

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

Three Years - Six Semesters Bachelor's Degree Programme

3 Years B.Sc. / 4 Years B.Sc. (Hons.) & 4 Years B.Sc. (Hons. with Research) Programme



Faculty of Science and Technology (Science Group)

Subject: **PHYSICS**
(Semesters III and IV)

**Effective from Academic Year 2025-26
(As per NEP 2020)**

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SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

FACULTY: Science and Technology

Subject: PHYSICS

**Teaching and Learning Scheme for the Degree of Bachelor of Science (B.Sc.)
Three Years / Four Years - (Six/Eight Semesters) Bachelor Degree Programme**

Examination, Evaluation and Assessment Scheme

Vertical No.	The Vertical	Mode of Examination, Evaluation & Assessment	Theory					Theory (Total)		Practical						Practical (Total)	
			External			Internal				External			Internal				
			Max. Marks	Min. Marks	Durati on (Hrs.)	Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks	Durati on (Hrs.)	Max. Marks	Min. Marks	Max. Marks	Min. Marks	
A	Major	External & Internal	30	9	2	20	6	50	20	25	10	3	25	10	50	20	
	IKS Major Specific		30	9	2	20	6	50	20	-	-		-	-	-	-	
B	Minor		30	9	2	20	6	50	20	25	10	3	25	10	50	20	
C	Generic/ Open Elective		30	9	2	20	6	50	20	--	--		--	--	--	--	
D	VSC	Internal	--	--						--	--		50	20	50	20	
	SEC	Internal	--	--						--	--		50	20	50	20	
F	Internship/ Apprenticeship	Internal	Assessment of these verticals shall be based on various activities/practices. It shall be evaluated by giving maximum marks of 50 per 2 Credit Course with separate activity weightages/levels. A detailed SOP for thisassessment process shall be prescribed separately.														
	FP/CEP																
	CC																

Internal Assessment for Theory/Practical/Laboratory:

All the internal assessments should be conducted on the basis of Continuous Assessment Tests (CAT).

Continuous Assessment Tests (CAT):

For internal assessment, the Continuous Assessment Tests (CAT) shall be conducted as under

- Three CAT each of 10 Marks (Theory) and 10 Marks (Practical).
 - First on completion of 25% Syllabus of the course or on completion of 25 teaching days,
 - Second on completion of 50% Syllabus of the course or on completion of 50 teaching days,
 - Third on completion of 75% Syllabus of the course or on completion of 75 teaching days.
- Each concurrent assessment (CAT-I, II & III) will be mapped to relevant Course Learning Outcome.
- Total Performance in CAT (i.e.40 %) shall be based on the best two out of three in CAT examinations
- Internal assessment shall be carried out by the respective course teacher by choosing variety of assessment tools/methods such as class test, seminar, case study, field work, mini project work, quiz or any innovative method, which may be deemed to be appropriate for assessing the relevant course outcome.

External Assessment for Practical (Major/Minor Lab):

- Experiment Performance : 20 Marks
- Viva-Voce : 05 Marks
- **Total : 25 Marks**
- Duration of Examination : 03 Hrs.

Internal Assessment for Practical (Major/Minor Lab):

- Internal Assessment based on CAT : 20 Marks
- Record Book : 05 Marks
- **Total : 25 Marks**

Internal Assessment for Practical (SEC/VSC Lab):

- Internal Assessment based on CAT : 20 Marks
- Record Book : 10 Marks
- End Semester Examination : 20 Marks
(Experiment/ Demonstration/ Hands on Activity Performance: 15 Marks + Viva-Voce: 05 Marks)
- **Total : 50 Marks**
- Duration of End Semester Examination : 03 Hrs.

Evaluation and Assessment for FP/CEP:

- Project Report: The final report will be assessed based on its content, organization, and the quality of the research. (20 Marks)
- Oral Presentation: The presentation will be evaluated on clarity, engagement, and the ability to answer questions. (10 Marks)
- Faculty Evaluation: The faculty mentor will assess the student's performance throughout the project. (20 Marks)
- Total 50 Marks

Note: The external assessments of theory courses will be conducted in accordance with the guidelines issued by the SGBA University.

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**Teaching and Learning Scheme for the Degree of Bachelor of Science (B.Sc.)
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SECOND YEAR: Level 5.0 - SEMESTER – III (T & L Credit Scheme)

Mode of Teaching	Vertical No.	The Vertical	Type of Course	Course Code	Course Name	Credits	Workload (Hrs./Week)	Vertical Workload (Hrs./Week)
Classroom Teaching/ Lab Work (Practical)/ Outdoor/ Field/ Online/ Hybrid	a	Major Physics MJ	Physics MJ Theory 3	129212	Mathematical Background, Electrostatics and Magnetostatics	2	2	10
			Physics MJ Theory 4	129213	Solid State Devices I	2	2	
			Physics MJ Lab/ Practical 3	129214	Experiments Related to Physics MJ Th3 and MJ Th4	2	4	
		IKS- SS	IKS-Physics Theory	129215	IKS-Physics	2	2	
	b	Minor	Physics MN Theory 3	129216	Mathematical Physics and Solid State Devices	2	2	6
			Physics MN Lab/ Practical 3	129217	Experiments Related to Physics MN Th3	2	4	
	c	Generic/ Open Elective	Physics OE-5 Theory	129218	Solar Energy and Its Applications	2	2	2
	d	VSC	Physics VSC-2 Lab/ Practical	129219	Electrical Installation for Residential Buildings	2	4	4
	f	FP/CEP	Physics FP/CEP-1 Project	129220	Field Project / CE Services in Physics: Phase-I	2	4	8
		CC	Outdoor	-	Separate SOP will be released	2	4	

Physics MJ Theory 3 – 129212	
Mathematical Background, Electrostatics and Magnetostatics	
Credits: 02	Workload (Hrs./Week): 02
Course Objectives:	1. To provide students with a strong foundation in the mathematical tools essential for physics, including scalar and vector fields, gradient, divergence, curl, and integral theorems. 2. To develop an understanding of electrostatics, including electric fields, electric potential, Gauss's theorem, and their applications to various charge distributions. 3. To introduce the concept of capacitance and its applications in different configurations of capacitors, including the effects of dielectric materials. 4. To familiarize students with magnetostatics, including Biot-Savart's law, Ampere's circuital law, and their applications to current-carrying conductors and solenoids. 5. To enhance problem-solving skills through numerical applications and practical examples related to electrostatics and magnetostatics.
Course Outcomes:	By the end of the course, students will be able to: 1. Apply mathematical concepts such as gradient, divergence, curl, and integral theorems to solve physics problems. 2. Analyze and compute electric fields and potentials for various charge distributions using Gauss's theorem and other electrostatic principles. 3. Evaluate the capacitance of different capacitor configurations and understand the role of dielectric materials in capacitors. 4. Determine magnetic fields due to current-carrying conductors and solenoids using Biot-Savart's law and Ampere's circuital law. 5. Solve numerical problems related to electrostatics and magnetostatics, demonstrating a clear understanding of theoretical concepts. 6. Relate the physical significance of key concepts such as electric flux, potential, and magnetic induction to real-world applications.

Unit	Contents	Work-load Allotted	Weight-age of Marks Allotted	Incorporation of Pedagogies
I	Mathematical Background: Scalar and Vector fields, Scalar and Vector product, Gradient and its physical significance, Divergence and its physical significance, Curl and its physical significance, Line integral, Surface integral and Volume integral, Gauss's divergence theorem, Stoke's theorem, Numerical.	8 Hrs.	8 Marks	• Use diagrams, simulations, or animations to illustrate: Scalar and vector fields, • Engage students with interactive simulations about Gradient, Divergence and Curl. • Explain in details about Gauss's divergence theorem, Stoke's theorem.
II	Electrostatics-I Coulomb's Law, Electric field, Electric Flux and its expression, Work done on charge in electrostatics field, Gauss's theorem, Applications of Gauss's theorem: Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and uniformly charged solid sphere, Numerical.	7 Hrs.	7 Marks	• Demonstrate Coulomb's Law • Use diagrams, animations, or simulations to illustrate Electric field and Electric Flux • Engage students in discussions about Gauss's theorem. • Provide details about Applications of Gauss's theorem.
III	Electrostatics-II: Electric potential, Electric potential at a point due to a point charge, Electric potential as line integral of electric field, Relation between electric field and electric potential, Capacitors: Introduction, Capacitance of isolated spherical conductor, parallel plate capacitor, spherical & cylindrical capacitors, parallel plate capacitor with and without	7 Hrs.	7 Marks	• Use animations to illustrate concept and working of Capacitors. • Conduct experiments or Demonstrations to illustrate spherical conductor, parallel plate capacitor, spherical & cylindrical capacitors working. • Discuss and solve numerical.

	dielectric medium, energy of capacitor, Numerical.			
IV	Magnetostatics: Magnetic induction (B), Magnetic field strength (H), permeability (μ), relative permeability (μ_r), Biot-Savart's law, applications to find B due to straight conductor, circular coil and Solenoid carrying current. Ampere's circuital law, applications to find B inside an infinite solenoid and near straight conductor. Numerical.	8 Hrs.	8 Marks	• Use animations to illustrate concept of permeability, relative permeability. • Conduct demonstrations to illustrate applications of Biot-Savart's law. • Explain about Ampere's circuital law and its applications.

References:	1. Mathematical Physics, Kakani and Hemrajani, CBS Publishers & Distributors. 2. Mathematical Physics, B.S. Rajput, Pragati Prakashan. 3. Physics B.Sc. first year, by C.L. Arora, P.S. Hemne, S. Chand & Co. Ltd, New Delhi. 4. Electricity and magnetism, R. Murugesan, S. Chand & Co. Ltd, New Delhi. 5. Introduction to Electrodynamics, David Griffiths, Pearson Publications. 6. Electromagnetism, Kakani and Hemrajani, CBS Publishers & Distributors. 7. Electrodynamics, by Gupta, Kumar, Sharma, Pragati Prakashan, Meerut. 8. Concepts of Modern Physics, Arthur Baiser, McGraw Hill Education New Delhi. 9. Vector analysis and electrostatics by J.P. Agrawal, Sanjay Singh, S.A. Waghole, Pragati Prakashan. 10. Magneto statics and Electromagnetic-waves, Sanjay Singh, S.A. Waghole, Pragati Prakashan. 11. Mechanics and Electrodynamics S. Chand & Co. Brijlal, Subramanyam. 12. Electricity and magnetism by Satyaprakash, Pragati Prakashan Meerut. 13. Classical electrodynamics J.D. Jackson, Wiley Easter. 14. Electromagnetic fields Dr. Murty, S. Chand & Co. Ltd.
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Model questions for theory external examination.	
One sentence/ Very short answer questions	1. Define capacitance. 2. What is the SI unit of magnetic field strength (H)? 3. What is the SI unit of electric potential?

Short answer questions	1. Distinguish between magnetic induction (B) and magnetic field strength (H). 2. What is relative permeability? How it is related to absolute permeability? 3. State Ampere's circuital law and mention its applications.
Long answer questions	1. Derive the expression for electric field due to an infinite line of charge using Gauss's theorem. Also discuss the variation of electric field with distance. 2. State and prove Gauss's divergence theorem. Explain its physical significance. 3. Derive the expression for electric field due to a uniformly charged spherical shell at points inside and outside the shell using Gauss's theorem.

Physics MJ Theory 4 – 129213	
Solid State Devices I	
Credits: 02	
Workload (Hrs./Week): 02	
Course Objectives:	1. To introduce the fundamental concepts of semiconductors and types. 2. To explain the working principles of PN junctions, rectifiers, and their applications in power supplies. 3. To analyze the role of filter circuits in reducing ripple voltage and their design considerations. 4. To explore the characteristics and applications of Zener diodes as voltage regulators. 5. To study the construction, working principles, and applications of key semiconductor devices such as LEDs, photodiodes, varactor diodes, and SCRs. 6. To provide hands-on problem-solving experience through numerical examples and circuit analysis.
Course Outcomes:	By the end of this course, students will be able to: 1. Understand the behavior of electrons and holes in intrinsic and extrinsic semiconductors, and calculate Fermi levels. 2. Analyze the characteristics of PN junctions under different biasing conditions and their applications in rectifiers. 3. Design basic power supply circuits incorporating rectifiers, filters, and regulators to achieve stable DC output. 4. Evaluate the performance of filter circuits (capacitor, inductor, L-section, π-section) and compute ripple factors. 5. Apply Zener diodes in voltage regulation circuits and solve related numerical problems. 6. Demonstrate the working principles of LEDs, photodiodes, varactor diodes, and SCRs in practical applications such as inverters and temperature control systems. 7. Interpret circuit diagrams and troubleshoot common issues in semiconductor-based electronic systems.

Unit	Contents	Work-load Allotted	Weight-age of Marks Allotted	Incorporation of Pedagogies
I	Semiconductors: Introduction, intrinsic and extrinsic semiconductors. P type and N type extrinsic semiconductor, majority and minority charge carriers, electrons and holes concentration in intrinsic semiconductors, Fermi level in intrinsic and extrinsic semiconductors, Hall effect, expression for Hall coefficient.	8 Hrs.	8 Marks	• Use diagrams, simulations, or animations to illustrate Semiconductor concept • Engage students with interactive simulations about Intrinsic and extrinsic semiconductors. • Provide step-by-step information about electrons and holes concentration in intrinsic and extrinsic semiconductors.
II	PN junction: Formation of PN junction, PN junction with no bias, depletion region, barrier potential, forward bias and reverse bias of PN junction diode and characteristics. Rectifiers: Half wave rectifier, full-wave rectifier, bridge rectifier, comparison of rectifiers. Power Supply: Ordinary power supply, line and load regulation, regulated power supply.	8 Hrs.	8 Marks	• Use diagrams, animations, or simulations to illustrate formation of PN junction. • Engage students in discussions about Rectifiers and working of different rectifier circuits. • Provide details about Ordinary and regulated power supply.
III	Filter circuits: Capacitor filter, inductor filter, L-section and π-section filter. Zener diode: Zener diode (construction, biasing, characteristics and applications), Zener diode as voltage regulator. Numerical.	7 Hrs.	7 Marks	• Use animations to illustrate concept and working of different filter circuits and Zener diode. • Conduct experiments or demonstrations to illustrate construction, biasing, characteristics of Zener diode. • Explain about Zener diode as voltage regulator.

IV	Semiconductor Devices: Construction, working, characteristics and applications of Light Emitting Diode (LED). Construction, working, characteristics and applications of Photodiode. Construction and working of Varactor diode. Principle, construction, working and characteristics of Silicon controlled rectifier (SCR), applications of Silicon controlled rectifier in inverter and temperature controller (with circuit diagram)	7 Hrs.	7 Marks	• Use animations to illustrate concept and working of Light emitting diode, Varactor diode, Silicon controlled rectifier. • Conduct experiments or demonstrations to illustrate construction, biasing, characteristics of Light emitting diode, Varactor diode and Silicon controlled rectifier. • Demonstrate the applications of Light emitting diode, Varactor diode and Silicon controlled rectifier.
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References:	1. Basic Electronics by B. L. Theraja, S. Chand Publication. 2. Elements of electronics M.K. Bagade and S.P. Singh, S. Chand Publication. 3. Principles of Electronics by V. K. Mehta, S. Chand Publications. 4. Electronics Devices & Circuits, Sanjeev Gupta, Dhanpat Rai Publication (2010). 5. Electronics Devices & Circuits-I & II – Godse & Bakshi (Tech. Pub., Pune) (2010). 6. Solid State Electronics Devices, B. G. Streetman, PHI Learning Pvt. Ltd. 7. Electronics devices & Circuits, A. Mottershead, PHI Learning Pvt. Ltd. 8. Solid State Devices & Electronics, Kamal Singh & S. P. Singh, S. Chand & Co. Publication. 9. Physics for Degree Students B.Sc. Second Year, C. L. Arora and P.S. Hemane, S-Chand Publication Reprint, 2015. 10. Electronic Fundamentals and Applications, D. Chattopadhyay and P. C. Rakshit, New Age International.
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Model Questions	
One sentence/ Very short answer questions	1. What is an intrinsic semiconductor? 2. What is depletion region in PN junction? 3. Name two filter circuits used in DC power supplies.
Short answer questions	1. What is Hall effect? State an application. 2. What is the principle of working of a photodiode?

	3. What is the difference between regulated and unregulated power supply?
Long answer questions	1. Derive an expression for Hall coefficient. Explain how Hall effect can be used to determine the type of semiconductor. 2. Explain the construction, working principle and V-I characteristics of Zener diode. 3. Explain the working of L-section and π-section filters. Compare their filtering action.

Physics MJ Lab/ Practical 3 – 129214	
Experiments related to Physics MJ Th3 and MJ Th4	
Credits: 02	
Workload (Hrs./Week): 04	
Course Objectives:	1. Understanding basic electronic components and instruments. 2. Develop hands-on skills in circuit assembly and testing 3. Develop skills in data analysis and graphical representation. 4. Emphasize the connection between theoretical predictions and experimental results. 5. Foster analytical and critical thinking. 6. Emphasize the importance of documenting procedures, results, and conclusions. 7. Develop oral communication skills through presentations of experimental findings.
Course Outcomes:	By the end of this course, students will be able to: 1. Identify and use basic electronic components and instruments. 2. Learn how to write clear and concise laboratory reports. 3. Create and interpret graphical representations of experimental data. 4. Develop critical thinking skills by analyzing and interpreting experimental results. 5. Demonstrate an understanding of concepts involved in semiconductor devices operation and their characteristics. 6. Identify and handle different types of semiconductor devices. 7. Learn best practices for handling, cleaning and maintaining the instruments. 8. Construct and troubleshoot electronic circuits. 9. To develop experimental thinking about electrostatics and magnetostatics.

List of Experiments:
Perform at least eight (8) experiments from the given list. (at least 3 experiments related to each theory paper)
1. Study of Hall effect. 2. To study characteristics of P-N Junction rectifier diode. 3. To study forward characteristics of Light Emitting Diode. 4. To study forward characteristics of Point Contact Diode. 5. To study Photodiode Characteristics. 6. To study Zener regulated power supply. 7. To study Half Wave and Full Wave/ Full Wave Bridge Rectifier without filter. 8. To study Half Wave and Full Wave/ Full Wave Bridge Rectifier with Capacitor filter. 9. To study characteristics of Silicon controlled rectifier. 10. To study gate firing circuit for SCR.

11. To determine the capacitance of a capacitor by leakage method.
12. To verify laws of capacitances by repeated charge decay method.
13. To determine the capacitance of condenser by de-Sauty's bridge.
14. To study parallel plate capacitor and to find dielectric constant of a given material.
15. To determine charge sensitivity of ballistic galvanometer.
16. To determine capacitance of capacitor by absolute method using ballistic galvanometer.
17. To plot equipotential curves for bar electrode, disc electrode and for ring electrode.
18. To determine susceptibility of liquid by Quinck's method.
19. To determine susceptibility of magnetic material by Guys balance method.
20. To Measure Magnetic Field along the Axis of a Current-Carrying Circular Coil.
21. To draw the magnetic lines of force due to a bar magnet.
22. To draw the magnetic lines of force due to a solenoid.
23. To study the variation of magnetic field due to Helmholtz coil and single coil carrying current.
24. To represent the gradient of scalar field and divergence and curl of vector field using Scilab.

References:

1. Basic Electronics by B. L. Theraja, S. Chand Publication.
2. Principles of Electronics by V. K. Mehta, S. Chand Publications
3. Electronics Devices & Circuits, Sanjeev Gupta, Dhanpat Rai Publication (2010)
4. Electronics Devices & Circuits-I & II – Godse & Bakshi (Tech. Pub., Pune) (2010)
5. Electromagnetic fields Dr. Murty, S. Chand & Co. Ltd.
6. <https://vlab.amrita.edu/>
7. <https://www.vlab.co.in/>
8. <http://vlabs.iitb.ac.in/vlab/labsps.html>

IKS-Physics Theory – 129215	
Indian Knowledge Systems (IKS)-Physics	
Credits: 02	
Workload (Hrs./Week): 02	
Course Objectives:	1. To introduce students to the foundational concepts of Indian Knowledge Systems and their contributions to physical sciences. 2. To explore ancient Indian theories of matter, atomic structure, and energy, and compare them with modern scientific principles. 3. To examine the historical development of mechanics and motion in ancient Indian texts, including early understandings of gravity and forces. 4. To study the astronomical and cosmological models proposed by ancient Indian scholars and their relevance to modern astronomy. 5. To analyze the integration of traditional Indian knowledge with contemporary physics and its influence on modern Indian scientists.
Course Outcomes:	By the end of the course, students will be able to: 1. Explain the key concepts of Indian Knowledge Systems and their significance in the history of science. 2. Compare Kanada's atomic theory (Anu theory) with Dalton's atomic theory and evaluate their similarities and differences. 3. Describe ancient Indian perspectives on motion (Gati), forces (Bala), and gravity as documented in texts like "Lilavati" and others. 4. Analyze the contributions of Aryabhata, Varahamihira, and other scholars to astronomy and cosmology, including models like the Surya Siddhanta. 5. Evaluate the influence of ancient Indian scientific thought on modern physics and scientists such as C.V. Raman and S.N. Bose. 6. Appreciate the interdisciplinary connections between traditional knowledge systems and contemporary scientific research.

Unit	Contents	Workload Allotted	Weightage of Marks Allotted	Incorporation of Pedagogies
I	Introduction to Indian Knowledge Systems: Overview of Indian Knowledge Systems (IKS); Concept of Science in Ancient India; Historical evolution of physical sciences in India; Vedic Physics and Philosophy: Study of the philosophical and metaphysical foundations of Indian physics, Concepts like Prakriti (nature), Purusha (consciousness), and their relevance to physics. Theory of five elements (Pancha Bhuta) and the concept of ether (Akasha), Concepts like sound (Nada), light (Prakasha), and heat (Tejas) in Indian Physics.	7 Hrs.	7 Marks	Discuss the concepts of science in Vedic scripture and see their educational implications. Understanding the framework for studying the universe's fundamental nature, including the origins of matter, energy, and the forces that govern them as per the Vedic philosophy. Encourage comparison between ancient and modern scientific concepts.
II	Matter and Atomic Theories: Kanada's Vaisheshika philosophy: Atomism and Anu theory; Six categories of reality (Padarthas); Comparison with Dalton's atomic theory; Energy and motion according to ancient Indian thought.	7 Hrs.	7 Marks	- Analyze translated verses from Vaisheshika Sutra and explain meaning in modern terms. - Discuss the metaphysical basis of atomic motion in Indian thought.
III	Mechanics and Motion: Ancient concepts of motion (Gati) and forces (Bala); Bhaskaracharya's "Lilavati" and laws of motion; Understanding concepts like gravity in	8 Hrs.	8 Marks	- Compare Bhaskara's motion problems with modern kinematic equations. - Solve select Lilavati problems in groups, interpret in SI units.

	ancient Indian texts; Indian Ancient Instruments for measuring time and studying motion: Sundials, Water Clocks, Dhanu Yantra, Yasti Yantra.			• Enact a dialogue between Bhaskara and Newton discussing gravity and motion.
IV	Astronomy and Cosmology: Aryabhata's and Varahamihira's contributions to Astronomy; Solar system models (Surya Siddhanta); Time measurements: Yuga, Kalpa, and cosmic cycles; Ancient Indian observatories (Jantar Mantar) Modern Perspectives and Integration: Bridging traditional knowledge with modern physics; Contributions of modern Indian physicists influenced by ancient knowledge (e.g., C.V. Raman, S.N. Bose)	8 Hrs.	8 Marks	• Create a dual timeline showing developments in Indian astronomy and Western astronomy. • Derive planetary positions using simplified Surya Siddhanta formulas and compare with modern models. • Field trip/Case studies of instruments at Jantar Mantar; virtual astronomy apps. • Presentations on C.V. Raman, S.N. Bose, etc., focusing on their Indian intellectual heritage. • Debate on cyclic time (Indian) vs. linear time (Western cosmology).

References:	1. "Science and Technology in Ancient India" by Debiprasad Chattopadhyaya 2. "Knowledge Traditions and Practices of India" (NCERT Publication) 3. "Foundations of Indian Science" by C.K. Raju 4. Original texts (translations) like Vaisheshika Sutra, Aryabhataiya, Surya Siddhanta
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Model Questions	
One sentence/ Very short answer questions	1. What is the primary goal of Indian Knowledge System (IKS)? 2. Which domain of Indian Knowledge system includes works like the Vedas, Upanishads and the Bhagavad Gita? 3. How Many Vedas are there in Indian Knowledge System? 4. Which ancient Indian text discusses the concept of motion & mechanics?
Short answer questions	1. What does IKS stand for? What are the main characteristics of IKS? 2. Define Purusa and Prakriti. 3. What is “Vaisheshika” 4. What are Four Vedas? 5. What is the significance of Surya Siddhanta?
Long answer questions	1. What is the concept of "Panchabhuta" in ancient Indian science, and how does it relate to the understanding of the universe? 2. What is “Yuga” concept in Indian Astronomy, and how was it used to measure time and track seasonal changes within the Indian Calendar system? 3. Briefly describe Kanada’s atomic theory. 4. Describe Bhaskara’s concept of gravity, its relevance to the understanding of celestial bodies, and how it predates Newton's law of gravity. 5. Discuss the importance of the six Padarthas in understanding the nature of reality, according to the Vaisesika philosophy.

Physics MN Theory 3 – 129216	
Mathematical Physics and Solid State Devices	
Credits: 02	
Workload (Hrs./Week): 02	
Course Objectives:	1. To provide students with a strong foundation in mathematical tools essential for physics, including scalar and vector fields, gradient, divergence, curl, and integral theorems. 2. To introduce the fundamental concepts of semiconductors, including intrinsic and extrinsic types, carrier concentrations, and Fermi levels. 3. To explain the working principles of PN junctions, rectifiers, and power supplies, along with their applications in electronic devices. 4. To equip students with problem-solving skills through numerical applications in semiconductor physics.
Course Outcomes:	By the end of the course, students will be able to: 1. Apply mathematical concepts such as gradient, divergence, curl, and integral theorems to solve physics problems. 2. Explain the behavior of intrinsic and extrinsic semiconductors, including carrier concentrations and Fermi levels. 3. Describe the operation of PN junctions under different biasing conditions and interpret their characteristics. 4. Compare the performance of half-wave, full-wave, and bridge rectifiers and their applications in power supplies. 5. Demonstrate an understanding of the construction and working principles of Zener diodes, LEDs, and photodiodes. 6. Solve numerical problems related to Mathematical Physics and semiconductor physics.

Unit	Contents	Work-load Allotted	Weight-age of Marks Allotted	Incorporation of Pedagogies
I	Mathematical Background: Scalar and Vector fields, Scalar and Vector product, Gradient and its physical significance, Divergence and its physical significance, Curl and its physical significance, Line integral, Surface integral and Volume integral, Gauss's divergence theorem, Stoke's theorem, Numerical.	8 Hrs.	8 Marks	• Use diagrams, simulations, or animations to illustrate: Scalar and vector fields. • Engage students with interactive simulations about Gradient, Divergence and Curl. • Explain in details about Gauss's divergence theorem, Stoke's theorem.
II	Semiconductors: Introduction, intrinsic and extrinsic semiconductors. P type and N type extrinsic semiconductor, majority and minority charge carriers, electrons and holes concentration in intrinsic semiconductors, Fermi level in intrinsic and extrinsic semiconductors, Hall effect, expression for Hall coefficient.	7 Hrs.	7 Marks	• Use diagrams, simulations, or animations to illustrate Semiconductor concept • Engage students with interactive simulations about Intrinsic and extrinsic semiconductors. • Use diagrams, animations, or simulations to illustrate formation of PN junction.
III	PN junction: Formation of PN junction, PN junction with no bias, depletion region, barrier potential, forward bias and reverse bias of PN junction diode and characteristics. Rectifiers: Half wave rectifier, full-wave rectifier, bridge rectifier, comparison of rectifiers. Power Supply: Ordinary power supply, line and load regulation,	8 Hrs.	8 Marks	• Use animation to demonstrate the working of PN junction diode. • Use animation to demonstrate the breakdown mechanism of PN junction diode in reverse bias. • Use animation to demonstrate the different types of rectifiers.

	regulated power supply.			
IV	Filter circuits: Capacitor filter, inductor filter, L-section and π -section filter. Zener diode: Zener diode (construction, biasing, characteristics and applications), Zener diode as voltage regulator. Numerical.	7 Hrs.	7 Marks	• Use diagrams, animations, or simulations to illustrate formation of PN junction. • Engage students in discussions about Rectifiers and working of different rectifier circuits. • Provide details about Ordinary and regulated power supply.

References:	1. Mathematical Physics, Kakani Hemrajani CBS Publishers& Distributors. 2. Mathematical Physics, B.S.Rajput, Pragati Prakashan. Basic Electronics by B. L. Theraja, S. Chand Publication. 3. Vector analysis and electrostatics by J.P.Agrawal, Sanjay Singh, S.A. Waghole, Pragati Prakashan. 4. Elements of electronics M.K. Bagade and S.P. Singh S. Chand Publication 5. Principles of Electronics by V. K. Mehta, S. Chand Publications. 6. Electronics Devices & Circuits, Sanjeev Gupta, Dhanpat Rai Publication (2010). 7. Solid State Electronics Devices, B. G. Streetman, PHI Learning Pvt. Ltd. 8. Electronics devices & Circuits, A. Mottershead, PHI Learning Pvt. Ltd. 9. Solid State Devices & Electronics, Kamal Singh & S. P. Singh, S. Chand & Co. Publication. 10. Physics for Degree Students B.Sc. Second Year, C. L. Arora and P.S. Hemane, S-Chand Publication Reprint, 2015. 11. Electronic Fundamentals and Applications, D. Chattopadhyay and P. C. Rakshit, New Age International. 12. Concepts of Modern Physics, Arthur Baiser, McGraw Hill Education New Delhi.
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Model Questions	
One sentence/ Very short answer questions	1. What is an intrinsic semiconductor? 2. Name the majority charge carriers in P-type semiconductor. 3. What is the main application of Zener diode?
Short answer questions	1. Differentiate between intrinsic and extrinsic semiconductors. 2. Compare half-wave and full-wave rectifiers (any two points). 3. What is line regulation in power supply?

Long answer questions	1. Derive Stoke's theorem and explain its physical significance with suitable examples. 2. Describe the formation of PN junction in detail. Explain the barrier potential and depletion region with energy band diagrams. 3. Explain the working of π-section filter with circuit diagram. Derive the expression for ripple factor and discuss its advantages over other filters.
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Physics MN Lab/ Practical 3 – 129217	
Experiments related to Physics MN Th3	
Credits: 02	
Workload (Hrs./Week): 04	
Course Objectives:	1. Understanding basic electronic components and instruments. 2. Develop hands-on skills in circuit assembling and testing 3. Develop skills in data analysis and graphical representation. 4. Emphasize the connection between theoretical predictions and experimental results. 5. Foster analytical and critical thinking. 6. Emphasize the importance of documenting procedures, results, and conclusions. 7. Develop oral communication skills through presentations of experimental findings.
Course Outcomes:	On successful completion of this course, the students would be able to 1. Identify and use basic electronic components and instruments. 2. Learn how to write clear and concise laboratory reports. 3. Create and interpret graphical representations of experimental data. 4. Develop critical thinking skills by analyzing and interpreting experimental results. 5. Demonstrate an understanding of concepts involved in semiconductor devices operation and their characteristics. 6. Identify and handle different types of semiconductor devices. 7. Learn best practices for handling, cleaning and maintaining the instruments. 8. Construct and troubleshoot electronic circuits.

List of Experiments:

Perform at least eight (8) experiments from the given list.

1. Study of Hall effect.
2. To study characteristics of P-N Junction rectifier diode.
3. To study forward characteristics of Light Emitting Diode.
4. To study forward characteristics of Point Contact Diode.
5. To study Photodiode Characteristics.
6. To study reverse characteristics of Zener diode
7. To study Zener regulated power supply.
8. To study Half Wave Rectifier without filter.
9. To study Half Wave Rectifier with capacitor filter.
10. To study Full Wave Rectifier without filter.
11. To study Full Wave Rectifier with capacitor filter.
12. To study Full Wave Bridge Rectifier without filter.
13. To study Full Wave Bridge Rectifier with capacitor filter.
14. To study Full Wave Bridge Rectifier with L-section filter.
15. To study Full Wave Bridge Rectifier with pi-section filter.
16. To represent the gradient of scalar field and divergence and curl of vector field using Scilab.

References:

1. Basic Electronics by B. L. Theraja, S. Chand Publication.
2. Principles of Electronics by V. K. Mehta, S. Chand Publications
3. Electronics Devices & Circuits, Sanjeev Gupta, Dhanpat Rai Publication (2010)
4. Electronics Devices & Circuits-I & II – Godse & Bakshi (Tech. Pub., Pune) (2010)
5. Electronics Devices, Millman and Halkis, Ta-MGH publication.
6. <https://vlab.amrita.edu/>
7. <https://www.vlab.co.in/>
8. <http://vlabs.iitb.ac.in/vlab/labsps.html>

Physics OE-5 Theory – 129218	
Solar Energy and Its Applications	
Credits: 02	Workload (Hrs./Week): 02
Course Objectives:	1. To introduce students to the fundamental concepts of energy, sustainability, and the critical role of renewable energy in addressing environmental challenges. 2. To provide an overview of solar energy, including its principles, advantages, and limitations, without requiring advanced mathematical background. 3. To explore practical solar thermal applications such as water heating, cooking, and space conditioning. 4. To explain the basics of solar photovoltaics, including electricity generation, types of solar panels, and their applications in residential and industrial settings. 5. To examine emerging solar technologies like solar-powered vehicles, solar architecture, and innovative trends such as floating solar plants. 6. To analyze the economic and policy aspects of solar energy, including costs, incentives, and global or regional (e.g., Indian) perspectives.
Course Outcomes:	By the end of the course, students will be able to: 1. Explain the importance of energy sustainability and the environmental benefits of transitioning to renewable sources like solar energy. 2. Describe the basic principles of solar radiation and how it is harnessed for practical applications. 3. Compare different solar thermal technologies (e.g., water heaters, cookers) and their suitability for specific needs. 4. Outline the process of electricity generation using solar photovoltaics and distinguish between types of solar panels. 5. Discuss emerging solar technologies and their potential to revolutionize transportation, architecture, and large-scale energy production. 6. Evaluate the economic viability of solar energy projects and the impact of government policies on adoption. 7. Contextualize solar energy trends within a regional framework (e.g., India's solar mission or global initiatives).

Unit	Contents	Workload Allotted	Weightage of Marks Allotted	Incorporation of Pedagogies
I	Introduction to Energy and Sustainability: Importance of energy in modern life; Environmental issues and climate change; Role of renewable energy; Basics of Solar Energy: What is solar energy? Solar radiation: basics (simple concepts, no equations); Advantages and challenges.	7 Hrs.	7 Marks	• Ask students to create a mind map connecting energy use to different aspects of modern life. • Use short documentaries (e.g., NASA's Climate Change visualizations). • Greenhouse effect using jars, thermometers, and lamps. • Students act as policymakers proposing a clean energy plan for a fictional country.
II	Solar Thermal Applications: Solar water heaters; Solar cooking technologies; Solar space heating and cooling.	7 Hrs.	7 Marks	• Use digital tools (like Energy3D or Solar Design Tool) to simulate energy gains/losses in solar-heated buildings. • Discussion on: "Why is solar cooling more relevant for tropical countries like India?" • Simple solar cooker or solar garden light.
III	Solar Photovoltaics: Basics of electricity generation using solar cells; Different types of solar panels; Small-scale and large-scale solar applications (home, industry)	8 Hrs.	8 Marks	• Show the step-by-step process of how sunlight is converted into electricity. • Use a mini solar panel to power a fan or LED in real-time sunlight.

				• Compare a solar cell to a water pump - sunlight acts like pressure that moves electrons (like water). • Group Presentation: Each group presents one type of panel and its merits/drawbacks.
IV	Emerging Solar Technologies: Solar-powered vehicles; Solar architecture (buildings designed with solar passive techniques); New trends like floating solar plants. Economics and Policy of Solar Energy: Costs and benefits; Incentives, subsidies, and government policies; Global and Indian context (can localize based on your country)	8 Hrs.	8 Marks	• Students sketch their own model of a solar vehicle with key components labeled. • Group Discussion: Benefits and limitations of solar transport in urban vs rural areas. • Design of buildings to maximize use of sunlight for heating, lighting, and ventilation. • Compare a conventional vs. solar-passive designed building in terms of energy efficiency. • Estimate the cost of installing a 2kW rooftop solar system and calculate payback period.

References:	1. "Solar Photovoltaics: Fundamentals, Technologies and Applications", by Chetan Singh Solanki (IIT Bombay) 2. "Energy Technology: Non-Conventional, Renewable and Conventional", by S. Rao and B.B. Parulekar 3. Energy Technology: Non-Conventional, Renewable and Conventional, S. Rao, B.B. Parulekar, Khanna Publishers, 4th Edition
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	4. Non-Conventional Energy Resources, G.D. Rai, Khanna Publishers 5. Solar Energy: Fundamentals and Applications, H.P. Garg, J. Prakash, Tata McGraw-Hill Education 6. Renewable Energy: Engineering and Technology – Principles and Practice, S.P. Sukhatme, J.K. Nayak, Tata McGraw-Hill Education 7. Solar Photovoltaics: Fundamentals, Technologies and Applications, Chetan Singh Solanki, PHI Learning Pvt. Ltd.
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Model Questions	
One sentence/ Very short answer questions	1. What does “PV” in solar PV stand for? 2. State one disadvantage of solar energy. 3. Which material primarily used to make Solar panels?
Short answer questions	1. Define solar energy. 2. State two environmental benefits of solar energy. 3. What is a photovoltaic effect? 4. Mention two applications of solar energy in daily life. 5. Define renewable energy. How is it different from non-renewable energy?
Long answer questions	1. Explain the working principle of a photovoltaic cell. 2. Describe the structure and function of a typical solar panel. 3. Discuss the advantages and limitations of solar energy. 4. Explain how solar energy contributes to sustainable development.

Physics VSC-2 Lab/ Practical – 129219	
Electrical Installation for Residential Buildings	
Credits: 02	
Workload (Hrs./Week): 04	
Course Objectives:	1. Introduce Fundamental Electrical Concepts 2. Develop Proficiency in Electrical Tools and Safety Practices 3. Explain Residential Electrical Components and Systems 4. Teach Electrical Circuit Design and Load Calculation 5. Enable Hands-On Wiring and Installation Skills 6. Impart Troubleshooting and Maintenance Skills 7. Foster Compliance with Standards and Codes 8. Encourage Systematic Project Execution
Course Outcomes:	After completing the course, the student will be able to: 1. Define key electrical terms, list safety rules, and identify basic tools used in residential wiring. 2. Explain working principles of residential circuits and components; interpret wiring diagrams and basic load calculations. 3. Demonstrate proper use of tools and install residential electrical wiring, DBs, switches, sockets, and light fixtures. 4. Diagnose electrical faults in residential systems and suggest corrective actions. Assess electrical installations for adherence to safety codes (like IS/IE rules) and quality workmanship 5. Design, plan, install, and test a fully functional residential electrical wiring project based on a given layout.

Unit	Theoretical Background	Lab/ Practical/ Demonstrations/Activities
I	Basics of Electricity & Electrical Wiring Systems • Basic electrical concepts: Voltage, current, resistance, power • AC vs DC, Single-phase vs Three phase • Types of wiring systems (conduit, surface, concealed) • Types of wires and cables • Circuit protection devices (MCBs, RCDs, ELCBs)	1. Identifying and using hand tools: Screwdrivers, testers, pliers, multimeters 2. Using power tools: Drills, conduit benders 3. Safety demo: Proper handling of live wires 4. Wire stripping, jointing, soldering 5. Installing switches, sockets, and light fixtures 6. Color coding and cable management
II	Circuit Design, Load Calculation & Residential Distribution Boards • Basic circuit design • Load calculation for appliances and lighting • Understanding and interpreting wiring diagrams • DB components: Busbars, MCBs, Isolators, RCDs • Earthing systems	7. Creating circuit layouts on paper 8. Connecting a basic lighting and power circuit 9. Identifying overload issues in setups 10. Installing and wiring a distribution board 11. Connecting different loads to appropriate breakers 12. Testing for continuity and insulation resistance
III	Lighting Systems & Earthing • Types of residential lighting: CFL, LED, Smart lights • Switching systems: 1-way, 2-way, intermediate • Importance of earthing • Types of earthing: Plate, pipe, rod	13. Installing different types of light fixtures 14. Configuring multiple switch types 15. Light dimming and timer-based setups 16. Installing earthing electrodes 17. Testing earth resistance 18. Bonding water pipes and metal parts
IV	Smart Home Basics • Introduction to Smart home devices • Smart Switches, Smart Plugs	19. Install and configure smart switch 20. Connect and configure a Wi-Fi

	• Wi-Fi enabled bulbs, IR blaster • Alexa / Google Home / Apple Siri integration	enable bulb 21. Install and configure smart plug 22. Integration of smart switch, smart plug and Wi-Fi bulb with the Alexa / Google Home / Apple Siri App
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References:	1. Basic Electrical Engineering, V.K. Mehta, Rohit Mehta, S. Chand & Company Pvt. Ltd., 2018 2. Electrical Wiring Estimating and Costing, Surjit Singh, Dhanpat Rai & Co., 2015 3. Installation, Testing, and Commissioning of Electrical Installations, J.B. Gupta, S.K. Kataria & Sons, 2013 4. Electrical Wiring Estimating and Costing, S.L. Uppal, G.C., Garg, Khanna Publishers 2016 5. Practical Guide to Electrical Wiring, H. Joshi, McGraw Hill Education (India) Pvt. Ltd., 2014 6. A Course in Electrical Power, J.B. Gupta, S.K. Kataria & Sons, 2013
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Physics FP/CEP-1 Project – 129220	
Field Project / CE Services in Physics: Phase-I	
Credits: 02	Workload (Hrs./Week): 04
Course Objectives:	1. To provide hands-on experience in applying theoretical physics knowledge to real-world challenges through field-based projects or community engagement (CE) services. 2. To train students in identifying, analyzing, and solving practical problems encountered in physics-related fieldwork or community service activities. 3. To encourage students to integrate physics concepts with interdisciplinary knowledge, technology, and societal needs. 4. To develop students' abilities to document, present, and communicate their field-based or community engagement work effectively to diverse audiences. 5. To instill a sense of responsibility and service by involving students in projects that address community issues related to science and technology.
Course Outcomes:	1. Students will be able to apply physics principles and analytical techniques to investigate and solve real-world problems in field settings. 2. Students will demonstrate proficiency in using experimental tools, instruments, and data analysis methods relevant to their field project or CE service. 3. Students will be able to design, plan, and execute a field project or community service activity from inception to completion, including documentation and reporting. 4. Students will effectively communicate their project findings and outcomes through written reports, presentations, or community engagement events. • Students will demonstrate an understanding of the ethical, environmental, and societal impacts of their work, showing a commitment to responsible scientific practice and community well-being.
• Guidelines/SOP for Selection and Implementation of Field Projects / CE Services	
1. Project Selection and Planning	• Faculty Guidance: Students will be assigned a faculty mentor to guide their project, providing expertise and resources. • Project Topic: The project topic should be relevant to physics and align with the student's interests and the available resources.

	• Literature Review: Students are expected to conduct a thorough literature review to understand existing knowledge and identify research gaps. • Data Collection and Analysis: Projects often involve experiments, simulations, or data analysis from existing sources, depending on the topic. • Project Timeline: The total time allocation for the student to carry out field project is 60 hours.
2. Data Analysis and Interpretation	• Statistical Methods: Students will learn and apply appropriate statistical methods to analyze data. • Interpretation of Results: Data should be interpreted within the context of the project, highlighting significant findings and limitations.
3. Report Writing and Presentation	• Report Format: A structured report format is usually followed, including an abstract, introduction, methodology, results, discussion, and conclusion. • Data Presentation: Data should be presented clearly and accurately using tables, graphs, and figures. • Oral Presentation: Students will be required to present their findings to peers and faculty.
4. CE Services (Community Engagement)	• Community Needs: Projects may focus on addressing specific community needs or challenges relevant to physics. • Collaboration: Students can collaborate with local organizations to implement their projects. • Impact Assessment: The impact of the project on the community should be evaluated.
5. Evaluation and Assessment	• Project Report: The final report will be assessed based on its content, organization, and the quality of the research. (20 Marks) • Oral Presentation: The presentation will be evaluated on clarity, engagement, and the ability to answer questions. (10 Marks) • Faculty Evaluation: The faculty mentor will assess the student's performance throughout the project. (20 Marks) • Total 50 Marks
Examples of Field Projects/CE Services in Physics	• Environmental Physics: Studying the impact of pollution on local ecosystems or developing renewable energy solutions. • Health Physics: Investigating the effects of radiation on human health or developing medical imaging technologies. • Education: Designing physics experiments or teaching physics to younger students. • Community Outreach: Organizing science workshops or engaging in scientific literacy initiatives.

	• Research Project: Study related to the subject that contribute to the advancement of knowledge and the well-being of life on Earth.
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SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

FACULTY: Science and Technology

Subject: PHYSICS

**Teaching and Learning Scheme for the Degree of Bachelor of Science (B.Sc.)
Three Years / Four Years - (Six/Eight Semesters) Bachelor Degree Programme**

SECOND YEAR: Level 5.0 - SEMESTER – IV (T & L Credit Scheme)

Mode of Teaching	Vertical No.	The Vertical	Type of Course	Course Code	Course Name	Credits	Workload (Hrs./Week)	Vertical Workload (Hrs./Week)
Classroom Teaching / Lab Work (Practical) / Outdoor / Field/Online/ Hybrid	a	Major	Physics MJ Theory 5	129221	Solid State Devices-II	2	2	8
			Physics MJ Theory 6	129222	Optics and Laser	2	2	
			Physics MJ Lab/Practical 4	129223	Experiments related to Physics MJ Th5 and Th6	2	4	
	b	Minor	Physics MN Theory 4	129224	Transistor, Op-Amp, Fibre Optics and Laser	2	2	6
			Physics MN Lab/Practical 4	129225	Experiments related to Physics MN Th4	2	4	
	c	Generic/ Open Elective	Physics OE-6 Theory	129226	Physics in Agriculture	2	2	2
	d	VSC	Physics VSC-3 Lab/Practical	129227	Mobile Repairing Technician	2	4	8
		SEC	Physics SEC-3 Lab/Practical	129228	Computing in Scilab	2	4	
	f	FP/CES	Physics FP/CES-2 Project	129229	Field Project / CE Services in Physics: Phase-II	2	4	8
		CC	Outdoor	-	Separate SOP will be released	2	4	

Physics MJ Theory 5 – 129221	
Solid State Devices-II	
Credits: 02	Workload (Hrs./Week): 02
Course Objectives:	1. To introduce the fundamental principles of Bipolar Junction Transistors (BJTs), including their construction, working, configurations, and characteristics. 2. To analyze transistor biasing techniques, stability factors, and the operation of different amplifier classes (A, B, AB and C). 3. To study Field Effect Transistors (FETs), including JFETs and MOSFETs, their construction, working principles, characteristics, and differences from BJTs. 4. To understand the basics of Operational Amplifiers (Op-Amps), their ideal characteristics, key parameters, and applications in analog circuits. 5. To develop problem-solving skills through numerical analysis of transistor and FET parameters. 6. To explore practical applications of transistors and Op-Amps in amplifier circuits, signal processing, and other electronic systems.
Course Outcomes:	By the end of the course, students will be able to: 1. Explain the construction, working of CB and CE configurations of BJT and interpret their characteristics. 2. Analyze transistor biasing circuits, stability factors, and the significance of the operating point in amplifier design. 3. Compare the performance of different amplifier classes (A, B, AB and C) and their applications. 4. Describe the working principles of JFETs and MOSFETs, their characteristics, and key differences from BJTs. 5. Interpret the ideal characteristics and parameters of Op-Amps. 6. Design basic Op-Amp circuits (inverting/non-inverting amplifiers, adders, subtractors, differentiators, and integrators). 7. Solve numerical problems related to transistor biasing, FET parameters, and Op-Amp configurations. 8. Evaluate the role of transistors and Op-Amps in modern electronic devices and signal-processing applications.

Unit	Contents	Work-load Allotted	Weight-age of Marks Allotted	Incorporation of Pedagogies
I	Bipolar Junction Transistor: Types of transistors, construction and working of PNP and NPN transistor, Transistor configuration (CB, CE and CC) modes, characteristics of transistor in CB and CE mode, current gain α and β , relation between α and β , Analysis of transistor: dc load line, operating point, active region, cut-off region and saturation region.	8 Hrs.	8 Marks	• Use diagrams, simulations, or animations to illustrate transistor and their types. • Provide step-by-step information of different configurations of transistor to reinforce understanding. • Engage students with interactive simulations or experiments showcasing characteristics of transistor.
II	Transistors Biasing: Stability factor, Thermal runaway, Voltage divider bias CE amplifier. Hybrid parameters, low frequency hybrid equivalent circuit of CE amplifier and its analysis, Input impedance, Output impedance, Current gain, Voltage gain and Power Gain, Classification of Amplifier: class A, B, AB and C amplifiers.	8 Hrs.	8 Marks	• Use diagrams, animations, or simulations to illustrate the concept of thermal runaway and biasing stability of CE transistor Amplifier. • Use diagrams and analyze the various parameters of CE Amplifier. • Engage students in discussions towards the practical approach of amplifier classifications.
III	Field Effect Transistor (FET): Types of JFET, construction and working of JFET, Characteristics of JFET, parameters of JFET and their relation, difference between JFET and BJT, MOSFET: Construction. Working and Characteristics of N-channel depletion and enhancement type	7 Hrs.	7 Marks	• Use animations or diagrams to illustrate field effect transistor. • Engage students to identify and differentiate the BJT, FET and MOSFET. • Conduct experiments to understand the construction and working of JFET.

	MOSFET. Numerical.			
IV	Operational Amplifier: Difference Amplifier, Block diagram of Op-Amp, Characteristics of an Ideal Op-Amp, Op-Amp IC 741 (pin diagram), Input bias current, Input offset current, Input offset voltage, Open-loop & Closed-loop Gain, Slew rate, CMRR, concept of Virtual ground. Applications of Op-Amp: Inverting Amplifier, Non-inverting Amplifier, Adder, Subtractor, Differentiator and Integrator.	7 Hrs.	7 Marks	• Use animations or diagrams to illustrate Operational Amplifier. • Engage students in to identify Pins OP-Amp IC-741 and their role in electronic circuit. • Conduct experiments using OP-Amp to study the related applications.

References:	1. Basic Electronics: Solid State by B.L. Theraja, (2006) S. Chand Publication. 2. Electronic Principles by Albert Malvino, David J. Bates, 7th Ed (2017) MGH publication. 3. Principle of Electronics by V. K. Mehta, Rohit Mehta, (2022) S. Chand Publication. 4. Op-Amps and Linear Integrated Circuits by Ramakant Gaikwad, 4th Ed, PHI publication. 5. Digital and Analogue Techniques by Navneet, Kale, Gokhale, Kitab Mahal Publication. 6. Electronics Fundamentals, David M. Buchla, Thomas L Floyd, 8th Ed. Pearson New International.
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Model Questions	
One sentence/ Very short answer questions	1. Define current gain β in a transistor. 2. What does CMRR stand for in operational amplifiers? 3. Name the modes of operation of transistor.
Short answer questions	1. Distinguish between PNP and NPN transistors in terms of current flow direction. 2. List the characteristics of an ideal operational amplifier. 3. Compare JFET and BJT on any two parameters.

Long answer questions	1. Explain the working of n-channel JFET with its construction diagram. Draw and explain the drain and transfer characteristics of JFET. 2. Draw the construction diagram of an NPN transistor and explain its working principle. 3. Draw the block diagram of an operational amplifier and explain the function of each block.
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Physics MJ Theory 6 – 129222	
Optics and Laser	
Credits: 02	Workload (Hrs./Week): 02
Course Objectives:	1. To introduce the fundamental principles of wave optics, including interference, diffraction, and polarization, and their significance in understanding light behavior. 2. To analyze interference phenomena in thin films, Newton's rings, and Michelson interferometer, including numerical problem-solving. 3. To study diffraction patterns (Fresnel and Fraunhofer) and their applications in determining light wavelength using single/double slits and diffraction gratings. 4. To explain the concept of polarization, its production methods (e.g., Nicol prism, retardation plates), and its role in creating elliptically/circularly polarized light. 5. To explore the principles of lasers, including stimulated emission, population inversion, and the working of Ruby, He-Ne, and semiconductor lasers. 6. To highlight practical applications of optical phenomena and lasers in medical, industrial, agricultural, and research fields.
Course Outcomes:	By the end of the course, students will be able to: 1. Describe the conditions for interference and apply the superposition principle to analyze thin-film interference and Newton's rings. 2. Solve numerical problems related to wavelength determination using interference (Michelson interferometer) and diffraction (grating) techniques. 3. Distinguish between Fresnel and Fraunhofer diffraction and interpret diffraction patterns from single/double slits. 4. Explain polarization mechanisms (e.g., double refraction, quarter/half-wave plates) and demonstrate how to produce polarized light. 5. Illustrate the working principles of lasers, including population inversion and pumping processes in 3-level/4-level systems. 6. Compare the construction and operation of Ruby, He-Ne, and semiconductor lasers. 7. Discuss real-world applications of lasers and polarized light across diverse fields (e.g., medical surgery, optical communications).

Unit	Contents	Work-load Allotted	Weight-age of Marks Allotted	Incorporation of Pedagogies
I	Interference: Introduction, principle of superposition of waves, conditions for steady interference, Interference in thin film due to reflected and transmitted light, Newton's rings (formation, theory and application for determination of wavelength), Michelson Interferometer (principle, construction & working), Numerical.	7 Hrs.	7 Marks	• Encourage students to explore and discover interference phenomena through guided experiments or simulations. • Use visual aids, physical models, and hands-on demonstrations to illustrate interference patterns. • Integrate simulations, animations and digital tools.
II	Diffraction: Rectilinear propagation of light, Fresnel and Fraunhofer diffraction, Fraunhofer diffraction due to single slit, Fraunhofer diffraction due to double slit, theory of plane transmission grating, determination of wavelength of light by diffraction grating, Numerical.	8 Hrs.	8 Marks	• Use physical demonstrations and models to help students visualize wave behavior. • Use simulations and virtual labs to understand diffraction phenomenon.
III	Polarization: Concept of polarization, optic axis, double refraction, polarization by double refraction, phase retardation plate: Quarter wave plate, half wave plate, Nicol prism, production and analysis of polarized light, Theory of production of elliptically and circularly polarized light.	7 Hrs.	7 Marks	• Use models and demonstrations to make polarization more intuitive. • Use Interactive simulations and digital tools to visualize polarized light.
IV	Laser: Introduction to Laser, Characteristics of laser, Absorption, Spontaneous and stimulated emission, population	8 Hrs.	8 Marks	• Utilize simulations and digital animations to explain complex laser mechanisms.

	inversion, pumping process, Main components of laser system, three level and four level laser system. Construction and working of Ruby laser, He-Ne laser, Semiconductor laser, Applications of laser (Medical, Industrial, Agriculture and Research).			• Use short conceptual quizzes and diagnostics to clarify understanding.
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References:	1. A text book of Optics, N. Subrahmanyam, Brijlal, M. N Avadhanulu, S. Chand Publication. 2. Physics for degree students (B.Sc.1st year), C. L. Arora and P.S. Hemne, S. Chand Publication. 3. Fundamentals of Optics, Devraj Singh, PHI Learning Pvt. Ltd. 4. Optics by Ajoy Ghatak, McGraw Hill Education (India) Private Limited. 5. Optics by N. B. L. Mathur, Anmol Publications Pvt. Ltd. 6. Optics and Spectroscopy, P. K. Mittal, S. Chand & Company. 7. Lasers, Theory and Application, Thyagrajan and Ajay Ghatak, Macmillan India Ltd. 8. Laser and Nonlinear Optics, B. B. Laud (2nd Ed.), New Age International.
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Model Questions	
One sentence/ Very short answer questions	1. Define polarization of light. 2. What is population inversion in laser? 3. State principle of superposition of light.
Short answer questions	1. Write any two conditions for getting steady interference pattern of light. 2. Distinguish between Fresnel and Fraunhofer diffraction. 3. What is meant by three-level laser system?
Long answer questions	1. Explain the formation and theory of Newton's rings. How can Newton's rings be used to determine the wavelength of light? 2. Describe the construction and working of Ruby laser. 3. Explain Fraunhofer diffraction due to double slit. How does it differ from single slit diffraction?

Physics MJ Lab/ Practical 4 – 129223	
Experiments related to Physics MJ Th5 and MJ Th6	
Credits: 02	Workload (Hrs./Week): 04
Course Objectives:	1. Develop practical skills in optical experimentation, measurement, and analysis. 2. Understand the principles of wave optics, including interference, diffraction, and polarization, through hands-on experiments. 3. Apply experimental techniques to measure physical constants and optical properties of materials. 4. Analyses the behavior of light in various optical systems, including lasers, polarizers, and diffraction gratings. 5. Foster a deeper understanding of the connection between theory and practice in optical physics.
Course Outcomes:	On successful completion of this Practical course, the students would be able to: 1. Understand the different optical phenomena like Interference, Diffraction and Polarization. 2. Determine the wavelength of light by different phenomena like Interference and diffraction. 3. Demonstrate an understanding of the key concepts of LASER. 4. Acquire skills in observing and measuring different types of errors. 5. Perform procedures and techniques related to experiments based on Optics and Lasers. 6. Learn best practices for handling, cleaning and maintaining equipments, components & devices.

List of Experiments: Perform at least eight (8) experiments from the given list. (at least 3 experiments related to each theory paper)
1. To determine characteristics of transistor in CB mode. 2. To determine characteristics of transistor in CE mode. 3. To study variation of gain of CE transistor amplifier with load. 4. To study gain frequency response of CE transistor Amplifier. 5. To determine characteristics of FET. 6. To Study transfer and output characteristics of an N- channel MOSFET. 7. To study FET as a voltmeter. 8. Study of OP AMP as an inverting amplifier. 9. Study of OP AMP as non-inverting amplifier. 10. Study of OP AMP as an adder. 11. Study of OP AMP as subtractor.

12. Study of OP AMP as differentiator.
13. Study of OP AMP as an integrator.
14. To determine the Refractive Index of the Material of a given Prism using Sodium Light.
15. To determine the value of Cauchy's Constants of a material of a prism.
16. To determine wavelength of Sodium light using Fresnel Biprism.
17. To determine wavelength of Sodium light using Michelson's Interferometer.
18. To determine wavelength of Sodium light using Newton's Rings.
19. To determine wavelength of Sodium light using plane diffraction Grating.
20. To determine the Resolving Power of a Plane Diffraction Grating.
21. To determine the wavelength of laser light by plane diffraction grating.
22. To find the number of lines per centimeter of the given diffraction grating.
23. To determine the resolving power of telescope.
24. To verify Malu's law.
25. To verify Brewster's law.
26. To determine the refractive indices for ordinary and extra-ordinary rays using double image prism.
27. Study of elliptically polarized light using photodetector.
28. To determine specific rotation of sugar solution by half shade polarimeter.
29. To study the divergence of a LASER beam.
30. To determine the focal length of a given convex lens using LASER.

References:

1. Basic Electronics: Solid State by B.L. Theraja, (2006) S. Chand Publication.
2. Electronic Principles by Albert Malvino, David J. Bates, 7th Ed (2017) MGH publication.
3. Principle of Electronics by V. K. Mehta, Rohit Mehta, (2022) S. Chand Publication.
4. Op-Amps and Linear Integrated Circuits by Ramakant Gaikwad, 4th Ed, PHI publication.
5. Digital and Analogue Techniques by Navneet, Kale, Gokhale, Kitab Mahal Publication.
6. Electronics Fundamentals, David M. Buchla, Thomas L Floyd, 8th Ed. Pearson New International.
7. A Textbook of Practical Physics by S. L. Gupta and V. Kumar, Pragati Prakashan.
8. Practical Physics by R. K. Shukla, Anchal Srivastava, New Age Publishers.
9. Practical Physics by Brij Lal and N. Subramaniam, S. Chand & Co Ltd.
10. Experimental Physics – Vol. 1 by C. L. Arora, S Chand & Co Ltd.
11. <https://vlab.amrita.edu/>
12. <https://www.vlab.co.in/>

Physics MN Theory 4 – 129224	
Transistor, Op-Amp, Fibre Optics and Laser	
Credits: 02	
Workload (Hrs./Week): 02	
Course Objectives:	1. To provide a comprehensive understanding of Bipolar Junction Transistors (BJTs), including their construction, working principles, configurations (CB, CE, CC), and characteristics. 2. To analyze transistor biasing techniques, stability factors, and the performance of CE amplifiers, including hybrid parameters and gain calculations. 3. To introduce the fundamentals of fiber optics, including light propagation, acceptance angle, numerical aperture, and their applications in communication systems. 4. To study the principles of lasers, including stimulated emission, population inversion, and the working of Ruby and He-Ne lasers, along with their practical applications. 5. To develop problem-solving skills through numerical analysis of transistor parameters and fiber optic properties.
Course Outcomes:	By the end of the course, students will be able to: 1. Explain the construction, working, and configurations of PNP and NPN transistors, and interpret their characteristics in CB and CE modes. 2. Analyze transistor biasing circuits, stability factors, and the DC load line to determine the operating point in different regions (active, cut-off, saturation). 3. Evaluate the performance of CE amplifiers by calculating input/output impedance, current gain, voltage gain, and power gain using hybrid parameters. 4. Describe the principles of fiber optics, including total internal reflection, light propagation, and the significance of acceptance angle and numerical aperture. 5. Compare the advantages and disadvantages of optical fibers and their applications in communication systems. 6. Illustrate the working of lasers, including population inversion and pumping processes in three-level and four-level systems. 7. Discuss the applications of Ruby and He-Ne lasers in medical, industrial, agricultural, and research fields. 8. Solve numerical problems related to transistor biasing, fiber optics, and laser parameters.

Unit	Contents	Work-load Allotted	Weight-age of Marks Allotted	Incorporation of Pedagogies
I	Bipolar Junction Transistor: Types of transistors, construction and working of PNP and NPN transistor, Transistor configuration (CB, CE and CC) modes, characteristics of transistor in CB and CE mode, current gain α and β , relation between α and β ., Analysis of transistor dc load line, operating point, active region, cut-off region and saturation region.	8 Hrs.	8 Marks	• Use diagrams, simulations, or animations to illustrate transistor and their types. • Provide step-by-step information of different configurations of transistor to reinforce understanding. • Engage students with interactive simulations or experiments showcasing characteristics of transistor.
II	Transistors Biasing: Stability factor, Thermal runaway, base bias and emitter bias CE amplifier. Op-Amp: Block diagram of Op-Amp, Characteristics of an Ideal Op-Amp, Op-Amp IC 741 (pin diagram), Input bias current, Input offset current, Input offset voltage, Open-loop & Closed-loop Gain, Slew rate, CMRR, concept of Virtual ground. Applications of Op-Amp: Inverting Amplifier, Non-inverting Amplifier, Adder, Subtractor.	7 Hrs.	7 Marks	• Use diagrams, animations, or simulations to illustrate the concept of thermal runaway and biasing stability of CE transistor Amplifier. • Use animations or diagrams to illustrate Operational Amplifier. • Engage students in to identify Pins OP-Amp IC-741 and their role in electronic circuit. • Conduct experiments using OP-Amp to study the related applications.
III	Fiber optics: Introduction to fiber optics, total internal reflection, structure and classification of optical fiber. Propagation of light wave in an optical fiber, Acceptance angle and numerical aperture, fiber	7 Hrs.	7 Marks	• Use animations and simulations to show light rays propagating through fibre cores and how dispersion occurs. • Use hands-on experiments such as measuring the numerical

	optic communication. Advantages and Disadvantages of optical fibers, applications of fiber optics.			aperture or visualizing light transmission through plastic fibres.
IV	Laser: Introduction to Laser, Characteristics of laser, Absorption, Spontaneous and stimulated emission, population inversion, pumping process, Main components of laser system, three level and four level laser system. Ruby laser, He-Ne laser, Applications of laser (Medical, Industrial, Agriculture and Research).	8 Hrs.	8 Marks	- Utilize simulations and digital animations to explain complex laser mechanisms. - Use short conceptual quizzes and diagnostics to clarify understanding.

References:	1. Basic Electronics: Solid State, B.L. Theraja, (2006) S. Chand Publication. 2. Electronic Principles, Albert Malvino, David J. Bates, 7th Ed (2017) MGH publication. 3. Principle of Electronics, V. K. Mehta, Rohit Mehta, (2022) S. Chand Publication. 4. Electronics Fundamentals, David M. Buchla, Thomas L Floyd, 8th Ed. Pearson New International. 5. Fundamentals of Optical Fibre Communication, M. Sathish Kumar, PHI publication 6. Textbook on Optical Fiber Communication and Its Applications, S. C. Gupta, PHI publication. 7. Lasers, Theory and Application, Thyagrajan and Ajay Ghatak, Macmillan India Ltd. 8. Laser and Nonlinear Optics, B. B. Laud (2nd Ed.), New Age International.
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Model Questions	
One sentence/ Very short answer questions	1. Name the modes of transistor operation. 2. What is total internal reflection? 3. What are the two main types of bipolar junction transistors?
Short answer questions	1. Distinguish between PNP and NPN transistors based on their construction. 2. What are the characteristics of an ideal operational amplifier?

	3. What are the main components of a laser system?
Long answer questions	1. Derive the relationship between current gains α and β in a bipolar junction transistor. Also explain their physical significance. 2. Explain the structure and classification of optical fibers. 3. Explain the four-level laser system and state the applications of lasers in industry.

Physics MN Lab/ Practical 4 – 129225	
Experiments related to Physics MN Th3	
Credits: 02	Workload (Hrs./Week): 04
Course Objectives:	1. Develop practical skills in optical experimentation, measurement, and analysis. 2. Understand the principles of wave optics, including interference, diffraction, and polarization, through hands-on experiments. 3. Apply experimental techniques to measure physical constants and optical properties of materials. 4. Analyses the behavior of light in various optical systems, including lasers, polarizers, and diffraction gratings. 8. Foster a deeper understanding of the connection between theory and practice in optical physics.
Course Outcomes:	On successful completion of this Practical course, the students would be able to: 1. Understand the different optical phenomena like Interference, Diffraction and Polarization. 2. Determine the wavelength of light by different phenomena like Interference and diffraction. 3. Demonstrate an understanding of the key concepts of LASER. 4. Acquire skills in observing and measuring different types of errors. 5. Perform procedures and techniques related to experiments based on Optics and Lasers. 6. Learn best practices for handling, cleaning and maintaining equipments, components & devices.

List of Experiments:
Perform at least eight (8) experiments from the given list.
1. To determine characteristics of transistor in CB mode. 2. To determine characteristics of transistor in CE mode. 3. To study variation of gain of CE transistor amplifier with load. 4. To study gain frequency response of CE transistor Amplifier. 5. Study of OP AMP as an inverting amplifier. 6. Study of OP AMP as non-inverting amplifier. 7. Study of OP AMP as an adder. 8. Study of OP AMP as subtractor. 9. To determine the wavelength of LASER light by plane diffraction grating. 10. To study the divergence of a LASER beam. 11. To determine the thickness of thin wire using Laser beam 12. To determine the focal length of a given convex lens using LASER. 13. To determine Numerical Aperture of Fibre Optic Cable.

References:	1. Basic Electronics: Solid State by B.L. Theraja, (2006) S. Chand Publication. 2. Electronic Principles by Albert Malvino, David J. Bates, 7th Ed (2017) MGH publication. 3. Principle of Electronics by V. K. Mehta, Rohit Mehta, (2022) S. Chand Publication. 4. Op-Amps and Linear Integrated Circuits by Ramakant Gaikwad, 4th Ed, PHI publication. 5. Digital and analogue Techniques by Navneet, Kale, Gokhale. 6. Electronics Fundamentals, David M. Buchla, Thomas L Floyd, 8th Ed. Pearson New International. 7. A Textbook of Practical Physics by S. L. Gupta and V. Kumar, Pragati Prakashan. 8. Practical Physics by R. K. Shukla, Anchal Srivastava, New Age Publishers. 9. Practical Physics by Brij Lal and N. Subramaniam, S. Chand & Co Ltd. 10. Experimental Physics – Vol. 1 by C. L. Arora, S Chand & Co Ltd. 11. https://vlab.amrita.edu/ 12. https://www.vlab.co.in/ 13. https://vlabs.iitb.ac.in/vlab/labsps.html
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Physics OE-6 Theory – 129226	
Physics in Agriculture	
Credits: 02	
Workload (Hrs./Week): 02	
Course Objectives:	1. To develop an appreciation of the role of physical principles in traditional and modern agriculture. 2. To encourage interdisciplinary understanding of agriculture as a blend of science, environment, and economics. 3. To promote awareness about sustainable agricultural techniques using basic scientific ideas.
Course Outcomes:	By the end of this course, students will be able to: 1. Recognize how natural physical forces like gravity, pressure, and energy affect farming. 2. Describe the use of sunlight, water, and soil in crop production from a layperson's scientific viewpoint. 3. Understand simple working principles of tools and machines used in agriculture. 4. Appreciate the role of climate, light, and renewable energy in farming systems. 5. Promote sustainable practices and technological awareness in rural communities.

Unit	Contents	Workload Allotted	Weightage of Marks Allotted	Incorporation of Pedagogies
I	Agriculture and Natural Forces: How gravity, wind, water, and sunlight shape farming. Seasons and weather: their impact on crops. Role of sunlight and shade in plant growth.	7 Hrs.	7 Marks	• Demonstration: Soil erosion models using trays and water flow. • Seasonal Calendar: Students prepare crop-weather suitability charts.
II	Water and Soil: The Essentials; How water moves in soil (capillary action in simple terms). Rainwater harvesting, traditional water storage. Importance of soil texture and slope in farming.	8 Hrs.	8 Marks	• Observation Activity: Compare plant growth in sun and shade over a week. • Interactive Experiment: Use light filters to study growth under different light conditions. • Lab Demo: Capillary action using glass tubes and water in different soil types. • Soil Texture Feel Test: Sand, loam, and clay analysis by hand.
III	Light, Heat, and Storage: Greenhouses and controlled environments. Drying crops using sunlight – traditional and modern methods. Cold storage basics and food preservation.	8 Hrs.	8 Marks	• Mini Greenhouse Build: Create a bottle greenhouse. • Compare Methods: Traditional vs. modern drying – moisture content, time. • Guest Talk: Invite a farmer or agri-entrepreneur to discuss storage innovations.
IV	Energy and Sustainability in Agriculture:	7 Hrs.	7 Marks	• Planning a sustainable village farm using renewable energy.

	Use of solar energy, wind energy, and biogas in farms. Energy saving in farming activities. Sustainable practices and local success stories. Incentives, subsidies, and government policies			• Discuss on: Energy-efficient techniques (e.g., drip irrigation). • Discuss on: Government subsidies and schemes (PM-KUSUM, Biogas schemes).
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References:	1. "Textbook of Environmental Studies for Undergraduate Courses" Erach Bharucha (UGC Recommended) 2. "Traditional Water Management Systems of India" Anupam Mishra 3. "Principles of Agronomy" Reddy and Reddy 4. "Agricultural Energy Use and the Environment" N.K. Tyagi 5. "Soil Science: An Introduction" D.K. Das 6. "Solar Energy: Fundamentals, Design, Modelling and Applications" G.N. Tiwari 7. Reports and Booklets from Indian Ministries: MNRE (Ministry of New and Renewable Energy) publications on PM-KUSUM, solar pumps, and biogas. 8. ICAR extension booklets on organic and sustainable agriculture.
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Model Questions	
One sentence/ Very short answer questions	1. Which instrument is used to measure soil moisture? 2. Which principle is used in drip irrigation? 3. Which instrument is used to measure humidity?
Short answer questions	1. Explain how solar dryers are used in agriculture. 2. Describe energy saving methods in farming activities. 3. Explain importance of soil texture in agriculture. 4. Describe in brief food preservation techniques. 5. State the importance of sunlight and shade in plant growth.
Long answer questions	1. What is greenhouse effect and how is it utilized in agriculture? 2. Explain the role of solar energy in modern agriculture with suitable examples. 3. Discuss the applications of heat transfer in crop storage. 4. Describe various renewable energy sources used in agriculture.

Physics VSC-3 Lab/Practical – 129227	
Mobile Repairing Technician	
Credits: 02	Workload (Hrs./Week): 04
Course Objectives:	1. Diagnose and fix common hardware issues (displays, batteries, charging ports, speakers) through hands-on disassembly and soldering techniques. 2. Troubleshoot OS failures, perform firmware flashing (Android/iOS), bypass FRP locks, and repair IMEI/baseband errors. 3. Troubleshoot power circuits, replace ICs, and repair water-damaged devices using microsoldering and jumper techniques. 4. Complete practical repairs on live faulty devices, from screen replacements to motherboard troubleshooting. 5. Build confidence to launch a repair business or work in service centers, with knowledge of tools, safety, and customer service basics.
Course Outcomes:	After completing the course, the student will be able to: 1. Replace broken displays (LCD/OLED), batteries, charging ports, and speakers. 2. Fix power issues (dead phone, overheating) using multimeter and soldering techniques. 3. Flash stock/custom ROMs using Odin, SP Flash Tool, and iTunes. 4. Bypass FRP (Google Lock) and repair IMEI/network issues. 5. Repair water-damaged phones and replace faulty ICs (charging IC, WiFi/BT IC). 6. Perform microsoldering and jumper wire repairs on PCBs. 7. Extract data from locked/crashed phones using software/hardware methods. 8. Understand service center operations, pricing strategies, and customer handling

Unit	Theoretical Background	Lab/ Practical/ Demonstrations/Activities
I	Basics & Hardware: Introduction to mobile phones (Android, iOS); Basic electronics (voltage, current, resistance); Tools & safety (multimeter, soldering, ESD protection); Mobile components (display, battery, PCB, sensors)	1. Disassemble/assemble phones (screw patterns, adhesives) 2. Identify faulty components using diagrams 3. Use multimeter to test battery, charging port, fuses
II	Software & Flashing: Mobile OS architecture (Android/iOS); Common software issues (bootloop, hang, virus); Flashing tools (Odin, SP Flash Tool, iTunes); FRP bypass, IMEI repair, jailbreaking (basics)	4. Flash firmware on dead/bricked phones 5. Remove FRP lock on Android devices 6. Factory reset & software troubleshooting
III	Hardware Repair: Display types (LCD, OLED) & touch issues; Charging circuit (IC, port, coil); Audio/speaker, camera, network problems; Water damage treatment	7. Replace broken screens (glass + digitizer) 8. Solder charging ports & jumper wires 9. Fix no-power issues (dead phone) 10. Repair speaker/microphone issues
IV	Advanced Troubleshooting: Microsoldering & BGA reballing (concepts); Data recovery from damaged phones; Business tips (service center setup, pricing)	11. Practice IC rework (under microscope) 12. Real-case repairs (students bring faulty phones) 13. Final assessment: Diagnose & fix 3 faults

References:	1. Hardware repair, circuit diagrams, troubleshooting, Manohar Lotia, BPB Publications 2. Step-by-step repair guide for Android & iPhone, Nitesh Kumar, Techniaut Books 3. Basic to advanced repairs, tools, and safety, P. K. Ghosh, Satya Prakashan 4. Circuit tracing, soldering, and fault finding, P. Babu, Dreamtech Press 5. Simplified guide for entry-level technicians, Rajiv Sharma, Kindle Edition <i>YouTube Channels and Websites</i> 1. "Gadget Repair Training" (Indian repair tutorials) 2. "Mobile Repairing Online" (Live fault fixing demos) 3. GSMForum.in (Indian mobile repair community) 4. Mobile Repairing Course Notes (PDF – Available on Google)
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Physics SEC-3 Lab/Practical – 129228	
Computing in Scilab	
Credits: 02	
Workload (Hrs./Week): 04	
Course Objectives:	1. Equip students with practical computing skills using Scilab. 2. Enable application of computational methods to physics problems. 3. Train in symbolic and numerical computation, data visualization, and simulation. 4. Familiarize students with Xcos for physical system modelling.
Course Outcomes:	Upon successful completion, students will be able to: 1. Use Scilab for solving mathematical and physics-based problems. 2. Write and execute scripts using programming constructs. 3. Perform matrix operations, calculus, and numerical methods. 4. Simulate systems and analyse data using built-in visualization tools. 5. Model physical systems using Xcos.

Unit	Theoretical Background	Lab/ Practical/ Demonstrations/Activities
I	Scilab Fundamentals & Programming Concepts 1. Introduction to SciLab: Installation, interface, uses in physics. 2. Data types, variables, constants, arrays. 3. Operators and built-in functions. 4. Script files and editor. 5. Control structures: if, else, for, while loops. 6. User-defined functions and modular coding.	1. Installing compatible version of Scilab. 2. Write basic scripts for arithmetic and physics-based calculations. 3. Use if-else to classify the type of motion based on initial velocity and height. 4. Use a for loop to calculate displacement $s = ut + \frac{1}{2} at^2$ over a series of time intervals. 5. Demonstrate use of a while loop to compute n! 6. Classify the projectile as short-, medium-, or long-range based on calculated range.
II	Matrix Algebra, Equation Solving & Symbolic Computation 1. Matrix creation and operations (transpose, inverse, determinant). 2. Linear algebra: Solving systems of equations. 3. Working with polynomials (roots, evaluation). 4. Curve fitting and interpolation methods. 5. Solving algebraic and simultaneous equations.	1. Create 2x2 Matrix and find Matrix Transpose, Inverse, Determinant 2. Solve 3 equations representing a circuit loop using matrices. 3. Create polynomial i) in terms of its roots and ii) in terms of its coefficients. 4. Fit an exponential curve to given decay data: $N(t) = N_0 e^{-\lambda t}$ 5. Estimate voltage output of a thermocouple for unknown temperature by interpolation from given data set.
III	Calculus, Differential Equations & Fourier Analysis 1. Numerical and symbolic differentiation and integration. 2. Solving ordinary differential equations (using ODE solver). 3. Modelling special differential equations (SHM, RC circuits). 4. Fourier series: Concept, computing coefficients, waveform reconstruction.	1. Differentiate a symbolic expression for displacement $s(t)=5t^3+2t^2+7$ to find velocity and acceleration functions. 2. Compute work done $W = \int_a^b F(x) dx$, where $F(x) = 3x^2 + 2x$ over $[0, 5]$. 3. Solve First-Order ODE for RC and RL Circuit 4. Solve Second-Order ODE for Simple Harmonic Oscillator (SHM) 5. Modelling of Special Differential Equations of damped oscillators and electric circuits.

		6. Compute Fourier Coefficients for a Square Wave. 7. Reconstruct a Square Wave Using Fourier Series 8. Obtain Fourier series plots for square and triangular waves.
IV	Data Visualization & System Simulation using Xcos 2D & 3D plotting: functions, labels, legends, subplots. - Plotting experimental data with error bars. - Introduction to Xcos: Interface and block diagram modeling. - Simulating physical systems: RC circuits, harmonic oscillator, mass-spring systems.	- Simulating motion of charged particle in electric and magnetic field. - Plotting trigonometric functions and Polynomials. - Plotting projectile motion, potential surfaces. - Model an RC or LCR circuit using Xcos. - Solve Schrödinger equation (discrete version) and plot wavefunctions. - Creating Xcos models for real-time system behaviour analysis.

References:	- Computing in Scilab, Chetana Jain (Cambridge University Press) - Learning Physics through Scilab Programming, Bikash Kumar Naik (Notion Press) - Computer Simulations in Quantum Physics, Prof. O. S. K. S. Sastri (Notion Press) - SciLab Official Site: https://www.scilab.org/ - FOSSEE SciLab Textbook Companion: https://scilab.in/foss_textbook https://sites.google.com/view/pankajnagpure/online-courses/physics-with-scilab/video-lectures-lecture-notes https://spoken-tutorial.org/tutorial-search/?search_foss=Scilab&search_language=English
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Physics FP/CES-2 Project – 129229	
Field Project / CE Services in Physics: Phase-II	
Credits: 02	
Workload (Hrs./Week): 04	
Course Objectives:	1. To provide hands-on experience in applying theoretical physics knowledge to real-world challenges through field-based projects or community engagement (CE) services. 2. To train students in identifying, analyzing, and solving practical problems encountered in physics-related fieldwork or community service activities. 3. To encourage students to integrate physics concepts with interdisciplinary knowledge, technology, and societal needs. 4. To develop students' abilities to document, present, and communicate their field-based or community engagement work effectively to diverse audiences. 5. To instill a sense of responsibility and service by involving students in projects that address community issues related to science and technology.
Course Outcomes:	1. Students will be able to apply physics principles and analytical techniques to investigate and solve real-world problems in field settings. 2. Students will demonstrate proficiency in using experimental tools, instruments, and data analysis methods relevant to their field project or CE service. 3. Students will be able to design, plan, and execute a field project or community service activity from inception to completion, including documentation and reporting. 4. Students will effectively communicate their project findings and outcomes through written reports, presentations, or community engagement events. 5. Students will demonstrate an understanding of the ethical, environmental, and societal impacts of their work, showing a commitment to responsible scientific practice and community well-being.
• Guidelines/SOP for Selection and Implementation of Field Projects / CE Services	
1. Project Selection and Planning	• Faculty Guidance: Students will be assigned a faculty mentor to guide their project, providing expertise and resources. • Project Topic: The project topic should be relevant to physics and align with the student's interests and the available resources. • Literature Review: Students are expected to conduct a thorough literature review to understand existing knowledge and identify research gaps. • Data Collection and Analysis: Projects often involve experiments, simulations, or data analysis from existing sources, depending on the topic. • Project Timeline: The total time allocation for the student to carry out field project is 60 hours.

2. Data Analysis and Interpretation	• Statistical Methods: Students will learn and apply appropriate statistical methods to analyze data. • Interpretation of Results: Data should be interpreted within the context of the project, highlighting significant findings and limitations.
3. Report Writing and Presentation	• Report Format: A structured report format is usually followed, including an abstract, introduction, methodology, results, discussion, and conclusion. • Data Presentation: Data should be presented clearly and accurately using tables, graphs, and figures. • Oral Presentation: Students will be required to present their findings to peers and faculty.
4. CE Services (Community Engagement)	• Community Needs: Projects may focus on addressing specific community needs or challenges relevant to physics. • Collaboration: Students can collaborate with local organizations to implement their projects. • Impact Assessment: The impact of the project on the community should be evaluated.
5. Evaluation and Assessment	• Project Report: The final report will be assessed based on its content, organization, and the quality of the research. (20 Marks) • Oral Presentation: The presentation will be evaluated on clarity, engagement, and the ability to answer questions. (10 Marks) • Faculty Evaluation: The faculty mentor will assess the student's performance throughout the project. (20 Marks) • Total 50 Marks
Examples of Field Projects/CE Services in Physics	• Environmental Physics: Studying the impact of pollution on local ecosystems or developing renewable energy solutions. • Health Physics: Investigating the effects of radiation on human health or developing medical imaging technologies. • Education: Designing physics experiments or teaching physics to younger students. • Community Outreach: Organizing science workshops or engaging in scientific literacy initiatives. • Research Project: Study related to the subject that contribute to the advancement of knowledge and the well-being of life on Earth.

Note: The extended portion of the Field Project/CE Services in Physics from Phase-I may be carried forward as Field Project/CE Services in Physics: Phase-II in the fourth semester, subject to the approval of the assigned faculty mentor.