ST. MARY'S COLLEGE (Autonomous)

(Re-accredited with 'A^{+}' Grade by NAAC)

Thoothukudi-628001, Tamil Nadu

(Affiliated to ManonmaniamSundaranar University)

B.Sc. Physics

School of Physical Sciences

Outcome Based Curriculum

(W.e.f.2024)

B.Sc., PHYSICS SYLLABUS

Preamble

Physics is one of the basic and fundamental sciences. The curriculum for the graduate programme in Physics is revised as per the UGC guidelines on Learning Outcome based Course Framework. The learner-centric courses let the student progressively develop a deeper understanding of various aspects of physics.

The new curriculum offer courses in the core areas of mechanics, acoustics, optics and spectroscopy, electricity and magnetism, atomic and nuclear physics, solid state, electronicsand other fields. The courses will train students with sound theoretical and experimental knowledge that suits the need of academics and industry.In addition to the theoretical course work, the students also learn physics laboratory methods for different branches of physics, specialized measurement techniques, analysis of observational data, including error estimation and etc. The students will have deeper understanding of laws of nature through the subjects like classical mechanics, quantum mechanics, statistical physics etc. The problem solving ability of students will be enhanced. The students can apply principles in physics to real life problems. The courses like integrated electronics and microprocessors will enhance the logical skills as well as employability skills. The numerical methods and mathematical physics provide analytical thinking and provide a better platform for higher level physics for research.

The restructured courses with well-defined objectives and learning outcomes provide guidance to prospective students in choosing the elective courses to broaden their skills not only in the field of physics but also in interdisciplinary areas. The elective modules of the framework offer students choice to gain knowledge and expertise in specialized domains of physics like astrophysics, medical physics, etc.

Programme Outcome

PO No.	After completion of the Undergraduate programme the students of St. Mary's College will be able to
PO 1	acquire an in-depth domain knowledge and a comprehensive knowledge of various disciplines to become skilled professionals
PO 2	enrich their communicative skills, and enhance their creative, numerical, analytical and problem solving skills
PO 3	gain potential skills to excel indigital literacy, team management, scientific reasoning, research and self-directed life-long learning to emerge as entrepreneurs
PO 4	be aware of the environment with a social responsibility for the well-being of humanity and the planet at large
PO 5	be an empowered, economically independent woman with a global perspective to emerge holistically in the egalitarian society

Programme Specific Outcome

PSO No.	After completion of the Undergraduate programme in Physics the students of St. Mary's College will be able to
PSO 1	**Theoretical Proficiency:** Demonstrate a comprehensive understanding of diverse Physics topics.
PSO 2	**Experimental Proficiency:** Develop hands-on skills through laboratory work, enabling students to design, conduct, and interpret experiments to validate theoretical concepts and explore real -world applications.
PSO 3	**Critical Thinking and Problem- Solving:** Cultivate the capacity to analyse and solve complex problem in physics, fostering critical thinking skills and the ability to apply theoretical knowledge to practical situations.
PSO 4	**Effective Communication:** Communicate scientific concepts and findings effectively, both orally and in writing, demonstrate the ability to convey complex ideas to diverse audiences.
PSO 5	**Scientific Inquiry:** Cultivate a curiosity-driven approach to scientific inquiry, encouraging students to explore, question, and critically analyse information while developing a mindset for lifelong learning.

Department of Physics
UG Course Structure 2024-2027
Semester –I

Part	Components	Course Code	Course Title	Hours/ Week	Credits	Max. Marks		
						CIA	ESE	Total
I	Tamil / French	24ULTA11 24ULFA11	இக்கால இலக்கியம் செய்யுள், இலக்கணம், இலக்கிய வரலாறு, சிறுகதை Fundamental French Course	6	3	40	60	100
II	General English	24UGEN11	Poetry, Prose, Extensive Reading and Communicative English I	6	3	40	60	100
III	Core I	24UPHC11	Properties of Matter and Mechanics	5	5	40	60	100
	Core Practical I	24UPHCR1	Practical I	3	3	40	60	100
	Generic Elective I	24UCHE11	Chemistry for Physical Sciences I	4	3	40	60	100
	Generic Elective Practical I	24UCHER1	Chemistry Practical I	2	1	40	60	100
IV	Skill Enhancement Course I	24UPHSE1	Physics for Everyday Life	2	2	20	30	50
	Ability Enhancement Course I	24UAVE11	Value Education	2	2	20	30	50
Total				**30**	**22**			

Semester –II

Part	Components	Course Code	Course Title	Hours/ Week	Credits	Max. Marks		
						CIA	ESE	Total
I	Tamil / French	24ULTA21 24ULFA21	சமய இலக்கியங்கள் செய்யுள்,இலக்கணம், இலக்கிய வரலாறு Proficient French Course	6	3	40	60	100
II	General English	24UGEN21	Poetry, Prose, Extensive Reading and Communicative English II	6	3	40	60	100
III	Core II	24UPHC21	Thermal Physics and Optics	5	5	40	60	100
	Core Practical II	24UPHCR2	Practical II	3	3	40	60	100
	Generic Elective II	24UCHE21	Chemistry for Physical Sciences II	4	3	40	60	100
	Generic Elective Practical II	24UCHER2	Chemistry Practical II	2	1	40	60	100
IV	Skill Enhancement Course II	24UPHSE2	Energy Physics	2	2	20	30	50
	Ability Enhancement Course II	24UAEV21	Environmental Studies	2	2	20	30	50
Total				**30**	**22**			

Semester III

Part	Components	Course Code	Course Title	Hours/ Week	Credits	Max. Marks		
						CIA	ESE	Total
I	Tamil / French	24ULTA31 24ULFA31	காப்பிய இலக்கியங்கள் செய்யுள், இலக்கணம், இலக்கிய வரலாறு, புதினம் French Literature and Grammar I	6	3	40	60	100
II	General English	24UGEN31	Poetry, Prose, Extensive Reading and Communicative English III	6	3	40	60	100
III	Core III	24UPHC31	Electricity and Electromagnetism	4	4	40	60	100
	Core Practical III	24UPHCR3	Practical III	3	3	40	60	100
	Generic Elective III	24UMAE31	Mathematics I	6	4	40	60	100
	NME I	24UPHN31	Applied Physics I	2	2	20	30	50
IV	Skill Enhancement Course III	24UPHSE3	Instrumentation Physics	2	2	20	30	50
	Ability Enhancement Course III	24UAYM31	Yoga and Meditation	1	1	20	30	50
	Self-Study/ MOOC / Internship (Compulsory)	24UPHSS1/ 24UPHI31	Astrophysics		+2	--	50	50
Total				**30**	**22+2**			

Semester IV

Part	Components	Course Code	Course Title	Hours/ Week	Credits	Max. Marks		
						CIA	ESE	Total
I	Tamil /	24ULTA41	சங்க இலக்கியங்கள் செய்யுள், இலக்கணம், இலக்கிய வரலாறு, நாடகம்	6	3	40	60	100
	French	24ULFA41	French Literature and Grammar II					
II	General English	24UGEN41	Poetry, Prose, Extensive Reading and Communicative English IV	6	3	40	60	100
III	Core IV	24UPHC41	Analog Electronics	4	4	40	60	100
	Core Practical IV	24UPHCR4	Practical IV	3	3	40	60	100
	Generic Elective IV	24UMAE41	Mathematics II	6	4	40	60	100
	NME II	24UPHN41	Applied Physics II	2	2	20	30	50
IV	Skill Enhancement Course IV	24UPHSE4	Physics for Competitive Examinations	2	2	20	30	50
	Ability Enhancement Course IV (Entrepreneurial Based)	24UAPH41		1	1	20	30	50
V	NCC / NSS / Sports				1			
	CDP Extension Activity				+1			
Total				**30**	**23+1**			

Semester V

Part	Components	Course Code	Course Title	Hours/ Week	Credits	Max. Marks		
						CIA	ESE	Total
III	Core V	24UPHC51	Material Science	5	5	40	60	100
	Core VI	24UPHC52	Digital Electronics	5	5	40	60	100
	Core VII	24UPHC53	Computational physics	5	5	40	60	100
	Core practical V	24UPHCR5	Non Electronics I	3	2	40	60	100
	Core Practical VI	24UPHCR6	Electronics I	3	2	40	60	100
	Core practical VII	24UPHCR7	C++ Programming I	3	2	40	60	100
	Discipline Specific Elective I	24UPHE51/ 24UPHE52	Nanoscience and Nanotechnology / Mathematical Physics	4	3	40	60	100
IV	Skill Enhancement Course V	24UPHSE5	Microprocessor 8085 (Practical only)	2	1	20	30	50
	Self Study / Online Course / Internship (Optional)	24UPHSS2/ 24UPHI51	Body mechanics and Sensory physics		+2		50	50
				30	**25+2**			

Semester VI

Part	Components	Course Code	Course Title	Hours/ Week	Credits	Max. Marks		
						CIA	ESE	Total
III	Core VIII	24UPHC61	Relativity and Quantum Mechanics	4	4	40	60	100
	Core IX	24UPHC62	Atomic and Nuclear Physics	4	4	40	60	100
	Core X	24UPHC63	Opto Electronics and Fibre Optics Communication	4	4	40	60	100
	Core Practical VIII	24UPHCR8	Non Electronics II	3	2	40	60	100
	Core Practical IX	24UPHCR9	Electronics II	3	2	40	60	100
	Core Practical X	24UPHCR10	C++ Programming II	2	2	40	60	100
	Core XI (Project)	24UPHP61	Project and Viva voce	6	5	40	60	100
	Discipline Specific Elective II	24UPHE61/ 24UPHE62	Advanced Physics / Communication Electronics	4	3	40	60	100
				30	**26**			

SEMESTER- I			
Core I - Properties of Matter and Mechanics			
Course Code: 24UPHC11	**Hours/Week: 5**	**Hrs/ Semester: 75**	**Credits :5**

Objectives:

- To learn about mechanics and properties of matter
- To know their relevance in day to day applications.
- To learn about conservation laws, collisions and gravitational force, elasticity, surface tension and viscous nature of matter.

Course outcomes:

CO.No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	Demonstrate a comprehensive knowledge of Newton's law of motion, conservation laws, elasticity, viscosity, surface tension and collision.	K1
CO-2	Exhibit a deep understanding of the fundamental concepts underlying Newton's laws, conservation principles, elasticity and fluid dynamics.	K2
CO-3	Apply the acquired knowledge to solve problems related to collisions, projectiles, bending of beams and fluid flow phenomena.	K3
CO-4	Analyse complex physical scenarios involving multiple forces, motion, and interactions such as the two-body problem, non uniform bending of beams and turbulent flow, to identify patterns, relationships and underlying principles.	K4
CO-5	Critically evaluate experimental data, theoretical models, and engineering designs assessing their accuracy, validity and applicability in real world situations and proposing improvements.	K5

SEMESTER- I			
Core I - Properties of Matter and Mechanics			
Course Code: 24UPHC11	**Hours/Week: 5**	**Hrs/ Semester: 75**	**Credits :5**

Unit I: Elasticity

Stress – strain – Hooke's law – stress and strain curve - relation connecting elastic moduli – Poisson's ratio - work done in stretching a wire – twisting couple on a cylindrical wire (torsion) – expression for couple per unit twist – work done in twisting – torsion pendulum – theory – determination of rigidity modulus by dynamic method.

Unit II: Bending of Beams

Bending of beams – expression for bending moment – cantilever – experiment to find the young's modulus - uniform bending – theory and experiment to determine the young's modulus using pin and microscope – non uniform bending – theory and experiment to determine the young's modulus using scale and telescope– I – shape girders.

Unit III: Viscosity and Surface Tension

Streamlined motion – turbulent motion – coefficient of viscosity – rate of flow of liquid in a capillary tube by Poiseuille's formula – analogy between liquid flow and current flow – terminal velocity and Stoke's formula - experimental determination of viscosity of a liquid by Stoke's method.

Surface tension – explanation of surface tension on kinetic theory - work done in increasing area of the surface – work done in blowing a bubble – experimental determination of surface tension by Jaegar's method –excess pressure inside a liquid drop – excess pressure inside a soap bubble - excess of pressure inside a curved liquid surface.

Unit IV: Conservation laws

Newton's laws of Motion- inertial frames – gravitational mass – conservation of linear momentum, conservation of angular momentum –conservation of energy – work energy theorem – conservative force and potential energy – centre of mass of a system of particles – two body problem and reduced mass – moment of inertia of system of diatomic molecules.

Unit V: Collision and Projectiles

Collision – impulse and linear momentum – elastic and inelastic collision – fundamental principles of impact – direct and indirect impact – velocities and kinetic energy in direct impact – loss of k.e in an indirect impact – transfer of energy in collision between two equal masses – projectile – expression for time of flight and horizontal range of a projectile – path of a projectile – range of a projectile on an inclined plane.

Text Books:

1. Murugeshan R. *Properties of matter*. S. Chand & Company Ltd. Revised edition 2008.
2. Ubald Raj A. and Jose Robin G. *Mechanics and Thermal Physics*. Marthandam: Indira publication, 2003.
3. Ubald Raj A. and Jose Robin G. *Mechanics and relativity*. Marthandam: Indira Publications. 2008.

Books for Reference:

1. Mathur D. S. *Mechanics*. S. Chand & Co. Ltd. 1984.
2. Mathur D. S. *Properties of matter*. Ram Nagar: Shyamlal Charitable trust. 1992.
3. Brijlal and Subramanyam N. *Mechanics*. Himalaya Publishing House. ISO 9001:2015 certified.
4. Dr. Upadhyaya J.C. *Classical Mechanics*. Himalaya Publishing House. ISO 9001:2015 certified.

Web Sources:

1. https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work
2. http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.html
3. https://www.youtube.com/watch?v=gT8Nth9NWPM
4. https://www.youtube.com/watch?v=m4u-SuaSu1s&t=3s
5. https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work
6. https://learningtechnologyofficial.com/category/fluid-mechanics-lab/
7. http://www.sound-physics.com/
8. http://nptel.ac.in/courses/112104026/

Mapping with program outcomes and programme specific outcomes:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** and Programme Specific Outcomes **(PSO)** in the 3-point scale of HIGH (**3, ≥ 70%**), MEDIUM (**2, ≥ 40%** and < **70%**) and LOW (**1, <40%**).

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	2	1	1	1	1	2	1	1	1	1
CO-2	2	2	2	2	1	2	1	1	2	2
CO-3	3	3	2	2	1	2	3	3	3	3
CO-4	3	3	2	2	2	3	3	3	3	3
CO-5	3	3	2	2	2	3	3	3	3	3
Ave.	2.6	2.4	1.8	1.8	1.4	2.4	2.2	2.2	2.4	2.4

SEMESTER I			
Core Practical I - Practical I			
Course Code: 24UPHCR1	**Hrs/Week: 3**	**Hrs/ Semester: 45**	**Credits: 3**

Objective:

- Apply various physics concepts to understand Properties of Matter, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results.

Minimum of Seven Experiments from the list:

1. Determination of rigidity modulus without mass using Torsional pendulum.
2. Determination of Young's modulus by uniform bending – load elevation graph.
3. Determination of Young's modulus by cantilever – load depression graph.
4. Determination of surface tension & interfacial surface tension by drop weight method.
5. Determination of co-efficient of viscosity by Stokes' method – terminal velocity.
6. Determination of g using compound pendulum.
7. Determination of specific heat by cooling – graphical method
8. Determination of A and μ - Spectrometer
9. Determination of velocity of sound using Kundts tube.
10. Determination of frequency of an electrically maintained tuning fork

SEMESTER I			
Skill Enhancement Course I - Physics for Everyday Life			
Course Code: 24UPHSE1	**Hrs/Week: 2**	**Hrs/ Semester: 30**	**Credits: 2**

Objective:

- To know where all physics principles have been put to use in daily life and appreciate the concepts with a better understanding also to know about Indian scientists who have made significant contributions to Physics

Course outcomes:

CO.No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	Recall the basics of spring scales, vision corrective lenses, televisions, solar cells and contributions of Indian physicist.	K1
CO-2	Discuss the principle behind the working of bicycles, polaroid glasses, air conditioners, solar water heaters and the contributions of C.V. Raman to science and technology.	K2
CO-3	Implement the working of rockets, UV protective glasses, microwave ovens, solar cells and present the contributions of A.P.J. Abdul Kalam to science and technology.	K3
CO-4	Examine the working of roller coaster, polaroid camera, vacuum cleaner, solar photovoltaic cells and outline the contributions of Vikram Sarabhai to science and technology.	K4
CO-5	Judge the performance of bouncing balls, vision corrective lenses, television, solar cells and support the contributions of Indian physicist.	K5

SEMESTER I			
Skill Enhancement Course I - Physics for Everyday Life			
Course Code : 24UPHSE1	**Hrs/Week: 2**	**Hrs/ Semester: 30**	**Credits : 2**

Unit I: Mechanical objects

Spring scales – bouncing balls –roller coasters – bicycles –rockets and space travel.

Unit II: Optical Instruments and Laser

Vision corrective lenses – polaroid glasses – UV protective glass – polaroid camera – colour photography – holography and laser.

Unit III: **Physics of Home Appliances**

Bulb – fan – hair drier – television – air conditioners – microwave ovens – vacuum cleaners.

UNIT IV: Solar Energy

Solar constant – General applications of solar energy – Solar water heaters – Solar Photo – voltaic cells – General applications of solar cells.

UNITV: Indian Physicist and their Contributions

C.V.Raman, Homi Jehangir Bhabha, Vikram Sarabhai, Subrahmanyan Chandrasekhar, Venkatraman Ramakrishnan, Dr. APJ Abdul Kalam and their contribution to science and technology.

Text Books:

1. The Physics in our Daily Lives, Umme Ammara, Gugucool Publishing, Hyderabad, 2019.
2. For the love of physics, Walter Lawin, Free Press, New York, 2011

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Map course outcomes **(CO)** for each course with program outcomes **(PO)** and Programme Specific Outcomes **(PSO)** in the 3-point scale of HIGH (**3, ≥ 70%**), MEDIUM (**2, ≥ 40%** and < **70%**) and LOW (**1, <40%**).

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	2	1	2	2	1	2	1	1	1	2
CO-2	3	2	3	3	1	2	1	1	1	2
CO-3	3	2	3	3	1	3	2	2	2	3
CO-4	3	2	3	2	1	3	2	2	2	3
CO-5	3	2	3	1	1	3	2	2	2	3
Ave.	2.8	1.8	2.8	2.2	1	2.6	1.6	1.6	1.6	2.6

SEMESTER –I			
Ability Enhancement Course I – Value Education			
CourseCode:24UAVE11	**Hrs/Week:2**	**Hrs/Semester:30**	**Credits:2**

Unit-I Introduction to value Education

Concept of Values- Types of values – Approaches to values – Benefits of Value Education – Need for Value Education- Life and Values – Internalization of Values.

Unit-II: **Human Values**

Human values – Sources of Human values – Love – Compassion – Gratitude – Courage – Optimism – Forgiveness –Integrity – Humility- Truthfulness- Sacrifice- Sincerity

Unit-III Social Values

Role of family and society in teaching values – Role of educational institutions in inculcating values – General functions of education for society – Self – Reflection - Our society's needs - Social Responsibilities of a student

Unit-IV Spiritual Values

Spiritual Values – Spiritual development – Moral development – importance of spiritual values – Cultivation of spiritual values – Most common spiritual values – for spiritual resources.

Unit-V Values for Life Enrichment

Goal setting – Building relationship – Friendship – Love relationship – Family Relationship – Professional relationship interpersonal Relationship – Essential life skills that help in students future Development – Life Enrichment Skills Domain.

Books for Reference:

1. Arumugam, N. S. Mohana, Lr. Palkani, *Value Based Education*, Saras Publication , Latest Edition
2. Sneha M. & K. Pushpanandham Joshi. *Value Based Leadership in Education Perspective and Approaches*, Anmol Publications Pvt. Limited, , latest Edition
3. Venkataiah. N. *Value Education*, APH Publishing, Latest Edition .
4. Pramod Kumar M.A. *Handbook on Value Education*, Ramakrishna Mission Institute of Culture (RMIC) latest Edition
5. Jagdosh Chand. *Value Education*. Shipra Publication latest Edition
6. Indrani Majhi (Shit) Ganesh Das, *Value Education*, Laxmi Publication Pvt. Ltd., latest Edition.

SEMESTER- II			
Core II - Thermal Physics and Optics			
Course Code : 24UPHC21	**Hours/Week: 5**	**Hrs/ Semester: 75**	**Credits : 5**

Objectives:

- To gain knowledge about the laws of thermodynamics.
- To understand the concept of transport phenomena and thermal conductivity.
- To provide a solid understanding of low temperature physics and optical phenomena.
- To know the spectacular nature of light by studying interference, diffraction and polarisation.

Course Outcomes:

CO.No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	Gain a thorough understanding of the fundamental principles and laws governing thermodynamics, heat transfer, dispersion and polarization of light.	K1
CO-2	Interpret and explain the various phenomena and experimental methods related to thermal physics and optics showcasing a deeper understanding beyond memorization.	K2
CO-3	Apply the principles learnt to solve complex problems in real world scenarios, demonstrating practical skills and analytical thinking.	K3
CO-4	Analyse experimental data and theoretical concepts to draw conclusions and make connections between different topics within thermodynamics heat transfer, dispersion, interference, diffraction and polarization of light.	K4
CO-5	Design experiments, propose solutions to interdisciplinary problems and evaluate the validity and the significance of scientific findings.	K5

SEMESTER- II			
Core II - Thermal Physics and Optics			
Course Code: 24UPHC21	**Hours/Week: 5**	**Hrs/ Semester: 75**	**Credits: 5**

Unit I: Laws of thermodynamics and Transport Phenomena

Zeroth law of thermodynamics – first law of thermodynamics – isothermal change – adiabatic change – second law of thermodynamics – entropy – change of entropy when ice converted into steam - third law of thermodynamics – mean free path - transport phenomena - expression for the viscosity of a gas – expression for thermal conductivity of a gases – expression for the coefficient of diffusion

Unit II: Transfer of heat and low temperature physics

Conduction, convection and radiation – conduction of heat – Lee's Disc's method of determining K of a bad conductor – convection of heat – Newton's law of cooling by convection – experimental verification of Newton's law of cooling – the Joule Porous plug experiment – relation between inversion, Boyle and critical temperatures – adiabatic demagnetization – theory and experimental setup.

Unit III: Dispersion and Aberrations

Dispersion through a prism – angular dispersion – dispersive power – achromatism in prisms – deviation without dispersion – dispersion without deviation – direct vision spectroscope – constant deviation prism – constant deviation spectroscope – spherical aberration in lenses – methods of minimizing spherical aberration – condition for minimum spherical aberration of two thin lenses separated by a distance – aplanatic lens – chromatic aberration in lenses – condition for achromatism of two thin lenses in contact – coma.

Unit IV: Interference and Diffraction

Interference – conditions for sustained interference – interference by reflected systems – production of colours in thin films– air wedge – determination of diameter of a thin wire by air wedge – test for optical flatness.

Fresnel's diffraction – Fraunhofer diffraction – plane transmission diffraction grating – grating at normal incidence –determination of wavelength of light by normal incidence method and minimum deviation method.

Unit V: Polarisation

polarisation of light – double refraction – Nicol prism – polarizer and analyzer – quarter wave plate and half wave plate – plane, elliptically and circularly polarized light: production and detection – optical activity – Fresnel's theory of optical activity – experimental verification of Fresnel's theory – specific rotator power – Laurent's half shade polarimeter.

Text Books:

1. Ubald Raj A. and Jose Robin G. *Mechanics and Thermal Physics*. Marthandam: Indira publication.
2. Murugeshan R. *Thermal Physics and Geometrical Optics*.
3. Murugeshan Kiruthiga Sivaprasath R. *Optics and Spectroscopy*. S. Chand & Company Ltd. Revised edition 2014.

Books for Reference:

1. Gupta B. and Roy H.P. *Thermal Physics*. Books and Allied (P) Ltd., Second edition 2005.
2. Brijlal and Subramanyam N. *Heat and thermodynamics*, S. Chand & Co. Ltd. 2005.
3. Arunabhasen and Gupta A. B. *College Physics.* volume I. Books and Allied (P) Ltd. 2005.
4. Brijlal and Subramanyam N. *Optics*. S. Chand & Co. Revised by M.N. Avadhanulu. 23rd revised edition 2006.

WEBLINKS

1. https://youtu.be/M_5KYncYNyc
2. https://www.youtube.com/watch?v=4M72kQulGKk&vl=en

Mapping with program outcomes and programme specific outcomes:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** and Programme Specific Outcomes **(PSO)** in the 3-point scale of HIGH (**3, ≥ 70%**), MEDIUM (**2, ≥ 40%** and < **70%**) and LOW (**1, <40%**).

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	2	1	1	1	1	2	1	2	2	2
CO-2	3	2	2	1	1	3	1	2	2	2
CO-3	3	3	3	2	1	3	3	2	2	3
CO-4	3	3	2	2	1	3	3	3	3	3
CO-5	3	3	2	2	1	3	3	3	3	3
Ave.	2.8	2.4	2	1.6	1	2.8	2.2	2.2	2.4	2.6

SEMESTER- II			
Core Practical II - Practical II			
Course Code: 24UPHCR2	**Hours/Week: 3**	**Hrs/ Semester: 45**	**Credits: 3**

Objective:

- To apply their knowledge gained about the concept of heat and sound waves, resonance, calculate frequency of ac mains set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results.

Minimum of Seven Experiments from the list:

1. Determination of Young's modulus by non-uniform bending – scale & telescope.
2. Determination of thermal conductivity of a bad conductor by Lee's disc method.
3. Compare the mass per unit length of two strings using Melde's apparatus.
4. Frequency of AC mains using sonometer.
5. Determination of refractive index of the solid prism
6. Thickness of a thin wire using Air wedge
7. Spectrometer – dispersive power of the prism
8. Determination of co-efficient of viscosity by Poiseullie's flow - Burette method.
9. Determination of rigidity modulus using Bifilar pendulum

SEMESTER II			
Skill Enhancement Course II –Energy Physics			
Course Code: 24UPHSE2	**Hrs/ Week :2**	**Hrs/ Semester: 30**	**Credits:2**

Objectives:

- To get the understanding of the conventional and non-conventional energy sources, their conservation and storage systems.

Course Outcomes:

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	Explain the basis of energy sources and its storage.	K1
CO-2	Relate the various types of energy sources and summarise the importance of energy storage.	K2
CO-3	Apply the knowledge about energy sources to harness, store and utilise energy, considering emerging technology and trends.	K3
CO-4	Analyse the impact of energy choices, encouraging sustainable and responsible approaches to energy utilisation.	K4
CO-5	Judge the availability, accessibility and environmental impact of renewable energy sources.	K5

SEMESTER II			
Skill Enhancement Course II –Energy Physics			
Course Code: 24UPHSE2	**Hrs/ Week :2**	**Hrs/ Semester: 30**	**Credits:2**

Unit I: Introduction to Energy Sources

Energy consumption as a measure of prosperity – world energy future – energy sources and their availability – conventional energy sources – non-conventional and renewable energy sources – comparison – merits and demerits.

Unit II: Solar Energy

Solar energy Introduction – solar constant – solar radiation at the Earth's surface – solar radiation geometry – Solar radiation measurements – solar radiation data –solar energy storage and storage systems – solar pond – solar cooker – solar water heater – solar greenhouse – types of green houses – solar cells.

Unit III: Wind Energy

Introduction –nature of the wind – basic principle of wind energy conversion – wind energy data and energy estimation – basic components of Wind Energy Conversion Systems (WECS) – advantages and disadvantages of WECS – applications – tidal energy.

Unit IV: Biomass Energy

Introduction – classification – biomass conversion technologies –photosynthesis – fermentation - biogas generation –classification of biogas plants – anaerobic digestion for biogas – wood gasification – advantages & disadvantages.

Unit V: **Energy Storage**

Importance of energy storage- batteries - lead acid battery -nickel-cadmium battery – fuel cells – types of fuel cells – advantages and disadvantages of fuel cells – applications of fuel cells - hydrogen storage.

Text Books:

1. G.D.Rai, Non-Conventional Sources of Energy, Khanna Publishers, 2009, 4thEdn.
2. S P Sukhstme, J K Nayak, Solar Energy, Principles of Thermal Collection and Storage, McGraw Hill, 2008, 3rdEdn.
3. D P Kothari, K P Singal, RakeshRajan, PHI Learning Pvt Ltd, 2011, 2ndEdn.

Reference Books:

1. John Twidell& Tony Weir, Renewable Energy Resources, Taylor & Francis, 2005, 2ndEdn.
2. S.A. Abbasi and NasemaAbbasi, Renewable Energy sources and their environmental impact, PHI Learning Pvt. Ltd, 2008.
3. M. P. Agarwal, Solar Energy, S. Chand & Co. Ltd., New Delhi,1982
4. H. C. Jain, Non-Conventional Sources of Energy, Sterling Publishers,1986.

Mapping with program outcomes and programme specific outcomes:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** and Programme Specific Outcomes **(PSO)** in the 3-point scale of HIGH (**3, ≥ 70%**), MEDIUM (**2, ≥ 40%** and < **70%**) and LOW (**1, <40%**).

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	1	1	1	1	2	1	1	2	2
CO-2	3	2	3	3	1	2	1	2	2	2
CO-3	3	2	3	3	2	3	3	2	3	3
CO-4	3	2	3	3	2	3	3	2	3	3
CO-5	3	3	3	3	2	3	3	3	3	3
Ave.	3	2	2.6	2.6	1.6	2.6	2.2	2	2.6	2.6