BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI-620024

B.SC. PHYSICS

CHOICE BASED CREDIT SYSTEM–LEARNING OUTCOMES BASED CURRICULUM FRAME WORK (CBCS - LOCF)

(Applicable to the candidates admitted from the academic year 2026-2027 onwards)

Sem	Part	Courses	Title	Ins. Hrs.	Credits	Exam. Hours	Maximum Marks		
							Int.	Ext.	Total
I	I	Ability Enhancement Course – I (AEC - I)	(Tamil$ / Other Languages+, #)	6	3	3	30	70	100
	II	Ability Enhancement Course –II (AEC - II)	English Course - I	6	3	3	30	70	100
	III	Core Course -1 (CC - 1)	Properties of Matter and Acoustics	4	4	3	30	70	100
		Core Practical - 1 (CP - 1)	Physics Practial - I	4	4	3	40	60	100
		Allied Course – 1 (AC - 1)	Any one from the list	4	4	3	30	70	100
		Allied Course Practical - I (AP-I)	Any one from the list	2	**	**	**	**	**
	IV	Value Education		2	2	3	30	70	100
		Interdisciplinary Course – 1 (IDC - 1) #	One Course from Outside Department	2	2	3	30	70	100
	Total			**30**	**22**	--	--	--	**700**
II	I	Ability Enhancement Course –III (AEC - III)	(Tamil$ / Other Languages+, #)	6	3	3	30	70	100
	II	Ability Enhancement Course –IV (AEC - IV)	English Course - II	6	3	3	30	70	100
	III	Core Course- 2(CC - 2)	Mechanics and Theory of Relativity	4	4	3	30	70	100
		Core Practical - 2(CP - 2)	Physics Practical - II	4	4	3	40	60	100
		Allied Course – 2 (AC - 2)	Any one from the list	4	4	3	30	70	100
		Allied Course Practical - I (AP-I)	Any one from the list	2	4	3	40	60	100
	IV	Skill Enhancement Course - 1(SEC - 1) ##	NaanMudhalvan Course/SEC (List enclosed)	2	2	3	30	70	100
		Interdisciplinary Course – 2 (IDC - 2) #	One Course from Outside Department	2	2	3	30	70	100
	Total			**30**	**26**	--	--	--	**800**

III	I	Ability Enhancement Course –V(AEC - V)	(Tamil$ / Other Languages+, #)	6	3	3	30	70	100
	II	Ability Enhancement Course –VI (AEC - VI)	English Course - III	6	3	3	30	70	100
	III	Core Course- 3(CC - 3)	Heat and Thermodynamics	4	4	3	30	70	100
		Core Practical - 3 (CP - 3)	Physics Practical - III	4	4	3	40	60	100
		Allied Course – 3 (AC - 3)	Any one from the list	4	4	3	30	70	100
		Allied Course Practical - II (AP-II)	Any one from the list	2	**	**	**	**	**
	IV	Skill Enhancement Course - 2 (SEC - 2) ##	NaanMudhalvan Course/SEC (List enclosed)	2	2	3	30	70	100
		Interdisciplinary Course – 3 (IDC - 3) $$	One Course from Outside Department	2	2	3	30	70	100
		Health & Wellness @		--	1	--			100
	Total			**30**	**23**	--	--	--	**800**
	I	Ability Enhancement Course –VII (AEC - VII)	(Tamil$ / Other Languages+, #)	6	3	3	30	70	100
IV	II	Ability Enhancement Course –VIII (AEC - VIII)	English Course - IV	6	3	3	30	70	100
	III	Core Course- 4(CC - 4)	Electricity and Magnetism	4	4	3	30	70	100
		Core Practical - 4(CP - 4)	Physics Practical - IV	4	4	3	40	60	100
		Allied Course – 4 (AC - 4)	Any one from the list	4	4	3	30	70	100
		Allied Course Practical - II (AP-II)	Any one from the list	2	4	3	40	60	100
	IV	Skill Enhancement Course - 3 (SEC - 3) ##	Naan Mudhalvan Course/SEC (List enclosed)	2	2	3	30	70	100
		Interdisciplinary Course – 4 (IDC - 4) $$	One Course from Outside Department	2	2	3	30	70	100
	Total			**30**	**26**	--	--	--	**800**
	Summer Internship / Industrial Activity during the Summer Vacation after II Year								

V	III	Core Course - 5 (CC - 5)	Optics and Lasers	4	4	3	30	70	100
		Core Course - 6 (CC - 6)	Solid State Physics	5	4	3	30	70	100
		Core Course - 7 (CC - 7)	Basic Electronics	5	4	3	30	70	100
		Core Course - 8 (CC - 8)	Digital Electronics and Microprocessors	5	4	3	30	70	100
		Core Practical - 5(CP - 5)	Physics Practical -V	5	4	3	40	60	100
	IV	Skill Enhancement Course - 4 (SEC - 4)	Any one from the list	2	2	3	30	70	100
		Skill Enhancement Course - 5 (SEC - 5) ##	NaanMudhalvan Course/SEC (List enclosed)	2	2	3	30	70	100
		Introduction to Disaster Management		2	2	3	30	70	100
		Summer Internship / Industrial Activity @@	(with Viva-Voce)	--	2	--	20	80	100
	Total			**30**	**28**	--	--	--	**900**
VI	III	Core Course - 9(CC - 9)	Wave Mechanics and Spectroscopy	4	4	3	30	70	100
		Core Course- 10(CC - 10)	Atomic and Molecular Physics	5	4	3	30	70	100
		Core Course- 11(CC - 11)	Nuclear and Particle Physics	5	4	3	30	70	100
		Core Project Work(CPW) @@	Project Work (with Viva-Voce)	6	4	3	20	80	100
	IV	Value Added Course	General Studies for Competitive Examinations	2	1	--	30	70	100
		Skill Enhancement Course - 6 (SEC - 6)	Any one from the list	2	2	3	30	70	100
		Skill Enhancement Course - 7 (SEC - 7) ##	NaanMudhalvan Course/SEC (List enclosed)	2	2	3	30	70	100
		Environmental Studies		2	2	3	30	70	100
		Gender Studies		2	1	3	30	70	100
		Extension Activities *		--	1	--	--	--	--
	Total			**30**	**25**	**--**	**--**	**--**	**900**
	Grand Total			**180**	**150**	--	**--**	**--**	**4900**

ALLIED COURSE

First Year Students	**Second Year Students**
Mathematics	Chemistry (or) Electronics

SKILL ENHANCEMENT COURSE (SEC)			
Sl. No.	**Title of paper**	**Sl. No.**	**MANDATORY Naan Mudhalvan Scheme##**
1.	Mobile Phone Trouble Shooting	1.	**2nd Semester:**
2.	LATEX		
3.	MATLAB	2.	**3rd Semester:**
4.	C++		
5.	Embedded Systems	3.	**4th Semester:**
6.	Digital Photography		
7.	Artificial Intelligence and Digital Skills	4.	**5th Semester:**
--		5.	**6th Semester:**

INTERDISCIPLINARY COURSE (IDC) FOR WHO HAVE OPT TAMIL AS PART-I (for other Department Students only)	
1st Semester	Renewable Energy Resources and Harvesting Techniques
2nd Semester	Biomedical Instrumentation
3rd Semester	Basic Instrumentation Skills
4th Semester	Physics for Everyday Life

INTERDISCIPLINARY COURSE (IDC)# FOR WHO HAVE NOT OPTED TAMIL AS PART - I		
Those who have studied Tamil upto10th+2 but opt for other languages in degree	1st Semester	Special Tamil - I
	2nd Semester	Special Tamil - II
Those who have not studied Tamil in school level	1st Semester	Basic Tamil - I
	2nd Semester	Basic Tamil – II
Those students who opt for either special Tamil (or) Basic Tamil as IDCs, have to choose 2 more IDCs courses in their 3rd and 4th Semester from Outside his/her department.		

INTERDISCIPLINARY COURSE (IDC) $$ FOR NCCCADETS ONLY	
NCC Course is a Compulsory Course for the NCC Cadets in the 3rd Semester:	**NCC Course is a Compulsory Course for the NCC Cadets in the 4th Semester:**
Introduction to NCC	1. Special Subject Army **(or)** 2. Special Subject Navy **(or)** 3. Special Subject Air force
Those students who opt for NCC Courses as IDCs, have to choose 2 more IDCs courses in their 1st and 2nd Semester from Outside his/her department.	

SUMMARY OF CURRICULUM STRUCTURE OF UG PROGRAMMES

Sl. No.	Part	Types of the Courses	No. of Courses	Credits for each Course	Total Credits	Marks
1.	I	Ability Enhancement Course	4	3	12	400
2.	II	Ability Enhancement Course	4	3	12	400
3.	III	Core Course	11	4	44	1100
4.		Core Practical	5	4	20	500
5.		Allied Course (AC)	4	4	16	400
6.		Allied Course Practical (AP)	2	4	8	200
7.		Core Project Work (CPW)	1	4	4	100
8.	IV	Skill Enhancement Course (SEC)	7	2	14	700
9.		Interdisciplinary Course (IDC)	4	2	8	400
10.		Value Education	1	2	2	100
11.		Health and Wellness	1	1	1	100
12.		Introduction to Disaster Management	1	2	2	100
13.		Summer Internship / Industrial Activity	1	2	2	100
14.		Value Added Course	1	1	1	100
15.		Environmental Studies	1	2	2	100
16.		Gender Studies	1	1	1	100
17.		**EXTENSIONACTIVITIES** (NCC / NSS / SPORTS / ANTI DRUG CELL / YRC & Any Other Activities	--	1	1	--
Total			**49**	**-**	**150**	**4900**

<table>
<tr><td>$</td><td>For those who havestudiedTamilupto10th+2(Regular Stream)</td></tr>
<tr><td>+</td><td>Syllabus for other Languages should be on par with Tamil at degree level</td></tr>
<tr><td>#</td><td>Those who have studied Tamilupto10th+2 but opt for other languages in degree level under Part -I should study special Tamil and those who have not studied Tamil in the school level should study Basic Tamil in Part– IV under the Ability Enhancement Course.</td></tr>
<tr><td>##</td><td>Naan Mudhalvan Scheme: As per the Naan Mudhalvan Scheme instructions 5 courses from 2nd to 6th semester should be studied under Skill Enhancement Course.</td></tr>
<tr><td>$$</td><td>NCC Course is one of the Choices in the Ability Enhancement Course. Only the NCC Cadets are eligible to choose this course. However, NCC Course is a Compulsory Course for the NCC Cadets.</td></tr>
<tr><td>@</td><td>Health and Wellness: Assessments:
Use self-reflective worksheets to assess their understanding
submit the worksheets to internal audit / external audit
Every student's activity report should be documented and the same have to be assessed by the Physical Director with Mentor. The evaluation should be for 100 marks. No examination is required.

Scheme of Evaluation:

<table>
<tr><th>Part</th><th>Description</th><th>Marks</th></tr>
<tr><td>A</td><td>Report</td><td>40</td></tr>
<tr><td>B</td><td>Attendance</td><td>20</td></tr>
<tr><td>C</td><td>Activities (Observation During Practice)</td><td>40</td></tr>
<tr><td colspan="2">Total</td><td>100</td></tr>
</table>
</td></tr>
<tr><td>@@</td><td>Summer Internship / Industrial Activity

Summer Internship will be carried out during the summer vacation after the second year. Viva Voce will be conducted by the college and Marks shall be sent to the University and the same will be included in the 5th semester Mark Statement.

Summer Internship / Industrial Activity & Project

Scheme of Evaluation:

<table>
<tr><th>Description</th><th>Marks</th></tr>
<tr><td>Report</td><td>80</td></tr>
<tr><td>Viva-Voce</td><td>20</td></tr>
<tr><td>Total</td><td>100</td></tr>
</table>
</td></tr>
<tr><td>*</td><td>Extension Activities shall be outside instruction hours.</td></tr>
</table>

Programme Outcomes

PO1	**Communication Skill:** Mandatory language courses facilitate to become proficient in communication, culturally aware, and more employable in both Indian and global contexts. Improve presentations skill, debates, and professional communication.
PO 2	**Disciplinary Knowledge:** Learn in-depth complex scientific concepts, demonstrate their ability to explain and apply their knowledge. Consistent in learning by earning extra credits in specialized courses within the science domain and enhance disciplinary knowledge.
PO 3	**Critical thinking:** Field and academic visits will help students to develop observation skills, grasping ability, collect and interpret data and propose models that will help them to understand hypotheses and conclusions.
PO 4	**Analytical Reasoning:** Through the interactions,students will develop skills of critical reading of texts, identifying gaps in knowledge, formulating scientific questions, and on will recognizing the synthesis of new ideas.
PO 5	**Scientific Reasoning:** Skill oriented courses will provide details on principles, conduct of proper calibration and use of scientific instrumentation and appropriate use of scientific techniques in experimental design
PO 6	**Self-directed Learning:** Preparation of field reports helps them to present their results and discussion in a written format that is typically required for their future professions.
PO 7	**Reflective Thinking:** All core courses with laboratory components will provide exposure to a wide range of research techniques, therein enhancing their understanding of the application of techniques in their domain.
PO 8	**Problem Solving:**Students will develop the ability to reason, apply numerical concepts, and equations in their fields of study for interpreting scientific data and drawing relevant scientific conclusions.
PO 9	**Research-related Skills:** Students undertaking a internship will have the opportunity to design, develop and execute their own research ideas in their experiments, thus expanding their knowledge of research methods and laboratory skills.
PO 10	**Lifelong Learning:** Ability to understand the gaps in knowledge and skill, adapt to technological change, engage in self-directed learning.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

Upon successful completion of the B.Sc. Physics Programme, students will be able to:

- Demonstrate the importance of the fundamental concepts, principles, laws, and applications of Physics across various domains.
- Critically interpret and apply mathematical models to physical systems, and effectively communicate scientific information through graphs, diagrams, and quantitative representations.
- Employ scientific reasoning, analytical thinking, and problem-solving skills to address theoretical and practical challenges.
- Exhibit proficiency in experimental techniques, data analysis, interpretation of results, and the effective use of scientific instruments and laboratory resources.
- Function as competent, self-directed, ethically responsible,remain thirsty to pursue higher studies, accept and crab research opportunities, choose relevant professional careers, and ready to deliver promptly the temporal requirements of science, technology, and the needs of our society.

First Year **CORE COURSE 1** **Semester I**

PROPERTIES OF MATTER AND ACOUSTICS

Code: **(Theory)** **Credit: 4**

COURSE OBJECTIVES:

- To inculcate the knowledge of Physical properties of matter namely, Elasticity, Surface tension and Viscosity.
- To enable the students to understand and comprehend the basic concepts of sound.
- To describe the experimental techniques for the determination of values of relevant quantities deciding the properties and thus enriching the learners to carry out the experiments with better understanding.

UNIT – I ELASTICITY:

Introduction - Hooke's law-Stress- Strain diagram – Factors affecting elasticity – Moduli of elasticity - Poisson's ratio -Twisting couple on a cylinder – Determination of rigidity modulus by static torsion– Work done in twisting a wire - Torsional oscillations of a body – Determination of rigidity modulus and moment of inertia.

UNIT – II BENDING OF BEAMS:

Bending of beams – Expression for bending moment – Cantilever – Young's modulus by measuring the tilt in a loaded cantilever – Oscillation of a cantilever - Experimental determination of Young's modulus using pin and microscope method (Uniform bending and Non-uniform bending) – Determination of Young's modulus by Koenig's method.

UNIT – III SURFACE TENSION:

Introduction – Molecular forces – Explanation of surface tension on kinetic theory – Surface energy – Work done on increasing the area of a surface - Angle of contact - Neumann's triangle - Excess pressure inside a liquid drop and soap bubble –Force between two plates separated by a thin layer of a liquid – Experimental determination of surface tension - Drop- weight method – Jagger's method - Surfactants.

UNIT – IV VISCOSITY

Introduction – streamlined and turbulent motion – Reynold's number - Poiseuille's formula for the flow of a liquid through a horizontal capillary tube – Experimental determination of co-efficient of a liquid by Poiseuille's method - Ostwald's viscometer – Terminal velocity and Stokes' formula – Viscosity of gases - Rankine's method - Lubricants.

UNIT – V ACOUSTICS:

Introduction – Classification of sound – Intensity of sound – Measurement of intensity of sound – Bel – Decibel and Phone - Reverberation– Sabine's Reverberation formula– Factors affecting the Acoustics of Buildings – Ultrasonic – Production of ultrasonic waves (Piezoelectric method) – Detection of ultrasonic waves (Quartz crystal method) – Applications of Ultrasonic waves.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Modulus of toughness and modulus of elasticity for different types of concrete - Elasticity and Seismic waves – Bending beam load cell – Composite beams – Surface tension and wetting behaviour of nanofluids – Viscosity of nanofluids – Acoustics sensors.

REFERENCES:

1. R. Murugeshan, Properties of Matter, S. Chand & Co. Pvt. Ltd.,
Revised edition, 2012.
2. D. S. Mathur, Elements of Properties of Matter, S. Chand & Co. Pvt. Ltd., Revised edition, 2010
3. Brijlal& N. Subramanyam, Properties of Matter, Vikas Publishing. Pvt. Ltd, 2005.
4. Brijlal& N. Subramanyam, ATextBook of Sound, Vikas Publishing. Pvt. Ltd, 2008.
5. Feynman,Lectures on Physics, Vol.I& II by Richard P. Feynman, The New Millennium Edition, 2012.
6. David Halliday and Robert Resnick, Fundamentals of Physics by Wiley Plus, 2013.
7. B. H. Flowers and E. Mendoza, Properties of matter, Wiley Plus, 1991. 8. H. R. Gulati, Fundamentals of General properties of matter, S. Chand & Co. Pvt. Ltd, 2012.
9. Chatterjee and Sen Gupta, A treatise on general properties of matter, New central Books agency (p) Ltd, Kolkata, 2001.
10. R.L.Saihgal, A Text Book of Sound, S. Chand & Co. Pvt. Ltd, New
Delhi, 1979.

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

COURSE OUT COMES	**CO1**	Differentiate the moduli of elasticity of different materials
	CO2	Analyze the moduli of elasticity of materials made in the form of beams
	CO3	Understand the practical applications of surface tension in real life.
	CO4	Acquire the knowledge of the flow of liquids based on their viscous nature and the variation of viscosity with temperature and pressure
	CO5	Understand the various characteristics of sound and their practical implications.

MAPPING WITH PROGRAM OUTCOMES: Map Course Outcomes (CO) for each course with Program Outcomes (PO) in the 3-point scale of STRONG (S), MEDIUM (M) and LOW (L).

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	M	S	M	M	M	L
CO2	S	S	S	S	M	M	L	M	M	M
CO3	S	M	M	S	S	M	M	M	M	M
CO4	S	S	S	S	S	M	M	M	M	S
CO5	S	S	M	S	S	S	M	M	M	S

First Year | **CORE PRACTICAL 1** | **Semester I**

PHYSICS PRACTICAL - I

Code: | **(Practical)** | **Credit: 4**

(ANY EIGHT EXPERIMENTS)

COURSE OBJECTIVES:

- To impart the skill of using measuring instruments
- To motivate the learner to study some properties of materials by determining the elastic constants, surface tension and viscosity through experiments.
- To make the learner to realize the vibrations of stretched strings.

EXPERIMENTS:

1. Basic measurements using Vernier calipers, Screw gauge and travelling microscope- breadth of a scale, thickness of a scale, and thickness of a thin wire/fibre, respectively.
2. Determination of Young's modulus - Non-uniform bending using pin and microscope.
3. Determination of Young's modulus - Uniform bending using single optic lever.
4. Determination of Young's modulus - Cantilever depression using scale and telescope.
5. Surface tension and interfacial surface tension – Drop weight method.
6. Surface tension by capillary rise method.
7. Coefficient of viscosity of a liquid - Poiseuille's flow method.
8. The viscosity of highly viscous liquid - Stoke's method.
9. Sonometer -Verification of laws of transverse vibrations of a stretched string and determination of the frequency of a tuning fork/mass of any material.
10. Determination of frequency of a tuning fork using Melde's string apparatus.
11. Absolute determination of M and H using deflection and vibration magnetometer.
12. Spectrometer - Determination of refractive index of the material of a solid prism.

REFERENCES:

1. Department of Physics, *Practical Physics*, (B.Sc. Physics Main), St. Joseph's College, Tiruchirappalli, 2009.
2. Dr. S. Somasundaram, *Practical Physics*, Apsara Publications, Tiruchirappalli, 2012.
3. C. C. Ouseph, U.J. Rao and V. Vijayendran, *Practical Physics and Electronics*, Viswanathan Printers and Publishers, PVT Ltd, 2014.

4 S. Srinivasan, *A Text Book of Practical Physics*, S. Sultan Chand Publications, 2005

5.R. Sasikumar, *Practical Physics*, PHI Learning Pvt. Ltd, New Del, 2011.

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to:

- Demonstrate proficiency in the use of measuring instruments for the precise determination of physical quantities required in laboratory experiments.
- Evaluate the elastic properties of structural materials through the analysis and interpretation of experimental data.
- Examine and determine the physical properties of liquids, including surface tension and viscosity, through practical experimentation.
- Develop the ability to experimentally verify and validate fundamental laws and principles of Physics.
- Investigate and understand the vibrational behavior of stretched strings through laboratory-based experiments.

First Year **CORE COURSE 2** **Semester II**

MECHANICS AND THEORY OF RELATIVITY

Code: **(Theory)** **Credit: 4**

COURSE OBJECTIVES:

- To provide a better insight into the change of position of any physical object or event and their consequences.
- To inculcate the Newton's law of gravitation and Kepler's laws of planetary motion and their implications
- To impart the knowledge of theory of relativity and its applications.

UNIT – I PROJECTILE, IMPULSE AND IMPACT:

Projectile – Particle projected in any direction – Path of a projectile - Range of a projectile on plane inclined to the horizontal - Maximum range on the inclined plane - Impulse of a force - Laws of impact - Direct impact and oblique impact between two smooth spheres - Loss of KE due to direct impact - Oblique impact.

UNIT – II MOTION ON A PLANE CURVE

Centripetal and centrifugal forces - Hodograph - Expression for normal acceleration – Motion of a cyclist along a curved path - Motion of a railway carriage round a curved track- Motion of a carriage on a banked-up curve - Effect of earth's rotation on the value of the acceleration due to gravity.

UNIT – III DYNAMICS OF RIGID BODY AND CENTRE OF GRAVITY:

Moment of Inertia - Perpendicular and parallel axes theorems - Acceleration of a body rolling down on inclined plane without slipping - Compound pendulum - Centre of suspension and center of oscillation – Minimum period of a compound pendulum - Centre of gravity of a body - C.G. of a solid hemisphere and hollow hemisphere - C.G. of a tetrahedron and solid cone

UNIT – IV HYDROSTATICS ANDHYDRODYNAMICS:

Centre of pressure – Centre of pressure of a triangular lamina immersed in a liquid-law of floatation - metacentric height of a ship -

Equation of continuity of flow -Bernoulli's theorem – Applications of Bernoulli's theorem – Pitot tube and Wings of an airplane

UNIT – V THEORY OF RELATIVITY:

Galilean – Newtonian relativity - Galilean transformations – Michelson Morley experiment and its importance –Basic ideas of special theory of relativity - Lorentz transformations and its interpretation – consequence of Lorentz transformation – Length contraction, time dilation – relativistic addition of velocities – Mass energy equivalence.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Applied mechanics and growing utilization of theoretical mechanics - Structural Engineering – Hydraulics - External fluid dynamics.

REFERENCES:

1. M. Narayanamurthi and N. Nagarathinam, Dynamics, The National Publishing Company 2005, Chennai.

2. M. Narayanamurthi and N. Nagarathinam, Statics, Hydrostatics and Hydrodynamics - The National Publishing Company 2005, Chennai.

3. R. Murugesan and KiruthigaSivaprasath - Modern physics, 18th Revised edition November -2017, S.Chand& Company Ltd., New Delhi.

4. D.S. Mathur, Mechanics, S. Chand & Company Ltd., New Delhi, 2007.

5. Venkataraman, M K, Dynamics, Trichy: Agasthiar Book Deport, 2011.
6. R. Murugesan, Mechanics and Mathematical Physics, S. Chand & Company Ltd., New Delhi, 2008.
7. I. H. Shames, Introduction to Solid Mechanics, 2009.
8. David Tong, Dynamics and Relativity, University of Cambridge, 2012.
9. M. Ray and G. C. Sharma, A text book of Dynamics, Chand & Company Ltd., New Delhi. 13th revised edition, 2005.
10. D. RajanBabu, E. James Jebaseelan Samuel, P. Ramesh Babu, V. Ramasubramanian and C. AnuRadha, Modern Physics, Anuradha Publisher, 2010.
11. P. Duraipandian, LaxmiDuraiPandiyan and MuthamizhJayapragasam, Mechanics Chand & Company Ltd., New Delhi. 2000.
12. Agarwal, J P, Elements of Mechanics, India: PragatiPrakashan, 2010.
13. Knight W D, Ruderman M A, Helmholz A C and Moyer B J, Mechanics, Berkeley Physics Course: Volume 1, 2nd Edition (2011)
14. Kleppner D and Kolenkow R J, An Introduction To Mechanics (Special Indian Edition) (2007).
15. University Physics. F.W. Sears, M.W. Zemansky and H.D. Young, 13/e, 1986.Addison- Wesley.
16. https://archive.org/details/NPTEL-Physics
17.https://www.academia.edu/8233163/Basics_of_Mechanics_notes_

COURSE OUTCOMES: Upon completion of this course, the students would be able to

COURSE OUT COMES	**CO1**	Use the principles of projectiles to explain the manner in which gravity affects a projectile motion.
	CO2	Gain a deeper knowledge of mechanics and its fundamental concepts.
	CO3	Acquire the knowledge about the centre of mass of objects.
	CO4	Learn rigid body dynamics in terms of moment of inertia and also analyze the center of gravity of different bodies.
	CO5	Analyze the special theory of relativity and its applications

MAPPING WITH PROGRAM OUTCOMES: Map Course Outcomes (CO) for each course with Program Outcomes (PO) in the 3-point scale of STRONG (S), MEDIUM (M) and LOW (L).

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	M	M	S	M	M	L
CO2	S	S	M	S	S	M	L	M	M	M
CO3	S	M	S	S	M	M	M	M	M	M
CO4	S	S	S	S	S	M	M	M	M	M
CO5	S	S	S	S	S	M	M	M	M	S

First Year | **CORE PRACTICAL 2** | **Semester II**

PHYSICS PRACTICAL - II

Code: | **(Practical)** | **Credit: 4**

(ANY EIGHT EXPERIMENTS)

COURSE OBJECTIVES:

- To strengthen students' practical and experimental competencies through hands-on laboratory activities.
- To foster a deeper understanding of fundamental physical laws and theorems through systematic experimental investigations.
- To enable students to explore and comprehend the optical properties of various materials through practical experimentation.

EXPERIMENTS:

1. Determination of Young's modulus – Uniform bending by Koenig's method
4. Determination of Rigidity modulus of a rod by Static Torsion method.
5. Determination of Rigidity modulus of a wire and moment of inertia using Torsional pendulum.
6. Sonometer–Frequency of an AC source determination
7. Determination of 'g' and 'k' using a compound pendulum.
8. The figure of merit of a mirror Galvanometer.
9. Concave lens – Determination of focal length using auxiliary lens method
10. Determination of focal length, radius of curvature and refractive index of a long focus convex lens by auxiliary lens method.
11. Air wedge- Determination of thickness of a thin wire.
12. Spectrometer – Determination of Refractive index of the material of the prism.
13. Spectrometer– Determination of Refractive index of a liquid using a hollow prism.
14. Spectrometer – Small-angle prism.

REFERENCES:

1. Department of Physics, *Practical Physics*, (B.Sc. Physics Main), St. Joseph's College, Tiruchirappalli, 2009.
2. Dr.S. Somasundaram, *Practical Physics*, Apsara Publications, Tiruchirappalli, 2012.
3. C.C.Ouseph, U.J.Rao and V.Vijayendran, *Practical Physics and Electronics*, Viswanathan Printers and Publishers, PVT Ltd (www.svprinters.com), Chetpet, Chennai – 2014.
4. S. Srinivasan, *A Text Book of Practical Physics*, S.Sultan Chand Publications. 2005.
5. R. Sasikumar, *Practical Physics*, PHI Learning Pvt. Ltd, New Delhi, 2011.

COURSE OUTCOME:

Upon successful completion of this course, students will be able to:

- Demonstrate proficiency in the operation and handling of laboratory instruments and equipment.
- Assess and interpret experimental outcomes through both quantitative and qualitative analyses.
- Utilize experimental results to explain and describe physical phenomena effectively.
- Exhibit the ability to conduct experiments collaboratively while adhering to ethical laboratory practices.
- Develop analytical skills for investigating and evaluating the properties of various materials.

Second year	CORE COURSE 3	Semester III
	HEAT AND THERMODYNAMICS	
Code	(Theory)	Credit: 4

COURSE OBJECTIVES:

- To help students understand the theory of specific heat capacities of solids.
- To impart knowledge about entropy changes in different thermodynamic processes.
- To enable learners to evaluate the thermal conductivities of good and bad conductors.
- To familiarize students with different conventional and non-conventional energy sources.
- To provide knowledge of refrigeration principles and their practical applications.

UNIT–I SPECIFICHEATCAPACITY AND HEAT CONVECTION

Specificheatcapacityofsolids–Regnault'smethodofmixtures-Radiationcorrection-DulongandPetit'slaw–Einstein'stheory-Specificheatofliquids–Newton'slawofcooling–Specificheatofgases–Mayer'sRelation Transfer of heat – Convection – Sea breeze – Land breeze – Mirages.

UNIT–II CONDUCTION:

Conduction: Coefficient of thermal conductivity - thermal resistance –Rectilinear Flow of Heat along a Bar - Thermal conductivity of good conductors: Forbe's method - three dimensional flow of heat Thermal conductivity of a bad conductor: Lee's disc method –Heat flow through a Compound Wall – Wiedemann- Franz law- Practical Applications of Conduction of Heat.

UNIT–III RADIATION:

Stefan's law – Stefan- Boltzmann law- Deduction of Newton's law of Cooling from Stefan'slaw-Determination of Stefan's constant (laboratory method) – applications of heat radiations - Black Body Radiation – Wien's Displacementlaw -Rayleigh–Jeanslaw-Planck'sLaw-Solarconstant–Surface Temperature of the Sun – Angstrom's Pyrheliometer – Sources of Solar Energy- Photovoltaic cell – Green House Effect.

UNIT–IV LOWTEMPERATUREPHYSICS:

Joule - Kelvin effect - Temperature of inversion - Porous plug experiment - Liquefaction of gases - Principle of regenerative cooling -Linde's process - Liquefaction of Hydrogen -Adiabatic demagnetization - Liquefaction of Helium – Practical Applications of Low Temperature-Refrigeratingmechanism–AirConditioningmechanism-SolidCarbon dioxide (Dry Ice).

UNIT–V THERMODYNAMICS:

Laws of Thermodynamics: Zeroth law - First law – Second law of Thermodynamics - Heat engines-Isothermalandadiabaticprocesses-Reversibleandirreversibleprocesses- Carnot's theorem - Proof - heat – work – heat capacity- Entropy: Change of entropy in adiabatic process - Change of entropy in reversible and irreversible process - T-S diagram – Thermodynamic scale of temperature –Thermodynamic potentials - Maxwell's thermodynamical relations - Joule-Thomson or Joule-kelvin effect - third law of thermodynamics.

***UNIT–VI CURRENTCONTOURS** (For Continuous internal assessment only):*

Waste thermal Energy – Waste Heat Recovery – Thermal Energy Storage – Thermal Storage materials – Thermal conductivity of rubber – Thermal conductivity of glass - Phase change Materials – Thermal Energy Storage Applications: Waste heat to Electricity and Solar Thermal Energy

REFRENCES:

1. BrijLal, Dr. N. Subrahmaniyam and P.S. Hemine,"Heat, Thermodynamics and Statistical Physics", S. Chand & Co., New Delhi, 2015.
2. J.B. Rajam and C.L. Arora, "Heat and Thermodynamics", S. Chand & Co., New Delhi, 1983.
3. R. Murugesan, "Thermal Physics", 1st Edition, 2002.
4. D.S. Mathur, "Heat and Thermodynamics", S. Chand & Co., 2014.
5. Agarwal, Singhal and Sathyaprakash, "Heat and Thermodynamics".
6. H.C. Saxena and Agarwal, "Thermal Physics".
7. M. Narayanamoorthy and N. Nagarathinam, "Heat", National Publishing Co., Chennai, 8th Edition, 3. K. Pathak and Poppy Hazarika, "Thermal Physics", Vishal International Ltd., 2020.
8. A. B. Gupta and H.P. Roy, "Thermal Physics", 5th Edition, Books & Allied Pvt. Ltd., 2020.
9. Dr.UtpalJyotiMahanta, JunmiGogoi et al., "Basic Thermal Physics", Mahaveer Publications, 2020.

WEB REFERENCES

https://doi.org/10.1016/j.aej.2021.11.003
https://web.mit.edu
http://www.thermalfluidscentral.org/
https://www.grc.nasa.gov
https://peer.asee.org

COURSE OUTCOMES: Upon completion of this course, the students would be able to

COURSE OUT COMES	CO1	Evaluate the specific heat capacities of solids, liquids, and gases and understanding on heat convection
	CO2	Analyze heat conduction phenomena and determine thermal conductivity using experimental methods.
	CO3	Explain the principles of thermal radiation, black body radiation, solar energy, and related applications.
	CO4	Understand low temperature physics, liquefaction of gases, refrigeration, and air-conditioning mechanisms.
	CO5	Understand and apply the laws of thermodynamics, thermodynamic processes, entropy, and thermodynamic potentials to physical systems

MAPPING WITH PROGRAM OUTCOMES: Map Course Outcomes (CO) for each course with Program Outcomes (PO) in the 3-point scale of STRONG (S), MEDIUM (M) and LOW (L).

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	M	M	L	M	M	L
CO2	S	S	M	S	S	M	L	M	M	M
CO3	S	M	S	S	M	M	M	M	M	M
CO4	S	S	S	S	S	M	M	M	M	M
CO5	S	S	S	S	S	M	M	M	M	S

Second Year	CORE PRACTICAL 3 PHYSICS PRACTICAL III	Semester III
Code	(Practical)	Credit: 4

(ANY EIGHT EXPERIMENTS)

COURSE OBJECTIVES:

To develop the skill of using laboratory instruments to determine some physical quantities required for the understanding of the logics and principles in physics.

EXPERIMENTS

1. Specific heat capacity of a liquid- Newton's Law of cooling.
2. The emissive power of a surface -Spherical Calorimeter.
3. Joule's calorimeter- Specific heat capacity of a liquid.
4. Thermal conductivity of a bad conductor – Lee's disc method.
5. Spectrometer- i-d curve.
6. Spectrometer – i - i' curve
7. Spectrometer – Cauchy's constants.
8. Spectrometer – Grating – Normal incidence method.
9. P.O box – Determination of temperature coefficient of a coil.
10. Potentiometer – Calibration of an Ammeter.
11. Potentiometer – Temperature co-coefficient of a thermistor
12. Characteristics of a Junction diode and a Zener diode.

REFERENCES:

1. Department of Physics, *Practical Physics*, (B.Sc. Physics Main), St. Joseph's College, Tiruchirapalli 2009
2. Dr. S .Somasundaram, *Practical Physics*, Apsara publications, Tiruchirapalli, 2012.
3. C.C. Ouseph, U.J. Rao and V. Vijayendran, *Practical Physics and Electronics*, Viswanathan Printers and Publishers, PVT Ltd (www.svprinters.com), Chetpet, Chennai.- 2014
4. S. Srinivasan, *A Text Book of Practical Physics*, S. Sultan Chand publications. 2005
5. R. Sasikumar, *Practical Physics*, PHI Learning Pvt. Ltd, New Delhi, 2011.

COURSE OUTCOME:

On completion of the course the learner will be able to:

- Realize practically some phenomena of Physics.
- Acquire the skill of handling instruments.
- Develop the observation and circuit drawing skills.
- Enhance the skill of performing process-oriented experiments.
- Verify the laws in Physics through experimental results.

Second Year **CORE COURSE 4** **Semester IV**

ELECTRICITY AND MAGNETISM

Code (Theory) **Credit: 4**

COURSE OBJECTIVES:

- To study the fundamental ideas on electro statics and current electricity
- To classify materials based on their magnetic properties
- To under stand the concept of resonance circuits

UNIT–I ELECTROSTATICS:

Coulomb's Law – Gauss's Law and its applications (Electric Field due to a uniformly charged sphere, hollow cylinder & solid cylinder) – Electric Potential – Potential at a point due to a uniformly charged conducting sphere – Principle of a capacitor– Capacity of a spherical and cylindrical capacitors – Energy stored in a charged capacitor–Loss of energy on sharing of charges between two capacitors – Gauss divergence theorem – Stoke's theorem.

UNIT–II CURRENTELECTRICITY:

Ampere's circuit allow and it sapplications-Field along the axis of acircular coiland Solenoid– TheoryofBallisticGalvanometer–Figureofmerit–DampingCorrection–Kirchhoff's Laws of Electricity – Wheat stone's bridge – Carey Foster's Bridge–Potentiometer–Calibration of Ammeter–Calibration of Voltmeter (Low range and High range)–Comparison of Resistances.

UNIT–III ELECTROMAGNETICINDUCTION:

Laws of electromagnetic induction–Self and mutual induction–Self-inductance of a solenoid– Mutual inductance of a pair of solenoids–Coefficient of coupling–Experimental determination of self (Rayleigh's method) and mutual inductance– Faraday's laws from Lorentz force - Growth and decay of current in a circuit containing L and R–Growth and decay of charge in a circuit containing C and R– Measurement of High resistance by leakage.

UNIT–IV ACCIRCUITS:

Alternating EMF applied to series circuits containing LC, LR and CR–Alternating EMF applied to circuits containing L,C and R–Series and Parallel resonance circuits–Sharpness of resonance–Q factor– Comparison between Series and Parallel resonant circuits –Power in AC circuits(R,L-R,L-C-Ronly)– Power factor–Wattless current–Choke Coil–Transformer – Uses of Transformers – three phase induction motor - Skin Effect – Maxwell's bridge – Owen's bridge.

UNIT–V MAGNETIC PROPERTIES OF MATERIALS:

Magnetic induction (B) - Magnetisation (M) - relation between the three magnetic vectors B, H and M - magnetic susceptibility - magnetic permeability – Dia, Para, and Ferro magnetism and their properties - the electron theory of magnetism - magnetic hysteresis – area of the hysterisis loop; determination of susceptibility: Guoy's method – magnetic circuits –comparison of electrical circuit with magnetic circuit.

UNIT–VI Current contours (For continuous internal assessment only):

Maxwell's Equations, electromagnetic waves, reflection and refraction, wave guides, retarded potential,antennas,relativisticelectrodynamics,fourvectors,Lorentz,andtransformation of fields, Poisson's and Laplace's equations.

REFERENCES:

1. BrijLal and N. Subrahmanyam, "A Text Book of Electricity and Magnetism", S. Chand & Company Pvt. Ltd., New Delhi, 2020.
2. R. Murugeshan, "Electricity and Magnetism", S. Chand & Company Pvt. Ltd., New Delhi, 2017.
3. M. Narayanamurthy and N. Nagarathnam, "Electricity and Magnetism", NPC Publications, Revised Edition, 1992.
4. D.L. Sehgal, K.L. Chopra and N.K. Sehgal, "Electricity and Magnetism", Sultan Chand & Sons, New Delhi, 2020.
5. D.N. Vasudeva, "Electricity and Magnetism", S. Chand & Co., 2011.
6. K.K. Tewari, "Electricity and Magnetism", S. Chand & Co., 2002.
7. E.M. Purcell, "Electricity and Magnetism (Berkeley Physics Course, Vol. 2)", McGraw Hill Education, 2nd Edition, 2017.
8. D.C. Tayal, "Electricity and Magnetism", Himalaya Publishing Co., Fourth Edition, 2019.
9. D. Halliday, R. Resnick and J. Walker, "Fundamentals of Physics – Electricity and Magnetism", Wiley India Pvt. Ltd., 2011.
10. David J. Griffiths, "Introduction to Electrodynamics", Pearson Education India Learning Private Limited, 4th Edition, 2012.
11. R.B. Singh, "Fundamentals of Electricity and Magnetism", New Age International (P) Ltd., Publishers, 2018.
12. BasudevGhosh, "Foundations of Electricity and Magnetism", Books & Allied Publishers, 2021.
13. Edward M. Purcell and Edward M. Purcell, "Electricity and Magnetism", University Printing House Cambridge, 2013.

WEB REFERENCES:

https://nptel.ac.in/courses/115104088
https://www.uou.ac.in/sites/default/files/slm/BSCPH-102.pdf

COURSE OUTCOMES:

Upon completion of this course, the students would be able to

COURSE OUT COMES	**CO1**	Understand and apply the fundamental principles of electrostatics, electric fields, electric potential, capacitors, and Gauss's law.
	CO2	Analyze electrical circuits using Kirchhoff's laws, bridge circuits, potentiometers, and magnetic field concepts in current electricity.
	CO3	Explain the principles of electromagnetic induction, self and mutual inductance, and transient phenomena in electrical circuits.
	CO4	Understand the behavior of AC circuits, resonance phenomena, transformers, induction motors, and bridge networks.
	CO5	Evaluate the magnetic properties of materials and analyze concepts such as magnetization, susceptibility, permeability, hysteresis, and magnetic circuits.

MAPPING WITH PROGRAM OUTCOMES: Map Course Outcomes (CO) for each course with Program Outcomes (PO) in the 3-point scale of STRONG (S), MEDIUM (M) and LOW (L).

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	M	M	L	M	M	L
CO2	S	S	M	S	S	M	L	M	M	M
CO3	S	M	S	S	M	M	M	M	M	M
CO4	S	S	S	S	S	M	M	M	M	M
CO5	S	S	S	S	S	M	M	M	M	S

Second Year	CORE PRACTICAL IV PHYSICS PRACTICAL - IV	Semester IV
Code	(Practical)	Credit: 4

(**ANY EIGHT EXPERIMENTS)**

COURSE OBJECTIVES:

To provide the knowledge on utilization of electrical devices to determine some electrical parameters by executing experiments.

EXPERIMENTS:

1. Meter bridge – Determination of specific resistance of a coil.
2. Determination of specific resistance – Carey Foster's Bridge.
3. Potentiometer – Calibration of low range voltmeter.
4. Potentiometer – Determination of resistance of a coil.
5. Potentiometer – emf of a thermocouple
6. Potentiometer – Calibration of high range voltmeter.
7. B.G. Absolute capacity of a capacitor.
8. Field along the axis of a coil – Determination of moment.
9. B.G – Figure of merit.
10. B.G – Determination of mutual inductance.
11. Study of a Series resonance circuit.
12. Study of a Parallel resonance circuit.

REFERENCES:

1. Department of Physics, *Practical Physics*, (B.Sc. Physics Main), St. Joseph's College, Tiruchirapalli 2009
2. Dr.S.Somasundaram,*PracticalPhysics*,Apsara Publications, Tiruchirapalli, 2012.
3. C.C.Ouseph,U.J.Rao and V.Vijayendran, *Practical Physics and Electronics*,Viswanathan Printers and Publishers,PVT Ltd (www.svprinters.com), Chetpet, Chennai- 2014
4. S. Srinivasan, *A Text Book of Practical Physics*, S. Sultan Chand publications. 2005
5. R. Sasikumar, *Practical Physics*, PHI Learning Pvt. Ltd, New Delhi, 2011.

COURSE OUTCOME:

On completion of the course the learner will be able to

- Analyze the electrical parameters of some electrical components.
- Carry out electrical experiments with better understanding.
- Develop observation and circuit drawing skills.
- Enhance the skills of troubleshooting electrical circuits.
- Calibrate some electrical instruments

MAPPING WITH PROGRAM OUTCOMES: Map Course Outcomes (CO) for each course with Program Outcomes (PO) in the 3-point scale of STRONG (S), MEDIUM (M) and LOW (L).

Third Year | **CORE COURSE 5** | **Semester V**

OPTICS AND LASERS

Code | **(Theory)** | **Credit: 4**

COURSE OBJECTIVES: The main objectives of this course are

- To familiarize the fundamental laws concerning aberrations.
- To provide basic concepts and applications of phenomena like interference and their related optical techniques.
- To give a hands- on experience to study diffraction of different optical phenomena by performing experiments.
- To understand the phenomena of polarization.
- To learn and understand about the basic concepts of laser and their types.
- To learn and understand the different types of laser and their experimental verification.
- To know about the applications of laser and the principle of holography.

UNIT - I: LENSES , ABERRATIONS AND EYE PIECES

Deviation produced by thin lenses - Focal length of two thin lenses in and out of contact - Cardinal Points - Refraction through a thin prism - Dispersion - Deviation without dispersion - Dispersion without deviation - Aberration - Chromatic aberration in lenses- Achromatic combination of two lenses - Spherical aberration and its removal - Optical instruments - Eye pieces - Ramsden's eyepiece - Huygen's eyepiece -Its comparison - Gauss eyepiece.

UNIT - II: INTERFERENCE

Interference of light - Coherent sources - Phase difference - Path difference - Fresnel's mirror - Fresnel's Biprism - Determination of wavelength of light, distance between two virtual sources - Lloyd's single mirror - Interference in thin films - Interference due to reflected beam - Air wedge - Newton's Rings - Determination of R and μ - Michelson's Interferometer – Determination of wavelength.

UNIT - III: DIFFRACTION

Fresnel's and Fraunhofer diffraction - Fresnel's diffraction at a straight edge and Circular aperature - Zone plate - Difference between zone plate and convex lens - Fraunhofer diffraction at a single slit, double slit and N slits - Theory of plane transmission grating - Dispersive power of a grating - Resolving power of a telescope, microscope , prism and grating - Comparison of grating and prism.

UNIT - IV: POLARIZATION

Brewsterls Law - Polarisation by reflection and refraction - Law of malus- Double refraction - Nicol prism - Quarter wave - Optics axis - Ordinary and extradinary rays - Huygen's explanation of double refraction in uniaxial crystals plate - Half wave plat - Production and detection of plane, circularly and elliptically polarized light - Optical activity - Fresnel's explanation with analytical treatment - Specific rotatory power - Determination by half shade and biquartzpolarimeter.

UNIT - V: LASERS

Principle - Einstein's coefficients - Condition for light amplification - Population Inversion - Threshold condition - Line Shape function - Optical resonators (Qualitative only) - Three level level laser systems.

Ruby laser - Nd YAG laser - Helium - Neon laser - Carbon- di- oxide (Co_2) laser - Application of laser in Industry - Cutting - Welding- Holography - Theory of construction and reconstruction

REFRENCES:

1. Dr. N. Subramaniyam, Brijlal and Dr.M.N. Avathanulu, Optics, S. Chand& Co. Pvt. Ltd.- 9th revised edition, New Delhi ,2014
2. AjoyGhatak, Optics, (TMH), New Delhi, Fourth edition, 2009.
3. KrishnapadaGhoshAnandamoy Manna, Text book of Physical Optics,McMillan India Ltd, First edition, 2007.
4. Spectroscopy,byGurdeepChatwal and Sham Anand Himalaya Pub.(2009).
5. Fundamentals of Molecular spectroscopy ,CN.Banwell 3rdedisionMc.Graw hill. Ltd,(2016)
6. R. Murugeshan and KiruthigaSivaprasath, Optics and spectroscopy, S. Chand & Co, New Delhi (2010)
7. G. Aruldass, Molecular Structure and Spectroscopy, PHI (2007).
8. N. SubrahmanyamBrijlal, M N Avadhanulu, Optics,S. Chand Publishing. Pvt. Ltd. New Delhi, 25th revised edition, 2013.
9. Manna AnandamoyGhoshKrishnapada, Text book of Physical Optics, McMillan India Ltd, First edition, 2007. 3. KiruthigaSivaprasath, R. Murugeshan, Optics and Spectroscopy, S. Chand & Co, 5th edition, 2001
10. Singh &Agarwal, Optics and Atomic Physics, PragatiPrakashan Meerut, Nineth edition, 2002.
11. A.B. Gupta, Modern Optics, Books and Allied (P) Ltd, Kolkata, 5thedition, 2021.
12. AjoyGhatak, Optics, McGraw Hill, New Delhi, 7th edition, 2020.

Arial Lipson, Stephen G. Lipson and Hentry Lipson, Optical Physics, Cambridge University Press, 4thedition, 2011.

13. Hect Eugene, Schaum's Outlines, Optics, Tata McGraw Hill, 2011.
14. R.S. Longhurst, Geometrical and Physical Optics, Longman Group Ltd, UK, Third edition,1999

WEB SOURCES

1. https://www.youtube.com/watch?v=ML7HcZo6IaE
2. https://www.khanacademy.org/science/physics/light-waves/introduction-to-lightwaves/v/polarization- of- light- linear- and- circular
3. https://nptel.ac.in/courses/104/104/104104085/

COURSE OUTCOMES:

Upon completion of this course, the students would be able to

COURSE OUT COMES	**CO1**	Understand the principles of geometrical optics, lens systems, prisms, aberrations, and eyepieces used in optical instruments.
	CO2	Explain and analyze interference phenomena of light, including thin film interference, Newton's rings, air wedge, and Michelson interferometer applications.
	CO3	Describe the principles of diffraction, diffraction patterns due to apertures and gratings, and evaluate the resolving and dispersive powers of optical instruments.
	CO4	Understand the concepts of polarization, double refraction, optical activity, and the production and analysis of polarized light using optical devices.
	CO5	Explain the fundamental principles of lasers, population inversion, laser systems, holography, and industrial applications of lasers.

MAPPING WITH PROGRAM OUTCOMES: Map Course Outcomes (CO) for each course with Program Outcomes (PO) in the 3-point scale of STRONG (S), MEDIUM (M) and LOW (L).

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	M	M	L	M	M	L
CO2	S	S	S	S	M	M	L	M	M	M
CO3	S	S	S	S	S	M	M	M	M	M
CO4	S	S	M	S	M	M	M	M	M	M
CO5	S	S	S	S	S	S	M	M	M	S

Third year	**CORE COURSE 6**	**SemesterV**
	SOLID STAE PHYSICS	
Code	(Theory)	**Credit:4**

COURSE OBJECTIVES:

- To impart the knowledge of crystallography.
- To introduce the basic ideas of bonding and defects in solids
- To make the students understand the properties of metals and semiconductors
- To inculcate the knowledge of dielectric, magnetic and superconducting properties of materials.

UNIT – I CRYSTAL SYSTEMS: Basic concepts of crystal –Lattice – Basis – Crystal structure - Unit cell – primitive cell- lattice parameters – crystal systems – Bravais lattices – SC, BCC, FCC, HCP crystal structures –number of atoms in unit cell- atomic radius-coordination number - packing fraction-crystal planes – Miller indices- Bragg's law-crystal structure analysis-Laue's photographic method-Powder crystal diffraction method.

UNIT– II BONDING AND DEFECTS IN SOLIDS: Interatomic forces – Bonding in solids – Primary bonds – Ionic, Covalent and metallic bonds – Secondary bonds – Dipole, dispersion and hydrogen bonds. Defects in solids – point defects: vacancy, interstitials, impurity – Line defects: Edge dislocation, screw dislocation –Surface defects: Grain boundary, stacking faults-volume defects.

UNIT– III ELECTRON THEORY OF METALS AND SEMICONDUCTORS: Classical free electron theory of metals- – Electrical and Thermal conductivity-Wiedemann Franz law – Quantum free electron theory –Fermi energy- density of states – Band theory of solids – Brillouin zones. Semiconductors – carrier concentration of intrinsic-electrical conductivity- carrier concentration of P-type and n-type – Hall Effect – experimental determination of carrier concentration and mobility – application.

UNIT– IV DIELECTRIC AND MAGNETIC PROPERTIES: Dielectrics: – polarization — dielectric constant- types of polarization – Lorentz field (derivation) – Clausius - Mossotti relation – Properties of dielectric materials – Dielectric loss and breakdown. Magnetism:dia, para, ferro, antiferro and ferri-magnetism – Ferromagnetic domains- Anti ferromagnetic materials – Ferrimagnetic materials.

UNIT– V SUPER CONDUCTIVITY: Introduction – Historical developments – General properties of superconductivity - Critical field and Crystal temperature – Meissner effect — Type I and Type II superconductors – London equations - penetration depth - Isotope effect– BCS theory – DCJosephson effect –SQUIDS – Magnetic levitation trains.

UNIT– VI CURRENT CONTOURS (For Continuous internal assessment only): Smart Materials Introduction to smart materials – Components of smart materials – Classification of smart materials – Shape memory alloys – Applications of smart materials.

REFERENCES:

1. Solid State Physics – N. Singh, Wiley India, ISBN: 978-9390455249, 2021
2. Solid State Physics – Gupta & Kumar, K. Nath& Co, Meerut,2000.
3. Solid State Physics – Singhal, KedarnathRamnath& Co,Meerut,2005.
4. Material Science – M.Arumugam, Anuratha Agencies, 2002.
5. Materials Science – S. L. Kakani and AmitKakani, 3rd Edition, New Age International, 2016
6. Introduction to Solid State Physics – Charles Kittel, John Wiley, 2004.
7. Elementary Solid State Physics – Ali Omar, Addison Wesley Publishing Company, 1975.
8. Elements of Solid State Physics – J.P. Srivastava, Second Edition, PHI learning Pvt. Ltd., 2006.
9. Solid State Physics and Electronics – A.B. Gupta &NurulIslam, Books & Allied Ltd, 2012 ISBN: 978-8187134831
10. Solid State Physics - V. K. DhasDr. S. D. Aghav, B. M. Laware, Dr. P. S. Tambade, NiraliPrakashan Publishers, 2019.

COURSE OUTCOMES:

Upon completion of this course, the students would be able to

COURSE OUT COMES	**CO1**	To find the crystal structure of materials applying their learnt knowledge.
	CO2	To differentiate the bonding in solids and identify the defects prevalent in crystalline solids
	CO3	To apply the gained knowledge about theories on conductors and semiconductors for learning related advanced topics
	CO4	To analyze the dielectric and magnetic various materials.
	CO5	To review the peculiar properties of superconducting materials and their implications.

MAPPING WITH PROGRAM OUTCOMES: Map Course Outcomes (CO) for each course with Program Outcomes (PO) in the 3-point scale of STRONG (S), MEDIUM (M) and LOW (L).

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	M	M	L	M	L	L
CO2	S	S	M	S	M	M	L	M	M	L
CO3	S	S	S	S	S	M	M	M	M	M
CO4	S	S	M	S	S	M	M	M	M	M
CO5	S	S	S	S	S	M	M	M	M	S

Third Year	CORE COURSE 7 BASIC ELECTRONICS	Semester V
Code	(Theory)	Credit:4

COURSE OBJECTIVES: Upon completion of this course, the students will be able to:

- Understand the fundamental concepts of semiconductors, charge carriers, and energy band theory.
- Explain the construction, characteristics, and applications of PN junction diodes and rectifier circuits.
- Analyze the operation and characteristics of bipolar junction transistors and their applications as amplifiers and switches.
- Understand amplifier principles, feedback techniques, and their influence on circuit performance.
- Study oscillators, power supply circuits, filters, and voltage regulation techniques used in electronic systems.

UNIT I SEMICONDUCTOR FUNDAMENTALS:

Atomic structure and energy bands - Conductors, semiconductors, insulators - Intrinsic and extrinsic semiconductors - Doping, P-type and N-type materials - Charge carriers- concentration and mobility.

UNIT IIPN JUNCTION & DIODE CIRCUITS :

PN junction formation and depletion region - Forward and reverse bias - V-I characteristics of a junction diode - Rectifiers (half-wave, full-wave, bridge) - Filters (capacitor, inductor basics) - Zener diode - Breakdown-voltage regulators- Schotky diode - Tunnel diode – Negative resistance.

UNIT IIITRANSISTORS:

Structure and working of Transistors (PNP, NPN) - Transistor configurations (CE, CB, CC) - Input and output characteristics –hybrid parameters- Load line analysis (basic idea) - Transistor as amplifier and switch- Field Effect Transistors - characteristics

UNIT IVAMPLIFIERS& FEEDBACK :

Basic amplifier concept - Voltage gain, current gain - Types of amplifiers (CE amplifier basics) - Feedback (positive and negative) - Advantages of negative feedback- power amplifier – push pull amplifier

UNIT V OSCILLATORS

Oscillators: concept and criteria for oscillations - RC and LC oscillators (basic idea) –Hartley oscillator – Colpit oscillator – Relaxation oscillator – Multivibrators – Mononstable – bistable and astablemultivibrators

Unit VI CURRENT CONTOURS (For continuous internal assessment only):

Conductors, semiconductors, insulators - Rectifiers (half-wave, full-wave, bridge) - Transistor configurations (CE, CB, CC) - Input and output characteristics - Types of amplifiers (CE amplifier basics)- Filters (C, LC, π filters).

REFERENCES:

1. V.K. Mehta and Rohit Mehta, *Principles of Electronics*, S. Chand & Company Ltd., New Delhi, 2020.
2. S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, *Electronic Devices and Circuits*, McGraw Hill Education, New Delhi, 2018.
3. R.L. Boylestad and Louis Nashelsky, *Electronic Devices and Circuit Theory*, 11th Edition, Pearson Education, 2013.
4. jacobMillman and Christos C. Halkias, *Electronic Devices and Circuits*, McGraw Hill Education, 2015.
5. Donald A. Neamen, *Electronic Circuit Analysis and Design*, 4th Edition, McGraw Hill Education, 2010.
6. Ben G. Streetman and Sanjay Kumar Banerjee, *Solid State Electronic Devices*, 7th Edition, Pearson Education, 2016.
7. Robert L. Boylestad, *Introductory Circuit Analysis*, 13th Edition, Pearson Education, 2015.
8. Sedra and Smith, *Microelectronic Circuits*, 7th Edition, Oxford University Press, 2015.
9. A.P. Malvino and David J. Bates, *Electronic Principles*, 8th Edition, McGraw Hill Education, 2016.
10. Thomas L. Floyd, *Electronic Devices: Conventional Current Version*, 10th Edition, Pearson Education, 2017.
11. S. Salivahanan and N. Suresh Kumar, *Electronics Devices and Circuits*, McGraw Hill Education, 2018.

COURSE OUTCOMES:

Upon completion of this course, the students would be able to

COURSE OUT COMES	**CO1**	Explain the concepts of energy bands, intrinsic and extrinsic semiconductors, doping, and charge carrier transport in semiconductor materials.
	CO2	Analyze the characteristics and applications of PN junction diodes, rectifiers, filters, and Zener diode voltage regulators.
	CO3	Understand the construction, operation, characteristics, and applications of bipolar junction transistors as amplifiers and switches.
	CO4	Evaluate the performance of amplifiers and explain the role and advantages of feedback in electronic circuits.
	CO5	Describe the principles of oscillators, power supply circuits, filters, and voltage regulation techniques used in electronic devices.

MAPPING WITH PROGRAM OUTCOMES: Map Course Outcomes (CO) for each course with Program Outcomes (PO) in the 3-point scale of STRONG (S), MEDIUM (M) and LOW (L).

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	M	M	L	M	L	L
CO2	S	S	M	S	S	M	L	M	M	L
CO3	S	S	S	S	S	M	M	M	M	M
CO4	S	S	M	S	S	M	M	M	M	M
CO5	S	S	S	S	S	M	M	M	M	S

Third Year **CORE COURSE 8** **Semester V**

DIGITAL ELECTRONICS AND MICROPROCESSOR

Code **(Theory)** **Credit:4**

COURSE OBJECTIVES: Upon completion of this course, the students will be able to:

- Understand various number systems, Boolean algebra, logic gates, and digital logic simplification techniques.
- Explain the design and operation of combinational and sequential digital circuits used in electronic systems.
- Analyze the characteristics and applications of operational amplifiers and their basic linear and nonlinear circuits.
- Understand the architecture, instruction set, and addressing modes of the Intel 8085 microprocessor.
- Develop assembly language programs for solving basic computational and data-processing problems using the 8085 microprocessor.

UNIT – I NUMBER SYSTEMS, LOGIC GATES AND BOOLEAN ALGEBRA:

Number Systems: Introduction to decimal, binary, octal, hexadecimal number systems – Inter conversions– 1's and 2's complements. Logic Gates: Symbols and their truth tables – AND, OR, NOT, NAND, NOR, XOR, and XNOR – Universality of NAND and NOR gates. Boolean Algebra: De-Morgan's theorems -Reducing Boolean expressions using Boolean laws – SOP forms of expressions (minterms) – Karnaugh map simplification (Four variables).

UNIT – II COMBINATIONAL AND SEQUENTIAL DIGITAL SYSTEMS:

Combinational Digital Systems- Half and full adders – Half and full subtractors –
Decoder(2:4 line) – Encoder(4:2 line)– Multiplexer(4:1 line) – Demultiplexer (1:4 line) – Sequential Digital Systems Flip flop – RS –clocked RS – T and D flip flops – JK and master slave flip flops – Counters –Four bit asynchronous ripple counter – Mod-10 counter - Shift registers – SISO and SIPO shift registers.

UNIT – III OPERATIONAL AMPLIFIER:

Operational amplifier - Characteristics of an ideal op-amp – Inverting and Non-inverting amplifier – Voltage follower – Adder, Subtractor, Integrator and Differentiator circuits – Log and antilog amplifiers – Digital to Analog and Analog to digital conversions- R-2R ladder method – Binary weighted method – successive approximation method(ADC) .

UNIT –IV INTEL 8085 MICROPROCESSOR ARCHITECTURE AND INSTRUCTIONS

History of microprocessors - INTEL 8085 - Pin Diagram - Architecture - Various registers - Status Flags - 8085 Instructions: Machine Language, Assembly Language, Instruction Set and Format - Data Transfer, Arithmetic, Logical, Branching and Machine Control Operations - Addressing Modes: Register, Implied, Immediate, Direct and indirect addressing.

UNIT – V ASSEMBLY LANGUAGE PROGRAMMING:

Addition - subtraction - multiplication -division of two 8- bit numbers - Finding the largest and smallest number in a data array-Arranging a list of numbers in ascending or descending order-complement – shift – mask-look up table– multibyte addition and subtraction –decimal addition - subtraction.

REFERENCES:

1. Malvino, A.P. and Leach, D.P., *Digital Principles and Applications*, 8th Edition, McGraw-Hill Education, 2015.
2. Ram, B., *Fundamentals of Microprocessors and Microcomputers*, 7th Edition, DhanpatRai Publications, New Delhi, 2018.
3. V.K. Mehta and Rohit Mehta, *Principles of Electronics*, S. Chand & Company Ltd., New Delhi, 2020
4. M. Morris Mano and Michael D. Ciletti, *Digital Design*, 6th Edition, Pearson Education, 2018.
5. R.P. Jain, *Modern Digital Electronics*, 5th Edition, McGraw-Hill Education, 2018.
6. Ramesh S. Gaonkar, *Microprocessor Architecture, Programming and Applications with the 8085*, 6th Edition, Penram International Publishing, 2013.
7. V. Hall, *Microprocessors and Interfacing: Programming and Hardware*, 3rd Edition, McGraw-Hill Education, 2017.
8. R.A. Gayakwad, *Op-Amps and Linear Integrated Circuits*, 4th Edition, Pearson Education, 2015.
9. S. Salivahanan and N. Suresh Kumar, *Electronic Devices and Circuits*, 5th Edition, McGraw-Hill Education, 2018.
10. A. Anand Kumar, *Fundamentals of Digital Circuits*, 4th Edition, PHI Learning Pvt. Ltd., 2016.
11. Douglas V. Hall and J.E. Jordan, *Microprocessors and Interfacing*, 2nd Edition, McGraw-Hill Education, 2014.

Web Resources:

1. NPTEL: https://nptel.ac.in
2. Virtual Labs: https://www.vlab.co.in
3. Spoken Tutorial: https://spoken-tutorial.org
4. Electronics Tutorials: https://www.electronics-tutorials.ws
5. All About Circuits: https://www.allaboutcircuits.com
6. GeeksforGeeks: https://www.geeksforgeeks.org
7. MIT OpenCourseWare: https://ocw.mit.edu

COURSE OUTCOMES:

Upon completion of this course, the students would be able to

COURSE OUT COMES	**CO1**	Apply number systems, Boolean algebra, logic gates, and Karnaugh maps to simplify and analyze digital circuits.
	CO2	Design and analyze combinational and sequential digital circuits such as adders, subtractors, multiplexers, flip-flops, counters, and shift registers.
	CO3	Explain the characteristics and applications of operational amplifiers and implement basic op-amp circuits for signal processing.
	CO4	Understand the architecture, instruction set, addressing modes, and operational features of the Intel 8085 microprocessor.
	CO5	Understand the architecture, instruction set, addressing modes, and operational features of the Intel 8085 microprocessor.

MAPPING WITH PROGRAM OUTCOMES: Map Course Outcomes (CO) for each course with Program Outcomes (PO) in the 3-point scale of STRONG (S), MEDIUM (M) and LOW (L).

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	M	M	L	M	L	L
CO2	S	S	S	S	S	M	L	M	M	L
CO3	S	S	M	S	S	M	M	M	M	M
CO4	S	S	S	S	S	M	M	M	M	M
CO5	S	S	S	S	S	M	M	M	M	S

Third Year	**CORE PRACTICAL V**	**Semester V**
	PHYSICS PRACTICAL - V	
Code	**(Practical)**	**Credit: 4**

(ANY EIGHT EXPERIMENTS)

COURSE OBJECTIVES:

To ignite the minds of the learners with the practical knowledge of Physics by enhancing the hidden talents in troubleshooting experiments.

EXPERIMENTS:

1. Spectrometer – Grating – Minimum deviation position.
2. Spectrometer – Dispersive power of a grating.
3. Construction and study of a Full Wave Rectifier.
4. Transistor characteristics – CE configuration.
5. FET characteristics.
6. Single-stage RC coupled amplifier – Transistor.
7. Hartley oscillator
8. Colpit oscillator
9. AND, OR and NOT Gates – Discrete components.
10. AND, OR and NOT Gates – Using ICs
11. Realizing NOR gate as a Universal gate.
12. Realizing NAND gate as a Universal gate.
13. OP-AMP - Adder and Subtractor

REFERENCES:

1. Department of Physics, *Practical Physics*, (B.Sc. Physics Main), St. Joseph's College, Tiruchirapalli 2009
2. Dr.S.Somasundaram, *Practical Physics*, Apsara publications, Tiruchirapalli, 2012.
3. C.C. Ouseph, U.J. Rao and V. Vijayendran, *Practical Physics and Electronics,* Viswanathan Printers and Publishers, PVT Ltd (www.svprinters.com), Chetpet, Chennai- 2014
4. S. Srinivasan, *A Text Book of Practical Physics*, S. Sultan Chand Publications. 2005
5. R. Sasikumar, *Practical Physics*, PHI Learning Pvt. Ltd, New Delhi, 2011.

COURSE OUTCOMES: On completion of the course the learner will be able to:

- Understand the characteristics of electronic components.
- Evaluate a process based on the results obtained from the experiments quantitatively and qualitatively.
- Obtain the scope of the investigation as expected.
- Link a process with help of the outcomes of an experiment.
- Develop the skill of experimenting collaboratively and ethically.

Third Year **CORE COURSE 9** **Semester VI**

WAVE MECHANICS & SPECTROSCOPY

Code **(Theory)** **Credit:4**

COURSE OBJECTIVES: On successful completion of this course, the students will be able to:

- Understand the fundamental concepts and principles of quantum mechanics and wave mechanics.
- Analyze quantum systems using Schrödinger wave equations and probability interpretations.
- Apply wave mechanical concepts to explain the behavior of microscopic particles.
- Explain the interaction of electromagnetic radiation with matter and the principles of spectroscopy.
- Understand spectroscopic instrumentation and their applications in scientific and technological investigations.

UNIT – I FOUNDATIONS OF QUANTUM MECHANICS:

Inadequacy of classical physics – Black body radiation – Planck's quantum hypothesis – Photoelectric effect – Compton effect – Wave-particle duality – de Broglie matter waves – Davisson and Germer experiment – Heisenberg uncertainty principle and applications – Wave packet – Group and phase velocities.

UNIT – II SCHRÖDINGER WAVE MECHANICS:

Wave function and its physical interpretation – Probability density – Normalization of wave function – Operators and observables – Eigen values and Eigen functions – Expectation values – Time-dependent and time-independent Schrödinger equations – Postulates of quantum mechanics.

UNIT – III APPLICATIONS OF WAVE MECHANICS:

Particle in a one-dimensional box – Potential step – Potential barrier – Quantum mechanical tunneling – Barrier penetration – Harmonic oscillator (elementary treatment) – Hydrogen atom (wave mechanical treatment) – Probability interpretation of atomic orbitals.

UNIT- INTRODUCTION TO SPECTROSCOPY:

Formation of molecules – ionic and covalent bonds – rotational spectra of diatomic molecules – rigid rotator model – vibrational spectra – harmonic oscillator model – vibration–rotation spectra – Raman effect – classical and quantum theory of Raman effect – rotational and vibrational Raman spectra – electronic spectra of molecules – Franck–Condon principle-Interaction of radiation with matter – absorption, spontaneous emission and stimulated emission – broadening of spectral lines.

UNIT-VSPECTROSCOPY APPLICATIONS:

Spectroscopic instrumentation – microwave spectroscopy and its applications – infrared spectroscopy and molecular vibrations – ultraviolet and visible spectroscopy – Beer–Lambert law – Raman spectroscopy and instrumentation – fluorescence and phosphorescence – laser spectroscopy (elementary ideas) – applications of spectroscopy in molecular structure determination, chemical analysis, medical diagnostics, environmental monitoring, and semiconductor studies.

COURSE OUTCOMES:

At the end of this course, the students will be able to demonstrate the ability to:

COURSE OUT COMES	**CO1**	Explain the limitations of classical physics and describe the fundamental concepts underlying the development of quantum mechanics.
	CO2	Apply Schrödinger wave mechanics, operators, and wave functions to analyze simple quantum systems and interpret their physical significance.
	CO3	Analyze quantum mechanical phenomena such as energy quantization, tunneling, potential barriers, and the behavior of particles in confined systems.
	CO4	Explain the interaction of electromagnetic radiation with matter and describe the fundamental principles governing spectroscopic processes.
	CO5	Explain the interaction of electromagnetic radiation with matter and describe the fundamental principles governing spectroscopic processes.

MAPPING WITH PROGRAM OUTCOMES: Map Course Outcomes (CO) for each course with Program Outcomes (PO) in the 3-point scale of STRONG (S), MEDIUM (M) and LOW (L).

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	M	M	L	M	L	L
CO2	S	S	S	S	S	M	M	M	M	M
CO3	S	S	S	S	S	M	M	M	M	M
CO4	S	M	S	S	M	M	M	M	M	M
CO5	S	S	S	S	S	M	M	M	M	S

Third Year **CORE COURSE X** **Semester VI**

ATOMIC AND MOLECULAR PHYSICS

Code **(Theory)** **Credit: 4**

COURSE OBJECTIVES:

- To develop a strong foundation in atomic structure and quantum theory through the study of vector atom model, quantum numbers, coupling schemes and atomic spectra.
- To impart advanced understanding of many electron atoms, X-ray spectra, molecular structure and molecular spectra using modern theoretical and experimental approaches.
- To equip students with knowledge of spectroscopic techniques and their interdisciplinary applications in science and technology, thereby fostering analytical ability, scientific reasoning and professional competence in atomic and molecular physics.

UNIT-I ATOMIC STRUCTURE AND VECTOR ATOM MODEL:

Development of atomic models – Thomson atom model – Rutherford atom model – Bohr atom model and its limitations – Sommerfeld atom model – vector atom model – quantum numbers – orbital angular momentum – electron spin – space quantization – magnetic dipole moment of electron – Bohr magneton – Stern–Gerlach experiment – Pauli exclusion principle – electronic configuration – selection rules – intensity rule.

UNIT-II ATOMIC SPECTRA AND MAGNETIC EFFECTS:

Origin of atomic spectra – hydrogen spectral series – excitation and ionization potentials – Frank–Hertz experiment – spectral terms and notations – fine structure of spectral lines – spin orbit interaction – LS and JJ coupling – Zeeman effect – Larmor's theorem – quantum mechanical explanation of normal Zeeman effect – anomalous Zeeman effect (qualitative study) – Paschen–Back effect – Stark effect.

UNIT-III MANY ELECTRON ATOMS AND X–RAYS:

Many electron atoms – central field approximation – spectral terms and term symbols – equivalent and non-equivalent electrons – Hund's rules – hyperfine structure – magnetic dipole moment due to orbital and spin motion – X-ray production – continuous X-rays – characteristic X-rays – Moseley's law and its importance – Bragg's law – X-ray diffraction – absorption of X-rays – applications of X-rays in crystallography, medicine and industrial radiography.

UNIT – IV MOLECULAR PHYSICS:

Molecular spectra – Theory of the pure rotational spectrum of a molecule - Theory of the origin of vibration -rotationspectrumofamoleculeElectronicspectraofmolecules-Molecular orbital theory of Hydrogen molecule ion – Heitler-London theory of Hydrogen molecule.

UNIT – V MOLECULAR ORBITALS: Molecular Orbitals – Introduction – Linear Combination of Atomic Orbitals (LCAO) – Proper overlap between atomic orbitals – Molecular Orbital Theory – Introduction –Postulates – Types of molecular orbitals – Formation of molecular orbitals – Characterization of molecular orbitals – Features of molecular orbitals.

UNIT-VI PROFESSIONAL COMPONENTS: (For internal assessment only)

Expert lectures – seminars – webinars – assignments – scientific communication skills – report writing – ethics in science – environmental awareness – social accountability – patriotism – lifelong learning skills.

REFRENCES:

1. J.B. Rajam – *Atomic Physics*, S. Chand Publishing, 20th Edition, 2010.
2. Brijlal and N. Subrahmanyam – *Atomic and Nuclear Physics*, S. Chand Publishing, 5th Edition, 2014.
3. Arthur Beiser – *Concepts of Modern Physics*, McGraw Hill Education, 6th Edition, 2003.
4. H.E. White – *Introduction to Atomic Spectra*, McGraw Hill Education, 1934.
5. Banwell and McCash – *Fundamentals of Molecular Spectroscopy*, McGraw Hill Education, 4th Edition, 1994.
6. Bransden and Joachain – *Physics of Atoms and Molecules*, Pearson Education, 2nd Edition, 2007.
7. W. Demtroder – *Atoms, Molecules and Photons*, Springer, 2006.
8. Haken and Wolf – *The Physics of Atoms and Quanta*, Springer, 7th Edition, 2010.
9. Herzberg – *Molecular Spectra and Molecular Structure*, Krieger Publishing, 1989.
10. C.N. Banwell – *Fundamentals of Molecular Spectroscopy*, McGraw Hill Education, 1994.
11. Foot Christopher – *Atomic Physics*, Oxford University Press, 2005

WEB RESOURCES

1. HyperPhysics – Atomic and Molecular Physics
2. Khan Academy – Quantum and Atomic Physics
3. NPTEL Physics Courses
4. MIT OpenCourseWare – Atomic Physics

COURSE OUTCOMES:

At the end of the course, the student will be able to:

COURSE OUT COMES	**CO1**	Understand the development of atomic models and analyze vector atom model, quantum numbers and electronic configuration of atoms.
	CO2	Analyze atomic spectra and understand excitation and ionization potentials, coupling schemes and magnetic field effects.
	CO3	Acquire knowledge on many electron atoms, X-ray spectra, diffraction and their applications in science and technology.
	CO4	Understand molecular structure and analyze rotational, vibrational and Raman spectra of molecules.
	CO5	Understand different spectroscopic techniques, instrumentation and their applications in scientific and technological fields.

MAPPING WITH PROGRAM OUTCOMES: Map Course Outcomes (CO) for each course with Program Outcomes (PO) in the 3-point scale of STRONG (S), MEDIUM (M) and LOW (L).

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	M	S	M	M	S	M
CO2	S	S	S	S	M	S	M	M	M	M
CO3	S	S	S	S	S	M	M	M	M	M
CO4	S	S	S	M	S	M	S	M	M	M
CO5	S	S	S	S	S	S	M	M	M	S

Third Year **CORE COURSE XI** **Semester VI**

NUCLEAR AND PARTICLE PHYSICS

Code **(Theory)** **Credit:4**

COURSE OBJECTIVES:

- To provide a comprehensive understanding of nuclear structure, nuclear properties, radioactive decay processes, and their practical applications in modern physics.
- Familiarity with nuclear instrumentation, radiation detectors, particle accelerators, nuclear reactions, reactor physics, and the principles of nuclear fission and fusion.
- To introduce the concepts of elementary particles and fundamental interactions, thereby developing analytical thinking and scientific understanding in the field of nuclear and particle physics.

UNIT – I NUCLEAR STRUCTURE AND NUCLEAR FORCES:

Constituents of nucleus – nuclear size, charge and mass – isotopes, isobars, isotones and isomers – nuclear spin, parity and magnetic moment – mass defect and binding energy – binding energy curve and nuclear stability.

Nuclear forces – characteristics of nuclear forces – meson exchange theory – Yukawa potential.

Nuclear models: Liquid drop model – semi-empirical mass formula – shell model – magic numbers – collective model (basic concepts).

UNIT – II RADIOACTIVITY AND NUCLEAR DECAY:

Natural and artificial radioactivity – law of radioactive disintegration – decay constant – half-life and mean life – radioactive equilibrium.

Alpha decay – properties of alpha particles – Geiger-Nuttall law – Gamow's theory of alpha decay (qualitative study).

Beta decay – beta ray spectrum – neutrino hypothesis – Fermi theory of beta decay – parity violation.

Gamma decay – internal conversion – electron capture – nuclear isomerism.

Applications of radioisotopes in medicine, agriculture, industry and scientific research.

UNIT – III NUCLEAR DETECTORS AND PARTICLE ACCELERATORS:

Principle and working of detectors: Ionization chamber – proportional counter – Geiger-Muller counter – scintillation counter – semiconductor detector – cloud chamber – bubble chamber.

Particle accelerators: Linear accelerator – cyclotron – synchrocyclotron – betatron – synchrotron. Applications of accelerators in medical, industrial and research fields.

UNIT – IV NUCLEAR REACTIONS AND REACTOR PHYSICS:

Nuclear reactions – conservation laws in nuclear reactions – Q-value of nuclear reactions – threshold energy – nuclear cross section.

Nuclear fission – chain reaction – critical size and critical mass – nuclear reactor – components of nuclear reactor – breeder reactor – nuclear power production.

Nuclear fusion – thermonuclear reactions – proton-proton cycle – carbon cycle – controlled thermonuclear fusion.

Radiation hazards – biological effects of radiation – radiation protection and safety measures.

UNIT – V PARTICLE PHYSICS:

Elementary particles – classification of particles: leptons, mesons and baryons – antiparticles – strange particles – quark model.

Fundamental interactions: Strong interaction – electromagnetic interaction – weak interaction – gravitational interaction.

Conservation laws: Conservation of charge – baryon number – lepton number – strangeness and isospin. Gauge bosons – Higgs boson – Standard Model (introductory concepts).
Cosmic rays – origin and properties of cosmic rays – primary and secondary cosmic rays – Big Bang theory (basic ideas).

UNIT – VI CURRENT CONTOURS(Self-directed Learning Activities for Continuous Internal Assessment Only)

The following activities may be assigned for internal assessment:

- Seminar on nuclear energy and its applications.
- Assignment on nuclear reactors in India.
- Presentation on CERN and Large Hadron Collider experiments.
- Study report on radiation safety and health physics.
- Mini project on particle detectors.
- Review of recent discoveries in particle physics.
- Poster presentation on Standard Model particles.
- Virtual laboratory experiments and simulations.
- Scientific article review from journals and magazines.

REFRENCES:

1. D.C. Tayal – *Nuclear Physics*, Himalaya Publishing House, 2015.
2. S.N. Ghoshal – *Atomic and Nuclear Physics*, S. Chand Publishing, 1997.
3. Irving Kaplan – *Nuclear Physics*, Addison-Wesley Publishing Company, 1963.
4. H.A. Enge – *Introduction to Nuclear Physics*, Addison-Wesley Publishing Company, 1975.
5. David Griffiths – *Introduction to Elementary Particles*, Wiley-VCH, 2008.
6. W.E. Burcham and M. Jobes – *Nuclear and Particle Physics*, Pearson Education, 1995.
7. Kenneth S. Krane – *Introductory Nuclear Physics*, John Wiley & Sons, 1987.
8. .Arthur Beiser – *Concepts of Modern Physics*, McGraw-Hill Education, 1963.
9. Robert Resnick – *Introduction to Special Relativity and Particle Physics*, John Wiley & Sons, 1968.
10. B.L. Cohen – *Concepts of Nuclear Physics*, McGraw-Hill Education, 1971.

WEB Resources

- NPTEL Physics Courses
- CERN Educational Resources
- IAEA Learning Resources
- MIT OpenCourseWare Physics

COURSE OUTCOMES:

At the end of the course, the student will be able to:

COURSE OUT COMES	**CO1**	Understand the basic properties of atomic nuclei, nuclear forces and various nuclear models such as liquid drop model and shell model.
	CO2	Acquire knowledge on radioactivity and radioactive decay laws and analyze alpha, beta and gamma decay processes with their applications.
	CO3	Understand the working principles of nuclear detectors and particle accelerators and analyze their applications in research, medicine and industry
	CO4	Analyze nuclear reactions and conservation laws and acquire knowledge on nuclear fission, fusion and reactor physics.
	CO5	Understand elementary particles, fundamental interactions, quark model and cosmic rays and acquire introductory knowledge on the Standard Model.

MAPPING WITH PROGRAM OUTCOMES: Map Course Outcomes (CO) for each course with Program Outcomes (PO) in the 3-point scale of STRONG (S), MEDIUM (M) and LOW (L).

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	M	S	M	M	S	M
CO2	S	S	S	M	S	S	M	S	M	M
CO3	M	S	S	S	M	S	S	M	M	M
CO4	S	S	S	S	S	M	M	M	S	M
CO5	S	M	S	S	M	S	S	M	M	S

Third Year **CPW** **Semester-VI**

PROJECT WITH VIVA-VOCE

Code: **Credit: 3**

The candidate shall be required to take up a Project Work by group or individual and submit it at the end of the final year. The Head of the Department shall assign the Guide who, in turn, will suggest the Project Work to the students in the beginning of the final year. A copy of the Project Report will be submitted to the University through the Head of the Department on or before the date fixed by the University. The Project will be evaluated by an internal and an external examiner nominated by the University. The candidate concerned will have to defend his/her
Project through a Viva-voce.

ASSESSMENT/EVALUATION/VIVA VOCE:

1. PROJECT REPORT EVALUATION (Both Internal & External)
   - I. Plan of the Project - 20 marks
   - II. Execution of the Plan/collection of Data / Organisation of Materials / Hypothesis, Testing etc and presentation of the report. - 45 marks
   - III.Individual initiative - 15 marks
2. Viva-Voce / Internal & External - 20 marks

TOTAL - 100 marks

PASSING MINIMUM:

Project	**Vivo-Voce 20 Marks** 40% out of 20 Marks (i.e. 8 Marks)	**Dissertation 80 Marks** 40% out of 80 marks (i.e. 32 marks)

A candidate who gets less than 40% in the Project must resubmit the Project Report. Such candidates need to defend the resubmitted Project at the Viva-voce within a month. A maximum of 2 chances will be given to the candidate.

SKILL ENHANCEMENT COURSE COURSE I **Semester II**

MOBILE PHONE TROUBLESHOOTING

Code: **(Theory)** **Credit: 2**

COURSE OBJECTIVES:

- To raise the value of the importance of boarding on self-employment
- To develop the assurance, basic smart phone system trouble shooting
- To learn cell phone components servicing, defect diagnostics and testing and inspection.

UNIT – I MOBILE COMMUNICATION TECHNOLOGY:

Introduction to communication - Development of the GSM Cellular Technology and Phone: 1G, 2G , 3G , 4G LTE and 5G - Mobile Phone Structure and Form Factors: Bar phones, Flip phones and Slider phones – Classification of mobile phones - Types of networks in cell phones, Dual Band(SIM) Handset

UNIT – II MOBILE PHONE COMPONENTS AND REPAIR TOOLS:

Introduction - Peripheral Input/ Output Components - The Battery and its connector - The Microphone and speakers – Ringers and vibrators – Display unit, ON-OFF Switch, Keypads, Camera and Antenna – Various types of connectors - Various Mobile Phone Hardware Repair Tools.

UNIT – III MOBILE PHONE HARDWARE ISSUES:

Mobile Phone Disassembly and Reassembly – Testing of various component using multimeter - Network problems, Power failure (dead), Mobile phone hardware troubleshooting (Battery and Battery charging issues, Network issue, ringer and vibration issues, keypad issues, sim faults) - Soldering and de-soldering - SMD rework station.

UNIT – IV HARDWARE FAULTS, DETECTION AND REPAIR PROCEDURES:

Common Faults in Mobile Phones and Tablets - Testing, Troubleshooting & Repair Action Steps: Power-On failure, Battery charging faults, Touch screen, Switch faults, Memory card faults, Restarting/Rebooting Mobile Device Faults, PCB/Motherboard Faults, Water damage faults.

UNIT – V UNDERSTANDING MOBILE PHONE SOFTWARE REPAIR:

Introduction – Types of mobile phone software - Real Time Systems (RTOS) - Flasher boxes and Their Supported Products - Mobile Phone Software Faults Diagnosis - Mobile Phones Viruses - Mobile Phone Flash Programming Process - Some Platform-Specific Flash Programming Procedures and Interface.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

The Character for Entrepreneurial Success of a mobile service technician - Useful Work Routine Guides and Customer Service for a technician - General Service Centre Operational Routines - Technologies for top brand smart mobiles - Adequate safety measures to be followed in Smart Phones- Avoiding of Electro Magnetic Radiation on Smart Phones.

REFERENCES:

1. C. Oparandu, Mobile Phones and Tablets Repairs: A Complete Guide for Beginners and Professionals (Unit
2. M. A. Azeemi, Learn Cell Phone Repair: A Do-It-Yourself Guide
3. Prabhu, Cell Phone Service Training Tamil Book (Chipsystems, 2015)
4. N. Sharma, Troubleshooting of Electronic Devices (Firewall Media Publications, New Delhi)
5. Prabhu, Cell Phone Service Training Tamil Book, CHIPSYSTEMS (2015)

6. SanjibPandit, Advance Mobile Repairing: Multicolour Circuits, Service Diagrams & Repairing (2010)
7. ManahrLotia, Modern Latest Mobile Phone Circuits & Fault Finding (2009)
8. DevratnAgrawal, Advance Mobile Flashing Software, Booksclinic Publishing (2020)
9. https://www.edx.org/learn/mobile-development
10. https://www.udemy.com/topic/cell-phone-repair/

COURSE OUTCOMES:

On completion of this course, student will be able to

COURSE OUT COMES	**CO1**	Recognize how a generation of mobile technology handles calls and comprehend GSM concepts.
	CO2	Recognize the different pieces that make up mobile phones and receive training on how to put them together and take them apart.
	CO3	Acquire knowledge of SMT technology, soldering, and de-soldering
	CO4	Gain an understanding of SIM card and network issues and learn how to troubleshoot them..
	CO5	Use diagnostic tools to identify any issues with the mobile phone and replace any necessary modules.

MAPPING WITH PROGRAM OUTCOMES: Map Course Outcomes (CO) for each course with Program Outcomes (PO) in the 3-point scale of STRONG (S), MEDIUM (M) and LOW (L).

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	L	M	M	M	M	M
CO2	S	S	M	S	S	M	M	M	M	M
CO3	S	S	S	S	M	M	M	M	M	M
CO4	S	S	S	S	M	M	M	M	M	M
CO5	S	S	S	S	S	L	M	M	M	S

SKILL ENHANCEMENT COURSE II **Semester II**

LATEX

Code: **(Theory)** **Credit: 2**

COURSE OBJECTIVES:

- To make the students learn the art of typing mathematics text on their own.
- To inculcate professional training required to become a scholar in mathematics.

UNIT – I:

Basic Structure of Latex 2e - Input file structure - Layout -Editors - Forward Search - Inverse Search - Compiling - Conversion to various formats, Symbols and Commands: Command names and arguments – Environments– Declarations – Lengths – Special characters

UNIT – II:

Typesetting simple documents - sectioning - Titles- page layout listing –enumerating - quote - letter formats.

UNIT – III:

Displayed Text: Changing font style – Centering and indenting – Lists – Generalized lists Theorem like-declarations.Using package amsmath typing equations labeling and referring.

UNIT – IV:

Text in Boxes: Boxes - Footnotes and marginal notes. Tables: Tabular stops – Tables, Figure inclusion

UNIT – V:

Bibliography - Index typing - Beamer Presentation Styles.

UNIT – VI: (Contemporary Issues)

Type a physics and mathematical articles using various journal style files

REFERENCES:

1. Leslie Lamport. LATEX: A Document Preparation System, Addison Wesley, Reading, Massachusetts, second edition, 1994.
2. Guide to LaTeX, Helmut Kopka and Patrick W.Daly, Fourth Edition, Addison - Wesley, Pearson Education, 2004
3. Tobias Oetiker, Hubert Partl, Irene Hyna and Elisabeth Schlegl., The (Not So) Short Introduction to LATEX2e, Samurai Media Limited (or available online at http://mirrors.ctan.org/info/lshort/english/lshort.pdf)
4. LATEX Tutorials - A Primer, Indian TeX Users Group, available online at
5. https://www.tug.org/twg/mactex/tutorials/ltxprimer1.0.pdf
6. H. J. Greenberg. A Simplified introduction to LATEX, available online at https://www.ctan.org/tex-archive/info/simplified 34 latex/ Using Kile - KDE Documentation, https://docs.kde.org/trunk4/en/extragear_office/kile/quick using.html
7. Amsmath and geometry package available in Ctan.org. feature of including bibliographies and indexes.

COURSE OUTCOMES:

On completion of this course, student will be able to

COURSE OUT COMES	**CO1**	Explain the basic structure of LaTeX 2e, document layout, commands, environments, and compilation processes for preparing scientific documents.
	CO2	Create and format simple documents using sectioning, titles, page layouts, lists, quotations, and letter formats in LaTeX.
	CO3	Apply advanced text formatting, theorem-like declarations, and mathematical typesetting using the amsmath package.
	CO4	Design documents with boxes, footnotes, tables, figures, and graphical inclusions using appropriate LaTeXenvironments.
	CO5	Prepare professional documents with bibliographies, indexes, and Beamer presentations for academic and technical communication.

MAPPING WITH PROGRAM OUTCOMES: Map Course Outcomes (CO) for each course with Program Outcomes (PO) in the 3-point scale of STRONG (S), MEDIUM (M) and LOW (L).

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	S	L	L	M	M	L
CO2	S	M	S	M	S	L	M	M	M	M
CO3	S	S	S	S	M	M	M	L	M	M
CO4	S	M	S	S	S	M	M	M	M	M
CO5	S	M	M	S	S	M	L	M	M	S

SKILL ENHANCEMENT COURSE III **Semester III**

MATLAB

Code: **(Theory)** **Credit: 2**

Course Objectives:

1. To introduce the students to MATLAB as programming and scientific computing tool.
2. To enable the students to solve basic problems and matrix operations using MATLAB.
3. To introduce the students to basic numerical techniques to solve first order ordinary differential equations, numerical integration
4. To familiarize the students with basic plotting tools available in MATLAB

Unit I Environment and Basics

Interface Overview- Command Window, Workspace, Current Folder, and Command History.
Variables and Data Types: Scalars, vectors, matrices, strings, and cell arrays-Basic Operations: Arithmetic operators, precedence, and built-in mathematical functions.

Unit II Matrix and Array Operations

Matrix Manipulation: Creating matrices, indexing, transposing, and concatenating -Array Mathematics: Element-by-element vs. standard matrix multiplication (dot operators).

Unit III Programming Constructs (Scripts and Functions)

M-Files: Creating and running scripts- Control Flow: Using if-else statements, switch cases, and logical operators. -Loops: Implementing for and while loops for iterative processes.User-Defined Functions: Writing and calling local functions, subfunctions, andanonymous functions

Unit IV Data Visualization and File I/O

2D & 3D Plotting: Generating standard waveforms, line plots, scatter plots, subplots, and 3D surface meshes. -Plot Customization: Adding titles, labels, legends, and grid lines.
File Management: Reading and writing data from/to .txt, .csv, and .xlsx files.

Unit V Advanced Applications & Simulink

Numerical Methods: Solving algebraic equations, numerical integration (Trapezoidal/Simpson's rule), curve fitting, and Ordinary Differential Equations (ODEs like ode45).Introduction to Simulink: Building block diagrams, connecting signals, and configuring simulation parameters.

Suggested readings:

1. A Guide to MATLAB - for Beginners and Experienced Users", 2nd Ed., Brian R. Hunt, Ronald L. Lipsman, Jonathan M. Rosenberg, Cambridge University Press, 2006.
2. PratapRudra, Getting started with MATLAB: A quick Introduction for Scientist and Engineers, Oxford University Press, 2010.
3. Wolfram S., TheMathematica, Cambridge University Press, 2003.

Learner outcomes:

After the completion of these courses, the learner will be able to
1. Get a general understanding of the purpose of MATLAB.
2. Use MATLAB effectively to analyze and visualize data.
3. Have an in-depth understanding and use of MATLAB fundamental data structure. 4. Create and control simple plots and user interface graphics, objects in MATLAB.
5. Write simple programs to solve various numerical problems like solving a system of linear equations, perform numerical integrations, ODE, and so on.

MAPPING WITH PROGRAM OUTCOMES: Map Course Outcomes (CO) for each course with Program Outcomes (PO) in the 3-point scale of STRONG (S), MEDIUM (M) and LOW (L).

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	S	M	M	M	M	M
CO2	S	S	S	S	S	M	M	M	M	S
CO3	S	S	M	S	S	M	M	S	M	S
CO4	M	S	S	S	S	M	M	M	M	S
CO5	M	S	S	S	S	S	M	S	M	S

SKILL ENHANCEMENT COURSE IV **Semester III**

C++ PROGRAMMING

Code: **(Theory)** **Credit: 2**

COURSE OBJECTIVES:

- To introduce the fundamentals of C++ programming, including program structure, data types, variables, operators, and input/output operations.
- To develop problem-solving skills using decision-making and looping constructs in C++.
- To provide knowledge of functions, arrays, and modular programming techniques for developing efficient programs.
- To familiarize students with pointers and string manipulation concepts in C++.
- To introduce the basic principles of Object-Oriented Programming (OOP) using classes, objects, constructors, and encapsulation.

UNIT I BASICS OF C++ PROGRAMMING:

Structure of a C++ program - Tokens, keywords, identifiers - Data types, variables,constants - Input/output using cin and cout - Operators (arithmetic, relational,logical).

UNIT II CONTROL STRUCTURES:

Decision making: if, if-else, switch - Looping: for, while, do-while - Nestedloops - Break and continue statements.

UNIT III: FUNCTIONS & ARRAYS

Functions: definition, declaration, call - Types of functions (with/without arguments& return values) - Arrays (1D and 2D basics) - Passing arrays to functions

UNIT IV: POINTERS & STRINGS

Pointers: declaration and initialization - Pointer arithmetic (basic idea) - Strings inC++ (character arrays) - Basic string operations.

UNIT V: OBJECT-ORIENTED PROGRAMMING (OOP) BASICS

Classes and objects - Data members and member functions - Constructors (basic idea)- Encapsulation - Simple programs using classes.

UNIT VI: CURRENT CONTOURS (For continuous internal assessmentonly):

Structure of a C++ program - Tokens, keywords, identifiers - Looping: for, while,do-while - Nested loops - Arrays (1D and 2D basics) - Pointers: declaration andinitialization - Pointer arithmetic (basic idea) - Basic string operations.

REFERENCES:

1. Object Oriented Programming with C++, E. Balagurusamy, McGraw Hill Education, Latest Edition.
2. The C++ Programming Language, Addison-Wesley, 4th Edition.
3. Programming with C++, McGraw Hill Education, Latest Edition.
4. C++: The Complete Reference, McGraw Hill Education, Latest Edition.
5. Let Us C++, BPB Publications, Latest Edition.
6. Programming Principles and Practice Using C++, Addison-Wesley, 2nd Edition.

COURSE OUTCOMES:

On completion of this course, student will be able to

COURSE OUT COMES	**CO1**	Explain the basic structure of C++ programs, data types, variables, operators, and input/output statements.
	CO2	Apply decision-making and looping constructs to solve computational problems
	CO3	Develop modular programs using functions and arrays for data processing applications.
	CO4	Demonstrate the use of pointers and string operations in C++ programming.
	CO5	Design and implement simple object-oriented programs using classes, objects, constructors, and encapsulation.

MAPPING WITH PROGRAM OUTCOMES: Map Course Outcomes (CO) for each course with Program Outcomes (PO) in the 3-point scale of STRONG (S), MEDIUM (M) and LOW (L).

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	S	L	L	M	L	M
CO2	S	S	S	M	L	L	M	S	M	M
CO3	S	S	S	S	S	L	L	M	M	M
CO4	S	S	M	M	S	M	M	M	L	M
CO5	S	S	S	S	S	M	M	M	M	S

SKILL ENHANCEMENT COURSE V **Semester IV**

EMBEDDED SYSTEMS

Code: **(Theory)** **Credit: 2**

COURSE OBJECTIVES:

- To introduce the fundamentals, characteristics, and applications of embedded systems in modern technology.
- To provide knowledge of microcontroller architecture, memory organization, registers, and input/output operations using the 8051 microcontroller.
- To develop basic programming skills in Embedded C for controlling embedded hardware devices.
- To familiarize students with sensor and actuator interfacing, data conversion techniques, and serial communication concepts.
- To impart knowledge of embedded system design methodologies, real-time systems, and practical embedded applications.
- To enable students to analyze and develop simple embedded system solutions for real-world applications.

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS:

Definition and characteristics of embedded systems - General-purpose vs embedded systems - Components: microcontroller, memory, I/O devices - Applications (home appliances, medical, automotive basics).

UNIT II MICROCONTROLLERS BASICS:

Architecture of 8051 Microcontroller - CPU, memory organization, registers - I/O ports and pin configuration - Simple programs (LED blinking concept).

UNIT III PROGRAMMING CONCEPTS :

Embedded C basics - Data types and operators in embedded C - Control structures (if,loops) - Interfacing simple devices (LED, switch).

UNIT IV INTERFACING & PERIPHERALS:

Interfacing sensors (temperature, light basics) - Actuators (LED, buzzer, motor basics) - ADC and DAC (basic idea) - Communication basics (serial communication)

UNIT V EMBEDDED SYSTEM APPLICATIONS & DESIGN:

Embedded system design flow - Real-time systems (basic idea) - Case studies: washing machine, traffic light controller - Introduction to development tools (IDE, programmer basics).

UNIT VI: CURRENT CONTOURS (For continuous internal assessmentonly):

General-purpose vs embedded systems - CPU, memory organization, registers - I/Oports and pin configuration - Control structures (if, loops) - ADC and DAC (basic idea) - -Case studies: washing machine, traffic light controller.

COURSE OUTCOMES:

On completion of this course, student will be able to

COURSE OUT COMES	**CO1**	Explain the architecture, characteristics, components, and applications of embedded systems.
	CO2	Describe the organization and operation of the 8051 microcontroller, including memory, registers, and I/O ports.
	CO3	Develop simple Embedded C programs using variables, operators, control structures, and basic device interfacing.
	CO4	Demonstrate the interfacing of sensors, actuators, ADC/DAC modules, and basic communication peripherals..
	CO5	Analyze embedded system design flow, real-time concepts, and implement simple embedded solutions for practical applications.

MAPPING WITH PROGRAM OUTCOMES: Map Course Outcomes (CO) for each course with Program Outcomes (PO) in the 3-point scale of STRONG (S), MEDIUM (M) and LOW (L).

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	L	M	L	L	M	L	M
CO2	S	S	M	M	S	L	L	M	L	M
CO3	S	S	S	M	S	L	L	M	M	M
CO4	S	S	M	M	S	M	M	M	L	M
CO5	S	S	S	S	S	M	M	M	M	S

SKILL ENHANCEMENT COURSE VI **Semester IV**

DIGITAL PHOTOGRAPHY

Code: **(Theory)** **Credit: 2**

COURSE OBJECTIVES:

- To introduce the fundamental principles of photography, including light, optics, image formation, exposure, and camera operations.
- To develop an understanding of photographic lenses, focal length, aperture, depth of field, and image stabilization techniques.
- To familiarize students with film-based cameras, their components, and various camera types used in photography.
- To provide knowledge of digital imaging technologies, digital cameras, image storage formats, and image quality parameters.
- To develop practical skills in digital image processing, editing, retouching, and printing using modern photographic software and hardware.

UNIT-I FUNDAMENTALS OF PHOTOGRAPHY:

History of photography - Basics of light and optics - Image formation principles - Camera obscura - Exposure concept - Aperture, shutter speed, ISO - Depth of field - Focal length and lenses - White balance - Types of photography.

UNIT-II: LENSES – CONTROLLING THE IMAGES:

Photographic lens – focal length and angle of view (problems) – focusing movement – aperture and f-numbers (problems) – depth of field– depth of focus – image stabilization – lenses for digital cameras – lens and camera care.

UNIT-III: CAMERA USING FILMS AND ITS TYPES:

Camera and its essential components– shutter – aperture – light measurement – film housing – camera types: view camera– view finder camera – Reflex camera– single lens reflex (SLR) camera.

UNIT-IV Digital Cameras Principle And Types:

Principle of digital image capturing –comparison of digital and analog picture information – megapixel – grain, noise and pixel density – optical and digital zooming – image stabilizer – bit depth – white balance – colour modes – file formats (TIFF, RAW and JPEG) – storage cards and types – digital cameras: camera phones – compact camera – hybrid camera – digital SLR.

UNIT-V THE DIGITAL IMAGE – POSTPRODUCTION:

Hardware: computer and its peripherals – software: saving digital file – basic editing: navigating the image – undo/redo/history – crop – rotate – brightness and contrast – colour balance – hue/saturation – dodge/burn – cloning and retouching – removing an element in an image – advanced editing: histogram/levels – curves – selection tools: magic wand – printing digital images: inkjet printer – laser printer – dye sub printer – lambda/light jet printers.

UNIT-VI PRACTICAL PHOTOGRAPHY AND PORTFOLIO WORK:

Photo assignments based on portrait, nature, product and event photography – Practice in camera settings and lighting techniques – Image editing and enhancement using software tools – Preparation of

digital photo album and portfolio – Printing and presentation of photographs – Viva voce and portfolio evaluation.

REFERENCES:

1. Michel J.Langford , Anna Fox and Richard Sawdon Smith, Basic photography, 9th Edition, 2010-NL, Focal press, London
2. Henry Carroll, Read this if you want to take great photographs of people, Laurence King Publishing Mark Galer, Digital Photography in Available Light essential skills, 2006, Focal press, London
3. Paul Harcourt Davies, The Photographer's practical handbook, 2005, UK PRESS
4. Michael Freeman – The Photographer's Eye

COURSE OUTCOMES:

On completion of this course, student will be able to

COURSE OUT COMES	**CO1**	Explain the principles of photography, image formation, exposure control, camera optics, and various photographic techniques
	CO2	Analyze the effects of focal length, aperture, depth of field, and lens characteristics on image quality and composition.
	CO3	Describe the construction, working principles, and applications of film-based cameras and their essential components..
	CO4	Evaluate digital imaging concepts, digital camera technologies, file formats, storage systems, and image quality parameters.
	CO5	Apply image editing and post-production techniques using digital tools for enhancing, retouching, and printing photographic images,

MAPPING WITH PROGRAM OUTCOMES: Map Course Outcomes (CO) for each course with Program Outcomes (PO) in the 3-point scale of STRONG (S), MEDIUM (M) and LOW (L).

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	L	M	M	L	L	M	L	M
CO2	S	S	S	M	M	L	L	M	L	M
CO3	S	M	M	M	M	S	M	M	M	S
CO4	S	M	S	S	S	M	M	M	S	M
CO5	S	S	S	S	S	M	L	S	M	S

SKILL ENHANCEMENT COURSE VII **Semester V**

ARTIFICIAL INTELLIGENCE AND DIGITAL SKILLS

Code: **(Theory)** **Credit: 2**

COURSE OBJECTIVES:

- To introduce the basic concepts of artificial intelligence, digital technologies and computational methods related to physics applications.
- To develop fundamental programming, data analysis and digital skills useful for physics experiments, scientific learning and modern technology.
- To equip students with basic technological knowledge and professional digital skills required for higher studies, research and scientific careers.

UNIT I DIGITAL TECHNOLOGY AND SCIENTIFIC COMPUTING:

Introduction to computers – operating systems – internet and cloud computing – digital communication – data storage – cybersecurity basics – applications of digital technology in physics and science education.

UNIT-IIBASICS OF PROGRAMMING FOR PHYSICS:

Algorithms and flowcharts – introduction to Python programming – variables, operators and control statements – functions and arrays – simple scientific calculations – plotting graphs using programming – basic computational ideas in physics

UNIT-IIIINTRODUCTION TO ARTIFICIAL INTELLIGENCE:

Introduction to artificial intelligence – scope of AI – basics of machine learning – supervised and unsupervised learning (elementary ideas) – applications of AI in physics, healthcare and industry – ethical aspects of AI.

UNIT-IVDATA ANALYSIS AND DIGITAL TOOLS:

Collection of scientific data – spreadsheet applications – graphical representation of data – basics of data analysis and visualization – virtual laboratories – simulation software for simple physics experiments – digital tools for scientific presentations and reports.

UNIT-VMODERN DIGITAL APPLICATIONS IN PHYSICS:

Sensors and smart devices – digital instruments – basics of Internet of Things (IoT) – online scientific resources – digital learning platforms – applications of AI and digital technology in modern physics research and everyday life.

UNIT-VICURRENT CONTOURS (Self-Directed Learning Activities for Continuous Internal Assessment Only):

Seminar presentation on recent developments in Artificial Intelligence and Physics – assignment on digital tools used in physics laboratories – case study on AI applications in healthcare, astronomy or industry – group discussion on ethical issues in AI and digital technologies – report writing and presentation using digital platforms.

REFERENCES:

1. E. Balagurusamy – *Programming in Python*, McGraw Hill Education, 2021.
2. V. Rajaraman – *Fundamentals of Computers*, PHI Learning, 6th Edition, 2014.
3. ReemaThareja – *Python Programming Using Problem Solving Approach*, Oxford University Press, 2017.
4. Stuart Russell and Peter Norvig – *Artificial Intelligence: A Modern Approach*, Pearson Education, 4th Edition, 2021.
5. S. Sumathi and S.N. Sivanandam – *Introduction to Machine Learning*, Springer, 2006.
6. Jake VanderPlas – *Python Data Science Handbook*, O'Reilly Media, 2016.
7. Al Sweigart – *Automate the Boring Stuff with Python*, No Starch Press, 2019.
8. Wes McKinney – *Python for Data Analysis*, O'Reilly Media, 2022.
9. Mark Newman – *Computational Physics*, CreateSpace Independent Publishing, 2012.
10. S.K. Sinha – *Computer Fundamentals*, BPB Publications, 2010.

ONLINE RESOURCES

1. NPTEL – Artificial Intelligence and Programming Courses
2. MIT OpenCourseWare – Computational Physics
3. Khan Academy – Computing and Programming
4. Coursera – AI and Data Science Courses
5. Python Official Documentation

COURSE OUTCOMES:

At the end of the course, the student will be able to:

COURSE OUT COMES	**CO1**	Understand the fundamentals of digital technology, scientific computing and their applications in physics.
	CO2	Develop programming and computational skills for solving basic scientific and physics-related problems.
	CO3	Understand the principles of artificial intelligence and machine learning and their applications in modern physics research..
	CO4	Analyze and represent scientific data using digital tools, simulations and computational techniques.
	CO5	Apply digital technologies, AI tools and smart instrumentation in scientific learning, experimentation and research applications.
	CO6	Develop self-learning ability, professional ethics, scientific communication and interdisciplinary problem-solving skills through digital and research-oriented activities.

MAPPING WITH PROGRAM OUTCOMES: Map Course Outcomes (CO) for each course with Program Outcomes (PO) in the 3-point scale of STRONG (S), MEDIUM (M) and LOW (L).

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	S	S	M	M	M	M	M
CO2	S	S	S	S	M	M	M	M	M	S
CO3	S	S	M	S	S	M	M	S	M	S
CO4	M	S	S	S	S	M	M	M	M	S
CO5	M	S	M	S	S	S	M	S	M	S
CO6	M	M	M	M	M	S	S	S	M	S

First Year **INTERDISCIPLINARY COURSE I** **Semester I**

RENEWABLE ENERGY RESOURCES AND HARVESTING TECHNIQUES

Code: **(Theory)** **Credit: 2**

COURSE OUTCOMES:

- Understand the classification, availability, and comparative merits and demerits of various non-conventional energy resources.
- Explain the working principles, construction, and applications of solar photovoltaic and solar thermal energy systems.
- Describe the principles, working mechanism and performance of geothermal and fuel cells.
- Understand wind, biomass, ocean thermal, wave, and tidal energy technologies in terms of site selection, working, and efficiency.
- Students will able to develop new ways to effectively produce energy storing devices for sustainable energy.

UNIT I RENEWABLE AND NON-RENEWABLE ENERGY SOURCES :

Earth's Energy Budget, Solar radiation at the Earths surfaces, Instruments for measuring Solar Radiation, Applications of Solar Energy, **Solar cell** (Photovoltaic conversion) - Types, Principle and Working-Efficiency- Characteristics, Efficiency, Advantages, Disadvantage and Applications of Solar Cells.

UNIT II SOLAR ENERGY COLLECTION:

Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors and application. Solar thermal power plants, thermal energy storage for solar heating and cooling, limitations.

UNIT III GEOTHERMAL ENERGY:

Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations. Fuel Cells: Principle of working of various types of fuel cells and their working, performance and limitations.

UNIT IV THERMO-ELECTRICAL AND THERMIONIC CONVERSIONS:

Principle of working, performance and limitations. Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance and characteristics, Advantages and Disadvantages. Nuclear Energy-fission & Fusion reaction, Nuclear reactor and its applications.

UNIT V BIO- ENERGY:

Principles of Bio-Conversion, Anaerobic /aerobic digestion, Energy from Bio-mass and Bio-Gas-Sketch Diagram-Production and applications. Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations. Wave and Tidal Wave: Principle of working, performance and limitations.

UNIT VI CURRENT CONTOURS (For continuous internal assessment only):

Global Energy Scenario and Sustainable Development Goals (SDGs)-Recent Advances in Solar Photovoltaic and Solar Thermal Technologies- Wind Energy Developments and Hybrid Renewable Energy Systems- Green Hydrogen Production and Fuel Cell Technologies- Energy Storage Systems:

Batteries and Supercapacitors. Biomass-Waste-to-Energy and Biofuel Technologies-Renewable Energy Policies- Net-Zero Initiatives and Clean Energy Transition in India.

REFERENCES:

1. Raja et al., Introduction to Non-Conventional Energy Resources, SciTech Publications.
2. John Twidell and Tony Weir, Renewable Energy Resources, BSP Publications, 2006.
3. M.V.R. KoteswaraRao, Energy Resources: Conventional & Non-Conventional, BSP Publications, 2006.
4. D. S. Chauhan, Non-conventional Energy Resources, New Age International.
5. Godfrey Boyle, Renewable Energy Power for A Sustainable Future, Oxford University Press.
6. V. S. John, et.al, Allied and applied physics, Jega Publications, 1995.
7. GD. Rai, Nonconventional energy Sources- Khanna Publication, (2004), New Delhi.

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

COURSE OUT COMES	**CO1**	Explain the significance of renewable and non-renewable energy sources and describe the principles and applications of solar energy conversion systems.
	CO2	Illustrate the working principles of solar energy collection systems, solar thermal power plants, and energy storage techniques.
	CO3	Discuss the utilization of geothermal energy and fuel cell technologies, including their performance and environmental impacts.
	CO4	Analyze thermoelectric, thermionic, wind, and nuclear energy conversion systems and their practical applications
	CO5	Describe biomass, biogas, ocean thermal, wave, and tidal energy technologies and evaluate their role in sustainable energy development.

MAPPING WITH PROGRAM OUTCOMES: Map Course Outcomes (CO) for each course with Program Outcomes (PO) in the 3-point scale of STRONG (S), MEDIUM (M) and LOW (L).

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	L	M	S	M	L	M
CO2	S	S	S	M	M	M	S	M	L	M
CO3	S	M	S	S	M	M	S	M	L	M
CO4	S	S	S	S	M	M	S	M	L	M
CO5	S	M	M	S	M	S	S	M	M	M

INTERDISCIPLINARY COURSE II **Semester II**

BIOMEDICAL INSTRUMENTATION

code **(theory)** **Credit 2**

COURSE OBJECTIVES:

The course has the following objectives:

- To introduce an fundamentals of transducers as applicable to physiology
- To explore the human body parameter measurements setups
- To make the students understand the basic concepts of forensic techniques.
- To give basic ideas about how multimedia evidences are useful in crime investigation.

UNIT-I Physiology and transducers

Cell and its structure, Resting and Action Potential, Nervous system: Functionalorganization of the nervous system, Structure of nervous system, neurons, synapse,transmitters and neural communication, Cardiovascular system, respiratory system, Basiccomponents of a biomedical system, Transducers, selection criteria, Piezo-electric,ultrasonic transducers, Temperature, measurements - Fiber optic temperature sensors.

UNIT-II Electro – Physiological measurements

Electrodes: Limb electrodes, floating electrodes, pre-gelled disposable electrodes, Micro,needle and surface electrodes, Amplifiers: Preamplifiers, differential amplifiers,chopper amplifiers, Isolation amplifier. ECG, EEG, EMG, ERG, Lead systemsandrecording methods, Typical waveforms. Electrical safety in medical environment:shock hazards, leakage current-Instruments for checking safety parameters of biomedicalequipment

UNIT-III Non-electrical parameter measurements

Measurement of blood pressure, Cardiac output, Heart rate, Heart soundPulmonaryfunction measurements, spirometer, Photo Plethysmography, Body Plethysmography,Blood Gas analyzers : pH of blood, measurement of blood pCO2, pO2, finger-tipoximeter, ESR, GSR, measurements, Standard HL7

UNIT-IV Medical Imaging

Radiographic and fluoroscopic techniques, X rays, Computer tomography,Mammography, MRI, fMRI, Ultrasonography, Endoscopy, Thermography, Differenttypes of biotelemetry systems and patient monitoring

UNIT-V Assistance through therapeutic equipments

Pacemakers, Defibrillators, Ventilators, Nerve and muscle stimulators, Diathermy, HeartLung machine, Audio meters, Dialyzers, Lithotripsy

Text and Reference Books

1. R.S.Khandpur, 'Hand Book of Bio-Medical instrumentation', Tata Mc Graw Hill Publishing Co Ltd., 2003.
2. Leslie Cromwell, Fred J.Weibell, Erich A. Pfeiffer, 'Bio-Medical Instrumentation and Measurements', II edition, Pearson Education, 2002 / PHI.
3. J.Webster, 'Medical Instrumentation', John Wiley & Sons, 1995.
4. L.A. Geddes and L.E.Baker, 'Principles of Applied Bio-Medical Instrumentation', John Wiley & Sons, 1975.

Course Outcomes: After completing the course, the students will able to:

CO1 Understand the physiology of biomedical system
CO2 Measure biomedical and physiological information
CO3 Discuss the application of Electronics in diagnostics
CO4 Understand the application of life saving equipments
CO4 Apply the ideas of physics in the field of medical treatment.

MAPPING WITH PROGRAM OUTCOMES: Map Course Outcomes (CO) for each course with Program Outcomes (PO) in the 3-point scale of STRONG (S), MEDIUM (M) and LOW (L).

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	M	M	M	M
CO2	S	S	S	S	M	M	M	M	M	S
CO3	S	S	M	S	S	M	M	S	M	S
CO4	M	S	S	S	S	M	M	M	M	S
CO5	M	S	M	S	S	S	M	S	M	S

Second Year **INTERDISCIPLINARY COURSE III** **Semester III**

BASIC INSTRUMENTATION SKILLS

Code: **(Theory)** **Credit: 2**

COURSE OBJECTIVES

- To provide fundamental knowledge of measurement principles, standards, errors, calibration techniques, and data analysis used in instrumentation.
- To develop practical skills in the operation and application of analog and digital measuring instruments, including multi meters, electronic voltmeters, and AC millivoltmeters.
- To impart a thorough understanding of Cathode Ray Oscilloscopes (CRO), Digital Storage Oscilloscopes (DSO), signal generators, and waveform analysis techniques.
- To enable students to measure and analyze electrical parameters such as voltage, current, frequency, time period, resistance, and impedance using modern instrumentation tools.
- To familiarize students with impedance bridges, Q-meters, digital measuring instruments, and their performance characteristics, specifications, and applications.

UNIT I BASICS OF MEASUREMENT AND ERRORS:

Physical quantities and units - Standards of measurement - Accuracy and precision - Types of errors (systematic, random, gross) - Error propagation - Least count and significant figures - Calibration methods - Sensitivity and resolution - Noise and uncertainty - Statistical analysis of data.

Multimeter: Principles of measurement of dc voltage and dc current- ac voltage, ac current and resistance- Specifications of a multimeter and their significance.

UNIT II ELECTRONIC VOLTMETER:

Advantage over conventional multimeter for voltage measurement withrespect to input impedance and sensitivity- Principles of voltage, measurement (block diagram only)- Specifications of an electronic Voltmeter/ Multimeter and their significance.

AC millivoltmeter: Type of AC millivoltmeters: Amplifier- rectifier, and rectifier- amplifier. Block diagram ac millivoltmeter, specifications and their significance.

UNIT III CATHODE RAY OSCILLOSCOPE:

Block diagram of basic CRO- Construction of CRT- Electron gunelectrostatic focusing and acceleration- brief discussion on screen phosphor- visual persistence &chemical composition-Time base operation, synchronization- Front panel controls- Specifications of a CRO and their significance.Use of CRO for the measurement of voltage (dc and ac frequency, time period.Special features of dual trace, introduction to digital oscilloscope, probes. Digital storage Oscilloscope: Block diagram and principle of working.

UNIT IV Signal Generators and Analysis Instruments: Block diagram, explanation and specifications of low frequency signal generators. pulse generator, and function generator. Brief idea for testing, specifications.Distortion factor meter, wave analysis.

UNIT VI MPEDANCE BRIDGES & Q-METERS:

Block diagram of bridge - working principles of basic (balancing type) RLC bridge- Specifications of RLC bridge - Block diagram & working principles of a Q- Meter- Digital LCR bridges.

Digital Instruments: Principle and working of digital meters- Comparison of analog& digitalinstruments - Characteristics of a digital meter- Working principles of digital voltmeter.

Digital Multimeter: Block diagram and working of a digital multimeter- Working principle of time interval- frequency and period measurement using universal counter/ frequency counter- time- base stability, accuracy and resolution.

UNIT VI CURRENT CONTOURS (INSTRUMENTATION PRACTICE AND MINI PROJECT: FOR CONTINUOUS INTERNAL ASSESMENT ONLY)

Hands-on training with multimeter, CRO and digital instruments – Measurement of voltage, frequency and resistance – Calibration and error analysis experiments – Signal generation and waveform observation – Mini project using electronic measuring instruments – Record submission and viva voce.

REFERENCES:

1. A.K. Sawhney – Electrical and Electronic Measurements
2. A text book in Electrical Technology - B L Theraja - S Chand and Co.
3. Performance and design of AC machines - M G Say ELBS Edn.
4. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
5. Logic circuit design, Shimon P. Vingron, 2012, Springer.
6. Digital Electronics, SubrataGhoshal, 2012, Cengage Learning.
7. Electronic Devices and circuits, S. Salivahanan& N. S.Kumar, 3rd Ed., 2012,Tata Mc-GrawHill.

COURSE OUTCOMES :

Upon successful completion of this course, students will be able to:

COURSE OUT COMES	**CO1**	Explain the concepts of measurement standards, errors, calibration techniques, uncertainty analysis, and statistical treatment of experimental data.
	CO2	Operate and evaluate the performance of multimeters, electronic voltmeters, and AC millivoltmeters for accurate electrical measurements.
	CO3	Describe the construction, working principles, controls, specifications, and applications of Cathode Ray Oscilloscopes (CRO) and Digital Storage Oscilloscopes (DSO).
	CO4	Measure and analyze electrical signals using CROs, DSOs, signal generators, and waveform analysis instruments.
	CO5	Apply the principles of impedance bridges, Q-meters, digital voltmeters, digital multimeters, and frequency counters in practical measurement systems.

MAPPING WITH PROGRAM OUTCOMES: Map Course Outcomes (CO) for each course with Program Outcomes (PO) in the 3-point scale of STRONG (S), MEDIUM (M) and LOW (L).

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	M	L	L	M	M	L
CO2	S	S	S	M	S	M	L	L	M	M
CO3	S	S	M	L	L	M	M	M	M	M
CO4	S	S	S	S	S	M	M	M	M	M
CO5	S	S	M	S	S	M	M	M	S	S

Second Year **INTERDISCIPLINARY COURSE IV** **Semester IV**

PHYSICS FOR EVERY DAY LIFE

Code: **(Theory)** **Credit: 2**

COURSE OBJECTIVES:

- To provide a comprehensive understanding of the physical principles governing everyday phenomena, modern technological devices and applied scientific systems through the study of mechanics, optics, electronics and communication physics.
- To develop knowledge on energy resources, environmental physics, healthcare technologies and sustainable scientific applications while enhancing analytical ability, problem-solving skills and technological awareness.
- To equip students with scientific reasoning, professional competence and ethical responsibility by relating physics concepts to real-life applications, modern innovations and societal needs.

UNIT-IPHYSICS IN EVERYDAY LIFE:

Role of physics in daily life – units and measurements – motion and forces in daily activities – friction and lubrication – pressure and fluid mechanics – Bernoulli's principle and applications – elasticity and surface tension – heat transfer mechanisms – thermal insulation – refrigerators and air conditioners – energy efficiency in household systems.

UNIT-IIOPTICS AND ACOUSTICS:

Reflection and refraction – total internal reflection – optical fibers and communication – optical instruments: microscope, telescope and camera – defects of vision and correction – LASER (elementary ideas) – sound waves – resonance and reverberation – acoustics of buildings – ultrasonic waves and applications in medicine and industry

UNIT-IIIELECTRICITY AND ELECTRONIC DEVICES:

Current electricity – Ohm's law – electrical power and energy consumption – domestic wiring – fuse, MCB and earthing – transformers – semiconductor diode – transistor and rectifier – LED and solar cell – household electronic appliances – sensors and smart devices.

UNIT-IVCOMMUNICATION AND MODERN TECHNOLOGY:

Electromagnetic waves – radio and television communication – mobile communication – satellite communication – radar and GPS – digital communication (elementary ideas) – internet technology – nanotechnology and applications – smart technologies in everyday life.

UNIT-VENERGY, ENVIRONMENT AND MEDICAL PHYSICS:

Conventional and renewable energy sources – solar and wind energy – energy conservation – greenhouse effect and global warming – environmental pollution – radiation and its effects – X-rays and ultrasound imaging – CT scan and MRI (elementary ideas) – applications of physics in healthcare and environmental monitoring.

UNIT-VI CURRENT CONTOURS (For Continues Internal assessments Only)

1. **Smart Technologies and Internet of Things (IoT):** Application of sensors, smart devices, and home automation systems in everyday life.
2. **Advanced Communication Systems:** Developments in fiber-optic communication, 5G networks, satellite communication, and GPS technologies.

3. **Renewable Energy and Sustainability:** Emerging trends in solar energy, wind energy, energy conservation, and sustainable technologies.
4. **Medical Physics and Healthcare Innovations:** Modern diagnostic techniques such as LASER applications, ultrasound imaging, CT scans, and MRI.
5. **Nanotechnology and Environmental Monitoring:** Use of nanomaterials, smart sensors, and remote sensing technologies for environmental protection and industrial applications.

REFERENCES :

1. Arthur Beiser – *Concepts of Modern Physics*, McGraw Hill Education, 6th Edition, 2003.
2. V.K. Mehta and Rohit Mehta – *Principles of Electronics*, S. Chand Publishing, 11th Edition, 2008.
3. R. Murugesan – *Allied Physics*, S. Chand Publishing, 2011.
4. A. Ghatak – *Optics*, McGraw Hill Education, 5th Edition, 2012.
5. D.C. Tayal – *Electricity and Magnetism*, Himalaya Publishing House, 2012.
6. Halliday, Resnick and Walker – *Fundamentals of Physics*, John Wiley & Sons, 10th Edition, 2013.
7. H.D. Young and R.A. Freedman – *University Physics*, Pearson Education, 14th Edition, 2015.
8. S.O. Pillai – *Solid State Physics*, New Age International Publishers, 8th Edition, 2010.
9. B.K. Pandey and S. Chaturvedi – *Engineering Physics*, Cengage Learning, 2014.
10. C.L. Arora – *Physics for Degree Students*, S. Chand Publishing, 2010.

WEB RESOURCES:

1. HyperPhysics
2. Khan Academy – Physics
3. NPTEL Physics Courses
4. MIT OpenCourseWare – Physics
5. Physics Classroom

COURSE OUT COMES	**CO1**	Understand the role of physics principles in everyday phenomena and household systems.
	CO2	Explain the applications of optics, sound and wave phenomena in modern technology.
	CO3	Acquire knowledge on electricity, electronic devices and domestic electrical systems.
	CO4	Understand communication systems, smart technologies and modern applications of physics.
	CO5	Analyze the importance of renewable energy, environmental protection and medical applications of physics.
	CO6	Develop scientific awareness, analytical thinking and professional responsibility towards society and environment.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	M	M	S	S	M	M	M
CO2	S	S	S	M	S	M	M	M	M	M
CO3	S	S	S	S	S	S	M	S	M	M
CO4	M	S	S	S	S	M	M	M	M	S
CO5	S	S	M	S	S	S	S	S	M	S
CO6	M	S	M	M	M	S	S	S	S	S