

UNIVERSITY OF MADRAS
B.Sc. DEGREE PROGRAMME IN MATHEMATICS
SYLLABUS WITH EFFECT FROM 2023-2024

COURSE	ELECTIVE PAPER
COURSE TITLE	ELECTIVE PHYSICS –II (134E2A)
CREDITS	3
COURSE OBJECTIVES	To understand the basic concepts of optics, modern Physics, concepts of relativity and quantum physics, semiconductor physics, and electronics.

UNITS	COURSE DETAILS
UNIT-I	OPTICS: interference – interference in thin films – colors of thin films – air wedge – determination of diameter of a thin wire by air wedge – diffraction – diffraction of light vs sound – normal incidence – experimental determination of wavelength using diffraction grating (no theory) – polarization – polarization by double reflection – Brewster’s law – optical activity – application in sugar industries
UNIT-II	ATOMIC PHYSICS: atom models – Bohr atom model – mass number – atomic number – nucleons – vector atom model – various quantum numbers – Pauli’s exclusion principle – electronic configuration – periodic classification of elements – Bohr magneton – Stark effect – Zeeman effect (elementary ideas only) – photo electric effect – Einstein’s photoelectric equation – applications of photoelectric effect: solar cells, solar panels, optoelectric devices
UNIT-III	NUCLEAR PHYSICS: nuclear models – liquid drop model – magic numbers – shell model – nuclear energy – mass defect – binding energy – radioactivity – uses – half life – mean life - radio isotopes and uses – controlled and uncontrolled chain reaction – nuclear fission – energy released in fission – chain reaction – critical reaction – critical size- atom bomb – nuclear reactor – breeder reactor – importance of commissioning PFBR in our country – heavy water disposal, safety of reactors: seismic and floods – introduction to DAE, IAEA – nuclear fusion – thermonuclear reactions – differences between fission and fusion.
UNIT-IV	INTRODUCTION TO RELATIVITY AND GRAVITATIONAL WAVES: frame of reference – postulates of special theory of relativity – Galilean transformation equations – Lorentz transformation equations – derivation – length contraction – time dilation – twin paradox – mass-energy equivalence – introduction on gravitational waves, LIGO, ICTS opportunities at International Centre for Theoretical Sciences

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UNIT-V	SEMICONDUCTOR PHYSICS: p-n junction diode – forward and reverse biasing – characteristic of diode – zener diode – characteristic of zener diode – voltage regulator – full wave bridge rectifier – construction and working – advantages (no mathematical treatment) – USB cell phone charger –introduction to e-vehicles and EV charging stations
UNIT-VI	PROFESSIONAL COMPONENTS: Expert lectures –seminars – – webinars – industry inputs – social accountability – patriotism
TEXT BOOKS	<ol style="list-style-type: none"> 1. R.Murugesan (2005), Allied Physics, S.Chand and Co, New Delhi. 2. K.Thangaraj and D.Jayaraman (2004), Allied Physics, Popular Book Depot, Chennai. 3. Brijlal and N.Subramanyam (2002), Textbook of Optics, S.Chand and Co, New Delhi. 4. R.Murugesan (2005), Modern Physics, S.Chand and Co, New Delhi. 5. A.Subramaniam Applied Electronics, 2nd Edn., National Publishing Co., Chennai.
REFERENCE BOOKS	<ol style="list-style-type: none"> 1. Resnick Halliday and Walker (2018), Fundamentals of Physics, 11thEdn., John Willey and Sons, Asia Pvt. Ltd., Singapore. 2. D.R.Khanna and H.R. Gulati (1979). Optics, S.Chand and Co. Ltd., New Delhi. 3. A.Beiser (1997), Concepts of Modern Physics, Tata McGraw Hill Publication, NewDelhi. 4. Thomas L. Floyd (2017), Digital Fundamentals, 11thEdn., Universal Book Stall, New Delhi. 5. V.K.Metha (2004), Principles of electronics, 6th Edn. ,S.Chand and Company, New Delhi.
WEB RESOURCES	<ol style="list-style-type: none"> 1. https://www.berkshire.com/learning-center/delta-p-facemask/https://www.youtube.com/watch?v=QrhuU47gtj4https://www.youtube.com/watch?time_continue=318&v=D38BjgUdL5U&feature=emb_logo 2. https://www.youtube.com/watch?v=JrRrp5F-Qu4 3. https://www.validyne.com/blog/leak-test-using-pressure-transducers/ 4. https://www.atoptics.co.uk/atoptics/blsky.htm - 5. https://www.metoffice.gov.uk/weather/learn-about/weather/optical-effects

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METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	75	100	

COURSE OUTCOMES:

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

COURSE OUTCOMES	CO1	Explain the concepts of interference diffraction using principles of superposition of waves and rephrase the concept of polarization based on wave patterns
	CO2	Outline the basic foundation of different atom models and various experiments establishing quantum concepts. Relate the importance of interpreting improving theoretical models based on observation. Appreciate interdisciplinary nature of science and in solar energy related applications.
	CO3	Summarize the properties of nuclei, nuclear forces structure of atomic nucleus and nuclear models. Solve problems on delayrate half-life and mean-life. Interpret nuclear processes like fission and fusion. Understand the importance of nuclear energy, safety measures carried and get our Govt. agencies like DAE guiding the country in the nuclear field.
	CO4	To describe the basic concepts of relativity like equivalence principle, inertial frames and Lorentz transformation. Extend their knowledge on concepts of relativity and vice versa. Relate this with current research in this field and get an overview of research projects of National and International importance, like LIGO, ICTS, and opportunities available.
	CO5	Summarize the working of semiconductor devices like junction diode, Zenerdiode, transistors and practical devices we daily use like USB chargers and EV charging stations.

MAPPING WITH PROGRAM OUT COMES:

Map course outcomes (CO) for each course with program outcomes (PO) in the 3-point scale of STRONG(S), MEDIUM(M) and LOW(L).

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

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COURSE	EVEN SEMESTER - CORE
COURSETITLE	ELECTIVE PHYSICS PRACTICAL– II
CREDITS	3
COURSE OBJECTIVES	Apply various Physics concepts to understand concepts of Light, electricity and magnetism and waves, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results
<p>Minimum of Eight Experiments from the list:</p> <ol style="list-style-type: none"> 1. Radius of curvature of lens by forming Newton’s rings 2. Thickness of a wire using air wedge 3. Wavelength of mercury lines using spectrometer and grating 4. Refractive index of material of the lens by minimum deviation 5. Refractive index of liquid using liquid prism 6. Determination of AC frequency using sonometer 7. Specific resistance of a wire using PO box 8. Thermal conductivity of poor conductor using Lee’s disc 9. Determination of figure of merit table galvanometer 10. Determination of Earth’s magnetic field using field along the axis of a coil 11. Characterisation of Zener diode 12. Construction of Zener/IC regulated power supply 13. Construction of AND, OR, NOT gates using diodes and transistor 14. NOR gate as a universal building block 	

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
40	60	100	