifth edition), Pearson publishers (2017)
4. E.A. Saleh and M.C. Teich, 'FUNDAMENTALS OF PHOTONICS', John Wiley & Sons, Inc. (1991)
5. https://nptel.ac.in/courses/115105104/
6. http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html

COURSE OUTCOME

- Develop an intuitive understanding of basic concepts of light as ray, wave and particle/photon.
- Understand the nature of light, its propagation and interaction with matter.
- Understand the principles of lasers and their applications.
- Handle and align optical elements and set-up basic optical experiments.
- Operates optical devices and equipment.

INTRODUCTION TO PROGRAMMING - PYTHON

OBJECTIVE: To learn the foundation concepts of programming to enable the students to design logic of new programs on their own.

Semesters: V Code: 19 PHY -P - 501 Hours per week: 2 Credits: 3

Unit I

Programming language as an interpreter and calculator: scripts – program files editor; Integrated Development Environment

Variables expression statements: literal values and variables, assignment, data types, operators, operands expression, evaluation, value; simple statements-assignments, input/output

Functions: Function definition function call, parameters arguments, fruitful functions; variables and parameters being local.

Unit 2

Execution flow (compound statement): sequential, conditional loop

Conditional: comparison operators and logical expression (conditional): logical operators; conditional statement, alternative statement, chained conditionals.

Loop (iteration): State variables; tuple assignment: while loop statement; program execution by hane: different patterns of loop.

Unit 3

Compound data type list: list values, accessing and updating element: lists being mutable: lists as objects; list operations and functions and slices; for loops; object references and object values. Aliasing andcloning of lists; tuples and lists

Compound data types-strings: immutable: operations and functions

Unit 4

Functions: Scope rules-local global built in names space: default arguments; keyword arguments, functions with side effects

Unit 5

Functional programming: pure VS impure functions nested functions, higher order functions-map, filter, reduce, zip-list comprehension.

BOOKS FOR REFERENCES

1. Allen Downey, etl, 'HOW TO THINK LIKE A COMPUTER SCIENTIST-LEARNING WITH PYTHON', green tea press
2. Dromey R G, 'HOW TO SOLVE COMPUTER', prentice Hall of India, 1999
3. http/www.python.org/
4. https://nptel.ac.in/106106145/

COURSE OUTCOME

- At the end of the class, we expect students to have a good understanding about the concept of object-oriented programming using python, be able to write basic Python code for solving physics problems.

ASTROPHYSICS
(General Elective)

Objective: To elucidate the nature of the myriad objects and the universe as a whole to understand the structure and formation of these objects in the course of time.

Semesters: V Code: 19 PHY -E -501 Hours per week: 4 Credits: 3

UNIT 1: OPTICAL ASTRONOMY:

Electromagnetic spectrum and astronomical sources - emission and absorption spectra Doppler Effect -units of distances- distance measurements in astronomy stellar distances –Apparent - Absolute, Bolometric magnitudes - Luminosity - Solar system Telescopes for optical astronomy -reflecting and refracting types.

UNIT 2: STARS

Spectral classification of stars - H-R diagram: binary and multiple stars visual, astrometric and eclipsing binaries -galactic and globular clusters -Stellar evolution - birth and death of a star -interstellar medium – stellar rotation and magnetic fields - SUN –typical star -Structure of sun -sun's rotation -solar constant -temperature of sun -photosphere -sunspots -chromosphere -solar eclipse -solar flares -associated ionospheric disturbances.

UNIT 3: MOON

The moon's orbit relative to the earth -moon's distance -moon's phases -sidereal and synodic month -the character of moon's surface -lunar eclipse -lunar tides -origin of moon.

UNIT4: BETWEEN THE PLANETS

Asteroids -meteoroids -meteors -comets -orbits of comets -spectrum of comets - formation of comet's tail.

UNIT 5: DISCOVERING OUR GALAXIES:

The Milky Way Structural Feature Galaxies- Galaxies and universe: shape of galaxies – distance of galaxies big bang and steady state theory- galatic rotation- cluster of galaxies – cosmology.

BOOKS FOR STUDY:

1. K.S.Krishna Swamy, ASTROPHYSICS, New Age International Limited, New Delhi, (2003)
2. Arnab Rai Choudhuri, ASTROPHYSICS FOR PHYSICISTS, Cambridge University Press.(2010)

BOOKS FOR REFERENCE:

1. Fredrick and Baker -D.Van, ‘ASTRONOMY’, Nostrand company.

2. Robert Chapman – 'DISCOVERING ASTRONOMY', W.H.Freeman and company
3. Kaufmann 'UNIVERSE', -W.H.Freeman and company.

COURSE OUTCOME

- Apply physics principles to the interpretation of a broad range of astrophysical observations
- Explain stellar evolution, including red giants, supernovas, neutron stars, pulsars, white dwarfs and black holes, using evidence and presently accepted theories
- Demonstrate an understanding of the basic properties of the Sun
- Summarize the structure and origin of moon, lunar eclipse and moon calendar.
- Describe the features of objects in the Solar System (i.e. asteroids, comets, planetary interiors, atmospheres, etc.) giving details of similarities and differences between these objects
- Detail the main features and formation theories of the various types of observed galaxies, in particular the Milky Way; expanding Universe using concepts of Big Bang Theory.

DIGITAL AND ANALOG CIRCUITS

Objective: To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits to handle substantial and challenging design problems.

SEMESTER:VI CODE:19 PHY - M - 601 HOURS/WEEK:5 CREDITS: 3

UNIT: 1 DIGITAL CIRCUITS

LOGIC CIRCUITS: Basic gates - De - morgan's law - NOR,NAND gates - universal gates - minimization techniques -Boolean Algebra and K – map techniques - min terms and max terms - k –maps – POS and SOP.

ARITHMETIC CIRCUITS: Half adder –full adder - BCD adder - Subtractors - signed binary adder - full subtractor.

COMBINATORIAL CIRCUITS: Code converters - BCD to seven segments decoder - demultiplexers - multiplexers - encoders - parity checker using logic gates.

UNIT:2 SEQUENTIAL LOGIC CIRCUITS

FLIP FLOPS: RS latch - clocked RS latch—D flip flop - JK flip flop - T flip flop –JK M/S flip flop.

COUNTERS: Ripple counters - modulus of a counter - up down counters - synchronous counters - Ring counter – Johnson counters (shift counters)

REGISTERS: Serial in – serial out registers - serial in parallel out registers – parallel in serial out - parallel in parallel out register – Shift registers – Applications.

UNIT: 3 OPERATIONAL AMPLIFIER AND APPLICATIONS

Operational amplifier – differential amplifier – characteristic of ideal op amp – inverting and non inverting mode operation – adder – subtractor - multiplier – sign changer – scale changer – integrator – differentiator - analog computation – solving simultaneous equation, differential equation - sign wave and square wave generators.

UNIT: 4 TIMER IC 555 APPLICATIONS

Internal architecture – astable multivibrator - monostable multivibrator - schmidt trigger –VCO, PLL concept –face lock loop- FSK

UNIT: 5 DATA CONVERTERS

Digital to analog converters - variable resistor network - R - 2R ladder network - 1408 IC - analog to digital convertors and its types :simultaneous (flash type),counter type - SAR - dual slope –applications

BOOKS FOR STUDY:

1. Millman and Halkias, INTEGRATED ELECTRONICS, McGRAW Hill book co., New York (1972).
2. A.P. Godse & D.A. Godse, DIGITAL PRINCIPLES & SYSTEM DESIGN 3E, Technical Publication (2011).
3. Jacob Milman and Arvin Grabel , MICROELECTRONICS, 2nd Edition, Tata Mc Graw Hill , New Delhi (2001).
4. Leech, Malvino and Saha, "DIGITAL PRINICIPAL AND APPLICATIONS 7th Edition McGRAW HILL BOOK CO, New Delhi, (2011)
5. Malvino and Leach DIGITAL PRINICIPAL AND APPLICATIONS 4th Edition, Tata Mc GRAW – Hill. New Delhi (1986)
6. Thomas L. Floyd, DIGITAL FUNDAMENTALS, 9th Edition, Pearson Educational India (2006).

BOOKS FOR REFERENCE:

1. William H Gothmann DIGITIAL ELECTRONICS - AN INTRODUCTION TO THEORY AND PRACTICE , Prentice Hall of India Pvt.Ltd,(1982).
2. Vijayendran "INTRODUCTION TO ELECTRONICS: DIGITAL AND ANALOG, S.Viswanathan printers and Publishers, Chennai.(2009).
3. Albert Paul Malvino and Jerald A. Brown, DIGITAL COMPUTER ELECTRONICS, 3rd Edition, Tata Mc Graw Hill , New Delhi (2003).

COURSE OUTCOME

- Employ the codes and number systems converting circuits and Compare different types of logic families which are the basic unit of different types of logic gates.
- Apply the design and analysis procedures to design the assigned combinational logic circuits of decorders and encoders.
- Analyze the sequential logic circuits by understanding flip flops, counters and register circuits.
- Have a broad coverage in the field that is relevant to design Linear circuits using Op-amps.
- Apply the fundamental knowledge of analog and digital electronics to get different types analog to digitalized signal and vice-versa converters in real world with different changing circumstances.

QUANTUM MECHANICS AND RELATIVITY

Objective: To acquire working knowledge of the quantum mechanics postulates of the physical and universal systems

Semester: VI Code: 19 PHY - M - 502 Hours/Week: 4 Credits: 3

UNIT 1: ORIGIN OF QUANTUM THEORY

Difficulties of classical physics and success of Quantum theory: Black body radiation - Planck's law of black body - radiation - derivation or other laws from Planck's law - Laws of photoelectric emission - Quantum theory of photoelectric effect - measurement of Planck's constant - Compton effect - - Compton shift.

UNIT' 2: De BROGLIE'S THEORY AND UNCERTAINTY PRINCIPLE

Phase velocity and group velocity - de Broglie's hypothesis of matter waves - Davison and Germer experiment - G. P. Thomson's experiment - Heisenberg's uncertainty principle — (i) diffraction of electrons through a slit - (ii) Gamma ray microscope - applications of uncertainty principle.

UNIT 3: WAVE MECHANICS

Postulates of Quantum Mechanics - Linear operators - Eigen value - Hermitian operator - significance of Hermitian operator and its properties - observables - operators for momentum and angular momentum - commutation relations between position and momentum - angular momentum components - Schrodinger equation - wave function and its interpretation.

UNIT 4: APPLICATIONS OF SCHRODINGER EQUATION

One - dimensional problems: (i) particle in a box (ii) barrier penetration problem (iii) Linear harmonic oscillator.

UNIT 5: SPECIAL THEORY OF RELATIVITY

Moving frame of reference - motion in a rotating frame - classical relativity - Michelson - Morley experiment - special theory of relativity - fundamental postulates - Lorentz transformation equations.

Addition of velocities - relativity of simultaneity - time dilation - length contraction - variation of mass with velocity - Einstein's mass - energy relation.

BOOKS FOR STUDY

1. F. K. Ritchinyer, E. I L Kennard and John N. Cooper, INTRODUCTION TO MODERN PHYSICS, Tata McGraw I fill, New Delhi.
2. Wehr Richards, PHYSICS OF THE ATOM, Narosa, New Delhi.

3. S. P. Singh and M K. Bagde, QUANTUM MECHANICS, S Chand &Co., New Delhi.
4. Arthur Beiser, CONCEPTS OF MODER\ PHYSICS, International Student Edition.

BOOKS FOR REFERENCE

1. R. P. Feynman et al, THE FEYNMANN LECTURES ON PHYSICS Volume II & HI, Narosa Publishing House, New Delhi
2. P. M. Mathews and K. Venkatesan, A TEXT BOOK OF QUANTUM MECHANICS, Tata McGraw Hill, New Delhi
3. Robert Resnick and David Halliday, PHYSICS PART 1 AND 11, Wiley Eastern Private Limited, New Delhi.
4. D. Griffiths, INTRODUCTION TO QUANTUM MECHANICS, 5. J. B. Rajarn, ATOMIC PHYSICS, S. Chand & Co., New Delhi.

COURSE OUTCOME

1. understand and explain the differences between classical and quantum mechanics
2. understand the idea of wave function
3. understand the uncertainty relations
4. solve Schrodinger equation for simple potential spot, identify and relate the eigen value problems for energy, momentum, angular momentum and central potentials explain the idea of spin

NUCLEAR PHYSICS

Objectives

To enable the students to gain an insight into the theories of nuclear structures and nuclear forces and also to understand the working of various particle detectors and accelerators and to obtain knowledge about various nuclear reactions and their applications

Semester: VI Code: 19 PHY - M - 603 Hours /week :4 Credits:3

Unit 1: NUCLEAR STRUCTURE

Nuclear constituents –Nuclear radii-isotopes and isobars - atomic masses -mass defect –binding energies of nuclides -stable and unstable nuclides - Einstein's mass –energy relation

NATURAL RADIOACTIVITY

The nature of radioactivity - the properties of alpha rays, beta rays and gamma rays - Geiger –Nuttal rule - radioactivity as a measurable quantity –the age of the earth –Radio carbon dating

Unit 2: PARTICLE DETECTORS AND ACCELERATORS

Wilson's cloud chamber –bubble chamber –ionization chamber –proportional counter –Geiger –Muller counter –scintillation counter - semiconductor counter –spark chamber –Cerenkov counter –neutron counter –the photographic plate.

Cockroft wallton proton accelerator -linear accelerator –Lawrence cyclotron -betatron -synchrotron: proton synchrotron, electron synchrotron

Unit 3: NUCLEAR MODELS

Liquid drop model –Weizacker semi - empirical mass formula –shell model - magic number (no theory) - collective model.

ARTIFICIAL RADIOCTIVITY

Discovery of positron –K - electron capture -origin of electrons and positrons inside the nucleus- nuclear isomerism -production of radio isotopes - some uses of radio isotopes.

NEUTRON PHYSICS

Properties of neutron – neutron bombardment reactions.

Unit 4: NUCLEAR REACTIONS

NUCLEAR FISSION: Theory of fission –energy of nuclear fission –distribution of fission products –characteristics of fission neutrons –chain reactions –controlled fission and nuclear reactors –reactors in India.

Thermonuclear fusion: Thermo nuclear reaction –sources of stellar energy –pp cycle –CN cycle –plasma –controlled nuclear fusion reactions in the plasma.

UNIT5: ELEMENTARY PARTICLE PHYSICS

Cosmic Rays - nature and origin of cosmic rays – Latitude effect, Altitude effect, Azimuth effect – cosmic ray showers - Van Allen Belts.

Classification of elementary particle-particles and antiparticles-The fundamental interactions-Elementary particle Quantum number-conservations laws-The Quark model

BOOKS FOR STUDY

1. T. A. Little field and N. Thorley, ATOMIC AND NUCLEAR PHYSICS, ELI3S and Van Nostrand Reinhold Co., Ltd., London.
2. R. Murugeshan, MODERN PHYSICS, S. Chand & Co. Ltd., New Delhi.
3. N. Subramanyam and Brij Lal, ATOMIC AND NUCLEAR PHYSICS, S. Chand & Co. Ltd., New Delhi.

BOOKS FOR REFERENCE

1. Harveye White, INTRODUCTION TO ATOMIC AND NUCLEAR PHYSICS, Affiliated East - West Press Pvt. Ltd., New Delhi
2. F. K. Richmyer, E. H.' Kennard John N. Cooper, INTRODUCTION TO MODERN PHYSICS, Tata McGraw Hill Pub., Co., Ltd., New Delhi.
3. Samuel Glasstone, SOURCE BOOK ON ATOMIC ENGERY, Affiliated East - West Press Pvt. Ltd., New Delhi.
4. D. E. Kaplan, NUCLEAR PHYSICS, Narosa, New Delhi.
5. S. P. Patel, NUCLEAR PHYSICS, New Age International, New Delhi.
6. Charles D. Hodgman, Robert C. Weast and Samuel M. Selby, HAND 1300K OF CHEMISTRY AND PHYSICS, The Chemical Rubber Publishing Co., Cleveland.

COURSE OUTCOME

The students will be able to

- Apply their knowledge to investigate more energy producing reactions
- Identify the appropriate particle detectors for the needed application
- Further research in the cosmos

MICRPROCESSOR AND ITS APPLICATIONS

Objectives:
This course will enable students to: Familiarize basic architecture of 8085 microprocessor and understand the programming of 8085, Understand interfacing of 16 bit microprocessor with memory and peripheral chips involving system design

Semester: VI Code: 19 PHY - S - 601 Hours/Week: 5 Credits:4

UNIT 1: INTRODUCTION TO MICROPROCESSORS

Basics of microcomputer | block diagram | types of memories | ROM | PROM | EPROM |EEPROM | dynamic RAM | static RAM

8085 microprocessor architecture | address, data and control buses | flag registers | generation of control signals | demultiplexing of address and data lines | interrupt signals | types of interrupt | hardware and software interrupts, multiple interrupts and priorities | stack and subroutine

UNIT 2: INSTRUCTION AND ADDRESSING MODE SET OF 8085

Types of instructions | addressing modes | register addressing | direct addressing | immediate addressing | indirect addressing and implicit addressing | timing diagram | instruction cycle | machine cycle and T states.

UNIT 3: PROGRAMMING 8085

Programs: 8 and 16 bit addition, subtraction, multiplication, simple division | ascending, descending, and reversing of an array | programs with time delays | waveform generation: square wave, rectangular wave and triangle wave.

UNIT 4: INTERFACING OF MEMORY & I/O DEVICES

Memory organization | memory mapping | address mapping | I/O mapped I/O | memory mapped I/O with examples | data transfer schemes | synchronous, interrupt driven I/O, 8255 programmable peripheral interface | applications: LED display interface

UNIT 5: MICROCONTROLLER

8051 microcontroller | general architecture | special register | RAM | organization, instruction sets | addressing modes | basic concept of embedded system | ATmega 328

Sensor: LDR, LM35, Ultrasonic module, sensor based electronic automation, morning alarm, darkness activated garden light, fire alarm, security alarm.

BOOKS FOR STUDY: -

1. Gaonkar R.S., "MICROPROCESSOR ARCHITECTURE, PROGRAMMING AND APPLICATIONS", 5th Ed., Penram International, (2007).
2. Hall D.V., "MICROPROCESSOR AND INTERFACING-PROGRAMMING AND HARDWARE", 2nd Ed.,Tata McGraw-Hill Publishing Company Limited, (2008).
3. Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely "THE 8051 MICRO CONTROLLER AND EMBEDDED SYSTEMS", PHI Pearson Education, 5th Indian reprint,(2003).
4. Soumitra Kumar Mandal, "MICROPROCESSOR & MICROCONTROLLER ARCHITECTURE, PROGRAMMING & INTERFACING USING 8085, 8086, 8051", McGraw Hill Edu, (2013).

BOOKS FOR REFERENCE: -

1. Walter A Triebel and Avtar Singh '16 Bit "MICROPROCESSOR ARCHITECHTURE SOFTWARE AND INTERFACE TECHNIQUES" Prentice Hall Inc., Eaglewood New Jersy (1985).
2. Short K. L., "MICROPROCESSORS AND PROGRAMMED LOGIC", 2nd Ed., Pearson Education, New Jersy, (2008).
3. Stewart J, "MICROPROCESSOR SYSTEMS- HARDWARE, SOFTWARE AND PROGRAMMING", Prentice Hall International Edition, (1990).
4. Kenneth J Ayala `" THE MICROCONTROLLER: ARCHITECTURE, PROGRAMMING AND APPLICATION" West Publishing Co..New York, (1991).
5. Krishna Kant, "MICROPROCESSOR AND MICROCONTROLLERS", Eastern Company Edition, Prentice Hall of India, New Delhi, (2007).
6. N.Senthil Kumar, M.Saravanan, S.Jeevananthan, "MICROPROCESSORS AND MICROCONTROLLERS", Oxford, (2013).
7. Valder – Perez, "MICROCONTROLLER – FUNDAMENTALS AND APPLICATIONS WITH PIC," Yeesdee Publishers, Tayler & Francis, (2013).
8. https://nptel.ac.in/courses/106108100/

COURSE OUTCOME:

At the end of the course students will be able to:

- Explain 8085 Microprocessors, Architecture of 8085
- Write 8085 Assembly level programs
- Interface 8085 with 8255 and write interfacing programs
- Explain 8051 microcontroller and write basic programs

INTRODUCTORY SOLID STATE PHYSICS

Objective:

To enable the student to get knowledge about various crystal structures and its characterisation, the behaviour of magnetic materials and appreciate the applications of ceramics and nonmaterial in various field.

Semester: VI Code: 19 PHY - S - 602 Hours/Week:5 Credits:4

Unit I INTRODUCTION

Classification of materials and their properties – structural and optical property relationship – optical property – chemical bonding – bond energy – bond type – bond length – ionic bonding – covalent bonding – metallic bonding – secondary bonding – variation in bonding character and properties.

Unit II CRYSTALLOGRAPHY AND CRYSTAL GROWTH

Crystalline and amorphous solids: crystal lattice – Miller indices - seven crystal systems and fourteen Bravis lattices- symmetry in crystal – X- ray crystallography –Laue, rotating crystal and powder methods –structural determination – defects in solids – point , line, surface and volume defect.

Crystal growth techniques: nucleation –solution growth –gel growth –PVD - CVD (qualitative)

Unit III ELECTRICAL PROPERTIES OF SOLIDS

Dielectrics and related properties : free electron theory of metals –Weidemann and Franz law –failure of free electron theory –origin of energy gap - bands and zones in solids –classification of solids into insulators, semi conductors and metals –super conducting materials (qualitative) - electric dipoles in constant and in alternating fields - dielectric strength – breakdown of dielectric materials – thermal and discharge breakdown – chemical deterioration - optical absorption in metals ,insulators, semiconductors – colour centers in crystals –piezoelectricity.

Unit IV MAGNETIC, CERAMIC AND NANO MATERIALS

MAGNETIC MATERIALS: Classification of magnetic materials –dia, para, ferro, anti-ferro and ferri magnetic materials (qualitative) –domain theory - soft and hard magnetic materials - ferroelectricity - ferrites and their uses.

CERAMICS: Classification of ceramic materials and its uses –structural features - production techniques - mechanical properties.

Nano materials –nano clusters and nano tubes and its applications.

Unit V MATERIAL CHARACTERISATION

X-ray diffraction instrumentation (overview) – rotational and vibrational spectroscopy – FTIR spectroscopy – instrumentation – UV – electronic stimulation – instrumentation – AFM – SEM.

BOOKS FOR STUDY

1. V.Raghavan , MATERIAL SCIENCE AND ENGINEERING – A FIRST COURSE, 5th edition, Prentice – Hall of India private limited, NewDelhi. (2005).
2. R.S. Khurmiand, R.S Sedha, MATERIAL SCIENCE, S.Chand and co.ltd , New Delhi .(2014).
3. P. Ramasamy and P. Santhana Raghavan, CRYSTAL GROWTH PROCESSES AND METHODS, KRU Publications, Kumbakonam, 1999.

BOOKS FOR REFERENCE

1. Ashcroft N.W. and Mermin N.D., SOLID STATE PHYSICS, Holt, Rinehart and Winiton, International Edition, Philadelphia. (1976).
2. S.O.Pillai, SOLID STATE PHYSICS, Revised 6th edition, New Age International (P) Limited, Publishers, NewDelhi.(2006).
3. Ali Omar .M, ELEMENTARY SOLID STATE PHYSICS, Pearson Education, Singapore, (2002).
4. William D.Callister Jr, MATERIAL SCIENCE AND ENGINEERING –AN INTRODUCTION, 6th edition, John Wiley & Sons, NewYork.(2004).
5. P.K.Palanisamy, MATERIAL SCIENCE, Scitech Publications, India. (2015).

COURSE OUTCOME

On the successful completion of this course the student will be able to

- ❖ Identify the crystal and grow it using different techniques.
- ❖ Analyze the behavior of magnetic materials.
- ❖ Chose ceramic and polymer materials in day to day life.

ALLIED PHYSICS I

Objective: To understand basic theories and concept in Physics and to acquire basic understanding of laboratory technique and motivate the students in the field of Physics.

Semester: 1 Code: 19 PHY - A - 101 Hours per Week: 4 Credits: 5

Unit 1 Thermal physics

Thermometry: Heat and temperature – construction and working of a constant volume hydrogen thermometer – variation of resistance with temperature – platinum resistance thermometer.

Thermal properties of matter: Expansion of solid – expansion of liquid – variation of density with temperature.

Heat transfer: definition of thermal conductivity – diffusivity – determination of thermal conductivity – Lee's disc method

Unit 2 Acoustics

Characteristic of sound waves – Doppler effect- application – expression for velocity of sound in elastic medium – vibration of air columns.

Characteristics of musical sound – loudness – units of loudness – decibel.

Ultrasonic – Production of ultrasonic by Piezo Electric Oscillator – uses of ultrasonic.

Unit 3 Elasticity

Elastic Moduli and Poison's ratio – Relation between Elastic Moduli – bending of beams – theoretical determination of Y by cantilever – angle of twist – angle of shear – twisting couple of a cylindrical rod – by static torsion and torsion pendulum.

Unit 4 Gravitation

Kepler's Law – gravitation – Newton's law of gravitation – Boy's method of finding G – gravitational field and potential – expression for field and potential – expression for field and potential at a point inside and outside of a solid sphere.

Unit 5 Viscosity and surface tension

Viscosity – Coefficient of Viscosity – critical velocity – Poiseuille's equation of flow of liquid through a tube – experimental determination of viscosity – Ostwalds's viscometer.

Surface tension: Molecular theory of surface tension – pressure difference across liquid surface – formation of drops and bubbles – surface tension by drop weight.

Books for study:

1. Brij Lal and N.Subrahmanyam, 'HEAT AND THERMODYNAMICS', S.Chand& Co. Ltd., New Delhi. (2008)
2. Brij Lal and N.Subrahmanyam, 'WAVES AND OSCILLATIONS', S.Chand &Co; New Delhi.
3. R. Murugeshan, 'PROPERTIES OF MATTER', S.Chand& Co. Ltd., New Delhi (1994).
4. D.S. Mathur, 'MECHANICS', S.Chand& Co. Ltd., New Delhi (1981).

Books for Reference:

1. D. Halliday, Resnick, and Walker, 'FUNDAMENTALS OF PHYSICS', (sixth edition), John Wiley and Sons Inc.,New York (2006).
2. R.P.Feyman et al, 'THE FEYNMAN LECTURES ON PHYSICS VOLUME I & II', Narosa and Publishing House.
3. http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
4. https://onlinecourses.nptel.ac.in/

COURSE OUTCOME

On the successful completion of this course the student will be able to

- Explain basic concepts in mechanics and properties of matter, thermal physics, fluid properties, acoustics, and elasticity.
- Analyze and solve elementary problems in the above mentioned fields.

ALLIED PHYSICS II

Objective: To induce a taste and scientific temper in some fields of physics

Semester: II Code: 19 PHY – A – 201 Hours per week: 4 Credits: 2

UNIT 1: GEOMETRICAL OPTICS

Refraction of light through a prism – total internal reflection – grazing incidence and grazing emergence in prism – dispersive power and small angle prism – combination of two prisms for dispersion without deviation and deviation without dispersion.

UNIT 2: WAVE AND QUANTUM OPTICS

Interference: interference of light – conditions – interference due to reflected and transmitted light in a thin film – air wedge – Michelson's interferometer – application
Diffraction: Fresnel and Fraunhofer diffractions – Fresnel diffraction at a circular aperture - zone plate – Fraunhofer diffraction at a single slit – double slit – plane transmission grating – determination of wavelengths.
Polarization: Polarization by reflection – Brewster's law – optical activity – polarimeter – Laurent's half shade polarimeter – uses
Lasers: Laser principle – Helium – neon laser – semiconductor laser – uses.

UNIT 3: ELECTRICITY AND ELECTROMAGNETISM

Electrostatics: Electric field and potential – potential due to point charge – capacitance – calculation of capacitance of a spherical, cylindrical, and parallel plate capacitors – energy of a charged capacitor.

Electromagnetic induction: Faraday's law – Lenz's law – self inductance – Growth and decay of current in an inductance and resistance circuit.

UNIT 4: ELECTRONICS

Semiconductor devices; Junction diode - zener diode – LED – Transistors and FET characteristics in each case.
Amplifiers: voltage amplifiers – frequency response of a single stage amplifier.
Oscillators: Principle and working of Colpitt's oscillator.

UNIT 5: DIGITAL ELECTRONICS

Logic gates using ICs – Truth table – Boolean Algebra – Demorgan's theorem – flip flops(RS,RST,D,JK&MS) – Registers – binary counters – ring and shift counters.

BOOKS FOR STUDY & REFERENCE:

1. Brij Lal, M N Avadhanulu & N Subrahmanyam 'A TEXT BOOK OF OPTICS', S.Chand& Co., New Delhi (2012)
2. R. Murugeshan, 'ELECTRICITY AND MAGNETISM', S. Chand & Co., New Delhi.(2017)

3. V.K.Metha, 'PRINCIPLE OF ELECTRONICS', S.Chand & Co., New Delhi.(2006).
4. Malvino, Leach, and saha, 'DIGITAL ELECTRONICS AND APPLICATIONS', Tata McGraw Hill, New Delhi (2014).
5. D. Halliday, Resnick, and Walker, 'FUNDAMENTALS OF PHYSICS', (sixth edition), John Wiley and Sons Inc.,New York (2006).
6. http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
7. https://onlinecourses.nptel.ac.in/

COURSE OUTCOME

On the successful completion of this course the student will be able to

- ❖ Explain basic concepts in geometrical, wave and quantum optics.
- ❖ Explain basic concepts on electricity, electronics and digital electronics
- ❖ Analyze and solve elementary problems in the above mentioned fields.

B.Sc PHYSICS – MAJOR PHYSICS PRACTICALS
PHYSICS PRACTICALS I&II

Objective
To bridge the gap between theory and practical through constructive mind provoking experiments throughout the programme

SEMESTERS I, II, III & IV CODE: 19 PHY - M – 1P1&2P1 Hours/week: 6
CREDITS: 6

Any 32 of the following experiments

Mechanics and properties of matter

1. Surface tension by drop weight method
2. Viscosity of highly viscous liquid – stokes fall method
3. Comparison of viscosity – burette method
4. Moment of inertia – torsional oscillations
5. Moment of inertia – fly wheel
6. Loaded spring – spring constant
7. q by non uniform bending - pin and microscope
8. q by uniform bending – scale and telescope
9. surface tension by capillary rise method
10. viscosity of a given liquid – poiseuille's flow
11. bifilar pendulum
12. q by non uniform bending - pin and microscope
13. q by uniform bending – scale and telescope
14. n by static torsion – pointer and scale

HEAT

15. Joules calorimeter
16. Newton's law of cooling
17. Thermal conductivity – lee's disc method

OPTICS AND SOUND

18. Spectrometer - μ of a prism
19. Spectrometer – hollow prism
20. Spectrometer – Cauchy's constant and dispersive power of prism
21. Newton's ring – refractive index of the material of the given lens
22. Grating – normal incidence of the material of the given lens
23. Melde's string – frequency of vibrating tuning fork (transverse and longitudinal)
24. Kundt's tube

ELECTRICITY

25. Calibration of low range voltmeter – potentiometer
26. Post office box – specific resistance

27. Series resonance circuit
28. RC – differentiator, integrator and filter circuits
29. Ammeter to voltmeter conversion
30. Carey - foster's bridge – specific resistance
31. Comparison of resistances – table galvanometer
32. MG – comparison of low resistance
33. MG – figure of merits
34. Comparison of low resistances potentiometer
35. Post office box- temperature coefficient
36. Carey - foster's bridge – temperature coefficient
37. Comparison of resistances – table galvanometer
38. MG – emf of thermocouple
39. BG – comparison of mutual inductances

ELECTRONIC

40. Junction diode – V - I characteristics
41. Logic gates – universal gates
42. De - Morgan's theorem
43. Transistor CE configuration – determination of β

BOOKS FOR REFERENCE

1. M.N.Srinivasan , S..Balasubramanian and R.Ranganathan,, A TEXTBOOK OF PRACTICAL PHYSICS ,Sultan Chand and Sons , Reprint (2003) New Delhi.
2. C.Ouseph and C.Rangarajan, A TEXT BOOK OF PRACTICAL PHYSICS, S. Viswanathan(Printers and Publishers) Pvt Ltd ,Revised edition (1988).
3. S.Philomin Raj, B.Sc PRACTICAL PHYSICS, Alpha Publishing house , 1st edition (1989).
4. Department study materials.

PHYSICS PRACTICALS III

SEMESTERS V&VI CODE:19- PHY - M 5P1&6P1 Hours/week: 6 CREDITS: 6

ANY 36 OF THE FOLLOWING EXPERIMENTS:

1. Stokes fall- viscosity of the given liquid
2. q of a cantilever - static method
3. q of a cantilever –dynamic method
4. n by static torsion – scale and telescope
5. Compound pendulum
6. n by torsional oscillation
7. q, n ,σ by Searle's method
8. MI by torsional oscillations
9. q by Koenig's method
10. i - d curve –spectrometer
11. D, D+1, D+2 settings –spectrometer
12. Air- wedge – thickness of a given wire
13. Polarimeter
14. Biprism
15. i_1 - i_2 curve –spectrometer –stokes law
16. small angle prism
17. Grating minimum deviation –calculation of λ of Hg lines
18. Grating –Fraunhoffer lines –Rydberg's constant
19. Arc spectra –hartman's formula
20. Spectrometer – Rydberg's constant – H discharge tube
21. Potentiometer –calibration of high range voltmeter
22. BG –determination of mutual inductance
23. BG – absolute capacitance of a condenser
24. Figure of merit of BG – Hibberts magnetic standard
25. BG –comparison of capacitances
26. Potentiometer –EMF of a thermocouple
27. K of BG –solenoid
28. I - H curve –magnetometer
29. Field along the axis – determination of B_H
30. Regulated power supply using IC 7805
31. Single stage RC coupled amplifier
32. Hartley oscillator –transistor
33. Colpitts oscillator –transistor
34. Adder, subtracted, differentiator and integrator using IC 741
35. 555 timer –astablemultivibrator
36. A. Wien bridge oscillator using IC 741
    B.phase shift oscillator using IC 741
37. Logic gates using ICs and verification of universal gates
38. Study of decade counter 7490

39. Study of modulus counter using 7473
40. Encoder – decoder –seven segment display
41. Combinational network design using K map
42. 4 - BIT binary adder /subtractor using 7483
43. UJT characteristics and relaxation oscillator
44. FET characteristics and CS, CD amplifier

BOOKS FOR REFERENCE

1. M.N. SRINIVASAN , S. BALASUBRAMANIYAM AND R. RANGANATHAN , A TEXT BOOK OF PRACTICAL PHYSICS , Sultan Chand and Sons (2003)
2. S.PHILOMIN RAJ , B.Sc PRACTICAL PHYSICS (FOR MAIN AND ALLIED), Alpha P.H.D Publishing House (1989)
3. OUSEPH, C.RANGARAJAN , TEXT OF PRACTICAL PHYSICS PART 1 & PART 2, S.VISHWANATHAN PRINTERS AND PUBLISHERS Pvt.Ltd,(1990)

COURSE OUTCOME

Students are trained

- By the end of the first year (2nd semester), to have a common level of understanding in basic mechanics and properties of matter, Heat and thermodynamics courses in theory so to enhance their experimental and data analytic skills Experiments are framed to complement the core for their future courses at laboratory.
- By the end of the second year (4th semester), they are well trained with Electricity and Electromagnetism, Wave Physics and Numerical methods, Physics of appliances and Devices courses in theory. So they would have attained an enhanced technical expertise in Electricity and Optics laboratory.
- By the end of third year (6th semester) they are well trained in Electronics, Optics, and Spectroscopy in theory which is extended to his practical application as experiments.
- At the end of the programme a holistic well developed technically sound Graduate with practical knowledge to design and solve the problems in gadgets and other real life applications is developed.

ALLIED PHYSICS PRACTICALS

Objective: To give an exposure of everyday appliances of Physics to non-major students.

Semester: 1&II Code: 19- PHY - A - 1PI & 2PI Hours per Week: 2 Credits: 2

1. Young's Modulus of a Cantilever – pin and microscope.
2. Young's modulus by Non Uniform bending – scale and telescope.
3. Rigidity modulus by torsional pendulum.
4. Surface tension and interfacial surface tension – drop weight method.
5. Viscosity of a high viscous liquid – stokes fall method.
6. Viscosity of a less viscous liquid – burette method
7. Specific heat capacity of a given liquid – Joules calorimeter.
8. Disperse power of prism – Spectrometer.
9. Newtons Ring.
10. Wavelength of the spectral lines – grating (normal incidence)
11. Figure of Merit – MG
12. Calibration of Low range Voltmeter – Potentiometer
13. Comparison of (i) capacities and (ii) EMF's – BG
14. VI characteristics of Junction diode, Zener diode and FET
15. Logic Gates – IC's

EXTRA EXPERIMENTS (may be used to replace any of the above experiments from the list given below)

1. Young's Modulus (q) by uniform Bending – Pin and microscope
2. Rigidity modulus (n) by static torsion (pointer and scale)
3. Lees disc
4. Melde's String apparatus.
5. Refractive index of the prism – Spectrometer
6. Temperature Co - Efficient – Carey fosters Bridge.
7. RC coupled Amplifier.
8. Specific Resistance – Post office box
9. Colpitt's oscillator
10. Solving a Boolean expression and verify using logic gates.

BOOKS FOR REFERENCE

1. M N Srinivasan , S. Balasubramanium and R. Ranganathan, A text book of PRACTICAL PHYSICS, Sultan Chand and Sons(2003)
2. S.Philomin Raj, B. Sc PRACTICAL PHYSICS (FOR MAIN AND ALLIED), Alpha P.H.D Publishing House.(1989)
3. Ouseph, C.Rangarajan, TEXT BOOK OF PRACTICAL PHYSICS PART I AND PART II, S.Viswanathan Printers and Publishers Pvt. Ltd., (1990)

COURSE OUTCOME

At the end of first year (2nd semester) the students can understand and enjoy the theory behind optics, electronics, electricity with Practical knowledge in laboratory.