



DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY
CHHATRAPATI SAMBHAJINAGAR (M.S.) - 431001



FACULTY OF SCIENCE AND TECHNOLOGY

B.Sc. Degree Programme

(Three Year / Four Years (Honors) / Four Years (Honors with Research)

Course Structure and Curriculum

(Revised)

(AS PER NEP-2020)

Subject (Major): PHYSICS

For

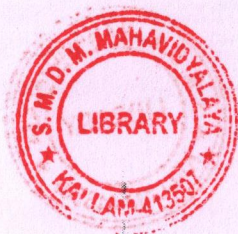
B.Sc. Second Year
(Semester – III and IV)

Effective from

Academic Year 2025-26

Prinmer
25.02.2025

Shirur
Librarian
S.M.Dnyandeo Mohekar Mahavidyalaya
Kallam Dist. Osmanabad



Board of Studies in Physics

Sr. No.	Name and Organization	Contact No.
01	Dr. B. N. Dole , Professor, Department of Physics, Dr. B. A. M. University, Chhatrapati Sambhajanagar. Email: drbndole.phy@gmail.com	8237006572
02	Dr. R. H. Kadam , Professor, Shrikrishna College, Gunjoti, Dist. Dharashiv Email: ram111612@yahoo.co.in	9423450152
03	Dr. S. T. Alone , Associate Professor, Rajarshi Shahu College, Pathri, Dist. Chhatrapati Sambhajanagar. Email: drsureshalone@gmail.com	9423188740
03	Dr. C. M. Kale , Professor, Indraraj College, Sillod, Dist. Chhatrapati Sambhajanagar Email: cmkale1973@gmail.com	9423741037
04	Dr. M. L. Mane , Associate Professor, S. M. R. G. Shinde College, Paranda, Dist. Dharashiv Email: mane.maheshkumar@hotmail.com	8329138327
05	Dr. G. M. Dharane , Associate Professor, Department of Physics, Dr. B. A. M. University, Chhatrapati Sambhajanagar. Email: drgmddharane@gmail.com	9420264944
06	Dr. C. T. Birajdar , Professor, S. M. P. College, Murum, Dist. Dharashiv Email: dretbirajdar@gmail.com	9420334083
07	Dr. S. B. Deshmukh , Professor, R.G. Bagadia Arts, S. B. Lakhotia Commerce and R Benzonji Science College, Jalna Email: sushant.dsg@gmail.com	9420416654
08	Dr. S. B. Sayyed , Professor, Miliya Arts, Science and Management College, Beed Email: syedsb@rediffmail.com	9325710235
09	Dr. P. T. Sonwane , Professor, Sant Ramdas Arts, Commerce and Science College, Ghansawangi, Dist. Jalna Email: drptsonwane@gmail.com	7507188163
10	Dr. V. B. Patil , Professor, Department of Physics, Punyashlok Ahilyadevi Holkar Solapur University, Solapur	9422532521
11	Dr. S. E. Shirsath , Lecturer, Vivekanand College, Chhatrapati Sambhajanagar Email: shirsathsagar@hotmail.com	9421666605
12	Dr. Pravina Pawar , Head and Professor, Department of Physics, Dr. B. A. M. University, Chhatrapati Sambhajanagar.	9657079997
13	Shri. Uday Deshpande , Scientist F, UGC-DAE Consortium for Scientific Research University, Indore	
14	Dr. Arvind Chinchure , Baner Road, Pune, IN - 411045 Email: chinchure@gmail.com	
15	Shri. L. Malleshwara Rao , Officer in R&D at Sterlite Technologies Ltd. Chhatrapati Sambhajanagar, Maharashtra, India	



PREFACE

As we stand on the threshold of a new era in education, the dawn of the National Education Policy 2020 illuminates our path toward a holistic, inclusive, and progressive educational landscape. The Bachelor of Science (B. Sc.) curriculum outlined herein reflects the ethos and aspirations of this transformative policy, aiming to equip learners with the knowledge, skills, and values necessary to thrive in the dynamic world of the 21st century.

At its core, the National Education Policy 2020 envisions an educational framework that is learner-centric, multidisciplinary, and geared towards fostering creativity, critical thinking, and innovation. It emphasizes the integration of knowledge across disciplines, breaking down traditional silos to encourage holistic understanding and application of concepts. The Bachelor of Science (B. Sc.) curriculum embodies these principles by offering a diverse array of courses spanning various scientific domains, while also incorporating interdisciplinary studies to nurture well-rounded graduates capable of addressing complex challenges with agility and insight.

Furthermore, the curriculum is designed to promote experiential learning, research, and hands-on exploration, recognizing the importance of practical engagement in deepening understanding and cultivating real-world skills. Through laboratory work, field experiences, internships, and project-based learning opportunities, students will have the chance to apply theoretical knowledge in practical settings, develop problem-solving abilities, and cultivate a spirit of inquiry and discovery.

Integral to the National Education Policy 2020 is the commitment to inclusivity, equity, and access to quality education for all. The Bachelor of Science (B. Sc.) curriculum reflects this commitment by embracing diversity in perspectives, backgrounds, and experiences, and by fostering an inclusive learning environment where every student feels valued, supported, and empowered to succeed.

Moreover, the curriculum emphasizes the cultivation of ethical values, social responsibility, and global citizenship, instilling in students a sense of accountability towards society and the environment. By integrating courses on ethics, sustainability, and social sciences, the Bachelor of Science (B. Sc.) program aims to produce graduates who are not only proficient in their respective fields but also compassionate, ethical leaders committed to making a positive impact on the world.

As we embark on this journey of educational transformation guided by the National Education Policy 2020, the Bachelor of Science (B. Sc.) curriculum stands as a testament to our collective vision of a more equitable, inclusive, and enlightened society. It is our hope that through rigorous academics, innovative pedagogy, and unwavering dedication to excellence, we can inspire the next generation of scientists, scholars, and change-makers to realize their full potential and contribute meaningfully to the advancement of knowledge and the betterment of humanity.



**Structure of B. Sc. (Three/Four Years Honours/Honours with Research Degree)
Program with Multiple Entry and Exit Options**

B. Sc. Second Year: 3rd Semester

Subject: Physics

Students will have to select / declare choice of **one major subject** and **one minor subject** from three major options M1, M2 and M3 (which were opted in the first year)

Course Type	Course Code	Examination Code	Course Name	Teaching Scheme (Hrs / Week)		Credits Assigned		Total Credits
				Theory	Practical	Theory	Practical	
Major (Core) Mandatory DSC	PHY/DSC/T/200	SAC00062003T	Modern Physics	2		2		2+2+2+2 = 08
	PHY/DSC/T/201	SAC00062013T	Electricity and Magnetism	2		2		
	PHY/DSC/P/226	SAC00062263P	Practical based on SUB/DSC/T/200		4		2	
	PHY/DSC/P/227	SAC00062273P	Practical based on SUB/DSC/T/201		4		2	
Minor (Choose any two from pool of courses)	PHY/Mn/T/200		It is from different discipline of the same faculty	2		2		2+2 = 04
	PHY/Mn/T/201		It is from different discipline of the same faculty	2		2		
Generic / Open Elective (GE/OE) (Choose any one from pool of courses)	PHY/GE/OE/T/200		It should be chosen compulsorily from the faculty other than that of Major	2		2		02
VSC (Vocational Skill Courses) (Choose any one from SUB/VSC/T/ 200 and SUB/VSC/T/ 201) and corresponding Practical's	PHY/VSC/T/200	SEC00062003T	Solar Cell Devices	1		1		1+1 = 02
	PHY/VSC/T/201	SEC00062013T	Electrical Vehicle Technology	1		1		
	PHY/VSC/P/226	SEC00062263P	Practical's based on SUB/VSC/T/ 200		2		1	
	PHY/VSC/P/227	SEC00062273P	Practical's based on SUB/VSC/T/ 201		2		1	
AEC, VEC, IKS	SUB/AEC/T/200		English (Common for all the faculty)	2		2		2 + 2 = 04
	SUB/VEC/T/201		Environmental Studies	2		2		
OJT/ FP/CEP/CC/RP	SUB/CC/P/226		Cultural Activity / NSS, NCC (Common for all the faculty)		4		2	02
				15	14	15	07	22

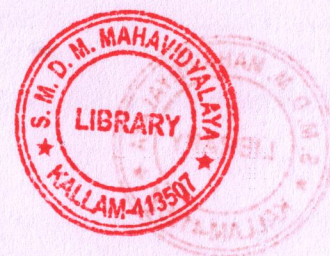
Minor Courses Designed for other Discipline of the same Faculty

SUB/Mn/T/ 200: Soil Physics (SCC00062003T)

SUB/Mn/T/ 201: Digital Electronics (SCC00062013T)

Generic /Open Elective Courses for other faculty

SUB/GE/OE/T/200: Data Analysis Techniques Using Excel (SDC00062003T)



**Structure of B. Sc. (Three/Four Years Honours/Honours with Research Degree)
Program with Multiple Entry and Exit Options**

B. Sc. Second Year: 4th Semester

Subject: Physics

Course Type	Course Code	Examination Code	Course Name	Teaching Scheme (Hrs / Week)		Credits Assigned		Total Credits
				Theory	Practical	Theory	Practical	
Major (Core) Mandatory DSC	PHY/DSC/T/250	SAC00062504T	Heat and Thermodynamics	2		2		2+2+2+2 = 08
	PHY/DSC/T/251	SAC00062514T	Electrodynamics	2		2		
	PHY/DSC/P/276	SAC00062764P	Practical based on SUB/DSC/T/250		4		2	
	PHY/DSC/P/277	SAC00062774P	Practical based on SUB/DSC/T/ 251		4		2	
Minor (Choose any two from pool of courses)	PHY/Mn/T/250		It is from different discipline of the same faculty	2		2		2+2 = 04
	PHY/Mn/T/251		It is from different discipline of the same faculty	2		2		
Generic / Open Elective (GE/OE) (Choose any one from pool of courses)	PHY/GE/OE/T/250		It should be chosen compulsorily from the faculty other than that of Major	2		2		02
SEC (Skill Enhancement Courses) (Choose any one from SUB/SEC/T/250 and SUB/SEC/T/ 251) and corresponding Practical's	PHY/SEC/T/250	SEC00062504T	Drone Technology	1		1		1+1 = 02
	PHY/SEC/T/251	SEC00062514T	Generative AI	1		1		
	PHY/SEC/P/276	SEC00062764P	Practical's based on SUB/SEC/T/250		2		1	
	PHY/SEC/P/277	SEC00062774P	Practical's based on SUB/SEC/T/ 251		2		1	
AEC, VEC, IKS	SUB/AEC/T/250		Modern Indian Language (MIL-2) (Choose any one from pool of language courses)	2		2		02
OJT/ FP/CEP/CC/RP	SUB/FP/P/276		Field Project		4		2	2+2= 04
	SUB/CC/P/277		(Fine/ Applied/ Visual/ Performing Arts) (Common for all the faculty)		4		2	
				13	18	13	09	22

Exit Option: Award of UG Diploma in major and minor with 88 credits and an additional 4 credits NSQF course (related to major / minor) / Internship during summer vacation OR Continue with Major and Minor

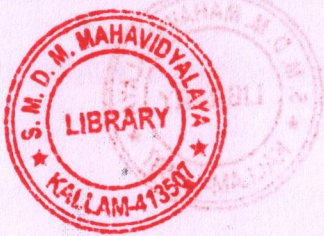
Minor Courses Designed for other Discipline of the same Faculty

SUB/Mn/T/ 250: Nuclear Chemistry (SCC00062504T)

SUB/Mn/T/ 251: Thermal Physics (SCC00062514T)

Generic /Open Elective Courses for other faculty

SUB/GE/OE/T/250: Renewable Energy (SDC00062504T)



Detailed Illustration of Courses included in 3rd and 4th semester:

1) Major (Core) subject is mandatory.

SUB/DSC/T/200: This is a 2-credit theory course corresponding to Major (core) subject

SUB/DSC/T/201: This is a 2-credit theory course corresponding to Major (core) subject

SUB/DSC/P/226: This is a 2-credit practical course based on SUB/DSC/T/200

SUB/DSC/P/227: This is a 2-credit practical course based on SUB/DSC/T/201

SUB/DSC/T/250: This is a 2-credit theory course corresponding to Major (core) subject

SUB/DSC/T/251: This is a 2-credit theory course corresponding to Major (core) subject

SUB/DSC/P/276: This is a 2-credit practical course based on SUB/DSC/T/250

SUB/DSC/P/277: This is a 2-credit practical course based on SUB/DSC/T/251

2) Minor: It is from different discipline of the same faculty

SUB/Mn/T/200: This is a 2-credit theory from different discipline of the same faculty

SUB/Mn/T/201: This is a 2-credit theory from different discipline of the same faculty

SUB/Mn/T/250: This is a 2-credit theory from different discipline of the same faculty

SUB/Mn/T/251: This is a 2-credit theory from different discipline of the same faculty

3) Generic / Open Elective (GE/OE): (Needs to be chosen (any one) from pool of courses available at respective college). These courses should be chosen compulsorily from faculty other than that of Major.

SUB/GE/OE/T/200: This is a 2-credit theory course should be chosen compulsorily from faculty other than that of Major.

SUB/GE/OE/T/250: This is a 2-credit theory course should be chosen compulsorily from faculty other than that of Major.

4) VSC (Vocational Skill Courses): Choose any one from pool of courses. These courses should be based on Hands on Training corresponding to Major (core) subject.

SUB/VSC/T/200: This is a 1 credit theory course-based Hands-on Training corresponding to Major (core) subject.

SUB/VSC/T/201: This is a 1 credit theory course-based Hands-on Training corresponding to Major (core) subject.

SUB/VSC/P/226: This is a 1 credit practical course based on SUB/VSC/T/200

SUB/VSC/P/227: This is a 1 credit practical course based on SUB/VSC/T/201



- 5) **SEC (Skill Enhancement Courses):** Choose any one from pool of courses. These courses should be based on Hands on Training corresponding to Major (core) subject.

SUB/SEC/T/250: This is a 1 credit theory course to enhance the technical skills of the students in specific area.

SUB/SEC/T/251: This is a 1 credit theory course to enhance the technical skills of the students in specific area.

SUB/SEC/P/276: This is a 1 credit practical course based on **SUB/SEC/T/250**

SUB/SEC/P/277: This is a 1 credit practical course based on **SUB/SEC/T/251**

- 6) **AEC (Ability Enhancement courses):** The focus of these courses should be based on linguistic and communication skills.

SUB/AEC/T/200: English

This is a 2-credit theory course based on linguistic proficiency.

SUB/AEC/T/250: Modern Indian Language MIL-2 (Hindi/ Marathi/ Pali & Buddhism/ Sanskrit/ Urdu)

This is a 2-credit theory course based on linguistic proficiency. Students will have to choose one of the above-mentioned languages.

- 7) **VEC: Environmental Studies**

SUB/VEC/T/201: Environmental Studies

This is 2-credit theory course based on Environmental Studies.

- 8) **FP-1: Field Project:**

SUB/FP/P/276: This is a 2-credit course, should be corresponding to Major (core) subject

- 9) **CC (Curricular Courses):** The courses such as Health and wellness, Yoga education, Sports and Fitness, Cultural activities, NSS/NCC, Performing Arts.

SUB/CC/P/226: Cultural Activity / NSS, NCC

This is a 2-credit practical course based on Co-curricular activities. It will be common for all the faculty

SUB/CC/P/277: Fine/ Applied/ Visual/ Performing Arts

This is a 2-credit practical course based on Co-curricular activities. It will be common for all the faculty



SEMESTER- III



DSC-5: Modern Physics Course Code: PHY/DSC/T/200 Examination Code: SAC00062003T		
Total Contact Hours: 30	Credit 02	Marks 50 (CA=20, ESE 30)
Learning Objectives: <i>By the end of this course, students will be able to:</i> <ul style="list-style-type: none"> • Explain the fundamental principles of the photoelectric effect, X-rays, and lasers. • Describe key experimental techniques and their significance. • Derive and analyse mathematical relationships in modern physics. • Explore applications of photoelectric devices, X-rays, and lasers. • Solve numerical and conceptual problems in modern physics. 		
Course Outcomes: <i>After successful completion of this course students will be able to</i> <ul style="list-style-type: none"> • Able to explain the factors influencing photoelectric effect, explain the experimental setup and apply it for applications • Understand the fundamentals of lasers, laser systems, their characteristics and diversified applications including industry, medicine and Défense • Use this knowledge for applications of lasers in specific fields of their interest • Solve numerical problems on the photoelectric effect, X-rays, and lasers. 		
Module No.	Topic/Actual content of the syllabus	Contact Hours
I	Photoelectric effect: Introduction, Lenard's method to determine e/m for photoelectrons, Richardson and Compton experiment, Relation between photoelectric current and retarding potential, Relation between velocity of photoelectrons and frequency of light, photoelectric cells- (1) Photo- emissive cell (2) Photo- voltaic cell (3) Photoconductive cell, numericals.	10
II	X-rays: Introduction, absorption of X-rays, Laue's experiment, Bragg's law, Bragg's X-ray spectrometer, powder crystal method, X-ray spectra, main features of continuous X-ray spectrum, Characteristics X-ray spectrum, numericals.	10
III	Lasers: Introduction, induced absorption, spontaneous emission, stimulated emission, population inversion, properties of laser beam, laser pumping, Types of laser-Ruby laser, He-Ne laser, carbon dioxide (CO_2) laser, Applications of laser-Biological, medical and industrial, numericals.	10
Learning Resources: <ol style="list-style-type: none"> 1) Modern Physics: J. B. Rajan, S. Chand Publication 2) Modern Physics: R. Murugesan, Er. Kirutyhiga, Sivaprasath. S. Chand Publication 3) Introduction to Modern Physics: R. B. Singh, New Age International Publisher 4) LASERS: Fundamentals and Applications, K. Thyagarajan, Ajoy Ghatak 		



DSC-6: Electricity and Magnetism Course Code: PHY/DSC/T/201 Examination Code: SAC00062013T		
Total Contact Hours: 30 Credit 02 Marks 50 (CA=20, ESE 30)		
Learning Objectives: <i>By the end of this course, students will be able to:</i> <ul style="list-style-type: none"> • Explain Coulomb's law, Gauss's law, Biot-Savart law, and Ampere's law. • Determine electric and magnetic fields for various charge and current distributions. • Understand dielectric properties and key parameters like polarization and displacement. • Solve numerical problems in electrostatics, dielectrics, and magnetostatics. 		
Course Outcomes: <i>On successful completion of this course students will be able to:</i> <ul style="list-style-type: none"> • Develop an understanding on the concepts of electricity and magnetism. • To understand the knowledge of various mathematical operations required for electrostatics and magnetostatics. • Explain the fundamental concepts and operations of vector analysis. • To increase the ability to perform calculations of various mathematical expressions and laws. • To develop ability among the students to identify, remember and grasp the meanings, definitions and laws of electricity and magnetism. 		
Module No.	Topic/Actual content of the syllabus	Contact Hours
I	Electrostatics: Coulomb's law (Statement only), concept of electric field, Electric potential, Electric field and potential due to point charge, Electric field and potential due to continuous charge distribution, Relation between electric intensity and potential, Electric dipole and dipole moment, Gauss law (with proof), numericals.	10
II	Dielectrics: Introduction, polar and non-polar molecules, polar and non-polar molecules in electric field, Electric polarisation of matter, electric polarisation vector (P), Electric field in dielectric, Gauss's law in dielectrics, relation between three vectors (D , E , P), boundary conditions on field vectors D and E , numericals.	10
III	Magnetostatics: Introduction, concept of magnetic field and magnetic induction, Biot and Savart law, Applications of Biot-Savart's law - i) magnetic induction due to long straight wire carrying current, ii) magnetic induction due to circular current loop, iii) magnetic induction inside a solenoid, Ampere's Circuital law, magnetic induction inside the toroids, Magnetization of Matter, numericals.	10
Learning Resources: <ol style="list-style-type: none"> 1) Mathematical Methods in Physics: D. Biswas (New Central book agency, 2009 edition) 2) Electricity and Magnetism: R Murugesan (S. Chand, 2008 edition) 3) Electrodynamics: Gupta, Kumar, Singh (Pragati Prakashan, Merrut, 18th Edition, 2005) 4) Foundation of Electromagnetic theory: Reitz, Milford, Chirstey IIIrd Edition) 5) Fundamentals of Physics: Halliday Rensik and Walkar, 8th Edition 6) Electromagnetics: B. B. Laud 7) Electricity and Magnetism: Brijlal, Subramanyan (Ratan Prakashan (Revised edition, 1997) 8) Electricity and Magnetism: Edward M. Purcell, 1986, McGraw – Hill Education 9) Electricity and Magnetism: D. C. Tayal, 1988, Himalaya Publishing house. 		



DSC-7: Practical's Based on DSC-5

Course Code: PHY/DSC/P/226

Examination Code: SAC00062263P

Total Contact Hours: 60

Credit 02

Marks 50 (CA=20, ESE 30)

Learning Objectives: *By the end of this course, students will be able to:*

- Understand the fundamental principles behind the photoelectric effect and its experimental verification using a photocell.
- Investigate the relationship between photoelectric current and retarding potential and study the characteristics of different types of photoelectric cells.
- Analyse the behaviour of laser beams, including their divergence, diffraction, and interactions with materials.
- Apply optical techniques to measure physical constants like Planck's constant and the wavelength of light.
- Develop experimental skills in using lasers for precision measurements and analysis of optical phenomena.

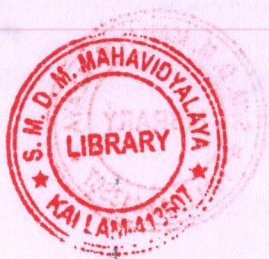
Course Outcomes: *On successful completion of this course students will be able to:*

- Verify the inverse square law and measure Planck's constant using the photoelectric effect.
- Compare luminous intensities of different light sources using photocells.
- Understand and apply the principles of laser optics for diffraction, beam divergence, and precision measurements.
- Analyse experimental data from photocell and laser-based experiments to draw meaningful conclusions about physical constants.

Expt. No	Name of Experiment
01	To verify the inverse square law using photocell
02	'h' by photocell
03	To compare the luminous intensities of two lights sources using photocell
04	Study of the relation between photoelectric current and retarding potential
05	Characteristics of photoconductive and photo-emissive cells
06	Measurement of the focal length of a given convex lens using laser
07	Diffraction of grating using laser beam
08	Divergence of a laser beam
09	Determination of the diameter of a thin wire using laser
10	Determination of lattice constant of given X-ray diffraction data

Learning Resources:

- 1) B. Sc. Practical Physics: C. L. Arora (S. Chand Publications)
- 2) College Practical Physics: Khanna and Gulati (S. Chand Publication)
- 3) Practical Physics: Gupta and Kumar (Pragati Prakashan, Meerut)
- 4) A text book of Practical physics: Shrinivasan and Balsubramanyam

**DSC-8: Practical's Based on DSC-6**

Course Code: PHY/DSC/P/227

Examination Code: SAC00062273P

Total Contact Hours: 60

Credit 02

Marks 50 (CA=20, ESE 30)

Learning Objectives: *By the end of this course, students will be able to:*

- Understand the principles and experimental methods for measuring fundamental electrical and electronic properties.
- Determine the energy band gap of a semiconductor using a thermistor.
- Explore bridge methods for precise measurement of resistance, capacitance, and inductance.
- Analyze the growth and decay of current in RC circuits and evaluate the charge-to-mass ratio (e/m) using Thomson's method

Course Outcomes: *On successful completion of this course students will be able to:*

- Measure the energy band gap of a semiconductor and analyze temperature dependence.
- Perform accurate resistance and capacitance measurements using bridge methods.
- Determine high resistance and absolute capacity of a condenser using B.G. techniques.
- Investigate transient behavior in RC circuits and determine e/m using Thomson's method.

Expt. No	Name of Experiment
01	Energy band gap of a semiconductor by using thermistor.
02	Calibration of a bridge wire by using Carry Foster's Bridge.
03	Determination of absolute capacity of condenser by using B.G.
04	High resistance by leakage through condenser
05	To determine the dielectric constant of different solids.
06	Whetstone Bridge
07	Meter bridge
08	e/m by Thomson's method
09	Growth of current in RC circuit
10	Decay of current in RC circuit

Learning Resources:

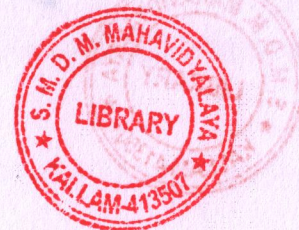
- 1) B. Sc. Practical Physics: C. L. Arora (S. Chand Publications)
- 2) College Practical Physics: Khanna and Gulati (S. Chand Publication)
- 3) Practical Physics: Gupta and Kumar (Pragati Prakashan, Meerut)
- 4) A text book of Practical physics: Shrinivasan and Balsubramanyam



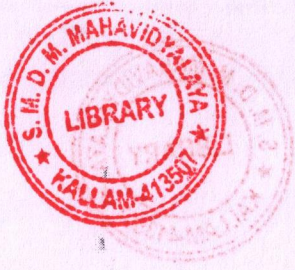
Minor-1: Soil Physics Course Code: PHY/Mn/T/ 200 Examination Code: SCC00062003T		
Total Contact Hours: 30	Credit 02	Marks 50 (CA=20, ESE 30)
Learning Objectives: <i>By the end of this course, students will be able to:</i> <ul style="list-style-type: none"> • Understanding Soil Composition: Gain knowledge of the composition of soil, including minerals, organic matter, air, and water, and their influence on soil properties. • Soil Structure and Texture: Learn how soil particles are organized to form aggregates and how particle size distribution affects soil texture and structure. • Soil Water Relations: Understand the movement, retention, and availability of water in soils, soil water potential. 		
Course Outcomes: <i>On successful completion of this course students will be able to:</i> <ul style="list-style-type: none"> • Explain the fundamental concepts, importance, and interdisciplinary interactions of soil physics. • Describe soil formation, profile development, texture, and methods for particle size analysis. • Analyze soil physical properties, including density, porosity, structure, and water content. • Interpret the energy state of soil water, soil-moisture potential, and measurement techniques. 		
Module No.	Topic/Actual content of the syllabus	Contact Hours
I	Introduction to Soil Physics: Introduction, Importance of Soil Physics, Interactions of Soil Physics with Other Disciplines, Soil Formation, Soil Profile, Soil Texture, Soil Separates, Methods for Particle Size Measurement, Particle Shapes	10
II	Soil Physical Properties: Physical Properties of Soil, Soil Color, Soil Particle Density, Soil Bulk Density, Soil Porosity, Soil Water Content, Soil Structure, Types of Soil Structure, Properties of Soil Aggregates	10
III	Energy state of soil water: Definitions and Components of Soil Water Potential, Total Soil Water Potential, Pressure Potential, Matric Potential, Gravitational Potential, soil-moisture characteristic curve; hysteresis, measurement of soil-moisture potential.	10
Learning Resources <ol style="list-style-type: none"> 1) Soil physics an introduction by Manoj K. Shukla, CRC press, Taylor & Francis group (2014). 2) Textbook of Soil Physics By Arun Kumar Saha, Anuradha Saha, Kalyani Publishers, India (2012) 3) Textbook of Soil Science by T. Biswas, S Mukherjee McGraw Hill Education (India); 2nd edition (2017) 4) Fundamentals of soil science Henry D. Forth, John Wiley & Sons, 8th Edition (1990). 5) Soil physics companion by A. W. Warrick, CRC press, (2002). 6) Soil Physics by Ghildyal BP & Tripathi RP, New Age International (2001) 		



Minor-2: Digital Electronics Course Code: PHY/Mn/T/ 201 Examination Code: SCC00062013T		
Total Contact Hours: 30 Credit 02 Marks 50 (CA=20, ESE 30)		
Learning Objectives: <i>By the end of this course, students will be able to:</i> <ul style="list-style-type: none"> • Understand the basics of digital electronics and its applications in scientific fields. • Develop proficiency in designing and interpreting simple digital circuits. • Relate digital systems to real-world scientific experiments. • Gain foundational knowledge to explore advanced digital systems in the future. 		
Course Outcomes: <i>On successful completion of this course students will be able to:</i> <ul style="list-style-type: none"> • Describe and explain the fundamentals of digital electronics. • Perform number system conversions and basic logic operations. • Design and simulate simple combinational and sequential logic circuits. • Recognize the importance of digital systems in scientific research and experiments. 		
Module No.	Topic/Actual content of the syllabus	Contact Hours
I	Number System: Binary, decimal, octal, and hexadecimal number system; Number system conversions, Arithmetic operations on binary number system: Addition, Subtraction Multiplication and division, numericals	10
II	Logic Gates: Basic concepts of logic gates, All basic logic gates (AND, OR, NOT) Algebraic form, graphical symbols truth tables and physical circuit with switches, Implementation of NOT gate using all basic gates, Universal gates (NAND, NOR), Implementation of gates using universal gates	10
III	Boolean Algebra: Concept of Boolean Algebra, Boolean Laws: Commutative Law, Associative Law, Distributive Law, Identity Law, Null Law, Complement Law, De Morgan's theorem, SOP and POS form of Boolean expression, simplification of Boolean Expression	10
Learning Resources <ol style="list-style-type: none"> 7) Digital Fundamentals: by Thomas L. Floyd 8) Digital Principles and Applications: by Donald P. Leach, Albert Paul Malvino, and Goutam Saha 9) Digital Electronics: Principles and Applications, by Roger L. Tokheim 10) Modern Digital Electronics: by R.P. Jain 11) Digital Electronics: by S. Salivahanan 12) Digital Electronics: Principles and Integrated Circuits" by Anil K. Maini's 		



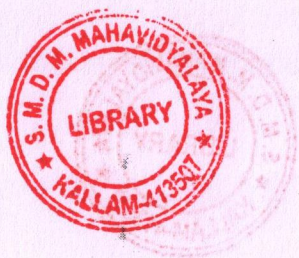
GE/OE: Data Analysis Techniques Using Excel Course Code: PHY/GE/OE/T/200 Examination Code: SDC00062003T		
Total Contact Hours: 30	Credit 02	Marks 50 (CA=20, ESE 30)
Learning Objectives: <i>By the end of this course, students will be able to:</i> <ul style="list-style-type: none"> To introduce students to the fundamental concepts of data analysis using Microsoft Excel. To equip students with essential skills for organizing, analyzing, and visualizing data effectively. To provide practical knowledge relevant to real-world applications in arts, commerce, and science. To develop decision-making abilities through data interpretation and presentation. 		
Course Outcomes: <i>On successful completion of this course students will be able to:</i> <ul style="list-style-type: none"> Understand and apply basic Excel functionalities for data management. Perform data cleaning, sorting, filtering, and visualization techniques. Use statistical functions for data interpretation and decision-making. Create professional reports and dashboards. Utilize Excel for business and social science applications. 		
Module No.	Topic/Actual content of the syllabus	Contact Hours
I	Basics of Excel: Introduction to Excel (Overview of interface, ribbons, and menus), Basic Data Entry (Formatting cells, rows, and columns; working with text, numbers, and dates), Essential Functions (SUM, AVERAGE, COUNT, MIN, MAX), Sorting and Filtering Data, Conditional Formatting, Creating Basic Charts (Line, Column, Pie charts, and their interpretation)	10
II	Intermediate Excel Skills Formulas and Functions (IF, VLOOKUP, HLOOKUP, COUNTIF, CONCATENATE), Pivot Tables and Pivot Charts (Creating and analysing summary reports), Data Validation and Drop-down Lists, Introduction to Excel Tables (Structured references and table-specific tools), Working with Multiple Worksheets (Linking data across sheets, using 3D references)	10
III	Advanced Data Analysis and Reporting Advanced Functions (INDEX, MATCH, TEXT functions, and nested formulas), Data Cleaning Techniques (Removing duplicates, handling missing values, and splitting data using Text to Columns), Introduction to Excel Macros (Basics of recording and running macros), Data Visualization, Advanced chart types (Combo charts, Waterfall) and customization. Case Studies (Solving real-world data problems relevant to Arts and Commerce disciplines)	10
Learning Resources: <ol style="list-style-type: none"> 1) Excel Data Analysis For Dummies: Paul McFedries 2) Microsoft Excel 365 Data Analysis and Business Modeling: Wayne L. Winston 3) Excel 2019 Bible: Michael Alexander, Richard Kusleika, and John Walkenbach 4) Data Analysis Using Microsoft Excel: Ash Narayan Sah 5) Excel Basics to Blackbelt: Elliot Bendoly 		



GE/OE: एक्सेल वापरून डेटा विश्लेषण तंत्र Course Code: PHY/GE/OE/T/200 Examination Code: SDC00062003T		
एकूण संपर्क तास: 30	क्रेडिट 02	गुण: 50 (CA=20, ESE 30)
Learning Objectives: या कोर्सच्या शेवटी विद्यार्थी हे शिकू शकतील: <ul style="list-style-type: none"> मायक्रोसॉफ्ट एक्सेल वापरून डेटा विश्लेषणाच्या मूलभूत संकल्पना समजून घेणे. डेटा व्यवस्थित करणे, विश्लेषण करणे आणि प्रभावीपणे सादर करण्यासाठी आवश्यक कौशल्ये मिळवणे. कला, वाणिज्य आणि विज्ञान शाखांमधील प्रत्यक्ष जीवनातील उदाहरणांसाठी उपयुक्त ज्ञान मिळवणे. डेटाचे विश्लेषण करून योग्य निर्णय घेण्याची क्षमता विकसित करणे. 		
Course Outcomes: हा कोर्स यशस्वीरीत्या पूर्ण केल्यावर विद्यार्थी हे करू शकतील: <ul style="list-style-type: none"> एक्सेलमधील मूलभूत फंक्शन्स समजून घेऊन डेटा व्यवस्थापन करणे. डेटा स्वच्छ करणे, सॉर्ट करणे, फिल्टर करणे आणि विडज्युअलायझेशन तंत्र वापरणे. आकडेवारीवरील फंक्शन्स वापरून डेटा विश्लेषण आणि निर्णय घेणे. व्यावसायिक अहवाल आणि डॅशबोर्ड तयार करणे. व्यवसाय आणि सामाजिक शास्त्र विषयांसाठी एक्सेलचा प्रभावी वापर करणे. 		
प्रकरण क्र.	अभ्यासक्रमाचा विषय/वास्तविक सामग्री	एकूण तास
I	एक्सेलच्या मूलभूत संकल्पना: एक्सेलची ओळख (इंटरफेसची ओळख, रिबन्स आणि मेनू), मूलभूत डेटा एंट्री (सेल्स, ये आणि कॉलमचे फॉर्मॅटिंग; text, number आणि Date यांची ओळख), महत्त्वपूर्ण फंक्शन्स (SUM, AVERAGE, COUNT, MIN, MAX), डेटा सॉर्टिंग आणि फिल्टरिंग, कंडिशनल फॉर्मॅटिंग, मूलभूत चार्ट तयार करणे (लाइन, कॉलम, पाई चार्ट आणि त्यांचे विश्लेषण)	10
II	मध्यम-स्तरीय एक्सेल कौशल्ये: सूत्रे (Formulas) आणि फंक्शन्स (IF, VLOOKUP, HLOOKUP, COUNTIF, CONCATENATE), पिक्चोट टेबल आणि पिक्चोट चार्ट (विश्लेषण करून संक्षिप्त अहवाल तयार करणे), डेटा व्हॅलिडेशन आणि ट्रॉप-डाउन सूची, एक्सेल टेबलसची ओळख (टेबलसाठी ठरावीक संदर्भ आणि उपयोगी साधने), एकापेक्षा जास्त (Multiple) वर्कशीट्ससह कार्य करणे (शीट्समध्ये डेटा लिंक करणे, 3D संदर्भ वापरणे)	10
III	एडव्हान्स डेटा विश्लेषण आणि अहवाल तयार करणे: एडव्हान्स फंक्शन्स (INDEX, MATCH, text फंक्शन्स आणि नेस्टेड फॉर्म्युले), डेटा Cleaning तंत्र (डुप्लिकेट हटवणे, missing value हाताळणे, "Text to Columns" चा वापर करून डेटा विभाजित करणे), एक्सेल मॅक्रोची ओळख (मॅक्रो वापरणे व रेकॉर्ड करण्याचे बेसिक नियम), डेटा विडज्युअलायझेशन आणि प्रगत (Advance) चार्ट प्रकार (कॉम्बो चार्ट, वॉटरफॉल चार्ट इ.) व गरजेनुसार बदल करणे, केस स्टडीज (कला आणि वाणिज्य शाखेतील प्रत्यक्ष डेटासंबंधी समस्यांचे समाधान)	10
Learning Resources: <ol style="list-style-type: none"> Excel Data Analysis For Dummies: Paul McFedries Microsoft Excel 365 Data Analysis and Business Modeling: Wayne L. Winston Excel 2019 Bible: Michael Alexander, Richard Kusleika, and John Walkenbach Data Analysis Using Microsoft Excel: Ash Narayan Sah Excel Basics to Blackbelt: Elliot Bendoly 		



VSC-1: Solar Cell Devices Course Code: PHY/VSC/T/ 200 Examination Code: SEC00062003T		
Total Contact Hours: 15 Credit 01 Marks 50 (CA=20, ESE 30)		
Learning Objectives: <i>By the end of this course, students will be able to:</i> <ul style="list-style-type: none"> • Understand the fundamental principles of solar energy and photovoltaic technology. • Learn about the materials and fabrication processes involved in solar cells. • Develop skills to analyze and evaluate the performance of solar cells. • Explore advancements and applications in solar technology 		
Course Outcomes: <i>On successful completion of this course students will be able to:</i> <ul style="list-style-type: none"> • Explain the principles of photovoltaic energy conversion. • Identify and compare materials used in various types of solar cells. • Demonstrate an understanding of solar cell fabrication and testing techniques. • Analyze solar cell performance using key metrics like efficiency and fill factor. • Discuss challenges and future trends in solar cell technology 		
Module No.	Topic/Actual content of the syllabus	Contact Hours
I	Introduction to Solar Energy and Photovoltaic Technology: Introduction to solar energy and its significance in renewable energy systems, Photovoltaic effect and principles of solar cells. Overview of different types of solar cells: monocrystalline, polycrystalline, thin-film, organic, and perovskite.	05
II	Fundamentals of Solar Energy: Basics of semiconductor physics for photovoltaics, including bandgap, charge carriers, and recombination. Key parameters in solar cells: efficiency, open-circuit voltage, short-circuit current, and fill factor, Properties of solar cell materials, Materials for solar cells, Fabrication methods.	05
III	Performance Analysis and Applications of Solar Cells: Electrical characterization: I-V curve measurement, efficiency calculation and fill factor analysis, Spectral response and external quantum efficiency measurements. Environmental testing: stability under temperature, humidity, and UV exposure, Advances in solar cell technology, Applications and integration.	05
Learning Resources: <ol style="list-style-type: none"> 1) Principles of Solar Cells, LEDs and Related Devices: The Role of the PN Junction, 2nd Edition, Adrian Kitai, Wiley. 2) Solar Cell Devices II nd Edition Stephen J. Fonash Academic Press is an imprint of Elsevier. 3) 4.. Solar Cells from Basics to Advanced Systems Chenming Hu Richard M. White University of California, Berkeley McGraw-Hill Series in Electrical Engineering ISBN D-D7-D3Q7MS-fl. 4) 5. Physics of Solar Cells, Wuerfel Peter, Wiley-VCH Verlag GmbH 5) 6. Solar Energy: Principles of Thermal Collection and Storage by S.P. Sukhatme, Tata Mc Graw-Hill 6) 7. Solar energy by M P Agarwal, S Chand and Co. Ltd. 		



VSC-2: Electrical Vehicle Technology Course Code: PHY/VSC/T/ 201 Examination Code: SEC00062013T		
Total Contact Hours: 15	Credit 01	Marks 50 (CA=20, ESE 30)
Learning Objectives: <i>By the end of this course, students will be able to:</i> <ul style="list-style-type: none"> To provide fundamental knowledge of electric vehicle systems, components, and principles of operation. To develop an understanding of energy storage, battery technologies, and charging infrastructure. To equip students with hands-on experience in basic diagnostics, assembly, and testing of EV components. 		
Course Outcomes: <i>On successful completion of this course students will be able to:</i> <ul style="list-style-type: none"> Demonstrate a clear understanding of electric vehicle technology and its role in sustainable mobility. Apply knowledge of battery systems, energy management, and charging techniques in practical scenarios. Perform basic diagnostics, assembly, and maintenance of electric vehicles. 		
Module No.	Topic/Actual content of the syllabus	Contact Hours
I	Overview of Electric Vehicles (EVs): Definition, types, and advantages, Comparison of EVs with internal combustion engine (ICE) vehicles, Environmental and economic benefits of EVs, Career opportunities in the EV sector.	05
II	EV Components and Systems: Basic EV Architecture: Powertrain, motor, controller. Battery Technology: Types, working principles, capacity, energy density. Charging Systems: Types of chargers, charging standards and infrastructure, Regenerative Braking Systems.	05
III	Emerging Trends and Challenges in EV Technology: Smart Features in EVs: Connectivity, IoT, and autonomous capabilities. Challenges: Range anxiety, battery recycling, and infrastructure limitations, Future Trends: Advances in battery technology, hydrogen fuel cells, hybrid EVs, Government initiatives and policies for EV adoption in India.	05
Learning Resources: <ol style="list-style-type: none"> Modern Electric Hybrid Electric & Fuel Cell Vehicles, by Stefano Longo Mehرداد Ehsani, Yimin Gao, TAYLOR & FRANCIS EXCLUSIVE(OTHERS); Third edition (2019) Electric and Hybrid Vehicles, by A. K. Babu, Khanna Publishing (2022) Electric and Hybrid Electric Vehicles, by James D. Halderman, Curt Ward, Pearson Education India, Fundamentals of Hybrid and Electric Vehicles, by Prof. K.C.Jain, Dr.Amit R.Patil, Dr. Arvind J. Bhosale, Dr. S.S. Raghuvanshi, Khanna Publishers New Delhi; First Edition (2024) 		

**VSC-3: Practical's based on VSC-1****Course Code: PHY/VSC/P/ 226****Examination Code: SEC00062263P****Total Contact Hours: 30****Credit 02****Marks 50 (CA=20, ESE 30)****Learning Objectives:** *By the end of this course, students will be able to:*

- Understand the I-V characteristics of a solar cell and analyze its performance under varying conditions.
- Examine the effect of light intensity on the efficiency and output power of a solar cell.
- Demonstrate the impact of series and parallel connections on the voltage and current output of solar cells.
- Investigate the spectral response, quantum efficiency, and temperature dependence of solar cell efficiency.

Course Outcomes: *On successful completion of this course students will be able to:*

- Analyze the I-V characteristics of a solar cell and determine key performance parameters.
- Evaluate the effect of light intensity and temperature variations on solar cell efficiency.
- Compare the electrical behavior of solar cells connected in series and parallel configurations.
- Interpret spectral response and quantum efficiency data for solar cell performance assessment.

Expt. No	Name of Experiment
1	I-V Characteristics of a Solar Cell
2	Effect of Light Intensity on Solar Cell Performance
3	Series and Parallel Connection of Solar Cells
4	Spectral Response and Quantum Efficiency of Solar Cells
5	Temperature Dependence of Solar Cell Efficiency



VSC-4: Practical's based on VSC-2

Course Code: PHY/VSC/P/227

Examination Code: SEC00062273P

Total Contact Hours: 30

Credit 02

Marks 50 (CA=20, ESE 30)

Learning Objectives: *By the end of this course, students will be able to:*

- Develop hands-on skills in assembling, testing, and troubleshooting electric vehicle (EV) components.
- Understand the working principles of an electric drive system, including motor and controller integration.
- Foster problem-solving abilities by diagnosing issues and maintaining basic EV systems effectively.

Course Outcomes: *On successful completion of this course students will be able to:*

- Demonstrate proficiency in assembling and testing a basic electric drive system, ensuring proper functionality.
- Analyze and troubleshoot issues in EV components, such as motor performance or battery connections.
- Apply safety practices while handling EV components and performing maintenance tasks, ensuring reliability and durability.

Expt. No	Name of Experiment
1	Basic EV Component identification and functionality. <i>Identifying key EV components: Battery, motor, controller, inverter, etc., Understanding the functionality of each component.</i>
2	Battery Management and Safety <i>Basics of lithium-ion battery handling and safety precautions, Simple experiments on battery charging and discharging cycles</i>
3	Assembly of a Simple Electric Drive System <i>Connecting a basic motor and controller circuit for a small EV model, Testing and troubleshooting assembly issues</i>
4	EV Charging Station Setup and Operation <i>Demonstrating the working of an EV charging station, Practical exposure to plug-in charging systems and safety protocols</i>
5	Basic EV Diagnostics and Maintenance <i>Using diagnostic tools to identify issues in EV systems, performing routine maintenance tasks like checking battery health and motor performance</i>



SEMESTER- IV



DSC-9: Heat and Thermodynamics Course Code: PHY/DSC/T/250 Examination Code: SAC00062504T		
Total Contact Hours: 30 Credit 02 Marks 50 (CA=20, ESE 30)		
Learning Objectives: <i>By the end of this course, students will be able to:</i> <ul style="list-style-type: none"> • Learn about the heat and transfer of heat, flow of heat which is helpful to know the concept of thermal conductivity. • To gain the knowledge of kinetic theory of heat, state change, Behaviour of gases at different thermodynamic conditions. • Gain knowledge about the laws of thermodynamics, and thermodynamic process • Acquire the knowledge of heat engine, and its efficiency. 		
Course Outcomes: <i>On successful completion of this course students will be able to:</i> <ul style="list-style-type: none"> • Understand the concepts of heat and thermodynamics. • Describe and apply the physical concepts of heat, and laws of thermodynamics. • Develop ability among the students to identify, remember and grasp the meanings, definitions and laws of heat and thermodynamics. • Perform calculations of heat conduction in various geometries. 		
Module No.	Topic/Actual content of the syllabus	Contact Hours
I	Thermal Conductivity: Introduction, Modes of transfer of heat, Coefficient of thermal conductivity, Recti-linear flow of heat along a metal bar, Methods of radial flow of heat: 1) Spherical shell method, 2) Flow of heat along the wall of a cylindrical tube, Thermal conductivity of a bad conductor by using Lees and Chariton's method, Comparison of conductivities of different metals (Ingen-Hausz experiment), numericals	10
II	Kinetic Theory of Heat: Introduction, Mean free path, Sphere of influence, Expression for mean free path (Clausius expression and Maxwell's formula), Variation of Mean free path with temperature and pressure, Change of state, Behavior of gases at high pressure, Reason for modification of a gas equation, Van-der Waal's equation of state, Critical point and critical constants, Estimation of critical constants, Constant of Van-der Waal's equation, numericals	10
III	Thermodynamics: Introduction, Thermodynamical system, Zeroth Law of Thermodynamics, First law of thermodynamic, Thermodynamic processes (isothermal, adiabatic, isochoric, isobaric), P-V diagram or indicator diagram, Work done during isothermal process, Work done during adiabatic process, Second law of thermodynamics (Kelvin and Clausius statement).	10
Learning Resources: <ol style="list-style-type: none"> 1. Physics for degree students. B.Sc. Second year, C. L. Arora, Dr. P. S. Hemne, S-Chand and Company Pvt. Ltd. (Second Revised Edition-2013). 2. Heat and Thermodynamics – D. S. Mathur (S. Chand Publications) 3. Heat, thermodynamics and Statistical Physics. Brijlal, Dr. N. Subramanyam, P. S. Hemne. S-Chand and Company Pvt. Ltd. (Revised Edition-2010). 4. Heat and thermodynamics, S.S. Singhal, J. P. Agarwal, S. Praksh. Pragati Prakashan. 5. Thermodynamics and Statistical Physics. S.L. Kakani. 		



DSC-10: Electrodynamics Course Code: PHY/DSC/T/251 Examination Code: SAC00062514T		
Total Contact Hours: 30	Credit 02	Marks 50 (CA=20, ESE 30)
Learning Objectives: <i>By the end of this course, students will be able to:</i> <ul style="list-style-type: none"> Understand electrostatics and apply Gauss's law to find electric fields. Learn electromagnetic induction and derive Maxwell's equations. Study the nature and propagation of electromagnetic waves. Apply Poisson's and Laplace's equations in electrostatics. Understand Poynting's theorem and energy flow in waves. 		
Course Outcomes: <i>On successful completion of this course students will be able to:</i> <ul style="list-style-type: none"> Apply Gauss's law to calculate electric fields. Explain and derive Maxwell's equations. Analyze electromagnetic waves in different media. Solve problems on induction and displacement current. Use Poynting's theorem for energy flow analysis. 		
Module No.	Topic/Actual content of the syllabus	Contact Hours
I	Electrostatics: Introduction, Electric field lines, electric flux and Gauss law, the divergence of E, Curl of E, Application of Gauss law: i) Electric field due to a uniform charged sphere ii) Electric field due to charged cylinder, Gaussian pillbox, Poisson's equation, Laplace's equation, Uniqueness theorem (Statement only), numericals.	10
II	Time Varying Fields: Faraday's Law of Electromagnetic induction, Lenz's law, Self-Induction, Mutual Induction, equation of continuity, Maxwell's displacement current, Maxwell's equations (Derivation by differential form), numericals.	10
III	Electromagnetic waves: Origin of electromagnetic waves, characteristics of electromagnetic wave, electromagnetic wave equations in a conducting medium, transverse nature of electromagnetic wave, plane polarized electromagnetic wave, The Poynting Vector, Poynting theorem, Polarization of Electromagnetic waves, numericals.	10
Learning Resources: <ol style="list-style-type: none"> 1. Introduction to Electrodynamics-David J. Griffiths, Third Edition. 2. Mechanics and Electrodynamics - Brijlal N. Subrahmanyam, Jivan Seshan 3. Classical Electrodynamics – S.P. Pure 4. Electrodynamics- B.B. Laud 5. Electrodynamics-Gupta, Kumar and Singh, Pragati Prakashan, Meerut 6. Electromagnetic waves and fields –R.N.Singh. 		



DSC-11: Practical's based on DSC-09

Course Code: PHY/DSC/P/276

Examination Code: SAC00062764P

Total Contact Hours: 60

Credit 02

Marks 50 (CA=20, ESE 30)

Learning Objectives: *By the end of this course, students will be able to:*

- To develop practical skills in basic and conceptual Physics.
- To develop students to learn measuring skills in practical.
- To familiarize students with fundamental experimental techniques related to heat, conductor of heat and thermal conductivity.
- To prepare students for advanced laboratory work and increase the curiosity.

Course Outcomes: *On successful completion of this course students will be able to:*

- Understand the theoretical principles of basic practical Physics
- Develop awareness of minimizing errors.
- Handle carefully various instruments.
- Correlate theoretical concepts with the help of experiments.
- Gain knowledge about heat, conduction of heat, thermal conductivity of different materials and other phenomena of heat.

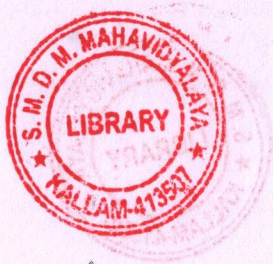
Expt. No	Name of Experiment
1	Thermal conductivity of rubber tube using Barton's correction
2	Determination of the thermal conductivity of a bad conductor by Lee's disc method.
3	To find the coefficient of thermal conductivity of a metal using Searle's apparatus
4	Determination of Stefan's constant by using thermocouple
5	To determine the temperature coefficient of the material of a wire using meter bridge
6	To determine the thermal conductivity of a materials by using Forbes method
7	To study the relationship between the temperature of a hot body and time by plotting a cooling curve. (Newton's law of cooling using a simple colorimeter)
8	Determination of melting point by cooling curve method
9	Study of temperature dependence of total radiation
10	Determination of the value of the mechanical equivalent of heat (J) by electrical method.

Learning Resources:

- 1) B. Sc. Practical Physics - C. L. Arora (S. Chand Publications)
- 2) College Practical Physics -Khanna and Gulati (S. Chand Publication)
- 3) Practical Physics -Gupta and Kumar (Pragati Prakashan, Meerut)
- 4) A text book of Practical physics - Shrinivasan and Balsubramanyam.



DSC-12: Practical's based on DSC-10 Course Code: PHY/DSC/P/277 Examination Code: SAC00062774P	
Total Contact Hours: 60	Credit 02
Marks 50 (CA=20, ESE 30)	
Learning Objectives: <i>By the end of this course, students will be able to:</i> <ul style="list-style-type: none"> Understand the magnetic field along the axis of a circular coil. Determine Earth's horizontal and vertical magnetic components using an inductor. Analyze self and mutual inductance of coils using experimental methods. Verify electrical network theorems and study rectifier circuits. 	
Course Outcomes: <i>On successful completion of this course students will be able to:</i> <ul style="list-style-type: none"> Measure and analyze the magnetic properties of materials using a magnetometer. Determine inductance and charge sensitivity using bridge and galvanometer techniques. Verify the capacities of condenser using De'Sauty's method. Determine the AC mains frequency using a sonometer experiment. 	
Expt. No	Name of Experiment
1	Field along the axis of circular coil
2	Determination of absolute value of BH and BV by using Earths Inductor
3	B-H curve using magnetometer
4	To find the coefficient of mutual inductance of two coils
5	To find the coefficient of self-inductance by Rayleigh method
6	To determine the charge sensitivity of a moving coil B.G. using known capacitor
7	Determination of frequency of AC mains by sonometer
8	Determine the constant of B.G. by using standard condenser method.
9	To compare capacitances using De'Sauty's bridge
10	Maxwell's bridge
Learning Resources: <ol style="list-style-type: none"> 1) B. Sc. Practical Physics - C. L. Arora (S. Chand Publications) 2) College Practical Physics - Khanna and Gulati (S. Chand Publication) 3) Practical Physics - Gupta and Kumar (Pragati Prakashan, Meerut) 4) A text book of Practical physics - Shrinivasan and Balsubramanyam 	



Minor - 3: Nuclear Chemistry

Course Code: PHY/Mn/T/250

Examination Code: SCC00062504T

Total Contact Hours: 30

Credit 02

Marks 50 (CA=20, ESE 30)

Learning Objectives: *By the end of this course, students will be able to:*

- Understand the fundamental concepts of nuclear chemistry, including radioactivity, nuclear reactions, and the principles of radioactive decay, with an emphasis on their theoretical and practical applications.
- Analyze and calculate energy changes in nuclear fission and fusion processes, and gain insights into the design, working, and safety aspects of nuclear reactors and radiation chemistry.
- Explore the applications of radioactive isotopes and tracers in diverse fields such as medicine, agriculture, analytical chemistry, and age determination techniques.

Course Outcomes: *On successful completion of this course students will be able to:*

- Understand the principles of radioactivity and radioactive decay, including half-life and radioactive equilibrium, and their applications in various fields.
- Analyze nuclear reactions, including fission and fusion, and evaluate the processes and energy changes involved in nuclear reactors and radiation chemistry.
- Apply the use of radioactive isotopes and tracers in medicine, agriculture, analytical chemistry, and age determination techniques.

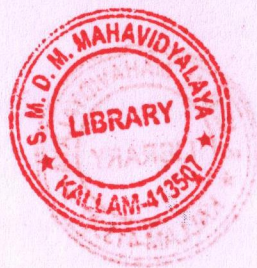
Module No.	Topic/Actual content of the syllabus	Contact Hours
I	Radioactivity: Rays from radioactive materials, radioactive disintegration, half-life period, radioactive equilibrium. Steady state, Theory of radioactivity, Carbon dating	10
II	Nuclear Fission: Calculation of energy released in nuclear fission, the fission chain reaction, The concept of critical mass, nuclear fusion, nuclear reactions, Radiation chemistry, Radiolysis of water, nuclear reactor	10
III	Radioactive Isotopes: Radiochemical principle in the use of tracers, applications of tracers in chemical investigations, physiochemical methods, analytical applications, age determinations, medical applications, agricultural applications	10

Learning Resources:

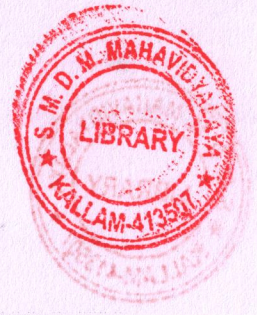
- 1) Nuclear Chemistry: Maheshwar Sharon, Madhuri Sharon, Springer; 2nd edition (1 February 2021)
- 2) Handbook of Nuclear Chemistry: Vol. I: Basics of Nuclear Science" Edited by Attila Vértés, Sándor Nagy, Zoltán Klencsár, Rezso György Lovas, Frank Rösch, Springer-Verlag New York Inc.; 2nd ed. 2011 edition (10 December 2010)
- 3) Nuclear and Radiochemistry: Gerhart Friedlander, Joseph W. Kennedy, and Julian M. Miller, by Gerhart Friedlander, Joseph W. Kennedy, Edward S. Macias, Julian Malcolm Miller, Wiley India Pvt Ltd; Third edition (29 January 2013)



Minor-4: Thermal Physics Course Code: PHY/Mn/T/251 Examination Code: SCC00062514T		
Total Contact Hours: 30 Credit 02 Marks 50 (CA=20, ESE 30)		
Learning Objectives: <i>By the end of this course, students will be able to:</i> <ul style="list-style-type: none"> Understand the principles of thermometry and various temperature measurement techniques. Develop a comprehensive understanding of heat transfer methods, focusing on thermal conductivity and its measurement techniques. Learn the basic concepts of thermodynamics, including laws, processes, and the application of thermodynamic equations. Gain hands-on experience in analyzing and solving practical problems related to heat transfer and thermodynamic processes. 		
Course Outcomes: <i>On successful completion of this course students will be able to:</i> <ul style="list-style-type: none"> Explain and apply the concepts of temperature, thermometers, and various temperature scales. Develop proficiency in calculating and interpreting thermal conductivity using different methods. Apply the laws of thermodynamics to various thermodynamic processes and calculate work done in specific processes. Students will be capable of using and understanding temperature measurement techniques and solving problems related to heat transfer and thermodynamics. 		
Module No.	Topic/Actual content of the syllabus	Contact Hours
I	Thermometry: Introduction, Concept of heat, temperature and its importance, Principles of thermometry and temperature scales (Celsius, Fahrenheit, Kelvin, and Rankine), Conversion between temperature scales, liquid-in-glass thermometers (mercury and alcohol), Gas thermometers (constant volume and constant pressure), Resistance thermometers: Principle and working, Thermocouples: Seebeck effect and thermoelectric series, Platinum resistance thermometer, numericals.	10
II	Heat Transfer: Introduction, transference of heat, coefficient of thermal conductivity, rectilinear flow of a heat along a metal bar, methods of radial flow of heat, (i) spherical shell method, and (ii) flow of heat along the wall of a cylindrical tube, comparison of conductivities of different metals (Ingen-Hause experiment), numericals.	10
III	Basic Concepts of Thermodynamics: Introduction, Zeroth law of thermodynamics, Thermodynamic variables, and equation of state, Van der Waal's equation of state, Estimation of critical constants, Differential form of the First Law of Thermodynamics, Application of the first law for (i) Cyclic Process (ii) Adiabatic Process (iii) Isochoric Process (iv) Isobaric Process and (v) Isothermal Process, Adiabatic Equations for Perfect gas, Work done during isothermal change, and adiabatic change, numericals.	10
Learning Resources: <ol style="list-style-type: none"> 1) Concept of Physics: H. C. Verma, Bharati Bhavan Publisher. 2) Heat and Thermodynamics: Brijlal, N. Subrahmanyam, S. Chand and Company Ltd. 3) Heat and Thermodynamics: Mark W. Zemansky, Richard H. Dittman, 7th Edition, Mc-Graw Hill, International Edition. 4) Thermodynamics and Statistical Physics: J. K. Sharma, K. K. Sarkar, Himalaya Publishing House. 5) Thermal Physics (Heat and Thermodynamics): A. B. Gupta, H. P. Roy books and Allied (P) Ltd. Calcutta. 		



GE/OE-2: Renewable Energy Course Code: PHY/GE/OE/T/250 Examination Code: SDC00062504T		
Total Contact Hours: 30 Credit 02 Marks 50 (CA=20, ESE 30)		
Learning Objectives: <i>By the end of this course, students will be able to:</i> <ul style="list-style-type: none"> • Know the need of renewable energy resources, historical and latest developments • Discuss wind energy conversion systems and explain sources of geothermal energy • Describe different biogas plants and working of different gasifiers • Explain the working principle of different fuel cells and ocean thermal energy conversion systems • Compare Solar, Wind and bio energy systems, their prospects, advantages and limitations 		
Course Outcomes: <i>On successful completion of this course students will be able to:</i> <ul style="list-style-type: none"> • Understand different energy sources, their availability, and the advantages and limitations of renewable energy sources. • Explain the working principles of wind and geothermal energy systems, along with their benefits and limitations. • Learn about biomass and biogas-based energy production, their conversion processes, and applications. 		
Module No.	Topic/Actual content of the syllabus	Contact Hours
I	Introduction to Energy sources: Energy sources and their availability, non-conventional sources, advantages of renewable energy sources, prospects of renewable energy sources. Sun as a source of energy: Solar energy collectors – flat plate collectors and concentrating collectors, solar energy. Storage systems: mechanical, electrical, chemical and electro-magnetic, solar pond. Applications of solar energy: solar water heating, solar distillation, solar cooking	10
II	Wind and Geothermal Energy: Wind Energy: Introduction, Principle of wind energy conversion, Advantages and disadvantages of wind mills, Applications of wind energy, Geothermal energy: Introduction - Estimates of Geothermal Power - Nature of geothermal, fields - Geothermal resources - Hydrothermal (convective) Resources Geo pressured resources	10
III	Bio-Energy: Energy from biomass - Sources of biomass. Different species: Conversion of biomass into fuels. Energy through fermentation: Pyrolysis, gasification and combustion, Biogas plants, Properties and characteristics of biogas.	10
Learning Resources: <ol style="list-style-type: none"> 1) Non-Conventional Energy Resources by B.H. Khan, Tata McGraw Hill Pub., 2009 2) Solar Energy, Fundamentals and Applications, Garg, Prakash, Tata McGraw Hill 3) Solar energy - M P Agarwal - S Chand and Co. Ltd 4) Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd 5) Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi 		



GE/OE: : नूतनीकरणयोग्य ऊर्जा Course Code: PHY/GE/OE/T/250 Examination Code: SDC00062504T		
एकूण संपर्क तास: 30	क्रेडिट 02	गुण: 50 (CA=20, ESE 30)
Learning Objectives: या कोर्सच्या शेवटी विद्यार्थी हे शिकू शकतील: <ul style="list-style-type: none"> नूतनीकरणयोग्य ऊर्जा स्रोतांची गरज, त्याचा इतिहास आणि नवी प्रगती समजून घेणे. वायु ऊर्जा रूपांतरण प्रणालींवर चर्चा करणे आणि भू-औष्णिक ऊर्जा स्रोत समजावून सांगणे. वेगवेगळ्या बायोगॅस प्रकल्पांचे प्रकार आणि विविध गॅसिफायरची कार्यपद्धती समजून घेणे. विविध इंधन पेशी (फ्युएल सेल्स) आणि महासागर तापीय ऊर्जा रूपांतरण प्रणालींचे कार्य समजावून सांगणे. सौर, वायु आणि जैव-ऊर्जा प्रणालींची तुलना करणे, त्यांचे भविष्यातील उपयोग, फायदे आणि मर्यादा समजून घेणे. 		
Course Outcomes: हा कोर्स यशस्वीरीत्या पूर्ण केल्यावर विद्यार्थी हे करू शकतील: <ul style="list-style-type: none"> विविध ऊर्जा स्रोत, त्यांची उपलब्धता, तसेच नूतनीकरणयोग्य ऊर्जा स्रोतांचे फायदे आणि मर्यादा समजून घेणे. वायु आणि भू-औष्णिक ऊर्जेच्या तत्वांवर आधारित प्रणालींचे कार्य, त्यांचे फायदे आणि मर्यादा समजावून सांगणे. बायोगॅस आणि बायोगॅसवर आधारित ऊर्जा निर्मितीचे प्रकार, प्रक्रिया आणि त्यांचे उपयोग समजून घेणे. 		
प्रकरण क्र.	अभ्यासक्रमाचा विषय/वास्तविक सामग्री	एकूण तास
I	ऊर्जा स्रोतांची ओळख: ऊर्जा स्रोत आणि त्यांची उपलब्धता, अपारंपरिक स्रोत, नूतनीकरणयोग्य ऊर्जा स्रोतांचे फायदे, आणि त्यांची भविष्यातील संधी. सूर्य ऊर्जेचा स्रोत: सौर ऊर्जा गोळा करणारे उपकरणे – सपाट प्लेट संकलक (Flat Plate Collector) आणि केंद्रित संकलक (concentrating collectors), सौर ऊर्जा साठवण प्रणाली – यांत्रिक, विद्युत, रासायनिक आणि विद्युत चुंबकीय पद्धती, सौर तलाव, तसेच सौर ऊर्जेची उपयोगिता – सौर ऊर्जेने पाणी तापवणे, सौर आसवन (Distillation), आणि सौर ऊर्जेचा उपयोग करून स्तरापात तयार करणे.	10
II	वायु आणि भू-औष्णिक ऊर्जा: वायु ऊर्जा: परिचय, वायु ऊर्जा रूपांतरणाची तत्वे, पवनचक्क्यांचे फायदे आणि तोटे, वायु ऊर्जेचे उपयोग. भू-औष्णिक ऊर्जा: परिचय: भू-औष्णिक ऊर्जेच्या उपलब्धतेचा अंदाज, भू-औष्णिक क्षेत्रांचे स्वरूप, भू-औष्णिक स्रोत, हायड्रोथर्मल (संवहनी) स्रोत आणि भू-दाबयुक्त स्रोत.	10
III	जैव-ऊर्जा: जैव इंधनातून ऊर्जा, बायोगॅसचे स्रोत – विविध प्रकारचे वनस्पती आणि इंधनांमध्ये रूपांतरण, ऊर्जा निर्मितीसाठी प्रक्रिया: आंबवणे (फरमेंटेशन), पायरोलीसिस, वायूकरण आणि ज्वलन, बायोगॅस प्रकल्प: बायोगॅसचे गुणधर्म आणि वैशिष्ट्ये	10
Learning Resources: <ol style="list-style-type: none"> 1) Non-Conventional Energy Resources by B.H. Khan, Tata McGraw Hill Pub., 2009 2) Solar Energy, Fundamentals and Applications, Garg, Prakash, Tata McGraw Hill 3) Solar energy - M P Agarwal - S Chand and Co. Ltd 4) Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd 5) Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi 		



SEC-1: Drone Technology Course Code: PHY/SEC/T/250 Examination Code: SEC00062504T		
Total Contact Hours: 15 Credit 01 Marks 50 (CA=20, ESE 30)		
Learning Objectives: <i>By the end of this course, students will be able to:</i> <ul style="list-style-type: none"> To provide foundational knowledge about Drones, their components, and working principles. To explore the applications of Drones in different businesses, commerce, and industries, such as Agriculture, Logistics and Healthcare. To equip students with practical skills in operating Drones using Mobile Phone applications. 		
Course Outcomes: <i>On successful completion of this course students will be able to:</i> <ul style="list-style-type: none"> Understand the basic principles, components, and navigation systems of Drones. Identify various applications of Drones in businesses, commerce, and industries like Agriculture and Logistics. Recognize the legal, safety, and ethical guidelines for responsible Drone operation. 		
Module No.	Topic/Actual content of the syllabus	Contact Hours
I	Introduction to Drone Technology: History and Evolution of Drones. Types of Drones: Fixed-wing, Multi-rotor, and Hybrid. Components of a Drone: Frame, Propellers, Motors, Batteries, and Flight Controllers, Basics of Drone Navigation and Communication Systems	05
II	Applications of Drone Technology: Drones in Creative Arts: Aerial photography, videography, and creative projects, Drones in Commerce: Logistics, inventory management, and marketing campaigns. Other Applications: Disaster Management, Agriculture, and Real Estate, healthcare (e.g., medical supply delivery), environmental monitoring	05
III	Legal and Ethical Considerations: Drone Regulations and Permissions: Regulations of DGCA India-2021 (e.g., no-fly zones, altitude limits), FAA of USA (e.g., drone registration, Part 107 certification), and the importance of maintaining flight logs for compliance. Safety Measures in Drone Operations: Drone Safety and Risk Management. Ethical Issues in Drone Usage: Privacy, Security, and Environmental Concerns	05
Learning Resources: <ol style="list-style-type: none"> "Drone Technology for Beginners – Learn, Build, Fly Drones", by Dharna Nar and Dr. Radhika Kotecha, Published by Drone School India and Ane Books Pvt Ltd (2024) "Basics of Unmanned Aerial Vehicles: Time to Start Working on Drone Technology" by Garvit Pandya, Notion Press Chennai, (2021) "Fundamentals of Drone Technology", by I.V.S. Yeswanth, V.S. Sridhar, Authors Click Publishing (2024) Directorate General of Civil Aviation (DGCA), India, The Drone Rules, 2021, The Federal Aviation Administration (FAA) USA, (Drone Pilot Training Guide) Students are encouraged to refer to the official documentation of the listed tools and stay updated with emerging drone technologies and applications. 		



SEC-2: Generative AI Course Code: PHY/SEC/T/251 Examination Code: SEC00062504T		
Total Contact Hours: 15	Credit 01	Marks 50 (CA=20, ESE 30)
Learning Objectives: <i>By the end of this course, students will be able to:</i> <ul style="list-style-type: none"> • Introduce students to foundational concepts, tools, and applications of Generative AI. • Equip students to creatively apply Generative AI for text, image, and audio content generation. • Provide practical exposure to using Generative AI tools on mobile and desktop platforms. • Foster an understanding of the ethical implications and societal impact of Generative AI. 		
Course Outcomes: <i>On successful completion of this course students will be able to:</i> <ul style="list-style-type: none"> • Understand the foundational principles of Generative AI, including its capabilities and limitations. • Apply Generative AI tools to create innovative and practical content across domains. • Evaluate and address ethical considerations, such as copyright, misinformation, and privacy. • Explore career opportunities and emerging trends in Generative AI. 		
Module No.	Topic/Actual content of the syllabus	Contact Hours
I	Introduction to Generative AI: Basics of Artificial Intelligence and Machine Learning: A quick overview. Definitions and key concepts of Generative AI, and an introduction to key Generative AI models, like ChatGPT, DALL-E, and other accessible tools	05
II	Generative AI Techniques: Text Generation: Natural Language Processing (NLP) and Language Models. Image Generation: Basics of GANs (Generative Adversarial Networks) and AI-based Art. Audio and Video Generation: AI in Music and Deepfake Technology	05
III	Ethical and Practical Considerations: Ethical Implications: Copyright, Privacy, and Misinformation, Responsible Use of Generative AI, Exploring AI Tools and Platforms for Beginners, Career Opportunities and Future Trends in Generative AI	05
Learning Resources: <ol style="list-style-type: none"> 1) Books: - "Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play" by David Foster, O'Reilly Media (23 July 2019) 2) Online Platforms and Tutorials: - OpenAI Platform: Explore tools like ChatGPT and DALL-E using official documentation and examples. Coursera: - Courses such as AI For Everyone by Andrew Ng provide a beginner-friendly introduction to AI. 3) Mobile Applications: - ChatGPT: For text generation and conversational AI. Dream by Wombo: For AI-generated art and image creation, Canva AI: For designing graphics and content with AI assistance. 4) Web Tutorials and Blogs: - Towards Data Science: A blog on medium offering insights into AI tools and Generative AI applications, YouTube Channels: - Tutorials from channels like "Tech with Tim" and "AI Explained" for hands-on learning. 5) AI Sandbox Tools: - Runway ML: An accessible platform for exploring image, video, and text generation using Generative AI, Voicemod: For experimenting with AI-generated audio and voiceovers. 		



SEC-3: Practical's based on SEC-1

Course Code: PHY/SEC/P/276

Examination Code: SEC00062764P

Total Contact Hours: 15

Credit 01

Marks 50 (CA=20, ESE 30)

Learning Objectives: *By the end of this course, students will be able to:*

- Understand the fundamental concepts of Drone technology and its applications in various industries.
- Gain knowledge of legal and ethical considerations related to Drone usage.
- Develop basic technical proficiency in operating Drones using Mobile Phone devices.

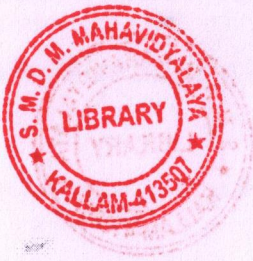
Course Outcomes: *On successful completion of this course students will be able to:*

- Demonstrate the ability to operate Drones using Android-based applications.
- Apply Drone technology for tasks such as aerial photography, videography, and route planning.
- Analyze and utilize data collected through drones for real-world applications in businesses, commerce, and industries.

Expt. No	Name of Experiment
1	Basic Drone Operation Tools: Free Android-based drone control apps (e.g., Drone Harmony, Free Flight Mini, etc.). Activity: Learn to pair and control a drone, including basic flight maneuvers, troubleshooting, common connection problems
2	Aerial Photography and Videography Tools: Open-source drone camera apps (e.g., Open Drone Map, Drone Harmony etc.). Activity: Capture aerial photos and videos for artistic or commercial use
3	Drone Navigation and Route Planning Tools: Free mission planning apps like Google Earth or QGround Control, etc. Activity: Create and execute a pre-planned flight route using GPS
4	Data Collection and Analysis Tools: Free Android-based mapping apps such as 'Drone Deploy,' 'Pix4Dcapture,' or similar apps, along with mobile-friendly GIS tools like 'Mappt' or 'SW Maps, etc. Activity: Use Android Mobile Phone apps to capture drone imagery, generate and visualize 2D/3D maps, perform analysis, (e.g., area measurements, elevation profiling, heatmaps), and interpret insights for agriculture, urban planning, or environmental monitoring
5	Simulated Drone Flight Training Tools: Free simulation mobile apps such as 'Quadcopter FX Simulator,' 'Crazyflie Simulator,' 'FPV Freerider Free Version,' or other similar apps. Activity: Practice virtual drone flights, including take-off, navigation, and landing; simulate complex routes like obstacle avoidance and GPS paths; handle emergencies like signal loss or low battery; and use analytics to track and enhance flying precision and efficiency

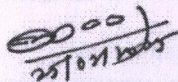


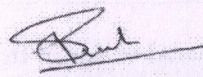
SEC-4: Practical's based on SEC-2 Course Code: PHY/SEC/P/277 Examination Code: SEC00062774P	
Total Contact Hours: 15	Credit 01
Marks 50 (CA=20, ESE 30)	
Learning Objectives: <i>By the end of this course, students will be able to:</i> <ul style="list-style-type: none"> Develop hands-on skills in using Generative AI tools for creating text, images, audio, and videos on Android mobile platforms. Understand the workflow of Generative AI-based content generation tools and their practical applications in real-world scenarios. Apply Generative AI tools creatively to design solutions for different business-related challenges. 	
Course Outcomes: <i>On successful completion of this course students will be able to:</i> <ul style="list-style-type: none"> Demonstrate proficiency in using Generative AI tools on mobile platforms to generate text, images, audio, and videos effectively. Apply Generative AI techniques to solve practical problems and create innovative content for arts, commerce, and business applications. Showcase creativity and technical skills in utilizing Generative AI tools responsibly and ethically in real-world scenarios. 	
Expt. No	Name of Experiment
1	Text Generation: Tools: ChatGPT or similar free apps. Activity: Generate creative content such as stories, blog posts, or personalized messages
2	Image Generation: Tools: Dream by Wombo, Canva AI or similar free AI art generator apps. Activity: Create AI-generated artwork and simple graphic designs using prompts
3	Voice and Audio Generation: Tools: Voicemod Clips, Voice.ai, Kinemaster and other free Android apps for text-to-speech and audio generation. Activity: Create voiceovers or generate sound effects and synthetic audio tracks
4	Video Generation and Editing: Tools: Cap Cut, In Shot, or similar free Android apps with AI-powered video editing capabilities. Activity: Produce and edit short videos by combining AI-generated content and user inputs
5	Practical AI Applications for Business and Commerce: Tools: Canva AI, Writesonic, or other free Android apps for designing marketing campaigns and content. Activity: Design social media campaigns, marketing materials, or presentations with AI-assisted tools

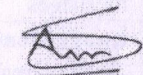


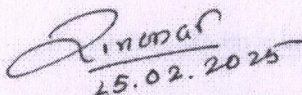
Structure / Pattern of 30 Marks Theory Course

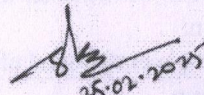
- The SEE of the theory course shall have two parts (10 + 20 = 30 Marks).
- **Part A** shall consist of 5 questions having 2 marks each (multiple choice questions / fill in the blanks / answer in sentence) as compulsory questions, and it should cover the entire course curriculum (10 Marks).
- **Part B** shall consist of 6 questions (5 marks for each question) (02 questions from each of 03 units / covering the entire syllabus), and students shall have to attempt any 04 questions out of 06 (20 Marks).
- Wherever possible, 20 to 30% weightage can be given to problems/numerical, wherein the use of a non-programmable scientific calculator may be allowed.
- The number of sub-questions (with the allotment of marks) in a question may be decided by the examiner.

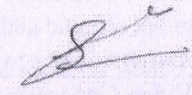

25/01/2025
Dr. M. L. Manoj

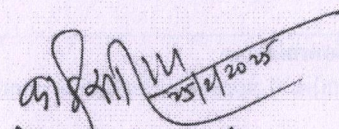

Deshmukh S.B.

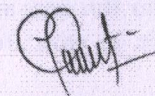

Dr. S.T. Alone

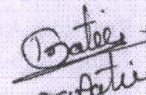

25.02.2025
Dr. R.H. Kadam

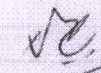

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Dr. Sayyad S.B.

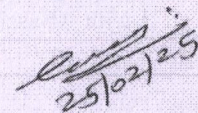

Dr. Sagar F. Shirsalkar


25/2/2025
Dr. E.M. Kale


Dr. V.K. Barote


Dr. Patekar M.R.


25.2.2025
Dr. G.M. Dharne


25/02/25