SAKTHI COLLEGE OF ARTS AND SCIENCE FOR WOMEN, ODDANCHATRAM

(Recognized Under Section 2(f) and 12(B) of UGC Act 1956)

(Affiliated to Mother Teresa Women's University, Kodaikanal)

PG & RESEARCH DEPARTMENT OF PHYSICS

CURRICULUM FRAMEWORK AND SYLLABUS FOR

OUTCOME BASED EDUCATION IN

SYLLABUS FOR

B.Sc., PHYSICS

FRAMED BY

MOTHER TERESA WOMEN'S UNIVERSITY, KODAIKANAL

UNDER

CHOICE BASED CREDIT SYSTEM

2018-2021

Preamble:

Physics, a core discipline, is the fundamental and foremost to all natural sciences. It has been significant and influential through advances in its understanding that have translated in to new technologies. The Department of Physics has been launched in the academic year 2009, with the introduction of B.Sc., (Physics) Degree Programme. It has met with the vertical growth by the introduction of M.Sc., (Physics) in 2010 and M.Phil., (Physics) in 2014.

The Department has highly qualified faculty members and support staff and is committed towards the development of innovative and handy ways of teaching at graduate, post graduate and research level and carrying out cutting edge research in various research fields. The department strives to nurture the young minds towards embracing various scientific challenges. Project work and problem sessions are encouraged to develop innovative and analytical approach to physics learning.

Fixing the Learning Objectives:

Since the Academic year 2018 – 2019, the learning objectives and outcomes of the programmes B.Sc., (Physics), M.Sc., (Physics) and M.Phil., (Physics) have been set, following the Bloom's Taxonomy Cognitive Domain. Accordingly, it is broken into six levels of learning objectives of each course. They are -

K1 / Knowledge = Remember

K2 / Comprehension = Understand

K3 / Application = Apply

K4 / Analysis = Analyze

K5 / Evaluation = Evaluate

K6 / Synthesis = Create

Mapping COs with POs:

For each programme, the Educational objectives and the Specific objectives are specified. The programme outcomes are designed according to the curriculum, teaching, learning and evaluation process. For each course, the definite outcomes are set, giving challenge to the cognitive domain. The course outcomes are mapped with the programme outcomes. The performance of the stakeholders is assessed and the attainment rate is fixed, by using the measurements 'high', 'medium' and 'low'. The restructuring of the curriculum is done based on the rate of attainment.

Institutional Objectives:

The institution has certain definite Institutional Objectives to be attained.

- Skill Development & Capacity Building
- Women Empowerment
- Self-reliance
- Gender Equity & Integrity

Programme Educational Objectives:

The Programmes B.Sc., M.Sc., and M.Phil., (Physics) are offered with certain Specific Objectives.

- To identify the fundamental laws for the study of various areas of physics and define and describe them with clarity.
- To know the application of principles and concepts of Physics with necessary practical background and assess their consequences
- To explain the basic foundation of the underlying principles and laws of Physics.
- To discuss, formulate and analyze problems in Physics and identify the key concepts and principles to solve them.
- To execute an experiment through careful observations, precise measurements, analyses, interpretation and effectively present the results.

Mapping PEOs with IOs:

Programme Educational Objectives	**Institutional Objectives**			
B.Sc. / M.Sc. / M.Phil., (Physics)	**1**	**2**	**3**	**4**
PEO1: To identify the fundamental laws for the study of various areas of physics and define and describe them with clarity.	*			
PEO2: To know the application of principles and concepts of Physics with necessary practical background and assess their consequences		*		
PEO3: To explain the basic foundation of the underlying principles and laws of Physics.			*	
PEO4: To discuss, formulate and analyze problems in Physics and identify the key concepts and principles to solve them.				*
PEO5: To execute an experiment through careful observations, precise measurements, analyses, interpretation and effectively present the results.			*	

Measuring: H – High; M – Medium; L – Low

B.Sc., PHYSICS

Programme Outcomes: (POs)

On completion of the B.Sc., (Physics) Programme, certain outcomes are expected from the learners.

PO1: Gaining a broad knowledge of the physical principles of the universe

PO2: Comprehending the fundamental laws for the study of various areas of physics and define and describe them with clarity.

PO3: Knowing the application of principles and concepts of Physics with necessary practical background and assess their consequences

PO4: Discussing, formulating and analyzing the problems and identifying the key concepts and principles to solve them.

PO5: Evaluating the basic foundation of the underlying principles and laws of Physics.

PO6: Developing critical thinking and quantitative reasoning skills,

PO7: Analyzing the scientific problems and experiments creatively and critically

ASSESSMENT PATTERN

CIA / QUESTION PATTERN & SCHEME

S.No	Section	Question Type	Marks Allotted
1	Part - A	Six questions in multiple choice pattern, testing K1 and K2 are to be given. Each question carries one mark.	03X01 = 03
2	Part - B	Two descriptive questions, with alternate options, testing K3 and K4, are to be given. Each question carries four marks.	02X02 = 04
3	Part - C	Two descriptive questions, testing K5 and K6, are to be given. Three questions are to be answered. Each question carries 15 marks.	02X04 = 08
4		Assignment	05
5		Seminar	05
		Total Marks in CIA	25

CE / QUESTION PATTERN & SCHEME

S.No	Section	Question Type	Marks Allotted
1	Part - A	Ten questions in multiple choice pattern, testing K1 and K2 are to be given. From each unit, two questions must be taken. Each question carries one mark.	10X1 = 10
2	Part - B	Five descriptive questions, with alternate options, testing K3 and K4, are to be given. Each question carries four marks. Questions are taken in the given order. Qtn. No. 11 (a) or (b) from Unit I Qtn. No.12 (a) or (b) from Unit II Qtn. No.13 (a) or (b) from Unit III Qtn. No.14 (a) or (b) from Unit IV Qtn. No.15 (a) or (b) from Unit V	5X4 = 20
3	Part - C	Six descriptive questions, testing K5 and K6, are to be given. Three questions are to be answered. Each question carries 15 marks. Questions are taken in the given order. Qtn. No. 16 from Unit I Qtn. No. 17 from Unit II Qtn. No. 18 from Unit III Qtn. No. 19 from Unit IV Qtn. No. 20 from Unit V	3X15 = 45
		Total Marks in CE	75

COMMON ACADEMIC STRUCTURE / B.Sc., PHYSICS / 2018 - 2021

Sem	Sub. Code	Title of the Course	Hrs	Credits	Marks		
					CIA	CE	Total
I	ULTA11	Part I – Tamil Ikkala Ilakkiyam	6	3	**25**	**75**	**100**
	ULEN11	Part II- English for Infotainment - I	6	3	25	75	100
	UPHT11	Part III – Core I -Properties of Matter	5	4	25	75	100
	UPHT12	Part III-Core II Thermal Physics	5	4	25	75	100
	UPHA11	Part III -Allied Mathematics I	5	4	25	75	100
	UVAE11	Part IV - Value Education	3	3	25	75	100
		Total	**30**	**21**			**600**
II	ULTA22	Part I Tamil- Idaikala Ilakkiam	6	3	25	75	100
	ULEN22	Part II English for Infotainment – II	6	3	25	75	100
	UPHT21	Part IIICore III Electricity&Electromagnetism	6	4	25	75	100
	UPHP21	Part – III Core Practical I	5	4	25	75	100
	UPHA22	Part – III Allied Mathematics - II	5	4	25	75	100
	UEVS21	Part – III Environmental Studies	2	2	25	75	100
		Total	**30**	**20**			**600**
III	ULTA33	Part I Tamil- Kaapiya Ilakkiam	6	3	25	75	100
	ULEN33	Part II English for Infotainment – III	6	3	25	75	100
	UPHT31	Part – III Core IV Mathematical Physics	5	4	25	75	100
	UPHA33	Part III – Allied (Chemistry)	5	4	25	75	100
	UPHE31	Part – III Elective I: Fiber optics	4	3	25	75	100
	UPHS31	Part IV -SBE I	2	2	25	75	100
	UPHN31	Part IV - ONME I	2	2	25	75	100
		Total	**30**	**21**			**700**
IV	ULTA44	Part I Tamil- Palanthamil Ilakkiyam	6	3	25	75	100
	ULEN44	Part II English for Infotainment – IV	6	3	25	75	100
	UPHT41	Part III - Core V Solid State Physics	4	4	25	75	100
	UPHP42	Part III Core Practical II	4	4	25	75	100
	UPHA41	Part III Allied Practical	4	4	25	75	100
	UPHE42	Part III - Elective-II-Solar thermal and Renewable energysystems	3	3	25	75	100
	UPHS42	Part IV- Skill based Elective Course II	2	2	25	75	100
	UPHN42	Part IV - ONME II	2	2	25	75	100
		Total	**31**	**25**			**800**
V	UPHT51	Part III – Core VI Electronics I	5	4	25	75	100
	UPHT52	Part III - Core VII Classical Mechanics	5	4	25	75	100
	UPHT53	Part III Core VIII Quantum Physics	5	4	25	75	100
	UPHT54	Part III - Core IX Laser Physics	5	4	25	75	100
	UPHT55	Part III - Core X Optics & Spectroscopy	5	4	25	75	100
	UPHE53	Part III - Elective-III-Medical Physics	**3**	3	25	75	100
	UPHS53	Part IV - SBE III	**2**	2	25	75	100

		Total	**30**	25			**700**
VI	UPHT61	Part III - Core XI Digital Electronics	5	4	25	75	100
	UPHT62	Part III - Core XII Nuclear Physics	5	4	25	75	100
	UPHT63	Core XIII Atomic Physics	5	4	25	75	100
	UPHP63	Core Practical III (Non Electronics)	5	4	25	75	100
	UPHP64	Core Practical IV (Electronics)	5	4	25	75	100
	UPHE64	Elective Astrophysics	3	3	25	75	100
	UPHS64	Part IV - SBE IV	2	2	25	75	100
	UEAS61	Extension Activity	2	3	25	75	100
		Total	**30**	28			**800**
		Total		**140**			**4200**

Programme: B.Sc., **Subject:** Physics

Semester: I **Course:** Properties of Matter

Course Type: Part – III/ Core Paper – I **Credits:** 4

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
Applying knowledge of the properties of matter, thermodynamics, and atomic and nuclear physics to explain natural physical processes and related technological advances.	Application (Level 3)
Assessing the contributions of physics to our evolving understanding of global change and sustainability while placing the development of physics in its historical and cultural context.	Evaluation (Level 5)
Using an understanding of elementary mathematics along with physical principles	Application (Level 3)
Designing experiments and acquire data in order to explore physical principles, effectively communicate results, and critically evaluate related scientific studies.	Synthesis (Level 6)
Solving problems encountered in everyday life, further study in science, and in the professional world.	Synthesis (Level 6)

COURSE CONTENT

Unit – I: Acceleration due to gravity

Acceleration due to gravity – The simple pendulum- Borda's pendulum Compound Pendulum – Interchangeability of the Centre of suspension and oscillation – Centre of Percussion –other points. Variation of the value of g at sea- Local changes in the value of g.

Unit – II: Gravitation

Historical – Kepler's laws- Note on Newton's deductions from Kepler's laws- Newton's Law of Gravitation – Determination of the gravitational constant – Density of the Earth- Qualities of Gravitation- Law of Gravitation and theory of relativity –Gravitational field- Intensity of the field – Gravitational potential – Potential energy – Gravitational potential at a point distant r from a body of mass – m- Velocity of escape – Equipotential Surface - Potential at a point outside and inside a Spherical Shell.

Unit – III: Elasticity

Introductory- Stress and strain – Hook's law- Three types of elasticity – Equivalence of a shear to a compression and an extension at right angles to each other- Shearing and an extension at right angles to each other- Shearing stress equivalent to an equal linear stress and an equal compression stress at right angles to each other- Work done in unit volume in a strain-

Deformation of a cube- Bulk Modulus- Modulus rigidity Young's Modulus- Relation connecting the elastic constant – Poisson's ratio – Determination of Young's modulus- Determination of Poisson's ratio for rubber.

Unit – IV: Flow of Liquids – Viscosity

Rate of flow of liquid – lines and tubes of flow- energy of the liquid – Bernoulli's theorem and its important applications Viscosity – Coefficient of viscosity – Fugitive elasticity – Critical Velocity – Poiseuille's equation for flow of liquid through a tube –Determination of coefficient of viscosity of a liquid – Stoke's Method – Rotation Viscometer – Variation of viscosity of a liquid with temperature Comparison of viscosities – Ostwald Viscometer.

Unit – V: Diffusion and Osmosis

Diffusion – Fick's law – relation between time of diffusion and length of column. Experimental measurement of diffusivity – Graham's law for diffusion of gases – Effusion – Transpiration and Transfusion and Osmotic pressure – Laws of Osmotic Pressure Kinetic theory of solutions – Osmosis and Vapor pressure of a solution – Osmosis and boiling point of a solution. Osmosis and freezing point of a solution.

Books for Study:

- Elements of Properties of Matter: D.S. Mathur

  Unit I– Chapter – VI; Unit II – Chapter – VII; Unit III – Chapter – VII;

  Unit IV – Chapter – XII; Unit V – Chapter – XIII
- Properties of Matter: R.Murugesan

Books for Reference:

- Mechanics – Prof. D.S Mathur. Revised by : Dr. P.S. Hemne. S. Chand and Co. New Delhi. Fist edition 1981, Reprint 2015
- Properties of matter – Brij Lal and Subramanyam. Eurasia publishing house (pvt.) LTD. New Delhi. Sixth Edition 1991.

Online Resources:

- http://www.propertiesofmatter.si.edu/contents.html
- http://www.physicstutorials.org/home/properties-of-matter

Programme: B.Sc., **Subject:** Physics

Semester: I **Course:** Thermal Physics

Course Type: Part – III/ Core Paper – II **Credits:** 4

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
Understanding the response of solids, liquids and Gases to heat in microscopic and macroscopic level and its heat capacity.	Comprehension (Level 2)
Learning and applying about basic concept of heat conduction and various laws of thermo dynamical principles.	Application(Level 3)
Understanding of various thermodynamic principles and its related laws	Analysis (Level 4)
Designing experiments and acquire data in low temperature physics doing experiments communicate results, and critically evaluate related scientific studies.	Evaluate (Level 5)
Applying theoretical concepts of heat in every day life, and performing thermal conductivity experiments.	Synthesis (Level 6)

COURSE CONTENT

Unit- I: Kinetic theory of Gases

Derivation of ideal gas equation- degrees of freedom- Maxwell's law of equi-partition energy- Ratio of specific heat capacities- Maxwell's Law of distribution of molecular velocities- Experimental verification- Mean free path – Transport phenomena – Diffusion viscosity and Thermal conduction of gases.

Unit – II: Transmission of heat conduction

Conduction Co-efficient of thermal conductivity- cylindrical flow of heat – K of rubber-K of bad conductor – Lee's disc method. Blank body – Stefan's law – Experimental determinations of Stefan's constant – Mathematical derivation of Stefan's constant – Solar constant temperature of the sun – solar spectrum

Unit III: Thermodynamics

I law of thermodynamics – gas equation during an adiabatic process determined by clement and Desorme's method.

II Law of thermodynamics and entropy – Change of entropy in reversible and irreversible process- Maxwell's thermodynamical relations- Application to Joule Kelvin effect – Claudius Claperyron equation.

Unit IV: Low temperature Physics

Joule Kelvin effect – Simple theory of porous plug experimental adiabatic demagnetization – Curie's Law – Giauque's method- Superconductivity.

Unit V: Calorimetry

C_v and C_p of a gas Meyer's relation experimental determination of C_V by expand method – specific heat of gas by Calender Barn's method.

Books for study

- Heat and Thermodynamics – D.S. Mathur, Sultan Chand & Sons – Tb, 2014
- Heat, Thermodynamics and Statistical Physics – Brijlal, Dr.N.Subrahmanyam, P.S.Hemne– ISBN81-219-2813-3.

Books for reference

- Thermal Physics – A.B.Gupta and H.P. Roy- Books and Allied PVT Ltd, 3rd Revised edition edition
- Heat and Thermodynamics – Brij lal and Dr.N. subrahmanyam, P.S. Hemne. S.Chand and Co. New Delhi. First Edition 1968. Reprint 2015
- Thermal physics – S.C Garg, Tata Mcgraw Hill Education Private Limited, 1st, 2007

Web Resource

- http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html

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Programme: B.Sc., **Subject:** Physics

Semester: II **Course:** Electricity and Magnetism

Course Type: Part – III/ Core Paper – III **Credits:** 4

Hours Required: 6 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
Acquiring the knowledge of basic concepts of Electricity and Magnetism.	Knowledge (Level 1)
Understanding the basic laws of laws of current and magnetism by doing experiments.	Comprehension (Level 2)
Applying the concept of Direct and Alternating current in various electrical experiments	Application (Level 3)
Analyzing the concept of electromagnetic induction, and critically evaluate related scientific studies.	Analysis (Level 4)
Solving problems in everyday life, regarding series and parallel connection of house hold devices	Synthesis (Level 6)

COURSE CONTENT

UNIT I: Current electricity

Current – current density – expression for current density – Kirchoff's laws – Wheat stone's network – Carey Foster's bridge – Determination of resistivity and temperature coefficient of resistance – potentiometer: principle – calibration of ammeter, voltmeter.

UNIT II: Magnetic fields of electric current

Magnetic field – flux – Biot-Savart law – magnetic induction due to straight conductor – force on a current element – torque on current loop – ampere's law – Maxwell's equations – magnetic induction due to circular loop – solenoid and toroid moving coil galvanometer's dead beat and ballistic. Properties of magnetic material: the three magnetic vectors – dia – para – ferromagnetism.

UNIT III: Electrostatics

Electric field and flux – gauss law – application of gauss law – field due to a charged sphere – coulomb's theorem – mechanical force on the surface of charged conductor. Electrical potential – equipotential surface – relation between field and potential – electric potential energy. Capacity of a parallel plate capacitor – spherical, cylindrical and parallel plate capacitors – types of condensers – energy stored in a capacitor.

UNIT IV: Electromagnetic induction

Law of electromagnetic induction – Maxwell equation self and mutual induction – determination of L by Rayleigh's methods – determination of M coefficient of coupling – Eddy current – uses.

UNIT V: Alternating currents

AC circuits RC, RL series, parallel – power of an ac circuit – Q factor – Bridges – Owen – Anderson's Maxwell bridges.

Book for study

1. Basic electrical, electronic and computer engineering – R. Muthusubramaniam, s. Salivahanan, K.A.Muraleedharan., 1994

Books for references

- Electricity and Magnetism – D.Chattopadhyay & P.C. Rakshit – New Central Book Agency Pvt.Ltd.,2015
- Kip, A.F. 1969, Fundamentals of Electricity and Magnetism, ,2nd edition., McGraw-Hill, New York

Web Reference:

- http://nptel.ac.in
- https://study.com/academy/lesson/electromagnetic-induction-definition-variables-that-affectinduction.

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Programme: B.Sc., **Subject:** Physics

Semester: II **Course:** Core Practical -I

Course Type: Part – III/ Core Practical -I **Credits:** 4

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description	Blooms' Taxonomy Level
Understanding Experimental ideas related to properties of Matter.	Comprehension (Level 2)
Identifying the correlation between theory and experiment.	Analysis (Level 4)
Applying the property of light and sound to various experiments	Application (Level 3)
Designing potentiometer experiments for calibration of Ammeter and Voltmeter.	Evaluation (Level 5)
Solving problems and analysing observation and make meaningful conclusions	Synthesis (Level 6)

COURSE CONTENT

Any Twelve

Estimation of errors

Young's modulus – Uniform bending pin and microscope method

Young's modulus – Non Uniform bending pin and microscope method.

Young's modulus – Uniform bending optical lever method.

Young's modulus – Non Uniform bending optical lever method.

Compound Pendulum – g and k.

Spectrometer – Dispersive power of prism .

Spectrometer –Grating minimum deviation.

Potentiometer – Low range voltmeter calibration.

Potentiometer – Low range ammeter calibration .

Sonometer – Laws verification.

Sonometer – Frequency of the tuning fork.

Melde's Experiment.

Determination of coefficient of viscosity – Stoke's method.

Potentiometer - resistivity & comparision of resistance.

Potentiometer – Ammeter calibration.

Potentiometer – EMF.

Newton's law of cooling.

Suggested Books

- C.C Ouseph, G.Rangarajan- A Text Book of Practical Physics- S. Viswanathan Publisher- Part I (1990).
- C.C Ouseph, C.Rangarajan, R.Balakrishnan- A Text Book of Practical Physics-S.Viswanathan Publisher-Part II (1996)
- S.L Gupta and V.Kumar- Practical Physics- Pragati Prakashan – 25th,Edition (2002)

Web References:

- https://www.youtube.com/watch?v=xASsYJo3zrM
- https://www.youtube.com/watch?v=WMQZWBi7fbE
- https://www.youtube.com/watch?v=N0lxwqANsd4
- https://www.youtube.com/watch?v=jhU5nQgtwXY
- https://www.youtube.com/watch?v=GTnPEtksTEc

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Programme: B.Sc., **Subject:** Physics

Semester: III **Course:** Mathematical Physics

Course Type: Part – III/ Core Paper – IV **Credits:** 4

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
Describing the mathematical basis of vectors and their application in physics problems..	Comprehend (Level 2)
Evaluating the concept of eigenvectors and eigen values and their physical meaning.	Evaluation (Level 5)
Using Matrices and Fourier series numerous physical Physical principles and problems can be solved	Application (Level 3)
Analysing the mathematical concepts and tools such as Beeta, Gama functions and partial differential functions to solve numerical problems of physics.	Analysis(Level 4)
Describing the usefulness of Fourier series in solving problems associated with periodicity.	Synthesis (Level 6)

COURSE CONTENT

Unit I : Vectors

Gradient of a scalar field - line, surface and volume Integrals – Divergence of vector function- Curl of a vector function and its physical significance- Gauss divergence theorem – Stoke's theorem – Green's theorem.

Unit II: Matrices

Algebraic operation on matices- transpose of a matrix – the conjugate of matrix – the conjugate transpose of a matrix- symmetric and anti-symmetric matrix- hermition and skew- hermition matrix- determinant of matrix – co-factor of a determinant-minors of a matrix- singular and non-singular matrix – adjoint matrix – invertible matrix- inverse of a matrix- orthogonal matrix – unitary matrix.

Unit III: Fourier series

Fourier series- Change of interval form – complex form of Fourier series- Fourier series of a function f(x) - Fourier series in interval – Uses of Fourier series – Physical examples of Fourier series- properties of Fourier series.

Unit IV: Beta and Gamma Function

Definition – Symmetry property of Beta function – Evaluation of Beta function – Transformation of Beta function – Evaluation and transformation of Gamma function – relation between Beta

and Gamma function.

Unit V: Partial Differential equation in Physics

Solution of Partial Differential Equation by the method of separation of Variables – Solution of Laplace's Equation in Two – dimensional cylindrical co-ordinates (r,θ): Circular Harmonics. – Solution of Laplace's Equation in General Cylindrical Co-ordinates – Solution of Laplace's Equation in Spherical Polar Co-ordinates – Spherical Harmonics.

Books for study:

- Mathematical Physics – Sathyaprakash, Sultan Chand and Sons, New Delhi. First Edition 1985-86, Reprint -2013.
- Mathematical Physics – B.D.Gupta, Vikas Publishing house PVT Ltd. Fourth Edition.
- Joshi, A.W. Matrices and tesnors in Physics, New age international publishers (ISBN:81-224-0563-0)

Books for reference:

- Mathematical Physics – H.K. Dass , Dr. Rama Verma. S. Chand and Co. New Delhi. FirstEdition 1997. Reprint 2014.

Web References:

- https://www.statlect.com/matrix-algebra/vectors-and-matrices
- https://arxiv.org/ftp/arxiv/papers/0903/0903.4323.pdf
- https://en.wikipedia.org/wiki/Partial_differential_equation

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Programme: B.Sc., **Subject:** Physics

Semester: III **Course:** Mechanics, Properties of Matter, Electricity, Electronics And Modern Physics

Course Type: Part – III/ Allied (Chemistry/Maths) **Credits:** 4

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
Understanding the motion of objects and attempts to comprehend the laws governing them. laws of motion, concepts of system of particles, dynamics of rigid bodies and oscillations.	Comprehension (Level 2)
Realizing the knowledge of gravitational force between bodies including planets. Comparing the fluid motion, determine the coefficient of viscosity by different method.	Analysis (Level 4)
Enhancing the application skills by relating the phenomena of electricity and magnetism with daily activities.	Application (Level 3)
Analyzing and applying the concepts of current electricity, transient currents and magnetic materials its types.	Evaluation (Level 5)
Understand a broad overview of the various optical instruments. Appreciating the fibre optics phenomena and communication**.** Solving problems encountered in everyday life, in the professional world.	Synthesis (Level 6)

COURSE CONTENT

Unit I: Force, work, power and energy

Forces in nature–central force-gravitational and electromagnetic-conservative and non-conservative forces- examples- nuclear force- friction- angle of friction – motion of bodies along an inclined plane – work done by a force- work done by a inclined plane- work done by a varying force- expression for kinetic energy- expression for potential energy- power.

Rotational motion

Angular velocity- normal acceleration (No derivation) centrifugal and centripetal forces- torque and angular acceleration - work and power in rotational motion- angular momentum-K. E. of rotation – moment of inertia- Laws of parallel and perpendicular axes theorems – M. I. of a circular ring. Circular Disc, solid spheres, Hollow spheres and Cylinder.

Unit II: Gravitation

Kepler's Law of planetary motion – law of gravitation-Boy's Method –determination of g- compound pendulum- expression for period experiment to find g- variation of g with latitude, attitude and depth- artificial satellites.

Viscosity

Derivation of poiseuille's formula (analytical method)-Bernoulli's theorem- proof- applications- Venturimeter- pitot tube.

Unit III: Electrostatics

Gauss law (no proof)- application field due to a charged sphere and an infinite plane sheet – field near a charge conducting cylinder coulomb's theorem – electric potential capacitors- expression for □ of parallel plate.

Magnetic Effect

Torque on a current loop, galvanometer, dead beat and ballistic- current sensitiveness- experiment- charge sensitiveness- damping – damping correction- experiments for charge sensitiveness- comparision of emf's and comparision of capacitors.

Unit IV: Electronics

Junction diodes- forward and reverse bias – diode characteristics- types of diodes- LED and Zener diode- bridge rectifier using junctions diodes- □ filter- basic gates- Universal gates- Demorgan's theorem.

Unit V: Photoelectricity

Laws of photoelectricity, Einstein's equation photo cells and their uses, photoemissive, photoconductive and photovoltaic cells – solar cells-photo detectors – fibre optics- light propagation in fibers- fiber optic communication systems.

Reference:

- Mechanics – Prof. D.S Mathur. Revised by : Dr. P.S. Hemne. S. Chand and Co. New Delhi. Fist edition 1981, Reprint 2015.
- Properties of matter – Brij Lal and Subramanyam. Eurasia publishing house (pvt.) LTD. New Delhi. Sixth Edition 1991Solid State Electronics- B. L. Theraja
- Electricity and Magnetism – D.Chattopadhyay & P.C. Rakshit – New Central Book Agency Pvt.Ltd.,2015
- Ancillary Physics- M. Palinappan, LMN Publication, 1993.
- University Physics with Modern Physics - Sears zemansky and Ground, 13th edition,2013.

- Modern Physics- R. Murugesan, S. Chand Publishing, 2011.
- Optics and Spectroscopy- R. Murugesan, S. Chand Publishing,1997.

Web Reference:

1. http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html

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Programme: B.Sc., **Subject:** Physics

Semester: III **Course:** Fiber Optics

Course Type: Part – III/ Elective – I **Credits:** 3

Hours Required: 4 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
Imparting knowledge about optical fibre and related technological advances.	Knowledge (Level 1)
Understanding the synthesis of optical fibre its classification and fibre loss.	Comprehension (Level 2)
Using an understanding of elementary mathematics along with physical principles	Application (Level 3)
Comparing the optical and electrical properties of optical fibre and studying of transmission characteristics in its communication system.	Analysis (Level 4)
Elaborating various sources and detectors used everyday life for further study in science.	Evaluation (Level 5)

COURSE CONTENT

Unit I : Optical fibers

Advantages of optical fiber communication – optical fiber waveguide: single mode fiber-step index fiber- graded index fiber.

Unit II: Transmission characteristic of optical fiber:

Attenuation – Material absorption losses – linear scattering losses – Non – linear scattering losses- Dispersion – intermodal dispersion – intermodal dispersion.

Unit III: Preparation techniques

Preparation of optical fibers – liquid phase techniques – vapour phase deposition techniques-cable design – fiber splices – fiber connection

Unit IV: Lasers

Lasers – induced absorption – spontaneous and stimulated emission – Ruby laser – He–Ne lasers –semiconductor laser – properties of laser beam

Unit V: Optical sources

Semiconductor injection laser – Light emitting diode(LED) structures – LED characteristics – optical detector – P-N photo diode – P-I-N photo diode – Avalanche photo diodes – planer wave guides

Books for study

- Optical fiber communication principles and practice – John M. Senior. Dorling Kindersley Pvt. India. 2012.
- Optical fiber communications – Gerd Keiser, Mc-Graw Hill, 2nd, Edition, 1991

Unit I: Chapter 1 & Chapter IV: Optical Fiber Communications Principles and Practice Third edition John M. Senior

Unit II: Chapter 3**:** Optical Fiber Communications Principles and Practice Third edition John M. Senior

Unit III: Chapter 4: Optical Fiber Communications Principles and Practice Third edition John M. Senior

Unit IV: Chapter 22**:** A text book of Optics –Dr. N.Subramanyan , Brij Lal, and Dr. M.N. Avadhanulu. S.Chand and Co. New Delhi. 24th revised Edition 2010. Reprint 2012.

Unit V: Chapter 8: Optical Fiber Communications Principles and Practice Third edition John M. Senior

Books for references

- Optical fiber and fiber optic communication systems- subir kumar sarkar. S. Chand and Co. New Delhi. 2008.
- Fundamentals of fiber optics in telecommunications and senor systems – B.P. Pal, Wiley Eastern, 1992.
- Applied Physics for engineering course (Photography) – Dr.P. Murugakoothan, Dr S. Sivasankaran, Dr.K.Sadayandi

Web References:

- *science.jrank.org/pages/2702/Fiber-Optics-Fiber-classifications.html*
- https://en.wikipedia.org/wiki/Fiber_optic_sensor

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Programme: B.Sc., **Subject:** Physics

Semester: III **Course:** Home Appliances

Course Type: Part – IV/ Skill Based Elective Paper-I **Credits:** 2

Hours Required: 2 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
Knowing the physics principles used in frequently used home appliances.	Knowledge (Level 1)
Imparting conceptual knowledge and skills regarding simple house hold appliance and its working**.**	Application (Level 3)
Acquiring the knowledge of Electrical wiring, switches and sockets.	Analysis (Level 4)
Designing simple electrical connections in home wiring, micro wave oven, Mixer, Grinder and vacuum cleaner.	Synthesis (Level 6)
Solving problems encountered in emergency lamp, refrigerator air conditioner and exhaust fans.	Evaluation (Level 5)

COURSE CONTENT

UNIT I:

Electrical wiring – Earthing -switches & sockets-fuse-

circuits breakerwiring of tube lights

UNIT II:

Geiser- protection –washing machine-top loading & front loading –drier-dish washer

UNIT III:

Microwave oven- induction stove-conventional oven- bread toaster- electric cooker-mixergrinder- vacuum cleaner

UNIT IV:

Emergency lamp-UPS-automatic street light- refrigerator

UNIT IV:

Air-conditioner- window & spilt- air cooler- electric chimney- exhaust fans

Books for Reference:

- Sedov, E. Entertaining Electronics, University Publishers.
- Leslie Cromwell, Biomedical Instrumentation and Measurements, Prentice Hall of

India.

- IvarUtial, 101 Science Games, PustakMahal, Delhi .

Web Reference:

- https://blog.schoolspecialty.com/physics-in-everyday-life-examples-for-the-classroom/
- https://www.onlinecolleges.net/100-amazing-videos-for-teaching-and-studying-physics/
- http://www.physics.org/explore.asp

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Programme: B.Sc., **Subject:** Physics

Semester: III **Course:** Fundamentals of Physics

Course Type: Part – IV/ Non Major Elective Paper I **Credits:** 2

Hours Required: 2 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
Understanding the fundamental constituents of atoms and classification of materials based on conductivity.	Comprehension (Level 2)
Applying the concept of projectile motion and circular motion and knowing about its velocity and acceleration.	Application (Level 3)
Analysing and understanding of Gravitational force, work energy theorem and types of energy.	Analysis (Level 4)
Acquiring knowledge about crystal structure, conservation of energy and non conventional energy sources.	Synthesis (Level 6)
Solving problems using fundamental knowledge of physical concepts.	Evaluation (Level 5)

COURSE CONTENT

Unit I

Atomic constituents - Duality - Particles and waves - Uncertainty principle Phases of matter Internal energy and temperature - If Law of Thermodynamics - Conductors, Insulators & Semi-conductors Superconductivity and super fluidity**.**

Unit II

Particle dynamics: Displacement, velocity and acceleration- distance –time graph- velocity – time graph – projectile motion – uniform circular motion – tangential acceleration in circular motion – relative velocity and acceleration

Unit III

Gravitational force – Newton's law of gravitation – Electromagnetic force – Nuclear force- Central force – conservative force – Non conservative force – Work – Work done by a varying force – Energy – Kinetic Energy, Potential Energy – Power.

Unit IV

Crystal structures: Introduction – periodic array of atoms – crystal lattice – unit cell – basis – symmetry considerations – classification of crystals – Bravais lattices in three dimensions – crystal planes and Miller indices – simple crystal structures.

Unit V

Conservation of energy - Planck's hypothesis - Mass-energy equivalence - Nuclear energy – Solar energy - Non-conventional sources of energy

Books for Reference:

- Mechanics – Prof. D.S Mathur. Revised by : Dr. P.S. Hemne. S. Chand and Co.New Delhi. Fist edition 1981, Reprint 2015.
- D.S.Mathur, Elements of properties of matter, S.Chand and Co., New Delhi, 1949.
- C.Kittel , Introduction to solid state physics – Wiley eastern 6^{th} edition, 1953.
- Physics of particles, Matter and the Universe: Roger J Blinstoyle - Institute of Physics Publishing, Bristol (1997)
- Science Matters, Robert' M. Hazen & James Trefil - Universities Press (India) Ltd.,Almost Everyone's guide to science, John Gribin - Universities Press (1998)
- Inside Science, Edited by John Allen - BBC Books, (1988).
- Physical Science Fundamentals, John J Merill, W Kenneth Hamblin, James M Thorne -Macmillan,NY (1982)

Web References:

- https://nptel.ac.in
- https://faraday.physics.utoronto.ca/GeneralInterest/Harrison/Flash/
- http://www.soulphysics.org/2008/06/get-started-learning-general-relativity/
- https://www.refsmmat.com/jsphys/relativity/relativity.html

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Programme: B.Sc., **Subject:** Physics

Semester: IV **Course:** Solid State Physics

Course Type: Part – III/ Core Paper – V

Credits: 4

Hours Required: 4 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
Understanding of the basics of fundamental building blocks of atoms and crystal structure through introduction of Solid State Physics..	Comprehension (Level 2)
Knowing the basic concept of x ray diffraction and crystal lattice structure.	Knowledge (Level 1)
Using an understanding of electron theory of solids and concept of phonon working of various diodes are known.	Application (Level 3)
On applying thermal energy the behaviour of materials is changed that property is utilized in many equipments.	Analysis (Level 4)
Applying the knowledge of crystal structure, electron theory and thermal properties of materials to various physical experiments.	Evaluation (Level 5)

COURSE CONTENT

Unit I: Crystal Structure

Introduction – lattice translation – vectors – lattices – the basis – crystal structure, Fundamentals types of lattices – Three dimensional lattice types – simple crystal structure – NaCl – hexagonal close packed, diamond structure – Miller indices.

Unit II: X-Ray Diffraction and Reciprocal Lattice

X- Ray diffraction –Bragg's law –Bragg's X-ray spectrometer- Powder crystal method – Rotating crystal method-Reciprocal Lattice vector – Diffraction conditions –Brillouin zones- Reciprocal lattice to sc., bcc., fcc., lattice.

Unit III: Phonons

Vibrations of crystals with monatomic basis: First Brillouin zone-group velocity- long wavelength limit-derivation of force constants from experiment. Two atoms per primitive basis- quantization of elastic waves- phonon momentum- inelastic scattering by phonons.

Unit IV: Electron Theory of Solids

Introduction – Classical free electron theory, Quantum theory- Thermionic emission-

photoelectric emission – Electric work function in metals – field emission – Schottky Richardsonequation – Tunnel Diode.

Unit V: Thermal Properties of Solids

Anharmonic crystal interaction – Thermal expansion, thermal conductivity – Lattice thermal resistivity – Umklapp processes – imperfections.

Books for Study:

- Solid State Physics – S.O.Pillai. New age international publishers, 6th Edition.2012.
- Introduction to Solid State Physics – Charles Kittel, Seventh Edition. 2011.

Books for References:

- Solid State Physics Principles and Applications – R. Asokamani, Anamaya Publishers, NewDelhi, cop. 2007. Edition/Format:
- Ibach, H. & Luth, H. 1991.Solid State Physics – An Introduction to Theory and Experiment,
  Narosa Publishing House,
- Srivatsava, J.P. 2007 Elements of Solid State Physics , II ed, Phi Publishers, ISBN 978-81-203-
  2847-1.

Web Reference:

- https://en.wikipedia.org/wiki/Debye_model
- https://en.wikipedia.org/wiki/Bloch_wave
- https://en.wikipedia.org/wiki/Reciprocal_lattice
- https://en.wikipedia.org/wiki/Tight_binding

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Programme: B.Sc., **Subject:** Physics

Semester: IV **Course:** Core Practical – II

Course Type: Part – III/ Core Practical – II

Credits: 4

Hours Required: 4 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
Understanding the spectrometer experiment and finding the angle of prism and deviation of light.	Knowledge (Level 1)
Identifying the link between theory and experiment on various experiments like Carey Foster, LCR series and parallel experiments.	Comprehension (Level 2)
Using an understanding of Zener diode experiments voltage regulation principles in electrical equipments can be known.	Application (Level 3)
Designing experiments and acquire data in order to study about the various working configuration transistor.	Analysis (Level 4)
Applying the knowledge of light property, diode and transistor characteristics students are able to correlate theory and experiments and make useful conclusions.	Synthesis (Level 6)

COURSE CONTENT

Any Twelve

Spectrometer – Prism – i-d curve

to find μ.Spectrometer –i-d

curve – i-i′ curve.

Spectrometer –Grating – resolving power &

dispersive power.Galvanometer / B.G – conversion

Ammeter.

Galvanometer / B.G – conversion

Voltmeter.Galvanometer Emfs.

Galvanometer Comparison of

capacitances.Carey Foster Bridge

– P and r.

Carey Foster Bridge – temperature

coefficient .Galvanometer / B.G

Charge sensitivity.

L- Owen' bridge.

LCR – series

Resonance Circuit.

LCR –Parallel

Resonance Circuit.L-

Anderson's Bridge.

L. Maxwell's Bridge.

L. Rayleigh's Bridge.

Spectrometer – Cauchy's

Constant.

Spectrometer – Resolving power

of prism.Zener diode – break

down voltage.

Zener diode – voltage

regulation. Transistor

characteristics – CE mode.

Transistor characteristics –

CC mode.Transistor

characteristics – CB mode

SUGGESTED BOOKS

1. C.C Ouseph, G.Rangarajan- A Text Book of Practical Physics- S. Viswanathan Publisher-Part I (1990).

2. C.C Ouseph, C.Rangarajan, R.Balakrishnan- A Text Book of Practical Physics- S.Viswanathan Publisher-Part II (1996)

3.S.L Gupta and V.Kumar- Practical Physics- Pragati Prakashan – 25th,Edition (2002)

Web References:

- https://www.youtube.com/watch?v=N0lxwqANsd4
- https://www.youtube.com/watch?v=WwexoU-gUoc
- https://www.youtube.com/watch?v=OGHpiUMSRwg
- https://www.cmi.ac.in/~debangshu/lab1/zener.pdf

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Programme: B.Sc., **Subject:** Physics

Semester: IV **Course:** Ancillary Physics Practical

Course Type: Part – III/ Ancillary Physics Practical

Credits: 4

Hours Required: 4 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
Understanding the experimental ideas related with Properties of matter, optics, electricity and magnetism.	Knowledge (Level 1)
Exposing the non physics under graduate students to the technique of handling simple measuring instruments and its physical concepts.	Comprehension (Level 2)
Using an understanding of viscosity of liquids by Stoke's Method and Poiseuille's principles the property of liquids can be understood	Application (Level 3)
By doing the potentiometer experiments for the calibration of Ammeter and voltmeter the students are able to analyze the error in the instrument and correct it.	Analysis (Level 4)
Designing experiments like diodes, logic gates and zener diodes, analyzing observation and make meaningful conclusions.	Evaluation (Level 5)

COURSE CONTENT

Any 12 experiments

1. Estimation of Error
2. Compound Pendulum – g and unknown mass determination
3. Young's Modulus – Uniform bending – pin and microscope method
4. Young's Modulus – Uniform bending – Optic lever method
5. Young's Modulus – Non Uniform bending – pin and microscope method
6. Viscosity –Stoke's Method
7. Viscosity – Poiseuille's method
8. Sonometer – frequency of a lining fork
9. Calibration of Voltmeter – potentiometer
10. Calibration of ammeter – potentiometer
11. Comparison of capacitances – B.G
12. Dispersive power of prism – Spectrometer
13. Logic Gates – AND, OR, NOT using discrete components

14. Logic Gates – NAND, Nor – using IC, s
15. Diode Characteristics
16. Zener diode Characteristics
17. Newton's rings of a liquid

SUGGESTED BOOKS

1. C.C Ouseph, G.Rangarajan- A Text Book of Practical Physics- S. ViswanathanPublisher-Part I (1990).

2. C.C Ouseph, C.Rangarajan, R.Balakrishnan- A Text Book of Practical Physics-S.Viswanathan Publisher-Part II (1996).

3.S.L Gupta and V.Kumar- Practical Physics- Pragati Prakashan – 25th,Edition (2002).

4.A. P. Malvino, Electronics,

cybergear, 2010. 5.John Morris,

Analog Electronics, Import, 1999.

6.Electrical Machines S.K. Bhattacharaya, (TTTI Chandigarh) - TMH 1998

Web References:

- https://www.youtube.com/watch?v=xASsYJo3zrM
- https://www.youtube.com/watch?v=WMQZWBi7fbE
- https://www.youtube.com/watch?v=N0lxwqANsd4
- https://www.youtube.com/watch?v=jhU5nQgtwXY
- https://www.youtube.com/watch?v=GTnPEtksTEc
- https://www.youtube.com/watch?v=N0lxwqANsd4
- https://www.youtube.com/watch?v=WwexoU-gUoc
- https://www.youtube.com/watch?v=OGHpiUMSRwg
- https://www.cmi.ac.in/~debangshu/lab1/zener.pdf

Programme: B.Sc., **Subject:** Physics

Semester: IV **Course:** Solar Thermal & Renewable Energy Systems

Course Type: Part – III/ Elective Paper - II **Credits:** 3

Hours Required: 3 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
Knowledge gaining, regarding conventional and nonconventional energy resources available for conversion to electricity and related technological advancements.	Knowledge (Level 1)
Assessing the solar radiation measurement, solar constant, solar radiation geometry and its tilted surface.	Evaluation (Level 5)
Using an understanding of solar energy utilization it can be used for water heating power generation for home and agricultural purposes.	Application (Level 3)
Designing experiments to trap wind energy using turbines and blades and convert to useful electrical energy.	Analysis (Level 4)
Solving problems of bio waste and how to convert them into useful electrical energy.	Synthesis (Level 6)

COURSE CONTENT

Unit I

Solar Radiation and its Measurement – Solar constant – Solar Radiation at the Earth's surface, Solar Radiation Geometry – Measurements and Data. Estimation of average Solar Radiation and Solar radiation on titled surfaces.

Unit II: Solar energy Collectors

Physics Principles of the conversion of solar radiation into heat – Flat Plate collector (FPC) – Performance analysis of FPC – Concentrating collector (CC) over FPC – Selective coatings – Photo voltaic Cell.

Unit III: Application of Solar energy

Solar water heating – Space heating – Space Cooling – Solar Electric Power generation – agricultural and industrial process heat – Solar distillation – Solar Pumping – Solar furnace – Solar cooking.

Unit IV: Wind energy

Basic principles of wind energy conversion – Nature of the wind – the power in the wind –

forces on the blades and thrust on turbines – wind energy conversion (WEC) – basic

components of wind energy conversion – classification of types of WEC systems – advantages and disadvantages of WECs.

Unit V: Biomass

Introduction – biomass conversion technologies – photosynthesis – biogas generation – factors

affecting biodigestion on generation of gas – classification and types of biogas plants –advantages and disadvantages of floating drum plant and fixed dome type plant

Book for study

- Solar energy utilization – G.D. Rai, Edition, 3. Publisher, Khanna Publishers, 1987.
- Non-Conventional Energy Sources", G.D. Rai ,4th Edition, Khanna Publishers, 2000.

Book for Reference:

- Sukhatme S.P. 1984. Solar Energy Principles thermal collection and storage, Tata McGraw Hill publications.

Web Reference

- http://www.environmentalpollution.in

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Programme: B.Sc., **Subject:** Physics

Semester: IV **Course:** Biomedical Instrumentation

Course Type: Part – IV/ Skill Based Elective Paper II **Credits:** 2

Hours Required: 2 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
Knowledge gaining about the biomedical instruments available for usage.	Knowledge (Level 1)
Understanding the working principles of Bio potential electrodes, purpose and its types.	Comprehend (Level 2)
Understanding of Micro piper, depth and needle electrodes, surface electrodes, elementary mathematics along with physical principles.	Comprehend (Level 2)
Designing experiments and acquire data in order to explore physical principles of ECG, EEG, EMG and effectively communicate results, and critically evaluate scientific studies.	Analysis (Level 4)
Analyzing the working of Pace Maker- Pace Maker batteries- defibrillators, defibrillators-nerve and muscle stimulators.	Evaluation (Level 5)

COURSE CONTENT

Unit I: Bio-Potential Electrodes

Electrodes- half of potential – purpose of electrode paste- Electrode material- types of electrode.

Unit II

Microelectrode-Metal microelectrode, Micropiper, depth and needle electrodes, surfaceelectrodes.

Unit III

Metal plate electrodes, multi point electrode, chemical electrode, hydrogen electrode.

Unit IV

System Characteristics for ECG, EEG, EMG, ERC- EOC.

Unit V

Pace Maker- Pace Maker batteries- defibrillators, synchronized and square pulse defibrillators-nerve and muscle stimulators.

Books for study:

- Biomedical Instrumentations – M. Arumugam- Anuradha agencies,

Kumbakonam,2002.

- Sedov, E. Entertaining Electronics, University Publishers.
- Leslie Cromwell, Biomedical Instrumentation and Measurements, Prentice Hall of India.

Books for Reference:

- IvarUtial, 101 Science Games, PustakMahal, Delhi.

Web Reference:

- https://www.onlinecolleges.net/100-amazing-videos-for-teaching-and-studying-physics/
- http://www.physics.org/explore.asp
- https://blog.schoolspecialty.com/physics-in-everyday-life-examples-for-the-classroom/

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Programme: B.Sc., **Subject:** Physics

Semester: IV **Course:** Electronics in Daily Life

Course Type: Part – III/ Non Major Elective Paper – II

Credits: 2

Hours Required: 2 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
Understanding of basic electronics concepts and itsapplications in daily life for non physics students.	Comprehension (Level 2)
Assessing the contributions of physics to electrical equipments, formulas, fuse wire transistors and IC chips.	Analysis (Level 4)
Using an understanding of physical principles and laws associated with electronic home appliances like Radio, Tape recorder, CD,DVD player	Application (Level 3)
Analysing the basic principles of Telephone, wireless phone and antenna.	Analysis (Level 4)
Safety mechanism in handling electrical appliances, hazards prevention protection and power saving methods.	Synthesis (Level 6)

COURSE CONTENT

UNIT I : FUNDAMENTALS

Electrical and Electronic symbols – Resistors - Capacitors – Resistance wale – Capacitor wale – Electrical quantities – Electrical formulas – Magnetism – Meters – Fuse wire Transistors

– Integrated chips.

UNIT II: ELECTRICAL APPLIANCES

Switchboard – Main box – Metal circular breakers (MCB) – AC – DC currents – Two phase – Three phase electrical connections – generators – uninterrupted power supply (UPS) – stabilizer – voltage regulators – Electrical devices – Iron box – Fan

UNIT III: ELECTRONIC HOME APPLIANCES

Radio – Audio taper veaulem, speaker – televisions – VCR – CD Player –DVD – calculators – Computers – Block diagram of a computer – Input device – Memory device – control unit – Arithmetic and logic unit – output device – microprocessor – RAM –ROM – scanner – printer – Digital camera – LCD Projectors – Display devices

UNIT IV: COMMUNICATION ELECTRONICS

Principles of optical fiber cables(OFC) – Telephone – Mobile Phones – wire less phone –Antenna – Internet – Intranet

UNIT V: SAFETY MECHANISM

Handling electrical appliances – power saving methods – hazards prevention methods – protection of Hi-Fi electronic devices.

Books for Study and reference:

- S.S. Kamble – Electronics and Mathematics Data Book – Allied Publishers Ltd – 1997
- William David Cooper, Electronic and Instrumentation and Measurement Technique (2nd Edition), 1978.
- Andrade, Physics for the Modern World, The English Language Book Society.

Web Reference

- https://www.onlinecolleges.net/100-amazing-videos-for-teaching-and-studying-physics/
- http://www.physics.org/explore.asp

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Programme: B.Sc., **Subject:** Physics

Semester: V **Course:** Electronics

Course Type: Part – III/ Core Paper – VI

Credits: 4

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
Providing the fundamental aspects regarding development of electronics in discrete components.	Knowledge (Level 2)
Understanding the Transistor characteristics and its parameters, Amplifiers and its applications.	Comprehension (Level 2)
Using an understanding of oscillators and amplifiers with its physical principles by doing experiments	Application (Level 3)
Designing experiments using integrated chips by constructing adder, subtractor integrator and differentiator..	Analysis (Level 4)
Evaluating the function of amplifier, oscillators and adder, subtractor..	Evaluation (Level 5)

COURSE CONTENT

Unit I: Band Structures of Semiconductor

Band structures- carrier energy distribution – carrier concentration in an intrinsic crystal. Donar and acceptor impurities – Fermi level continuity equation – theory of Tunnel diode – Avalanche and Zener Break down – Zener Diode. Photodiode.

Unit II

Two port network analysis –h - parameter – transistors – input and output characteristics – load line – quiescent point – fixed bias – universal divider bias – Emitter feedback bias- Amplifiers –

C.E. amplifiers.

Unit III: Amplifiers

Cascade amplifier: RC coupled- transformed coupled - direct coupled – power amplifier : class Aand Class B – Push pull amplifiers – frequency response of amplifiers.

Unit IV: Oscillators

Feedback – types of feedback – advantage of negative feedback – Barkhausan criterion - Hartley,colpitt and phase shift oscillators – Mulltivibrators using transistors: Astable,

Monostable and bistable.

Unit V: Integrated Electronics

Op- amp characteristics – Expression for gain (inverting mode only) – application as adder,subtractor, integrator and differentiator – analog computer.

Books for study:

- Electronic devices and circuits – S. Salivahana, N. Suresh kumar and Villa Raj,McGraw Hill Publishing co.Ltd., New Delhi 1998.
- Principles of Electronics- V.K.Mehta S. Chand and Co. New Delhi. 2014.

Books for references:

- Text book of applied Electronics – R.S.Sedha, Edition, 2. Publisher, S.Chand Limited, 2008.
- Electronics Principles- 8th Edition,By Albert Malvino and David Bates ,Copyright: 2016 .
- Basic Electronics for Scientist and Engineers J.J.Brophy – TMH, 2007
- Basic Electronics – A. Ubald Raj and G. Jose Robin. Indira Publications,Marthandam. First Edition 2014
- Basic electrical and electronics engineering – R. Muthusubramanian and S.Salivahanan. Mc Graw Hill education, New Delhi. 2015.
- Electronics Fundamentals and Applications – Millman and Halkias, McGraw-Hill, 1976.
- Transistors circuit approximations – Malvino. TMH, A.P. Publisher: TMH 1980Edition:
- Elements of Solid State Electronics – Ambrose and Vincent Devaraj, Mera publications -1993.

Web Reference:

- https://en.wikipedia.org/wiki/Electronic_oscillator
- https://www.electronics-tutorials.ws/opamp/opamp_1.html
- https://byjus.com › Physics › Physics Article

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Programme: B.Sc., **Subject:** Physics

Semester: V **Course:** Classical and Statistical Mechanics

Course Type: Part – III/ Core Paper – VII

Credits: 4

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
Understanding the concept of D'Alemberts principle and Langrange principle.	Comprehension (Level 2)
Acquiring the knowledge about variational principles and two body central force problem.	Knowledge (Level 1)
Using an understanding ofstatistical physics and elementary mathematics along with physical principles	Application (Level 3)
Designing experiments and acquire data in order to explore physical principles, phase space, Fermi energy and electron gas in metals.	Analysissis (Level 4)
Solving problems encountered in classical and statistical Mechanics.	Evaluation (Level 5)

COURSE CONTENT

Unit I: D Alembert's principle and Lagrange's equation

Mechanics of system of particles – contraints – D'Alembert's principle and Langrange's equations – velocity dependent potential and dissipation functions – application of Lagrange's formulation.

Unit II: Variational principles and Lagrange's equations:

Hamiltonian's principle – some techniques of the calculus of variations – derivation of lagrange's equation Hamiltonian's principle – extension of Hamilton's principles to non holonamic systems. Advantages of the variational principles formulation-conservation theorem

– symmetry properties.

Unit III: The two- body central force problem

The Kepler problems – detection of Kepler's law (I, II, III law) – center of mass – motion of the center of mass of a system of particle – two body problem and the reduced mass.

Unit IV: Statistical Physics

Equilibrium of distribution and partition function – molecular energies in an ideal gas-

equipartition theorem – Einstein and Debye's theory of specific heat capacity – thermal properties of non - metals (no derivations) and metals.

Unit V: Classical and quantum statistics

Phase space – probability of distribution – Maxwell's Boltzmann's statistics – Bose Einstein statistics – Planck's radiation – Fermi Dirac statistics – Fermi energy – electron gas in metals.

Books for study

Unit-I D Alambert's principle and Lagrange's EquationClassical mechanics- Gupta, Kumar, Sharma
Classical mechanics-G.Aruldhas
Unit-II Variational principle and Lagrange's EquationClassical mechanics-H.Goldstein
Classical mechanics-N.CRana & PS Jog Unit-III Two- body central force problemClassical Mechanics -H.Goldstein
Unit-IV &Unit-V Statistical physics & Classical and quantum statisticsStatistical mechanics –B.B.Laud

Books for Study:

- Classical Mechanics- H.Goldstein, Narusa publisher, new delhi. Second Edition.2001.
- Statistical Mechanics – Gupta and Kumar. Pragati prakashanm Meerut. 2009

Books for reference:

- Thermodynamics, Kinetic theory of Statistical thermodynamics – E.W.Sears andG.L.Salinger – Edition III, Narosa Publishing House, 2013
- Classical mechanics, Rana, Jog, Mcgraw Higher Ed, 1st Edition, 2001
- Dass, T., & Sharma, S.K., 1998. Mathematical Methods in Classical and Quantum Physics, University Press, ISBN 81-7371-089-9.
- Bhatia,V.B. Classical Mechanics – With Introduction to Nonlinear Oscillations and Chaos, 1997. Narosa Publishing House, ISBN 81-7319-104-2.

Web Resource:

- https://en.wikipedia.org/wiki/Two-body_problem
- https://en.wikipedia.org/wiki/Poisson_bracket
- https://en.wikipedia.org/wiki/Hamiltonian_mechanics

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Programme: B.Sc., **Subject:** Physics

Semester: V **Course:** Quantum Physics

Course Type: Part – III/ Core Paper – VIII **Credits:** 4

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
Understanding the basic concepts of Quantum Mechanics to explain natural physical processes and related technological advances.	Comprehension (Level2)
Acquiring the Knowledge about failure of classical and evolution of quantum physics.	Knowledge (Level 1)
Using an understanding of wave mechanical concepts schrodinger's wave mechanical concepts are known	Application (Level 3)
Acquiring knowledge about linear vector space, Eigen value and Eigen function and evaluation of related scientific studies.	Evaluation (Level 5)
Solving problems encountered in one dimensional and three dimensional problems free particle and square well potential.	Synthesis (Level 6)

COURSE CONTENT

Unit I: Origin of the quantum mechanics

Limitations of classical physics –Planck' quantum hypothesis – Quantum theory of specific heat

– Bohr Model of hydrogen atom – existence of stationary states- Wilson Somerfield quantizationrule-elliptic orbits of hydrogen atom- the rigid rotator – particle in the box- the correspondence principle – The stern Gerlach experiment – inadequacy of quantum theory.

Unit II: Wave mechanical concepts

Wave nature of particles – the uncertainty principle- the of superposition – wave packet- time dependent schrodinger equations – interpretation of wave functions – Ehrenfest's theorem –time independent schrodinger equation.

Unit III: General formalism of quantum mechanics

Linear vector space – linear operator – Eigen functions and eigenvalues – Hermitian operator- postulates of quantum mechanics- simultaneous measurability of observables- general uncertainty relation – Dirac's notation – equations of motion – momentum representation.

Unit IV: One dimensional energy eigenvalue problems

Square well potential with rigid walls- square well potential with finite walls-kronig penney square well periodic potential – linear harmonic oscillator-Schrodinger method – linear harmonicoscillator – operator method – free particle.

Unit V: Three-dimensional energy eigen value problemsParticle moving in spherically symmetric potential – system of two interacting particles- Rigid rotator – hydrogen atom – hydrogenise orbital's – the free particle – three dimensional square well potential – the deuteron.

Books for study:

- Quantum mechanics – G.Aruldhas second edition –PHI learning private ltd. NewDelhi, 2009.
- Modren Physics – Richmaire, Kennard and cooper, Mcgraw Hill , 2015

Chapters Taken From

Quantum mechanics – G.Aruldhas second edition –PHI learning private ltd. NewDelhi,2009. `

Unit I – Chapter – I

Unit II – Chapter – II

Unit III – Chapter – III

Unit IV – Chapter – IV

Unit V – Chapter – V

Books for reference:

- Quantum Mechanics – S.L. Kakani and H.M. Chandalia. S. Chand and Co. NewDelhi. 2007.
- Quantum mechanics – Leonard I Schiff – 3rd edition. TATA Mc Graw Hills, 4TH Edition,2014.
- Quantum Mechanics - A. Ubald Raj and G. Jose Robin. Indira Publications,Marthandam. First Edition 2014
- Quantum Mechanics – P.M. Mathews and K. Venkatesan. McGraw Hill Education Pvt, New Delhi. 2013.
- Introduction to quantum mechanics – David J.Griffiths – 2nd edition – publishing by Dorling Kindersley Pvt Ltd, 2004.

Web Reference:

- web.mst.edu/~parris/QuantumTwo/Class_Notes/GeneralFormulation.pdf
- www.damtp.cam.ac.uk/user/tong/aqm/aqmsix.pdf
- https://en.wikipedia.org/wiki/Matrix_mechanics

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Programme: B.Sc., **Subject:** Physics

Semester: V **Course:** Laser Physics

Course Type: Part – III/ Core Paper – IX

Credits: 4

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
Acquiring the knowledge about basic principles of Lasers and Laser spectroscopy.	Knowledge (Level 1)
Learning the characteristics of Laser, coherence and Intensity.	Comprehension (Level 2)
Using an understanding of basic physics of laser media together with the system configurations thatfacilitate a range of desirable options.	Application (Level 3)
Applying the knowledge of holography and deep insight into optical fibrecommunication. Designing experiments and acquire data in order to explore physical principles.	Analysis (Level 4)
Types and applications of waves, interference, coherence of spectral lines and mono chromaticity.	Evaluation (Level 5)

COURSE CONTENT

Unit I: Introduction

Directionality – Intensity – Monochromacity – Coherence – Principles, population inversion-Laser pumping.

Unit II: Einstein's Quantum theory of Radiation

Einstein coefficients – momentum transfer – life time - possibility of amplification.

Unit III: Interaction of radiation with matter

Time dependent perturbation theory- Creations and annihilation operators – Frock States –Quantization of the field – Zero – point energy – Coherent – state description of the electromagnetic field- Interaction of radiation with matter.

Unit IV: Lasers: Types and applications of Lasers

Solid state lasers: Ruby Laser- Nd: YAG Lasers - Gas Lasers: Helium –Neon Laser, Argon Ion Laser- CO_2 Laser - Semiconductor Lasers: Doped semimconductor – condition for Laser action - Liquid Lasers- Dye Lasers - Application of Lasers in Industry, Medicine and Communication.

Unit V: Theory Some Simple Optical Processes

Waves and interference – Coherence – Coherence of the field and the size of the source- Visibility and the size of the source – Coherence and monochromacity – shape and width of spectral lines – line broadening mechanisms – Natural or intrinsic broadening – Collision broadening Doppler broadening.

Books for study:

- Laser and nonlinear optics – B.B.Laud, New age international publications, New Delhi.Third Edition. 2011.
- Lasers: Fundamentals and applications – Ajay Ghatak, 2nd edition, 2010
- Narayanan, P. 1998. Essentials of Biophysics , New Age International Publishers, New Delhi,

Web Reference:

- https://www.particlesciences.com/news/technical-briefs/2009/protein-structure.html

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Programme: B.Sc., **Subject:** Physics

Semester: V **Course:** Optics and Spectroscopy

Course Type: Part – III/ Core Paper – X **Credits:** 4

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
Understanding the fundamentals of optics and related phenomena.	Comprehension (Level 2)
Acquiring basic knowledge about physical and classical optics.	Knowledge (Level 1)
Using an understanding of polarization and Diffraction various experimental facts can be understood	Application (Level 3)
Apply Paulis exclusion principle to interpret the electronic configuration of atoms. llustrate the splitting of spectral lines under the influence of magnetic and electric fields	Analysis (Level 4)
Application of light phenomena in infra red spectroscopy and Raman effect.	Evaluation (Level 5)

COURSE CONTENT

Unit I: Interference

Introduction: Light Waves; Superposition of Waves; Interference; Young's Double slit Experiment – Wavefront Division; Coherence; Conditions for Interference; Techniques of Obtaining Interference; Fresnel Biprism; Lloyd's Single Mirror; Fresnel's Double Mirror; Achromatic Fringes; Non- Localized Fringes; Visibility of Fringes; Fringe Pattern with white Light; Interferometry.

Unit II: Interference in thin films

Colours of thin film- Air Wedge – determination of diameter of a thin wire- Newton's rings – determination of refractive index for liquid- Michelson's interferometer – determination of λ and $d\lambda$ –uses.

Unit III: Diffraction

Fresnel and Fraunhofer classes of diffraction – Frenel's explanation for the rectilinear propagation of light zone plate- Frenel's diffraction at a straight edge – Theory of diffraction grating- determination of wavelength – dispersive and Rayleigh's criterion for resolving powerof grating – comparison between prism and grating spectra.

Unit IV: Polarisation

Double refraction Huygen's explanation – production , detection and analysis of plane,

circularlyand elliptically polarized light – quarter and half wave plates- optical rotation – Biot's law – Laurent half shade polarimeter – Frenel's theory of optical rotation.

Unit V: Spectroscopy

Classification of line, band and continuous spectra- Infrared spectroscopy - application Raman effect experimental set up characteristics of Raman lines – basis concepts of resonance spectroscopy.

Books for study:

- A text book of Optics –Dr. N.Subramanyan , Brij Lal, and Dr. M.N. Avadhanulu. S. Chand and Co. New Delhi. 24th revised Edition 2010. Reprint 2012.

Books for Reference:

- Optics and Spectroscopy – R. Murugeshan . Mrs . M. Shantha, Madurai. First Edition2003.
- Optics – A. Ubald Raj and G. Jose Robin. Indira Publications, Marthandam. First Edition2016.
- Spectroscopy - A. Ubald Raj and G. Jose Robin. Indira Publications, Marthandam. FirstEdition 2014.

Web Reference:

- https://en.wikipedia.org/wiki/Optical_networking
- https://en.wikipedia.org/wiki/Avalanche
- https://en.wikipedia.org/wiki/Optical_fiber

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Programme: B.Sc., **Subject:** Physics

Semester: V **Course:** Medical Physics

Course Type: Part – III/ Elective Paper – III **Credits:** 3

Hours Required: 3 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
Getting information regarding human physiological system, transport of ions through membrane resting and action potential.	Knowledge (Level 1)
Understanding Instrumentation for diagnostic X-rays and Instrumentation forthe medical of radio isotopes.	Comprehension (Level 2)
Understand the working of various medical instruments. Gain practical knowledge on various instruments.	Application (Level 3)
Designing experiments and acquire data in order to Instrumentation for Measuring the mechanics of Breathing – measurements of residual volume.	Analysis (Level 4)
Organization of the hospital for patient care monitoring, Aware of the biological effects of radiation, radiation hazards occurring in man, atmosphere and space.	Synthesis (Level 6)

COURSE CONTENT

Unit I: Human Physiological systems

Cells and their structure – transport of ions through Membrane – resting and action potential – bioelectric potentials – nerve fissures and organs – difference systems of human body.

Unit II: X – Ray and Radio Isotope Instrumentation

Generation of ionizing Radiation – Detection of Radiation – Instrumentation for diagnostic X-rays – visualization of X- rays – X-ray machines - Special techniques – Instrumentation forthe medical of radio isotopes

Unit III: Measurements in the Respiratory System

The Physiology of the Reparatory system – Tests and instrumentation for the Mechanics of breathing – Mechanical measurements – Instrumentation for Measuring the mechanics of Breathing – measurements of residual volume

Unit IV: Patient care and monitoring

The elements of intensive care monitoring – patient monitoring display – diagnosis calibration and repairability of patient Monitoring equipment – the organization of the

hospital for patient care monitoring.

Unit V: Operation theatre equipments

Surgical diathermy – short wave diathermy – microwave diathermy – ultrasonic diathermy.

Bio- telemetry

Basic and design of a bio-telemetry system – Radio Telemetry systems – Single channel telemetry system – transmission of bioelectric variables – active and passive measurements – tunnel diode FM transmitter – radio telemetry with sub carrier – multiple channel telemetry system.

Books for Study:

1. Biomedical Instrumentations – M. Arumugam- Anuradha agencies, Kumbakonam,2002.

Roy R.N. 2001.A text book of bio physics ,Books and Allied (P) Ltd.

Books for reference:

1. Bio Medical Instrumentations and measurement Leslicromwell, Leslie Cromwell. Edition,illustrated. Publisher, Prentice-Hall, 1973

2. Principles of applied biomedical Instruments – Geddes & Bakker, Wiley, New York, 1968.

3. Medicine and clinical Engineering – Prentice Hall of India, Prentice Hall (1 March 1977)

4. Bio Medical Telemetry: Sensing and Transmitting– Mackay, Stuart & John Wiley, Wiley-IEEE Press, 2nd Edition,. 1968.

5. Bio Medical Instrumentation – Chandpur, 3rd Edition, 1987

Web Reference:

- https://www.youtube.com/watch?v=l9swbAtRRbg
- https://www.medicalnewstoday.com/articles/153201.php
- https://www.youtube.com/watch?v=1HH_v6F-gZU

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Programme: B.Sc., **Subject:** Physics

Semester: V **Course:** Entertainment Electronics

Course Type: Part – III/ SBE Paper – III

Credits: 2

Hours Required: 2 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
Acquiring knowledge about various electronics house hold appliances.	Knowledge (Level 1)
Assessing the contributions of physics to the development of innumerable electrical devices .	Comprehension (Level 2)
Using an understanding of working principle of DVD, Camera, VCD and Computer.	Application (Level 3)
Designing experiments and acquire data in order to explore physical principles of I phone, I pad, laptop.	Analysis (Level 4)
Gathering knowledge about internet, film and video projector.	Evaluation (Level 5)

COURSE CONTENT

UNIT I:

Television, tape recorder and loud speaker, public address system, basic theory and working

UNIT II:

Introduction to DVD, Cameras-film and digital camera

UNIT III:

Basic theory of VCD and Computer

UNIT IV:

i-pod, i-phone, cell phone and laptop

UNIT V:

Introduction to Internet-film and video projector-DTH

Web References:

- https://en.wikipedia.org/wiki/Public_address_system
- https://en.wikipedia.org/wiki/Camcorder
- https://en.wikipedia.org/wiki/Video_CD
- https://en.wikipedia.org/wiki/IPod

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Programme: B.Sc., **Subject:** Physics

Semester: VI **Course:** Digital Electronics

Course Type: Part – III/ Core Paper – XI

Credits: 4

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
Understanding the various number system and conversion among one another.	Knowledge (Level 1)
Applying the basics binary arithmetic and solve the binary problems, logic gates and Boolean Algebra.	Application (Level 3)
Using an understanding of combinational and sequential logic system various binary problems can be solved.	Analysis (Level 4)
Designing registers and counters using logic circuits and flip flops.	Evaluation (Level 5)
Solving binary problems with A/D and D/A convertors	Synthesis (Level 6)

COURSE CONTENT

Unit I: Binary Number System

Number system – conversion of decimal number into binary number – binary to decimal conversion – binary addition - binary subtraction's complement methods – binary multiplicationand divisions – hexa decimal number binary coded decimals.

Unit II: Logic Gates

Basic logic gates – implementation – OR and AND gates using diodes and transistors – NOT using Transistors – Characteristics of logic gates – Calculation of input voltage in OR and AND gates – logic family TTL and DTL universal logic gates NOR and NAND logic gate – Exclusive OR gates.

De Morgan's Law and Applications:

Boolean algebra – De Morgan's law – Applications – different expression for Ex-OR gate – binary adders – Half adder – Full adder.

Unit III: Multivibrators

Schmit trigger (555 timer) monostable and astable Multivibrators using 555 timer - logic gate Flip – flops – R.S. Flip – Flop – J.K. Flip - Flop – R.S.Master slave Flip – Flop – J.K.Master slave Flip – Flop.

Unit IV: Counters and Registers

Types of counters – Binary Counter – Decade counter – four bit binary counter – shift register – ring counter – memory systems in computers – magnetic core as memory device magnetic disc memories – floppy disc.

Unit V: D/A and A/D Converter

Binary weighted resister – D/A converter – R2R Resistive ladder D/A converter – Counter type A/D converter – successive approximation A/D converter – Dual Slope A/D converter parallel comparator A/D converter.

Books for study

- Digital circuits and design by S.Salivahanan and S.Arivazhagan

  Unit-I Binary number system
- Digital principles and applications Donald P.Leach Albert Paul Malvino Goutam saha

  Unit-II Logic gates and Demorgan's law and applications

  Unit-III Multivibrators
- Digital principles and applications S. Salivahanan and S. Arivazhagan

  Unit-IV &Unit-V Counters and Registers &D/A and A/D converterDigital circuits
- Covered all units in the book Fundamental of Digital circuits- A. Anandkumar

Books for study:

- Digital circuits and design – S.Salivagahanan and S.Arivazhagan. Vikas publishinghouse pvt ltd . Third Edition 2007.
- Digital principles and computer design – Malvino and Leech, Mcgraw Higher Ed, 8th Edition,2014

Books for Reference:

- Digital electronics circuits and systems – V.K. Puri. Tata McGraw – Hill publishingcompany limited, New Delhi. 1997.
- Digital Electronics - A. Ubald Raj and G. Jose Robin. Indira Publications,Marthandam. First Edition 2014.
- Integrated Electronics - Milman and Halkies, Mcgraw Higher Ed, Edition: 2, 2011.
- Digital principles and computer design – Morris Mano, Pearson India, 1stEdition, 1979.

Web References:

- examradar.com/ad-and-da-converters
- https://www.ssucet.org/~jgallaher/.../Chapter9-LatchesFlip-FlopsAndTimers.pdf
- https://en.wikibooks.org/wiki/Digital_Circuits/Registers_and_Counters

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Programme: B.Sc., **Subject:** Physics

Semester: VI **Course: Nuclear Physics**

Course Type: Part – III/ Core Paper – XII

Credits: 4

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
Understanding fundamental concepts of Nuclear physics.	Knowledge (Level 1)
Acquiring knowledge about structure, properties of nucleus, isotopes and isobars.	Comprehension (Level 2)
Using an understanding of radioactivity principles and carbon dating and neutrino hypothesis.	Application (Level 3)
Designing experiments cyclotron, GM Counter, cloud chamber and photographic emulsion.	Analysis (Level 4)
Understanding the concept of cosmic rays, classification of elementary particles and conservation laws.	Comprehension (Level 2)

COURSE CONTENT

Unit I: Structure and Properties of Nucleus

Nuclear mass – Bain Bridge Astors – mass spectrum – Radius , mass defect – Binding energy –Einstein's mass energy relation – Nuclear moments Isotopes – Isobars.

Unit II: Radio Activity

Natural radioactive series , age of earth- carbon dating – successive radioactivity transient andsecular equilibrium – Gieger – Nuttal rule – Decay Gamov's theory of decay – spectrum of rays

– neutrino hypothesis.

Unit III: Accelerators and Detectors

Cyclotron- bunching effect – synchro cyclotron – Betatron – linear accelerators – basic ideas onGM counter – cloud chamber – photographic emulsion.

Unit IV: Nuclear Reactor

Four factor formula – moderator - coolent reactor assembly, thermo nuclear reation – Bathe'stheory for fusion energy – Hydrogen cycle – atom bomb – Hydrogen bomb.

Unit V: Sub Nuclear Reactions

Cosmic ray shower – pair production – annihilation – Van Allen belt – mesons – Mu meson(muonium atom) – classification of elementary particles – conservation laws.

Books for study:

- Nuclear Physics - D.C.Tayal, Himalaya publishing house. 2013.

Books for Reference:

- Nuclear Physics – R.R. Roy and B.P. Nigam.New age international pvt. 2011.
- Nuclear physics – S.N. Ghoshal. S. Chand and Co., New Delhi. 2012.
- Nuclear Physics and particle physics- Satya prakash., Sultan Chand and Sons,2014
- Moden Physics – R. Murugeshan and Er. Kiruthiga sivaprasath. S. Chand and Co.,New Delhi. 2015.

Web Reference:

- https://www.ssucet.org/~jgallaher/.../Chapter9-LatchesFlip-FlopsAndTimers.pdf
- https://en.wikibooks.org/wiki/Digital_Circuits/Registers_and_Counters
- https://brilliant.org/wiki/nuclear-decay/

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Programme: B.Sc., **Subject:** Physics

Semester: VI **Course: Atomic Physics**

Course Type: Part – III/ Core Paper – XIII **Credits:** 4

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
Understanding the basic concept of atoms and its primitive models.	Comprehension (Level 2)
Acquiring knowledge about the powerful phenomena of relativity and wave mechanics.	Knowledge (Level 1)
Using an understanding of photoelectric effect photoelectric cell can be constructed.	Application (Level 3)
Designing experiments and acquire data in Compton experiment and x – ray diffraction. Bragg's law and characteristics of X- rays	Analysissis (Level 4)
Solving problems encountered in everyday life, based on theory of relativity and characteristics of matter waves.	Synthesis (Level 6)

COURSE CONTENT

Unit I: Structure of the Atom

Critical potentials – Frank and Hertz experiments –Discovery of Photoelectric effect – results on photo electric effect – failure of the electromagnetic theory – Einstein's photoelectric effect – Milliken's experiment – photoelectric cell.

Unit II:X -rays

Diffraction of X – ray – Bragg's law – X- ray spectrometer – X- ray spectra- characteristics of X-ray spectrum – Mosley's law – Compton scattering – theory of experimental verification.

Unit III : Atom models

Review of Bohr atom model – Somerfield's relativistic model – vector atom model – various quantum number – LS and JJ coupling – Pauli's exclusion principle – electronic configuration of elements – magnetic dipole moment due to orbital motion and spin motion – Bohr magnetron – Stren Gerlach experiments.

Unit IV: Theory of relativity

Michelson – Morley experiment – interpretation of the Michelson Morley experiments – relative time – the Lorentz transformation – the relativistic velocity transformation – time dilation – illustration of time dilation – the twin paradox – length contraction –

relativity of mass – mass – energy equivalence.

Unit V: Wave Mechanics

De- Broglie's concept of matter wave – De- Broglie wavelength – Characteristics of De-Brogliematter wave. Davisson and Germaer's experiments – G.P.Thomson's experiments – Heisenberg

uncertinity principle principle – basic postulates of wave mechanics – derivation of timedependent form of Schrodinger's equation.

Books for study:

- Modern Physics – Richtmyer , Kennard and cooper, McGraw-Hill, 1969.

Books for Reference:

- Moden Physics – R. Murugeshan and Er. Kiruthiga sivaprasath. S. Chand and Co.,New Delhi. 2015.
- Modern Physics – Sehgal, Chopra, S. Chand Publishing,2013.
- Hollas, M: *Modern spectroscopy*, 4th ed., John Wiley, New York, 2004.

Web References:

- http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html

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Programme: B.Sc., **Subject:** Physics

Semester: VI **Course: Non- Electronics**

Course Type: Part – III/ Core Practical –III **Credits:** 4

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
By doing spectrometer experiment students are able to understand the properties of light.	Knowledge (Level 1)
Using Bridge experiments students are finding the capacitance values and ratio of capacitance.	Comprehension (Level 2)
Using an understanding of potentiometer experiment and calibrating ammeter and voltmeter, able to understand correction along with physical principles	Application (Level 3)
Understanding magnetometer experiment magnetization and magnetic induction can be found.	Analysis (Level 4)
Exposing the students to the technique ofhandling simple measuring instruments and also make them measure certain mechanical, electrical and optical properties of matter.	Evaluation (Level 5)

COURSE CONTENT

Any 12 Experiments

1. LCR – Series Resonance
2. LCR – Parallel Resonance
3. Spectrometer – i – d curve
4. Spectrometer – i – i' curve
5. Spectrometer – small angled prism
6. L – Anderson's bridge
7. L – Maxwell's bridge
8. L – Rayleigh's bridge
9. Potentiometer – high range ammeter
10. C1/C2 – Desauty's bridge
11. L – Owens's bridge
12. Impedance and power factor – LR circuit
13. B.G. – Absolute capacity of a condenser
14. Field along the axis of a coil – determination of B & M

15. M.G – emf of a thermocouple16. M1/M2 – B.G.

Suggested Books:

- C.C Ouseph, G.Rangarajan- A Text Book of Practical Physics- S. Viswanathan Publisher-Part I (1990).
- C.C Ouseph, C.Rangarajan, R.Balakrishnan- A Text Book of Practical Physics-S.Viswanathan Publisher-Part II (1996)
- S.L Gupta and V.Kumar- Practical Physics- Pragati Prakashan – 25th,Edition (2002)

Web References:

- https://www.youtube.com/watch?v=eYNU3LDYz2k
- https://www.youtube.com/watch?v=zDmRkE8-Nf8
- https://www.youtube.com/watch?v=N0lxwqANsd4

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Programme: B.Sc., **Subject:** Physics

Semester: I **Course: Electronics**

Course Type: Part – III/ Core Practical – IV

Credits: 4

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
Understanding the circuit connections of Diodes and Transistors and study of its characteristics.	Knowledge (Level 1)
Acquiring hands on knowledge and training of single and multistage amplifiers.	Evaluation (Level 5)
Using an understanding of elementary physical principles of oscillators and amplifiers functioning of various electronic devices can be understood.	Application (Level 3)
Designing experiments like a stable, mono stable and bi stable multivibrators generation of square wave pulses can be understood.	Analysis (Level 4)
Designing of full adder, half adder, half subtractor and full subtractor are studied	Evaluation(Level 5)

COURSE CONTENT

Zener diode – break down voltage. Zener diode – voltage regulation.

Transistor characteristics – CE mode.Transistor characteristics – CC mode.

Transistor characteristics – CB mode.Single stage amplifier.

Two stage amplifier.

Two stage amplifier – without feedback.LC- II filters.

Clippers and clampers using diode and CRO.Colpitt's oscillator – L.Determination.

Hartley oscillator –
L.Determination.UJT
relaxation oscillator.
Voltage doubler.
Dual power supply – IC 7812
IC 7912. Astable multivibrator
– transistor/ IC 555.Monostable
multivibrator – transistors.
Bistable multivibrator - RS flip flop
(transistors)Op-amp IC 741 –
characteristics.
Op-amp IC 741 – differentiator and
integrator.Op-amp IC 741 – adder
and subtractor.
All gates – using discrete components.
XOR and XNOR gates – using IC's –truth table
verification.Universal NAND gate.
Universal NOR gate.
Verification of
demorgan's theorem.RS,D
and JK flip flop.
Design of half
adder. Design
of full adder.
Design of half
subtractor.
Design of full subtractor.

Text Books

- Adrian C. Melissinos, Jim Napolitano, Experiments in Modern Physics, 2003.
- Paul B. Zbar and Albert B. Malvino, Basic Electronics (A Text-Lab Manual), TataMcGraw Hill, Edition, 5. Publisher, 1983.
- P. Malvino, Electronics, cybergear,

2010. 4. John Morris, Analog

Electronics, Import, 1999.

Web Reference:

- https://www.gopracticals.com/electronics/basic-electronics/to-obtain-v-i-zener-diode/
- https://byjus.com/physics/characteristics-of-a-transistor/
- https://www.electronicshub.org/ic-741-op-amp-basics/

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Programme: B.Sc., **Subject:** Physics

Semester: VI **Course: Astro Physics**

Course Type: Part – III/ Elective Paper – IV **Credits:** 3

Hours Required: 3 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
Understanding how to unravel the secrets of the universe.	Comprehension (Level 2)
Applying basic physical principles from a broad range of topics in physics to astronomical situations.	Application (Level 3)
Understanding of the Sun's continuous spectrum and solar interior	Knowledge (Level 1)
Acquiring knowledge about Birth of Stars – energy generation and the chemical composition of stars.	Comprehension (Level 2)
Getting information about solar eclipse, Galaxies and cosmology.	Knowledge (Level 1)

COURSE CONTENT

Unit I: Introduction

Sunlight and Spectroscopy – Atoms and Matter a Model of the atom – Simple spectroscopy – Analyzing sunlight – Kirchhoff's Rules – The conservation of energy – electromagnetic Spectrum .

Unit II: Our Star: The Sun

Ordinary Gases – The Sun's continuous spectrum – The solar absorption line spectrum – energy flow in the sun – The solar Interior – The active sun.

Unit III: The Universe of Stars

Birth of Stars – energy generation and the chemical composition of stars – Stellar Evolution and the hertz sprung (Russell Diagram) – Stellar Anatomy – Star models – theoretical Evolution of solar Mass star observational Evidence for Stellar Evolution.

Unit IV: Solar System

The Earth and the Moon

History of the Earth – Temperature of a planet – the atmosphere – pressure and Temperature distribution – the magnetosphere – The magnetosphere – the Moon – The Lunar surface – the lunar interior.

Galaxies

Introduction – Classification of Galaxies – Milky way galaxies – Over View – Differential galactic rotation – Rotation and Mass distribution – rotation curve and

Doppler shift – Determination of the Rotation curve – Average gas distribution – spiral structure in the milky way – optical traces of spiral structure – Radio tracers of spiral structure – The galactic center – Distribution of Material near the center – A massive black hole.

Unit V: Cosmology

Introduction – cosmological models – steady state model – Big Bang theory.

Book for study:

- Introduction to Advanced Astrophysics – Kurganoff. V, D. Reidel Publication company, 1980.

Books for Reference:

- Astronomy – The Evolving Universe – Michael Zeilik, 1976.
- Astronomy – A Physical Perspective – Mark L. Kutner, 2nd edition, 1987.

Web References:

- www.astronomy.ohio-state.edu/~depoy/courses/AST172...NOTES/.../structure3.html
- https://cosmic-watch.com/history-of-astronomical-instruments/
- https://www.tecepe.com.br/nav/inav_stars.htm

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Programme: B.Sc., **Subject:** Physics

Semester: VI **Course: Microprocessor**

Course Type: Part – III/ SBE Paper – IV **Credits: 2**

Hours Required: 2 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Blooms' Taxonomy Level
Understanding the basic concepts of microprocessor, Architecture of 8085 and its applications, solve simple numerical using the concept.	Knowledge (Level 1)
Acquiring the knowledge about Architecture of 8085 – Register organization.	Comprehension (Level 2)
Using an understanding of Addressing modes of 8085 microprocessor various example programmes can be solved.	Application (Level 3)
Data transfer and branch instructions are to be studied.	Analysis (Level 4)
Solving problems using assembly language and programming simple problems.	Synthesis (Level 6)

COURSE CONTENT

Unit I

Architecture of 8085 – Register organization – Concept of buses – control signals

Unit II

Pin Configuration of 8085 – Addressing mode of 8085 with examples.

Unit III

Instruction Set – Types of Instruction – Classification – Classification of Instruction

Unit IV

Data Transfer Instruction – Branch Instruction – Arithmetic and Logic Instruction

Unit V

Sub-routines – Assemble Language – programming Simple Programs

Books for Study:

- Microprocessor – B. Ram, Dhanpat Rai Publications, 2005.
- Microprocessor, Architecture, Programming and Applications – Ramesh Goanker,Wiley Eastern Ltd, Wiley Eastern Ltd. (1993).
- AdityaMathur, Introduction to Microprocessors

Lance A. Levanthal, Introduction to Microprocessors

Web References:

- https://www.geeksforgeeks.org/instruction-cycle-8085-microprocessor/.
- https://www.technicalsymposium.com/microprocessor_lab.pdf.
- https://en.wikipedia.org/wiki/Intel_MCS-51.
- https://www.quora.com/What-are-the-various-applications-of-microprocessors.