SACRED HEART COLLEGE (AUTONOMOUS)

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Ready for Every Good Work

A Don Bosco Institution of Higher Education, Founded in 1951 * Affiliated to Thiruvalluvar University, Vellore * Autonomous since 1987

Accredited by NAAC (4th Cycle – under RAF) with CGPA of 3.31 / 4 at 'A+' Grade

PG and Research Department of Physics
2021-2022
Programme structure of B.Sc. Physics under CBCS

Sem	Paper	Title of the Paper	Hours/ Week	Credits	Marks	
					CA	Sem
I	Main Core	Mechanics	3	3	50	50
	Main Core	Properties of matter	3	3	50	50
	Main Core Practicals	Physics Main Practicals – I	4	4	50	50
	Allied	Allied Mathematics – I	6	5	50	50
	Language	Tamil	5	3	50	50
	Language	General English	5	3	50	50
		Communicative English	-	1	50	50
	Life Education	Personal Skills	2	1	50	50
		Christian Religion–1 / Value Education-1	2	1	50	50
TOTAL			30	24		

Sem	Paper	Title of the Paper	Hours/ Week	Credits	Marks	
					CA	Sem
II	Main Core	Heat and Thermodynamics	3	3	50	50
	Main Core	Waves and Oscillations	3	3	50	50
	Main Core Practicals	Physics Main Practicals – I	4	4	50	50
	Allied	Allied Mathematics – II	6	5	50	50
	Language	Tamil	5	3	50	50
	Language	General English	5	3	50	50

		Communicative English		1	50	50
	Life Education	Social Skills	2	1	50	50
		Christian Religion-2/Value Education-2	2	1	50	50
TOTAL			30	24		

Evaluation pattern

(1) For Main core theory papers, Subject elective papers, Allied Physics theory papers and Non major elective papers

Component	Marks
CA	50
End semester exam	50
Total	100

CA components

Component	Marks
2 CA tests	30
MCQ(Quiz)/Assignment/ Problem solving / Open book test /Seminar	15
Attendance	5
Total	50

- In the CA components, 2 CA tests, Online quiz with multiple choice questions and attendance component are mandatory. Other components are optional and left to the discretion of the course teacher.

(2) Evaluation patterns for Practicals (B. Sc. Physics and Allied Physics Practicals)

Component	Marks
CA	50
Practical exam	50
Total	100

CA components

Component	Marks
Lab performance(preparation, performance, calculation, results)	20
2 CA tests	20
Record	10
Total	50

(3) For Subject skill papers

Subject skill papers will be evaluated purely internally by the respective course teachers.

Component	Marks
Theory	50
Practicals	50
Total	100

Evaluation pattern for the Subject skill theory papers

Component	Marks
CA	20
Semester exam	30
Total	50

CAcomponents

Component	Marks
2 CA tests	10
Assignment/ Problem solving /MCQ(Quiz)/ Open book test /Seminar	5
Attendance	5
Total	20

- In the CA components, 2 CA tests, Online quiz with multiple choice questions and attendance component are mandatory. Other components are optional and left to the discretion of the course teacher.

Evaluation pattern for the Subject skill practicals

Component	Marks
CA components (Viva, Circuit fault finding, Circuit analysis, Quiz, Mini projects etc.)	20
Practical exam	30
Total	50

(4) For self study papers

Self study papers will be evaluated **purely internally** by the respective course teachers for 100 marks. A minimum of 40% marks is essential for the award of extra credit(One extra credit per self study paper passed).

(5) For extra credits courses

For the extra credits course, Special Project- I, students may do a physics project of their choice. On completion of the project the students should submit a project report. The project report submitted by the student will be evaluated by a team of two staff members appointed by

the Head of the department. Based on their evaluation report, the students may or may not be awarded extra credits (maximum : 2 credits).

For the extra credits course, Special Project- II (Repair and maintenance of lab equipments), the students may choose some faulty equipment in the lab, identify the faults or problems in the equipments and rectify them. If the student rectifies the faults in the instrument and has spent a minimum of 20 hours in repairing the instrument, then based on their performance the staff in charge / HoD/ lab director may recommend extra credits (maximum : 2 credits) for the students.

NPTEL online courses: Students may enroll themselves in government approved online courses (NPTEL, MOOC, SWYAM etc). A student will be awarded 1 extra credit on the submission of the original pass certificate of an approved one credit online course and he/she will be awarded 2 extra credits on the submission of the original pass certificate of an approved two credits online course.

Internship : Students can obtain 2 extra credits by undertaking Summer Internship for a minimum duration of 25 days at the end of IV Semester.

Guidelines for Internship Program for Undergraduate Students

1. Internship programme(in IV semester) is optional (extra credit course) for B. Sc. Physics students.
2. Students may go for internship during summer vacation in IV semester.
3. Interested students should arrange for internship by themselves.
4. Students should go to an Institute/Industry for a period of minimum two weeks and carry out a project/ undergo training.
5. Before undertaking the internship the students should submit the following to the department
   - the Confirmation Letter / Email from the institute/industry
   - the letter of consent from the parents
6. After completing the internship the students should submit the following to the department
   - training/project report
   - attendance certificate from industry/organization
7. The Project/training report will be evaluated by the II B. Sc. Physics class teacher.
8. List of students who have completed the internship and who are eligible for extra credits will be issued by department to COE.

Question Paper Pattern for Semester Exam

(1) For Main Core theory papers(except Mathematical Physics and Subject Elective papers) and Allied Physics theory papers

Maximum marks : 100

Section A (10 x 2 = 20 Marks)

Ten short answer questions in which a minimum of two questions should be problems. Each question carries 2 marks. There should be two questions from each unit.

Section B (5 x 7 = 35 Marks)

Five either or type questions. Each question carries 7 marks. There should be one question from each unit. At least one subdivision (a or b) of any one of the questions should be a problem.

Section C (3 x 15 = 45 Marks)

Answer any Three out of Five essay type questions. Each question carries 15 Marks. There must be one question from each unit.

(2) For Mathematical Physics and Subject Elective papers:

Maximum marks : 100

Section A (10 x 2 = 20 Marks)

Ten short answer type questions. Each question carries 2 marks. There should be two questions from each unit.

Section B (5 x 7 = 35 Marks)

Five either or type questions. Each question carries 7 marks. There should be one question from each unit.

Section C (3 x 15 = 45 Marks)

Answer any Three out of Five essay type questions. Each question carries 15 Marks. There must be one question from each unit.

Question Paper Pattern for CA test

For Main Core theory papers, subject elective papers and Allied Physics theory papers

Maximum marks : 50

Section A (6 x 2 = 12 Marks)

Six short answer type questions in which a minimum of two questions should be problems. Each question carries 2 marks.

Section B (3 x 6 = 18 Marks)

Three either or type questions. Each question carries 6 marks.

Section C (2 x 10 = 20 Marks)

Answer any Two out of Three essay type questions. Each question carries 10 marks.

Mechanics

Semester: I **Hours / week: 3**

Course Code: P113 **Credits: 3**

Objectives

- To impart knowledge on concepts of Centre of gravity, Projectiles, Circular motion, Impact and Dynamics of rigid bodies.
- To learn the method of determining the centre of gravity of objects.
- To understand the projectile motion up and down an inclined plane.
- To learn the concept of Moment of inertia and the method of determining the Moment of Inertia of compound pendulum.
- To make the students to understand the basic concepts of Hydrostatics and Hydrodynamics.

CO	Course outcomes	Knowledge level
	On successful completion of the course, the students will be able to	
CO1	Differentiate between centre of mass and centre of gravity of objects and will be able to determine the Center of gravity of spheres and cones.	K2, K3
CO2	Apply the knowledge of circular motion to explain the concept of banking of curves.	K3, K4
CO3	State the laws of impact and Assess the loss of K.E. due to direct and oblique impact of two smooth spheres.	K1, K5
CO4	Determine the M.I. of solid sphere and spherical shell about a diameter and the M.I. of a compound pendulum about an axis through its centre of gravity.	K3
CO5	Derive Euler's equation and elucidate Bernoulli's theorem.	K6, K2
CO6	Solve simple problems related to circular motion, projectiles, Impact and Rotational motion of rigid bodies.	K6

Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO	3	3	2	3	2	2	2	3	2	3	2	2	2.4
CO	3	3	3	3	2	3	2	3	3	2	2	2	2.6
CO	2	2	3	2	3	2	2	3	2	2	2	2	2.3
CO	3	3	3	2	2	2	3	3	2	3	3	2	2.6
CO	2	2	2	3	2	2	2	3	2	3	3	3	2.4
CO	3	2	2	3	2	2	2	3	2	2	2	3	2.3
												Mean Overall Score	**2.4**
												Result	**HIGH**

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	10	10	20
Understand	10	10	30

Apply	10	10	10
Analyze	10	10	10
Evaluate	5	5	10
Create	5	5	20

Unit – I: Centre of gravity

Centre of mass –centre of gravity – distinction between centre of mass and centre of gravity – centre of gravity of solid cone, solid hemisphere, hollow hemisphere, solid tetrahedron.

Unit – II: Projectiles and Circular Motion

Projectiles: Projectile –range of projectile up an inclined plane – range of projectile down an inclined plane.

Circular Motion: Relation between linear velocity and angular velocity–Normal acceleration-banking of curve–motion of a carriage along a banked curved track.

Unit – III: Impulse and Impact

Impulse –impulsive force –impact – laws of impact – coefficient of restitution – impact of a smooth sphere on a smooth fixed horizontal plane –direct impact of two smooth elastic spheres – loss of kinetic energy due to direct impact–oblique impact of two smooth elastic spheres – loss of kinetic energy due to oblique impact.

Unit – IV: Dynamics of Rigid bodies

Moment of inertia –radius of gyration–Theorems of moment of inertia–moment of inertia of sphere about a diameter –moment of inertia of a spherical shell about a diameter.

Kinetic energy of rotation of a body–Compound pendulum – theory of compound pendulum – equivalent simple pendulum – reversibility of centre of oscillation and centre of suspension – determination of 'g' and M.I of a compound pendulum about an axis through its centre of gravity

Unit – V: Hydrostatics and Hydrodynamics

Hydrostatics: Laws of flotation-Pressure and thrust– center of pressure – centre of pressure of a rectangular lamina with one side in the surface of the liquid.

Hydrodynamics: Equation of continuity–Euler's equation for unidirectional flow –Bernoulli's theorem (no proof) – Applications: Torricelli's theorem.

Books for study

1. M.Narayanamurti and Nagarajan, Dynamics, National Publishing Company, 8th Edition, 2002.
2. R. Murugeshan, Mechanics and Mathematical Physics, S. Chand and company Pvt.Ltd., 2015.
3. M.Narayanamurti, Statics, Hydrostatics and Hydrodynamics, National Publishing Company, 1994.

Books for reference

1. P.Duraipandian, LaxmiDuraipandian, MuthamizhJayapragasam, Mechanics, 6th edition, S. Chand and Company Ltd., 2005.
2. D.S.Mathur, Mechanics, 3th Edition, S. Chand and Company Ltd., 1981.
3. M. Ray and G. C. Sharma, A Text Book on Dynamics, 13th Edition, S. Chand and company, New Delhi, 2005.
4. S.G. Venkatachalapathy, Mechanics, Margham Publication, 2012.
5. C. L. Arora, Refresher course in Physics for B. Sc. Classes (Vol-I), S. Chand Publishing, New Delhi, 1981.

6. Halliday, Resnick, Walker, Fundamentals of Physics, 8th Edition, John Wiley & Sons, New Delhi, 2009.
7. T.K. ManichavachagamPillai and Narayanan, Statics, The National Publishing Company, Madras, 1961
8. University Physics FW sears, M.W Zemansky and H.D Young 13e, 1986, Addision Wesley
9. Mechanics: Berkeley Physics course Volume 1: Charles Kittel et.al, 2007, Tata McGraw Hill.

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www.books.google.co.in/books?id=Zovge9bERh8C&pg=PA38&lpg=PA38&dq=compound+pendulum&source#v=onepage&q=compound%20pendulum&f=false.

Properties of Matter

Semester : I **Hours/week : 3**
Course Code: P114 **Credits : 3**

Objectives

- To impart knowledge on Elasticity, Moduli of elasticity, relation between elastic constants and the methods of determining rigidity modulus of material of objects.
- To learn, understand and determine the Young's modulus of material of objects.
- To learn about the concept of Viscosity and understand the Poiseuille's method and Searle's method of determining the viscosity of liquids.
- To comprehend the concept of Surface tension and evaluate the surface tension and interfacial surface tension of liquids by drop weight method.
- To learn and understand the concepts of osmosis and diffusion and their applications.

Learning outcomes

CO	Course outcomes	Knowledge level
	On successful completion of the course, the students will be able to	
CO1	Have an understanding of basic concepts of Elasticity and will be able to determine the rigidity modulus of materials in the form of wire or rod.	K1, K6
CO2	Evaluate the work done in stretching and twisting a wire and determine the rigidity modulus of materials in the form of wire and rod.	K5, K3
CO3	Determine the viscosity of liquids by Poiseuille's method and Searle's method and explain the theory behind the method.	K3

CO4	Evaluate the surface tension and interfacial surface tension of liquids by drop weight method.	K2, K1, K4
CO5	Distinguish between osmosis and diffusion and explain the methods of determining osmotic pressure and rate of diffusion of fluids.	K2, K4

Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO	3	3	2	2	3	2	2	3	3	2	2	2	2.4
CO	3	3	2	3	2	2	2	3	3	3	2	2	2.5
CO	3	3	2	3	2	2	2	3	3	2	2	2	2.4
CO	3	3	2	2	2	2	2	3	3	3	2	2	2.4
CO	3	3	2	2	3	2	2	3	3	3	2	2	2.5
Mean Overall Score													**2.44**
Result													**HIGH**

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit - I: Elasticity–I

Moduli of elasticity– relation between elastic constants – Poisson's Ratio – expression for Poisson's ratio in terms of elastic constants –Elastic energy - Factors affecting elastic modulus and tensile strength- work done in stretching and work done in twisting a wire – twisting couple on a cylinder – determination of Rigidity modulus by static torsion – Torsional pendulum – Rigidity modulus determination-

Unit - II: Elasticity–II

Bending of beams – expression for bending moment – cantilever – expression for depression at the loaded end – determination of Young's modulus by cantilever depression experiment (mirror and telescope) – non–uniform and uniform bending theory and experiment to determine Young's modulus (pin and microscope).

Unit - III: Viscosity

Viscosity – Streamline and turbulent flow – rate flow of liquid in a capillary tube – Poiseuille's formula – determination of coefficient of viscosity of a liquid by variable pressure head method

— viscosity of a highly viscous liquid – Searle's viscometer -variations of viscosity of a liquid with temperature – lubrication.

Unit - IV: Surface Tension

Synclastic and anticlastic surface – surface tension- Relation between surface tension and surface energy - surface tension and interfacial surface tension – drop weight method(Theory and experiment) – variation of surface tension with temperature – Jaegar's method

Unit - V: Osmosis and Diffusion

Osmosis-Reverse osmosis-Laws of osmosis-osmotic pressure-Experimental determination of osmotic pressure by Berkley Hartley's method-Osmotic and vapour pressure of a solution-biological significance of osmosis. Diffusion-Rate of diffusion –Explanation based on kinetic theory of matter-diffusion through the Cell Membrane -Pressures of Gases Dissolved in Water and Tissues

Books for study

1. R. Murugeshan, Er. KiruthigaSivaprasath, Properties of Matter and Acoustics, S. Chand company, New Delhi, 2012.
2. BrijLal, N. Subramaniam, Properties of Matter, S. Chand company, New Delhi, 2012.
3. J. C.Upadhayaya " Mechanics and Properties of Matter"Himalaya Publishing house,1st edition , 2017

Books for reference

1. S. Mathur, Elements of Properties of Matter,revised edition, Shymlal Charitable Trust, New Delhi, 2010.
2. Richard Wormell, An Elementary Course of Hydrostatics and Sound, Kessinger Publishing, 2009.
3. D. Halliday, R.Resnick and J. Walker "Fundamentals of physics", 6th Edition, Wiley plus , NY, 2013
4. Chatterjee and Sen Gupta, "A treatise on general properties of matter", New central Books agency (p) Ltd, Kolkata, 2001

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http://www.insula.com.au/physics/1279/L7.html
https://nptel.ac.in/content/storage2/courses/112106141/Pdfs/4_2.pdf
www.svce.ac.in/departments/physics/downloads/Notes/Unit–II/Unit–II–Part%20A.pdf
https://en.wikipedia.org/wiki/Lubrication
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https://brainly.in/question/14086206
http://www.askiitians.com/physics/mechanics/surface–tension.aspx
http://hyperphysics.phy-astr.gsu.edu/hbase/Kinetic/diffus.html
https://www.britannica.com/science/osmosis

Heat and Thermodynamics

Semester : II **Hours / Week: 3**
Course code: P212 **Credits: 3**

Objectives:

- To learn basic concepts of calorimetry, C_P and C_V of a gas, Vanderwaal's equation of state and derive expressions for critical constants in terms of Vanderwaal's constants.
- To define coefficient of thermal conductivity of a material and describe experimental methods for determining thermal conductivity of a good and a bad conductor.
- To learn about Planck's quantum theory of radiation and interpret energy distribution in the spectrum of a black body radiation.
- To study Boltzmann's Law of equipartition of energy and apply it to find the specific heat capacity of mono atomic and diatomic gases.
- To learn and understand Joule Thomson effect, explain the different methods of producing low temperature and liquefaction of Hydrogen and Helium.
- To learn laws of thermodynamics, explain the working of Otto engine, define thermodynamic potentials, derive Maxwell's relations and deduce Clausius-Clapeyron Equation.

Learning outcomes

CO	Course outcomes On successful completion of the course, the students will be able to	Knowledge level
CO1	Distinguish between thermal capacity and specific heat capacity, C_P and C_V of a gas. They will be able to develop Vanderwaal's equation of state and derive expressions for critical constants in terms of Vanderwaal's constants.	K2, K6
CO2	Define coefficient of thermal conductivity of a material and describe experimental methods for determining thermal conductivity of a good and a bad conductor.	K1
CO3	Explain Planck's quantum theory of radiation and interpret energy distribution in the spectrum of a black body radiation.	K4, K2
CO4	Explain Boltzmann's Law of equipartition of energy and apply it to find the specific heat capacity of mono atomic and diatomic gases.	K4, K3, K5
CO5	Describe Joule Thomson effect, explain the different methods of producing low temperature and liquefaction of Hydrogen and Helium.	K1, K4
CO6	State the laws of thermodynamics, explain the working of Otto engine, define thermodynamic potentials, derive Maxwell's relations and deduce Clausius-Clapeyron Equation.	K1, K4, K6

Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of Cos
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO	3	3	3	2	2	2	3	3	2	3	2	2	2.5
CO	3	3	3	2	2	2	2	3	2	3	2	2	2.4
CO	3	2	2	2	2	2	2	3	2	3	2	2	2.3
CO	3	3	3	3	2	2	2	3	2	3	3	2	2.6

CO	3	3	2	2	2	2	3	3	2	3	2	2	2.4
CO	3	3	3	2	2	2	2	3	2	3	2	2	2.4
Mean Overall Score													**2.4**
Result													**HIGH**

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit–I: Calorimetry

Specific heat capacity and thermal capacity– specific heat capacity of a liquid by cooling method (Spherical calorimeter) – specific heat capacity of a liquid by Joule's Calorimeter - specific heat capacity of gases – C_p and C_v– Meyer's relation – Joly's method to find C_V – Vanderwall's equation of state – critical constants – deduction of critical constants.

Unit–II: Transmission of Heat

Conduction

Thermal conductivity – rectilinear flow of heat – thermal conductivity of a good conductor – Forbe's method – thermal conductivity of a poor conductor – Lee's disc method

Black body Radiation

Blackbody radiation – Stefan – Boltzmann law – Planck's law-Planck's quantum theory of radiation- distribution of energy in the spectrum of a black body – Wien's displacement law and Rayleigh Jeans Law-

Unit–III: Kinetic Theory of Gases

Postulates – derivation of Maxwell's law of distribution of velocities – mean free path – transport phenomena: viscosity, conduction and diffusion – Boltzmann's Law of equipartition of energy and its applications to specific heat of gases; mono – atomic and diatomic gases.

Unit-IV Low temperature Physics

Joule-Thomson effect –Porus plug-theory and experiment-Liquefaction of hydrogen Liquefaction of Helium by K.Onnes method-Properties of Helium I and Helium II-Adiabatic demagnetization –- superconductivity-Type I and type II-Meissner effect –Applications of superconductors

Unit-V Thermodynamics

Thermodynamic equilibrium -I, II and III law of thermodynamics-Otto engine – working and efficiency-Fundamentals of thermodynamic potentials: Enthalpy, Gibbs, Helmholtz and Internal Energy functions – Maxwell's relations & applications:Clausius-Clapeyron Equation

– TdS equations-Entropy changes in reversible & irreversible processes, Entropy –temperature diagrams.

Books for study

1. R. Murugeshan, Er. KiruthigaSivaprasath, Thermal Physics, S. Chand company, New Delhi, 2012.
2. D. S. Mathur, Heat and Thermodynamics, S. Chand, New Delhi, 2011.
3. BrijLal, N. Subrahmanyam, P. S. Hemne, Heat Thermodynamics and Statistical Physics, S. Chand Company, New Delhi, 2012.
4. Dr.D.Jayaraman and Dr.K.Ilangovan, Thermal Physics and Statistical mechanics ,Revised edition, S.ViswanathanPvt Ltd,2016

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1. Bergman, Lavine, Incropera, Dewitt, Fundamentals of Heat and Mass Transfer, 7th Edition, John Wiley & Sons, 2011.
2. Moran, Shapiro, Fundamentals of Engineering Dynamics, 6th Edition, John Wiley & Sons, 2008.
3. Ronald Lane Reese, University Physics, Thomson Brooks/Cole, 2003,
4. A. Kumar , S.P. Taneja, Thermal Physics, S. Chand Publications, 2014.
5. M. W. Zemasky, R. Dittman, Heat and Thermodynamics, McGraw Hill, 1981.
6. MeghnadSaha, B.N. Srivastava , A Treatise on Heat, Indian Press, 1969.
7. Enrico Fermi, Thermodynamics, Courier Dover Publications,1956.
8. Krori“ Advanced Heat and Thermodynamics”New Central book agency Pvt.Ltd, New Delhi,2015.

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https://en.wikipedia.org/wiki/Meissner_effect
https://www.elprocus.com/what-is-superconductor-types-materials-properties/
http://www.shmoop.com/thermodynamics/kinetic–theory–gases.html

Waves and Oscillations

Semester: II **Hours / week: 3**
Course Code: P213 **Credits: 3**

Objectives

- To introduce the concepts of waves,wave motion, interference of sound waves, Beats

- To introduce the concept of interference of sound waves and beats.
- To understand SHM, Lissajous figures and the concepts related to them.
- To comprehend the concepts of damped vibrations, forced vibrations and resonance
- To acquire knowledge on the production, detection and applications of ultrasonic waves.
- To provide a better understanding of factors affecting acoustics of buildings

Learning Outcomes

CO	Course outcomes	Knowledge level
	On successful completion of the course, the students will be able to	
CO1	Explain the different types of waves and derive expressions for plane progressive waves and energy of progressive waves.	K2, K6
CO2	Distinguish between progressive and stationary waves, derive expressions for stationary waves and energy of stationary waves, explain the concept of beats and apply their knowledge on beats to estimate the frequency of sound waves.	K2, K6, K4, K5
CO3	Explain Simple Harmonic Motion, derive expression for the resultant motion of a particle subjected to two SHMs of equal periods acting at right angles to each other and predict the shape of the curve traced by the particle.	K2, K6
CO4	Define, differentiate and derive expressions for free, damped and forced vibrations and determine the frequency of a.c. using sonometer.	K1, K2, K6, K3
CO5	Define reverberation time, summarize the factors affecting acoustics of buildings and suggest ways to improve acoustics of buildings.	K1, K2
CO6	Enumerate the production, detection and applications of ultrasonic waves.	K2

Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO	3	2	2	2	2	2	2	3	2	2	2	2	2.2
CO	3	3	2	2	3	2	2	3	2	2	2	2	2.3
CO	2	2	2	2	2	2	2	3	3	3	2	3	2.3
CO	3	3	3	3	3	2	2	2	2	2	2	2	2.4
CO	3	2	2	2	2	2	3	3	2	2	2	2	2.3
CO	2	3	3	2	2	2	3	3	2	3	2	2	2.4
Mean Overall Score													**2.3**
Result													**HIGH**

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit - I: Waves and Wave Motion

Waves: Types of waves–Mechanical waves –Electromagnetic waves – Matter waves – shock waves– types of mechanical waves: transverse and longitudinal waves.
Wave Motion: Relation between frequency, wave length and velocity–progressive waves – expression for plane progressive waves– differential equation of wave motion –particle velocity – wave velocity – relation between particle velocity and wave velocity –Analytical treatment: Energy of progressive waves.

Unit - II: Stationary waves, Interferenceof sound waves
Stationary waves: Principle of superposition –formation of stationary waves–analytical treatment of stationary waves – energy of a stationary wave –distinction between a progressive and a stationary waves.
Interference of sound waves: Condition for interference – Demonstration: Quincke's tube-Beats – applications.

Unit - III: Harmonic Oscillations and Lissajous' figures
Simple harmonic motion – differential equation of simple harmonic motion –total energy of a vibrating particle – simple harmonic oscillations of a mass between two strings– oscillations in LC circuit.
Lissajous' figures-composition of two simple harmonic vibrations of equal periods acting at right angles.

Unit - IV: Vibrations
Free, damped and forced vibrations –theory of forced vibrations-sharpness of resonance–application.
Laws of transverse vibration of strings – Determination of frequency of a.c. mains by Sonometer (using steel wire)–Frequency of a vibrator Melde's method: Transverse mode and longitudinal mode.

Unit - V: Acoustics of Buildings and Ultrasonics
Acoustics of Buildings: Reverberation – reverberation time – absorption coefficient – Sabine's formula– optimum reverberation time – factors affecting acoustics of buildings.
Ultrasonics: Production of ultrasonics by piezo electric oscillator – detection:piezo electric detector – properties– Applications: Non-Destructive testing – SONAR – ultrasonic scanning.
Books for study

1. N. Subramanyam, Brijlal, A Text book of Sound, 2nd edition, Vikas Publishing House PvtLtd, New Delhi, 2008.
2. N.K.Bajaj, The Physics of waves and Oscillations, Tata McGraw Hill, New Delhi, 2006.
3. M. Ghosh, A text book of Sound, 2nd Edition, S. Chand & Co., New Delhi, 1987.

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1. Iain G. Main, University of Liverpool, Vibrations and waves in Physics, Cambridge University Press, 2012
2. D.P. Khandelwal, Oscillations and Waves (Himalaya Pub. House, Bombay)
3. S.P Puri, Fundamentals of vibrations and waves, Tata McGraw Hill, New Delhi, 1992.
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10. C. L. Arora, Refresher course series, Volume II, S. Chand & co., 16th Edition, New Delhi, 2001.
11. Baldevraj, Science and Technology of Ultrasonics, Narosa Publications, 2004.
12. N. Subrahmanyam&Brij Lal, Waves & Oscillations, Vikas Publishing House Pvt. Ltd.,New Delhi, 1994.
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http://www.brainkart.com/article/Superposition-principle-of-waves_3156/
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http://www.ques10.com/p/10186/piezoelectric–effect/
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http://www.nextgurukul.in/wiki/concept/ICSE/X/Physics/Free,–Damped–and–Forced–Vibrations.htm
http://www.brainkart.com/article/Vertical-oscillations-of-a-spring---Linear-Simple-Harmonic-Oscillator-(LHO)_36305/
http://www.brainkart.com/article/Energy-in-Simple-Harmonic-Motion_36309/
http://www.brainkart.com/article/Ultrasonic-Non-destruction-Testing_6876/#:~:text=Ultrasonic%20Flaw%20detector-,Principle%3A,as%20a%20Non%20Destructive%20method.
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Physics Main Practicals – I
Any 20 experiments

Semester : I & II **Hours/Week : 4**
Course Code: PP207 **Credits: 8**

Objectives

- To determine the Young's modulus of materials in the form of a beam.
- To calibrate voltmeter and ammeter using potentiometer.
- To determine the viscosity and surfacetension of liquids.

- To learn the usage of spectrometer and to determine the refractive index of material of a prism..
- To construct basic logic gates using discrete components and verify their truth tables.
- To construct low range power pack and stabilized power supply circuits and measure their outputs.

Learning outcomes

CO	Course outcomes On successful completion of the course, the students will be able to	Knowledge level
CO1	Acquire laboratory skills/practical skills, a capacity for self management and teamwork,. They will be able to handle optical, electrical and electronic instruments effectively to take measurements/observations.	K5
CO2	Develop analytical and scientific reasoning skills. They will be able to analyze the measurements/observations to draw valid conclusions.	K4, K5
CO3	Determine the Young's modulus of materials in the form of beam, the rigidity modulus of materials in the form of wire, Viscosity, surface tension and Interfacial surface tension of liquids and recall the theory behind the experiments.	K3, K1
CO4	State the laws of transverse vibration of strings and measure the frequency of tuning forks and ac using sonometer.	K1, K5
CO5	Determine the focal length of convex and concave lenses, measure the refractive index of material of a prism using spectrometer and estimate the thickness of a thin wire by forming air wedge.	K3, K5, K2
CO6	Design experiment to study the characteristics of Zener diode, construct stabilized power supply using zener diode, construct basic logic gates using diodes and transistor and examine their operation.	K6, K3, K4

Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO	3	3	2	3	2	2	2	3	2	3	2	3	2.5
CO	3	3	2	2	2	2	2	3	2	3	2	2	2.3
CO	3	2	3	2	2	3	2	3	2	3	2	2	2.4
CO	3	2	2	3	2	2	2	3	2	2	2	2	2.3
CO	3	2	2	3	2	2	2	3	2	3	2	2	2.3
CO	3	2	2	3	2	2	2	3	2	3	2	2	2.3
												Mean Overall Score	2.4
												Result	HIGH

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	5	5	10
Understand	5	5	10
Apply	15	15	30

Analyze	15	15	30
Evaluate	5	5	10
Create	5	5	10

1. Measurements of length (or diameter) using Vernier caliper, Screw gauge and Travelling microscope
2. Young's Modulus – By Cantilever Depression (Mirror and Telescope)
3. Young's Modulus-Non Uniform Bending –Pin and Microscope
4. Rigidity Modulus by Torsional Pendulum
5. Surface Tension and Interfacial Surface Tension – Method of Drops
6. Viscosity of a Liquid– Constant Volume Method – Graduated Burette
7. Comparison of Viscosities – Constant Volume Method
8. Viscosity of a Highly Viscous Liquid – Stoke's Method
9. Sonometer – Frequency of AC mains
10. Sonometer – Determination of Frequency of Tuning fork
11. To determine the Frequency of an electrically maintained tuning fork by Melde's experiment
12. Focal length of a long focus convex lens
13. Focal length of a concave lens
14. Air wedge-Thickness of a wire
15. Spectrometer–Refractive index of the material of a Solid prism
16. Spectrometer – Refractive index of a liquid – Hollow prism
17. Potentiometer – Calibration of a low range Voltmeter
18. Verification of Ohm's law
19. Figure of merit of an aperiodic Galvanometer– Potential Divider Method
20. Post office box – Resistance and Specific resistance of a coil.
21. Construction of a low range power pack.
22. Zener Diode characteristics
23. Construction of logic gates AND & OR using diodes and NOT using transistor
24. Stabilized power supply using zener diode
25. Joule's Calorimeter-Specific heat capacity of a liquid-Half time correction

Books for reference

1. C.C. Ouseph, U. J. Rao, V. Vijayendran, Practical Physics and Electronics, S. Viswanathan Pvt. Ltd., Chennai, 2012.
2. M. N. Srinivasan, S. Balasubramaniam, R. Ranganathan, A Text Book of Practical Physics, 2nd Ed., S. Sultan Chand & Sons Publications, New Delhi, 2014.
3. Jerry D. Wilson, CBS college., 1986
4. D. Chattopadhyay, P.C. Rakshit , New central book agency (p) LTD., 1987
5. C. Isenberg, S.S Chomet, Viva books Private Limited., 1998
6. Narasimhan & Ramamoorthy, B.G. Paul & Co., 1961

Programme structure of Allied Physics under CBCS

Sem	Paper	Title of the Paper	Hours / Week	Credits	Marks	
					CA	Sem
I	Allied -I	Allied Physics for Mathematics I	4	3	50	50
	Allied practicals	Allied Physics practicals for Mathematics	2	1	50	50
II	Allied -II	Allied Physics for Mathematics II	4	3	50	50
	Allied practicals	Allied Physics practicals for Mathematics	2	1	50	50
Total			12	08		

Allied Physics for Mathematics–I

Semester: I **Hours/week: 4**

Course Code:AP105A **Credits: 3**

Objectives

- To develop an understanding of basic concepts of mechanics, elasticity, viscosity, surface tension, heat and optics.
- To study the elastic behavior of the solids and viscosity of the liquids
- To comprehend and learn the concepts of heat and heat transmission
- To understand the concepts of interference and polarization of light waves and their applications.

Learning outcomes

Sl. No.	Outcomes On successful completion of the course, the students will be able to	Knowledge level
CO1	Distinguish between centre of mass and centre of gravity of objects, state the laws of impact and calculate the loss of kinetic energy due to direct impact of smooth spheres.	K2, K1, K3
CO 2	Determine the Young's modulus of materials in the form of rod and rigidity modulus of material in the form of wire and explain the theory behind the experiments.	K3, K4
CO 3	Define and measure the viscosity and the surface tension of liquids	K1, K5
CO 4	Distinguish between C_P and $C_V$of a gas, describe experiments to measure the value of Cp and C_V of gas, thermal conductivity of poor conductors and different methods of producing low temperature.	K2, K1
CO 5	Differentiate between Spherical aberration and chromatic aberration in lenses, suggest ways to minimize them.	K2, K5
CO 6	Explain interference and polarization of light and perform experiment to determine the thickness of a thin wire by forming air wedge.	K4, K6

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)	Programme Specific Outcome (PSO)	Mean score

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	of CO
CO1	2	2	1	3	2	2	3	3	2	2	2	3	2.
CO2	3	3	1	3	2	2	2	2	3	3	2	3	2.
CO3	3	2	1	3	2	2	2	2	3	3	2	3	2.
CO4	2	2	1	3	2	2	3	2	2	2	2	3	2.
CO5	2	2	1	3	2	2	2	3	3	3	2	2	2.
Mean Overall Score													2.3
Results													Hi h

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit – I: Mechanics

Centre of mass–centroid- centre of gravity –centre of gravity of a solid cone –centre of gravity ofa hollow hemisphere – impulse – impulsive forces – conservation of linear momentum – collision – elastic and inelastic collision – impact – laws of impact – co-efficient of restitution – impact of a sphere on a smooth fixed plane – velocityand loss of kinetic energy of sphere after impact – direct impact between two smooth spheres – velocities of spheres after direct impact – loss of kinetic energy due to direct impact.

Unit–II: Elasticity

Moduli of elasticity – beam – bending of beams – expression for bending moment–cantilever –depression at the loaded end of a cantilever–determination of Young's modulus by cantilever depression method (scale and telescope)– non uniform bending theory and experiment (pin and microscope) – torsional couple per unit twist– work done in twisting a wire– torsional pendulum– theory– rigidity modulus by torsional oscillations (without symmetrical masses).

Unit – III: Viscosity and Surface Tension

Viscosity: coefficient of viscosity and its dimensions – rate of flow of liquid in a capillary tube (Poiseuille's formula) – determination of co-efficient of viscosity of a low viscous liquid by variable pressure head – variation of viscosity of a liquid with temperature.

Surface Tension: surface tension and its dimensions–synclastic and anticlastic surface– molecular theory – surface energy–excess pressure –application to spherical and cylindrical drops and bubbles – surface tension and interfacial surface tension – drop weight method.

Unit – IV: Heat

Heat – temperature – specific heat capacity and thermal capacity – specific heat capacity of a liquid by Joule's calorimeter–specific heat capacity of gases – C_p and C_v– Meyer's relation – Joly's method to find C_V – thermal conductivity – thermal conductivity of a poor conductor – Lee's disc method – Low temperature Physics: Joule – Kelvin effect – simple theory of Porous – Plug experiment – adiabatic demagnetization- refrigerating mechanism (ammonia gas plant)- superconductivity.

Unit – V: Optics

Aberration – spherical aberration in lenses – methods of minimizing Spherical aberration – chromatic aberration – achromatic combinations of two thin lenses in contact and at finite distance – dispersion of light – refraction through a prism of small angle –deviation – determination of refractive index of solid prism – interference – conditions for interference maxima and minima – air wedge – thickness of a thin wire –polarization – types of polarization –applications –polarizer and analyzer – double refraction–production and analysis by Nicol prism.

Books for study

1. R. Murugesan, Allied Physics paper I & II, S. Chand &Co. Ltd. New Delhi, 2010.
2. R. Murugesan, Mechanics and Mathematical Physics, S. Chand & Company Ltd, New Delhi, 2008.
3. R. Murugesan, Properties of matter, New Delhi, S. Chand & company Ltd, 2009.
4. BrijLal, N. Subrahmanyam, P. S. Hemne, Heat and Thermodynamics, S. Chand Company, New Delhi, 2012.
5. R. Murugeshan, Er. Kiruthiga Sivaprasath, Thermal Physics, S. Chand company, New Delhi, 2012.
6. R. Murugesan, Optics and spectroscopy, New Delhi, S. Chand & company Ltd., 2010.

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2. B. H. Flowers, E. Mendoza, Properties of matter, Wiley Plus, 1991.
3. A. Kumar , S.P. Taneja, Thermal Physics, S. Chand Publications, 2014.
4. Murugesan. R, Modern Physics, New Delhi, S. Chand & company Ltd, 2001.
5. Subrahmanyam. N and Brijlal, Optics, S. Chand& company Ltd, 2009.
6. S. L. Kakani, K. C. Bhandari, Optics ,S. Chand& Sons, New Delhi, 1987.
7. Ajoy Ghatak, Optics 5th Edition, Tata-McGraw Hill Education, 2012

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Allied Physics for Mathematics–II

Semester: II **Hours/week: 4**
Course Code:AP205 **Credits: 3**

Objectives

- To understand the working principle of Lasers and their applications
- To study the different types of optical fibers and its applications
- To understand the properties of ultrasonics and its applications
- To study the critical potential and quantum numbers associated with the vector atom model.
- To study the process of artificial transmutation, radio isotopes and their applications, working of accelerators.
- To study the fundamentals of electrical and electronic devices and circuits.

Learning outcomes

Sl. No.	Outcomes	Knowledge level
	On successful completion of the course, the students will be able to	
CO1	Explain working principle of lasers and describe the applications of Lasers and Optical fibers.	K2, K1
CO2	Define SHM and derive expression for the resultant motion of a particle subjected to two SHMs acting at right angles.	K1, K2
CO3	State laws of transverse vibration of strings, determine the frequency of AC using a Sonometer and describe methods of production and detection of ultrasonics.	K1, K3
CO4	Specify and explain the Quantum numbers associated with the vector atom model, state the laws of Photoelectric effect and derive Einstein's photoelectric equation.	K1, K6
CO5	Determine the value of a resistor from its colour coding, explain the growth and decay of current in a circuit containing resistance and inductance and design an experiment to calibrate a low range voltmeter.	K4, K2, K6,
CO6	Construct two inputs AND, OR gates using diodes and NOT gate using Transistor, examine their operation and evaluate their performance,	K6, K4, K5

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)							Programme Specific Outcome (PSO)					Mean score of CO
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	2	2	2	3	2	3	2	2	2	3	2.
CO2	2	3	2	2	2	3	2	2	3	3	2	3	2.
CO3	3	2	2	3	2	2	2	2	3	2	2	3	2.
CO4	3	3	2	3	2	3	3	2	2	3	2	3	2.
CO5	3	3	2	3	2	2	3	3	3	3	2	3	2.
Mean Overall Score													2.5
Results													Hi h

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit – I: Laser and Fiber optics

Laser: Characteristics of laser –conditions to achieve laser action– population inversion – pumping process – types of laser –Nd:YAG Laser – CO_2 Laser– applications of lasers.

Fiber optics: Construction of fiber – total internal reflection – acceptance angle and numerical aperture – applications – optical fibers in a simple communication system – fiber optic displacement sensor

Unit – II: Sound

Simple harmonic motion (SHM) –composition of two simple harmonic vibrations of equal time periods (1:1) acting at right angles to each other – Lissajou's figures –applications of Lissajou's figures – laws of transverse vibrations- determination of frequency of AC by Sonometer (steel wire) - ultrasonics – properties – production of ultrasonic waves by Piezo-electric oscillator method – detection of ultrasonics by Piezo-electric method – applications of ultrasonics: Industrial applications – SONAR – non-destructive testing (NDT): pulse echo technique.

Unit – III: Atomic Physics and Nuclear Physics

Atomic Physics: Vector atom model – Spatial quantization – Spinning electron – Quantum numbers associated with the vector atom model – Excitation potential – Ionization Potential – Determination of critical potentials – Frank and Hertz method–Photoelectric effect – Laws of photo electric emission – Einstein's photoelectric equation–photo cell.

Nuclear Physics: Radioactivity – Artificial Transmutation – Rutherford's experiment – Radio isotopes – Applications – Radiation damage and effects – Radiation dose, dosimetry – short term and long term biological effects of radiation – Radiation safety.

Unit – IV: Electricity

Current – voltage –resistance – Ohms law –Resistors– types of resistors – color coding scheme – series and parallel connections of resistors –voltage division in series circuits – current division in parallel circuits – capacitor – types of capacitors – series and parallel connections of capacitors –Growth and decay of current in a circuit containing resistance and inductance– Potentiometer – principle – Calibration of low range voltmeter –Calibration of High range Ammeter.

Unit V: Electronics

Analog Electronics: Zener diode – zener diode characteristics – low range stabilized power supply –Integrated circuits – Advantages and disadvantages

Digital Electronics: Binary concept – logic gates : OR, AND, NOT, NOR, NAND and Ex-OR gates – construction of two inputs AND, OR gates using diodes and NOT gate using Transistor – De Morgan's theorems – NAND as Universal gate – Arithmetic circuits: Half adder – Full adder–Half subtractor– Full subtractor.

Books for study

1. R. Murugesan, Allied Physics paper I & II, S. Chand &Co. Ltd. New Delhi, 2010.
2. M.R. Shenoy, Sunil K. Khijwania, Ajoy Ghatak, Bishnu P. Pal, Introduction to fiber optics, Viva Books, 3rd edition, 2015
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5. Murugesan. R, Electricity and Magnetism, S.Chand and Co New Delhi, 2003.
6. V. K. Metha, Principles of Electronics, S.Chand and Co New Delhi, 11th Edition, 2008.
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http://www.slideshare.net/rajeshkamboj/laser–notes–pdf–engineering–physics–kuk
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https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/
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Allied Physics Practicals for Mathematics

Any 12 Experiments

Semester– I& II **Hours/week: 2**
Course Code : PAP205A **Credits: 2**

Objectives

- To relate theoretical concepts to real world applications and experiments.
- To familiarize the students with elastic, optics, sound laboratory experiments and procedures.
- To observe reliable data and record the observations.
- To organize the measurements, estimate errors and write the laboratory record.
- To develop an understanding of basic concepts of electrical and electronic experiments

Learning outcomes

Sl. No.	Outcomes	Criteria/ Mapping
1	Understand and Explain the theoretical concepts behind the experiments	K2, K1
2	Analyze the observed data and infer logical conclusions	K4, K2
3	Define and determine the value of a physical quantity without error	K1, K3
4	Design simple electrical and electronic circuits and test their operation	K6, K5
5	Locate, detect and rectify faults in simple electrical and electronic circuits	K1, K5, K6
6	Apply their knowledge to choose proper optical, electrical and electronic measuring instruments and illustrate their effective usage	K3, K4

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)							Programme Specific Outcome (PSO)					Mean score of CO
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	2	3	1	3	3	3	3	3	3	2	2.6
CO2	3	2	2	3	1	3	3	3	3	1	3	2	2.5
CO3	3	3	2	3	1	3	3	3	3	1	2	2	2.5
CO4	3	3	2	3	2	3	3	3	3	3	3	3	2.9
CO5	3	3	2	3	2	3	3	3	3	3	2	2	2.7
Mean Overall Score													2.6
Results													High

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	5	5	10
Understand	5	5	10
Apply	15	15	30
Analyze	15	15	30
Evaluate	5	5	10
Create	5	5	10

List of experiments

1. Young's Modulus– Cantilever depression (Mirror & Telescope).
2. Young's Modulus-Non Uniform Bending(Pin and Microscope)
3. Rigidity Modulus by torsional oscillations (without symmetrical mass).
4. Co–efficient of viscosity of a liquid– graduated burette– Constant volume method.
5. Surface tension – Drop weight Method
6. Interfacial surface tension - Drop weight Method
7. Frequency of AC –Sonometer.
8. Air wedge–Determination of thickness of wire.
9. Verification of ohm's law.

10. Potentiometer– Calibration of low range voltmeter.
11. Logic gates using IC's (AND, OR, NOT) and Verification of De Morgan's theorems.
12. Zener diode Characteristics
13. Low range stabilized power supply using Zener diode
14. Construction of AND, OR logic gates using diodes and NOT gate using transistor.
15. NAND as Universal gate.
16. Half adder and half subtractor.

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1. C.C. Ouseph, U. J. Rao, V. Vijayendran, Practical Physics and Electronics, S. Viswanathan Pvt. Ltd., Chennai, 2012.
2. M. N. Srinivasan, S. Balasubramanian, and R. Ranganathan, A Text Book of Practical physics, 2nd revised edition, S. Sultan Chand & Sons publications, 2014.
3. D. Chattopadhyay, P.C. Rakshit , New central book agency (p) LTD., 1987
4. S.Panigrahi&B.Mallick,Engineering Practical Physics, Cengage Learning India Pvt.Ltd. 2015
5. R.P. Jain, Modern Digital Electronics, 4th Edition, Tata McGraw Hill publishing company limited,New Delhi, 2003.
6. AnchalSrinivasa&R.K.Shukla, Practical Physics, New age International Publishers, Bengaluru, 2nd edition, 2018.

PG and Research Department of Physics
2022-2023

Programme structure of B.Sc. Physics under CBCS

Sem	Paper	Title of the Paper	Hours/ Week	Credits	Marks	
					CA	Sem
III	Main Core	Electricity and Magnetism	3	3	50	50
	Main Core	Optics	3	3	50	50
	Main Core Practicals	Physics Main Practicals – II	4	4	50	50
	Allied	Allied Chemistry –I	4	3	50	50
	Alied	Allied Chemistry Lab work	2	1	50	50
	Language	Tamil	5	3	50	50
	Language	General English	5	3	50	50
	Life Education	Employability Skills –1	2	1	50	50
		Environmental Science	2	1	50	50
	Extra credit Course	1. Special Project- I 2. NPTEL online courses	-	2#	100	
TOTAL			30	22+2#		

Sem	Paper	Title of the Paper	Hours/ Week	Credits	Marks	
					CA	Sem
IV	Main Core	Modern Physics	3	3	50	50
	Main Core	Electromagnetism	3	3	50	50
	Main Core Practicals	Physics Main Practicals – II	4	4	50	50
	Allied	Allied Chemistry –II	4	3	50	50
	Alied	Allied Chemistry Lab work	2	1	50	50
	Language	Tamil	5	3	50	50
	Language	General English	5	3	50	50
	Life Education	Employability Skills –2	2	1	50	50
		Human Rights	2	1	50	50
	Extra Credit Course	1. Special Project II (Repair and Maintenance of Lab Equipments) 2. Internship	-	2#	100	
	Extension	Outreach program	-	2		
		SHELTERS	-	2		
TOTAL			30	26+2#		

Evaluation pattern

(6) For Main core theory papers, Subject elective papers, Allied Physics theory papers and Non major elective papers

Component	Marks
CA	50
End semester exam	50
Total	100

CA components

Component	Marks
2 CA tests	30
MCQ(Quiz)/Assignment/ Problem solving / Open book test /Seminar	15
Attendance	5
Total	50

- In the CA components, 2 CA tests, Online quiz with multiple choice questions and attendance component are mandatory. Other components are optional and left to the discretion of the course teacher.

(7) Evaluation patterns for Practicals (B. Sc. Physics and Allied Physics Practicals)

Component	Marks
CA	50
Practical exam	50
Total	100

CA components

Component	Marks
Lab performance(preparation, performance, calculation, results)	20
2 CA tests	20
Record	10
Total	50

(8) For Subject skill papers

Subject skill papers will be evaluated purely internally by the respective course teachers.

Component	Marks
Theory	50
Practicals	50
Total	100

Evaluation pattern for the Subject skill theory papers

Component	Marks
CA	20
Semester exam	30
Total	50

CAcomponents

Component	Marks
2 CA tests	10
Assignment/ Problem solving /MCQ(Quiz)/ Open book test /Seminar	5
Attendance	5
Total	20

- In the CA components, 2 CA tests, Online quiz with multiple choice questions and attendance component are mandatory. Other components are optional and left to the discretion of the course teacher.

Evaluation pattern for the Subject skill practicals

Component	Marks
CA components (Viva, Circuit fault finding, Circuit analysis, Quiz, Mini projects etc.)	20
Practical exam	30
Total	50

(9) For self study papers

Self study papers will be evaluated **purely internally** by the respective course teachers for 100 marks. A minimum of 40% marks is essential for the award of extra credit(One extra credit per self study paper passed).

(10) For extra credits courses

For the extra credits course, Special Project- I, students may do a physics project of their choice. On completion of the project the students should submit a project report. The project report submitted by the student will be evaluated by a team of two staff members appointed by the Head of the department. Based on their evaluation report, the students may or may not be awarded extra credits (maximum : 2 credits).

For the extra credits course, Special Project- II (Repair and maintenance of lab equipments), the students may choose some faulty equipment in the lab, identify the faults or problems in the equipments and rectify them. If the student rectifies the faults in the instrument and has spent a minimum of 20 hours in repairing the instrument, then based on their

performance the staff in charge / HoD/ lab director may recommend extra credits (maximum : 2 credits) for the students.

NPTEL online courses: Students may enroll themselves in government approved online courses (NPTEL, MOOC, SWYAM etc). A student will be awarded 1 extra credit on the submission of the original pass certificate of an approved one credit online course and he/she will be awarded 2 extra credits on the submission of the original pass certificate of an approved two credits online course.

Internship : Students can obtain 2 extra credits by undertaking Summer Internship for a minimum duration of 25 days at the end of IV Semester.

Guidelines for Internship Program for Undergraduate Students

9. Internship programme(in IV semester) is optional (extra credit course) for B. Sc. Physics students.

10. Students may go for internship during summer vacation in IV semester.

11. Interested students should arrange for internship by themselves.

12. Students should go to an Institute/Industry for a period of minimum two weeks and carry out a project/ undergo training.

13. Before undertaking the internship the students should submit the following to the department

- the Confirmation Letter / Email from the institute/industry
- the letter of consent from the parents

14. After completing the internship the students should submit the following to the department

- training/project report
- attendance certificate from industry/organization

15. The Project/training report will be evaluated by the II B. Sc. Physics class teacher.

16. List of students who have completed the internship and who are eligible for extra credits will be issued by department to COE.

Question Paper Pattern for Semester Exam

(3) For Main Core theory papers(except Mathematical Physics and Subject Elective papers) and Allied Physics theory papers

Maximum marks : 100

Section A (10 x 2 = 20 Marks)

Ten short answer questions in which a minimum of two questions should be problems. Each question carries 2 marks. There should be two questions from each unit.

Section B (5 x 7 = 35 Marks)

Five either or type questions. Each question carries 7 marks. There should be one question from each unit. At least one subdivision (a or b) of any one of the questions should be a problem.

Section C (3 x 15 = 45 Marks)

Answer any Three out of Five essay type questions. Each question carries 15 Marks. There must be one question from each unit.

(4) For Mathematical Physics and Subject Elective papers:

Maximum marks : 100

Section A (10 x 2 = 20 Marks)

Ten short answer type questions. Each question carries 2 marks. There should be two questions from each unit.

Section B (5 x 7 = 35 Marks)

Five either or type questions. Each question carries 7 marks. There should be one question from each unit.

Section C (3 x 15 = 45 Marks)

Answer any Three out of Five essay type questions. Each question carries 15 Marks. There must be one question from each unit.

Question Paper Pattern for CA test

For Main Core theory papers, subject elective papers and Allied Physics theory papers

Maximum marks : 50

Section A (6 x 2 = 12 Marks)

Six short answer type questions in which a minimum of two questions should be problems. Each question carries 2 marks.

Section B (3 x 6 = 18 Marks)

Three either or type questions. Each question carries 6 marks.

Section C (2 x 10 = 20 Marks)

Answer any Two out of Three essay type questions. Each question carries 10 marks.

Electricity and Magnetism

Semester: III **Hours / Week: 3**

Course code: P 312 **Credits: 3**

Objectives

- To introduce to the students the basic concepts of Electrostatics
- To make the students understand concepts on working and applications of capacitors and electrometers
- To explain the principle and working of Potentiometer and Carey Foster's Bridge. Also to understand the working of LCR and resonance circuits.
- To provide an overview of the fundamental principles of Coulomb's law, Biot-Savart law and magnetostatics.
- To make the students understand the various types of magnetism.

Learning outcomes

Sl. No.	Course outcomes	Knowledge level
	On successful completion of course, the students will be able to	
CO1	Explain and differentiate between electric field and electric potential and also illustrate the coulomb's law and its	K2, K3,K4
CO2	Understand the functions and the basic principles of capacitors and electrometers.	K2, K1
CO3	Explain the working principle of Carey-Foster bridge and Potentiometer and apply their knowledge to set up experiments in the laboratory.	K2, K3,K5
CO4	State and explain various laws of magnetostatics and illustrate their applications.	K1, K2, K3
CO5	Compare the properties of Dia, Para and Ferro magnetic materials and identify the form of magnetism possessed by a	K6, K2

Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO	3	2	2	2	2	2	3	3	2	3	2	2	2.3
CO	3	2	2	2	2	2	2	2	2	2	2	2	2.1
CO	3	3	2	2	2	2	2	3	2	2	2	2	2.3
CO	3	2	2	2	2	2	2	3	2	2	2	2	2.2
CO	3	3	2	2	2	2	2	3	2	2	2	2	2.3
												Mean Overall Score	**2.2**

Result	**HIGH**

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit I: Electrostatics

Gauss law – charge inside the closed surface – charge outside the closed surface – insulated conductor – electric field due to a uniformly charged sphere – Coulomb's law – electric field intensity – electric induction – electric potential – electric current – relation between electric field and electric potential in vector form – potential due to the charged conducting sphere – Poisson's and Laplace's equations

Unit II: Capacitors and Electrometers

Capacitance – principle of a capacitor – capacitance of spherical (inner sphere earthed and outer sphere earthed) and cylindrical capacitors – energy of a charged capacitor – energy density – loss of energy due to sharing of charges

Electrometers – Kelvin's attracted disc electrometer – measurement of potential difference and relative permittivity of a dielectric slab – Quadrant electrometer – heterostatic and idiostatic uses

Unit-III: Current Electricity

Carey foster's bridge – theory – measurement of resistance and temperature coefficient of resistance of a coil – Potentiometer – principle – resistance of potentiometer wire – calibration of ammeter – calibration of voltmeter (low range and high range) – LCR Circuit – series resonant circuit – parallel resonant circuit – comparison between series and parallel resonant circuits

Unit IV: Magnetostatics

Ampere's circuital law – curl of magnetic field – Biot-Savart law – magnetic induction at a point on the axis of a circular coil carrying current – Force on a current carrying conductor placed in a magnetic field – theory of moving coil ballistic galvanometer – damping correction – figure of merit of BG – absolute capacitance of a capacitor

Unit - V: Magnetism

Magnetic properties of materials: Magnetic intensity, permeability, magnetic susceptibility – relation between the three magnetic vectors B, H and M – Curie temperature – Magnetic materials: dia, para, ferro, antiferro, ferri – electron theory of magnetism – Langevin's theory of dia magnetism and para magnetism – general applications of magnetic materials

Books for study

1. R. Murugeshan, Electricity and Magnetism, S. Chand & Co, New Delhi, 2019.

2. M. Narayanamurthy., N. Nagarathanam., Electricity & Magnetism, Meerut, National publishing Co, 2001.

Books for reference

1. K. K. Tewari, Electricity and Magnetism, Magnetism, S Chand & co., New Delhi, 2001.
2. Brijlal and N. Subramanyan, Electricity and Magnetism, Agra., Ratan & Prakash,1995**.**
3. D. L. Shegal, K. L. Chopra, N. K. Sehgal, Electricity and Magnetism, Sultan Chand & Sons., New Delhi, 2006.
4. B. D. Dugal and C. L. Chopra. Fundamentals of Electricity and Magnetism, Shobanlal Nagin Chand, New Delhi, 2000.
5. Edward Purcell, Electricity and Magnetism, Cambridge University press, United Kingdom, 2011.
6. Dugald C. Jackson, An elementary book on Electricity, Magnetism and their Applications, The Macmillian Company, New York, 1994.

Websites

http://www.ncert.nic.in/html/learning_basket/electricity/electricity/electrostatics/laws_of_electrostatics.htm

www.learnnext.com/nextgurukul/wiki/concept/CBSE/X/Science/Magnetic-Effects-of-Electric-Current.htm

http://www-spof.gsfc.nasa.gov/Education/Imagnet.html

http://www.electronics-tutorials.ws/electromagnetism/electromagnetic-induction.html

https://www.electronics-tutorials.ws/accircuits/series-circuit.html

https://eng.libretexts.org/Bookshelves/Materials_Science/Supplemental_Modules_(Materials_Science)/Magnetic_Properties/Diamagnetism

https://www.toppr.com/ask/content/story/amp/capacitance-in-spherical-and-cylindrical-capacitor-problem-l1-76074/

Optics

Semester : III **Hours / week : 3**

Course code: P313 **Credits: 3**

Objectives

- To impart the knowledge on angular dispersion produced by prism, aberrations in lenses and methods of minimizing them in thin lenses.
- To understand the basic phenomena of interference and determination of thickness of a thin wire and refractive index of medium by using various interference experiments
- To explain the diffraction of light and classify Fresnel's and Fraunhofer diffraction with illustration of necessary theory and experiments.
- To Illustrate the polarization of light waves, their types and explain the various optical activity produced when the light passing through the crystal.
- To apply the LASER/MASER action produced in the material; analyze the principle, working mechanism and applications.

Sl. No.	Course Outcomes	Knowledge level
	On successful completion of the course, the students will be able to	
CO1	Differentiate the various aberrations in lenses and describe different methods of minimizing them.	K2, K4

CO2	Explain the phenomenon of interference and illustrate interference experiments to find the thickness of a thin wire and refractive index of medium	K2, K3
CO3	Exemplify the diffraction of light and compare the Fresnel's and Fraunhofer diffraction of light with an illustrative diffraction experiments	K2, K4
CO4	Compare the different types of polarization of light waves and analyze the optical characteristics when the light is passing through the crystals	K6, K4
CO5	State the principle of LASER/MASER action in materials and set up experiments to demonstrate the working mechanism of CO_2 and semiconductor lasers	K1, K5, K3

Mapping of CO with PO and PSO:

COs	Programmes Outcomes (POs)							Programmes Specific Outcomes (PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	3	3	2	3	3	2	1	3	2	1	2	2	2.5
2	2	2	3	3	2	3	2	3	2	2	3	3	2.3
3	3	2	1	3	2	2	2	3	2	3	2	3	2.8
4	3	3	3	3	3	3	3	3	2	2	3	2	2.5
5	3	3	2	3	3	2	2	3	2	3	2	2	2.5
Mean Overall Score													2.5
Result													High

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit – I: Geometrical Optics

Dispersion produced by a prism-angular dispersion-dispersive power-combination of prisms to produce (i) Dispersion without deviation (ii) deviation without dispersion-direct vision spectroscope. Aberration in lenses-spherical aberration-methods to minimize spherical aberration-chromatic aberration-achromatic combination of two lenses (i) in contact (ii) out of contact.

Unit– II: Interference

Interference: Amplitude and wave front – Young's Double Slit experiment – phase change on reflection: Stokes' treatment. Interference in Thin Films – condition for maxima and minima – Air wedge – thickness of thin wire – Newton's Rings: measurement of wavelength and refractive index – Michelson's Interferometer **–** Determination of wavelength – Wavelength difference.

Unit – III: Diffraction

Fresnel Diffraction: Half – period zones – Explanation of rectilinear propagation of light-theory of zone plate-Fresnel's Diffraction pattern of a slit and a narrow wire
Fraunhofer diffraction: Single slit– double Slit-diffraction grating - normal incidence-Experiment to determine wavelength and Dispersive power of grating

Unit – IV: Polarization
Transverse nature of light waves – double refraction – optical axis – plane polarized light – production and analysis by Nicol prism – circular and elliptical polarization – optical activity – Fresnel's explanation of optical rotation-Analysis of light by Laurent's half shade polarimeter- polaroids – applications.

Unit – V: LASER and MASER
Laser: characteristics – Einstein's' coefficients-Principle of laser-Population inversion – pumping – types – principle of Laser action – condition for Laser action – CO_2 Laser – semiconductor Laser – applications of Laser.
Maser – principle of Maser action – Ammonia gas Maser.

Books for study

1. BrijLal and N. Subramanyam, A text book of Optics, NirajPrakahshan, New Delhi, 2003.
2. Murugesan R, Modern Physics,S.Chand&Co.Ltd., New Delhi, 2001.
3. Arora C .L ,Optics , S.Chand&Co.Ltd., New Delhi, 1999.

Books for reference

1. R. Murugesan., Optics and spectroscopy, S. Chand & company Ltd., New Delhi, 2003.
2. A. Kumar, H.R. Gulati and D.R. Khanna, Fundamental of Optics, R. ChandPublications.New Delhi, 2011

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http://www.rpi.edu/dept/phys/Dept2/APPhys1/optics/optics/node7.html
http://hyperphysics.phy–astr.gsu.edu/hbase/phyopt/fresnelcon.html
www.microscopyu.com/techniques/polarized–light/introduction–to–polarized–light
http://hyperphysics.phy–astr.gsu.edu/hbase/optmod/fibopt.html
http://electrons.wikidot.com/principle–and–application–of–laser
https://www.youtube.com/watch?v=-sKpM5wRbwc

Modern Physics

Semester: IV **Hours/week : 3**
Course Code: 414 **Credits :3**

Objectives

- To gain knowledge about positive rays and mass spectrographs.
- To acquire knowledge about magnetic dipole moment due to orbital and spin motions of electron.
- To study and understand Zeeman effect and Paschen-Back effect.
- To gain knowledge about electronic spectroscopy.
- To review the fundamental concepts of vibrational spectroscopy.

Learning outcomes

Sl. No.	Course outcomes	

	On successful completion of the course, the students will be able to	**Knowledge level**
CO1	Differentiate between Positive rays and cathode rays and explain the working principle of different mass spectrographs.	K4, K2
CO2	List and explain the various quantum numbers associated with electrons and distinguish between LS coupling and jj coupling in atoms	K1, K2, K4
CO3	Differentiate between Zeeman effect and Anamolous Zeeman effect and explain Paschen–Back effect.	K4, K2
CO4	Understand the interaction of electromagnetic radiation with matter, state the basic laws of absorption and transmission of radiation and outline the principle involved in UV-Visible spectroscopic technique.	K2, K1, K4
CO5	Acquire a knowledge on Vibrational pectroscopy, inspect the functional groups in compounds using IR spectroscopy and Compare IR and Raman spectroscopy.	K2, K5, K6

Mapping of CO with PO and PSO

CO	**Programme Outcomes (PO)**							**Programme Specific Outcomes (PSO)**					**Mean Scores of COs**
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	
CO	3	2	2	3	3	2	2	3	2	3	2	2	2.41
CO	2	2	3	3	2	2	2	3	3	2	3	2	2.41
CO	3	3	3	3	3	3	2	2	3	3	3	3	2.83
CO	3	3	2	2	2	2	3	3	3	2	3	3	2.58
CO	3	2	3	3	3	3	3	2	2	3	2	3	2.66
CO	3	2	2	3	3	2	2	3	2	3	2	2	2.41
Mean Overall Score													**2.57**
Result													**HIGH**

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit - I: Positive rays : Discovery – Properties – Positive ray analysis: Thomson's Parabola method – Detection of Isotopes -Dempster's mass spectrographs –Aston's Mass spectrograph – uses of mass spectrograph.

Unit - II: Structure of the atom : Vector atom model – spatial quantization and electron spin – Quantum numbers associated with electron – Pauli's exclusion principle – Spin-orbit coupling in atoms: LS and jj couplings – periodic classification of elements.

Unit - III: Magneto Optical Properties of Spectrum: Magnetic dipole – moment due to orbital motion of the electron – Magnetic dipole moment due to spin – Stern and Gerlach experiment – Normal and Anomalous Zeeman effect – Experiment – Larmor's theorem – Paschen – Back effect.

Unit-IV: Electronic Spectroscopy: Electromagnetic spectrum – interaction of electromagnetic radiation with matter – scattering, dispersion and transmission of radiation- Fundamental laws of absorption- Lamberts Bouguer's law, Beer's law – deviations from Beer's law – absorptivity and absorbance – absorbance and transmission spectrum – Origin of visible and UV spectra-UV-Visible spectrophotometer

Unit-V: Vibrational Spectroscopy : Vibrational spectroscopy of diatomic and simple molecules: Harmonic Oscillator – Anharmonic Oscillator –Normal modes of vibration of CO_2 and H_2O molecules – Experimental setup of IR spectrometer.
Raman Effect - Classical theory of Raman Scattering - Quantum theory of Raman Scattering (no derivation) – experimental setup of Raman spectrometer – comparison of IR and Raman spectroscopy

Books for study

1. R. Murugeshan, Modern Physics, S. Chand and Company Ltd., New Delhi, 2009.
2. N. Subrahmanyam and Brijlal, Atomic Physics, S. Chand and Company Ltd., New Delhi, 2010.
3. C. N. Banwell, E. M. McCash, Fundamentals of Molecular Spectroscopy, 5th Edition, Tata McGraw-Hill Publications, New Delhi, 2002.

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1. S. N. Ghoshal, Atomic and Nuclear Physics, Volume–I, S. Chand and Company Ltd., New Delhi, 1996.
2. Arthur Beiser, Concepts of Physics, Tata Mcgraw – Hill – New Delhi, 2003.
3. Sehgal Chopra Sehgal – Modern Physics, Sultan Chand Sons, New Delhi, 2004.
4. G. Aruldas, Molecular Structure and Spectroscopy, 2nd Edition, Prentice – Hall of India Pvt.Ltd. New Delhi, 2007.
5. D. N. Satyanarayana, Vibrational Spectroscopy and Applications, New Age International Publications, New Delhi, 2004.
6. H. Kaur, Spectroscopy, Pragagi Edition, 7th Edition Meerut, 2012.

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http://hyperphysics.phy-astr.gsu.edu/hbase/quantum/paschen.html
http://www.readorrefer.in/article/Bragg---s-law-for-X-ray-diffraction_2933
http://www.readorrefer.in/article/X-ray-spectra---continuous-and-characteristic-X-ray-spectra_2935
http://www.readorrefer.in/article/Bragg-s-X-ray-spectrometer_2934
http://www.readorrefer.in/article/Moseley-s-law-and-Applications-of-Moseley-s-law_2936
http://nptel.ac.in/courses/122101002/downloads/lec-25.pdf

Electromagnetism

Semester : IV **Hours / week : 3**
Course code: P415 **Credits: 3**

- To impart knowledge on concepts of Electromagnetic induction
- To make students understand the concept of self-inductance
- To understand the working principle of Ballistic galvanometer and its applications
- To learn the principle and working of earth inductor and A.C generator
- To apply Maxwell's equations to discuss the propagation of electromagnetic waves in free space.

Learning Outcomes

Sl. No.	Course outcomes On successful completion of the course, the students will be able to	Knowledge level
CO1	State Faraday's laws of Electromagnetic induction and estimate the emf induced in a Rectangular loop of wire moving through a non uniform magnetic field	K1, K5
CO2	Explain self-induction and its physical significances and design Anderson bridge to determine the self inductance of an inductor using.	K2, K6, K5
CO3	Understand and apply the principle of B.G. to determine the mutual inductance between pair of coils	K2, K3, K5
CO4	Outline the principle, working and applications of Earth inductor, Search coil and A.C. Generator	K4
CO5	Explain the significance of Maxwell's equations in free space and apply it to electromagnetic waves in isotropic non-conducting media.	K2, K3

Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of Cos
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO	2	2	2	3	3	3	2	3	3	3	2	2	2.5
CO	3	2	3	3	2	2	2	3	3	2	3	3	2.58
CO	3	3	3	3	3	3	2	2	3	3	3	3	2.83
CO	3	3	3	3	2	2	3	3	3	2	3	3	
CO	3	2	3	3	3	2	2	2	2	3	2	2	2.41
CO	2	2	2	3	3	3	2	3	3	3	2	2	2.5
Mean Overall Score													**2.61**
Result													**HIGH**

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

UNIT-I: Electromagnetic Induction:
Faraday's laws of electromagnetic Induction-Deduction of Faraday's law from Lorentz' force-Rotational Electromotive force-Moving conducting rod in a constant magnetic field-Conducting rod sliding along a stationary U-shaped conductor placed on a uniform magnetic field-Rectangular loop of wire moving through a non uniform magnetic field

UNIT-IISelf Inductance
Self Inductance: Inductors and inductance-Physical significance of self-inductance-self inductance of solenoid, two parallel wires,two coaxial cylinders-Self inductance by Anderson Bridge.

UNIT-III Mutual Inductance
Mutual Inductance: Mutual Inductance between two arbitrary circuits-Newmaan's formula-reciprocity theorem-Proof-Theory of B.G-Damping correction-Measurement of mutual inductance by B.G

UNIT-IV Electromagnetic Devices:
Earth inductor: horizontal and vertical components of earth's magnetic field-Search coil: measurement of strong magnetic field-Eddy currents-Applications-Induction coil-Automatic make and Break arrangement-A.C.Generator

UNIT-V Electromagnetic waves

Maxwell's Displacement current-Significance of displacement current-Maxwell's equations in integral and differential forms-Significance-Maxwell's equations in free space-Electromagnetic waves in free space-Electromagnetic waves in isotropic non-conducting media (Dielectrics).

Books for study

1. K.K.Tewari, Electricity and magnetism, S.Chand and Company Ltd, New Delhi,2018
2. D.C.Tayal, Electricity and Magnetism, Himalaya Publishing House, New Delhi,2012

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1. Brijlal and N. Subrahmanyam, Electricity and Magnetism, RatanPrakashanMandir Educational & University Publishers, Agra, 1999.
2. R.Murugeshan, Electricity and Magnetism, S.Chand and Company Ltd, New Delhi, 1999.

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https://www.electrical4u.com/faraday-law-of-electromagnetic-induction/
https://courses.lumenlearning.com/physics/chapter/23-3-motional-emf/
http://vlabs.iitkgp.ernet.in/asnm/exp23/index.html
https://www.britannica.com/technology/induction-coil
http://odessa.phy.sdsmt.edu/~lcorwin/PHYS721EM1_2014Fall/ChiranjibiFinal.pdf
https://physicsabout.com/maxwells-equations/
http://hyperphysics.phy-astr.gsu.edu/hbase/electric/maxeq.html

Physics Main Practicals – II
Any 27 Experiments

Semester – III & IV **Hours/ Week: 4**
Course Code: PP413 **Credits : 8**

Objectives

- To determine the Young's modulus of materials in the form of a beam by subjecting them to Uniform and Nonuniform bending.
- To calibrate voltmeter and ammeter using potentiometer.
- To determine the viscosity and surfacetension of liquids.
- To learn the usage of spectrometer and to determine the wavelength of spectral lines.
- To verify the logic functions of basic logic gates and design arithmetic circuits using discrete components and ICs.
- To construct analog dual power supply and voltage stabilization circuits and measure their outputs.

Learning outcomes

Sl. No.	Course outcomes	Knowledge level
	On successful completion of the course, the students will be able to	

CO1	Use the spectrometer to estimate the wavelength of spectral lines and the refractive index of materials	K3, K6
CO2	Inspect the effective usage of Potentiometers, Careyfoster's bridge and BG	K4
CO3	Describe the working of microscope and the telescope and use them effectively	K3, K2
CO4	Recall the logic functions of basic logic gates and design arithmetic circuits using discrete components and ICs	K5, K1
CO5	Construct analog dual power supply circuits and voltage stabilization circuits and measure their outputs	K5, K6

Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO	3	3	2	2	2	2	2	3	3	3	2	2	2.4
CO	3	3	2	2	2	2	2	3	3	2	2	2	2.3
CO	3	3	3	2	2	2	2	3	3	3	2	2	2.5
CO	3	3	2	3	2	2	2	3	3	3	2	2	2.5
CO	3	3	3	3	2	2	2	3	3	3	2	2	2.6
Mean Overall Score													**2.5**
Result													**HIGH**

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	5	5	10
Understand	5	5	10
Apply	15	15	30
Analyze	15	15	30
Evaluate	5	5	10
Create	5	5	10

1. Young's Modulus – Non-Uniform Bending(Scale and Telescope)
2. Young's Modulus – Uniform Bending (Pin and Microscope)
3. Rigidity Modulus by Static Torsion method
4. Surface Tension of a liquid – Capillary rise method
5. Viscosity of a liquid – Graduated burette – Constant Time method
6. Viscosity of Highly viscous liquid–Searle's viscometer
7. Specific Heat Capacity of a liquid by cooling

8. Thermal conductivity of bad conductor – Lee's disc method
9. Resolving Power of a Prism
10. Newton's rings – Determination of R and μ
11. Air wedge –Thickness of insulation
12. Spectrometer – Grating – Minimum deviation method
13. Dispersive power of Grating – Normal incidence method
14. Refractive index of the material of a prism – i-d curve
15. Potentiometer – Resistance and Specific resistance of a wire
16. Potentiometer – Calibration of High range voltmeter
17. Potentiometer – Calibration of High range Ammeter
18. Carey Foster's Bridge – Resistance and Specific Resistance
19. Figure of merit for charge – BG
20. High Resistance by Leakage – BG
21. Comparison of Capacities
    i) Using BG
    ii) Using De-Sauty's Bridge
22. Voltage Stabilization using IC
23. Dual Power Supply using Zener diodes
24. Bridge rectifier using diodes
25. Logic Gates OR and AND using Transistors
26. Verification of truth tables of logic gates (AND, OR,NOT,NAND, NOR, EXOR) using ICs.
27. Verification of De Morgan's theorems
28. NAND as universal gate
29. Half adder and Full adder
30. To study the a series LCR circuit and determine its (a) Resonant Frequency, (b) Quality Factor

Books for reference

1. C.C. Ouseph, U. J. Rao, V. Vijayendran, Practical Physics and Electronics, S. Viswanathan Pvt. Ltd., Chennai, 2012.
2. M. N. Srinivasan, S. Balasubramanian, and R. Ranganathan, A Text Book of Practical physics, 2nd revised edition, S. Sultan Chand & Sons publications, 2014.
3. D. Chattopadhyay, P.C. Rakshit , New central book agency (p) LTD., 1987
4. S.Panigrahi&B.Mallick,Engineering Practical Physics, Cengage Learning India Pvt.Ltd. 2015
5. R.P. Jain, Modern Digital Electronics, 4th Edition, Tata McGraw Hill publishing company limited,New Delhi, 2003.
6. AnchalSrinivasa&R.K.Shukla, Practical Physics, New age International Publishers, Bengaluru, 2nd edition, 2018.

Programme structure of Allied Physics under CBCS

Sem	Paper	Title of the Paper	Hours / Week	Credits	Marks	
					CA	Sem
III	Allied -I	Allied Physics for Chemistry I	4	3	50	50
	Allied practicals	Allied Physics practicals for Chemistry	2	1	50	50
IV	Allied -II	Allied Physics for Chemistry II	4	3	50	50
	Allied practicals	Allied Physics practicals for Chemistry	2	1	50	50
III	Allied -I	Allied Physics for Computer Science I	4	3	50	50
	Allied practicals	Allied Physics practicals for Computer Science	2	1	50	50
IV	Allied -II	Allied Physics for Computer Science II	4	3	50	50
	Allied practicals	Allied Physics practicals for Computer Science	2	1	50	50
Total			24	16		

Allied Physics for Chemistry –I

Semester: III **Hours / week: 4**

Course Code: AP309A **Credits: 3**

Objectives

- To study the basics of elasticity and its importance in beams.
- To study the concepts of viscosity and the various methods to determine the parameters experimentally.
- To understand the concepts behind thermodynamics and thermodynamic laws.
- To study the propagation of sound waves, the production of ultrasonic waves, Acoustics and their applications.
- To distinguish the geometrical and physical optics.
- To understand the concept of basic electronics and digital electronics.

Learning Outcomes

Sl. No.	Course outcomes On successful completion of the course, the students will be able to	Knowledge level
CO1	Acquire basic knowledge about elasticity and viscosity of liquids and measure the viscosity of liquids by Poiseuille's method.	K1, K5
CO2	State and explain different laws of thermodynamics and distinguish between adiabatic and isothermal changes.	K1, K2, K4

CO3	Apply the laws of transverse vibrations to estimate the AC frequency using sonometer, describe the production and applications of Ultrasonic waves and recommend the conditions for good acoustics of auditoriums.	K2, K3, K6
CO4	Comprehend the concepts of spherical aberration, chromatic aberration and the methods of minimizing them and interference of light.	K2
CO5	Construct rectifiers and voltage regulators using diodes and explain the logic functions of basic logic gates.	K6, K2

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)							Programme Specific Outcome (PSO)					Mean score of CO
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	2	2	3	2	3	3	2	3	2	2	2.4
CO2	3	2	3	2	2	3	2	3	2	2	3	3	2.5
CO3	2	2	2	3	2	3	2	2	2	3	2	3	2.3
CO4	3	3	3	2	3	2	3	2	2	2	3	2	2.5
CO5	2	3	2	2	3	3	2	3	2	3	2	2	2.4
Mean Overall Score													2.4
Results													High

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit – I: Properties of matter

Elasticity: Stress – strain – Hooke's Law – Elastic moduli – beam – bending of beams – expression for bending moment – Young's modulus by non–uniform bending (Optic lever & telescope) theory and experiment – torsional couple per unit twist – work done in twisting a wire – torsional pendulum – theory – rigidity modulus by torsional oscillations experiment (without symmetrical masses).

Viscosity: Coefficient of viscosity – rate of flow of liquid in a capillary tube (Poiseuille's formula) – Poiseuille's method for determining coefficient of viscosity of a liquid (Variable pressure head).

Unit – II: Thermodynamics

Zeroth and first law of thermodynamics – reversible and irreversible processes – isothermal process – adiabatic process – work done during adiabatic and isothermal process - second law of thermodynamics – Carnot's engine – efficiency of Carnot's engine – Entropy –change of entropy when ice converted into steam - third law of thermodynamics –Maxwell thermodynamical relations ; derivation and application in Clausius - Clapeyron equation and specific heat relation.

Unit – III: Sound and Acoustics

Wave Motion: longitudinal waves and transverse waves – velocity of transverse vibrations in a stretched string – laws of transverse vibrations – experiment to determine the AC frequency using sonometer.

Ultrasonics: Definition – production of ultrasonic waves by Piezo-electric method – applications – non-destructive testing (Echo pulse method).

Acoustics: Intensity of sound–Decibel and Bel–Loudness of sound–Reverberation–Sabine's reverberation formula–Acoustic intensity–Factors affecting the acoustics of Buildings.

Unit – IV: Optics

Geometrical Optics: Chromatic and spherical aberration in lenses – condition for achromatism of two thin lenses placed in contact and separated by a finite distance – Methods of reducing spherical aberration ─deviation and dispersion of light – determination of refractive index of the given solid prism.

Physical Optics: Interference – condition for interference – air wedge – determination of thickness of a thin wire by air wedge – Newton's rings (determine the radius of curvature).

Unit – V: Electronics

Analog electronics: PN junction diode – rectifiers – half wave – full wave and bridge rectifiers – zener diode – characteristics of zener diode──zener diode as voltage regulator─junction transistor – types of transistors – working of NPN transistor (common base) – integrated circuits – advantages and disadvantages.

Digital electronics:AND, OR, NOT, NOR, NAND, EX-OR gate – construction of AND, OR gates using diodes (Two input) and NOT gate using transistor – NAND as a Universal gate – half and full adders**.**

Books for study

1. R. Murugeshan, Properties of matter, revised edition, S. Chand & Co. Pvt. Ltd, New Delhi, 2019.
2. N. Subrahmanyam, Brij Lal, Waves and oscillations, 2nd revised edition, Vikas publishing, 2019
3. R. Murugeshan, Optics, 25threvised edition, S. Chand & Co. Pvt. Ltd, New Delhi, 2012.
4. V. K. Metha, Principle of Electronics, S.Chand& Co. Pvt. Ltd, New Delhi, 2003.
5. Anil K. Maini, Digital Electronics: Principles, Devices and Applications, 1 st edition, John Wiley & Sons Ltd, 2007.
6. R. Murugeshan, Er. KiruthigaSivaprasath, Thermal Physics, revised edition, S. Chand & Co, 2018.

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1. N. Subrahmanyam, and Brij Lal, Properties of matter, S. Chand & Co. Pvt.Ltd, New Delhi, 2005.
2. N. Subrahmanyam, and Brij Lal, A text book of sound, Vikas Publishing House, New Delhi, 1985.
3. Murugeshan and KiruthigaSivaprasath., A Text Book of Optics, 9th revised edition, S. Chand & Co. Pvt. Ltd, New Delhi, 2014.

4. R. Murugeshan, KiruthigaSivaprasath, Modern Physics, 7th revised edition, S. Chand &Co., 2014
5. Devaraj Singh, Giridhar Mishra, Raja Ram Yadav, Thermal Physics, Kinetic Theory and thermodynamics, Narosa publications, 2016
6. Frank. L. Pedrotti, S. J Leno M. Pedorotti, Leno S. Pedorotti, Introduction to optics, 3rd edition, 2012
7. N. Subrahmanyam, and Brij Lal, Optics, 25threvised edition, S. Chand & Co. Pvt. Ltd, New Delhi, 2012.

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https://www3.nd.edu/~powers/ame.20231/notes.pdf

Allied Physics for Chemistry –II

Semester: 4 **Hours/ Week : 4**
Course code: **Credit: 3**

Objectives

- To study the basic ideas of electricity and magnetism
- To study vector atom model and to determine the methods of critical potential
- To study the structure of the alkali spectral lines
- To study the basics of nuclear reactions, process of radioactivity and its applications
- To understand the concepts of wave mechanics and dualistic nature of light
- To study the different methods of preparing thin films, nanomaterials and their applications

Learning Outcomes

Sl. No.	Course outcomes On successful completion of the course, the students will be able to	Knowledge level

CO1	**Describe the growth and decay of current in DC circuits, design experiments to calibrate ammeter and voltmeter using potentiometer and distinguish dia, para, and ferromagnetic materials.**	K2, K6, K4
CO2	**Explain the various** quantum numbers associated with the vector atom model.	K2
CO3	**Illustrate a knowledge on the basics of nuclear reactions, radioactivity and classification of elementary particles and estimate the amount of energy released in nuclear reactions.**	K3, K5
CO4	**State and explain the concepts of matter waves, Heisenberg's uncertainty principle and laws of photo electric effect.**	K1, K2
CO5	**Describe various methods of thin films and Nanomaterials preparation and state the applications of nanomaterials.**	K2, K1

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)							Programme Specific Outcome (PSO)					Mean score of CO
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	3	3	2	3	3	2	3	2	2	2.6
CO2	3	3	3	2	2	3	2	3	2	2	3	1	2.4
CO3	2	2	2	3	2	3	2	2	2	3	2	3	2.3
CO4	3	3	3	2	3	2	3	2	2	2	3	2	2.5
CO5	2	3	2	2	3	3	1	3	2	3	2	3	2.4
Mean Overall Score													2.5
Results													High

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit – I: Electricity and Magnetism

Electricity: D.C circuits: growth and decay of current in L.R circuit – growth and decay ofcharge in C.R circuit – time constant – potentiometer – principle – calibration of high rangeammeter – calibration of low range voltmeter.

Magnetism: Intensity of magnetization – susceptibility – types – Properties of para, dia andferromagnetic materials – Langevin's theory of diamagnetism.

Unit – II: Atomic Physics

Structure of the atom: Concepts of Sommerfeld's and Vector atom model – spatial quantization – spinning electron –quantum numbers associated with the vector atom model - Doublet structure of the alkali spectral lines – Fine structure of the hydrogen spectral terms - Pauli's exclusion principle.

Critical Potentials: Excitation potential – ionization Potential – determination of criticalpotential – Frank and Hertz method.

Unit – III: Nuclear Physics

Nuclear Reactions and Radioactivity: Nuclear reactions – types of reactions – conservationlaws – Q-value of a nuclear reaction – Neutron – discovery – detection – properties ofneutron – artificial transmutation – Rutherford's experiment – artificial radioactivity – radioisotopes – applications.

Nuclear Energy and Elementary particles: Nuclear fission – energy released in fission –chain reaction – nuclear fusion and particle accelerators – cyclotron and betatron - elementary particles – classification ofelementary particles.

Unit – IV: Modern Physics

Dual nature of light – matter waves – Louis de Broglie concepts of matter waves – de Brogliewavelength for matter waves – G.P. Thomson's experiment to confirm the wave nature ofelectron – Davisson and Germer'sexperiment.Heisenberg's Uncertainty principle – statement – position and momentum of a particle –Gamma ray microscope – diffraction of a beam of electrons by a slit.

Photo electric effect: Laws of photo electric emission – Einstein's photo electric equation – applications (Specific applications)

Unit – V: Material Science

Thin: Thin films – preparation of thin films –Thermal Evaporation– sputtering – pulsed laser deposition– applications of thin films -Thin film solar cells.

Nanomaterials and Applications: Nanomaterials – classification based on dimension –preparation of nanomaterials: top–down and bottom–up approach – ball milling – sol-gelmethod – applications of nanomaterials in medicine, industry, sensors and textiles – Moore's law – quantum dots – applications of quantum dots.

Books for study

1. R. Murugeshan, Kiruthiga Sivaprasath, Modern Physics, 18th Edison, S. Chand & Co. Ltd, New Delhi, 2019.
2. N. Subrahmanyam and Brij Lal, Atomic and Nuclear Physics, S Chand & Co., 2007.
3. R. Murugeshan, Electricity and Magnetism,10th Edison, S.Chand & Co. Ltd, New Delhi, 2017.
4. A. K. Bandyopadhyay, Nano Materials, New Age International Publishers, New Delhi, 2009.
5. S. Shanmugam, Nanotechnology, MJP Publishers; 1st edition (28 April 2019), Chennai, 2019.

Books for reference

1.N. Subrahmanyam and Brij Lal, Atomic Physics, S. Chand & Co. Ltd., New Delhi, 2013.

2.S.N. Ghoshal, Atomic and Nuclear Physics, S.Chand & Co. Ltd, New Delhi, 2004.

3.R.B. Gupta, Material Science and Processes, Satya Prakashan, New Delhi, 2002.

4.L.I. Maissel and R. Glang, Handbook of Thin film Technology, McGraw–Hill, New York, 2000.

5.A. Goswami, Thin Film Fundamentals, New Age International Pvt. Ltd, New Delhi, 2007.

6.V. Raghavan, Materials science and Engineering, Prentice–Hall of India Pvt. Ltd., New Delhi, 2009.

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http://ncert.nic.in/ncerts/l/leph203.pdf
http://www.iitg.ernet.in/physics/fac/charu/courses/ph405/uncertainty.pdf
http://shodhganga.inflibnet.ac.in/bitstream/10603/4025/8/08_chapter%202.pdf
http://www.sc.mahidol.ac.th/scpy/courses/scpy663/lecture3_evaporation.pdf
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http://ocw.nctu.edu.tw/course/physics/solidphysics_lecturenotes/chapter11.pdf
https://www.freebookcentre.net/physics-books-download/Atomic-and-Molecular-Physics-NPTEL.html
http://ducc.du.ac.in/web4/ever-shrinking-mex/43m9vc1.php?3c6e0b=langevin%27s-theory-of-dia-and-paramagnetism
https://nptel.ac.in/content/storage2/courses/113106065/Week%208/Lesson19.pdf
https://www.phys.sinica.edu.tw/TIGP-NANO/Course/2020_Spring/notes/
08_chapter_2_20200409.pdf
https://www.researchgate.net/publication/259118068_Chapter_-_INTRODUCTION_TO_NANOMATERIALS
http://www.sathyabamauniversity.ac.in/uploads/notes/note_1437661719.pdf

Allied Physics Practicals for Chemistry

Semester : III & IV **Hours / week : 2**
Course Code : PAP409A **Credits : 2**

Any 12 Experiments

Objectives:

1. To perform experiments on elasticity of materials and viscosity of liquids
2. To demonstrate an experiment to determine the frequency of ac mains
3. To perform experiments on interference of light waves and its applications.
4. To do calibration of voltmeter and ammeter using potentiometer
5. To design simple analog and digital electronic circuits.

Learning outcomes:

Sl. No.	Course outcomes On successful completion of the course, the students will be able to	Knowledge level
CO1	Apply their knowledge on properties of matter to perform experiments to determine the Young's modulus and Rigidity modulus of materials and viscosity of liquids	K3, K5
CO2	Perform an experiment to determine the frequency of ac mains using sonometer and analyze the result obtained.	K3, K4
CO3	Set up Newton's rings and air wedge experiments and apply their knowledge on interference of light waves to determine the refractive index of material of a lens and thickness of a wire.	K6, K3, K5
CO4	Use potentiometer to calibrate low range voltmeter and high range ammeter and explain the principle behind the experiment.	K3, K2

CO5	Recall the logic function of different logic gates and employ them to construct simple electronic circuits.	K1, K3

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)							Programme Specific Outcome (PSO)					Mean score of CO
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	3	3	2	3	3	2	3	3	3	2.8
CO2	3	3	3	2	2	3	2	3	2	2	3	3	2.6
CO3	2	2	2	3	2	3	2	2	2	3	2	3	2.3
CO4	3	3	3	2	3	2	3	2	2	2	3	2	2.5
CO5	2	3	2	2	3	3	3	3	2	3	2	3	2.6
Mean Overall Score													2.6
Results													High

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	5	5	10
Understand	5	5	10
Apply	15	15	30
Analyze	15	15	30
Evaluate	5	5	10
Create	5	5	10

1. Young's Modulus – Non-Uniform bending – Optic lever and Telescope.
2. Rigidity Modulus of the wire – Torsional Pendulum.
3. Co–efficient of viscosity of a liquid – graduated burette – Constant volume method.
4. Determining the AC frequency using sonometer
5. Construction of centre tap full wave rectifier using diodes.
6. Spectrometer – refractive index of the material of solid prism.
7. Air wedge – Determination of thickness of wire.
8. Zener diode regulated power supply.
9. Construction of AND, OR logic gates using diodes and NOT gate using transistor.
10. Logic gates using IC's (AND, OR, NOT, NOR, NAND, X–OR).
11. NAND as universal gate.
12. Potentiometer – Calibration of low range voltmeter.
13. Potentiometer – Calibration of high range ammeter.
14. Half adder and Full adder.
15. Newtons ring experiment to determine the focal length of the lens.

Books for reference

1. Department of Physics, Allied Practical Physics, (B. Sc Physics Main), Sacred Heart College, Tirupattur, 2015.
2. M. N. Srinivasan, S. Balasubramanian, and R. Ranganathan, A Text Book of Practical physics, 2nd revised edition, S. Sultan Chand & Sons publications, 2014.
3. R. Sasikumar, Practical Physics, PHI Learning Pvt. Ltd, New Delhi, 2011.

4. Dr.S.Somasundaram, Practical Physics, Apsara publications, Tiruchirapalli, 2012.

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3. https://www.youtube.com/watch?v=6dmfI_H5k7U
4. https://www.youtube.com/watch?v=Q8Otf6k3uGk
5. http://www.brainkart.com/article/Determination-of-coefficient-of-viscosity-of-water-by-Poiseuille-s-flow_method_3059/#:~:text=Consider%20a%20liquid%20_of%_20co,_the%20pressure%20gradient%20p%2Fl.
6. https://vlab.amrita.edu/?sub=1&brch=281&sim=1513&cnt=2
7. https://www.electronics-tutorials.ws/logic/logic_1.html
8. youtube.com/watch?v=cdMJvFT-Afc
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Allied Physics for Computer Science –I

Semester: 4 **Hours/ Week : 4**
Course code:AP309B **Credit: 3**

Objectives

- To make the students to explore the Physics in active devices and also to introduce the concept of semiconductors and their working principles
- To explore the principles and applications of passive devices.
- To understand the series and parallel circuits and their short and open circuits in real time applications.
- To induce the minds of the students to understand the principle and applications of LASER in science and technology.
- To make the students the importance of the optical fiber communication, LED, Photoresistor and solar cell.

Learning outcomes:

Sl. No.	Course outcomes On successful completion of the course, the students will be able to	Knowledge level
CO1	Analyze the functions of active devices especially diodes and transistors.	K3
CO2	Calculate the values of resistors and capacitors from the colour coding and understand the importance of the passive devices in everyday life.	K2, K5
CO3	Identify the short and open circuits in complex circuits which consist of series and parallel components.	K3, K4
CO4	Realize the importance of LASER in modern science and technology.	K1, K2
CO5	Understand the working principle of fiber optic cable, LED, LCD, photoresistor and solar cell.	K1, K2

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)							Programme Specific Outcome (PSO)					Mean score of CO
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	2	3	2	1	3	2	1	2	2	2.
CO2	2	2	3	2	2	3	2	2	2	2	3	3	2.
CO3	3	2	1	1	2	2	2	2	2	3	2	3	2.
CO4	3	3	3	2	3	3	3	3	2	2	3	2	2.
CO5	2	3	2	2	3	2	2	3	2	3	2	2	2.
Mean Overall Score													2.
Results													Hi h

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit – I: Active Devices

Semiconductor – types of semiconductor – PN junction diode – V-I characteristics of junction diode – zener diode – V-I characteristics of zener diode – zener diode as a voltage regulator – bipolar junction transistor(BJT): types – PNP and NPN transistor – working of NPN transistor – CB, CE andCCmodes – characteristics of CE mode – single stage CE transistor amplifier – band width and cut off frequencies.

Unit – II: Passive Devices

Resistor: Colour coding scheme–types of resistors–factors affecting resistance of amaterial – specific resistance.

Capacitor: Principle–capacitance–factors affecting capacitance of the capacitor–types ofcapacitor – capacitor coding – series and parallel connection of capacitors.

Integrated Circuits: Advantages and disadvantages–IC classification–fabrication ofcomponents resistor and capacitor on monolithic IC's.

Unit – III: Series and Parallel Circuits

Series Circuit:current– voltage– resistance – Total resistance in a series circuit- ohm's law– polarity of voltage drop–voltage division technique – short circuits – effects of short circuit – detecting short circuits – open circuit in series connection – effects of open circuit in series connection– detecting open circuit.

Parallel Circuit: Total resistance in parallel circuit–current divisiontechnique – shorts in parallel circuits – opens in parallel circuit – applications of parallel circuits – fuse and circuit breaker.

Kirchhoff's laws; current law and voltage law.

Unit – IV: LASER

LASER – characteristics – stimulated absorption – spontaneous emission – stimulated emission – population inversion – Einstein coefficients for three level system – types of pumping – principle of laser – conditions to achieve laser action – carbon di-oxide (CO_2) laser, Helium-Neon laser, Nd:YAG (Neodymium–doped Yttrium Aluminium Garnet; Nd:$Y_3Al_5O_{12}$) Laser– semiconductor laser – application of lasers in industry, computer and communication fields.

Unit – V: Fiber Optics and Opto–Electronic Devices

Optical fiber – construction – working principle – light propagation in optical fibers – acceptance angle and numerical aperture – classification of fibers based on materials, refractive index profile and modes– losses in optical fibers – fiber optic communication system – block diagram – advantages of optical fiber communication over conventional communication systems.

Construction and working: Light emitting diodes (LEDs) – liquid crystal display— photo resistor – photo diode – solar cells

Books for study

1. Bernard Grob, Basic Electronics, McGraw Hill Kogakusha Ltd, Delhi, 1977.
2. Mehta V. K., Principles of Electronics, S. Chand & Company, delhi, 2003.
3. Allen Mottershead, Electronic devices and Circuits: An introduction, Prentice Hall of India Private Limited, New Delhi, 2000.
4. Sarkar C.K and Sarkar D.C, Optoelectronics and Fiber optic communication, New Age International Publishers, New Delhi, 2001.

Books for reference

1. K. Maini, Electronics and Communications simplified, Khanna Publisher, New Delhi, 1993.
2. Pallab Bhattacharya, Semiconductor optoelectronic devices, Pearson Education (Singapore) Pvt. Ltd, New Delhi, 2001.
3. Subramanyam, Applied Electronics, The National Publishing Company, Chennai, 1996.

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https://en.wikipedia.org/wiki/Semiconductor
https://www.escomponents.com/blog/2019/7/31/active-amp-passive-components-what-is-the-difference-between-the-two
www.explainthatstuff.com/fiberoptics.html
ecee.colorado.edu/~bart/book/book/chapter4/ch4_6.htm
http://www.physics-and-radio-electronics.com/physics/laser/differenttypesoflasers.html
www.explainthatstuff.com/lasers.html
learn.sparkfun.com/tutorials/what–is–a–circuit
https://techterms.com/definition/circuit

Allied Physics for Computer Science – II

Semester: 4 **Hours/ Week : 4**
Course code:AP409B **Credit: 3**

Objectives

- To introduce the fundamental concepts and working principles of various semiconductor devices and their applications.
- To introduce the basic concepts of operational amplifier and its various applications.

- To familiarize the switching characteristics of transistor, various multivibrators, applications of diode as integrator, differentiator, clipper and clamper.
- To familiarize with the different number systems and combinational circuits utilized in the digital circuits.
- To study the working of various flip-flops, registers, counters and their applications.

Learning Outcomes

Sl. No.	Course outcomes On successful completion of the course, the students will be able to	Knowledge level
CO1	Understand the working principle of JFET and design rectifier circuits.	K2, K6
CO2	Apply knowledge on op-amp to design and analyze various applications of op-amps.	K3, K6, K4
CO3	Understand the working of multivibrators and design wave shaping circuits.	K2, K6
CO4	Gain knowledge of different types of number systems and their mutual conversions, State and prove DeMorgan's theorems and Explain the working principle of combinational circuits.	K1, K3, K2
CO5	Construct and evaluate the performance of flip-flops, registers and counters.	K6, K5

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)							Programme Specific Outcome (PSO)					Mean score of CO
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	2	3	2	3	3	3	3	2	2	2.(
CO2	3	3	3	2	2	3	2	3	3	2	3	3	2.7
CO3	3	2	3	3	2	3	2	3	2	3	2	3	2.(
CO4	3	3	3	2	3	3	3	3	2	2	3	2	2.7
CO5	3	3	2	2	3	3	2	3	2	3	3	2	2.(
Mean Overall Score													2.(
Results													Hi h

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit – I: Semiconductor Devices and Applications

Half wave, full wave and bridge rectifiers–efficiency–ripple factor–Filter circuits - Types of filters:capacitor filters – π filters—JFET – construction and working of n–channel FET – characteristics – parameters of JFET – advantages of JFET over BJT- Common source FET amplifier.

Unit – II: Operational Amplifiers and Applications

Operational amplifiers – characteristics of ideal operational amplifier – CMRR – voltage gain of op–amp in inverting and non–inverting modes – Applications of OPAMPin invertingmode: voltage follower– summer – subtractor – integrator and differentiator.

Unit – III: Switching and Wave Shaping Circuits

Switching circuit – switch – types – mechanical – electro-mechanical – transistor as an electronic switch – advantages of electronic switches over electromechanical switches – multivibrators – types: Astable and Bistable multivibrators using transistors – working – differentiating circuits – output waveforms – integrating circuits – output waveforms-clipping and clamping circuits using diodes.

Unit – IV: Combinational circuits

Number system: Binary, Decimal, Octal, Hexa decimal and their mutual conversions – logic gates AND, OR using diodes –NOT gate using Transistor –EXOR gate - NAND as a Universal gate – De Morgan's laws and their circuit implications – arithmetic circuits: half adder – full adder – half subtractor-full subtractor-Multiplexer(2:1) – demultiplexer(1:2).

Unit –V: Sequential circuits:

Flip Flops – triggering in flip-flops-types – clocked RS flip flop – D flip flop – J-K flip flop. Shift registers: serial in serial out-serial in parallel out-parallel in parallel out-parallel in serial out - Counters: Synchronous and asynchronous counters-Modulus of a counter-Synchronous and asynchronous decade counter.

Books for study

1. V.K Methta, Principles of Electronics, S. Chand & Co, New Delhi, 2001.
2. M. Arul Thalapathi, Basic and Applied Electronics, Comtec Publisher, Chennai, 2005.
3. Malvino Leach, Digital Principles and Applications, Tata McGraw Hill,1992.

Books for reference

1. Floyd, Digital Fundamentals, Pearson education, New Delhi, 2004.
2. V. Vijayendran, Digital Fundamentals, S. Viswanathan Publishers, Chennai, 1999.
3. Ramakant A. Gyakwad, Op–amps and Linear Integrated Circuits, PHI Pvt. Ltd, 2015.

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https://www.tutorialspoint.com/electronic_circuits/electronic_circuits_linear_wave_shapping.htm.
https://www.geeksforgeeks.org/multiplexing-and-demultiplexing-in-transport-layer/
https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/
https://circuitglobe.com/demorgans-theorem.html
https://www.maximintegrated.com/en/products/interface/high-speed-signaling/MAX9396.html
https://www.electronics-tutorials.ws/sequential/conversion-of-flip-flops.html
https://www.electronics-tutorials.ws/counter/count_2.html

Allied Physics Practicals for Computer Science

Semester: III &IV **Hours/week : 2**
Course Code: PAP409B **Credits : 1**

Objectives:

- To have an hands on training to handle the electronic components and bread broad
- To construct the logic circuits and demonstrate the output by truth tables
- To realize the importance of calibration of voltmeter and galvanometer
- To verify the theorems and Physics laws using passive and active devices
- To construct stabilized power supply by them self

Learning Outcomes

Sl. No.	Course outcomes On successful completion of the course, the students will be able to	Knowledge level
CO1	Handle the electronic components for constructing electronic circuits.	K2, K4
CO2	Construct logic gate circuits.	K2, K4, K6
CO3	Calibrate voltmeter and galvanometer.	K3, K4
CO4	Verify the Physics laws especially Ohms law and De Morgan's theorem.	K1, K3
CO5	Construct stabilized power supply.	K2, K4, K6

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)	Programme Specific Outcome (PSO)	Mean score

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	of CO
CO1	1	3	2	2	3	2	3	2	2	1	2	2	2.
CO2	2	2	3	2	2	1	2	2	2	2	3	3	2.
CO3	3	2	3	1	2	2	2	2	2	3	2	2	2.
CO4	3	3	3	2	3	3	3	3	2	2	3	2	2.
CO5	2	1	2	2	3	2	2	3	1	3	2	2	2.
Mean Overall Score													2.
Results													Hi h

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	5	5	10
Understand	5	5	10
Apply	15	15	30
Analyze	15	15	30
Evaluate	5	5	10
Create	5	5	10

1. Figure of merit of an aperiodic galvanometer – current sensitivity and voltage sensitivity.
2. R–S and D–Flip Flops using NAND gates.
3. (i)Logic gates AND,OR and NOT using IC (ii)Verification of De Morgan's theorem
4. Half adder and Half subtractor.
5. Frequency of AC – Sonometer.
6. Verification of Ohm's law.
7. Potentiometer – Calibration of low range voltmeter.
8. Zener diode characteristics.
9. Construction of stabilized power supply using zener diode.
10. Construction of logic gates OR and AND using diodes and NOT using transistor.
11. NAND as a Universal gate.
12. Full adder.

Books for reference

1. Jerry D. Wilson, CBS College, 1986.
2. D. Chattopadhyay, P.C. Rakshit , New Central Book Agency Pvt. Ltd, 1987.
3. C. Isenberg and S.S Chomet, Viva Books Private Limited, 1998.
4. Narasimhan, Ramamoorthy, B.G. Paul & Co, 1961.
5. S.R. Govindarajan & Co, Rochouse & Sons Private Ltd, 1959.
6. D.R. Khanna and H.R. Gulati, R. Chand & Co, New Delhi, 1967.
7. S.V. Gohawale, V.D. Gaikaiwari and V.D. Gokhale, S. Chand & Company Ltd, New Delhi, 1981.

PG and Research Department of Physics
2022-2023

Sem	Paper	Title of the Paper	Hours/ Week	Credits	Marks	
					CA	Sem
V	Main Core	Classical mechanics and Statistical Physics	4	4	50	50
	Main Core	Semiconductor devices and their Applications	4	4	50	50
	Main Core	Solid State Physics	4	4	50	50
	Main Core	Mathematical Physics	4	4	50	50
	Main Core	Physics Main Practicals – III(General experiments)	3	3	50	50
	Main Core	Physics Main Practicals – IV(Electronic experiments)	3	3	50	50
	Subject Elective	1. Nanomaterials and their applications 2. Electronic communication systems 3. Renewable Energy and Energy Harvesting	3	2	50	50
	Subject Elective	1. Programming in C 2. 8085 Microprocessor and its applications 3. Medical Physics	3	2	50	50
	Self-Study Paper	1. Astrophysics 2. Laser Physics and Fiber Optics	–	1*	100	
	Non-Major Elective	Offered by other departments	2	1	100	
TOTAL			30	27+1*		

Sem	Paper	Title of the Paper	Hours/ Week	Credits	Marks	
					CA	Sem
VI	Main Core	Applied Electronics	5	5	50	50
	Main Core	Nuclear and Particle Physics	5	5	50	50
	Main Core	Quantum Mechanics and Relativity	4	4	50	50
	Main Core	Physics Main Practicals – III (General experiments)	2	2	50	50
	Main Core	Physics Main Practicals – IV (Electronic experiments)	2	2	50	50
	Subject skill	Electrical circuits and Networks	5	4	50	50
	Subject skill	Basic Instrumentation	5	4	50	50
	Self-Study Paper	Physics Revisited	–	1*	100	
	Non-Major Elective	Offered by other departments	2	1	100	
Total			30	27+1*		

Paper	Sem	Title of the Paper			Marks

			Hours/ Week	Credits	CA	Sem
Non-Major Elective	V	Repair and Maintenance of Household Appliances (offered by Physics department to other department students)	2	1	100	
Non-Major Elective	VI	Physics in Everyday Life (offered by Physics department to other department students)	2	1	100	

Evaluation pattern

(11) For Main core theory papers, Subject elective papers, Allied Physics theory papers and Non major elective papers

Component	Marks
CA	50
End semester exam	50
Total	100

CA components

Component	Marks
2 CA tests	30
MCQ(Quiz)/Assignment/ Problem solving / Open book test /Seminar	15
Attendance	5
Total	50

- In the CA components, 2 CA tests, Online quiz with multiple choice questions and attendance component are mandatory. Other components are optional and left to the discretion of the course teacher.

(12) Evaluation patterns for Practicals (B. Sc. Physics and Allied Physics Practicals)

Component	Marks
CA	50
Practical exam	50
Total	100

CA components

Component	Marks
Lab performance(preparation, performance, calculation, results)	20
2 CA tests	20

Record	10
Total	50

(13) For Subject skill papers

Subject skill papers will be evaluated purely internally by the respective course teachers.

Component	Marks
Theory	50
Practicals	50
Total	100

Evaluation pattern for the Subject skill theory papers

Component	Marks
CA	20
Semester exam	30
Total	50

CAcomponents

Component	Marks
2 CA tests	10
Assignment/ Problem solving /MCQ(Quiz)/ Open book test /Seminar	5
Attendance	5
Total	20

- In the CA components, 2 CA tests, Online quiz with multiple choice questions and attendance component are mandatory. Other components are optional and left to the discretion of the course teacher.

Evaluation pattern for the Subject skill practicals

Component	Marks
CA components (Viva, Circuit fault finding, Circuit analysis, Quiz, Mini projects etc.)	20
Practical exam	30
Total	50

(14) For self study papers

Self study papers will be evaluated **purely internally** by the respective course teachers for 100 marks. A minimum of 40% marks is essential for the award of extra credit(One extra credit per self study paper passed).

(15) For extra credits courses

For the extra credits course, Special Project- I, students may do a physics project of their choice. On completion of the project the students should submit a project report. The project report submitted by the student will be evaluated by a team of two staff members appointed by the Head of the department. Based on their evaluation report, the students may or may not be awarded extra credits (maximum : 2 credits).

For the extra credits course, Special Project- II (Repair and maintenance of lab equipments), the students may choose some faulty equipment in the lab, identify the faults or problems in the equipments and rectify them. If the student rectifies the faults in the instrument and has spent a minimum of 20 hours in repairing the instrument, then based on their performance the staff in charge / HoD/ lab director may recommend extra credits (maximum : 2 credits) for the students.

NPTEL online courses: Students may enroll themselves in government approved online courses (NPTEL, MOOC, SWYAM etc). A student will be awarded 1 extra credit on the submission of the original pass certificate of an approved one credit online course and he/she will be awarded 2 extra credits on the submission of the original pass certificate of an approved two credits online course.

Internship : Students can obtain 2 extra credits by undertaking Summer Internship for a minimum duration of 25 days at the end of IV Semester.

Guidelines for Internship Program for Undergraduate Students

17. Internship programme(in IV semester) is optional (extra credit course) for B. Sc. Physics students.

18. Students may go for internship during summer vacation in IV semester.

19. Interested students should arrange for internship by themselves.

20. Students should go to an Institute/Industry for a period of minimum two weeks and carry out a project/ undergo training.

21. Before undertaking the internship the students should submit the following to the department

    - the Confirmation Letter / Email from the institute/industry
    - the letter of consent from the parents

22. After completing the internship the students should submit the following to the department

    - training/project report
    - attendance certificate from industry/organization

23. The Project/training report will be evaluated by the II B. Sc. Physics class teacher.

24. List of students who have completed the internship and who are eligible for extra credits will be issued by department to COE.

Question Paper Pattern for Semester Exam

(5) For Main Core theory papers(except Mathematical Physics and Subject Elective papers) and Allied Physics theory papers

Maximum marks : 100

Section A (10 x 2 = 20 Marks)

Ten short answer questions in which a minimum of two questions should be problems. Each question carries 2 marks. There should be two questions from each unit.

Section B (5 x 7 = 35 Marks)

Five either or type questions. Each question carries 7 marks. There should be one question from each unit. At least one subdivision (a or b) of any one of the questions should be a problem.

Section C (3 x 15 = 45 Marks)

Answer any Three out of Five essay type questions. Each question carries 15 Marks. There must be one question from each unit.

(6) For Mathematical Physics and Subject Elective papers:

Maximum marks : 100

Section A (10 x 2 = 20 Marks)

Ten short answer type questions. Each question carries 2 marks. There should be two questions from each unit.

Section B (5 x 7 = 35 Marks)

Five either or type questions. Each question carries 7 marks. There should be one question from each unit.

Section C (3 x 15 = 45 Marks)

Answer any Three out of Five essay type questions. Each question carries 15 Marks. There must be one question from each unit.

Question Paper Pattern for CA test

For Main Core theory papers, subject elective papers and Allied Physics theory papers

Maximum marks : 50

Section A (6 x 2 = 12 Marks)

Six short answer type questions in which a minimum of two questions should be problems. Each question carries 2 marks.

Section B (3 x 6 = 18 Marks)

Three either or type questions. Each question carries 6 marks.

Section C (2 x 10 = 20 Marks)

Answer any Two out of Three essay type questions. Each question carries 10 marks.

Classical Mechanics and Statistical Physics

Semester :V **Hours/ Week :4**
Course Code: P534 **Credits: 4**

Objectives

- To revise Newtonian mechanics and introduce Lagrangian formulation of mechanics.
- To learn Hamilton's principle and Hamiltonian formulation of mechanics.
- To realize the reduction of a two-body problem to a one-body problem in a central force system.
- To understand the properties of macroscopic systems using the knowledge of the properties of individual particles.
- To know about classical and quantum statistics and their applications.

Learning outcomes

Sl. No.	Course outcomes	Knowledge level
	On successful completion of the course, the students will be able to	
CO1	Identify the motion of mechanical systems and apply the Lagrangian formalism to generate equations of motion for them.	K1, K3
CO2	Apply the knowledge of Hamilton's principle to solve physical problems, including simple pendulum, compound pendulum, linear harmonic oscillator.	K3, K4
CO3	Determine the differential equation of orbit, stability of orbit under central force field	K5
CO4	Understand concepts of statistical mechanics and find the connection between statistics and thermodynamics	K2, K1
CO5	Differentiate between classical statistics and quantum statistics	K3
CO6	Solve some problems like monoatomic gas, photon gas and electron gas and find the energy distribution of them using statistical distribution laws.	K6, K1

Mapping of CO with PO and PSO

CO	Program outcome							Program specific outcome					Mean score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	3	2	2	3	2	3	2	3	2	2	3	2	2.4
2	2	3	2	3	3	2	1	3	3	3	2	2	2.5

3	3	2	3	2	3	1	3	2	3	3	3	3	2.5
4	2	1	2	3	2	1	1	3	2	2	2	2	1.9
5	2	3	1	3	2	2	2	3	3	3	2	2	2.4
												Mean overall score	2.4
												Result	High

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Classical Mechanics

Unit – I: Lagrangian Formulation and Applications

Conservation laws – Constraints – degrees of freedom – generalized co–ordinates – principle of virtual work – D'Alembert's principle – Lagrangian function – Lagrange's equation from D'Alembert's principle – applications: simple pendulum, compound pendulum and Atwood's machine.

Unit – II: Hamiltonian Formulation and Applications

Hamilton's principle – physical significance of the Hamiltonian function – Hamilton's canonical equations of motion from Hamilton's principle – Lagrange's equation from Hamilton's principle – applications of Hamilton's equations: simple pendulum, linear harmonic oscillator, motion of a disc.

Unit – III: Central Force Motion

Central force field – self energy motion of a particle under central force field – general properties of central force motion – two body central force problem – reduction to one body problem – central force and angular momentum -motion in an inverse square law force field–Virial theorem– first integrals – Lagrangian analysis –Kepler's problem: inverse square law of force.

Statistical Mechanics

Unit – IV: Classical Statistics

Phase space – microstate and macro state – ensembles – different types of ensembles – density of states – statistical postulates – entropy and thermo dynamical probability – Maxwell-Boltzmann distribution law – Application of Maxwell-Boltzmann distribution law to a mono atomic gas – average, RMS and most probablevelocities.

Unit – V: Quantum Statistics

Bose-Einstein distribution law – application of Bose - Einstein distribution law to photon gas (Black body radiation) – Fermi-Dirac distribution law – application of Fermi- Dirac distribution law to electron gas – Fermi energy – Fermi function – comparison of M-B, B-E and F-Dstatistics.

Books for study

1. G. Aruldhas, Classical Mechanics, Prentice–Hall of India Pvt. Ltd, NewDelhi,2008.
2. Brijlal, N. Subramanyam, Thermal and Statistical physics, S. Chand & Company Ltd, New Delhi, 2012.
3. S. L. Gupta, V. Kumar, Statistical mechanics, Meerut, PragatiPrakashan,2008.
4. Kamal Singh, S.P. Singh, Elements of Statistical mechanics, S. Chand & Company Ltd, New

Delhi,2021.
5. K. N. SrinivasaRao: Classical Mechanics, University Press, 2002.
6. K.C Gupta classical mechanics of particles and rigid bodies, wiley eastern , 2018.

Books for reference

1. Goldstein Poole &Safko, Classical Mechanics, 3rd Edition, Addison wesley Pvt. Ltd., 2011.
2. Gupta, Kumar and Sharma, Classical Mechanics, Meerut, PragatiPrakashan,2012.
3. K. SankaraRao, Classical Mechanics, Prentice – Hall of India (P) Ltd, New Delhi, 2005.
4. Palash B. Pal, An Introductory Course of Statistical Mechanics, Narosa Publishers, New Delhi,2008.
5. R. B. Singh, A primer of Statistical Mechanics, New Age International (P) Ltd, New Delhi,2006.

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http://www.cmi.ac.in/~souvik/books/mech/Goldstein.pdf/
http://www.colorado.edu/physics/EducationIssues/ClassicalMechanics/materials.html/
http://isites.harvard.edu/course/colgsas–2068/
http://ocw.mit.edu/courses/physics/
http://ocw.mit.edu/courses/physics/8–333–statistical–mechanics–i–statistical– mechanics–of–particles–fall–2013/
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Semiconductor Devices and their Applications

Semester– V **Hours/week : 4**
Course Code: P535Credits : 4

Course Objectives

- To introduce diodes and their types along with their applications
- To provide an overview of the principles, operation and applications of FET, MOSFET, UJTand SCR.
- To Provide an overview of small signal and large signal amplifiers.
- To Inculcating basic concepts about oscillators, their construction and working.
- To introducean operational amplifier and their linear and non–linear applications.

Learning Outcomes

Sl. No.	Course outcomes On successful completion of the course, the students will be able to	Knowledge level
CO1	explain the implications of characteristics of various types of diodes and different rectification process.	K2,K4,K5
CO2	acquiring knowledge on Fabrication of a transistor, JFET, MOSFET, UJT and SCR	K1
CO3	demonstrate the basic concept behind the working of a transistor amplifier, and able to explain the working of R-C coupled amplifier and calculate the gain of multistage amplifiers.	K2,K3

CO4	demonstrate the basic concept behind the working of anoscillator and multivibrators.	K2,K3
CO5	solving various mathematical operations like summing, difference, integrators, differentiators, sign changersetc.,using operational amplifier	K3,K6

Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	2	2	2	3	2	2	3	3	3	3	2	2	2.4
2	3	3	2	3	2	2	3	3	3	3	2	2	2.6
3	3	3	2	3	2	2	3	3	3	2	2	2	2.5
4	3	3	2	2	3	2	3	3	2	2	3	2	2.5
5	3	3	2	3	3	2	3	2	3	2	3	2	2.6
Mean Overall Score													2.5
Result													High

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit – I: **Diodes and their applications**

Diodes – PN junction diode - Photodiode (working and characteristics) –Avalanche diodes –Tunnel diode –Tunnel diode as switch -Diode rectifiers – Half wave, Center-tap full wave and full wave bridge rectifiers –efficiency – ripple factor — clipping andclamping circuits.

Unit–II: Transistors

JFET- biasing – characteristics – parameters – MOSFET – types- E MOSFET – construction and working of n-channel E–MOSFET – depletion MOSFET– construction and working of n-channel D-MOSFET– UJT – construction and working –characteristics – SCR - construction and working – characteristics.

Unit – III: **Amplifiers**

Small signal amplifiers:Amplifier- Faithful amplification – transistor biasing: voltage divider method – – two stage RC coupled amplifiers - decibel gain,bandwidth and GBW product –Multistage amplifier - GBW calculations for multistage amplifiers – Emitter follower.

Large signal amplifiers:Audio Power amplifiers –Classification - transformer coupled - class A power amplifier –difference between voltage and power amplifiers-Thermal runaway- heat sinks.

Unit – IV: **Oscillators**

Feedback amplifiers – types of feedback – Barkhausen criteria – Oscillators – Types of oscillators - Colpitts and Wien bridge oscillators - Construction ,working, expressions for frequency and conditions for oscillations – Multivibrators –Astable and Bistablemultivibrators – UJT relaxation oscillator.

Unit – V: **Operational Amplifiers**

Characteristics of ideal op. amp –CMRR – non-inverting amplifier – Inverting amplifier – applications – sign changer–scale changer – inverting adder – subtractor – integrator – differentiator – analoguecomputation: Solving simultaneous linear equation – solving second order differentialequation.

Books for study

1. V. K. Mehta, Principles of Electronics, S. Chand & Co. Ltd., New Delhi, 2017.
2. Atul P. Godse, Deepali A. Godse, Electronic Circuits, Technical Publications, Pune, 2009.
3. Ramakant A. Gayakwad, Op-Amps and Linear Integrated Circuits, Third impression, PHI Learning Private limited, New Delhi, 2016.

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1. J. Millman and C. Halkias, Integrated Electronics, Tata McGraw Hill, New Delhi, 2016.
2. Thomas L. Floyd, Electronic Devices, Kindersley (India) Pvt. Ltd., New Delhi, 2003.
3. Charles A. Schuler, Roger L. Tokheim, Electronic Principles and Applications, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
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6. Allen Mottorshead, Electronic Devices and Circuits, PHI Learning Private limited, New Delhi, 2011.
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https://www.electronics-tutorials.ws/oscillator/wien_bridge.html
https://electricalvoice.com/antilog-amplifier-circuit-applications/

Solid State Physics

Semester– V **Hours/week: 4**
Course Code : P536 **Credits: 4**

Objectives

- To impart knowledge on crystalline and amorphous substances, reciprocal lattice, cubic crystal structures, and X-ray diffraction.
- To analyse and understand the lattice vibrations and to learn Einstein and Debye theories of specific heat of solids.

- To understand various types of magnetic materials and to learn, their theories.
- To learn about dielectric materials, their properties and applications.
- To understand the basic concept of band theory of solids, classifications of solids based on band gap and explain superconductivity.

Learning outcomes:

Sl. No.	Course outcomes On successful completion of the course, the students will be able to	Knowledge level
CO1	Differentiate between crystalline and amorphous materials, understand the concept of reciprocal lattice, compare different crystal structures and the explain x-ray diffraction.	K4 , K5
CO2	Comprehend lattice vibrations and apply it to explain Einstein and Debye theories of specific heat of solids.	K2, K3
CO3	Discriminate between various types of magnetic materials and formulate theories to explain the origin of magnetic properties.	K5, K6
CO4	Describe polarization mechanism and outline theories of polarization.	K1
CO5	Understand the basic concepts of band theory of solids, classify solids based on band gap and expain the phenomenon of superconductivity.	K2, K4

Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	3	3	2	2	3	2	3	3	2	3	2	2	2.5
2	3	3	3	2	2	3	2	3	2	2	3	3	2.6
3	3	2	3	3	2	3	2	2	2	3	2	3	2.5
4	3	3	3	2	3	3	3	3	2	2	3	2	2.7
5	3	3	2	2	3	3	2	3	2	3	3	2	2.6
Mean Overall Score													2.6
Result													High

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit–I: Crystal Structure

Solids – amorphous and crystalline materials – lattice translation vectors – unit cell – primitive cell – reciprocal lattice-properties – Miller indices – packing factor – SC – BCC – FCC structures – Coolidge tube – Bragg's law.

Unit–II: Elementary Lattice Dynamics

Lattice vibrations and phonons – acoustical and optical phonons – qualitative description of the phonon spectrum in solids – specific heat capacity – Dulong and Pettit's law – Einstein and Debye theories of specific heat of solids.

Unit–III: Magnetic and Ferroelectric Properties of Matter

Paramagnetic materials-quantum mechanical treatment of paramagnetism – Curie's law – Weiss's theory of ferromagnetism – ferromagnetic domains – discussion of B-H curve –ferrites and their applications

Ferroelectric, Piezoelectric, Pyroelectricproperties of crystals-Ferroelectric domains-PE hysteresis loop.

Unit–IV: Dielectric Properties

Polarization – dielectric constant – local electric field at an atom – depolarization field – electric susceptibility – polarizability – Clausius-Mosotti equation – frequency and temperature dependence of polarization – classical theory of electronic polarizability – Langevin-Debye equation

Unit–V: Elementary band theory and Superconductivity

Elementary band theory: Bandgaps-Conductors – semiconductors and insulators-Conductivity of Semiconductors-mobility – Hall Effect – Hall coefficient-experiment.

Superconductivity: Experimental results – critical temperature – critical magnetic field – isotope effect – Meissner effect – type I and type II superconductors – bound electron pairs-BCS theory – London's equations – penetration depth-applications.

Books for study

1. Charles Kittel, Introduction to Solid State Physics, Wiley & Sons, New York, 1996.
2. A. J. Dekker, Solid State Physics, McMillan & Co, New Delhi, 2002.
3. S.O. Pillai, Solid State Physics, New age international publishers, New Delhi, 2003.

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1. J.P. Srivastava, Elements of Solid State Physics, 2nd edition, Prentice–Hall, India, 2006.
2. Leonid V. Azaroff, Introduction to Solids, Tata Mc–Graw Hill, 2004.
3. Neil W. Ashcroft, N. David Mermin, Solid State Physics, Cengage Learning, 1976.
4. Rita John, Solid State Physics, McGraw Hill, 2014.
5. H. Ibach, H Luth, Solid State Physics, Springer, 2009.
6. M. Ali Omar, Elementary Solid State Physics, Pearson, India, 1999.
7. M.A. Wahab, Solid State Physics, 3rd Edition, Narosa Publications, Reprint 2020.

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http://www.eng.utah.edu/~lzang/images/lecture-11.pdf
http://nptel.iitm.ac.in/courses/103104045/pdf_version/lecture20.pdf
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https://www.phybarik.com/2020/10/phonon-spectrum-in-solids.html
https://www.electrical4u.com/comparison-of-type-i-and-type-ii-superconductors/

Mathematical physics

Semester : V **Hours/Week : 4**
Course Code: P537 **Credits : 4**

Objectives

- To develop an understanding of vector differentiation and vector integration.
- To make the students familiarize with orthogonal curvilinear coordinates and vector spaces.
- To understand the Beta, Gamma and Dirac–Delta function.
- To impart the basic knowledge on Fourier series and its Applications.
- To familiarize partial differential equations and the applications of partial differential equations.

Learning Outcomes

Sl. No.	Course outcomes On successful completion of the course, the students will be able to	Knowledge level
CO1	Acquire a knowledge of vector differentiation and vector integration and will be able to apply their knowledge to solve problems in vector differentiation and vector integration.	K1 , K3
CO2	Understand the concepts of orthogonal curvilinear coordinates, linear independence, basis and dimension and apply these concepts to various vector spaces and subspaces.	K2, K3
CO3	Understand, analyze and solve problems on beta, gamma and Dirac delta functions.	K2, K3, K4
CO4	Comprehend and explain Fourier series, enumerate its importance and applications in physics.	K2, K1
CO5	Evaluate higher order partial differential equations by the method of separation of variables.	K5

Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	2	3	2	3	2	3	2	3	3	3	2	2	2.31
2	3	2	2	3	2	3	2	3	3	3	2	2	2.31
3	3	2	2	3	3	3	2	3	3	3	3	3	2.54
4	3	3	3	3	3	3	2	3	3	3	3	2	2.62
5	3	2	3	2	3	3	2	3	3	3	3	2	2.46
												Mean Overall Score	2.45
												Result	High

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5

Create	5	5	5

Unit – I: Vectors – I

Vector differentiation : Vector Function – gradient of a scalar field - Geometrical meaning of gradient – divergence of a vector field – Physical interpretation of divergence – curl of a vector field – Physical meaning of curl- Problems on gradient, divergence and curl – vector identities (formula only)

Vector integration: introductionto line, surface and volume integrals - Stoke's theorem (relation between line and surface integrals) Gauss's divergence theorem (relation between surface and volume integrals) – Green's theorem (using Gauss's divergence theorem) – Green's theorem for a plane – Green's theorem for area of the plane

Unit – II: Vectors – II

Orthogonal curvilinear coordinates: differential operators (gradient, divergence, Laplacian and curl) in terms of orthogonal curvilinear coordinates – differential operators (gradient, divergence, Laplacian and curl) in terms of spherical polar and cylindrical coordinates.

Vector spaces: Definition – examples of vector spaces – isomorphism of vector spaces- sub space -Basis and expansion-inner product – Schwarz inequality

Unit – III: Beta, Gamma and Dirac–Delta function

Beta function: definition - evaluation of beta function - symmetry property of beta function – transformation of beta function - Problems

Gamma function: definition - evaluation of gamma function - transformation of gamma function – relation between beta and gamma function – Problems

Dirac–Delta function – representations of Dirac Delta function – properties of Delta function – Fourier transform delta function – Laplace transform delta function

Unit–IV: Fourier series

Periodic functions – evaluation of Fourier coefficients – Dirichlet's conditions (statement only) – even and odd functions and their Fourier expansions – complex representation of Fourier series – Applications: half wave rectifier- full wave rectifier - Square wave – saw tooth wave – triangular wave

Unit – V: Partial Differential Equations

Partial Differential equations of the 1^{st}, 2^{nd} and higher order (introduction only) – Examples of Partial Differential equations (Laplace equation, Poisson equation, Diffusion equation, classical & quantum wave equations and KG equation) –Application of Partial Differential equations: solution of Laplace equation in Cartesian coordinates (method of separation of variables) – solution of Laplace equation in two dimensional cylindrical coordinates (circular harmonics) – solution of Laplace equation in spherical polar coordinates (Spherical harmonics) – Surface Zonal harmonics – variable linear flow in finite and infinite bar **–** Heat flow in circular plate.

Books for study

1. P. Satya Prakash, Mathematical Physics, S. Chand & Company Ltd, New Delhi, Sixth edition 2014.
2. H. K. Dass, Mathematical Physics, Sultan Chand and company, New Delhi, Eighth Edition - 2019.
3. B. D. Gupta, Mathematical Physics, Vikas Publishing House (P) Ltd., U.P, Fourth Edition – 2019

4. M. C. Jain, Vector spaces and Matrices in physics, Narosa Publication, New Delhi, Second edition- 2008.
5. Murray R. Spiegel, Schaum's Outline of Fourier Analysis With Applications to boundary value problems, McGraw-Hill, New York, 1974
6. B.S. Rajput, Mathematical Physics, Meerut, Pragati Prakashan Publishers, Meerut, 2019.

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1. Suresh Chandra, A text book of Mathematical Physics, Narosa Publication, New Delhi, Second edition- 2009
2. R. Murugeshan, Mechanics and Mathematical methods, S.Chand & Company Ltd, New Delhi, 2003.
3. G. B. Arfken and J. Weber, Mathematical methods for physicists, Elsevier academic press, 2005.
4. E. Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt Ltd, New Delhi, 2015
5. K. F. Riley, H. P. Hobson and S. J. Bence, Mathematical methods for physics and Enginnering, Cambridge university press, USA, 2006.
6. Mary L. Boas, Mathematical Method in the physical sciences, John Wiley & Sons (Asia), Pte Ltd, Singapore, Third Edition, 2006
7. Charlie Harper, Introduction to Mathematical Physics, Prentice–Hall Pvt. Ltd., New Delhi, 1993.

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https://www.khanacademy.org/math/linear-algebra/vectors-and-spaces
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Subject Elective I: Nanomaterials and their applications

Semester: V **Hours/week: 3**
Course Code:P538A **Credits: 2**

Objectives :

- To know the fundamentals of nanotechnology.
- To learn about various physical methods to synthesis nanomaterials.
- To familiarize the students regarding the preparation of nanomaterial by different chemical methods.
- To acquaint the importance of carbon and their various forms.
- To develop an understanding among students about the various applications of nanotechnology.

Learning outcomes

Sl. No.	Course outcomes	Knowledge level
	On successful completion of the course, the students will be able to	

CO1	explain the origin and emergence of nanotechnology and also able to relate different nanostructures with each other.	K1.K3
CO2	summarize and compare the electrical, vibrational and mechanical properties of nanomaterials	K2,K4,K5
CO3	prepare the nanomaterials by various physical and chemical methods.	K6
CO4	classify and compare carbon nanostructures and their properties.	K4,K5
CO5	summarize the importance of nanomaterials and evaluate its applications in different fields.	K2,K4,K5

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)							Programme Specific Outcome (PSO)					Mean score of CO
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	2	2	3	3	3	3	2	2	2	3	2.5
CO2	3	2	2	3	3	3	3	3	2	3	3	3	2.8
CO3	3	2	2	2	3	3	3	3	2	2	3	3	2.6
CO4	3	2	2	2	3	3	3	3	2	2	3	3	2.6
CO5	3	3	2	2	3	3	3	3	2	3	3	3	2.8
Mean Overall Score													2.7
Results													High

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit – I: Introduction to Nanomaterials

Historical perspective – bulk to nano transition – top-down and bottom up approaches –Classifications: Nanoparticles – 0D (Quantum Dots), 1D, 2D and 3D –size dependent properties: mechanical properties – elastic behavior – hardness and strength – electrical – dielectric – optical – thermal and magnetic properties.

Unit – II: Synthesis: Physical Methods

Thermal evaporation – spray pyrolysis – Molecular beam epitaxy – microwave heating Physical vapour deposition – sputtering – Ball milling technique – Advantages and disadvantages of physical methods.

Unit – III: Synthesis: Chemical Methods

Coprecipitation – Sol-gel – Solvothermal/Hydrothermal – Chemical vapour deposition – sonochemical synthesis – Electro chemical synthesis – Advantages and disadvantages of chemical methods.

Unit – IV: Nanotubes

New form of carbon – Fullerenes – C^{60} – types of carbon nanotubes – graphene sheet to single walled nanotubes – electronic structure of carbon nanotubes – Synthesis, properties and applications of CNTs.

Unit – V: Applications of Nanomaterials

MEMS – Robots –NEMS –Electrochemical sensor –bio sensor– LED and photovoltaic devices – fuel cells and display devices –Durg Delivery systems: Targeted drug delivery for tumor.

Books for study

1. T.Pradeep et al., A Textbook of Nanoscience and Nanotechnology,Tata McGraw Hill,New Delhi, 2012.
2. G. Cao, Nanostructures and Nanomaterials,Imperial College Press, London, 2004.
3. S. Shanmugam, Nanotechnology, Chennai, MJP Publishers, 2010.
4. K. K. Chattopadhyay, A. N. Banerjee, Introduction to Nanoscience and Technology, New Delhi, PHI learning Pvt. Ltd., 2009.

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1. Masuo Hosokawa, Kiyoshi Nogi, Makio Naito, Toyokazu Yokoyama, Nanoparticle Technology Handbook, Linacre House, Jordan Hill, 2007.
2. A. K. Bandyopadhyay, Nanomaterials, New Delhi, New Age (P) Ltd., 2009.
3. T. Pradeep, Nano: The Essentials, New Delhi, Tata McGrawHill Publishers Company Ltd., 2007.
4. R.W. Kelsall, I.W. Hamley and M. Geoghegan, Nanoscale Science andNanotechnology (John-Wiley & Sons, Chichester, 2005.
5. C.P. Poole and F.J. Owens, Introduction to Nanotechnology,Wiley, New Delhi, 2003.
6. H.S. Nalwa, Nanostructured Materials and Nanotechnology,Academic Press, SanDiego, 2002.
7. M. Wilson, K. Kannangara, G. Smith, M. Simmons, B. Raguse, Nanotechnology:Basic Science and Emerging Technologies,Overseas Press, New Delhi, 2005.

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https://en.wikipedia.org/wiki/Carbon_nanotube
https://www.nanowerk.com/nanotechnology/introduction/introduction_to_nanotechnology_22.php
https://www.youtube.com/watch?v=sbuIluJhT4A
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https://www.youtube.com/watch?v=kdb6dHEHCA0
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Subject Elective – I: Electronic Communication Systems

Semester– V **Hours/week: 3**
Course Code: P538B **Credits: 2**

Course Objectives

- **To provide a knowledge on fundamentals of electronic communication, electromagnetic spectrum and its applications.**
- To learn about the principles of various analog and digital modulation techniques.
- To impart knowledge on cellular communication system and recent advances in mobile communication systems.
- To make the students to understand the principles involved in fiber optic communication system and radar.
- To explore the roles of microwaves and Satellites in electronic communication

Learning outcomes

Sl. No.	Course outcomes On successful completion of the course, the students will be able to	Knowledge level
CO1	Understand the fundamentals of electronic communication, distinguish different regions of electromagnetic spectrum and describe their applications.	K2 , K1
CO2	Compare different modulation techniques and appraise their advantages and importance.	K5, K4
CO3	explain the operation of cellular communication system and compare GSM and CDMA.	K2, K5
CO4	Demonstrate their knowledge on fiber optic combination system and describe the working of radar and its applications.	K3, K1
CO5	understand and formulate the role of microwaves and satellites in electronic communication.	K2, K6

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)							Programme Specific Outcome (PSO)					Mean score of CO
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	1	3	1	2	2	3	3	3	2	2	2.2
CO2	3	2	1	3	2	2	2	3	3	3	2	2	2.3
CO3	3	2	1	3	2	2	2	3	3	3	2	2	2.3
CO4	3	2	1	3	2	1	2	3	3	3	2	2	2.2
CO5	3	2	1	3	2	1	2	3	3	3	2	2	2.2
Mean Overall Score													2.2
Results													High

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit–I: Fundamentals of Electronic Communication

Line communication – Wireless communication – Types of electronic communication Simplex -Half duplex – Full duplex – Elements of electronic communication system Transmitter – Channel – Receiver – Bandwidth – Noise – Signal – Analog and digital signal -Decibel – Signal–to – noise ratio–Electromagnetic Waves – Electromagnetic spectrum – Extremely low frequencies – Voice – Very low – Ultra high – Super high frequencies – Radio waves – Wave propagation –Ground waves – Space waves – Ionospheric layers – Sky waves – Critical frequency and critical angle – Multiple hop transmission–Skip distance – Maximum usable frequency.

Unit–II Modulation techniques

Analog Modulation :Need for modulation – Amplitude Modulation,- modulation index side bands – Frequency Modulation – Phase Modulation–comparison of AM,FM and PM – Channel capacity, band width - Sampling theorem (statement) -Multiplexing

Digital modulation: Types- Pulse Code Modulation– Sampling, Quantization and Encoding – Concept of Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK) – Phase Shift Keying (PSK), and Binary Phase Shift Keying (BPSK)-Applications of modulation techniques

Unit – III: Cellular Communication

Concept of cellular mobile communication – cell and cell splitting, frequency bands used incellular communication, absolute RF channel numbers (ARFCN), frequency reuse, Call hand off, authentication of the SIM card of the subscribers, IMEI number, concept of data encryption, architecture (block diagram) of cellular mobile communication network, CDMA technology, block diagram of cellular phone handset, Comparative study of GSM and CDMA, 2G, 3G and 4G concepts.

Unit – IV: Fiber optic, Radar and Internet communication

Optical fiber – classifications – acceptance cone half angle – numerical aperture – Losses inOptical fibers - fiber optic communication system – Advantages and disadvantages of OFC over metallic cables -Radar system-Types - Elements of a Radar System(Pulse Radar)– Radar equation – Radar Performance Factors – Radar Transmitting Systems – Radar Antennas– Radar Receivers and Indicators –

Internet– Internet service provider – Internet addressing–Internet applications: Concepts of E-mail – World Wide Web – E-commerce – On-line services – Bluetooth-wifi.

Unit – V: Microwave and Satellite Communication

Microwaves – Wave guides – Types of wave guides – Traveling wave tubes – Microwave antennas – Horn antenna – Parabolic antenna.

Satellites – Natural and Artificial satellites –active satellites – Passive satellites – Satellite spacing – Orbit fundamentals – Types of orbits – Effect of solar eclipse, path loss - Station

keeping – Attitude control – Tracking -Subsystems of a communication satellite block diagrams - Principles of satellite communication –simplified block diagram of earth station – Advantages of satellite communication – Applications of satellite communication-Concept of DTH.

Books for study

1. Louis E. Frenzel, Communication Electronics Principles and Applications, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2002.
2. Wayne Tomasi,Electronic communication systems,Pearson publications, New Delhi,2011.
3. William Schwebar, Electronic communication systems A complete course, Prentice Hall of India Pvt. Ltd., New Delhi, 2002.

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1. Dennis Roddy, John Coolen, Electronic communication, Prentice Hall of India Pvt. Ltd., New Delhi,2002.
2. Roy Blake, Wireless communication Technology, Eastern Press Pvt.Ltd., Bangalore,2001.
3. M. Mukundarao, Optical communication, Universities Pres Ltd., Hyderabad, 2000.
4. Dennis Roddy, Satellite communications, McGraw Hill Publishing International edition, New Delhi,2001.
5. Maroon cole, Introduction to Telecommunication: Voice, data and Internet, New Age Publishers, New Delhi, 2002.
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Subject Elective - I: Renewable Energy and Energy Harvesting

Semester– V **Hours/week: 3**
Course Code:P538C Credits: 2

Course Objectives:

1. To make the students to understand the importance of fossil fuels, conventional energy resources.
2. To provide a complete idea of basic components of a typical solar collectors and its applications in the solar energy absorption equipment's.
3. To make the students to analyze the dissimilarity between Horizontal axis and vertical axis WECS.
4. To enable the students to comprehend the concept behind various energy sources including biomass, tidal energy and hydrogen energy.

5. To give a basic knowledge about various methods of energy harnessing, storage systems and distribution.

Learning Outcomes

Sl. No.	Course outcomes	Knowledge level
	On successful completion of the course, the students will be able to	
CO1	Explain the basic ideas on commercial and non-conventional energy resources and illustrate their availability.	K2, K4, K3
CO2	Explain the construction and designing of solar collectors and its implementation in the solar energy equipments.	K2, K4, K6
CO3	Demonstrate the variance in the operation of vertical axis and horizontal axis WECS and its installation towards power production.	K3, K6, K5
CO4	Infer the knowledge on various energy sources including ocean, tidal and biomass conversion technologies.	K1, K2, K4
CO5	Realize the need of energy harvesting and describe the methods of storage systems to achieve the sustainability in the energy sector.	K1, K2, K5

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)							Programme Specific Outcome (PSO)					Mean score of CO
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	2	1	1	3	2	3	2	1	2.0
CO2	2	2	3	2	3	2	2	3	2	2	3	2	2.3
CO3	3	2	2	2	2	2	3	2	3	2	2	2	2.2
CO4	2	3	3	2	3	2	2	2	2	2	3	2	2.4
CO5	3	2	2	3	2	2	2	2	3	2	2	2	2.2
Mean Overall Score													2.2
Results													High

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit– I: Conventional and Alternate Sources of energy

Conventional energy sources -Fossil fuels– types and its limitations – Nuclear Energy – Advantages and disadvantages -working of thermal power plant, hydropower plant and nuclearpower plant – Need of alternative energy -Non conventional energy sources –Types- Present scenario in India and Worldwide

Unit–II: Solar energy and its applications

Significance of Solar energy – solar constant– solar energy collector – Types –Liquid Flat plate collector and concentrating collector – storage of solar energy – applications of solar energy – solar water heater — solar pump – solar cell-Solar panel(concept) .

Unit– III: Wind Energy and its applications

Wind energy - Wind mill – Power from the wind – site selection for the installation – Principle and operation of WECS – Types – advantages and disadvantages – Energy storage – Applications of wind energy.

Unit– IV: Other Energy Sources

Biomass – Types – conversion technologies – wet process – photosynthesis – Biogas – Biogas plant – Types – KVIC – Biogas from plant wastes – Geothermal Resources – Energy from the ocean –OTEC(open and closed cycle) –tidal energy–basic principles – hydrogen energy – production and storage

Unit– V: Energy storage and Distribution

Energy storage systems – Mechanical – electrical – chemical – electromagnetic – thermal – biological – Carbon captured technologies -Electric Energy Transfer and Control – energy loss during transfer – methods to minimize the losses- power consumption – Environmental issues –sustainability — energy costing

Books for study

1. S. P. Sukhatme, Solar Energy, Principles of thermal collection and storage, TataMc.GrawHills, New York, 1996.
2. G. D. Rai, Non conventional sources of Energy, Khanna publishers, New Delhi, 1996.
3. Kothari, Renewable energy sources and Emerging technologies, Prentice Hall India Learning Private Limited; 2 edition, 2011.
4. Dr.Niranjan Sahu " A handbook of Renewable energy and energy harvesting" ,KAAV Publications , 2017

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1. D. Yogi Gowswami, Principles of solar engineering, 3rd edition,CRC Press, 2015.
2. John Twidell and Tony weir, Renewable energy resources, 2005,2 edition, Routledge.
3. Frank Kreith, D. Yogi Gowswami Energy conversion, CRC Press, 2007.
4. G.N.Tiwari,M. K. Ghoshal, Renewable energy sources: Basic Principles and Applications, Alpha Science International,2005
5. D. Yogi Gowswami, Energy efficiency and renewable energy handbook, edition,CRC Press, 2015.
6. Dr. R. S. Khadayate, Dr. K. G. Kolhe, Dr. R. G. Bavane, "Renewable energy and Energy Harvesting" ,1st edition ,Prashanth Publications,2019.

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Subject Elective: Programming in C

Semester: V **Hrs/week: 3**
Sub Code: P539A **Credits: 2**

Objectives:

- To introduce the students to the basic concepts of C program
- To enable the students to understand the different types of operators, I/O functions, and their usage in writing programs
- To create the skill to write and execute simple C programs with control statements
- To learn to use functions in C programs and to solve problems.
- To know about the different kind of arrays and their usage to solve arithmetic problems.

Learning outcomes :

Sl. No.	Course outcomes	Knowledge level
	On successful completion of the course, the students will be able to	
CO1	Differentiate between C tokens, keywords and identifiers	K3
CO2	Declare and Initialize variables in C program	K1, K6
CO3	Understand the concept of operators and I/O functions and use them effectively in C program	K1, K3
CO4	Write and execute simple programs using control statements	K6, K5
CO5	Define a function and apply code reusability with functions	K1, K3
CO6	Classify the arrays, write programs with arrays, perform pointer arithmetic, and use the pre-processor.	K2, K4

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)							Programme Specific Outcome (PSO)					Mean score of CO
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	

CO1	3	2	2	2	2	2	2	2	3	3	2	3	2.
CO2	2	2	2	2	2	2	3	1	2	2	2	2	2
CO3	2	2	3	3	2	2	2	3	2	2	3	2	2.
CO4	3	3	3	3	3	2	3	2	3	3	2	3	2.
CO5	2	2	2	3	2	2	2	3	2	2	3	1	2.
Mean Overall Score													2.3
Results													Hi h

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit I: Introduction to C

Basic structure of C programs –Character set – C tokens –keyword and identifiers – Constants – Variables – Data types – Declaring variables – Initializing variables – type conversions.

Unit II: Operators, Expressions & I/O functions

Types of operators – Arithmetic operators - Relational, logical, and assignment operators - Increment and decrement operators – Conditional operators – Bit wise and special operators – arithmetic expressions – Mathematical functions – priority of operators- Data input and output – getchar( ), putchar( ), gets( ) , puts( ) - scanf( ), printf( ) - escape sequence.

Unit III: Control Statements

Simple IF statement – Simple IF- ELSE statement – Block IF Statement – Block IF-ELSE statement – looping operation using while statement – for statement – Break statement – continue statement - Switch statement – Go To statement – Simple programs. (Finding the solution of quadratic equation - Fibonacci series – finding the biggest of three nos, factorial of a no.)

Unit IV: Functions

Defining a function – Accessing a function – Category of function – Passing arguments to function –Recursion- Library function. Programs using functions – Binomial coefficient, Sin series, summing the numbers 1 to n using recursion.

Unit V: Arrays

Defining an Array – Processing an array – one, two dimensional arrays – Simple programs using arrays: (addition of two matrices - subtraction of two matrices – Multiplication of two matrices- ascending and descending order.)

Books for study

1. E. Balagurusamy, Programming in C, Third Edition, Tata Mcgraw Hill, 2004.
2. S. Ramasamy and P. Radhaganesan, Programming in C, Scitech Publications (India) Private Limited, Chennai and Hyderabad, 2006.
3. Byron Gottfried, Theory and problems of programming with C, Second edition, Tata Mcgraw Hill, 2004.

4. Pradip Dey and Manas Ghosh, Programming in C, Oxford University Press, Second Edition.

Books for reference

1. K R Venugopal, S R Prasad, Mastering C, Mc GrawHill Education
2. Ashutosh Pandey, Programming in C, Cyber Tech Publications
3. YashavantKanetker, Let Us C, BPB Publications

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Subject Elective II: 8085 Microprocessor and its Applications

Semester: V **Hours / week: 3**
Course Code:P539B **Credits:2**

Objectives

1. To introduce different number systems and their mutual conversions.
2. To familiarize the students with the architecture of 8085 microprocessor and its interrupts.
3. To understand the instruction set and addressing modes of 8085 microprocessor.
4. To learn methods of interfacing memory with 8085 microprocessor.
5. To develop assembly language program writing skills.

Learning Outcomes

Sl. No.	Course outcomes On successful completion of the course, the students will be able to	Knowledge level
CO1	Explain the different number systems and also recognize their mutual conversion methods.	K2
CO2	Describe the architecture and interrupts of 8085 microprocessor with neat sketch.	K1
CO3	Classify the different instructions and also explain the different addressing modes of 8085 microprocessor.	K2, K3
CO4	Understand and explain the basic concepts of memory interfacing and I/O interfacing with 8085 microprocessor.	K2, K4
CO5	Apply their knowledge to write simple assembly language programs for 8085 microprocessor.	K3, K6

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)							Programme Specific Outcome (PSO)					Mean score of CO
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	3	2	2	2	3	2	2	2	2	2.
CO2	3	2	2	3	2	2	2	3	2	2	2	2	2.
CO3	3	2	2	2	3	2	2	2	2	2	2	2	2.
CO4	3	3	2	2	2	2	2	3	3	2	3	2	2.
CO5	3	2	2	2	2	2	2	2	2	2	2	2	2.
Mean Overall Score													2.
Results													Hi h

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit – I: Number System and Fundamentals of Microcomputer

Number System: Binary – Decimal – Hexadecimal number systems and their mutual conversions.
Microcomputer Organization – Types of computers (Mini, Micro and Large computers) – Microprocessor – evolution of microprocessors – applications of microprocessor based systems –cache memory–tristate logic

Unit-II: Architecture of 8085 and Interrupts
Features of 8085 –pin-out diagram of 8085 – architecture of Intel 8085 microprocessor – Interrupts of 8085: classification of interrupts –hardware and software interrupts–vectored and non-vectored interrupts–maskable and non-maskable interrupts

Unit-III: Instruction set of 8085
Instruction set: Data transfer instructions– arithmetic instructions –logical Instructions – branch instructions –stack and stack related instructions–I/O instructions –subroutines. Addressing modes

Unit – IV: Interfacing Memory to 8085
Semiconductor Memories: RAM (static and dynamic), ROM, EPROM and E2PROM–BasicConcepts in Memory Interfacing –Demultiplexing address/data bus–Interfacing memory chips: 2K×8, 4K×8 RAM and 2K×8, 4K×8 EPROM chips.

Unit – V: Interfacing I/O Devices and Programming
Interfacing I/O Devices: I/O Mapped I/O–Memory Mapped I/O – Programmable Peripheral Interface (8255)–LEDInterface– Multiplexed Seven segment display interface
Programming: addition, subtraction, multiplication and division, ascending and descending order (8-bit).

Books for study

1. A. NagoorKani, Microprocessor and its Applications, 3rdEdition, Chennai, RBAPublications, 2017.
2. V.Vijayendran, Fundamentals of Microprocessor – 8085: Architecture, Programmingand Interfacing, Chennai, S.Viswanathan (Printers & Publishers) Pvt. Ltd., 2009.
3. Badri Ram, Fundamentals of Microprocessors and Microcontrollers, New Delhi, Dhanpat Raj & Sons, 2012.

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1. Ramesh S. Gaonkar, Microprocessor Architecture, Programming and applicationswith the 8085, 6th edition, New Delhi, New Age International Publishers Ltd., 2013.
2. N. Senthilkumar, M. Saravanan, S. Jeevananthan, Microprocessors andMicrocontrollers, Oxford University Press, 2010.
3. A.P. Godse, D.A. Godse, Microprocessor and Applications, Pune, TechnicalPublications, 2003.
4. U.S. Shah, Microprocessor and Applications, New Delhi, McMillan Publishers IndiaLtd., 2011.
5. AdityaMathur, Introduction to microprocessor, 3rd Edition, Tata Mc.Graw Hill Publishing Company Ltd., 2017.

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Subject Elective II: Medical Physics

Semester: V **Hours/week: 3**
Course Code:P539C **Credits: 2**

Objectives:

1. To provide a knowledge on the physics principles involved in the pressure system, optical system, dynamics of human body and acoustics of human body.
2. To understand radiation exposure and its measurement and the working mechanism of different radiation detectors.
3. To learn the principles and instrumentation involved in various diagnostic systems.
4. To enable the students to understand the principle, instrumentation and working of biological imaging systems.
5. To create awareness on radiation hazards and protection against radiation hazards.

Learning outcomes:

Sl. No.	Course outcomes On successful completion of the course, the students will be able to	Knowledge level
CO1	Explain and differentiate the various physics principles involved in the dynamics of human body and in the pressure system, optical system, and acoustics of human body.	K2
CO2	understand and distinguish the various units used in radiation exposure measurement and describe the working mechanism of different radiation detectors.	K2, K1
CO3	Demonstrate an understanding of working principle and instrumentation of various diagnostic systems.	K3
CO4	understand the principle, instrumentation and working of biological imaging systems and evaluate their merits and demerits.	K2, K5
CO5	Describe various radiation hazards and design equipment for protection against radiation hazards.	K1, K6

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)							Programme Specific Outcome (PSO)					Mean score of CO
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	

CO1	2	2	2	3	2	3	2	3	2	3	2	3	2.4
CO2	3	3	3	2	2	2	2	3	3	3	2	2	2.5
CO3	3	2	2	3	2	3	2	2	3	3	2	2	2.4
CO4	3	3	2	3	2	2	2	2	3	3	2	2	2.4
CO5	2	3	3	2	2	3	2	3	3	3	2	2	2.5
Mean Overall Score													2.5
Results													High

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit – I: Physics of the body

Mechanics of the body: Skeleton – forces – body stability – muscles and dynamics of bodymovement.

Energy household of the body: Energy balance in the body – energy consumption of the body – heat losses of the body – thermal regulation.

Pressure system of body: Breathing – cardiovascular system – blood and circulatory system– blood pressure

Acoustics of the body: Nature and characteristics of sound – production of speech – Physicsof the ear.

Optical and electrical system of the body: Physics of the eye – central and autonomicnervous system – electrical signals and information transfer.

Unit – II: Radiation physics and Detectors

Radiation Exposure – Absorbed dose – Units: rad, rontgen – REM – GRAY – KERMA- CEMA – stopping power – relative biological effectiveness – effective dose - photon fluenceand energy fluence. Detectors – types of detectors –Thimble chamber – condenser chambers – GM counter – Scintillation counter

Unit – III: Diagnostic Systems

X-ray tube – rotating anode – tube rating – quality and intensity of X-ray – X-ray film –diagnostic applications of X-rays (Skeletal system and soft tissues) – mobile and dental X ray machine.

CT scan – principle and working – Interaction of ultrasound with tissues (A Scan and B Scan) – Bio sensors applications (Diabetics, cardiovascular, cancer) – Radioactive tracers.

Unit – IV: Bio Medical Imaging and Instrumentation

MRI – radiological imaging – Ultrasound imaging in Tomography – ECG (Electrocardiography) – EEG (Electroencephalography) – EMG (Electromyography) – ENG(Electro neurography) – cardiac pacemakers (Natural and Artificial) – AC and DCsynchronized defibrillators – Endoscope.

Unit – V: Radiation hazards and protection

Radiation effects – radiation dose from natural radioactivity in the environment and manmadesources – effects of time and distance – radiation accidents emergencies in the use ofradiation sources in medicine – biological effects of radiation (somatic, genetic stochastic anddeterministic effect).
Radiation protection – shielding materials – permissible level of radiation – chemicalprotection – disposal of radioactive wastes safety rules and facilities – Dosimeter: TLD filmbadge, pocket dosimeter monitors – Radiation limits – Steps to reduce radiation to Patient,Staff and Public.

Books for study

1. J. P. Woodcock, Ultrasonic, Medical Physics Handbook series 1, Adam Hilger, Bristol, 2002
2. J.R. Cameron and J.G. Skofronick, Medical Physics, Wiley, 1978.

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1. K. ThayalanJayapee Brothers, Basic Radiological Physics Medical Publishing Pvt. Ltd., New Delhi, 2003.
2. Curry, Dowdey, Murry, Christensen's Physics of Diagnostic Radiology, Lippincot Williams and Wilkins, 1990.
3. F M Khan – Williams and Wilkins, Physics of Radiation Therapy, Third edition, 2003.
4. Irving P. Herman, Physics of the human body, Springer, 2007.
5. Bushberg, Seibert, Leidholdt and Boone Lippincot Williams and Wilkins The essential physics of Medical Imaging, Second Edition, 2002.
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https://en.wikipedia.org/wiki/Magnetic_resonance_imaging
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https://www.youtube.com/watch?v=gXR5Wdmeu_s
https://www.healthline.com/health/endoscopy

Astrophysics

Semester: V **Hours/week : 2**
Course Code: **Credits : 1**

Objectives

- To introduce the students to universe and its evaluation.
- To impart knowledge on galaxies and its types.
- To understand the basic structure and properties of milky way galaxy.
- To provide an overview of solar system.
- To learn methods of estimating astronomical distances and temperature and radius of stars.

Learning Outcomes

Sl. No.	Course outcomes	Knowledge level

	On successful completion of the course, the students will be able to	
CO1	Understand and explain the origin of Universe and predict the present age of the universe.	K2, K4
CO2	Describe the classification of galaxies.	K1, K2
CO3	Acquire basic knowledge of milky way galaxy and its properties.	K1
CO4	Explain the Solar system and its origin.	K2
CO5	Estimate astronomical distances and temperature and radius of stars.	K3, K5

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)							Programme Specific Outcome (PSO)					Mean score of CO
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	3	2	2	2	3	3	3	2	2	2.5
CO2	3	2	3	2	2	2	2	3	3	2	3	2	2.4
CO3	3	2	3	3	2	2	2	3	3	3	2	2	2.5
CO4	3	2	3	2	2	2	2	3	3	2	3	2	2.4
CO5	2	2	3	3	2	2	2	3	2	3	3	2	2.4
Mean Overall Score													2.5
Results													High

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

UNIT-I: Introduction to Universe

Origin of the universe-Big bang theory-Expansion of the universe-Hubble's law-Age of the universe-Stellar evolution-Birth and death of the star-Chandrasekhar limit

UNIT II: Galaxies

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

Unit III: The Milky Way:

Basic Structure and Properties of the Milky Way, Nature of Rotation of the Milky Way-Differential Rotation of the Galaxy and Oort Constant, Rotation Curve of the Galaxy and the Dark Matter, Nature of the Spiral Arms- Stars and Star Clusters of the Milky Way.

Unit-IV: The solar system:

Solar Parameters, Solar Photosphere, Solar Atmosphere, Chromosphere.Corona, Solar Activity, Basics of Solar Magneto-hydrodynamics. Helioseismology- The solar family Solar System: Facts and Figures, Origin of the Solar System: The Nebular Model, Tidal Forces and Planetary Rings, Extra-Solar Planets.

Unit-V: Astronomical Scales and Instruments:

Astronomical Scales:Astronomical Distance, Mass and Time, Scales, Brightness, Radiant Flux and Luminosity, Measurement of Astronomical Quantities Astronomical Distances, Stellar Radii, Masses of Stars, Stellar Temperature-Astronomical Instruments: The Hubble space telescope-Astronomical spectrographs

Books for study

1. K.S. Krishnasamy, 'Astro Physics a modern perspective,' Reprint, New Age International (p) Ltd, New Delhi,2002.
2. BaidyanathBasu, 'An introduction to Astro physics', Second printing, Prentice -Hall of India Private limited, New Delhi, 2001.

Books for reference

1. Frederick R. Chromey, ToMeasure the Sky, An Introduction to Observational Astronomy,Cambridge University Press, New York,2010
2. Michael A. Seeds, Dana E. Backman, Horizons, Exploring the Universe, Eleventh Edition, Brooks/ColeCengage learning, USA,2017.
3. S. Kumaravelu andSusheelaKumaravelu, Astronomy, R Chand and Co, New Delhi, 5thEdition, 2013

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https://www.nationalgeographic.com/science/article/origins-of-the-universe
https://www.e-education.psu.edu/astro801/content/l7_p6.html
https://www.britannica.com/science/galaxy/Types-of-galaxies
https://solarsystem.nasa.gov/solar-system/our-solar-system/overview/
https://www.nasa.gov/content/goddard/hubble-space-telescope-science-instruments

Self study: Laser Physics and Fiber Optics

Semester: V **Hours/week : 2**
Course Code: **Credits : 1**

Objectives:

- To introduce the students to the basic principles of LASER.
- To provide a knowledge on various types of LASERs.
- To enhance the knowledge of different applications of LASER in Material Processing and Electronics Industry.
- To familiarize the applications of LASERS in Nuclear Energy and medicine.
- To provide an opportunity for the students to learn about Optical fibres and Optical fibre communication system.

Learning Outcomes:

Sl. No.	Course outcomes	Knowledge level
	On successful completion of the course, the students will be able to	

CO1	Explain the basic principle of Laser emission.	K2
CO2	Examine the working principle and design considerations of various lasers.	K3
CO3	Outline the applications of laser in industries.	K1
CO4	Gain knowledge on applications of Lasers in fields such as Nuclear Energy, Medicine and Surgery.	K1, K2
CO5	Comprehend the significance of optical fibre communication system.	K2

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)							Programme Specific Outcome (PSO)					Mean score of CO
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	2	1	1	2	3	2	3	2	1	2.
CO2	3	3	2	3	1	1	3	3	2	2	3	1	2.
CO3	3	3	3	2	1	2	1	3	2	3	2	1	2.
CO4	3	3	2	2	3	2	1	3	3	2	1	2	2.
CO5	3	3	2	2	3	1	2	3	3	2	1	2	2.
Mean Overall Score													2.
Results													Hi h

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit I: **LASER basics**

LASER – Differences between LASER and ordinary light-Energy levels-Population-Population at thermal equilibrium-Absorption and Emission of light-Einstein's prediction – Absorption-Spontaneous emission-Stimulated emission-Einstein relations-conditions for large stimulated emissions-Population Inversion.

Unit II: LASER Devices

Classification of LASERS(on the basis of medium): Solid LASERS, Liquid LASERS, Gas LASERS, Semiconductor LASERS-Solid state LASERS: Ruby LASER, Tunable solid state LASERS - Types of Gas LASERS: Atomic LASERS- Ionic LASERS-Molecular LASERS-He-Ne LASER.

Unit III:LASER Applications-1:

LASERS in Material Processing: The surface treatments-Deoxidising De-painting LASER cleaning-Advantages of LASER cleaning-Drilling-Cutting-LASER microjet cutting-Different methods of cutting(Vapourization cutting-Melt and blow or Fusion cutting-Reactive cutting)-Advantages and disadvantages of LASER cutting-Welding-Heat treatment-**LAERS in Electronics Industry:** Scribing-Soldering-Trimming-Photolithography.

Unit IV: LASER Applications-2:

LASERS in Nuclear Energy: Isotope separation-Nuclear Fusion-Nuclear Fission-**Laser in Medicine and Surgery:** Eye LASER surgery-Photocoagulations-LASER Angioplasty-LASER endoscopy-LASER therapy-**LASERS in Defense:** LASER based military weapons(Laser gun-Anti Aircraft LASER etc)-LASER target Designator-**Measurement of Distance**: LIDAR(Light Detection and Ranging)-**Holography:**Principle-method-Advantages and Applications.

Unit V: Optical Fibres

Optical fibre-construction– principle of optical fibre – light transmission in a optical fibre – Acceptance angle – Numerical aperture- Classification of fibres based on material-Classification of fibres based on Fibre index profiles – Step index Fibre- graded index fibre – single mode and multimode step index fiber -optical fiber communication – advantages.

Books for study

1. Dr. M. N. Avadhanulu, Dr. P. S. Hemme, An Introduction to LASERS, Theory and Applications, 2nd Revised Edition, S. Chand Publishing, New Delhi, 2013.
2. William T Silfvast, Laser Fundamentals, Cambridge Univ Press, 2012.
3. R P Khare, Fiber Optics and Optoelectronics, Oxford 2012.
4. Sabir Kumar Sarkar, Optical fibres and Fibre Optic Communication , 4th Revised Edition, S. chand publishing, 2003.

Web sites:

https://www.britannica.com/technology/laser/Fundamental-principles
https://www.physics-and-radio-electronics.com/physics/laser/heliumneonlaser.html
https://www.youtube.com/watch?v=X5_BP0odPTg
https://www.youtube.com/watch?v=RyY4PEpV2RQ
https://nptel.ac.in/content/storage2/courses/117101054/downloads/lect7.pdf
https://www.physics-and-radio-electronics.com/physics/laser/applicationsoflasers.html
https://en.wikipedia.org/wiki/List_of_laser_applications
https://www.iitk.ac.in/dord/isro/Publications/DGoswami/marked_Chapter_07.pdf
https://www.youtube.com/watch?v=jZOg39v73c4
https://www.youtube.com/watch?v=Zeo3UOk7_vA
https://www.elprocus.com/basic-elements-of-fiber-optic-communication-system-and-its-working/
https://www.tutorialspoint.com/principles_of_communication/principles_of_optical_fiber_communications.htm

Applied Electronics

Semester : VI **Hours/week : 5**
Course Code: P631 **Credits : 5**

Objectives :

- To learn about basic logic gates, DeMorgan's theorems, Simplification of Boolean expressions and implementation of logic circuits using NAND-NAND logic.
- To learn design, working and truth table of combinational circuits.
- To study about different logic families and flip flops.
- To understand the working of Shift registers, Asynchronus counters and Synchronous counters.
- To study about the different types of ADC and DAC and the architecture and applications of timer IC 555.

Sl. No.	Course outcomes On successful completion of the course, the students will be able to	Knowledge level
CO1	Simplify Boolean expressions using K-map and design NAND-NAND logic circuits.	K4, K6
CO2	Construct arithmetic circuits and explain their operation.	K6, K3
CO3	Compare different logic families and explain the working of various flip flops.	K5, K2
CO4	Acquire a knowledge on Shift registers and counters and construct different Modulus counters.	K1, K6
CO5	Explain the working of different types of ADC and DAC and predict their output voltage and describe the architecture and applications of timer IC 555.	K2, K1

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)							Programme Specific Outcome (PSO)					Mean score of CO
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	1	3	1	2	2	3	3	3	2	2	2.2
CO2	3	2	1	3	2	2	2	3	3	3	2	2	2.3
CO3	3	2	1	3	2	2	2	3	3	3	2	2	2.3
CO4	3	2	1	3	2	1	2	3	3	3	2	2	2.2
CO5	3	2	1	3	2	1	2	3	3	3	2	2	2.2
Mean Overall Score													2.2
Results													High

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit – I: **Logic gates and Boolean Algebra**

Binary concept – basic logic gates using diodes and transistors – truth tables – EX-OR gate- NAND and NOR gates – NAND and NOR as Universal gates – De Morgan's theorems and their circuit implications – standard representation of logic functions (SOP and POS) – min term – max term - simplification of Boolean SOP equations by Karnaugh map up to 4 variables – NAND-NAND circuits.

Unit – II: Combinational circuits

Data processing circuits: multiplexer(4:1)-Multiplexer(4:1)with strobe/enable input – demultiplexers (1:4) – decoder (1-of-4 decoder) – BCD to decimal decoder – seven segment decoder (7447) – encoders(3:8) – decimal to BCD encoder– arithmetic circuits: half adder – full adder – parallel binary adder – half subtractor– full subtractor.

Unit – III :**Logic families andFlip flops**

Logic families: TTL NAND gate with totem pole output–ECL OR/NOR gate– CMOS inverter, NAND and NOR gates-comparison of logic families

Flip flops: RS flip flop–Clocked R-S flip flop- D flip flop – level checking and edge triggering – J-K flip flop – Preset and Clear operations – Race-around conditions in JK Flip – Flop-JK M/S flip flop – T type flip flop

Unit – IV: **Shift Register and Counters**

4-bit shift registers – types: serial in serial out–serial in parallel out – parallel in serial out – parallel in parallel out – Shift left shift right shift register-Applications of shift registers- ring counter – asynchronous Mod 8 and decade counter – decoding gates- synchronous Mod 8 and decade counter - 4 bit Binary up counter-4 bit Binary down counter.

Unit – V: **Signal conversion and Timer IC Applications**

D-A and A-D Conversion: variable resister and binary ladder D/A converters – accuracy, resolution and precision – A/D converter – successive approximation and simultaneous A/D converters.

Timer (IC 555) and its applications: Internal architecture of IC 555 (Block diagram)–Pin configuration of 555 – astable- mono-stable multivibrator circuits.

Books for study

1. V. Vijayendran, Introduction to Integrated Electronics–Digital and Analog, S. Viswanathan (Printers & Publishers), Pvt. Ltd., Chennai,2007.

Books for Reference

1. Thomas L. Floyd, Digital Fundamentals, 11th edition, Pearson education, New Delhi, 2017.
2. Atul P. Godse, Deepali A. Godse, Digital Electronics, Technical Publications, Pune,2014.
3. Anil Kumar Maini, Digital electronics: principles, devices and applications, Wiley, New Delhi, 2008.
4. A. P. Malvino, D. P. Leach, Digital principles and Applications,8th edition, Tata McGraw Hill, New Delhi, 2014.
5. Albert Paul Malvino, Digital computer Electronics, 3rd edition, Tata McGraw Hill Education Private Ltd., New Delhi, 2017.

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http://macao.communications.museum/eng/exhibition/secondfloor/MoreInfo/ FlipFlop.html
www.st–andrews.ac.uk/~www_pa/Scots_Guide/RadCom/part9/page1.htmlbooks.google.co.in/books/about/Television_and_Video_Engineering.html?id=cChPIg6iWPoC&redir_esc=y
http://www.ee.surrey.ac.uk/Projects/Labview/minimisation/karnaugh.html
http://www.32x8.com/
www.utdallas.edu/~dodge/EE2310/lec5.pdf
https://www.allaboutcircuits.com/textbook/digital/chpt-3/cmos-gate-circuitry/
https://www.electronics-tutorials.ws/counter/count_3.html
https://www.electronics-tutorials.ws/waveforms/555_oscillator.html

Nuclear and Particle Physics

Semester– VI **Hours/week: 5**
Course Code : P632 **Credits: 5**

Objectives

- To introduce to the basic properties of nucleus and different nuclear models.
- To study about different types of radiation detectors, radioactivity and particle accelerators.
- To understand the different types of nuclear reactions and radioactivity.
- To learn about fission, fusion and different types of nuclear reactors.
- To provide an overview of elementary particles and their interactions.

Learning outcomes

Sl. No.	Course outcomes On successful completion of the course, the students will be able to	Knowledge level
CO1	explain the properties of nucleus, different nuclear models and their predictions.	K2
CO2	different types of radiation detectors and particle accelerators.	K2, K1
CO3	demonstrate an understanding of the different types of nuclear reactions and radioactivity.	K3
CO4	Distinguish between nuclear fission and fusion, estimate the energy released in Nuclear reactions and compare different types of nuclear reactors.	K4, K5
CO5	Acquire a knowledge of elementary particles and their interactions.	K1

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)							Programme Specific Outcome (PSO)					Mean score of CO
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	3	2	2	2	3	2	2	2	2	2.
CO2	3	2	2	3	2	2	2	3	2	2	2	2	2.
CO3	3	2	2	2	3	2	2	2	2	2	2	2	2.
CO4	3	3	2	2	2	2	2	3	3	2	3	2	2.
CO5	3	2	2	2	2	2	2	2	2	2	2	2	2.
Mean Overall Score													2.
Results													Hi h

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)	Term End Exam (100)

	I CA (50)	II CA (50)	Marks Allotment
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit – I: Nuclear Properties and Nuclear models

Constituents of nuclei – Basic properties of a nucleus; charge, mass, size, density, spin, parity, magnetic moment and electric quadruple moment – isotopes, isobars, isotones and mirror nuclei - mass defect – packing fraction – binding energy – nuclear forces –characteristics of nuclear forces –Yukawa's theory.

Nuclear models – liquid drop model – semi empirical mass formula – shell model – evidence for magic numbers – predictions of shell model – Fermi gas model – collective model

Unit – II: Particle Detectors, Radioactivity and Accelerators

Particle detectors – ionization chamber – proportional counter – GM counter – scintillation counter – nuclear emulsions – radiation units – mean lethal dose and permissible radiation dose – personal dosimeter and survey dosimeter – chemical –Thermo luminescent dosimeter(TLD) – biological effects of radiation – protection from radiation hazards – radioactive series - Displacement law – radioactive dating – radioactivity of light elements

Particle accelerators – cyclotron – theory – limitations – synchrotron —betatron.

Unit – III: Radioactivity and Nuclear Reactions

Properties of alpha, beta and gamma rays – determination of e/m and charge of alpha particles –range of alpha particles – experimental measurement of range – Geiger-Nuttal law – disintegration energy – Gamow's theory of alpha decay-beta ray spectra – origin of line and continuous spectrum

Nuclear reactions – types of reactions – conservation laws – Q-value – nuclear transmutations – by alpha particles, protons, deuterons and neutrons – scattering cross section.

Unit – IV: Nuclear Energy and Nuclear Reactors

Nuclear fission – energy released in fission – chain reaction - fissile and fertile materials – deformation of liquid drop – Bohr Wheeler's theory of nuclear fission – four factor formula – the critical size— nuclear fusion and thermonuclear reactions – sources of stellar energy – controlled thermonuclear reactions – Advantages and disadvantages of nuclear energy.

Nuclear reactors:– pressurized water reactor – fast breeder reactor – power reactors – applications of nuclear reactor

Unit – V: Elementary Particles

Elementary particles – classification – particles & antiparticles – the fundamental interactions – elementary particle quantum numbers – conservation laws and symmetry – the quark model of nucleons – quantum chromo dynamics – standard model – unification of interactions – grand unified theories (no detailed theory is required).

Books for study

1. D. C. Tayal, Nuclear Physics, Mumbai, Himalaya Publishing house,2016
2. R. Murugeshan, Modern Physics, 18th Edition New Delhi, S.Chand&Co.Ltd, 2019.

Books for reference

1. V. Devanathan,Nuclear and particle physics, 2nd Edison, New Delhi, Alpha Science International publishers, 2011.
2. S. N. Ghoshal, Introduction to Nuclear physics, S.Chand&Co.Ltd, New Delhi, 2019.

3. Suresh Chandra, Mohit K. Sharma, Nuclear and Particle Physics, Alpha Science International publishers, 2012.
4. N. Subrahmanyam, Brijlal, Atomic and nuclear physics, 2nd Edison, New Delhi, S. Chand & Co.Ltd, 2008.
5. R. R. Roy, B.P. Nigam, Nuclear physics, New Delhi, New age International (P)Ltd Publishers, 2005.

Websites

https://www.hep.phy.cam.ac.uk/~chpotter/particleandnuclearphysics/Lecture_13_BasicNuclearProperties.pdf
https://byjus.com/physics/nuclear-reactor-based-on-nuclear-fission/
https://www.youtube.com/watch?v=3bwcXPmF2VA
https://www.energy.gov/ne/articles/nuclear-101-how-does-nuclear-reactor-work
https://www.youtube.com/watch?v=lMRFDwnLM54
http://www.sfu.ca/~mxchen/phys1021003/P102LN34.pdf
https://www.nust.na/sites/default/files/documents/Chapter%2012%20%E2%80%93Radioactivity.pdf
http://www.patnasciencecollege.org/econtent/BScPhys66.pdf

Quantum Mechanics and Relativity

Semester – VI **Hours/ week: 4**
Course Code:P633 **Credits : 4**

Objectives

- To introduce the concepts of Matter waves and Heisenberg's uncertainty principle.
- To learn the postulates of quantum mechanics, Schroedinger equations and Ehrenfest theorem.
- To understand the applications of Schroedinger equations.
- To study Galilean and Lorentz transformation equations and their applications.
- To provide an understanding on the relativistic variation of mass with velocity and postulates of general theory of relativity.

Learning Outcomes

Sl. No.	Course outcomes On successful completion of the course, the students will be able to	Knowledge level
CO1	Understand the concepts of Matter waves, estimate the de-Broglie's wave length of electrons and explain Heisenberg's uncertainty principle.	K2, K3
CO2	Distinguish between time dependent and time independent Schroedinger equations and apply Linear, momentum and energy operators.	K3, K4
CO3	Describe the basic principles of quantum mechanics and explain operator formulation of quantum mechanics.	K1, K2
CO4	Explain the concepts of frame of reference and inertial frames and state the fundamental postulates of Special theory of relativity.	K1, K2
CO5	State the postulates of General theory of relativity and enumerate its applications.	K1

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)	Programme Specific Outcome (PSO)	Mean score

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	of CO
CO1	3	2	3	2	3	2	3	2	3	2	3	2	2.5
CO2	3	2	2	3	1	2	3	3	2	2	2	3	2.4
CO3	3	3	3	2	2	3	2	3	3	3	2	3	2.7
CO4	3	3	3	2	2	2	2	2	3	3	3	2	2.5
CO5	3	3	2	3	2	2	3	2	3	3	3	2	2.6
Mean Overall Score													2.5
Results													High

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit – I: Matter waves and Uncertainty Principle

Inadequacy of classical mechanics – matter waves – de-Broglie's wave length – wave packet – relation between phase velocity and group velocity – G.P Thomson's experiment – Davisson and Germer's experiment- Heisenberg's uncertainty principle – Heisenberg's gamma ray microscope – diffraction of a beam of electrons by a slit.

Unit – II: Schrodinger's formulation

Postulates of quantum mechanics – Linear, Momentum and Energy operators – Eigen functions and Eigen values – Stationary states – Expectation values – Physical interpretation of the wave function – Limitations on the wave function – Probabilities and normalization condition – Time independent Schrodinger's equation – Time dependent Schrodinger's equation – Ehrenfest theorem – statement and proof.

Unit – III: Applications of Schrodinger's Equation

Particle in one dimensional box – One dimensional linear harmonic oscillator – Quantum mechanical scattering and tunneling in one dimensional rectangular potential barrier- Rigid rotator.

Unit – IV: Relativistic Mechanics -I

Frame of reference – inertial frames – non-inertial frames – fictitious forces – frame of reference and uniform motion – Galilean transformations – invariance of acceleration and force under Galilean transformation – Ether Hypothesis – Michelson–Morley experiment – Explanation of the Negative results – Special theory of relativity: Postulates – Lorentz transformation – length contraction – time dilation – twin paradox – relativity of simultaneity.

Unit –V: Relativistic Mechanics -II

Relativistic addition of velocities –Variation of mass with velocity – equivalence of mass and energy – Evidences confirming mass – momentum of a particle with zero rest mass – Minkowski's space – space-time continuum – postulates of general theory of relativity – gravitational red shift – advance of the perihelion of mercury – deflection of light by the gravitational field.

Books for study

1. R. Murugeshan, Modern Physics, New Delhi, S. Chand & Co. Ltd, 2019.
2. SathyaPrakash, Advanced Quantum Mechanics, Meerut, Kendra Nath Ram Nath, 2012.

Books for reference

1. Albert Einstein, Relativity: The Special and the General Theory, General press, 2012.
2. Leonard Schiff, Quantum Mechanics, Mcgraw Hill Education, 4th Edition, 2014.
3. V. Devanathan, Quantum Mechanics, New Delhi, Narosa Publishing House, 2005.
4. G. Aruldhas, Quantum Mechanics, NewDelhi, Prentice Hall of India Pvt. Ltd.,2007.
5. S.P. Singh, M. K. Bagde, Kamal Singh, Quantum Mechanics, NewDelhi, S. Chand and company Ltd, 2000.
6. Brijlal, Subrahmaniyan, Mechanics and Relativity, New Delhi, S. Chand & Co. Ltd, 2006.
7. A.P. French, Special Relativity, United Kingdom, English Language Book Society, 2007

Websites

http://www.einstein–online.info/elementary/specialRT
http://www.upscale.utoronto.ca/PVB/Harrison/SpecRel/SpecRel.html
http://www.space.com/17661–theory–general–relativity.html
http://www.hep.man.ac.uk/u/roger/PHYS10302/lecture15.pdf
www.navipedia.net/index.php/Phase_%26_Group_Velocity
http://www.einstein–online.info/elementary
http://hyperphysics.phy–astr.gsu.edu/hbase/quacon.html#quacon
http://quantumphysics.iop.org/http://www.quantum–physics.polytechnique.fr/en/

Physics Main Practicals – III (General Experiments)
Any 20 Experiments

Semester – V&VI **Hours/week : 4**
Course Code:PP615 **Credits : 5**

Objectives :

- To familiarize the students with physics concenpts and experiments.
- To acquaint the importance of practical experiments to students.
- To develop an understanding among students about conversion of a galvanometer into
- voltmeter and ammeters.
- To train the students in handling physics experiments.
- To facilitate the students for handling spectrometer and B.G experiments.

Learning Outcomes:

Sl. No.	Course outcomes On successful completion of the course, the students will be able to	Knowledge level
CO1	Design a circuit to convert a galvanometer into voltmeter and ammeter with desiredcalibration.	K6
CO2	Apply the knowledge on potentiometer toestimate the EMF of a thermocouple.	K2, K3, K5
CO3	Estimate the value of g using compound pendulum.	K2, K5
CO4	Recall the concept of Young's modulus and evaluate the young's modulus of the material of the given bar.	K1, K5

CO5	Demonstrate experiments using spectrometer to determine the dispersive power of prism and refractive index of the material of the prism	K2, K3
CO6	Determination of wavelength of Laser light using diffraction at a single slit	K5

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)							Programme Specific Outcome (PSO)					Mean score of CO
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	2	3	2	3	3	3	3	3	3	3	2.8
CO2	2	2	2	2	2	3	3	3	3	3	3	3	2.6
CO3	2	2	2	2	2	3	3	3	3	3	3	3	2.6
CO4	2	2	2	2	2	3	3	3	3	3	3	3	2.6
CO5	2	2	2	2	3	3	3	3	3	3	3	3	2.6
Mean Overall Score													2.6
Results													High

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	5	5	10
Understand	5	5	10
Apply	15	15	30
Analyze	15	15	30
Evaluate	5	5	10
Create	5	5	10

1. Viscosity of a liquid – Variable pressure head (ungraduated burette)
2. Young's modulus – Uniform bending(telescope and optic lever)
3. Young's modulus – Koenig's method – non uniform bending
4. Torsional pendulum – Dynamic method– I & n
5. Compound pendulum – Determination of g
6. Thermal conductivity of Good conductor-Forbe's method
7. Spectrometer – (i – i') curve
8. Narrow angled prism – Determination of μ
9. Field along the axis of circular coil – Deflection magnetometer – m and B_H
10. Spectrometer- Dispersive power of a prism
11. Spectrometer – Cauchy's constants determination
12. Hydrogen spectrum–Determination of wavelengths–Rydberg's constant
13. Carey foster's bridge – Temperature co–efficient of resistance
14. Conversion of a galvanometer into a voltmeter
15. Conversion of a galvanometer into an ammeter
16. EMF of a thermocouple – Potentiometer method

17. Absolute capacitance of a capacitor – B. G
18. Absolute mutual inductance– B.G
19. Comparison of mutual inductance - B.G
20. Field along the axis of a coil – Deflection magnetometer
21. Measurement of Dielectric Constant of a dielectric Materials with frequency
22. SVP of water – Joly's apparatus
23. Fresnel's Biprism – Determination of wavelength of Sodium light
24. Determination of wavelength of Laser light using diffraction at a single slit.
25. Determination of Boltzmann's constant using V–I characteristics of PN diode
26. Determination of ionization potential of Mercury

Books for reference

1. M.N. Srinivasan, S.Balasubramanian, R.Ranganathan, Text book of practical physics, Sultan Chand & sons, New Delhi, 2003.
2. C.C. Ouseph, U. J. Rao, V. Vijayendran, Practical Physics and Electronics, S. Viswanathan Pvt. Ltd., Chennai, 2012.
3. M. N. Srinivasan, S. Balasubramaniam, R. Ranganathan, A Text Book of Practical Physics, 2nd Ed., S. Sultan Chand & Sons Publications, New Delhi, 2014.
4. D. Chattopadhyay, P.C. Rakshit , New central book agency (p) LTD., 1987
5. C. Isenberg, S.S Chomet, Viva books Private Limited., 1998
6. Narasimhan & Ramamoorthy, B.G. Paul & Co., 1961

Physics Main Practicals – IV (Electronic Experiments)
Any 20 Experiments

Semester : V&VI **Hours/week : 5**
Course Code :PP616 **Credits : 5**

Objectives

- Toconstruct Half subtractor, Full subtractor, 4 bit binary adder and 4 bit binary subtractor circuits using ICs and verify their truth tables.
- To simplify the given Boolean expressions using Karnaugh map, construct NAND-NAND circuit for the simplified expression and verify the truth table.
- To design Inverting and Non inverting amplifiers, Summer, Subtractor, Differentiator and Integrator circuits using OPAMP.
- To learn to **c**onstruct amplifiers, Oscillators and Multivibrators using Transistors and measure their outputs.
- To write assembly language programs for performing Addition, Subtraction, Multiplication, Division, Arranging the numbers in ascending order and in descending order and execute them using 8085 microprocessor and verify the results.

Learning Outcomes

Sl. No.	Course outcomes	Knowledge level
	On successful completion of the course, the students will be able to	
CO1	Construct Half subtractor, Full subtractor, 4 bit binary adder and 4 bit binary subtractor circuits using ICs and verify their truth tables.	K3, K6, K1
CO2	Simplify given Boolean expressions using Karnaugh map, construct NAND-NAND circuit for the simplified expression and verify the truth table.	K4, K6
CO3	Design Inverting and Non inverting amplifiers, Summer, Subtractor, Differentiator and Integrator circuits using OPAMP.	K2, K6

CO4	Construct amplifiers, Oscillators and Multivibrators using Transistors and measure their outputs.	K1, K5, K6
CO5	Write assembly language programs for performing Addition, Subtraction, Multiplication, Division, Arranging the numbers in ascending order and in descending order and execute them using 8085 microprocessor and verify the results.	K6

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)							Programme Specific Outcome (PSO)					Mean score of CO
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	1	3	1	2	2	3	3	2	2	2	2.1
CO2	3	2	1	3	1	2	2	3	3	2	2	2	2.1
CO3	3	2	1	3	1	2	2	3	3	3	2	2	2.1
CO4	3	2	1	3	1	2	2	3	3	3	2	2	2.1
CO5	3	2	1	3	1	2	2	3	3	3	2	2	2.1
Mean Overall Score													2.1
Results													High

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	5	5	10
Understand	5	5	10
Apply	15	15	30
Analyze	15	15	30
Evaluate	5	5	10
Create	5	5	10

1. Half subtractor and Full subtractor
2. R–S, J–K, and D–Flip Flops using NAND gates
3. Simplification of Boolean expression using Karnaugh map (NAND- NAND Logic)
4. Seven Segment Display using IC 7447
5. Multiplexer and Demultiplexer
6. Single stage common emitter transistor amplifier
7. Emitter Follower
8. Static characteristics of UJT
9. Hartley Oscillator
10. Astable and Bistable Multivibrators
11. Designing inverting and non–inverting amplifiers of given gain using Op–amp.
12. Operational amplifier (IC741)– Inverting and Non– Inverting summer and Subtractor
13. Operational amplifier (IC741) – Differentiating and Integrating circuits.
14. Microprocessor – Arranging an array in ascending and descending order
15. Microprocessor – 8 bit Addition and Subtraction
16. Microprocessor – Double and Triple precision addition and subtraction

17. Microprocessor – 8 bit Multiplication and Division
18. Modulus counters (Mod: 4, Mod: 5, Mod:6, Mod:8 and Decade counter) using IC 7490
19. Frequency response characteristics of Op–amp inverting amplifier
20. Design of digital to analog converter (DAC) of given specifications
21. 4 bit binary adder and subtractor
22. Shift Register (serial–in and serial–out) using D–type/JK Flip–Flop ICs
23. RC Phase Shift Oscillator
24. JFET characteristics
25. Astable Multivibrator -IC 555
26. Clipper and Clamper : discrete components only

Books for reference

1. M.N. Srinivasan, S.Balasubramanian, R.Ranganathan, Text book of practical physics, Sultan Chand & sons, New Delhi, 2003.
2. C.C. Ouseph, U. J. Rao, V. Vijayendran, Practical Physics and Electronics, S. Viswanathan Pvt. Ltd., Chennai, 2012.
3. M. N. Srinivasan, S. Balasubramaniam, R. Ranganathan, A Text Book of Practical Physics, 2nd Ed., S. Sultan Chand & Sons Publications, New Delhi, 2014.
4. D. Chattopadhyay, P.C. Rakshit , New central book agency (p) LTD., 1987
5. C. Isenberg, S.S Chomet, Viva books Private Limited., 1998
6. Narasimhan & Ramamoorthy, B.G. Paul & Co., 1961

Subject Skill – I : Electrical Circuits and Networks (Theory)

Semester: VI **Hours/ Week: 3**

Course Code: P634S **Credits : 2**

Objectives

- To develop an understanding of the basics of electrical devices and circuits.
- To understand the fundamental laws of electrical circuits and various circuit analysis theorems.
- To develop an understanding of single-phase and three-phase AC.
- To know the effect of open circuits and short circuits
- To impart knowledge of domestic wiring and circuit breakers.

Learning Outcomes

Sl. No.	Course outcomes	Knowledge level
	On successful completion of the course, the students will be able to	
CO1	Understand the symbols and working principles of electrical devices and circuits	K1, K2
CO2	Analyze electrical circuits (DC and AC) using mesh and network simplification theorems.	K3, K4
CO3	Differentiate between single-phase and three-phase AC and explain the working of AC circuits.	K2, K3
CO4	Explain the effects of shorts and opens in series and parallel circuits.	K2

CO5	Understand domestic electrical wiring and the working of circuit breakers	K1, K2

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)							Programme Specific Outcome (PSO)					Mean score of CO
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	2	3	1	3	3	2	3	3	3	3	2.6
CO2	3	2	2	3	1	3	3	3	2	2	2	3	2.5
CO3	3	3	2	3	1	3	3	3	2	3	2	3	2.6
CO4	3	3	2	3	2	3	3	2	3	3	3	2	2.7
CO5	3	3	2	3	2	3	3	2	3	3	3	2	2.7
Mean Overall Score													2.6
Results													High

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit – I: Basics of Electrical circuits

Current (AC and DC) - Voltage – power– circuit elements - graphical symbols of common circuit elements – Resistor - principle of Resistance – types : fixed resistor, variable resistor, linear and nonlinear resistors – value of resistors using color codes – testing of resistors – resistors in series and parallel - Inductor – principle of inductance - air core inductor- iron core inductor- testing of inductors – capacitor - principle of capacitance – types : fixed capacitors, variable capacitors - testing of capacitors – capacitors in series and parallel.

Unit – II: Electrical Circuit laws and theorems (with DC circuits only)

Ohm's law – series circuits – voltage division – parallel circuits - current division- Kirchoff's laws:Current law and voltage law – star and delta transformation – Thevenins theorem – Norton's theorem – superposition theorem.

Unit – III: AC circuits

Single phase AC – instantaneous, peak, R.M.S. and Average values and form factor - concept of Reactance, Impedance, Susceptance and Admittance - Phase and Phase difference - concept of Power Factor.

Three phase AC – generation - importance of three phase circuits – star, delta connections – relation between voltages, currents of line and phase values in star and delta connections - live

and neutral wire – Domestic electric circuits – electrical appliances in parallel – current through appliances .

Unit – IV: Transformer, Short circuit and Open circuit

Transformer: Working Principle - construction - Types of Transformer - E.M.F. equation and transformer ratio - Transformer on no load -Transformer on load – Losses of transformer.

Short circuit: Single line to ground fault - line to line fault - double line to ground fault - Short circuits – effects of short circuit – detecting short circuits – symmetrical short circuit analysis.

Open circuit: open circuit in series connection – effects of open circuit in series connection– detecting open circuit.

Unit – V: Electrical Wiring and Electrical safety

Tools - method of joining conductors - house wiring methods – wood casing – tough – rubber sheathed, conduict or PVC pipe and concealed – main board preparation – switch board preparation – distribution box.

Safety precautions - relay - fuse – circuit breaker - earthing – reasons for earthing - system earthing- equipment earthing -Safety in electrical work, accidents and treatment for electric shock, first aid.

Books for study

1. B. L. Theraja, R..S. Sedha, Principles of Electronic devices and circuits, S. Chand and company Limited, New Delhi, 2008.
2. K. A. Smith and Alley R E, Electrical Circuits, Cambridge University press, USA, 2014.
3. K. S. Suresh Kumar, Electrical Circuits and Networks, Dorling Kindersley Pvt Limited, New Delhi, 2009.
4. David W Rongey, Home electrical wiring: A complete guide, 2013.

Books for reference

1. Dinesh C. Dube, Electronics circuits and analysis, New Delhi, Narosa publishing house Pvt Limited, 2006.
2. S. L. Kakani, K. C. Bhandari, A Text book of Electronics, New Age International (P) Limited, 2014.
3. James J. Brophy, Basic electronics for scientist Mc Graw –Hill Kogakusha Limited, New Delhi, 1977.
4. Edward L. Safford, Electrical Wiring Handbook, Tab Books; 1st edition, 1980.

Websites

https://www.allaboutcircuits.com/textbook/direct-current/chpt-1/electric-circuits/
https://www.allaboutcircuits.com/video-tutorials/essential-concepts-of-electric-circuits/
https://www.elprocus.com/basic-electrical-circuits-and-their-working-for-electrical-engineers/
https://www.elprocus.com/basics-of-network-theorems-in-electrical-engineering/
https://electrical-engineering-portal.com/resources/knowledge/theorems-and-laws
https://www.electronics-tutorials.ws/dccircuits/dcp_4.html
https://www.electronics-tutorials.ws/dccircuits/dcp_7.html
http://www.griet.ac.in/nodes/BEEE.pdf
https://www.cedengineering.com/userfiles/Fundamentals%20of%20DC%20Circuits.pdf
http://physics.bu.edu/~duffy/PY106/ACcircuits.html
https://www.electronics-tutorials.ws/accircuits/ac-resistance.html
https://www.allaboutcircuits.com/textbook/alternating-current/
https://www.electrical4u.com/open-and-short-circuit-test-on-transformer/
https://circuitglobe.com/open-circuit-and-short-circuit-test-on-transformer.html
https://ehs.princeton.edu/book/export/html/75
https://www.ehs.washington.edu/fire-life/basic-electrical-safety

Subject Skill – I : Electrical Circuits and Networks (Practicals)

Experiments

1. Testing continuity of conductors, electrical components using multimeter
2. (i) Study of voltage and current dividers

(ii) Study of series and parallel lamp circuits

3. Determining the value of resistors from Colour code
4. Study of series and parallel connections of resistors and capacitors
5. Current measurement by direct and indirect methods (using ammeter and Ohm's law)
6. Voltage measurement by direct and indirect methods (using voltmeter and Ohm's law)
7. Experimental verification of Kirchhoff's voltage law
8. Experimental verification of Kirchhoff's current law
9. To verify superposition theorem experimentally for a given resistive circuit consisting two independent sources
10. To verify Thevenin's theorem experimentally for a given circuit
11. To verify maximum power transfer theorem experimentally for a given circuit
12. Studying circuit schematics, identifying the faults and rectifying the faults of a regulated power supply
13. Studying and Testing different transformers
14. Switch board preparation

Websites for lab experiments

https://www.fluke.com/en-in/learn/blog/digital-multimeters/how-to-test-for-continuity
https://spark.iop.org/collections/series-and-parallel-circuits#gref
https://www.electronics-tutorials.ws/dccircuits/voltage-divider.html
https://www.electronics-tutorials.ws/resistor/res_2.html
https://www.allaboutcircuits.com/tools/resistor-color-code-calculator/
https://opentextbc.ca/universityphysicsv2openstax/chapter/resistors-in-series-and-parallel/
https://www.electronics-tutorials.ws/blog/voltmeter.html
http://courses.egr.uh.edu/ECE/ECE2100/Formal/Sample%20Formal%20Report.pdf
https://www2.gvsu.edu/peirsonb/kvl_kcl_ohms_law.pdf
https://www.allaboutcircuits.com/textbook/direct-current/chpt-10/superposition-theorem/
https://www.electronicshub.org/superposition-theorem/
https://www.khanacademy.org/science/electrical-engineering/ee-circuit-analysis-topic/ee-dc-circuit-analysis/a/ee-superposition
https://na.eventscloud.com/file_uploads/a99add5d970c11c3029e638a905df169_SubstationCommissioning1.pdf
https://www.eit.edu.au/resources/practical-troubleshooting-of-electronic-circuits-for-engineers-and-technicians/
https://www.circuitstoday.com/regulated-power-supply

Basic Instrumentation

Semester– VI **Hours/week: 3**

Course Code: **Credits: 3**

Objectives

- To develop knowledge of principles and working of various analog meters.
- To understand the principle and working of analog electrical instruments.
- To impart knowledge of principles and working of digital instruments.
- To learn about the working principle of various optical instruments used in measurement of physical quantities.
- To develop the skill of usage of environmental instruments.

Learning Outcomes

Sl. No.	Course outcomes	Knowledge level
	On successful completion of the course, the students will be able to	
CO1	Acquire knowledge about the working principles of various analog meter instruments.	K1
CO2	Understand the operation of various analog electrical instruments.	K1, K2
CO3	Differentiate between digital and analog instruments and explain their working.	K2, K3
CO4	Outline the working principle of various optical instruments.	K1
CO5	Gain knowledge on the working and applications of various environmental instruments.	K1, K3

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)							Programme Specific Outcome (PSO)					Mean score of CO
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	2	2	2	3	3	3	3	2	2.5
CO2	3	2	2	2	2	2	2	2	2	2	2	2	2.1
CO3	3	2	2	3	2	2	2	2	1	3	2	2	2.1
CO4	3	1	2	2	2	2	3	2	1	2	2	2	2.0
CO5	3	2	2	2	2	2	2	2	2	2	2	2	2.1
Mean Overall Score													2.1
Results													High

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit -I: Analog Electrical Instruments - I

Principle, Types, Working and Applications: Galvanometer – Ammeter – Voltmeter – Wattmeter – Ohmmeter – Analog IC tester – Thermocouple.

Unit - II: Analog Electrical Instruments - II

Principle and Usage: AFO– Function generator – VTVM– CRO – Transistor tester – Eliminator – Dual Power Supply – Vibrometer – Tachometer.

Unit - III: Digital Instruments

Block diagram, Working and Usage: Digital Voltmeter – Digital Multimeter – Digital Frequency Counter – Digital Conductivity Meter – Digital pH Meter – Digital Balance.

Unit - IV: Optical Instruments

Principle and Usage: Periscope–Binocular – Compound Microscope – Telescope: Terrestrial and Astronomical –Spectrometer –Michelson's Interferometer – Polarimeter.

Unit V: Environmental Instruments

Principle and Usage: Viscometer –Lactometer – Manometer – Hydrometer – Hygrometer – Anemometer– Turbidity Meter –Barometer – Rain Gauge – Noise Dosimeter – Radiation Dosimeter – Pyranometer and Pyrheliometer – Pyrometer.

Books for study

1. Rajendra Prasad, Electronic Measurements and Instrumentation, Khanna Publications, Chennai, 2004.
2. S.Ramambhadran, Electronic Measurements and Instrumentation, Khanna Publications, Chennai, 2003.

Books for reference

1. W. D. Cooper, A. D. Helfrick, Electronic Instrumentation and Measurement Techniques, New Delhi, Prentice Hall of India Pvt., Ltd, 1987.
2. J. Bouwens, Digital instrumentation, New Delhi, McGraw Hill international, 1987.
3. Randy D. Down, Jay. H. lehr, Environmental Instrumentation and Analysis Handbook, 2004

Websites

http://www.explainthatstuff.com/hygrometers.html
www.jma.go.jp/jma/jma–eng/jma–center/ric/material/1...Notes/CP7–Sunshine.pdf
http://nptel.ac.in/courses/112104118/lecture–4/4–5_mano_vacuum.htm
http://www.brookfieldengineering.com/products/viscometers/
http://amrita.olabs.edu.in/?sub=1&brch=5&sim=168&cnt=1
http://www.polarimeter.eu/
http://www.chem.ucla.edu/~bacher/General/30BL/tips/Polarimetry.html
http://www.ei–instrument.com/digital–conductivity–meter–601–611.htm
http://www.uniquecarsandparts.com.au/how_it_works_tachometer

Subject Skill Practicals – II: Basic Instrumentation (Practicals)

Experiments

1. Measurement of voltage, current and resistance using multimeter
2. (a) testing of active and passive components by multimeter, (b) continuity testing of conductors
3. Studying the function/purpose of different knobs and buttons in a CRO
4. Measurement of voltage, frequency, Period of AC using CRO
5. Measurement of radius of an object by microscope
6. Study of parts of a telescope and using it to view distant objects
7. Studying the functions of parts of a spectrometer and measuring the wavelength of a spectral line.

8. Measurement of pH of various liquids
9. Measurement of viscosity by viscometer
10. Measurement of density by Hydrometer
11. Measurement of pressure by manometer
12. Measurement of resistance using a bridge(Post office box)
13. Designing electrical circuits on PC board and soldering iron
14. Measure radius of curvature of a lens using spherometer.
15. Error, accuracy, precision measurements of instruments
16. Dismantling and assembling of spectrometer and microscope etc…

Non Major Elective –I : Repair and Maintenance of Household Appliances

Semester– VI **Hours/week: 2**

Course Code:NPH503 **Credits: 1**

Objectives

- To provide an understanding of the basics of electricity and electrical safety.
- To enable the students to understand the importance of earthing and energy storage devices.
- To expose the students to the principles and working of home appliances.
- To learn fault finding and replacing faulty component in electric iron.
- To train the students in Repaire and Maintenance of home appliances.

Learning Outcomes

Sl. No.	Course outcomes On successful completion of the course, the students will be able to	Knowledge level
CO1	Recall the safety precautions and apply them whenever it is necessary	K1
CO2	Understand the importance of earthing and acquire a knowledge on energy storage devices	K1, K2
CO3	Identify the fault in an electric iron box and rectify it	K3, K4
CO4	Explain the working of mixer, grinder, ceiling and table fans.	K2
CO5	Install and test fluorescent lamp chock and starter	K3, K4

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)							Programme Specific Outcome (PSO)					Mean score of CO
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	3	3	3	3	3	2	3	3	3	2.8
CO2	3	2	3	3	3	2	3	3	3	2	3	3	2.7
CO3	3	3	3	3	3	3	3	2	3	3	3	3	2.9
CO4	3	3	3	2	3	3	3	3	3	3	3	3	2.9
CO5	3	3	3	3	3	3	3	2	3	3	3	3	2.9
Mean Overall Score													2.8

Results	Hi

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit – I Electricity and Electrical safety

Introduction to electricity: Electric charge –conductors- Insulators- Voltage – current – resistance – resistor – Ohm's Law – power- capacitance- capacitor – inductor

Electrical safety: Safety – Tools for electrical safety – circuit breakers – fuse – Precaution during maintenance of home appliances – safety rules.

Unit – II: Earthing and energy storage devices

Need for earthing – types of earthing – working of earthing – advantage of earthing,

Batteries –Principle – working- Types of batteries-Primary and secondary – Lithium ion batteries – Lead acid batteries – Nickel cadmium batteries-Applications.

Unit – III: Home Appliances – I

Principle and working: electric iron, water heater, Electric kettle, fault finding – removal of faulty component in electric iron.

Unit – IV: Home Appliances – II

Principle and working: mixer grinder, ceiling and table fans – fault finding – removal of faulty component in mixer grinder.

Unit – V: Lamps and Electrical Insulation

Lamps: Working principle of fluorescent, CFL and LED lamps- series and Parallel connections.

Electrical Insulation: Need of electrical insulation–insulating materials–types ofinsulating materials.

Books for study

1. Mitchel E. Schultz Bernard Grob, Basic Electronics, McGraw Hill education Ltd., New Delhi, 2010.
2. B.L. Theraja Electrical Technology, Chand Publishers, New Delhi., 2012
3. K.B.Bhatia, Study of Electrical Appliances and Devices, Khanna Publishers, New Delhi., 2000.
4. Eric Kleinert., Troubleshooting and Repairing Major Appliances., 3 rd Edition., McGraw–Hill Professional Publishing., 2012
5. C.S. Indulkar , S. Thiruvengadam , An Introduction to Electrical Engineering Materials., S. Chand., 2006
6. Charles I. Hubert, Preventive Maintenance of Electrical Equipment, McGraw–Hill Inc.,1969

Books for reference

1. Bhatia., Study of Electrical appliances and devices, Khanna publishers., 2014.
2. Robert Rosenberg., Electric Motor Repair., Augie hand., 2011.

3. S.L. Uppal, J.M. Larcia, Electrical Wiring, Estimating and Costing, Khanna Publishers., 2004.

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http://www.hse.gov.uk/electricity/
https://www.wired.com/2015/02/size-battery-need-power-house/
https://www.swellenergy.com/how-home-batteries-work/
www.advanced–energy.com/upload/file/white_papers/eng–grounding–260–01.pdf
http://www.fixitclub.com/small–appliances–repairs/electric–iron–repair/
www.repairfaq.org/sam/tshoot.htm
Energy.gov/energy saver/insulation-materials
https://ebooks.schandpublishing.com/

Physics Revisited
(Self–Study Paper)

Semester– VI **Hours/week: —**
Course Code : **Credits: 1***

Objectives

- To enable the students to revise the concepts of mechanics, oscillations, waves, Black body radiation.
- To recollect the concepts of thermodynamics and statistical physics.
- To revisit the contents of Quantum mechanics
- To help the students to review the concepts in Atomic and Nuclear Physics.
- To understand the significance of semiconductor devices and their applications, this would help them to perform better in competitive examinations.

Learning outcomes

Sl. No.	Course outcomes On successful completion of the course, the students will be able to	Knowledge level
CO1	Recollect the basic concepts in mechanics, Waves and oscillations and explain black body radiation.	K1, K2
CO2	Recall the laws of thermodynamics, classical and quantum statistics.	K1
CO3	Formulate the Schrodinger wave equation for free state and bounded state problems and evaluate the energy eigen value	K3
CO4	Summarize the concepts in Atomic and Nuclear Physics.	K1
CO5	Outline the working principle of semiconductor devices .	K2

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)							Programme Specific Outcome (PSO)					Mean score of CO
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	2	2	2	2	2	3	2	2	2	1	2.

CO2	3	3	2	2	3	1	3	3	2	2	2	1	2.
CO3	3	3	2	2	3	2	1	2	3	3	2	1	2.
CO4	3	3	2	2	3	2	1	1	3	3	2	1	2.
CO5	3	3	2	2	3	1	2	1	3	3	2	1	2.
Mean Overall Score													2.
Results													Hi h

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit - I: Mechanics, oscillations and waves

Laws of motion – Work – Kinetic and potential energy – Friction – terminal velocity in air– Conservation of linear momentum and Angular momentum – Moment of inertia – Rotation about one axis – Planetary motion and Kepler's laws – Simple pendulum – simple harmonic motion– damped and forced oscillation– Transverse and Longitudinal waves – interference – beats – sound waves in air – Doppler effect.

Unit - II: Thermodynamic and Statistical Physics

Laws of thermodynamics – Thermodynamic potentials– Maxwell relations–Phase space – micro and macro states –Ensembles– Classical and quantum statistics – Ideal Bose and Fermi gases – Blackbody radiation and Planck's distribution law.

Unit - III: Atomic and Nuclear Physics

Quantum numbers – Pauli's exclusion principle – Electron spin – LS & JJ couplings – Photo electric effect – X-ray – Binding energy – semi–empirical mass formula – nuclear force – liquid drop model – shell model– alpha, beta and gamma decays – Fission and fusion– Elementary particles.

Unit - IV: Quantum mechanics

Wave–particle duality – De Broglie concepts – Uncertainty principle – Schrödinger equation – Eigen value problems (particle in a box, harmonic oscillator, etc) - Tunneling through a barrier – Wave function in coordinate and momentum representations.

Unit - V: Electronics

Semiconductor devices (diodes, transistors, field effect devices) – Opto-electronic devices (solar cells, photo–detectors, LEDs) – Operational amplifiers and their applications – Digital techniques and applications (registers, counters, comparators and similar circuits).

Books for study

1. R Murugeshan, Mechanics And Mathematical Physics, New Delhi, S.Chand Company, 2012.
2. Brij Lal, Dr.N. Subrahmanyam & Dr. P.S. Hemne, Heat Thermodynamics And Statistical Physics, New Delhi, S.Chand company, 2012.
3. R.Murugeshan, Modern Physics, New Delhi, S.Chand and Company Ltd., Ram Nagar, 2009.

4. Tayal. D.C., Nuclear Physics, Mumbai, Himalaya Publishing house,2011.
5. Mehta V. K, Principles of Electronics, New Delhi, S. Chand & Co. Ltd., 2003.

Books for reference

1. D Halliday, R. Resnick, J Walker, Fundamentals of Physics, Wiley New York 2001.
2. J. B. Rajam and C.L.Arora, Heat and Thermodynamics, New Delhi, S. Chand Company, 1984.
3. B. Basavaraj, A Text Book of Basic Electronics, Mumbai,Himalaya Publishing House, 2007.
4. G. Aruldhas, Quantum Mechanics, NewDelhi, Prentice Hall of India Pvt. Ltd.,2007.
5. S.P. Singh, M.K. Bagde, Kamal Singh, Quantum Mechanics, NewDelhi, S.Chand & company Ltd, 2000.

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http://www.atomicarchive.com/Physics/Physics1.shtml/
http://www.physicscatalyst.com/heat/thermodynamics_3.php/
http://physics.info/X-ray/
http://www.allaboutcircuits.com/textbook/semiconductors/chpt–5/junction–field–effect–transistors–jfet/
http://www.quantum–physics.polytechnique.fr/en/
http://www.futureelectronics.com/en/transistors/jfet–transistor.aspx

Non Major Elective: Physics in Everyday Life

Semester: VI **Hours/week: 2**
Course Code: NPH603 **Credits: 1**

Objectives

- To provide insights about the role of electromagnetic rays in everyday life
- To understand the origin of acoustic waves and their applications
- To understand the role of heat and fluids in our day to day life
- To explore the working principle of electrical devices
- To provide a broad view on heavenly bodies.

Learning outcomes

Sl. No.	Course outcomes	Knowledge level
	On successful completion of the course, the students will be able to	
CO1	Explain the reason behind the appearance of colors	K1, K2
CO2	explain the origin and applications of sound waves	K2
CO3	explain applications of heat in everyday life	K2
CO4	Rectify the faults in electrical heating devices	K3
CO5	describe the salient features of objects in the universe	K1

Mapping of CO with PO and PSO

CO	Programme Outcome (PO)	Programme Specific Outcome (PSO)	Mean score

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	of CO
CO1	3	3	2	2	3	2	3	3	2	3	2	2	2.
CO2	3	3	3	2	2	3	2	3	2	2	3	3	2.
CO3	3	2	3	3	2	3	2	2	2	3	2	3	2.
CO4	3	3	3	2	3	3	3	3	2	2	3	2	2.
CO5	3	3	2	2	3	3	2	3	2	3	3	2	2.
Mean Overall Score													2.
Results													Hi h

Assessment Pattern

Bloom's Category	CA Tests (Marks Allotment)		Term End Exam (100) Marks Allotment
	I CA (50)	II CA (50)	
Remember	15	15	30
Understand	15	15	40
Apply	5	5	10
Analyze	5	5	10
Evaluate	5	5	5
Create	5	5	5

Unit - I: Light

Electromagnetic spectrum – Light – Sunlight – Rayleigh scattering - blue and red colours of sky – reflection: colours of objects – houses in hot countries painted white – dark uniforms in winter and light ones in summer – refraction and dispersion of light – rainbow – DopplerEffect – colours of stars.

Unit - II: Sound

Production of sound – Music and noise – propagation of sound in different media – echo - acoustics of buildings – audible limit – Ultrasound: use of ultrasound by bats – SONAR - depth of sea.

Unit - III: **Fluids and Heat**

Fluids – density – Archimedes's principle – Applications: floating of ships, balloons – temperature-heat-heat flow- conduction-convection –radiation-thermometer-thermal expansion-effect of thermal expansion in railway tracks

Unit - IV: Electrical devices

Electricity – current – voltage – heating effect of current: electric iron, electric heaters – induction stove – microwave oven.

Unit-V: Astrophysics:

Sun-solar families-galaxies- types of galaxies – stars –birth and death of stars- black holes- origin of universe- eclipse (Solar and Lunar) –position of earth at every seasons (summer, winter, autumn, spring)

Books for study

1. Louis A. Bloomfield, How Things Work the physics of everyday life 5th Edition, TheUniversity of Virginia. 2013
2. Jay Newman, Physics of the Life Sciences, Springer Science+Business Media, 2008.
3. K.S. Krishnaswamy, Astrophysics a modern perspective, New Age International Pvt. Ltd, New Delhi, 2002.

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1. J. B. S. Haldane, Science and everyday life, Vigyanprasar, 2002.
2. Stan Gibilisco, Alternative Energy Demystified, the McGraw-Hill Companies, 2007.
3. Glen S. Aikenhead. Science Education for Everyday Life, Teachers College Press, 1234Amsterdam Avenue, New York, NY, 2006.
4. BaidyanathBasu, An Introduction to Astro Physics, Prentice – Hall of India Privatelimited, New Delhi, 2001.
5. R.Murugesan, Modern Physics, S. Chand & Company Ltd, New Delhi, 2009.
6. S.Kumaravelu, Astronomy, Jankicalendarcorporation, Sivakasi, 1993.

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