



**PSGR**  
**Krishnammal College for Women**



## **DEPARTMENT OF PHYSICS**

**LEARNING OUTCOMES- BASED CURRICULAR FRAMEWORK (LOCF)**

**BACHELOR OF PHYSICS (Aided & SF)**  
**2022-2025 BATCH**



## PROGRAMME LEARNING OUTCOMES-UG

At the end of the programme the students will

- PLO1** : Have enhanced academic abilities, personal qualities and transferable skills which will give them an opportunity to develop as responsible citizens.
- PLO2** : Excel in the competencies and value required for leadership to serve a rapidly evolving global community
- PLO3** : Acquire sound knowledge in the concepts and significance of the various physical phenomena.
- PLO4** : Be able to apply the theories learnt and the skills acquired to solve real time problems and to develop the interest to gauge the physical properties of materials.
- PLO5** : Be able to effectively apply the core concepts through information technology.
- PLO6** : Be endowed with creative and analytical skills, to equip them to become entrepreneurs and to find employability in core companies and software based industries.

## PROGRAMME SPECIFIC OUTCOMES

At the time of graduation the students will

- PSO1** : Gain a wide spectrum of skills which will enable them to solve both theoretical and experimental problems.
- PSO2** : Acquire laboratory skills as per standards, and will proficiently handle the electrical and electronic instruments.
- PSO3** : Understand the importance of energy conservation.
- PSO4** : A the skill to gauge the physical properties of materials.
- PSO5** : Be able to make effective use of information technology.



DEPARTMENT OF PHYSICS

**CHOICE BASED CREDIT SYSTEM (CBCS) & LEARNING OUTCOME  
BASED CURRICULAR FRAME WORK (LOCF)**

**SYLLABUS & SCHEME OF EXAMINATION (2022-2025 BATCH)**

Programme & Branch B.Sc Physics												
Scheme of Examination (Applicable to students admitted during the academic year 2022-2023 onwards)												
Semester	Part	Subject Code	Title of the Paper		Instruction hrs/week	Instruction hrs/sem	Tutorial hrs	Duration of Examination	Examination marks			
									CA	ESE	Total	Credits
I	I	TAM2201/ HIN2201/ FRE2201	Language T/H/F Paper I	Lan	6	86	4	3	50	50	100	3
	II	ENG2101	English Paper I	Eng	6	86	4	3	50	50	100	3
	III		<b>Group A – Core</b>									
		PS22C01	Core Physics Paper I: Mechanics, Properties of Matter and Sound	CC	6	86	4	3	50	50	100	5
		PS21CP1	Core Physics Practical I	CC	3			-	-	-	-	-
			<b>Group B – Allied - Paper I</b>									
		CE22A03	Allied Chemistry Paper –I (offered to B.Sc Physics)	GE	4	56	4	3	30	45	75	4
		TH22A01	Mathematical Statistics- I	GE								
		CE21AP2	Allied Chemistry Practicals (offered to B.Sc Physics)	GE	3			-	-	-	-	-
			<b>Non Tamil Students</b>									
	IV		NME22B1	Basic Tamil I	AEC	2	27	3	3	50	50	100
		NME22A1	Advanced Tamil I	AEC	2	27	3	3	50	50	100	
			<b>Students with Tamil as Language</b>									
		NME21ES	Introduction to Entrepreneurship	AEC	2	27	3	3	100	-	100	
II	I	TAM2202/ HIN2202/ FRE2202	Language T/H/F Paper II	Lan	6	86	4	3	50	50	100	3
	II	ENG2102	English Paper II	Eng	5	86	4	3	50	50	100	3
	III		<b>Group A – Core</b>									
		PS22C02	Core Physics Paper II: Heat and Thermodynamics	CC	5	71	4	3	50	50	100	5

		PS21CP1	Core Physics Practical I	CC	3			3	50	50	100	4
			<b>Group B – Allied - Paper I</b>									
		CE22A04	Allied Chemistry Paper –II (offered to B.Sc Physics)	GE								
		TH22A02	Mathematical Statistics- II	GE	5	71	4	3	30	45	75	4
		CE21AP2	Allied Chemistry Practicals (offered to B.Sc Physics)	GE	3	84		3	25	25	50	2
			<b>Group C</b>									
	IV	NME22B2	Basic Tamil II	AEC	SS	-	-	2	50	50	100	Grade
		NME22A2	Advanced Tamil II	AEC								
		21PEPS1	Professional English for Physical Sciences	AEC	3	42	3	2	50	50	100	2
			Open Course (Self Study online courses)		-	-	-	-	-	-	-	-
	I	TAM2203/ HIN2203/ FRE2203	Language T/H/F Paper III	Lan	6	88	2	3	50	50	100	3
	II	ENG2103	English Paper III	Lan	5	73	2	3	50	50	100	3
			<b>Group A – Core</b>									
	III	PS22C03	Core Physics Paper III Electricity and Magnetism	CC	4	58	2	3	50	50	100	4
		PS21CP2	Core Physics Practical – II	CC	3			-	-	-	-	-
			<b>Group B – Allied - Paper I</b>									
		TH22A12	Allied Mathematics for Physics - I	GE	7	103	4	3	50	50	100	5
		PL22A01	Allied Botany Paper- I		4	58	2	3	30	45	75	4
		AS22A01	Allied Zoology Paper I									
			<b>Skill Based Subject</b>									
		PS22SB01	Programming in C – Theory	SEC	3	41	4	2	100	-	100	3
	IV	NM22UHR	Universal Human Values and Human Rights	AEC	2	30	-	-	100	-	100	2
	IV	NM22EVS	Environmental Studies (Self Study)	AEC					100	-	100	Grade
	VI	JOB1801	Job Oriented Course Certificate Course on Robotics		After 12.50 PM			3	-	-	Grade	-
	IV	I	TAM2204/ HIN2204/ FRE2204	Lan	5	73	2	3	50	50	100	3
		II	ENG2204	Part II–English Paper III	Lan	6	88	2	3	50	50	100

			<b>Group A – Core</b>											
		PS22C04	Core Physics Paper IV Fundamentals of Digital Electronics	CC	4	58	2	3	50	50	100	4		
		PS21CP2	Core Physics Practical – II	CC	3	45	-	3	50	50	100	4		
			<b>Group B – Allied - Paper I</b>											
	III	TH22A31	Allied Mathematics for Physics - I	GE	7	103	2	3	50	50	100	5		
		PL22A02	Allied Botany Paper- II		4	58	2	3	30*	45*	75	4		
		AS22A02	Allied Zoology Paper II		3	45	-	3	25 <sup>#</sup>	25 <sup>#</sup>	50	2		
		PL21AP1	Allied Botany Practicals											
		AS21AP1	Allied Zoology Practicals											
					<b>Skill Based Subject</b>									
III /IV		PS22SBP1/ PS20SBCE	Programming in C – Practicals/Courseran- Python for Everybody	SEC	3	45/ 41	-/4	-	100	-	100	3		
	IV	NM22DTG	Design Thinking	FSA	2	30	-	2	100	-	100	2		
IV	V	COCOACT	NSS/NCC/YRC/ SPORTS&GAMES		-			-	-	100	100	1		
	VI	JOC1801	Certificate Course on Robotics Level 1 (Outside Class hours)		-	-	-	3	-	-	Grade	-		

CC – Core Courses

GE – Generic Elective

AEC – Ability Enhancing Course

FSA – Finishing School Part A

CA – Continuous Assessment

ESE – End Semester

\*CA Conducted for 25 converted to 20, ESE conducted for 75 converted to 55.

#CA Conducted for 25 converted to 15, ESE conducted for 75 converted to 55.

## **QUESTION PAPER PATTERN**

### **CIA Question Paper Pattern: 2 x 25 = 50 Marks**

One question from each unit with each question comprising of

- Two questions with a weightage of 2 marks (no choice)
- Two questions with a weightage of 6 marks (no choice)
- One question with weightage of 9 marks (Internal Choice at the same CLO level)

### **ESE Question Paper Pattern: 5 x 20 = 100 Marks**

One question from each unit with each question comprising of

- One question with a weightage of 2 marks (no choice)
- One question with a weightage of 6 marks (Internal Choice at the same CLO level)
- One question with weightage of 12 marks (Internal Choice at the same CLO level)

### ***CIA components for 2021-22 Batch with CIA: ESE pattern 50:50 Marks***

#### **INTERNAL COMPONENT MARKS:**

CA I	7
CA II	7
MODEL	10
Assignment	4
Seminar	5
Quiz	4
Class Participation	5
Application Oriented/Innovation/Creativity Assignment	5
Attendance	3
<b>TOTAL</b>	<b>50</b>

## RUBRICS

### *Rubrics for 5marks*

#### **(Application Oriented/Innovation/Creativity Assignment)**

<i>Criteria</i>	<i>Marks</i>
Originality	2
Presentation	2
References or Library Resources	1
<b>Total</b>	<b>5</b>

### **Assignment/Seminar**

#### **Maximum-20Marks (converted to 4 marks)**

<b>Criteria</b>	<b>4Marks</b>	<b>3Marks</b>	<b>2Marks</b>	<b>1Mark</b>
<b>Focus Purpose</b>	Clear	Shows awareness	Shows little awareness	No awareness
<b>Main idea</b>	Clearly presents a main idea.	Main idea supported throughout	Vague sense	No main idea
<b>Organisation: Overall</b>	Well planned	Good overall organization	There is a sense of organization	No sense of organization
<b>Content</b>	Exceptionally well presented	Well presented	Content is sound	Not good
<b>Style: Details and Examples</b>	Large specific examples and detailed descriptions	Some use of examples and detailed descriptions	Little use of specific examples and details	No use of examples

**CLASS PARTICIPATION**  
**Maximum-20 Marks (converted to 5 marks)**

<b>Criteria</b>	<b>5 Marks</b>	<b>4 Marks</b>	<b>3 Marks</b>	<b>2 Marks</b>	<b>1 Mark</b>
<b>Level of Engagement in Class</b>	Student proactively contributes to class by offering ideas and asks questions more than once per class.	Student proactively contributes to class by offering ideas and asks questions once per class	Student contributes to class and asks questions occasionally	Student rarely contributes to class by offering ideas and asking no questions	Student never contributes to class by offering ideas
<b>Listening Skills</b>	Student listens when others talk, both in groups and in class. Student incorporates or builds off of the ideas of others.	Student listens when others talk, both in groups and in class.	Student listens when others talk in groups and in class occasionally	Student does not listen when others talk, both in groups and in class.	Student does not listen when others talk, both in groups and in class. Student often interrupts when others speak.
<b>Behavior</b>	Student almost never displays disruptive behavior during class	Student rarely displays disruptive behavior during class	Student occasionally displays disruptive behavior during class	Student often displays disruptive behavior during class	Student almost always displays disruptive behavior during class
<b>Preparation</b>	Student is almost always prepared for class with required class materials	Student is usually prepared for class with required class materials	Student is occasionally prepared for class with required class materials	Student is rarely prepared for class with required class materials	Student is almost never prepared for class.



PS22C01	MECHANICS , PROPERTIES OF MATTER AND SOUND	Category	L	T	P	Credit
			86	6	-	5

### Preamble

To give the students fundamental ideas on conservation laws, rotational and vibrational motion of rigid bodies, elasticity, viscosity, surface tension and basics of sound.

### Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand and define the laws involved in mechanics , properties of matter and sound	K2
CLO2	Analyse the behaviour of various bodies due to kinematic and dynamic forces acting on the body.	K4
CLO3	Apply the key evidence of the classical description of the properties of matter	K3
CLO4	Recall the principles and basic equations and apply them to unseen problems	K4
CLO5	Acquire problem solving skills on par with industry	K4

### Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	M	M	S	S	S	S
CLO2	S	S	S	S	S	S
CLO3	S	S	S	S	S	S
CLO4	S	S	S	L	S	S
CLO5	S	M	M	M	S	S

S- Strong; M-Medium; L-Low

### Syllabus

#### Unit I

17 Hrs

#### Impact of elastic bodies and Friction

Conservation Laws - Collision- Impulse of a force – Fundamental principle of impact- Direct impact of two smooth spheres- loss of K.E due to direct impact of two smooth spheres-Oblique impact of a smooth sphere on a fixed smooth plane –oblique impact of two smooth spheres and loss of K.E due to oblique impact – friction – Laws of friction – angle of friction – cone of friction – Experimental method for determining co-efficient of friction between two surfaces-Equilibrium of a body on a rough inclined plane acted upon by an External force.

## **Unit II**

**17Hrs**

### **Rigid Body Dynamics**

Rigid body – rotational and vibrational motion – Torque – angular momentum-Angular impulse-moment of inertia – radius of gyration- dimensions and units of moment of inertia-Analogous parameters in translational and Rotational motion.

### **Simple Harmonic Motion**

Composition of two simple harmonic motions in a straight line- Composition of two simple harmonic motions of equal time periods at right angles-Lissajous Figures – Experimental methods – Uses of Lissajous Figures

## **Unit III**

**17 hrs**

### **Elasticity**

Elasticity - Three types of elastic moduli and relation between them – Poisson's ratio – Bending of beams – Expression for bending moment – Depression of the loaded end of a Cantilever – uniform – non uniform bending – theory – experiment - pin and microscope method – work done in uniform bending – Koenig's method – non-uniform bending - theory - expression for couple per unit twist - determination of rigidity modulus - Static torsion method with scale and telescope - Rigidity modulus by torsion pendulum with mass. I section girders.

## **Unit IV**

**17 hrs**

### **Viscosity and Surface tension**

Viscosity – Poiseuille's formula for the flow of a liquid through a capillary tube- corrections- Poiseuille's method to determine the coefficient of viscosity of liquid- Ostwald's viscometer- variation of viscosity with temperature and pressure – Searle's viscometer (rotating cylinder method). Effect of temperature on brake oils in cars.

**Surface tension**- work done in increasing the area of the surface- work done in blowing a bubble- experimental determination of surface tension – Jaegar's method- Quincke's method- variation of surface tension with temperature - drop weight method- experimental determination of interfacial tension between water and kerosene.

## **Unit V**

**18 hrs**

### **Sound**

Velocity of transverse waves along stretched string – Laws of transverse vibration of strings- Melde's experiment- Siren – Determinations of frequency of a tuning fork by revolving drum method and phonic stroboscopic method - Means of Lissajous method

**Acoustics**- Reverberation- Sabine's reverberation formula- Determination of absorption coefficient.

**Ultrasonics**- properties- production- Galton whistle – Magnetostriction oscillator – Piezo-electric oscillator- detection and application.

Importance of Industry 4.0 in Physics.

## Text Books

S.No	Authors	Title of the Book	Publishers	Year of Publication	Edition
1	Murugesan.R	Mechanics and Mathematical Methods	S.Chand& Co Ltd, New Delhi	2006	Reprint
2	Mathur D.S	Mechanics	S. Chand &Co Ltd, New Delh	2012	2 <sup>nd</sup> Edition
3	R.Murugesan	Properties of Matter	S.Chand and Company Pvt Ltd	2013	11 <sup>th</sup> edition
4	Saighal.R.L	Textbook of Sound	S.Chand&Co Ltd	1998	2 <sup>nd</sup> Edition
5	P. Kaliraj, T. Devi	Higher Education for Industry 4.0 and Transformation to Education 5.0			

## Reference Books

S.No	Authors	Title of the Book	Publishers	Year of Publication	Edition
1	Bhargava& Sharma	A Text Book of Mechanics	Ratan Prakashan Mandir	1990	7 <sup>th</sup> Edition
2	Brijlal Subramanyam	Properties of Matter	S. Chand and Company Pvt Ltd	1995	3 <sup>rd</sup> Edition
3	Murugesan. R	Properties of matter, Sound and thermal physics	S. Chand & Co Ltd	2011	1 <sup>st</sup> Edition

## Pedagogy

Chalk and Talk lectures, Group Discussion, Seminar, Interaction, power point presentation, Weblinks, NPTEL Lectures.

## Course Designers

1. Dr.M.Lavanya
2. Dr.S.ShanmugaSundari

PS22C02	HEAT AND THERMODYNAMICS	Category	L	T	P	Credit
			71	5	-	5

### Preamble

The aim of this course is to acquire knowledge in heat transfer, entropy, production of low temperature and liquefaction of gases, thermal radiation and statistical thermodynamics

### Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1.	Understand the central concepts and basic idea on specific heat, entropy, quantum theory of radiation	K2
CLO2.	Apply the concepts of low temperature physics in liquefaction of gases.	K3
CLO3.	Use the tools needed to formulate and solve problems in thermodynamical systems such as gases, heat engines etc	K3
CLO4.	Become familiarize with the concepts of thermodynamical potentials.	K3
CLO5.	Distinguish the particles based on the concepts and principles of Statistical Physics	K4

### Mapping with Programmes Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	M	M	S	S	M	S
CLO2	S	S	S	S	M	S
CLO3	S	S	S	M	M	S
CLO4	S	S	S	S	L	S
CLO5	S	S	S	S	S	S

S- Strong; M-Medium; L-Low

### Syllabus

#### Unit I

14 Hrs

#### Kinetic theory of gases

Maxwell's Law of Distribution of Velocities, Mean Free Path - Brownian motion – Langevin's theory of Brownian motion – Einstein's theory of Brownian motion – van der Waal's equation of state – critical constants – experimental determination of critical constants.

#### Quantum Theory of Specific Heat

Specific heat of solids - Dulong and Petits law and the deduction – failure of Dulong and Petit's law –

Einstein's theory and its limitation – Debye theory of specific heat of solids – specific heat of gases – Variation of specific heat of diatomic gases with temperature.

## Unit II

14 Hrs

### Low Temperature Physics

Methods of production of low temperatures – Joule Thomson effect – Porous plug experiment – its theory and result – Joule Thomson effect for perfect and real gases – Liquefaction of Hydrogen & Helium – Helium I and Helium II - Lambda point - super fluidity – adiabatic demagnetization – application in refrigerators and deep freezers.

## Unit III

14Hrs

### Thermal Physics

Quantum theory of radiation- Planck's hypothesis – average energy of Planck's oscillator – Planck's radiation law and its experimental verification -Derivation of Planck's law– Derivation of Wein's law and Rayleigh-Jean's from Planck's law – Stefan's and Wein's displacement laws from Planck's law – Room heaters and radiators in cars - solar thermal system (water heater)

## Unit IV

14Hrs

### Entropy

Entropy - Concept of entropy - temperature – entropy diagram – physical significance of entropy - Entropy of a perfect gas. Thermo dynamic potentials- internal energy (U)- Helmholtz function (F)-Gibb's function (G) and enthalpy (H) – significance of thermodynamic potentials - Maxwell's thermodynamics relation – the (T-dS) equation – Clapeyron's latent heat equation using Maxwell's thermodynamics relation – understanding entropy in steam engines.

## Unit V

15 Hrs

### Statistical Physics

Probability- Macrostate and microstate – thermodynamic probability – Ensembles – Kinds of Ensembles – Maxwell's Boltzmann distribution law- Maxwell's Boltzmann distribution in terms of temperature – Maxwell quantum statistics – phase space – Bose Einstein distribution law – Fermi - Dirac distribution law – Comparison of three statistics.

## Text Books

S. No	Authors	Title of the Book	Publishers	Year of Publication	Edition
1	Brijlal N Subrahmanyam P.S.Hemne	Heat Thermodynamics and Statistical Physics and applications	S. Chand	2012	3 <sup>rd</sup> edition
2	R.Murugeshan Er. KiruthigaSivaprassath	Thermal Physics	S.Chand	2012	3 <sup>rd</sup> edition

## Reference Books

S. No	Authors	Title of the Book	Publishers	Year of Publication	Edition
1	A.B Gupta H.P. Roy	Thermal Physics	Arunabha Sen	2005	1 <sup>st</sup> edition
2	Agrawal Prakash	Thermal Physics	PragatiPrakashan	2015	27 <sup>th</sup> edition
3	Agrawal Prakash	Thermodynamics and Statistical Physics	PragatiPrakashan	2015	27 <sup>th</sup> edition

## Pedagogy

Chalk and talk, PPT, Seminar, Group discussion, Interaction, Weblinks, NPTEL Lectures.

## Course Designers

1. Dr. G. Praveena

PS21CP1	CORE PRACTICALS I	Category	L	T	P	Credit
		I	-	-	3/Week	4

### Preamble

This course introduces students to the methods of experimental physics. Emphasis will be given on laboratory techniques such as accuracy of measurements and data analysis. The concepts that are learnt in the lecture sessions will be translated to the laboratory sessions thus providing a hands-on learning experience such as in measuring the basic concepts in properties of matter, Sound, Heat, Optics, Electricity and Magnetism.

### Course Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1.	Apply knowledge of mathematics and physics fundamentals and an instrumentation to arrive solution for various problems.	K2
CLO2.	Understand the usage of basic laws and theories to determine various properties of the materials given.	K2
CLO3.	Understand the application side of the experiments	K2
CLO4.	Use standard methods to calibrate the given low range voltmeter and ammeter and to measure resistance of the given coil and various physical quantities.	K3
CLO5.	Use of basic laws to study the spectral properties and optical properties of the given prism.	K3

### Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	S	S	L	L	L	L
CLO2	S	S	S	S	M	M
CLO3	S	S	S	S	M	M
CLO4	S	S	S	S	M	M
CLO5	S	S	S	S	M	M

S- Strong; M-Medium; L-Low

### Syllabus

#### List of Experiments

1. Determination of Young's Modulus of the given rectangular beam by Non Uniform bending using Optic lever.
2. Determination of Young's Modulus of the given rectangular beam by Uniform bending using pin and microscope.
3. Determination of Rigidity modulus of the material of the given rod by using Static torsion apparatus.

4. Determination of Rigidity modulus of the material of the suspension wire using Torsion pendulum.
5. Determination of Moment of Inertia of the given disc by torsional oscillations.
6. Determination of frequency of AC mains using Sonometer.
7. Determination of Acceleration due to gravity using Compound pendulum.
8. Determination of thermal conductivity of the given bad conductor using Lee's disc method.
9. Determination of Refractive index of the given solid prism using Spectrometer
10. Determination of Refractive index of a liquid using hollow prism - Spectrometer
11. Determination of wavelength of prominent lines of mercury spectrum using grating by minimum deviation method using Spectrometer
12. Calibration of a low range voltmeter using Potentiometer
13. Calibration of a low range ammeter using Potentiometer
14. Determination of unknown resistance of the given coil of wire using potentiometer.
15. Determination of Moment of a magnet using deflection magnetometer by Tan C method.
16. Determination of  $B_H$  by measuring the field along the axis using deflection magnetometer.
17. Determination of Temperature co-efficient of resistance of a Thermistor using Wheatstone's bridge.
18. Determination of Spring Constant of different metals.
19. Determination of frequency of tuning fork using Melde's apparatus.
20. Determination of Planck's constant using different Leds.

**Pedagogy:**

Demonstration and practical sessions

**Course Designers:**

1. Dr. P. Meena
2. Dr. G. Praveena



PS22A01	ALLIED PHYSICS PAPER- I (For Chemistry)	Category	L	T	P	Credit
		III	56	4	-	4

### Preamble

This paper introduces the students to the basic concepts of Elasticity, Rotational motion, Heat and thermodynamics, Sound, Optics, Atomic and Nuclear Physics

### Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Define the fundamental concepts of material properties, heat, sound, optics, atomic and nuclear physics.	K1
CLO2	Demonstrate the practical concepts behind the optics, heat and sound through experimental setup.	K2
CLO3	Apply the fundamental properties and the associated laws to understand physical systems.	K2
CLO4	Analyze the thermo dynamical, optical properties of matter and to recognize their applications in various real problems.	K3

### Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	S	S	S	M	L	L
CLO2	S	M	S	M	S	L
CLO3	S	M	S	L	M	S
CLO4	S	M	S	S	S	S

S- Strong; M-Medium; L-Low

### Syllabus

#### Unit – I

11 Hrs

#### Properties of Matter

**Elasticity: Moduli of elasticity-** bending moment-expression – **Young's modulus by uniform and non-uniform bending-theory and experiment-** I-section girders-Torsion pendulum-couple per unit twist-work done in twisting –determination of the rigidity modulus of the material of the wire.

#### Unit - II

11 Hrs

#### Transmission Of Heat

**Conduction process: Thermal conductivity-** Rectilinear field along a bar- Measurement of Thermal conductivity of a bad conductor by Lee's disc method

Convection process: Lapse rate-stability of atmosphere- Green house effect

Radiation process: Solar constant- **Pyroheliometer- solar energy and its applications (flat plate collector & solar cooker)** - concentration solar collector, Fresnel Lenses method.

**Unit - III****11 Hrs****Thermodynamics, Sound:**

Thermodynamics: Thermodynamic variables – Extensive and Intensive variables- Maxwell's Thermodynamic relation- Thermodynamic potential- Significance- relation of thermodynamics potentials with their variables

**Ultrasonics: Piezo electric & Magnetostriction method – Principle- Construction – Working and Applications.**

**Unit - IV****11 Hrs****Optics:**

Dispersion: Dispersive power-combination of prisms to produce (i) deviation without dispersion (ii) dispersion without deviation-direct vision spectroscope.

Interference: Air wedge-determination of diameter of a wire-Newton's rings-determination of refractive of a liquid

Polarisation: **Production, detection and analysis of different types of polarized light-quarter and half wave plates**

**Unit - V****12Hrs**

Atomic Physics: **Vector atom model** -Quantum numbers associated with vector atom model -Pauli's exclusion principle-excitation and ionization potential-experimental determination-**Franck and Hertz method.**

Nuclear Physics: **Elementary particles – classification-** particles and antiparticles- conservation laws and symmetry- Quark model.

**Books for Study:**

S.No	Authors	Title of the Book	Publishers	Year of Publication	Edition
1	Brijlal Subramaniam	Heat and thermodynamics	S.Chand andCo	2012	16 <sup>th</sup> Edition
2	Brijlal Subramaniam & Hemne.P.S	Heat thermodynamics and Statistical Physics	S.Chand andCo	2011	12 <sup>th</sup> Edition
3	Brijlal Subramaniam	Optics	S.Chand and Co	2012	21 <sup>st</sup> edition
4	Murugesan R	Allied Physics	S.Chand and Co	1998	1 <sup>st</sup> Edition

**Books for Reference:**

S.No	Authors	Title of the Book	Publishers	Year of Publication	Edition
1	Jayaprakash. N	Ancillary Physics, Volume I	J.P.Publications	1994	1 <sup>st</sup> Edition

2	Mathur D.S	Properties of Matter	S.Chand andCo	1970	2 <sup>nd</sup> Edition
3	Murugesan R	Modern Physics	S.Chand and Co	201	9 <sup>th</sup> edition

### Course Designers:

1. Mrs.S.Sowmya

### References For E-Content:

1. <https://youtu.be/qOhOYbztNIO>
2. <https://youtu.be/gcI-bkr7ilg>
3. <https://youtu.be/7tr4qWPgP40>
4. [https://youtu.be/N5GAHntU\\_nO](https://youtu.be/N5GAHntU_nO)
5. <https://youtu.be/hDP6egLrsdM>
6. <https://youtu.be/nmsPcTzIkrw>
7. <https://youtu.be/rAhvvvOBUt0>
8. <https://youtu.be/TUaTNzZ00oM>
9. <https://youtu.be/tDB3zP9MEZc>
10. <https://youtu.be/wvl0OAOcJvc>
11. <https://youtu.be/4nbBAG-848c>
12. [https://youtu.be/nJXB0vD\\_wEw](https://youtu.be/nJXB0vD_wEw)
13. [https://youtu.be/K4Do\\_yWJt2k](https://youtu.be/K4Do_yWJt2k)
14. <https://youtu.be/HH58VmUbOKM>
15. <https://youtu.be/DjnDX28l4xA>
16. <https://youtu.be/iVYGOWAtZCO>
17. <https://youtu.be/SOtOYCeI-Pc>
18. <https://youtu.be/kvkp-S8S5dU>

PS22A02	ALLIED PHYSICS PAPER- II (For Chemistry)	Category	L	T	P	Credit
			71	5	-	4

### Preamble

This paper introduces the student to the basic concepts of AC Circuits, Magnetic materials, electronics and digital electronics

### Course Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Explore the fundamental concepts of physics.	K1
CLO2	Import knowledge about the importance of material properties, heat, sound, optics, atomic and nuclear Physics.	K2
CLO3	Understand the energy involved in nuclear reaction.	K2
CLO4	Carry out the practical by applying these concepts.	K3
CLO5	Get depth knowledge of physics in day to day life.	K3

### Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	S	S	S	M	L	L
CLO2	S	M	S	M	S	L
CLO3	S	M	S	L	M	S
CLO4	S	M	S	S	S	S
CLO5	S	M	S	M	S	M

S- Strong; M-Medium; L-Low

## Syllabus

### Unit – I

11 Hrs

#### Alternating currents:

Mean and RMS values of AC – Series and parallel resonant circuits - Power factor – power factor of an ac circuit containing resistance, inductance and capacitance-Transformer-construction-working-losses.

### Unit – II

11 Hrs

#### Magnetic materials:

Magnetic Induction – Magnetization – Relation between the three magnetic vectors B, H and M- Magnetic susceptibility – Properties - diamagnetic – paramagnetic – ferromagnetic – anti ferromagnetism and ferrimagnetism – Electron theory of magnetism - Weiss's theory of ferromagnetism - energy loss in hysteresis – importance of hysteresis curves.

### Unit – III

11 Hrs

**Semiconductor Diodes:** P and N type semiconductors - PN Junction Diode - Current Flow Mechanism in Forward and Reverse Biased Diode - Zener Diode and Voltage Regulation - Principle and structure of (1) LEDs (2) Photodiode (3) Solar cell - Transistor – Characteristics of CB, CE and CC Configuration – Transistor biasing – Voltage divider biasing.

### Unit – IV

11 Hrs

**Two - terminal Devices and their Applications:** Rectifier Diode: Half- wave Rectifiers - Bridge Full-wave Rectifiers, Calculation of Ripple Factor and Rectification Efficiency - **Amplifiers:** Single stage amplifier (CE) - **Sinusoidal Oscillators:** Barkhausen's Criterion for self - sustained oscillations - RC Phase shift oscillator, determination of Frequency- Hartley oscillator.

### Unit – V

12 Hrs

#### Digital Electronics:

Boolean algebra- DeMorgan's theorem-OR, AND, NOT, XOR NOR and NAND gates-NOR and NAND gates as universal building blocks-half adder, full adder-flip flops - RS flip flop-JK flip flop

**Operational amplifier:** Characteristics-virtual ground-summing point-inverting and non-inverting amplifier-adder-subtractor.

#### Text Books

S.No	Authors	Title of the Book	Publishers	Year of Publication	Edition
1	R. Murugesan	Electricity and Magnetism	S.Chand andCo	2005	Revised Edition
2	V.K. Metha	Principles of electronics	S.Chand andCo	1980	1 <sup>st</sup> Edition
3	Murugesan R	Allied Physics	S.Chand and Co	2005	1 <sup>st</sup> edition

## Reference Books

S.No	Authors	Title of the Book	Publishers	Year of Publication	Edition
1	V. Vijayendran	Introduction to Integrated Electronics	Viswanathan Publishers	2005	1 <sup>st</sup> Edition

## Pedagogy

Chalk and talk, PPT, Seminar, Group discussion, Interaction

## Course Designers

1. Dr. G. Magesh

## Reference Links:

1. Mean and RMS values of AC - <https://www.youtube.com/watch?v=qDHsokTcgck>
2. Series & Parallel Resonant Circuits - <https://www.youtube.com/watch?v=G8KLJjq1E2o>
3. Transformer - Principle, Construction, Working and Efficiency - <https://www.youtube.com/watch?v=i29dCoSGa38>
4. Magnetization - <https://www.youtube.com/watch?v=C-OoUvKXbLU&t=2s>
5. BH Curve Experiment - <https://www.youtube.com/watch?v=1GGsbU698x8>
6. P and N type semiconductors - <https://www.youtube.com/watch?v=5ZNeDxfYAE>
7. Different types of diodes - <https://www.youtube.com/watch?v=-EqOEiEQGLI>
8. Diode rectifier circuits - <https://www.youtube.com/watch?v=Xmu31a-59vw>
9. Single stage amplifier - <https://www.youtube.com/watch?v=NEiVSbPYWNE>
10. RC Phase Shift Oscillator - <https://www.youtube.com/watch?v=Gvb4GIV5ig8>
11. Hartley Oscillator - [https://www.youtube.com/watch?v=3B\\_sBX\\_11Zw](https://www.youtube.com/watch?v=3B_sBX_11Zw)
12. Boolean Algebra and Logic gates - <https://www.youtube.com/watch?v=JQBRzsPhw2w>
13. Flip-flop - <https://www.youtube.com/watch?v=LTtuYeSmJ2g>
14. Operational amplifier - <https://www.youtube.com/watch?v=jsKSfaFQ4>

<b>PS21AP1</b>	<b>ALLIED PHYSICS PRACTICALS SEMESTERS I &amp; II</b> (For I BSc Chemistry and II BSc Mathematics)	Category	L	T	P	Credit
		-	-	-	3 Hrs/Week	3

### Preamble

To enable the student to gain practical knowledge

### Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1.	Gain knowledge in the scientific methods and learn the process of measuring different Physical variables	K1
CO2.	Educate The Basics Of Instrumentation, Data Acquisition And Interpretation of Results	K2
CO3.	Enhance The Students Understand The Concepts In Materials Properties	K2
CO4.	Have a deep knowledge of fundamentals of optics, electric circuits, magnetism and sound	K3

### Mapping with Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1.	S	S	S	S	M	S
CO2.	S	S	S	S	S	S
CO3.	S	M	S	M	M	M
CO4.	S	M	M	S	M	S

S- Strong; M-Medium; L-Low

### Syllabus

#### List of Experiments Any Eighteen

1. Young's Modulus –Non- Uniform bending –Pin and Microscope
2. Young's Modulus – Uniform bending – Optic lever
3. Rigidity modulus - Static torsion
4. Rigidity Modulus - torsional pendulum
5. Moment of inertia - torsional pendulum
6. Acceleration due to gravity - compound pendulum
7. Thermal conductivity of a bad conductor – Lee's disc method
8. AC frequency - Sonometer

9. Refractive index of solid prism - spectrometer
10. Refractive index of liquid-Hollow prism - spectrometer
11. Wave length- Grating - Minimum deviation method - Spectrometer
12. Low range Ammeter Calibration - Potentiometer
13. Low range Voltmeter Calibration - Potentiometer
14. Moment of a magnet in the Tan C position
15. Volt-Ampere characteristic of a p-n junction diode in the forward and reverse directions
16. Logic gates - Verification of the truth table
17. Characteristics of Zener diode
18. Closed loop gain of Operational Amplifier in Inverting mode
19. Closed loop gain of Operational Amplifier in Non Inverting mode.

### **Pedagogy**

Demonstration and Practical Sessions

### **Course Designers:**

1. Mrs. T. Poongodi



PS22C03	ELECTRICITY AND MAGNETISM	Category	L	T	P	Credit
		III	58	2	-	4

### Preamble

The aim of this course is i) to acquire in-depth knowledge in electrostatics and magnetostatics so that students would apply theories of static and moving charges and extend its applications to instruments involving electric and magnetic fields and ii) to give idea on the fundamentals of electromagnetic conduction and electromagnetic waves.

### Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO 1	Recall the basic knowledge of scalar, vector fields, AC/DC circuits and electromagnetic wave.	K1
CLO 2	Understand the concept of different laws in electrostatics, generation of currents and the variation of current in magnetic field.	K2
CLO 3	Apply theorems to construct and solve electrical circuits.	K3
CLO 4	Analyze the generation of magnetic fields by electrical currents through circuit laws.	K4

### Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO 1	M	M	S	S	M	S
CLO 2	S	M	S	S	M	S
CLO 3	S	M	S	S	S	S
CLO 4	S	M	S	S	S	S

S- Strong; M-Medium; L-Low

### Syllabus

#### Unit I

12 Hrs

#### Vector Analysis:

Scalar and Vector fields, **gradient of a scalar field, divergence of a vector field, Curl of a vector field and their physical significance**<sup>1,2,3,4</sup>, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss divergence theorem and Stoke's theorem of vectors (Statement and proof only)

#### Electrostatic Field:

Electric field, Continuous charge distribution, **Divergence and curl of electrostatic fields; Field lines, flux**<sup>5,6</sup> and Gauss' law statement and its proof, applications of Gauss's law – uniformly

charged spherical shell and conducting sphere, infinite line of charge, uniform infinite cylindrical charge and infinite plane sheet of charge, **Coulomb's Law**<sup>7,8</sup>.

## Unit II

12 Hrs

### Electric potential:

**Introduction to potential, Comments on potential**<sup>9,10</sup>, Poisson's and Laplace's equations, Potential of a localized charge distribution, electrostatic boundary value problems – Uniqueness theorem

### Electrical Images:

Solution of field problems in case of a point charge near a grounded conducting infinite plane. Boundary value problems: in uniform external field for (1) insulated Conducting Sphere (2) **conducting spherical shell and (3) dielectric sphere**<sup>11,12,13</sup>.

## Unit III

11 Hrs

### DC currents:

Growth and decay of charge in series RC circuit, **Growth and decay of current in series LR circuit**<sup>14</sup>, Growth and Decay of charge in series LCR circuit - **Damped, under-damped and over-damped conditions**

### AC Circuits:

Series resonance circuit- Parallel LCR Circuit – Complex form of LCR circuits- j operator method - Characteristics of LCR Circuit: (1) Resonance, (2) Quality Factor, (3) Band Width and (4) Sharpness of Resonance - power consumed by the above circuits.

## Unit IV

12 Hrs

### Magnetic Field:

Magnetic force between current elements and definition of Magnetic Field **B**. Biot-Savart's Law and its simple applications: long straight wire and **circular loop**<sup>15</sup>. Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole). Ampere's Circuital Law and its application to (1) Solenoid and (2) **Toroid. Properties of B: curl and divergence**<sup>15,16,17</sup>. Differential form of Ampere's circuital law- Magnetic scalar and Vector Potential -Importance.

## Unit V

11 Hrs

### Electromagnetic waves:

Equation of continuity – Displacement current – Significance of displacement current – Derivation of Maxwell's equations – Maxwell's equations in integral form - **Differential form – Plane electromagnetic waves – Transverse nature of electromagnetic waves**<sup>18,19,20</sup> - Maxwell's equations in free space-Electromagnetic waves in free space- Poynting theorem (Statement and Proof)

### Text Books

S. No	Authors	Title of the Book	Publishers	Year of Publication	Edition
1	R. Murugesan	Electricity and Magnetism	S. Chand & Co Pvt Ltd	2019	8 <sup>th</sup> Edition
2	Dr. K. K. Tewari	Electricity and Magnetism	S. Chand & Co Pvt Ltd	2016	Revised Edition
3	Brijlal and N. Subrahmanyam	Electricity and Magnetism	S. Chand & Co Pvt Ltd	2017	18 <sup>th</sup> Edition

## Reference Books

S. No	Authors	Title of the Book	Publishers	Year of Publication	Edition
1	David J Griffith	Electrodynamics	Prentice Hall	2015	4 <sup>th</sup> Edition
2	Edward M. Purcell	Electricity and Magnetism, Berkeley Physics Course – Volume 2	Tata Mc-Graw Hill Education	2013	3 <sup>rd</sup> Edition
3	D C Tayal	Electricity and Magnetism	Himalaya Publishing House	2009	Revised edition
4	Sehgal, Chopra, Sehgal	Electricity and Magnetism	S. Chand and sons	2020	2 <sup>nd</sup> edition
5	A S Mahajan, A A Rangwala	Electricity and Magnetism	S. Chand and sons	2017	6 <sup>th</sup> edition

## Pedagogy

Chalk and talk, PPT, Seminar, Group discussion, Interaction

## Course Designer

1. Dr.N.Priyadharsini

## References For E-Content

1. <https://www.youtube.com/watch?v=W8N8XswNei8>
2. <https://www.youtube.com/watch?v=gLsoAjuRWCw>
3. <https://www.youtube.com/watch?v=SZCsFS9izfQ>
4. <https://www.youtube.com/watch?v=v3ZC4Mo1fS0>
5. <https://www.youtube.com/watch?v=VBCzo91uUi8>
6. <https://www.youtube.com/watch?v=4VC3IHbuW8>
7. <https://www.youtube.com/watch?v=2GQTfpDE9DQ>
8. <https://www.youtube.com/watch?v=rYjo774UpHI>
9. [https://www.youtube.com/watch?v=j3GrOKre\\_0](https://www.youtube.com/watch?v=j3GrOKre_0)
10. <https://www.youtube.com/watch?v=PEcPcNMfNks>
11. <https://www.youtube.com/watch?v=-SakEHbtryA>
12. <https://www.youtube.com/watch?v=jippPv6GzI4>
13. <https://www.youtube.com/watch?v=7YbLDIbv17w>
14. <https://www.youtube.com/watch?v=04THKYsONKA>
15. [https://www.youtube.com/watch?v=I8X1EpH\\_VQY](https://www.youtube.com/watch?v=I8X1EpH_VQY)
16. <https://www.youtube.com/watch?v=sFre-bMvBeI>
17. <https://www.youtube.com/watch?v=yr0RkoUHgf0>
18. <https://www.youtube.com/watch?v=CX7X6YrVUdk>
19. <https://www.youtube.com/watch?v=pn9yxCxzJfY>
20. <https://www.youtube.com/watch?v=HvK35jjMb5I>

PS22SB01	PROGRAMMING IN C	Category	L	T	P	Credit
		III	41	3	-	2

### Preamble

The main objective of this course is to i) train the students to the basic concepts of programming language ii) to provide exposure to problem solving through programming iii) also create foundation for students to learn other complex programming languages like C++, Java etc.,

### Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO 1	Recall the fundamental concepts of C programming	K1
CLO 2	Understand the characteristics of operators, arrays, structures	K2
CLO 3	Apply the acquired knowledge to design programs and algorithms	K3
CLO 4	Analyze and develop programs for simple real time applications	K4

### Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO 1	S	M	M	M	S	S
CLO 2	S	S	S	M	M	S
CLO 3	S	M	S	S	S	M
CLO 4	S	S	S	S	S	M

S- Strong; M-Medium; L-Low

### Syllabus

#### Unit I

9 Hrs

#### Introduction to C

Overview of C - C character set - C tokens - Key words and identifiers-**Constants- Variables - Date types and sizes-** Declaration of variables –Assigning valued to the variables –Defining symbolic constants.

#### Unit II

8 Hrs

#### Operators and Expressions

Arithmetic operators - relational and logical operators-assignment operators - **increment and decrement operator-Conditional operator-Bit wise and Special operator** - Arithmetic Expression-Evaluation of expression – Precedence of arithmetic operations-Type conversion in

expressions- Operator precedence and some computational problems.

### Unit III

8 Hrs

#### Statements and Loops - I

IF Statement – **IF ELSE Statement- Nesting IF ELSE Statements- Switch Statements- the?: Operator-** GOTO Statements - Simple Programs

### Unit IV

8 Hrs

#### Statements and Loops - II

While Statements – DO statements – For Statements- Jumps in loops - Simple Programs

### Unit V

8 Hrs

#### Arrays and Structures

One Dimensional array - Two dimensional Array- Initializing two-dimensional Array- Multidimensional arrays - Dynamic Arrays. **Structure definition – Giving values to members- Structure initialization – Comparison of structure variables-** Arrays of Structures – Arrays within Structure – Structure with in Structures.

### Text Book

S. No	Authors	Title of the Book	Publishers	Year of Publication
1	E. Balagurusamy	Programming in ANSI C	Tata Mc Graw Hill, 8 <sup>th</sup> Edition.	2019

### Reference Books

S. No	Authors	Title of the Book	Publishers	Year of Publication
1	Byran Gottfried	Programming with C	Tata McGraw Hill, 3 <sup>rd</sup> Edition.	2013
2	V.Rajaraman	Computer Programming in C	Prentice Hall of India Pvt Ltd, 1 <sup>st</sup> Edition.	2004
3	Smarajit Ghosh	Programming in C	Prentice Hall of India Pvt Ltd, 1 <sup>st</sup> Edition.	2004
4	Yeswanth Kanethkar	Let us C	BPB Publications, 13 <sup>th</sup> Edition.	2014
5	MartinJ Gentile	An Easy Guide to Programming in C	Create Space Independent Publishing Platform, 2 <sup>nd</sup> Edition	2012

## **Pedagogy**

Chalk and talk, PPT, Discussion, Assignment, Quiz, Seminar.

## **Course Designer**

1. Dr. S. Shanmuga Sundari

## **References For E-Content:**

1. <https://www.youtube.com/watch?v=p5MRUoEv5bw>
2. <https://www.youtube.com/watch?v=NyT9vvSBoeo>
3. <https://www.youtube.com/watch?v=VSU7EaHMzI8>
4. <https://www.youtube.com/watch?v=S8TWdFIMrpU>
5. [https://www.youtube.com/watch?v=Z3WjR\\_KEVjk](https://www.youtube.com/watch?v=Z3WjR_KEVjk)
6. <https://www.youtube.com/watch?v=jlQmeyce65Q>
7. <https://www.youtube.com/watch?v=oWTnLzWkF5w>
8. <https://www.youtube.com/watch?v=0g82dDC-mtc>
9. <https://www.youtube.com/watch?v=LpHnHRI6gLc>
10. [https://www.youtube.com/watch?v=8\\_ACcusAhx4](https://www.youtube.com/watch?v=8_ACcusAhx4)
11. <https://www.youtube.com/watch?v=mw1qsMieK5c>

PS21CP2	CORE PRACTICALS II	Category	L	T	P	Credit
		III	-	-	3 hrs/Week	2

### Preamble

This course introduces students to the methods of experimental physics. Emphasis will be given on laboratory techniques such as accuracy of measurements and data analysis. The concepts that are learnt in the lecture sessions will be translated to the laboratory sessions thus providing a hands-on learning experience such as in measuring the basic concepts in properties of matter, heat, optics, electricity and electronics.

### Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the usage of basic laws and theories to determine various properties of the materials given.	K1,K2
CLO2	Understand the application side of the experiments.	K2
CLO3	Apply knowledge of mathematics and physics fundamentals and an instrumentation to arrive solution for various problems.	K3
CLO4	Use standard methods to calibrate the given high range voltmeter and to measure the elasticity and thickness of the given material.	K3
CLO5	Use of basic laws to study the spectral properties and optical properties of the given prism and grating.	K3

### Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	S	S	L	L	L	L
CLO2	S	S	S	S	M	M
CLO3	S	S	S	S	M	M
CLO4	S	S	S	S	M	M
CLO5	S	S	S	S	M	M

S- Strong; M-Medium; L-Low

## Syllabus

### List of Experiments

#### Any 16

1. Young's Modulus – Uniform Bending – Koenig's Method
2. i-d curve-  $\mu$  of the prism-Spectrometer
3. Dispersive Power of Grating – Spectrometer- Wave length of Mercury Spectral Lines by minimum deviation method
4. Refractive index ( $\mu$ ) of the material of the prism lens – Newton's rings method
5. Calibration of High Range Voltmeter –Potentiometer
6. Wave length of Mercury Spectral Lines – Grating - Normal Incidence –Spectrometer
7. Young's Modulus –Non-Uniform Bending – Koenig's Method
8. Thickness of a thin wire – Air Wedge method
9. EMF of thermocouple –Potentiometer
- 10.High resistance by i) Charging ii) Leakage using Ballistic Galvanometer
- 11.Comparison of Mutual Inductance's – Ballistic Galvanometer
- 12.Measurement of dielectric constant - Parallel Plate Capacitor Method
- 13.Series Resonant Circuit
- 14.Parallel Resonant Circuit
- 15.i) Verification of Truth Tables of IC Gates: OR, AND, NOT, XOR, NOR, and NAND  
ii) Verification of Demorgan's theorem using Logic Gates
- 16.Verification of Truth Table of Half and Full Adders
- 17.Verification of NAND as a Universal Building Block
- 18.Verification of NOR as a Universal Building Block
- 19.Verification of Truth Tables of Half and Full Subtractor

## Pedagogy

Demonstration

## Course Designer

1. Dr.M.Lavanya



PS22A03	ALLIED PHYSICS PAPER- I (For Mathematics)	Category	L	T	P	Credit
		III	58	2	-	4

### Preamble

This paper introduces the students to the basic concepts of Elasticity, Rotational motion, Heat and thermodynamics, Sound, Optics, Atomic and Nuclear Physics

### Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Define the fundamental concepts of material properties, heat, sound, optics, atomic and nuclear physics	K1
CLO2	Demonstrate the practical concepts behind the optics, heat and sound through experimental setup	K2
CLO3	Apply the fundamental properties and the associated laws to understand physical systems	K2
CLO4	Analyze the thermo dynamical, optical properties of matter and to find its applications in various fields	K3

### Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	S	S	S	M	L	L
CLO2	S	M	S	M	S	L
CLO3	S	M	S	L	M	S
CLO4	S	M	S	S	S	S
CLO5	S	M	S	M	S	M

S- Strong; M-Medium; L-Low

### Syllabus

#### Unit – I

11 Hrs

#### Properties of Matter

Elasticity: Moduli of elasticity<sup>1,2</sup>- bending moment-expression – Young's modulus by uniform and non-uniform bending-theory and experiment<sup>3</sup>- I-section girders-Torsion pendulum-couple per unit twist-work done in twisting –determination of the rigidity modulus of the material of the wire.

#### Unit - II

12 Hrs

#### Transmission Of Heat

**Conduction process:** Thermal conductivity<sup>4,5</sup>- Rectilinear field along a bar- Measurement of Thermal conductivity of a bad conductor by Lee's disc method

Convection process: Lapse rate-stability of atmosphere- Green house effect

Radiation process: Solar constant- Pyroheliometer- solar energy and its applications (flat plate collector & solar cooker)<sup>6,7,8,9,10</sup> - concentration solar collector, Fresnel Lenses method.

**Unit - III****12 Hrs****Thermodynamics, Sound:**

Thermodynamics: Thermodynamic variables – Extensive and Intensive variables- Maxwell's Thermodynamic relation- Thermodynamic potential- Significance- relation of thermodynamics potentials with their variables

**Ultrasonics:** Piezo electric & Magnetostriction method – Principle- Construction – Working and Applications<sup>11,12,13</sup>.

**Unit - IV****11 Hrs****Optics:**

Dispersion: Dispersive power-combination of prisms to produce (i) deviation without dispersion (ii) dispersion without deviation-direct vision spectroscopy.

Interference: Air wedge-determination of diameter of a wire-Newton's rings-determination of refractive of a liquid

Polarisation: Production, detection and analysis of different types of polarized light-quarter and half wave plates<sup>14,15,16</sup>

**Unit - V****12 Hrs**

Atomic Physics: Vector atom model<sup>17</sup> -Quantum numbers associated with vector atom model -Pauli's exclusion principle-excitation and ionization potential-experimental determination-**Franck and Hertz method**<sup>17</sup>.

Particle Physics: Elementary particles – classification<sup>18</sup> - particles and antiparticles- conservation laws and symmetry- Quark model.

**Books for Study:**

S. No	Authors	Title of the Book	Publishers	Year of Publication
1	Brijlal Subramaniam	Heat and thermodynamics	S.Chand and Co, 16 <sup>th</sup> Edition.	2012
2	Brijlal Subramaniam & Hemne.P.S,	Heat thermodynamics and Statistical Physics	S.Chand and Co, 12 <sup>th</sup> edition	2011
3	Brijlal Subramaniam	Optics	S.Chand and Co, 21 <sup>st</sup> Edition	2012
4	Murugeshan R	Allied Physics	S.Chand and Co, 1 <sup>st</sup> Edition	1998

**Books for Reference:**

S. No	Authors	Title of the Book	Publishers	Year of Publication
1	Jayaprakash. N	Heat and thermodynamics	S Chand and Co, 16 <sup>th</sup> Edition.	2012
2	Mathur D.S	Properties of Matter	S Chand and Co, 2 <sup>nd</sup> Edition	1970
3	Murugesan R	Modern Physics	S.Chand and Co , 9 <sup>th</sup> edition	2013

**Pedagogy**

Chalk and talk, PPT, Seminar, Group discussion, Interaction

**Course Designers:**

1. Mrs.S.Sowmya

**References For E-Content:**

1. <https://youtu.be/qQhOYbztNIQ>
2. <https://youtu.be/gcI-bkr7ilg>
3. <https://youtu.be/7tr4qWPgP40>
4. [https://youtu.be/N5GAHntU\\_nQ](https://youtu.be/N5GAHntU_nQ)
5. <https://youtu.be/hDP6egLrsdM>
6. <https://youtu.be/nmsPcTzIkrw>
7. <https://youtu.be/rAhvvyQBUt0>
8. <https://youtu.be/TUaTNzZ00oM>
9. <https://youtu.be/tDB3zP9MEZc>
10. <https://youtu.be/wvl0QAQCJyc>
11. <https://youtu.be/4nbBAG-848c>
12. [https://youtu.be/nJXB0yD\\_wEw](https://youtu.be/nJXB0yD_wEw)
13. [https://youtu.be/K4Do\\_yWJt2k](https://youtu.be/K4Do_yWJt2k)
14. <https://youtu.be/HH58VmUbOKM>
15. <https://youtu.be/DjnDX28l4xA>
16. <https://youtu.be/iVYGOWAtZCQ>
17. <https://youtu.be/SQtOYCeI-Pc>
18. <https://youtu.be/kykp-S8S5dU>

<b>PS21AP1</b>	<b>ALLIED PHYSICS PRACTICALS</b> (For I BSc Chemistry Sem I and II and II BSc Mathematics Sem III and IV)	Category	L	T	P	Credit
		III	-	-	3 Hrs/ week	3

### Preamble

To enable the student to gain practical knowledge

### Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1.	Gain knowledge in the scientific methods and learn the process of measuring different Physical variables	K1
CO2.	Educate The Basics Of Instrumentation, Data Acquisition And Interpretation of Results	K2
CO3.	Enhance The Students Understand The Concepts In Materials Properties	K2
CO4.	Have a deep knowledge of fundamentals of optics, electric circuits, magnetism and sound	K3

### Mapping with Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1.	S	S	S	S	M	S
CO2.	S	S	S	S	S	S
CO3.	S	M	S	M	M	M
CO4.	S	M	M	S	M	S
CO5.	S	S	S	S	M	S

S- Strong; M-Medium; L-Low

### Syllabus

#### List of Experiments Any Eighteen

1. Young's Modulus –Non- Uniform bending –Pin and Microscope
2. Young's Modulus – Uniform bending – Optic lever
3. Rigidity modulus - Static torsion
4. Rigidity Modulus - torsional pendulum
5. Moment of inertia - torsional pendulum
6. Acceleration due to gravity - compound pendulum

7. Thermal conductivity of a bad conductor – Lee’s disc method
8. AC frequency - Sonometer
9. Refractive index of solid prism - spectrometer
10. Refractive index of liquid-Hollow prism - spectrometer
11. Wave length- Grating - Minimum deviation method - Spectrometer
12. Low range Ammeter Calibration - Potentiometer
13. Low range Voltmeter Calibration - Potentiometer
14. Moment of a magnet in the Tan C position
15. Volt-Ampere characteristic of a p-n junction diode in the forward and reverse directions
16. Logic gates - Verification of the truth table
17. Characteristics of Zener diode
18. Closed loop gain of Operational Amplifier in Inverting mode
19. Closed loop gain of Operational Amplifier in Non Inverting mode.

### **Pedagogy**

Demonstration and Practical Sessions

### **Course Designers:**

1. Mrs. T. Poongodi

PS22C04	FUNDAMENTALS OF DIGITAL ELECTRONICS	Category	L	T	P	Credit
		III	58	2	-	4

### Preamble

The aim of this course is to make students acquire knowledge about Boolean algebra, logic circuits, designing counters and the basic concepts of memory and programmable logic device.

### Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Outline the fundamental concepts and techniques used in digital electronics.	K1
CLO2	Understand the various basic and complex digital circuits	K2
CLO3	Apply the acquired knowledge to build and troubleshoot digital circuits.	K3
CLO4	Design and analyze the working of digital circuits and system.	K4

### Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	S	S	M	M	S	S
CLO2	S	S	S	S	S	S
CLO3	S	S	S	S	S	M
CLO4	S	S	S	M	S	M

S- Strong; M-Medium; L-Low

### Syllabus

#### Unit I

##### Number Systems, Logic gates and Boolean algebra

12 Hrs

Number Systems-Binary-octal-Hexadecimal and its conversions-**Binary Codes- BCD codes- 8421 code-Excess 3 code-Grey code**<sup>1,2</sup>-**Logic gates – AND, OR, NOT, NAND, NOR gates**<sup>3,4</sup> – Boolean algebra- operators – logic expressions De-Morgan's theorem – laws and rules of Boolean algebra – truth table – reducing Boolean expressions – Karnaugh maps – simplification of digital circuits.

#### Unit II

##### Arithmetic circuits and Flip flops

12 Hrs

Half adder- full adder – Parallel binary adder, half subtractor – full subtractor – Parallel binary Subtractor, parity generator – **encoder – decoder**<sup>5,6</sup>.

Flip flop –NAND Latch- RS Flip Flop- Edge triggered RS Flip Flop, D and T Flip Flop - JK Flip Flop, Master Slave Flip Flop.

#### Unit – III

##### Registers and Counters

12 Hrs

Registers – Shift Registers-Shift left and Shift right registers – Ring Counter – Johnson's Counter - Asynchronous / Ripple counters – modulus counter- Mod 3, 4, 5, 6, 7, 8 and 9 counters - **Decade counter**<sup>7,8</sup> - Synchronous Counters.

**Unit – IV****11 Hrs****A/D & D/A Converters**

Digital to Analog (D/A) converter- Binary weighted resistor method – R / 2R Ladder Network  
 - Analog to Digital (A/D) Converter – counter type - Dual slope integrator – **successive approximation A/D Converter**<sup>9,10</sup>.

**Unit – V****11 Hrs****Semiconductor memory**

Read only memory – **Random access memory – PROM – EPROM-SRAMs – DRAMS**<sup>11,12,13</sup>. Digital IC Characteristics –Resistor Transistor Logic (RTL) – Transistor Transistor Logic (TTL) – Schottky TTL – Emitter Coupled Logic (ECL).

**Books for Study:**

S.No	Authors	Title of the Book	Publishers	Year of Publication	Edition
1	Malvino & Leach	Digital principles and applications	Tata Mc Graw Hill	1995	5 <sup>th</sup> Edition
2	M. Morris Mano	Digital Logic & Computer Designs	Prentice Hall Of India.	2014	4 <sup>th</sup> Edition
3	Vijayendran V	Introduction to Integrated electronics	S. Viswanathan (Printers & Publishers, Chennai)	2005	1 <sup>st</sup> Edition

**Books for Reference:**

S.No	Authors	Title of the Book	Publishers	Year of Publication	Edition
1	Chatterji B.N	- Digital Computer technology	Khanna Publishers, Delhi	1986	2 <sup>nd</sup> Edition
2	Puri V K	Digital Electronics circuits and systems	Tata McGraw Hill Publishing Company Limited New Delhi	1997	1 <sup>st</sup> Edition
3	S Salivahanan S Arivazhagan	Digital Circuits and Design	Vikas Publishing House Private Limited	2007	3 <sup>rd</sup> Edition

**References For E-Content**

- <https://www.youtube.com/watch?v=A-gWV5liKxM>
- <https://www.youtu.be/IeWcvAsz88o>
- [https://www.youtu.be/AzyG\\_wL3qMY](https://www.youtu.be/AzyG_wL3qMY)
- <https://youtu.be/sJXT03EZoxM>
- <https://youtu.be/DqCDOH44y9>
- <https://youtu.be/feBvhLFOEDk>
- <https://youtu.be/vu0wgiDlrRs>
- <https://youtu.be/iaIu5SYmWVM>
- <https://www.youtube.com/watch?v=SAcVlreweOc>

10. <https://www.youtube.com/watch?v=dpq1uqFcKnM>
11. <https://youtu.be/p4R0Ej6FCn0>
12. <https://youtu.be/nemTyWV5lv8>
13. [https://youtu.be/r787m\\_IaR1I](https://youtu.be/r787m_IaR1I)

## **Pedagogy**

Chalk and Talk lectures, Seminar, Interaction, Power Point Presentation, E-content

## **Course Designer**

2. D. Niveditha
3. S. Sivaranjani



PS22CP2	CORE PRACTICALS II	Category	L	T	P	Credit
		III	-	-	3 hrs/Week	4

### Preamble

This course introduces students to the methods of experimental physics. Emphasis will be given on laboratory techniques such as accuracy of measurements and data analysis. The concepts that are learnt in the lecture sessions will be translated to the laboratory sessions thus providing a hands-on learning experience such as in measuring the basic concepts in properties of matter, heat, optics, electricity and electronics.

### Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the usage of basic laws and theories to determine various properties of the materials given.	K1,K2
CLO2	Understand the application side of the experiments.	K2
CLO3	Apply knowledge of mathematics and physics fundamentals and an instrumentation to arrive solution for various problems.	K3
CLO4	Use standard methods to calibrate the given high range voltmeter and to measure the elasticity and thickness of the given material.	K3
CLO5	Use of basic laws to study the spectral properties and optical properties of the given prism and grating.	K3

### Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	S	S	L	L	L	L
CLO2	S	S	S	S	M	M
CLO3	S	S	S	S	M	M
CLO4	S	S	S	S	M	M
CLO5	S	S	S	S	M	M

S- Strong; M-Medium; L-Low

## Syllabus

### List of Experiments

#### Any 16

20. Young's Modulus – Uniform Bending – Koenig's Method
21. i-d curve-  $\mu$  of the prism-Spectrometer
22. Dispersive Power of Grating – Spectrometer- Wave length of Mercury Spectral Lines by minimum deviation method
23. Refractive index ( $\mu$ ) of the material of the prism lens – Newton's rings method
24. Calibration of High Range Voltmeter –Potentiometer
25. Wave length of Mercury Spectral Lines – Grating - Normal Incidence –Spectrometer
26. Young's Modulus –Non-Uniform Bending – Koenig's Method
27. Thickness of a thin wire – Air Wedge method
28. EMF of thermocouple –Potentiometer
29. High resistance by i) Charging ii) Leakage using Ballistic Galvanometer
30. Comparison of Mutual Inductance's – Ballistic Galvanometer
31. Measurement of dielectric constant - Parallel Plate Capacitor Method
32. Series Resonant Circuit
33. Parallel Resonant Circuit
34. i) Verification of Truth Tables of IC Gates: OR, AND, NOT, XOR, NOR, and NAND  
ii) Verification of Demorgan's theorem using Logic Gates
35. Verification of Truth Table of Half and Full Adders
36. Verification of NAND as a Universal Building Block
37. Verification of NOR as a Universal Building Block
38. Verification of Truth Tables of Half and Full Subtractor

## Pedagogy

Demonstration

## Course Designer

1. Dr. M. Lavanya

<b>PS22SBP1</b>	<b>PROGRAMMING IN C - Practicals</b>	Category	L	T	P	Credit
			-	-	41	-

### Preamble

The main objective of this course is to i) train the students to the basic concepts of programming language ii) to provide exposure to problem solving through programming iii) create foundation for students to learn other complex programming languages like C++, Java, etc.,

### Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Remember the concept and the ability to analyze the problem	K1
CLO2	Identify the syntax and semantics of the given problem to develop a program	K2
CLO3	Analyze and debug possible errors during program execution	K3
CLO4	Apply the skills to develop the program for real time applications	K4

### Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	S	M	M	M	S	S
CLO2	S	M	M	M	S	S
CLO3	S	M	M	S	S	S
CLO4	S	M	M	M	S	S

S- Strong; M-Medium; L-Low

## Syllabus

### PROGRAMMING IN C

Any 16

1. Write a program to perform transpose of a given matrix
2. Write a program to perform Matrix Addition
3. Write a program to perform Matrix Multiplication
4. Write a C Program to Convert Decimal Number to Binary Number
5. Write a C Program to Convert Binary to Gray Code using Recursion
6. Write a C program to use of XOR operations on two numbers.
7. Write a C program to print pascal triangle
8. Write a C program to solve the Quadratic Equation.
9. Write a C program to generate prime numbers within a range.
10. Write a C program to find sum of the digits and reverse the digits.
11. Write a C program to generate the Fibonacci series.
12. Write C program to find the Factorial of a given number using function.
13. Write C Program to add two complex numbers
14. Write a C program to maintain a student record using array of structures
15. Write a C program to find whether the given string is Palindrome or not.
16. Write a program to find the sum, average, standard deviation for the given numbers.
17. Write a C program to Count the number of positives, negatives and zeroes.
18. Write a C program to Sort set of numbers in ascending and descending order.
19. Write a C program to swap values of two variables without use of third variable.
20. Write C program to simulate a 4-bit binary full adder and half adder

## Pedagogy

Practical sessions

## Course Designer

1. Dr. S. Shanmuga Sundari
2. Dr. C. R. Minitha

<b>PS22A04</b>	<b>ALLIED PHYSICS PAPER- II (For Mathematics)</b>	Category	L	T	P	Credit
			58	2	-	4

### Preamble

This paper introduces the student to the basic concepts of AC Circuits, Magnetic materials, electronics and digital electronics

### Course Outcomes

On the successful completion of the course, students will be able to

<b>CLO Number</b>	<b>CLO Statement</b>	<b>Knowledge Level</b>
CLO1	Remember the fundamental concepts of physics.	K1
CLO2	Understanding the importance of electronics, digital circuits and magnetic materials.	K2
CLO3	Apply the acquired knowledge of physics in day today life.	K3
CLO4	Analyze the concept of electronics, digital circuits and magnetic materials and to recognize their applications in various real time problems.	K4

### Mapping with Programme Learning Outcomes

<b>CLOs</b>	<b>PLO1</b>	<b>PLO2</b>	<b>PLO3</b>	<b>PLO4</b>	<b>PLO5</b>	<b>PLO6</b>
CLO1	S	S	S	M	M	L
CLO2	S	S	S	S	L	M
CLO3	S	S	S	S	M	M
CLO4	S	S	S	S	M	S

S- Strong; M-Medium; L-Low

## Syllabus

### Unit – I

12 Hrs

#### Alternating currents:

Mean and RMS values of AC – Alternating current relation between current and voltage in Pure R, C and L - Analysis of AC circuits containing i) resistance and inductance, ii) resistance and inductance iii) capacitance and resistance - Series and parallel resonant circuits - Power factor- - Transformer-construction-working-losses.

### Unit – II

11 Hrs

#### Magnetic materials:

Magnetic Induction – Magnetization – Relation between the three magnetic vectors B, H and M –BH curve Experiment -Magnetic susceptibility – Properties - diamagnetic – paramagnetic – ferromagnetic – anti ferromagnetism and ferrimagnetism – Electron theory of magnetism - Weiss's theory of ferromagnetism - energy loss in hysteresis – importance of hysteresis curves.

### Unit – III

11 Hrs

**Semiconductor Diodes:** P and N type semiconductors - PN Junction Diode - Current Flow Mechanism in Forward and Reverse Biased Diode - Zener Diode and Voltage Regulation - Principle and structure of (1) LEDs (2) Photodiode (3) Solar cell - Transistor – Characteristics of CB, CE and CC Configuration – Transistor biasing – Voltage divider biasing.

### Unit – IV

12 Hrs

**Two - terminal Devices and their Applications:** Rectifier Diode: Half- wave Rectifiers - Bridge Full-wave Rectifiers, Calculation of Ripple Factor and Rectification Efficiency - **Amplifiers:** Single stage amplifier (CE) and Multi stage amplifier (CE) - **Sinusoidal Oscillators:** Barkhausen's Criterion for self - sustained oscillations - RC Phase shift oscillator, determination of Frequency- Hartley oscillator.

### Unit – V

12 Hrs

#### Digital Electronics:

Analog and Digital Signals- Boolean algebra- Boolean theorem- Simplification of Boolean expression- DeMorgan's theorem-OR, AND, NOT, XOR NOR and NAND gates-NOR and NAND gates as universal building blocks-half adder, full adder-flip flops - RS flip flop-JK flip flop (Truth table and circuit).

**Operational amplifier:** Characteristics-virtual ground-summing point-inverting and non-inverting amplifier-adder-subtractor.

## Text Books

S.No	Authors	Title of the Book	Publishers	Year of Publication	Edition
1	R. Murugesan	Electricity and Magnetism	S.Chand andCo	2005	Revised Edition
2	V.K. Metha	Principles of electronics	S.Chand andCo	1980	1 <sup>st</sup> Edition
3	Murugesan R	Allied Physics	S.Chand and Co	2005	1 <sup>st</sup> edition

## Reference Books

S.No	Authors	Title of the Book	Publishers	Year of Publication	Edition
1	V. Vijayendran	Introduction to Integrated Electronics	Viswanathan Publishers	2005	1 <sup>st</sup> Edition

## Pedagogy

Chalk and talk, PPT, Seminar, Group discussion, Interaction

## Course Designers

1. Dr. G. Magesh

## Reference Links:

1. Mean and RMS values of AC - <https://www.youtube.com/watch?v=qDHsokTcgck>
2. AC Circuit Analysis - <https://www.youtube.com/watch?v=flRocvQxQw4>
3. Series & Parallel Resonant Circuits - <https://www.youtube.com/watch?v=G8KLJjq1E2o>
4. Transformer - Principle, Construction, Working and Efficiency - <https://www.youtube.com/watch?v=i29dCoSGa38>
5. Magnetization - <https://www.youtube.com/watch?v=C-OoUvKXbLU&t=2s>
6. BH Curve Experiment - <https://www.youtube.com/watch?v=1GGsbU698x8>
7. P and N type semiconductors - <https://www.youtube.com/watch?v=5ZNeDxfgYAE>
8. Different types of diodes - <https://www.youtube.com/watch?v=-EqOEiEQGLI>
9. Diode rectifier circuits - <https://www.youtube.com/watch?v=Xmu31a-59vw>
10. Single stage amplifier - <https://www.youtube.com/watch?v=NEiVSbPYWNE>
11. Multistage amplifier - <https://www.youtube.com/watch?v=vDePe-if1gs>
12. RC Phase Shift Oscillator - <https://www.youtube.com/watch?v=Gvb4GIV5ig8>
13. Hartley Oscillator - [https://www.youtube.com/watch?v=3B\\_sBX\\_11Zw](https://www.youtube.com/watch?v=3B_sBX_11Zw)
14. Boolean Algebra and Logic gates - <https://www.youtube.com/watch?v=JQBRzsPhw2w>
15. Flip-flop - <https://www.youtube.com/watch?v=LTtuYeSmJ2g>
16. Operational amplifier - <https://www.youtube.com/watch?v=jsKSfaFQ4d4>