B.Sc. Physics with CA

Syllabus

AFFILIATED COLLEGES

Program Code: ***

2023 – 2024 onwards

BHARATHIAR UNIVERSITY

(A State University, Accredited with "A++" Grade by NAAC,
Ranked 21st among Indian Universities by MHRD-NIRF)

Coimbatore - 641 046, Tamil Nadu, India

BHARATHIAR UNIVERSITY:: COIMBATORE 641046

B.Sc PHYSICS (CA) Curriculum (Affiliated Colleges)

(For the students admitted during the academic year 2023– 24)

Scheme of Examination

Part	Course Code	Title of the Course	Credits	Hours/week		Maximum Marks		
				Theory	Prac-tical	CIA	CEE	Total
FIRST SEMESTER								
I	11T	Language: Tamil I	4	6	-	25	75	100
II	12E	English I	4	6	-	25	75	100
III	13A	Core I - Mechanics, Properties of Matter and Sound	4	6	-	25	75	100
III	23P	Core Practical I	-	-	3	-	-	-
III	1AA	Allied Mathematics I	4	7	-	25	75	100
IV	1FA	Environmental Studies #	2	2	-	-	50	50
	Total (First Semester)		**18**	**27**	**3**			**450**
SECOND SEMESTER								
I	21T	Language - Tamil II	4	6	-	25	75	100
II	22E	English II	2	4	-	25	25	50
II	2NM[$]	Effective English: Language Proficiency for Employability http://kb.naanmudhalvan.in/Bharathiar_University_(BU)	2	2	-	25	25	50
III	23A	Core II - Heat and Thermodynamics	4	6	-	25	75	100
III	23P	Core Practical I	4	-	3	40	60	100
III	2AA	Allied Mathematics II	4	7	-	25	75	100
IV	2FB	Value Education: Human Rights #	2	2	-	-	50	50
	Total (Second Semester)		**22**	**27**	**3**			**550**
THIRD SEMESTER								
I	31T	Language - Tamil III	4	6	-	25	75	100
II	32E	English III	4	6	-	25	75	100
III	33A	Core III - Optics	4	4	-	25	75	100
III	43P	Core Practical II	-	-	2	-	-	-
III	3AH	Allied Chemistry I	3	4	-	20	55	75
III	4PH	Allied Chemistry Practical	-	-	3	-	-	-
IV	3ZA	Skill Based Subject - MS Office	3	3	-	20	55	75
IV	3FC	Non-major elective I - Women's Rights #	2	2	-	-	50	50
	Total (Third Semester)		**20**	**25**	**5**			**500**

FOURTH SEMESTER								
I	41T	Language - Tamil IV	4	6	-	25	75	100
II	42E	English IV	4	6	-	25	75	100
III	43A	Core IV - Atomic Physics and Spectroscopy	4	4	-	25	75	100
III	43P	Core Practical - Physics Practical II	3	-	2	20	55	75
III	4AH	Allied Chemistry II	3	4		20	55	75
III	4PH	Allied Chemistry Practical	2	-	3	20	30	50
IV	4ZB	Skill based subject - Principles of Programming Concepts and C Programming	2	3	-	25	25	50
IV	4NM$	Office Fundamentals: Digital Skills for Employability http://kb.naanmudhalvan.in/Bharathiar_University_(BU)	2			25	25	50
IV	4FE	Non-major elective II - General Awareness #	2	2	-	-	50	50
	Total (Fourth Semester)		**26**	**25**	**5**			**650**
FIFTH SEMESTER								
III	53A	Core V - Mathematical Physics	4	5	-	25	75	100
III	53B	Core VI - Applied Electronics	4	4	-	25	75	100
III	53C	Core VII - Solid State Physics	4	5	-	25	75	100
III	53D	Core VIII - Electricity and Magnetism	4	4	-	25	75	100
III	63P	Core Practical III - Electronics	-	-	2	-	-	-
III	5EA	Elective I - Principles of Digital Electronics and Microprocessor	3	3	-	20	55	75
III	63Q	Elective Practical - Digital and Micro Processor	-	-	2	-	-	-
IV	5ZC	Skill based Subject - Object Oriented Programming in C++	3	3	-	20	55	75
IV	6ZP	Skill based Practical V - Object Oriented Programming in C++ and MS Office	-	-	2	-	-	-
	Total (Fifth Semester)		**22**	**24**	**6**			**550**
SIXTH SEMESTER								
III	63A	Core IX - Quantum Mechanics and Relativity	4	5	-	25	75	100
III	63B	Core X - Nuclear Physics	4	4	-	25	75	100
III	63C	Core XI - Numerical Methods	4	5	-	25	75	100
III	63D	Core XII - Fundamental of Nanomaterials	4	4	-	25	75	100
III	63P	Core Practical III - Electronics Lab	4	-	3	25	75	100
III	6EA	Elective II - MATLAB	3	3	-	20	55	75
III	63Q	Elective Practical - Digital and Micro Processor	3	-	2	20	55	75
IV	6ZP	Skill based Practical - Programming in C and C++ and MS Office	2	-	2	25	25	50

IV	6NM$	Project Based learning - Advanced Platform Technology - (Physics, Electronics, Mathematics, Statistics, Data Science) - Govt(auto) & Govt (Non-Auto) Data Analytics with Advanced Tools - (Physics, Electronics, Mathematics, Statistics, Data Science) - Aided (Non-auto) & SF (Non-Auto) http://kb.naanmudhalvan.in/Bharathiar_University_(BU)	2		2	25	25	50
V	67A	Extension Activities @	2	-	-	50	-	50
	Total (Sixth Semester)		**32**	**21**	**9**			**800**
	Grand Total		**140**					**3500**

2NM$.4NM$, & 6NM$ - Naan Mudalvan Courses.,
@ No University Examinations. Only No Continuous Internal assessment (CIA).
# No Continuous Internal assessment (CIA). Only University Examinations.

SEMESTER I

Course code	13A	MECHANICS, PROPERTIES OF MATTER AND SOUND	L	T	P	C
Core/Elective/ SBS		CORE PAPER I	6	0	0	4

Pre-requisite	The students are expected to know the fundamental properties of matter and sound	Syllabus Version	2023-24

Course Objectives:

The main objectives of this course are to:
1. explore the basic laws governing the behavior of matter in everyday life.
2. demonstrate practical knowledge and skill in understanding the elastic properties of solids.
3. identify the behavior of simple harmonic waves
4. access the importance of Ultrasonics

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	understand and define the laws involved in mechanics.	K1
2	gain deeper understanding of mechanics and its fundamental concepts.	K2
3	understand the concept of properties of matter and to recognize their applications in various real problems.	K3
4	analyze the universal behavior of wave motion.	K4
5	learning the basic concepts of elasticity, surface tension, Gravitation, viscosity, and sound and evaluating their values for various materials.	K5
6	explore the production and application of ultrasonic wave	K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Conservation Laws	18 hours

Impulse – Impact – Direct and oblique impact – Final velocity and loss of kinetic energy –Motion of a particle in a vertical circle – friction – Laws of friction – angle of friction – resultant reaction – cone of friction – Equilibrium of a body on a rough inclined plane to the horizontal and when the inclination is greater than the angle of friction.

Unit:2	Motion of Rigid Body	18 hours

Moment of inertia – Parallel and perpendicular axes theorem – M.I. of rectangular Lamina and Triangular lamina – M. I of a solid sphere about an axis through its C.G. – Compound pendulum – torque and angular momentum – Relation – Kinetic rotation – conservation of angular momentum.

Unit:3	Gravitation	18 hours

Kepler's Laws of planetary motion – Laws of gravitation – Boy's method for G –Gravitational potential – Gravitational field at a point due to spherical shell – Variation of 'g' with latitude, altitude and depth.
Elasticity: Elastic modules – Poisson's ratio – relation between them – Expression for bending moment – determination of Young's modulus by uniform and non-uniform bending – I section girders – Rigidity modulus – Static Torsion – Expression for couple per unit twist – Torsional oscillation.

Unit:4	**Surface Tension**	**16 hours**
Definition and dimension of surface Tension – Excess of Pressure over a curved surface – Variation of S.T. with temperature – Jaeger's Experiment. **Viscosity:** Definition – Rotation viscometer- viscosity of gases, Meyer's Modification of Poiseuille's formula – Rankine's method for viscosity of a gas.		
Unit:5	**Sound**	**18 hours**
Simple Harmonic vibration – Progressive waves – properties – Composition of two S.H.M. and beats – stationary waves – Properties Melde's Experiment for the frequency of electrically maintained tuning fork – Transverse and longitudinal modes – Ultrasonics –Properties and application.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**90**

Text Book(s)	
1	Properties of Matter and Acoustics, R. Murugesan, 2nd Edition, S.Chand & Co. (2017).
2	Properties of Matter, Brijlal and N.Subrahmanyam, 3rd Edition, S.Chand & Co. (2005).
Reference Books	
1	Elements of Properties of Matter, D.S. Mathur, 11th Edition, S.Chand & Co., (2010).
2	A text book of Sound, Brijlal N.Subramaniam, Vikas Publishing, 2nd edition, (2010).
3	A Textbook of Sound, M. N. Srinivasan, Himalaya Publishing house, (1991).
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.physicstutoronline.co.uk/alevelphysicsnotes/
2	https://latestcontents.com/bsc-physics-mechanics-notes/
3	www.khanacademy.org/science/physics/elasticity/surface tension
4	https://sites.google.com/brown.edu/lecture-demonstrations/home?authuser=0
Course Designed By: BoS - Physics CA	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	M	S	S	S	L	S	S
CO2	S	S	M	M	S	S	S	L	S	S
CO3	S	S	M	L	S	M	L	M	S	M
CO4	S	S	M	M	S	S	S	L	S	M
CO5	S	S	S	S	S	S	S	M	M	S
CO6	M	M	M	L	S	S	M	L	S	S

*S-Strong; M-Medium; L-Low

SEMESTER II

Course code	23A	HEAT AND THERMODYNAMICS	L	T	P	C
Core/Elective/SBS		CORE PAPER II	6	0	0	4
Pre-requisite		The students are expected to know the fundamental concepts of heat and thermodynamics	Syllabus Version		2023-24	

Course Objectives:

The main objectives of this course are to:

- investigate the role of various laws of heat and thermodynamics in our daily life
- substantiate the concepts of heat and thermodynamics experimentally
- explore the applications of heat engines

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	To realise various principles and laws of heat	K2
2	To derive expressions and find experimental verifications for the laws studied	K3
3	To analyse the applications of heat and thermodynamics in various areas and solve the real life problems.	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Calorimetry	17 hours

Definitions – Newton's law of cooling – specific heat of a liquid calendar and Barne's continuous flow method – two specific heats of a gas – specific heat of a gas by Joly's differential steam calorimeter – Regnault's method – Dulong and Petit's law – variation of specific heat and atomic heat with temperature.

Unit:2	Transmission of Heat	17 hours

Conduction: Co-efficient of thermal conductivity – Cylindrical flow of heat – Thermal conductivity of rubber – Lee's disc method for bad conductors. **Radiation:** Black body – Wein's displacement law – Raleigh-Jean's law – Stefan's law – Experimental Determination of Stefan's constant – Mathematical derivation of Stefan's law.

Unit:3	Kinetic Theory of Gases	18 hours

Maxwell's law of distribution of molecular velocities – Experimental verification – equilibrium speed distribution of velocities. Mean free path – transport phenomena – diffusion – viscosity and thermal conduction of gases – Vander walls equation – relation between Vander Wall's constant and critical constants.

Unit:4	Laws of Thermodynamics	18 hours

First law of thermodynamics – Isothermal and Adiabatic process – gas equation during an adiabatic process – Work done in adiabatic expansion of gas – Determination of γ by Clement and Desorme's method – second law of thermodynamics – Carnot's engine- Working – efficiency – Carnot's refrigerator – Carnot's Theorem.

Unit:5	**Concept of Entropy**	**18 hours**
Entropy – Change in entropy – Change in entropy in a reversible cycle – Principle of increase of entropy – temperature entropy diagram – Entropy of a perfect gas – Thermo dynamic variables – Maxwell's thermodynamical relations – Applications: Joule Thomson effect – Temperature of inversion - Claussius and Clapeyron's equation.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**90**

Text Book(s)	
1	Thermal Physics, R. Murugesan, S.Chand & Co (2008).
2	Heat & Thermodynamics, Brijlal & N. Subramaniam, S.Chand & Co (2007)
3	Heat – M. Narayanamurthi and N. Nagaratnam, National Publishers.
Reference Books	
1	Heat and Thermodynamics – Zemansky and R.H. Dcltanann, TMH (2017)
2	Heat and Thermodynamics – D.S. Mathur, S. Chand & Co. (2002).
3	Heat and Thermodynamics – Agarwal, Singhal, Sathyaprakash, KedarNath Ramnath and Co. (2003).
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.askiitians.com/revision-notes/physics/heat-transfer/
2	https://www.askiitians.com/revision-notes/physics/kinetic-theory-of-gases/
3	https://www.askiitians.com/revision-notes/physics/heat-phenomena/
4	https://www.askiitians.com/revision-notes/physics/thermodynamics/
Course Designed By: **BoS - Physics CA**	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	S	M	S	S	M	M	M
CO2	S	S	S	S	M	M	M	S	M	S
CO3	M	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

SEMESTER I & II

Course code	**23P**	**CORE PRACTICAL I** (Examination at the end of Second Semester)	**L**	**T**	**P**	**C**
Core/Elective/SBS		**CORE PRACTICAL**	**0**	**0**	**3**	**4**
Pre-requisite		Should have the fundamental knowledge of experimental Physics	**Syllabus Version**		**2023-24**	

Course Objectives:

The main objectives of this course are to:

- To develop the experimental skills in Mechanics and Properties of matter
- To gain knowledge about the experiments based on Electricity and Magnetism
- To motivate the students to apply the experimental techniques in Optics and Sound.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	analyze the concepts of Viscosity, Surface Tension and Young's Modulus of different substances	K4
2	explore the knowledge of Spectrometer and other Optical instruments	K5
3	realize principles and applications of Potentiometer, Sonometer, Magnetometer and PN junction diode.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

LIST OF EXPERIMENTS (Any twelve experiments) **84 Hours**

1. Acceleration due to gravity - Compound Pendulum
2. Surface tension of a liquid – Drop Weight Method
3. Viscosity by Capillary flow method
4. Comparison of Viscosities – Capillary Flow Method
5. Rigidity modulus – Static Torsion – Scale and Telescope
6. Young's Modulus – Non - Uniform bending – Pin and Microscope
7. Young's Modulus – Uniform bending – Optic lever
8. Young's Modulus – Cantilever – Dynamic method
9. Frequency of A.C. - Sonometer
10. Frequency of Vibrator - Melde's Strings
11. Refractive index of Solid Prism - Spectrometer
12. Determination of wave length λ - Grating – Minimum deviation - Spectrometer
13. Refractive index of Prism - (i-d) Curve - Spectrometer
14. Refractive index of liquid - Hollow prism – Spectrometer
15. Thickness of Wire - Air Wedge
16. Low range voltmeter Calibration - Potentiometer
17. Low range Ammeter Calibration - Potentiometer
18. Velocity of Sound - Resonance Column apparatus
19. Moment of magnet – Tan C Position
20. Characteristics of a Junction Diode

Contemporary Issues	6 Hours
Online workshop, Webinars on Experimental Physics	
Total Practical hours: 90	

Reference Books	
1	A text book of Practical Physics, M.N.Srinivasan, S.Balasubramanian, R.Ranganathan, Sultan Chand & Sons(2017)
2	Practical Physics and Electronics, C.C.Ouseph, U.J.Rao, V.Vijayendran, S.Viswanathan Publishers (2007)

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/course.html/physics/experimental physics I, II and III
2	https://nptel.ac.in/courses/115/105/115105110/
3	https://www.youtube.com/playlist?list=PLuiPz6iU5SQ8-rZn_LgLofRX7n8z4tHYK

Course Designed By: **BoS - Physics CA**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	M	M	S	M	L	M	S
CO2	S	S	S	M	M	M	L	M	S	S
CO3	M	M	S	S	L	M	S	S	S	M

*S-Strong; M-Medium; L-Low

SEMESTER III

Course code	33A	OPTICS	L	T	P	C
Core/Elective/ SBS		CORE PAPER III	4	0	0	4
Pre-requisite		The students should acquire knowledge basic properties of light. They should be familiar with the behaviour of light in different medium.	Syllabus Version		2023-24	

Course Objectives:

The main objectives of this course are to:
gain knowledge towards geometrical and physical optics
provide a good platform in the field of Optics
provide a basic knowledge on the behavior of light energy and their propagation
inspire the concepts of LASER and their applications.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	remember the behavior of light on passing through lens, prism, thin film and grating	K1
2	understand the phenomena of light like Interference, diffraction, polarization and population inversion	K2
3	analyze and apply the concepts of dispersive power, refractive index, resolving power, double refraction, specific rotation and optical pumping for different materials	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1 Geometrical Optics **10 hours**

Aberrations - Spherical aberrations in lens - coma - Astigmatism - chromatic aberration - dispersion by a prism - Cauchy's dispersion formula - dispersive power, achromatism in prism - deviation without dispersion - chromatic aberrations in a lens - circle of least confusion - achromatic lens - condition for achromatism of two thin lenses separated by a finite distance.

Unit:2 Physical Optics – Interference **12 hours**

Fresnel's Biprism – Interference in thin films due to reflected light – Fringes due to wedge shaped thin film – Newton's rings – Refractive index of the Liquid – Michelson interferometer – Determination of a wave length of monochromatic light – difference in Wave length between two neighboring spectral lines – Fabry Perot Interferometer.

Unit:3 Diffraction **12 hours**

Fresnel's assumptions – rectilinear propagation of light – half period zone – Zone Plates – Action and Construction – comparison with a convex lens – Fresnel and Fraunhofer diffraction – Fraunhofer diffraction at a Single light – Diffraction grating – Resolving power & Dispersive power of Grating.

Unit:4	**Polarization**	**12 hours**
Double Refraction – Huygen's explanation --Optic axis in the plane of incidence, inclined and perpendicular to the crystal surface – Production and Detection of Plane, Circularly and Elliptically Polarized light – Optical Activity – Fresnel's explanation – Specific rotation – Half Shade Polarimeter.		
Unit:5	**Quantum Optics**	**12 hours**
Light quanta and their origin – Resonance radiation – Metastable states – Population Inverse – Optical pumping – Spontaneous and Stimulated emission – Einstein's coefficient – Ruby, He- Ne, CO_2 laser – Resonant cavities – elements of non-linear optics – second harmonic generation– threshold condition for laser – Stimulated Raman scattering.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60**

Text Book(s)	
1	A Text book of Optics, Brijlal & Subramaniam, S. Chand Ltd. (2001)
2	Modern Physics, R Murugesan, S. Chand Publishing, 18th Edition (2017)
Reference Books	
1	Optics and Spectroscopy, R Murugesan, S. Chand Publishing, 5th Edition (2013)
2	Optoelectronics, Ajoy Kumar Ghatak,K. Thyagarajan, Cambridge University Press (1989).
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.youtube.com/watch?v=ML7HcZo6IaE
2	https://www.khanacademy.org/science/physics/light-waves/introduction-to-light-waves/v/polarization-of-light-linear-and-circular
3	https://nptel.ac.in/courses/104/104/104104085/
Course Designed By: **BoS - Physics CA**	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	M	M	S	M	M	M	S
CO2	S	M	S	M	S	M	M	M	S	S
CO3	M	M	M	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

SEMESTER III

Course code	**3ZA**	**MS OFFICE**	**L**	**T**	**P**	**C**
Core/Elective/SBS		**SKILL BASED SUBJECT**	**3**	**0**	**0**	**3**
Pre-requisite:		Students should know the importance of computer for accuracy and speed	**Syllabus Version**		**2023-24**	

Course Objectives:

The main objectives of this course are to:

- understand the basic principles of computer, and computer-based technology.
- enable students to use Internet, E-mail, web page etc.
- know about MS word, MS excel, Power point and their uses.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	use internet and Email etc.	K1
2	understand the concept of computer and its accessories.	K2
3	Analyze and apply MS word, MS excel wherever needed	K3, K4
4	choose a suitable software and apply it.	K3
5	evaluate the problems using computer programs	K5
6	design and execute required programs.	K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	**Basics of computer**	**9 hours**

Introduction: What is a Computer - Software and Hardware Hardware Components -Hardware Accessories Operating System Software -Software Application.

Computer Network: LAN - Internet - E-Mail – Browsers- E-Mail – Clients

Unit:2	**MS Word**	**9 hours**

Setting Page Style - Formatting -Border & Shading –Columns -Header & foot- Setting Footnotes - Inserting manual Page break - Column break and line break.-Creating sections and frames- Inserting Clip arts, pictures, and other files-. Anchoring & Wrapping.

Setting Document Styles - Table of Contents -Index - Page Numbering, data &Time, Authoretc., Creating Master Documents -Web page.

Unit:3	**MS Excel**	**9 hours**

Creating worksheet - entering and editing text, numbers, formulas - saving – Excel functions modifying worksheet range selection copying and moving data - defining names - inserting of deleting rows of columns - moving around worksheet naming worksheet, copying inserting of deleting worksheet - formatting, gauging, heading displaying value- changing of selecting fonts, protesting data using style so templates - reprinting worksheet creating charts - managing date - what if tables pate tables wraps, macros, linking worksheets.

Unit:4	**MS Power point**	**9 hours**

Creating a presentation: Setting presentation style - Adding Text to the presentation **Formatting a presentation:** Adding style - Color, gradient fills - Arranging objects - Adding Header & Footer - Slide Background - Slide layout

Adding Graphics to the presentation: Inserting pictures, movies, tables, etc., into thepresentation - Drawing Pictures using Draw. **Adding effects to the presentation:** Setting Animation & transition effect - Adding audio and video.		
Unit:5	**Files**	**7 hours**
Introduction: Database concepts - Tables - Queries - Forms - Reports **Opening & Saving database files**: Creating Table Design - Indexing - Entering data – Importing data **Creating Queries**: SQL statements - Setting relationship - Using wizards **Creating Forms**: GUI - Form Creating & printing reports		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**45**

Text Book(s)	
1	Step by Step Microsoft Office System (W/CD) by Curtis Frye, Joyce Cox, SteveLambert
2	Microsoft Office Word Plain & Simple by Jerry Joyce & Marianne Moon
3	The Unofficial Guide to Microsoft Office Excel, Julia Kelly & Curt Simmons
4	Microsoft Office Power Point Plain & Simple Nancy Muir
Reference Books	
1	Microsoft Office Word Inside Out Microsoft Press Publication
2	Microsoft Office Excel Inside Out Microsoft Press Publication
3	Beyond Bullet Points: Using Microsoft Power Point Microsoft Press Publication
4	Microsoft Office Access Inside Out Microsoft Press Publication
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	MS excel https://www.linkedin.com/learning/excel-2021-essential-training-office-2021-ltsc?trk=share_android_course_learning&shareId=ZeoQBxVnRYipE3%2BpHYDcqw%3D%3D
2	MS word https://www.linkedin.com/learning/word-2021-essential-training-office-2021-ltsc?trk=share_android_course_learning&shareId=xZc0B%2BvRS26YccZtFwpcYA%3D%3D
Course Designed By: **BoS - Physics CA**	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	M	M	S	M	M	L	S	S
CO2	S	S	S	M	M	M	M	L	S	S
CO3	S	S	S	M	S	M	M	M	S	S
CO4	S	S	S	S	S	S	M	M	S	S
CO5	S	M	S	M	M	S	S	M	M	M
CO6	M	S	S	M	M	S	S	S	M	M

*S-Strong; M-Medium; L-Low

SEMESTER IV

Course code	43A	ATOMIC PHYSICS AND SPECTROSCOPY	L	T	P	C
Core/Elective/SBS		CORE PAPER IV	4	0	0	4
Pre-requisite		The students should have the awareness on structure of atoms, photoelectric effect and on X rays	Syllabus Version		2023-24	

Course Objectives:

The main objectives of this course are to:
provide a detailed study of atom
learn the impact of magnetic fields on spectra
study the concept of photo electric cells

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	analyse various types of spectrographs to study about the positive rays	K4
2	explain magneto optical properties of materials	K5
3	find applications of photo electrical cells and X Rays	K3

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Positive Rays	11 hours

Positive rays – Discovery – Properties – Positive ray analysis – Thomson's Parabola method – action of Electric and Magnetic fields – Determination of e/m – determination of mass – discovery of stable isotopes– Limitations – Dempster's mass spectrograph –Aston's mass spectrograph- mass defect and packing fraction – polarization of X –rays – scattering of X- rays (Thomson's formula).

Unit:2	Structure of the Atom	12 hours

The Bohr atom model – Critical Potentials – Method of excitation of atoms – Experimental determination of critical potentials by Davison and Goucher's method - Sommerfield's relativistic model– Vector atom model – Quantum numbers associated with Vector atom model – coupling schemes (LS, JJ coupling) – Pauli's exclusion principle – Periodic classification of elements.

Unit:3	Magneto Optical Properties of Spectrum	12 hours

Magnetic dipole moment due to orbital motion of the electron – Magnetic dipole moment due to spin – The Stern and Gerlach experiment – Optical spectra – Fine Structure of the sodium D line – Zeeman effect – Experiments – Lorentz classical theory – Expression for the Zeeman shift – Larmor's theorem – Quantum mechanical explanation of the normal Zeeman effect – Anomalous Zeeman effect – Paschen – Back effect – Stark effect.

Unit:4	Photoelectric Effect	11 hours

Introduction – Richardson and Compton experiment – Relation between Photoelectric current and retarding potentials – Relation between velocity of Photo electrons and the frequency of light – Laws of Photoelectric emission – Failure of electromagnetic theory – Einstein's Photo electric equation – Experimental verification – Millikan's Experiments – Photo electric cells – Photo emissive cell – Photo Voltaic cell – Photo conductive cell – Applications of Photo electric cells.

Unit:5	**X-Ray Spectra**	**12 hours**
X-ray – Coolidge tube – Properties – X-ray Spectra – Continuous and characteristics X-ray spectrum – Mosley's law (Statement, Explanation and Importance) – Compton effect – Expression for change of wave length - X-ray diffraction-Bragg's law- Bragg's spectrometer- Powder crystal method – **Quantum theory**: The distribution of energy in the spectrum of a black body – its results - Planck's hypothesis – derivation of Planck's law of radiation.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60**

Text Book(s)	
1	Modern Physics, Murugesan R. and Kiruthiga Sivaprasath. S. Chand, 18th ed. (2016).
Reference Books	
1	Modern Physics, Sehgal D.L. Chopra K.L. and Sehgal N.K. Sultan Chand & Sons, 9th ed.,(2004)
2	Atomic Physics, Rajam J B, S. Chand and Company Ltd, New Delhi, 20th edition (2009).
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.askiitians.com/revision-notes/physics/atomic-physics/
2	https://nptel.ac.in/courses/115/101/115101003/
3	https://www2.physics.ox.ac.uk/sites/default/files/2011-10-19/atomic_physics_lectures_1_8_09_pdf_pdf_18283.pdf
Course Designed By: **BoS - Physics CA**	

Mapping with Programme Outcomes

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

*S-Strong; M-Medium; L-Low

SEMESTER III & IV

Course code	**43P**	**CORE PRACTICAL II** (Examination at the end of Fourth Semester)	**L**	**T**	**P**	**C**
Core/Elective/SBS		**CORE PRACTICAL**	**0**	**0**	**2**	**3**
Pre-requisite		Should have the fundamental knowledge of Physics	**Syllabus Version**		**2023-24**	

Course Objectives:

The main objectives of this course are to:

- develop the experimental skills in Mechanics and Properties of matter
- gain knowledge about the experiments based on Electricity and Magnetism
- motivate the students to apply the experimental techniques in Optics.

Expected Course Outcomes**:**

On the successful completion of the course, student will be able to:

1	apply the concepts of Specific heat capacity and Young's Modulus of different substances	K3
2	acquire the knowledge of Physical optics using Spectrometer	K4
3	evaluate principles and applications of Potentiometer, Magnetometer and BG.	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

LIST OF EXPERIMENTS (Any twelve experiments**)** **56 hours**

1. Rigidity Modulus – Torsional Pendulum – With & Without symmetrical masses
2. Specific heat capacity – Newton's Law of cooling – Spherical Calorimeter
3. Determination of wave length λ - Grating – Normal Incidence - Spectrometer
4. Refractive index of Prism - (i – i') curve - Spectrometer
5. Determination of Cauchy's constants - Spectrometer
6. Dispersive Power of Prism - Spectrometer
7. Refractive index of a lens - Newton's rings
8. Comparison of magnetic moments – Deflection magnetometer – Tan A position
9. Magnetic field intensity - Field along the axis of a circular coil
10. Young's Modulus – Cantilever – Depression – Pin and Microscope
11. Young's Modulus – Koenig's Method – Non-Uniform bending
12. Young's Modulus – Koenig's Method – Uniform bending
13. Specific resistance of a wire - Potentiometer
14. EMF of a thermocouple - Potentiometer
15. Calibration High range voltmeter - Potentiometer
16. Temperature Coefficient of Resistance - Thermistor - Carey Foster's Bridge
17. Characteristics of Zener diode
18. Figure of Merit – Charge sensitivity - Ballistic Galvanometer
19. Comparison of Mutual Inductance - BG
20. Determination of High Resistance by leakage- BG

Contemporary Issues	**4 hours**
Online workshop, Webinars on Experimental Physics	
Total Practical Hours:	**60**

Reference Books

1	A text book of Practical Physics, M.N.Srinivasan, S.Balasubramanian, R.Ranganathan, Sultan Chand & Sons(2017)
2	Practical Physics and Electronics, C.C.Ouseph, U.J.Rao, V.Vijayendran, S.Viswanathan Publishers(2007)

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://nptel.ac.in/course.html/physics/experimental physics I, II and III
2	https://nptel.ac.in/courses/115/105/115105110/
3	https://www.youtube.com/playlist?list=PLuiPz6iU5SQ8-rZn_LgLofRX7n8z4tHYK

Course Designed By: **BoS - Physics CA**

Mapping with Programme Outcomes

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

*S-Strong; M-Medium; L-Low

SEMESTER IV

Course code	**4ZB**	**PRINCIPLES OF PROGRAMMING CONCEPTS AND C PROGRAMMING**	**L**	**T**	**P**	**C**
Core/Elective/SBS		**SKILL BASED SUBJECT**	**3**	**0**	**0**	**2**
Pre-requisite		Students should know the preliminaries of programming concepts	**Syllabus Version**		**2023-24**	

Course Objectives:

The main objectives of this course are to:

- develop logics which will aid in developing programs and applications
- solve problems using functional and logical thinking.
- use ideas from various paradigms when programming in a language of different paradigm

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	design features of programming languages, and justify their own design decisions	K2
2	critically evaluate what paradigm and language are best suited for a new problem	K5
3	use C programming to solve Physics problems.	K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	**Constants, variables and data types**	**9 hours**

Introduction – character sets – constants – keywords – and identifiers – variables –variables – data types – declaration of variables – assigning values to variables – defining symbolic constants.

Unit:2	**Operators and expressions**	**9 hours**

Arithmetic operators – relational operators – logical operators – assignment operators –incrementand decrement operators – conditional operators – special operators – arithmetic expression – evaluation of expression. – Precedence of arithmetic operators – some computer problems – type conversion in expression – operator precedence and associativity – mathematical functions.

Unit:3	**Decision making, branching and looping**	**9 hours**

Reading and writing character – formatted input and output – decision making: IF statement: Simple IF – IF ELSE – Nesting of IF.. ELSE – ELSE. IF Ladder – Switch Statement – operator- go to statement – while, do while – For loop – Jumps in loops – simple programs.

Unit:4	**Arrays and strings**	**9 hours**

Arrays: Introduction – One dimensional array – declaration of array – Initiating on two and multidimensional arrays – declaring and initializing string variables – reading strings fromterminal – writing strings on the screen – Arithmetic operations on characters – simple programs.

Unit:5	**User defined functions**	**7 hours**

Need for user defined functions – A multifunction program – RETURN values and their types – functions calls – category of functions – no arguments and no return values – simple programs.

Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**45**

Text Book(s)	
1	Programming in ANSI C, E. Balagurusamy, TMH (2008)
2	The C Programming Language, Brian Kernighan, Dennis Ritchie, Prentice Hall, (1978)

Reference Books	
1	Programming in C by Ashok N. Kamthane First Indian Print, Pearson (2004).
2	Computing Fundamentals and C Programming, E. Balagurusamy, TMH(2011)

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.programiz.com/c-programming
2	https://www.geeksforgeeks.org/c-language-set-1-introduction/
3	https://beginnersbook.com/2014/01/c-tutorial-for-beginners-with-examples/

Course Designed By: **BoS - Physics CA**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	M	S	M	S	M	S	S
CO2	M	S	M	M	M	M	S	S	M	S
CO3	S	S	S	S	M	S	M	M	S	S

*S-Strong; M-Medium; L-Low

SEMESTER V

Course code	**53A**	**MATHEMATICAL PHYSICS**	**L**	**T**	**P**	**C**
Core/Elective/SBS		**CORE PAPER V**	**5**	**0**	**0**	**4**
Pre-requisite		Should have the basic knowledge of Mathematics and Mechanics	**Syllabus Version**		**2023-24**	

Course Objectives:

The main objectives of this course are to:
enable the students to acquire the problem-solving ability
apply the equations for the situation of different physical problems.
motivate the students to apply the mathematical principles of in their day–to–day life.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	derive Lagrange's and Hamilton's equations	K2
2	apply Lagrange's and Hamilton's equations to physical problems	K3
3	analyze gamma and beta functions and their applications	K3
4	solve problems on Matrices and apply them to relevant problems	K4
5	apply Stoke's and Gauss theorems to suitable physical problems	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	**Classical Mechanics – I**	**12 -- hours**

Constraints and Degrees of Freedom – Generalized coordinates – Generalized displacement –Velocity – Acceleration – Momentum – Force – Potential Energy – D'Alembert's Principle –Lagrangian equation from D'Alembert's principle – Application of Lagrange's equation of motion to Linear Harmonic Oscillator, Simple Pendulum and Compound Pendulum.

Unit:2	**Classical Mechanics – II**	**12 hours**

Phase Space – Hamiltonian function – Hamiltonian Principle – Hamilton's canonical equations of motion- Physical significance of H – Applications of Hamiltonian equations of motion to Simple Pendulum, Compound Pendulum and Linear Harmonic Oscillator.

Unit:3	**Special Functions**	**12 hours**

Definition – The Beta function – Gamma function – Evaluation of Beta function – Other forms of Beta function – Evaluation of Gamma function – Other forms of Gamma function – Relation between Beta and Gamma functions – Problems.

Unit:4	**Matrices**	**10 hours**

Introduction – special types of Matrices – Transpose of a Matrix – The Conjugate of a Matrix – Conjugate Transpose of a Matrix – Symmetric and Anti symmetric – Hermitian and skew Hermitian – Orthogonal and Unitary Matrices – Properties – Characteristic equation – Roots and characteristic vector – Diagonalization of matrices – Cayley–Hamilton theorem –Problems

Unit:5	**Vector Calculus**	**12 hours**
∇ Operator – Divergence – Second derivative of Vector functions or fields – The Laplacian Operator – Curl of a Vector – Line Integral – Line Integral of a Vector field around an infinitesimal rectangle – Curl of Conservative field – Surface Integral – Volume Integral (without problem) – Gauss's Divergence theorem and it's proof - Simple problems – Stoke's theorem and its proof - Simple problems.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture Hours	**60**

Text Book(s)	
1	Mathematical Physics, B.D. Gupta-Vikas Publishing House, 4 th Edition (2006)
2	Classical Mechanics, S.L.Gupta, V. Kumar&H.V.Sharma, PragatiPrakashan (2017)

Reference Books	
1	Mathematical Physics, Sathya Prakash, Sultan Chand, 6th edition (2014)
2	Mathematical Physics Rajput, Pragathi Prakasan Pub., (2017)
3	Mathematical Physics, H.K. Dass, S. Chand & Co., Eighth edition (2018)
4	Classical Mechanics, J.C.Upadhyaya, Himalaya Publishing House(2012)

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/course.html/Physics/Introduction to classical mechanics
2	https://nptel.ac.in/course.html/Physics/Integrals and vector calculus
3	https://nptel.ac.in/course.html/Physics/Matrix analysis and with applications

Course Designed By: **BoS - Physics CA**

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

*S-Strong; M-Medium; L-Low

SEMESTER V

Course code	**53B**	**ELECTRONICS**	**L**	**T**	**P**	**C**
Core/Elective/ SBS		**CORE PAPER VI**	**4**	**0**	**0**	**4**
Pre-requisite		Should have the basic knowledge of Semiconducting devices	**Syllabus Version**		**2023-24**	

Course Objectives:

The main objectives of this course are to:
acquire knowledge and apply it to various electronic instruments.
gain knowledge about the development of the electronic instruments.
motivate the students to apply the principles of electronics in their day-to-day life.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	differentiate between different types of amplifiers and their applications	K2
2	design different types of oscillators	K3
3	apply switching ideas to various devices	K3
4	analyze the power electronic devices and their uses	K4
5	design operational amplifier circuits and to analyze their properties	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create;

Unit:1	**Amplifiers**	**12 hours**

Characteristics of an amplifier, Voltage amplifiers - Feedback amplifier- feedback and related terms- block diagram of a feedback amplifier-Transfer gain of an amplifier with feedback- Emitter follower circuit - an example of negative feedback.

Unit:2	**Oscillators**	**11 hours**

Introduction - Types of oscillators - Fundamental principle of oscillators - Concept of feedback oscillators - Hartley oscillators –Analysis - Colpitts oscillators –Analysis - Phase shift oscillators- Analysis - Wien bridge oscillator – Analysis.

Unit:3	**Solid state switching circuits**	**12 hours**

Introduction - important terms - Collector leakage current - Saturation collector current -Switching transistors - Switching action transistor – OFF region – ON region – Active Region. Multivibrator – Types of multivibrator –Transistor Astable multivibrator – circuit details -Operations - ON or OFF time – transistor mono stable multivibrator -Circuit details – operations
– transistor Bistable multivibrator - Circuit details – operations.

Unit:4	**Wave Shaping Circuits**	**12 hours**

Differentiating circuit - Output waveforms - Integrating circuit – Output waveforms-Important applications of diodes – Clipping circuit – positive clipper – biased clipper – combinations clipper – applications of clipper- Clamping Circuits-basic idea of a clamper-Positive clamber – Operations – negative clamper

Unit:5	**Power Electronics**	**11 hours**
Introduction - power electronics - The Triac – Construction - Operations – Characteristics - Applications. The Diac – Operations – Applications of Diac – Lamp dimmer heat control. Uni junction transistor – Constructions – Operations - equivalent circuit of UJT – Characteristics of UJT - advantages of UJT – UJT relaxations Oscillator - UJT over voltage detector.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60**

Text Book(s)	
1	Foundations of Electronics, D Chattopadhyaya & P C Rakshit, New Age Intl. Pub., II Ed. (2005)
2	Principles of Electronics, V K Mehta, Rohit Mehta, S. Chand Co., Eleventh revised Ed. (2015)

Reference Books	
1	A textbook of Applied Electronics, R S Sedha, S. Chand Co., 1st Ed. (2010)
2	Integrated Electronics, Jacob Millman and Christos C. Halkias, TMH, 2nd ed. (2015)
3	Electronic devices and Circuits, S. Salivahanan and N. Sureshkumar, TMH, 4th ed. (2016)

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/course.html/Electronics/Basic electrnics
2	https://www.askiitians.com/revision-notes/physics/solid-and-electronic-device/
3	https://nptel.ac.in/course.html/electronics/operational amplifier

Course Designed By: **BoS - Physics CA**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	L	M	S	M	L	S	M	M
CO3	S	S	M	S	M	S	M	L	S	M
CO3	S	M	M	S	S	M	L	M	S	S
CO4	S	S	L	M	S	M	M	M	S	S
CO5	S	S	M	L	M	S	S	M	M	S

*S-Strong; M-Medium; L-Low

SEMESTER V

Course code	53C	SOLID STATE PHYSICS	L	T	P	C
Core/Elective/SBS		CORE PAPER VII	5	0	0	4
Pre-requisite		The students should know the fundamentals on kinds of bonds and classification of solids	Syllabus Version		2023-24	

Course Objectives:

The main objectives of this course are to:

1. learn about the crystal structure and properties of solids.
2. know about bond theory and optical properties of solids.
3. gain knowledge on magnetic, electric and dielectric materials and their application.
4. understand the superconducting process for the fabrication of new devices.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	choose the right material for a given application based on Fermi level concept	K3
2	analyze the magnetic materials for utilization in varied fields.	K4
3	design new components or devices using dielectrics and superconductors.	K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Crystallography	12 hours

Distinction between crystalline and amorphous solids – Different features of the crystal – Crystal lattice – Basis – Crystal structure – Unit cell – Number of lattice points per unit cell- Bravais lattices – Miller indices – Elements of Symmetry – Structure of KCl and NaCl crystal – Atomic Packing – Atomic radius –-Lattice constant and density- Crystal structure (sc; hcp; fcc;bcc.)

Unit:2	Bond Theory of Solids	10 hours

Classification of solids – Basics of Bond theory – Optical properties of solids – Specific heat capacity of solids – Dulong and Pettit's law – Einstein's theory of specific heat of solids – Fermi levels .

Unit:3	Magnetic Properties of Materials	12 hours

Introduction – Langevin's theory of diamagnetism –Langevin's theory of Paramagnetism – Ferromagentism – Weiss theory of Ferromagentism –Nuclear magnetic resonance – Ferroelectricity – Ferroelectric crystals – Quantum theory of paramagnetism – Cooling by adiabatic demagnetization of a paramagnetic salt.

Unit:4	Free Electron Theory	12 hours

Free electron theory – Drude Lorentz theory – Explanation of Ohm's law – Electrical conductivity – Thermal conductivity – Wide-Mann and Franz ratio – Sommerfield model – Schotcky effect – Hall effect – Hall voltage and Hall coefficient – Mobility and Hall angle – Importance of Hall effect – Experimental determination of Hall coefficient.

Unit:5	**Dielectrics and Super Conductivity**	**12 hours**
Dielectrics- Dielectric constant and displacement vector- Clausiss Mossotti relation- Atomic or molecular polarizability – Types of polarizability -Super conductivity – Phenomena – magnetic properties – Super conductor – Meissner effect – Experimental facts – Isotopes effect – Thermodynamic effect.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60**

Text Book(s)	
1	Solid State Physics Gupta and Kumar, K. Nath & Co. (2018)
2	Modern Physics R Murugesan, S Chand Publishing; Eighteenth edition (2016)

Reference Books	
1	Introduction to Solid State Physics Charles Kittel, Wiley (2019)
2	Solid State Physics A J Dekker, Macmillan (2011)

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://youtu.be/RImqF8z91fU
2	https://nptel.ac.in/courses/115/105/115105099/

Course Designed By: BoS - Physics CA

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	S	S	M	M	S	M
CO2	M	M	S	S	M	S	S	M	M	S
CO3	M	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

SEMESTER V

Course code	**53D**	**ELECTRICITY AND MAGNETISM**	**L**	**T**	**P**	**C**
Core/Elective/SBS		**CORE PAPER VIII**	**4**	**0**	**0**	**4**
Pre-requisite		The students are supposed to have the basic knowledge of electricity and magnetism	**Syllabus Version**		**2023-24**	

Course Objectives:

The main objectives of this course are to:

- make the students familiar with the laws of electricity and magnetism and their verifications
- understand the properties of electric and magnetic materials
- acquire experimental skills to construct technically useful devices.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	define and derive the laws of electricity and magnetism	K2
2	update the knowledge of properties and magnetism	K3
3	expertise the skills to manufacture devices	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	**Gauss Theorem and its Applications**	**12 hours**

Normal electric induction Gauss theorem, application of gauss theorem - Electric intensity at a point immediately adjacent to a charged conductor - Energy stored in unit volume of an electric field.

Capacitance and Capacitors

Spherical capacitor: cylindrical capacitor, Force of attraction between charged plates of a capacitor – capacity of a parallel plate capacitor; effect of introducing a dielectric slab between the plates – Guard ring condenser - polarization in dielectric materials.

Unit:2	**Magnetic Properties of Materials**	**12 hours**

Electron theory of magnetism; dia, para, ferromagnetism and their properties magnetic field B; magnetization M; magnetic field intensity H; magnetic susceptibility and magnetic permeability; magnetic materials and magnetization; magnetic hysterisis – area of the hysterisis loop; determination of susceptibility: Guoy's method – magnetic circuits –comparison of electrical circuit with magnetic circuit.

Unit:3	**Thermo Electricity**	**11 hours**

Seebeck effect – Laws of thermo e.m.f – Peltier effect; Peltier Co- efficient – determination of Peltier co-efficient – thermo dynamical consideration of Peltier effect – Thomson effect – Thomson Co-efficient – e.m.f generated in a thermocouple taking both Peltier effect and Thomson effect in the metals – Thermo electric power – Application of thermodynamics to Thermocouple – Thermoelectric diagrams and their uses.

Unit:4	**Helmholtz Equation of Varying Current**	**11 hours**

Growth and decay of current in an inductive – resistive circuit – charging and discharging of a capacitor through a resistance – growth of charge in a circuit with inductance, capacitance and resistance (LCR) - torque on a current loop in a magnetic field – Theory of Ballistic Galvanometer – correction for damping – current and voltage sensitivities.

Unit:5	**Dynamics of Charged Particles**	**12 hours**
Motion of charged particle in uniform electric field – longitudinal – transverse – motion of charged particle in alternating electric field – motion of charged particle in uniform constant magnetic field – Motion of charged particle in crossed electric and magnetic field. **Electromagnetic Induction:** A conducting rod moving through a uniform magnetic field – inductance in series – inductance in parallel – self-inductance of co-axial cylinders – self-inductance of toroidal coil of rectangular cross section – self -inductance of toroidal coil of circular cross section.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60**

Text Book(s)	
1	Electricity and Magnetism, Brijlal and Subramaniam, Educational and Univ. Pub. (1984)
2	Electricity and Magnetism, R. Murugesan, S. Chand & Co (2017)
Reference Books	
1	Electricity and Magnetism, D.N. Vasudeva, S.Chand & Co, 12th ed. (2007)
2	Electricity and Magnetism, Edward Mills Purcell and D. J. Morin, (2013) 3rd ed. Cambridge University Press
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.askiitians.com/revision-notes/physics/current-electricity.html
2	https://www.askiitians.com/revision-notes/physics/electromagnetic-induction-and-alternating-current/

Course Designed By : BoS - Physics CA

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	M	M	S	S	M	M	S
CO2	S	M	M	M	S	M	M	S	S	M
CO3	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

SEMESTER V

Course code	**5ZC**	**OBJECT ORIENTED PROGRAMMING IN C++**	**L**	**T**	**P**	**C**
Core/Elective/SBS		**SKILL BASED SUBJECT**	**3**	**0**	**0**	**3**
Pre-requisite		The students are expected to possess fundamental knowledge in object-oriented programming paradigm	**Syllabus Version**		**2023-24**	

Course Objectives:

The main objectives of this course are to:

- understand how C++ improves C with object-oriented features.
- learn how to write inline functions for efficiency and performance.
- learn the syntax and semantics of the C++ programming language.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	understand the concept of data abstraction and encapsulation	K1,K2
2	design C++ classes for code reuse.	K6
3	use exception handling in C++ programs.	K3

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	**Principles, Tokens, Expressions and Control Structures**	**9 hours**

Structure of C++ program - Tokens – Key words- Identifiers & constants– Basic data types – User defined Data Types – Derived data types – symbolic constants – Type compatibility – Declaration of variables – Dynamical Initialization of variables – Reference variables – Operators in C++ - Scope resolution operators.

Unit:2	**Functions in C++**	**9 hours**

Functions in C++: The main function – Function prototyping – call by reference –Inline functions – Default arguments – Function overloading-Math library functions-Specifying a class-defining member functions- c++ program with class-making an outside function inline-nesting of member functions-static data members-static member functions-Friendly functions.

Unit:3	**Constructors**	**9 hours**

Constructors: Introduction – constructors – parameterized constructors – multiple constructors in a class – constructors with default arguments – copy constructor-dynamic constructors.

Unit:4	**Destructors & Operator over loading**	**9 hours**

Destructors- defining operator over loading - over loading unary operators - over loading binary operators – rules for over loading operators.

Unit:5	**Inheritance**	**7 hours**

Inheritance-Defining derived classes-single inheritance-Multilevel inheritance-Multiple inheritance-Hierarchical inheritance, Hybrid inheritance.

Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**45**

Text Book(s)	
1	"Object Oriented Programming with C++" by E. Balagurusamy, Second edition. (2013)
2	Programming with C++, John R. Hubbard, TMH Publications, (2002).

Reference Books	
1	Programming with C++, John R. Hubbard, II Edition 2002, TMH Publications
2	Programming: Principles and Practice Using C++, Bjarne Stroustrup, Addison- Wesley, (2008)

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.tutorialspoint.com › cplusplus
2	https://www.programiz.com › cpp-programming
3	https://www.toptal.com/c/the-ultimate-list-of-resources-to-learn-c-and-c-plus-plus

Course Designed By: BoS - Physics CA

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	L	L	M	S	M	M	M	S	S
CO2	S	S	L	S	S	S	S	M	M	M
CO3	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

SEMESTER – VI

Course code	63A	QUANTUM MECHANICS AND RELATIVITY	L	T	P	C
Core/Elective/SBS		CORE PAPER IX	5	0	0	4

Pre-requisite	The students are expected to have the knowledge of particle nature and wave nature of matter	Syllabus Version	2023-24

Course Objectives:

The main objectives of this course are to:

- understand the wave property of matter
- acquire knowledge of uncertainity principle and its applications
- apply the concept of relativity to solve various physical problems

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	acquire the knowledge of wave nature of matter and its experimental verification	K2
2	understand Heisenberg uncertainity principle and apply it to verify problems in atomic and nuclear Physics	K3
3	Identify the reason behind various physical problems using relativity and to solve them	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Wave Properties of Matter	17 hours

Introduction – de Broglie wavelength – Phase velocity – Expression for Phase velocity – Group velocity – Analytical treatment – Expression for group velocity – Relation between group velocity (v_g) and phase velocity (v_p) – Velocity of de Broglie wave – (i)Phase velocity (v_p) – (ii)Group velocity (v_g). Verification of de Broglie relation – Davisson and Germer's experiments – G P Thomson's experiment.

Unit:2	Uncertainty Principle	17 hours

Introduction – Uncertainty Principle – Elementary proof between – Displacement and Momentum – Energy and Time – Physical Significance of Heisenberg's Uncertainty Principle – Illustration – Diffraction of electrons through a slit – Gamma ray microscope thought experiment – Applications – Non-existence of free electrons in the nucleus – Size and Energy in the ground state of Hydrogen atom.

Unit:3	Schrödinger's Wave Equation	18 hours

Introduction – Wave function for a free particle – Schrödinger's one dimensional wave equation – Time-dependent and Time independent – Limitations of wave function – Normalization of wave function – Operators – Eigen function – Eigen Value – Eigen equation – Operator for Momentum, Kinetic Energy and Total Energy – Postulates of Quantum Mechanics – Orthogonality of Energy Eigen function – Proof – Ehrenfest's theorem – Statement and proof.

Unit:4	**Spherical Symmetrical systems**	**18 hours**
Three-dimensional Schrödinger's wave equation –Hydrogen atom – Wave equation for the Motion of an electron – Separation of variables – Azimuthal wave equation and its solution – Radial wave equation and it's solutions – Polar wave equation and its solution – Ground size of the Hydrogen atom.		
Unit:5	**Relativity**	**18 hours**
Galilean Transformation equation – Ether Hypothesis – Michelson-Morley experiment – Explanation of the Negative results – special theory of Relativity – Lorentz transformation equation – Length contraction – Time dilation – Addition of Velocities – Variation of Mass with velocity – Mass energy equivalence.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**90**

Text Book(s)	
1	Elements of Quantum Mechanics, Kamal Singh, S. P Singh, S.Chand & Co (2005)
2	Quantum Mechanics, S P Singh, M. K Bagde, S.Chand & Co, second edition (2004).
3	Modern Physics, R Murugesan, S.Chand & Co (2016)

Reference Books	
1	Quantum Mechanics, Sathya Prakash, C.K.Singh, Kedar Nath Ram Nath&Co.(1997)
2	Quantum Mechanics, Schiff, Tata McGraw-Hill, second edition, (1968).

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.youtube.com/playlist?list=PLbMVogVj5nJTDMhThY9xu2Tvg0u1RPuxO
2	https://medium.com/predict/what-is-quantum-mechanics-what-is-theory-of-relativity-fdbe87eb9c79
3	https://www.askiitians.com/revision-notes/physics/special-theory-of-relativity/

Course Designed By: **BoS - Physics CA**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	M	M	M	M	S	M	M	M
CO2	S	S	S	M	S	S	M	M	S	S
CO3	M	S	S	S	S	S	S	S	S	S

SEMESTER VI

Course code	63B	NUCLEAR PHYSICS	L	T	P	C
Core/Elective/SBS		CORE PAPER X	4	0	0	4
Pre-requisite		The students should have knowledge about the basic constituents of atoms. They should be familiar with the structure of atoms and nucleus.	Syllabus Version		2023-24	

Course Objectives:

The main objectives of this course are to:

- acquire the knowledge to understand about nucleus and nucleus structure.
- familiarize with different types of radiation detectors and particle accelerators
- study the radioactivity phenomenon of nucleus
- motivate the students to analyze the energy released during fission and fusion process
- acquire the basic knowledge of cosmic rays and elementary particles.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	understand the General properties of Nucleus	K2
2	analyze the construction and working of radiation detectors	K4
3	device instruments utilizing the behavior of nuclear particles	K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Introduction to the Nucleus	16 hours

General properties of Nucleus (Size, Mass, Density, Charge, Spin, Angular momentum, Magnetic dipole moment) – Binding energy – BE/A and stability of Nucleus – Packing fraction – Nuclear stability – Nuclear forces – Definition – Properties – Meson theory – Model of Nuclear Structure – The Liquid Drop model – Semi-Empirical mass formula – The Shell model – Evidence for Shell model –The collective model.

Unit:2	Detector and Particle Accelerators	18 hours

Interaction between the energetic particles and matter – Heavy charged particles – Electrons – Gamma ray-Ionization chamber – Solid State detector – GM counter – Wilson Cloud chamber – Nuclear emission – Linear accelerators – Cyclotron – Betaron.

Unit:3	Radioactivity	18 hours

Natural Radioactivity – Alpha, Beta and Gamma rays – Properties – Determination of e/m of Alpha particle – Determination of Charge of Alpha particle – Determination of e/m of Beta particle – determination of Wavelength of Gamma rays (Dumond Spectrometer) – Origin of Gamma rays – Laws of Radioactivity – Soddy-Fajan's displacement law – Law of Radioactive disintegration – Half life period – Mean life period (Definitions, Expression) – Units of Radioactivity – Artificial Radioactivity – Preparation of radio elements – Application of radio isotopes.

Unit:4	**Nuclear Fission and Fusion Reactions**	**18 hours**
Nuclear fission – Energy released in Fission – Bohr and Wheelers theory of Nuclear fission – Chain reaction – Multiplication factor – Critical size – Natural Uranium and chain reactions – Atom Bomb – Nuclear reactor – Nuclear fusion – Source of Stellar energy – Carbon Nitrogen cycle – Proton-Proton cycle – Hydrogen bomb – Controlled thermo nuclear reactions.		
Unit:5	**Cosmic Rays and Elementary Particles**	**18 hours**
Cosmic rays – Origin of cosmic rays – Latitude effect – Azimuthal effect – Attitude effect – Seasonal, Diagonal changes – Primary and Secondary Cosmic rays – cascade theory of shower – Pair production and Annihilation – Van Allen Belts – Elementary particles – Introduction – particles and antiparticles – Antimatter – The fundamental interactions – The Quark model.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**90**

Text Book(s)	
1	Modern Physics, R Murugesan, S. Chand Publishing, 18th Edition (2017).
2	Nuclear Physics, D C Tayal, Publisher Himalaya Publishing House (2009).

Reference Books	
1	Concept of Modern Physics, Arthur Beiser, McGraw-Hill, (2007).
2	Introduction to Modern Physics, F K Richtmyer Etal, McGraw-Hill; 6th edition (1969).

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/115/104/115104043/
2	https://nptel.ac.in/courses/115/103/115103101/
3	https://www.youtube.com/watch?v=xrk7Mt2fx6Y

Course Designed By: **Dr. K. Selvaraju**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	M	S	M	M	M	S	M	M
CO2	M	S	S	M	L	M	S	M	S	S
CO3	S	M	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

SEMESTER VI

Course code	63C	NUMERICAL METHODS	L	T	P	C
Core/Elective/ SBS		CORE PAPER XI	5	0	0	4
Pre-requisite		The students should have knowledge about the basic Mathematics. They should be capable of solving problems.	Syllabus Version		2023-24	

Course Objectives:

The main objectives of this course are to:

- ensure the students to analyze and solve complicated problems.
- Understand and apply various related theories.
- Gain knowledge in solving differential equations of higher order

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	understand the eigenvalue problems	K2
2	analyze and interpolate the results	K4
3	Solve the problems using differential equations	K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Solution of equations and eigenvalue problems	16 hours

Linear interpolation methods (method of false position) – Newton's method – Statement of Fixed point Theorem – Fixed point iteration: x=g(x) method – Solution of linear system by Gaussian elimination and Gauss-Jordon methods- Iterative methods: Gauss Jacobi and Gauss-Seidel methods- Inverse of a matrix by Gauss Jordon method – Eigenvalue of a matrix by power method

Unit:2	Interpolation and approximation	18 hours

Lagrangian Polynomials – Divided differences – Interpolating with a cubic spline – Newton'sforward and backward difference formulas

Unit:3	Numerical differentiation and integration	18 hours

Derivatives from difference tables – Divided differences and finite differences –Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two and Three point Gaussian quadrature formulas – Double integrals using trapezoidal and Simpson'srules

Unit:4	Initial value problems for ordinary differential equations	18 hours

Single step methods: Taylor series method – Euler and modified Euler methods – Fourth order Runge – Kutta method for solving first and second order equations – Multistep methods: Milne'sand Adam's predictor and corrector methods

Unit:5	Boundary value problems in ordinary and partial differential equations	18 hours

Finite difference solution of second order ordinary differential equation – Finite difference solution of one-dimensional heat equation by explicit and implicit methods – One dimensionalwave equation and two-dimensional Laplace and Poisson equations

Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**90**

Text Book(s)	
1	Gerald, C.F, and Wheatley, P.O, "Applied Numerical Analysis", Sixth Edition, Pearson Education Asia, New Delhi, 2002.
2	Balagurusamy, E., "Numerical Methods", Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 1999.
Reference Books	
1	Kandasamy, P., Thilagavathy, K. and Gunavathy, K., "Numerical Methods", S.Chand, 2003.
2	Burden, R.L and Faires, T.D., "Numerical Analysis", 7th Ed., Thomson Asia, Singapore, 2002
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://onlinecourses.nptel.ac.in › noc19_ma21 › preview
2	https://nptel.ac.in › courses
3	https://www.mooc-list.com › Course Subject/Skill
Course Designed By: BoS - Physics CA	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	M	M	M	M	S	M
CO2	S	M	S	M	S	S	M	S	M	S
CO3	M	S	M	M	S	L	S	S	S	L

*S-Strong; M-Medium; L-Low

SEMESTER VI

Course code	63D	FUNDAMENTALS OF NANO MATERIALS	L	T	P	C
Core/Elective/SBS		CORE PAPER XII	4	0	0	4
Pre-requisite		The students should have knowledge about the size and basic properties of nanoparticles	Syllabus Version		2023-24	

Course Objectives:

The main objectives of this course are to:

- Impart knowledge on nanostructures and nanomaterials
- Understand size dependent physical properties
- Gain knowledge on quantum confinement in zero, one, and two dimensional nanosystems

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Know the basic concepts of nanoparticles and nanotechnology	K1,K2
2	Analyze and apply various synthesis methods	K4
3	Apply nanotechnology and nanoparticles in the required areas	K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Introduction to Nanoscience	16 hours

Definition of nano scale system - size & scale of atoms, molecules, clusters and particles - Classification of nanomaterials - dimensions - Surface to volume ratio, lotus leaf self-cleaning effect, Gecko feet effect, carbon allotropes: graphite, fullerene, carbon nanotubes, graphene structures.

Unit:2	Size dependent properties	18 hours

Electron confinements in quantum dots, wires, and sheets - density of states characteristics, metal nanoparticle- surface plasmon resonance, single domain magnetic nanoparticle- super para magnetism and ferrofluids, optical quantum dots- blue shift and red shift.

Unit:3	Synthesis of nanomaterial	18 hours

Top-down and Bottom-up synthesis approaches, strategies in Sol-Gel synthesis method, hydrothermal technique - Ball milling method - particle size and shape optimization - chemical vapour deposition and physical vapour deposition methods. Molecular Beam Epitaxy, Lithographic techniques.

Unit:4	Characterization of nanomaterial	18 hours

Powder XRD diffraction - interpretation of XRD pattern and crystallite size determination - scanning and transmission electron microscopic analysis - elemental mapping - EDAX analysis, UV-visible spectroscopy and FTIR spectroscopy.

Unit:5	Application of nanomaterials	18 hours

Implications of Drug delivery - Polymeric Nanoparticles as Drug carriers and controlled release implant devices - Magnetic Data Storage - Magneto optics and magneto - optic recording- Nano Sensors - Physical, chemical and biosensors

Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**90**

Text Book(s)	
1	Introduction to Nanotechnology, Charles P. Poole, Jr., Frank J. Owens, John Wiley (2003)
2	Nanotechnology: Principles and Practices, Sulabha K. Kulkarni, Springer Nature (2015)
Reference Books	
1	Textbook of Nanoscience and Nanotechnology, B.S. Murty, P. Shankar, Baldev Raj, James Murday, Springer (2013)
2	Nanostructures and Nanomaterials: Synthesis, Properties, and Applications, Guozhong Cao, Ying Wang, World Scientific, 2011
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.pnnl.gov › nano › links
2	https://www.loc.gov › scitech › nanotechnology
Course Designed By: **BoS - Physics CA**	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	M	M	S	M	S	M	M	S	S	S
CO2	M	S	M	S	M	S	M	M	S	M
CO3	S	S	M	L	S	S	S	L	M	M

*S-Strong; M-Medium; L-Low

SEMESTER V&VI

Course code	**63P**	**CORE PRACTICAL III ELECTRONICS (**Examination at the end of Sixth Semester**)**	**L**	**T**	**P**	**C**
Core/Elective/SBS		**CORE PRACTICAL III**	**0**	**0**	**3**	**4**
Pre-requisite		Should have the fundamental knowledge of Basic Electronics	**Syllabus Version**		**2023-24**	

Course Objectives:

The main objectives of this course are to:
transform the principles of Basic Electronics into Experimental techniques
gain knowledge about different electronic gadgets.
motivate the students to apply the principles of electronics in their day-to–day life.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	design different types of Power supplies, Amplifiers and Oscillators	K4
2	to analyze the characteristics of various Electronic devices like BJT, UJT, LDR, and Solar cell	K4
3	acquire the knowledge of the characteristics of an operational amplifier	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

LIST OF EXPERIMENTS (Any twelve experiments)	**56 hours**

1. Logic Gates using diodes and transistor.
2. Bridge rectifier with Zener voltage regulator
3. Regulated Power Supply - IC
4. Dual Power Supply
5. Voltage Doubler
6. Characteristics of Transistor - CE mode
7. Differentiating and Integrating Circuits.
8. Clipping and Clamping Circuits
9. R.C. Coupled Amplifier –Single stage - Transistor
10. Emitter Follower
11. Series and Parallel resonance circuits
12. Hartley Oscillator – Solid State
13. Colpitt's Oscillator – Solid State
14. Square wave generator using IC 555 Timer
15. Astable Multivibrator
16. Study of Solar Cell
17. Study of LDR
18. Characteristics of UJT
19. Inverting and Non inverting amplifiers - Op-amp (IC 741)
20. Adder and Subtractor circuits - Op-amp (IC 741)

Contemporary Issues	**4 hours**

Online workshop, Webinars on Experimental Electronics

Total Practical Hours:	**60**

Reference Books	
1	Practical Physics and Electronics, C.C.Ouseph, U.J.Rao, V.Vijayendran, S.Viswanathan (2007)
2	A text book of practical Physics, M.N.Srinivasan, S.Balasubramanian, R.Ranganathan, Sultan Chand & Sons (2017)
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.slideshare.net/mobile/sunilrathore77398/basicanalogelectronics
2	https://www.slideshare.net/mobile/PatruniChidanandaSas/basics-of-electronics-53962342
Course Designed By: **BoS - Physics CA**	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	S	S	M	L	M	S	M
CO2	S	S	M	S	S	L	M	S	S	S
CO3	M	M	S	S	L	M	S	S	S	M

*S-Strong; M-Medium; L-Low

SEMESTER V & VI

Course code	**63Q**	**DIGITAL AND MICROPROCESSOR** (Examination at the end of sixth semester)	**L**	**T**	**P**	**C**
Core/Elective/SBS		**ELECTIVE PRACTICAL**	**0**	**0**	**2**	**2**
Pre-requisite		Should have the fundamental knowledge of Digital Electronics and Microprocessors	**Syllabus Version**		**2023-24**	

Course Objectives:

The main objectives of this course are to:
understand the principles and applications of Digital Electronics
gain knowledge about the development of the Microprocessors.
motivate the students to apply the principles of Digital Electronics in their day–to–day life.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	analyze the different types of digital circuits and their applications	K4
2	realize the applications of registers in computers	K5
3	update the knowledge of Microprocessor programming	K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

LIST OF EXPERIMENTS (Any twelve experiments by choosing **at least five** from each division)	**56 hours**

DIGITAL ELECTRONICS

1. Verification of truth tables of logic gates using IC's: OR, AND, NOT, XOR, NOR and NAND.
2. NAND as universal building block- AND, OR, NOT and Ex-OR
3. NOR as universal building block- AND, OR, NOT and Ex-NOR
4. Verification of De Morgan's theorem.
5. Boolean Algebra – problem solving
6. Study of RS Flip-Flop.
7. Half adder and Half Subtractor
8. Full adder
9. Full Subtractor.
10. 4 Bit – Binary Adder/ Subtractor using 7483

MICROPROCESSORS

11. 8085 ALP for 8 bit Addition and Subtraction
12. 8085 ALP for 8 bit addition with carry and subtraction with borrow
13. 8085 ALP for 8 Bit Multiplication
14. 8085 ALP for 8 Bit Division
15. 8085 ALP for One's Complement, Masking off most significant 4 bits and setting bits.
16. 8085 ALP for Two's compliment Addition and Subtraction
17. 8085 ALP for finding the biggest number element in the array and Sum of the elements in the array.
18. 8085 ALP for arranging Ascending and Descending order of the given set of numbers
19. 8085 ALP for conversion of Hexadecimal into Decimal number.
20. 8085 ALP for conversion of Hexadecimal into Binary number.

Contemporary Issues	**4 hours**
Online workshop, Webinars on Experimental Digital Electronics and Microprocessors	
	Total Practical Hours: 60

Reference Books

1	Practical Physics and Electronics, C.C.Ouseph, U.J.Rao, V.Vijayendran, S.Viswanathan Publishers(2007)
2	A text book of practical Physics, M.N.Srinivasan, S.Balasubramanian, R.Ranganathan, Sultan Chand&Sons(2017)

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	http://www.sircrrengg.ac.in/images/Others/CSE/MP-LAB-MANUAL.pdf
2	https://www.youtube.com/playlist?list=PL_pGb42kre_QXwuaizYb21tSYpoHyXsCQ

Course Designed By: **BoS - Physics CA**

Mapping with Programme Outcomes

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

*S-Strong; M-Medium; L-Low

SEMESTER V&VI

Course code	**6ZP**	**MS OFFICE, C AND C++ PROGRAMMING** (Examination at the end of sixth semester)	**L**	**T**	**P**	**C**
Core/Elective/SBS		**SKILL BASED SUBJECT PRACTICAL**	**0**	**0**	**2**	**2**
Pre-requisite		Should have the fundamental knowledge of C, C++ Programming and MS Office	**Syllabus Version**		**2023-24**	

Course Objectives:

The main objectives of this course are to:

- Understand Programming concepts of C and C++
- Apply Programming concepts of C and C++ to various programmes
- Motivate the students to learn MS Office

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Write and execute programmes in C and C++	K3
2	Analyze the programming concepts for Physics problems	K4
3	Evaluate the solutions for different Mathematical problems	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

LIST OF EXPERIMENTS (Any twelve experiments by choosing **at least three** from each division)	**84 hours**

MS Office

MS Word

1. Type Chairman's speech/ Auditor's report / Minutes/ Agenda and perform the following operations: Bold, Underline, Font Size, style, Background color, Text color, Line spacing, SpellCheck, Alignment, Header & Footer, Inserting pages and page numbers, Find and Replace

2.Prepare a Class Time Table and perform the following operations: Inserting the table, DataEntry, Alignment of Rows and Columns, Inserting and Deleting the Rows and Columns andChange of Table Format

MS Excel

1. Prepare a statement of Bank customer's account showing simple and compound interest calculations for 10 different customers using mathematical and logical functions.

2. Prepare a mark list of your class (minimum of 5 subjects) and perform the following operations: Data Entry, Total, Average, Result and Ranking by using arithmetic and logical functions and sorting.

MS Power point

1. Design presentation slides for a product of your choice. The slides must include name, brandname, type of product, characteristics, special features, price, special offer etc. Add voice ifpossible to explain the features of the product. The presentation should work in manual mod

2. Design presentation slides for the Seminar/Lecture Presentation using animation effects and perform the following operations: Creation of different slides, changing background color, fontcolor using word art

B. Programming in C

1. Find the number of Days elapsed between two dates.
2. Convert Integer in the range 1 to 100 in words.
3. Write a program that uses functions to compare two strings input by user. The Programshould state whether the first string is less than, equal or greater than the second Strings.
4. Write a Program to compare two files printing the Character position where they equaland where they are differ.
5. Write a Program for Matrix addition
6. Write a Program for Matrix Multiplication.
7. Write a Program for Addition of Two times
8. Write a Program for find the Inverse of given Matrix
9. Write a Program for display the Multiplication table.

Programming in C++

1. To read any two number through the key board and to perform simple ArithmeticOperation (Use Do while loop)
2. To display the name of the day in a week, depending upon the number entered throughthe keyboard using Switch – case statement.
3. To read the elements of the given two matrix of m X n and to perform the Matrix addition
4. Write a Program for Matrix Multiplication table.
5. Write a Program to find the Inverse of Given m X n Matrix
6. Write a Program to find the Modulus of the Given Number
7. Write a Program to compare two files printing the character position where they are equaland where they are differed.

Contemporary Issues	**6 hours**
Online workshop, Webinars on C and C++ programming	
Total Practical Hours:	**90**

Reference Books

1	Programming in ANSI C by E. Balagurusamy, Tata McGraw Hill, sixth Edition(2012)
2	Object Oriented Programming with C++ by E. Balagurusamy, Tata McGraw Hill, Sixth Edition (2013)

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://nptel.ac.in/course.html/computerscience and engineering//C, C++ programming
2	https://www.geeksforgeeks.org/introduction-to-c-programming-language/

Course Designed By: **BoS - Physics CA**

Mapping with Programme Outcomes

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

*S-Strong; M-Medium; L-Low

LIST OF ELECTIVE PAPERS
SEMESTER V

Course code	**5EA**	**DIGITAL AND MICRO PROCESSOR**	**L**	**T**	**P**	**C**
Core/Elective/SBS		**ELECTIVE PAPER – I A**	**3**	**0**	**0**	**3**
Pre-requisite		The students are expected to procure foundational knowledge on digital and micro processor	**Syllabus Version**		**2023-24**	

Course Objectives:

The main objectives of this course are to:
give description for the students in order to make use of digital devices and microprocessors
learn the concepts of logic circuits and to construct the logic circuit for any Boolean equation
acquire basic knowledge of binary addition
understand the action of flip flops.
5. learn basic programming with microprocessor 8085.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	draw and construct the logic circuit for any Boolean equation.	K2
2	apply the Karnaugh Map to simplify Boolean equation and draw a simplified circuit	K3
3	understand the function of data processing and arithmetic circuits	K4
4	understand the Mnemonics and Opcodes in the Microprocessor	K4
5	develop programming skills using the basic concepts.	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Unit:1	**Arithmetic Circuits and Flip-Flops**	**10 hours**

Arithmetic Circuits: Binary addition - Binary Subtraction – Unsigned Binary numbers - sign magnitude numbers –2's complement representation – 2's complement Arithmetic – Arithmetic building blocks – The Adder – Subtractor
Flip-Flops: RS flip flop – Clocked RS flip flop – D flip flop – Edge triggered D flip flop – JK flip Flop – Master Slave flip flop – Schmitt trigger

Unit:2	**Shift Register and Counters**	**12 hours**

Types – Serial In Serial Out – Serial In Parallel Out – Parallel In Serial Out – Parallel In Parallel Out – Ring counter – Asynchronous counter – Decoding gates – Synchronous counter – Mod 3counter – Mod 5 counter – shift counter

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Unit:3	**Semiconductor Memories**	**12 hours**

Basic – Memory addressing – ROM's PROM's and EPROM's – RAM's – DRAM's –Dynamic Ram's.
D/A and A/D Conversion
Variable – Resistor Network – Binary ladder – D/A converter – A/D converter – Simultaneous conversion – Counter method – continuous A/D conversion

Unit:4	**Microprocessor and Data Representation**	**12 hours**
Basic concept – what is Microprocessor, 4, 8, 16, 32 – Organization of Microprocessor – Microprocessor Programming – Instruction – Machine and Mnemonic codes – Machine and Assembly Language Programming – High level Language programming – Timing diagram conventions. Organization of 8085 – Data and Address buses addressing – TheI/O devices – Register in 8085– Instruction types – Classification of Instruction –Addressing modes – Programming the 8085 –The Programming process – machinelanguage programming – Assembler Programming.		
Unit:5	**Semi-Conductor Memories**	**12 hours**
Introduction – Registers – Primary memory – Mass storage, cache – off line backup – memory chips – static and dynamic RAMs, ROMs and their versions characteristics of memories: Memory chip capacity and organization – memory size – combining the chips together with example electrical signals. Static RAM: Organization of 6264 – Read and write cycle of 6264 –dynamic RAMS: Organization of 51100 x – Read and write cycle of 51100 x RAS only fresh hidden fresh – Burst and distributed i.e., fresh – pseudo static ram and automatic refresh.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60**

Text Book(s)	
1	Digital Principles and Applications – Albert Paul Malvino & Donald P Leach (FourthEdition, TMH).
2	Introduction to Microprocessors by Aditya P Mathur (3rd Edition TMH).
Reference Books	
1	Integrated Electronics – Millmann & Halkeias
2	Microprocessors by Goenkar - Microprocessors by K Ramachandran
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.tutorialspoint.com/microprocessor/microprocessor_overview.html
2	https://www.geeksforgeeks.org/introduction-of-microprocessor/

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

*S-Strong; M-Medium; L-Low

SEMESTER V

Course code	**5EA**	**ENERGY PHYSICS**	**L**	**T**	**P**	**C**
Core/Elective/SBS		**ELECTIVE PAPER - I B**	**4**	**0**	**0**	**4**
Pre-requisite		The students should know the fundamental principle of motor and classification of energy	**Syllabus Version**		**2023-24**	

Course Objectives:

The main objectives of this course are to:

- learn about the production of electricity.
- know about fibre optical communication system.
- gain knowledge on atomic, molecular energy and thermal energy.
- understand the non-conventional energy resources and utilization.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	understand the heating effect of current and application of it.	K2
2	select the correct material for making waveguide based on basic optical laws.	K3
3	understand Maxwell's law of equipartition of energy.	K2
4	analyze the distribution of energy in the thermal spectrum.	K4
5	Calculate effective utilization of solar radiation, power in the wind and tidal energy	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	**Electrical Energy**	**12 hours**

Principle of production of A.C. – A.C generators – D.C generators –D.C Motors. Heat developed in current carrying conductor – Application of heating effect – Electric heater or stove – Electric radiation and Electric Iron – Electric welding and electric furnace – Carbon arc – Electric Lamp – Efficiency of a Lamp – Measurement of Electric Power.

Unit:2	**Optical Energy**	**12 hours**

Characteristics of Light – Light sources – LED, LASER – optical fiber– Light propagation through optical fibers: Basic optical laws used in optical fibers – Optical parameters of optical fiber: Acceptance angle and Numerical aperture – Types of optical fibers: Based on material, Number of modes and refractive index profile – Fiber optical communication system – Block Diagram – Source – Transmitter – Optical fiber – Receiver.

Unit:3	**Atomic And Molecular Energy**	**12 hours**

Degrees of freedom – Number of Degrees of Freedom of Mono, Di and Tri Atomic system – Maxwell's Law of equipartition of Energy – Molar Specific heat capacity at constant volume and constant pressure – Total Internal Energy and Ratio of Heat capacities in monoatomic gas, Diatomic gas, Non Linear and Linear type of Tri atomic gas molecular system.Gas and Vapour Distinction – Measurement of saturated and unsaturated vapour Pressure: Regnault's statistical method – Their characteristics – Graphical Illustration of Gas laws.

Unit:4	**Thermal Energy**	**12 hours**
Definition of Total thermal Energy density - Spectral Energy density – Spectral Emissive power – Emissivity – Emissive power – Absorptive power – Reflective power – Kirchoff's Law of radiation and its proof – verification of Kirchoff's Results: Ritche's Experiment. Distribution of Energy in the thermal spectrum – Lummer and Pringsheim Experiment and its Results – Wien's Displacement Law and Radiation Law – Rayleigh Jean's Law Planck's Radiation Law – Deduction of Wien's Law and Rayleigh – Jean's Law from Planck's law. Solar constant – Temperature of sun – Disappearing filament optical Pyrometer - **Pyrheliometers**: Angstrom Pyroheliometer – Water flow Pyrohelio meter.		
Unit:5	**Nonconventional Energy**	**10 hours**
Solar Energy: Solar radiation – Solar radiation outside the earth's atmosphere Solar radiation at the earth's surface – Solar Thermal Energy – Solar Thermal devices and systems: Solar water heater – Sub components of solar water heater – Solar Cooker and its merits and demerits. **Wind Energy**: Power in the wind – Types of wind energy systems –Horizontal axis wind Turbine – Vertical axis wind Turbine. **Ocean Energy**: Tidal Energy – Ocean Thermal Energy Conversion (OTEC) – Closed Cycle OTEC system – Open Cycle OTEC System.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars - webinars		
	Total Lecture hours	**60**

Text Book(s)	
1	Renewable Energy Environment and Development - Maheshwar Dayal. Konark Publ., (1989)
2	Engineering Physics - I- G. Senthil Kumar, VRB Publishers, (2011)

Reference Books	
1	Solar Energy Utilization - G.D. Rai Khhanna Publishers, (1995)
2	Engineering Physics - II- M. Arumugham, Anuradha Publishers (2010)

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.askiitians.com/revision-notes/physics/heat-phenomena/
2	https://www.askiitians.com/revision-notes/physics/thermodynamics/

Course Designed By: **BoS - Physics CA**

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

*S-Strong; M-Medium; L-Low

SEMESTER V

Course code	**5EA**	**AGRICULTURAL PHYSICS**	**L**	**T**	**P**	**C**
Core/Elective/SBS		**Elective Paper I C**	**3**	**0**	**0**	**3**
Pre-requisite		Students should possess the fundamental knowledge on agronomy which is described using physical sciences.	**Syllabus Version**		**2023-24**	

Course Objectives:

The main objectives of this course are to:

- have knowledge of physical phenomena in agricultural environment.
- evoke logical thinking in the field of farming.
- improve practical knowledge of the student.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	understand the role of physics in daily life.	K2
2	introduce technological applications into agriculture.	K3
3	explore the physical properties of soil and water.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	**Soil Physics**	**12 hours**

Mechanical composition of soil – physical properties of soil, pore space, bulk density, particle density – classification – significance of clays – plasticity, shrinkage, flocculation and deflocculation – Soil structure – soil colour – Thermal properties of soil and soil temperatures – types of soil water – its retention, movement – viscosity, swelling – soil moisture losses – Elementary ideas of soil water conservation.

Unit:2	**Water Physics**	**10 hours**

Water qualities – Rain fall – Ground water – surface water pollution – instrumentation and sampling – water quality monitoring

Unit:3	**Electric Power**	**12 hours**

Principle of production of A.C. – Average value of A.C. voltage or current – R.M.S. value of alternating voltage or current – power consumed in A.C. Circuits – kilo watt hour – A.C. generator – Three phase A.C. – Distribution of three phase A.C. Three phase power system – The choke- The transformer – Transmission of electric power over long distances.

Unit:4	**Hygrometry and Pumps**	**12 hours**

Absolute Humidity – Relative Humidity – Dew point, Daniell's Hygrometer, Regnault's hygrometer. Advantages of Regnault's hygrometer – wet and Dry and Bulb hygrometer. Water pumps – common pump – force pump – Fire engine, inflator (or) compression pump – pressure after n strokes – Exhaust pump (or) common air pump.

Unit:5	**Solar Collector and Applications**	**12 hours**
Solar Air heaters- Application of solar air heaters. Solar Drying with various driers – Heating and Drying of Agricultural products – Theory of solar drying – moisture content and its measurement – solar ponds – Application of solar ponds – Solar pumping – Solar pump system components – Turbine driven pump – Application of solar energy to agricultural crops.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars - webinars		
Total Lecture hours		**60**

Text Book(s)	
1	The Nature and Properties of Soil, H.O. Buckman, Brady, Macmillan, (1967).
2	Soil Physics, H. Kohnke, McGraw-Hill, (1968).
3	Systematic Hydrology, John C. Rodda, Richard A. Downing, Frank M. Law, Newnes-Butterworths, (1976).

Reference Books	
1	Electricity and Magnetism, R. Murugesan, S.Chand, (2017).
2	Hydrostatics, A. S. Ramsey, Cambridge University Press, (2017).
3	Solar energy Utilization, G.D. Rai, Khanna Publisers, (1987).

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/soil-physics
2	https://www.sciencedirect.com/science/article/pii/S1631071304002780
3	https://www.sciencedirect.com/topics/engineering/solar-energy-application

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Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	M	M	M	M	S	M	S	M
CO2	M	S	S	S	S	S	M	S	M	M
CO3	M	S	S	M	S	M	S	S	S	S

*S-Strong; M-Medium; L-Low

SEMESTER VI

Course code	**6EA**	**MAT LAB**	**L**	**T**	**P**	**C**
Core/Elective/SBS		**ELECTIVE II A**	**3**	**0**	**0**	**3**
Pre-requisite		The students should have basic understanding in arithmetic and arrays	**Syllabus Version**		**2023-24**	

Course Objectives:

The main objectives of this course are to:
impart knowledge on basic arithmetic and arrays
evoke logical thinking in the field of MAT LAB.
improve practical knowledge of the student.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Solve arithmetic and arrays related problems using MAT LAB	K5
2	Analyze various types of operators	K4
3	Create and work with files	K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	**MATLAB windows**	**12 hours**

Working in the Command Window – Arithmetic operations with scalars – order of Precedence – Display formats – Elementary Math built-in functions – Assignment operator – Rules about variable names.
Creating a one dimensional array - Creating a two dimensional array – zeros, ones and eye commands – Transpose operator - Array addressing - adding elements to a matrix – deleting elements – Built – in – functions in handling arrays.

Unit:2	**Mathematical operations with arrays**	**12 hours**

Array addition and subtraction – Array Multiplication – array division – element – by – element operations – Relational operations – Logical operations, Trigonometric and exponential functions – character strings - Command line functions, Inline functions – Anonymous functions - Programs

Unit:3	**Script files**	**12 hours**

Creating and saving a script file – Running a script file – input to a script file – output commands – disp command – fprintf command, Creating a Function File – function definition line – input and output arguments – Localand Global variables – saving a function file, for loops – while loops – if – elseif – else statements – Switch – case – otherwise – breakstatement – Programs.

Unit:4	**Conditional statements and Loops**	**12 hours**

Conditional statements: if … end structure – if .. else … end structure – if .. elseif .. else … end structure – switch – case statement –
Loops: for …end loops – while .. end loops - Nested loops and nested conditionalstatements – break and continue commands

Unit:5	**Two dimensional plots**	**10 hours**
Plot command line specifies – Property name and Property value– fplot command -Plotting multiple graphs in the same plot – Formatting a plot: x label, y label, title, legends, text – subscript and superscript - axis command – grid command – formatting a plot using the plot editor		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars - webinars		
	Total Lecture hours	**60**

Book(s) for Study

1. MATLAB An introduction with Applications: Amos Gilat Wiley India Pvt Ltd, New Delhi
2. MATLAB 7 : Rudra Pratap, 1st edition, 2006, Oxford University Press, 2002edition

Book(s) for Reference

1. MATLAB and its Applications in Engineering : Raj Kumar Bansal, Ashok Kumar Goel and Manoj Kumar Sharma, Published by Dorling Kindersley (India) Pvt Ltd..
2. A guide to MATLAB :Brian R. Hunt, Ronald L. Lipsman and Jonathan M.Rosenberg, Cambridge University Press, 1st edition, reprinted 2003.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://www.mathworks.com › products › matlab-online
2. https://matlab.mathworks.com

Course Designed By: BoS - Physics CA

Mapping with Programme Outcomes

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

*S-Strong; M-Medium; L-Low

SEMESTER VI

Course code	**6EA**	**OPTICAL FIBERS AND FIBER OPTIC COMMUNICATION SYSTEMS**	**L**	**T**	**P**	**C**
Core/Elective/SBS		**ELECTIVE II B**	**3**	**0**	**0**	**3**
Pre-requisite		The students must know the basic optical laws and properties of optical fiber.	**Syllabus Version**		**2023-24**	

Course Objectives:

The main objectives of this course are to:

- learn about the propagation of light waves in an optical fiber.
- know about fiber fabrication and cables.
- gain knowledge on fiber losses and dispersion.
- understand the structures of light sources for optical fiber optic communication.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	understand the fiber classification.	K2
2	test the cables during installation of cable based on cable selection criteria.	K3
3	analyze the attenuation and dispersion in an optical fiber.	K4
4	calculate the efficiency, modulation bandwidth and spectral emission of light sources.	K5
5	use the knowledge to make varied link and networking.	K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	**Fiber Classification**	**12 hours**

Propagation of light waves in an optical fiber – Acceptance angle and Acceptance cone of a fiber – Numerical Aperture (NA) – NA of a graded Index fiber – Mode of propagation. Fiber – classification – stepped index fiber – stepped index mono mode fiber – Graded index multimode fiber – Comparison of step and graded index fibers.

Unit:2	**Fiber Fabrication and Cables**	**12 hours**

Classification of Techniques – External chemical vapour deposition – Characteristics – Internal chemical vapour deposition (1st method only) – Characteristics – Phasil system Fiber cable construction – losses incurred during installation of cable – Testing of cables – cable selection criteria.

Unit:3	**Fiber Losses and Dispersion in Optics**	**12 hours**

Attenuation in optic fiber – Rayleigh Scattering losses – Absorption losses – Bending losses – Radiation induced losses – Inherent defect losses – Core and Cladding losses. Dispersion in an Optical Fiber – Inter-modal dispersion – Material Chromatic Dispersion – Dispersion Power penalty – Total Dispersion delay.

Unit:4	**Light Sources For Optical Fibers**	**10 hours**

LED – The process involved in LEDs – Structures of LED – Fiber – LED Coupling – Modulation bandwidth and Spectral Emission of LEDs.

Unit:5	**Applications**	**12 hours**
Introduction – Video Link Satellite Link – Computer Link – Nuclear Reaction Link – Community Antenna Television – Switched Star CATV – Networking		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars - webinars		
	Total Lecture hours	**60**

Text Book(s)	
1	Optical Fibers and Fiber Optic Communication Systems, Subir Kumar Sarkar, S. Chand Limited, (2007)
2	Fiber Optics Communication, D.C.Agarwal, S.Chand (2010)
3	Optical fiber Communication, Keiser, McGraw Hill (2010)
Reference Books	
1	Optical Fibers and Fiber Optic Communication Systems, R.K.Puri and V.K.Babbar, S. Chand & CO
2	Introduction to Fiber Optics, Ajoy Ghatak, K. Thyagarajan, Cambridge (2009)
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/115/107/115107095/
2	https://www.youtube.com/playlist?list=PLq-Gm0yRYwTgr7v3HhdrI_Kcc38369fw-

Course Designed By: **BoS - Physics CA**

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

*S-Strong; M-Medium; L-Low

SEMESTER VI

Course code	**6EA**	**BIO PHYSICS**	**L**	**T**	**P**	**C**
Core/Elective/SBS		**ELECTIVE PAPER – II C**	**3**	**0**	**0**	**3**
Pre-requisite		The students are expected to have basic knowledge in the area of biophysics.	**Syllabus Version**		**2023-24**	

Course Objectives:

The main objectives of this course are to:

- deal with how physics applies to the processes of biology.
- discover how to modify micro-organisms for producing bio fuel.
- replace bio-electricity in the place of coal and petroleum products for producing electricity.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	understand interactions between various systems of cells.	K2
2	provide life-saving treatment methods like radiation therapy.	K4
3	find powerful vaccines against infectious diseases.	K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	**Structure of Biomolecules**	**12 hours**

Introduction - Atomic structure - Hydrogen atom - Bonds between atoms and molecules - secondary or weak bonds - Bond energy - Disulphate bonds – Peptide bond - Structure of Proteins - Molecular weight determination - Kinetic methods - Static methods - Structure of nucleic acids - DNA - RNA.

Unit:2	**Kinetics of Molecules I**	**10 hours**

Diffusion: Factors affecting diffusion·- Simple diffusion – Fick's law of diffusion - Diffusion of electrolytes - Biological significance of diffusion. **Osmosis:** Osmosis - Osmotic pressure - Laws of osmosis - osmometry - osmotic pressure of electrolytes. **Filtration:** Filtration - Passage of fluid though blood vessels - Formation of Urine- Dialysis Principle of dialysis in artificial kidney - kinds of dialysis.

Unit:3	**Kinetics of Molecules II**	**12 hours**

Adsorption: Adsorption - Factors affecting adsorption - Adsorption of ions by Solids and Liquids - adsorption of Gases by solids - Biological significance of adsorption. **Hydrotropy**: Hydrotropy - Biological importance of hydrotropy. **Precipitation:** Precipitation - Biological significance. **Colloids:** Types of colloids - characteristics of colloids - stability of colloids - Gel - Emulsions - Techniques for the separation of colloids - Biological importance of colloids – Gibb's Donnan Equilibrium.

Unit:4	**Optical Techniques in Biological Studies**	**12 hours**

Characteristics of light- compound· microscope - Ultraviolet microscope - Electron microscope Transmission electron microscope - Scanning Electron microscope - Monochromator - Light sensitive detectors- Spectrophotometer - Atomic absorption flame photometer - Electromagnetic radiation Spectroscopy - Ultraviolet, visible, infrared and fluorescent spectroscopy - Atomic absorption and emission spectroscopy - mass spectroscopy - Raman spectroscopy – X-ray diffraction crystallography.

Unit:5	**Bioelectricity and Radiation Biology**	**12 hours**
Membrane potential - Resting membrane potential - Action potential and nerve impulse conduction Rate of nerve impulse conduction- Recording of nerve impulses by C.R.O - Resting membrane potential -.J Injury potential- Monophasic and diphasic action potentials - Radioactivity - Natural radioactivity Artificial or induced radioactivity - Radioactive disintegration - units of Radioactivity.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars - webinars		
	Total Lecture hours	**60**

Text Book(s)	
1	Biophysics: Principles and Techniques, M.A. Subramanian, MJP Publishers, (2015).
2	Principles of biophysics, Dr S. Palanichamy, Dr.M. Shanmugavelu, Palani Paramount Publications, (1996).
Reference Books	
1	Biophysics, S. Thiravia Raj, Saras Publication, (2009).
2	Basic Biophysics for Biologist, M. Daniel, Agro-Bios, (1998).
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.sciencedirect.com/topics/earth-and-planetary-sciences/biophysics
2	https://onlinecourses.nptel.ac.in/noc20_ph02/preview
Course Designed By: **BoS - Physics CA**	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	M	M	S	M	M	M	S	M
CO2	M	S	S	M	S	S	S	M	S	S
CO3	M	S	S	S	S	S	M	S	S	S

*S-Strong; M-Medium; L-Low

VALUE ADDED COURSE I

Value added course	OPTOELECTRONICS	L	T	P	C
		30	0	0	4
Pre-requisite	Students are expected to possess some basic knowledge in the field of Semiconductor technology.	Syllabus Version	2023-24		

Course Objectives:

The main objectives of this course are to:

- understand the optical process in a semiconductor.
- understand the basic optoelectronics devices-LED, OLED, photo detector and photovoltaic devices.
- be familiar with recent trends in optoelectronics.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	describe basic laws and phenomena that define behaviour of optoelectronic devices.	K1
2	describe the development and application of optoelectronic systems	K2
3	interpret the acquired data and measured results.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Module:1	2 hours
Electron - hole pair formation and recombination, absorption in semiconductor direct and indirect band gap semiconductors.	
Module:2	**2 hours**
Effect of electric field on absorption, Franz-Keldysh effect in semiconductors.	
Module:3	**2 hours**
Light Emitting Diodes — Materials for light emitting diodes, Principle of action of LED, expression for light power in terms of photon energy, homo structured LED and Hetero junction LED, drawbacks of homo structured LED.	
Module:4	**2 hours**
Types of LED structures—planar, dome type, surface emitter, edge emitter, super luminescent structure.	
Module:5	**2 hours**
Performance characteristics of LED—Optical output power-current characteristics, forward current voltage characteristics.	
Module:6	**2 hours**
Performance characteristics of LED—Optical output power-current characteristics, forward current voltage characteristics, Modulation bandwidth, power bandwidth product, Lifetime, Rise time/fall time, reliability,	
Module:7	**2 hours**
Internal quantum efficiency, advantages / disadvantages of using LED. Numerical problems	
Module:8	**2 hours**
Organic light emitting diodes (OLED), The principle of OLED, characterisation, structure, efficiency, multilayer OLED.	

Module:9	**2 hours**
Important parameters of photo detectors, Detector responsivity, spectral response range, response time, quantum efficiency, capacitance, noise characteristics.	
Module:10	**2 hours**
Absorption of radiation—absorption coefficient, mention of expression for photocurrent, long wavelength cut off, direct and indirect absorption T.	
Module:11	**2 hours**
Types of photodiodes—Junction photodiodes, pin diode, avalanche photodiodes, CCD photodetectors; Comparison of different detectors, Photomultiplier tubes.	
Module:12	**2 hours**
Phototransistors—characteristics. Photo conductive detectors—expression for photoconductive gain. Numerical problems.	
Module:13	**2 hours**
Solar cell—IV characteristics, efficiency, materials	
Module:14	**2 hours**
Organic photovoltaic diodes (OPVD)—fundamental process, exciton absorption, exciton dissociation	
Module:15	**2 hours**
Charge transport, charge collection, characterisation. numerical problems	
Total Lecture hours	**30**

Text Book(s)	
1	Fibre Optics Communications, Harold Kolimbiris, Prentice Hall, (2004).
2	Optical Fibre Communications, Keiser G, McGraw Hill, (2000).
Reference Books	
1	Fibre Optic Communication, Agarwal D C, Wheeler Publications, (1996).
2	Optical Communication, Katiyar S, S K Kataria and Sons, (2010).
3	Optoelectronics and Photonics: Principles and Practices, Kasap S O, Pearson, (2013).
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/115/102/115102026/
2	https://moodle.usth.edu.vn/course/view.php?id=362#section-1
3	https://www.classcentral.com/course/swayam-semiconductor-optoelectronics-10043
Course designed by: **BoS - Physics CA**	

VALUE ADDED COURSE II

Value added course	NON – DESTRUCTIVE TESTING	L	T	P	C
		30	0	0	4
Pre-requisite	Students should be aware of some fundamental principles of non – destructive testing and thermography.	**Syllabus Version**		**2023-24**	

Course Objectives:

The main objectives of this course are to:

- learn the fundamentals of NDT and its applications which will be used for solving problems in industries to produce flawless components.
- acquire the knowledge about different types of Non-Destructive testing methods and to apply those principles to identify defects in various products produced in industries.
- study and understand various Non-Destructive evaluations, testing methods, theories and their industrial applications.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	understand the magnetic testing methods and interpretation of results and applications.	K2
2	understand the application of Thermography, eddy current testing method, ultrasonic and acoustic emission testing.	K3
3	understand the instrumentation of various Radiography and testing techniques such as Fluoroscopy, Xerography, Computed Radiography and Computed Tomography.	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Module:1	**2 hours**
Introduction of materials testing -Classification of materials tests – Overview of non-destructive testing methods.	
Module:2	**2hours**
Various NDT methods- selection of NDT methods-Visual Inspection.	
Module:3	**2hours**
Introduction-principle-types of visual testing- Experiments used in visual inspection -Applications.	
Module:4	**2 hours**
Liquid Penetrant Testing – Principles - Testing Process - penetrant materials – Developers.	
Module:5	**2 hours**
Penetrant testing methods- Interpretation of results- Applications.	
Module:6	**2 hours**
Magnetic Particle Testing- Magnetic testing methods-Interpretation and evaluation of test indications. - Application of Magnetic particle Inspection.	
Module:7	**2 hours**
Thermography principles- Contact and non-contact inspection methods-Techniques for applying liquid crystals-Advantages and limitation.	

Module:8	2 hours
Infrared radiation and infrared detectors-Generation of eddy currents, Properties of eddy currents	
Module:9	**2 hours**
Eddy current sensing elements, Probes, Instrumentation, Types of arrangement, Applications, advantages, Limitations, Interpretation/Evaluation.	
Module:10	**2 hours**
Ultrasonic and acoustic emission testing - Basics of ultrasonic waves- Principle- Equipment for ultrasonic testing- Testing methods.	
Module:11	**2 hours**
Ultrasonic transducers- Mode of displays- Application.	
Module:12	**2 hours**
Introduction- Basic principle- Instrumentation of acoustic emission testing- Modes- Four channel data acquisition- Applications.	
Module:13	**2 hours**
Radiography testing - Principle-Equipment of Radiography Testing-film and film less techniques- types and use of filters and screens.	
Module:14	**2 hours**
Characteristics of films -graininess, density, speed, contrast-characteristic curves- Radiographic techniques.	
Module:15	**2 hours**
Fluoroscopy- Xerography-Computed Radiography- Computed Tomography.	
Total Lecture hours	**30**

Text Book(s)

1	Practical Non-Destructive Testing, Baldev Raj, T.Jayakumar, M.Thavasimuthu, Narosa Publishing House, (2014).
2	Non-Destructive Testing Techniques, Ravi Prakash, New Age International Publishers, (2010).

Reference Books

1	Handbook of Non-destructive evaluation, Charles, J. Hellier, McGraw Hill Professional, (2001).
2	Introduction to Non-destructive testing: a training guide, Paul E Mix, Wiley, 2nd Edition New Jersey, (2005).

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://nptel.ac.in/courses/113/106/113106070/

Course designed by: **BoS - Physics CA**

VALUE ADDED COURSE III

Value added course	**Biomedical instrumentation**	**L**	**T**	**P**	**C**
		30	**0**	**0**	**4**
Pre-requisite	Students are expected to have some basic knowledge in the field of physiology, operations and instruments used in medical field.	**Syllabus Version**	**2023-24**		

Course Objectives:

The main objectives of this course are to:
understand the working principles of Biomedical Instruments.
find applications of various biomedical instruments.
impart the knowledge of electronics on various biomedical instruments.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	study the safety instrumentation against radiation, physiological effects due to current passage and electrical accidents in the hospitals.	K1
2	analyse the theory of Bio-Telemetry, its problems and uses.	K4
3	evaluate the advances in biomedical instrumentation such as lasers in medicine, endoscope, CT scan, ultrasonic imaging, MRI and biofeedback instrumentation	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Module:1	**2 hours**

Physiological Assist Devices: -Introduction – pacemakers – pace maker batteries.

Module:2	**2 hours**

Artificial heart valves – nerve and muscle stimulators.

Module:3	**2 hours**

Heart lung machine – kidney machine.

Module:4	**2 hours**

Operation theatre equipment: Introduction – surgical diathermy – ventilators – anesthesia machine.

Module:5	**2 hours**

Cardiac output measurements – pulmonary function analysers – gas analysers.

Module:6	**2 hours**

Blood gas analysers – oxymeters – elements of intensive care monitoring.

Module:7	**2 hours**

Bio-Telemetry: Elements of bio-telemetry system.

Module:8	**2 hours**

Design of a bio-telemetry system – radio telemetry system.

Module:9	**2 hours**

Problems in implant telemetry – uses of bio-telemetry.

Module:10	**2 hours**
Safety instrumentation Introduction – radiation safety instrumentation.	
Module:11	**2 hours**
Physiological effects due to 50 Hz current passage – electrical accidents in hospitals.	
Module:12	**2 hours**
Devices to protect against electrical hazards – hospital architecture.	
Module:13	**2 hours**
Advances in bio-medical instrumentation: Introduction – computers in medicine – lasers in medicine.	
Module:14	**2 hours**
Endoscopes – cryogenic surgery – CT scan – ultrasonic imaging.	
Module:15	**2 hours**
MRI – biofeedback instrumentation – biomaterials.	
Total Lecture hours	**30**

Text Book(s)	
1	Biomedical instrumentation, M. Arumugam, AnuradhaPublicatios, (2009).
2	Introduction to biomedical electronics, Joseph Dubovy, Tata McGraw Hill Company (1978).
Reference Books	
1	Biomedical Instrumentation and Measurements, Leslie Cromwell, Fred J. Weibell And Erich A. Pfeiffer, Measurements Prentice Hall of India (1997).
2	Handbook of biomedical instruments, Khandpur. R.S, Tata McGraw Hill Company (2003).
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/108/105/108105101/
2	https://onlinecourses.nptel.ac.in/noc20_ee41/preview
3	https://www.classcentral.com/course/bioengineering-20126
Course designed by: **BoS - Physics CA**	

VALUE ADDED COURSE IV

Value added course	Modern Display Devices and Storage Materials	L	T	P	C
		30	0	0	4
Pre-requisite	Students are expected to know some basic concepts of display devices, its usage and about some storage materials.	Syllabus Version	2023-24		

Course Objectives:

The main objectives of this course are to:
acquire knowledge about different types of electronic devices and about some storage materials.
understand the selection process which will be used in industries.
create various electronic and optoelectronic devices using suitable materials.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	evaluate display performances which are necessary to appropriately select a LCD in clinical situations.	K1
2	present information in visual or tactile form.	K2
3	apply these concepts for electronic visual displays.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Module:1	2 hours

Selection of materials for different devices: Selection Criteria- Operating Parameters-Manufacturing Process-Functional Requirements-Cost consideration.

Module:2	2 hours

Engineering Requirements-Types of Materials-Examples of selection criteria.

Module:3	2 hours

Modern Engineering materials: Metallic Glasses-Structure-Preparation-Properties-Applications.

Module:4	2 hours

Shape memory alloys- Introduction-Structural Changes-General Characteristics-Characterization Techniques-Commercial SMAs-Applications.

Module:5	2 hours

IC Packaging Materials. Introduction-IC packing-Package type-Package materials.

Module:6	2 hours

Display Devices: Introduction-Electroluminescence process- LED materials.

Module:7	2 hours

Fabrication of LED - Applications - Active and passive display devices.

Module:8	2 hours

Liquid crystals-Types -General features of liquid crystals-liquid crystal display systems-TN-LED (twisted nematic liquid crystal display) - merits and Demerits**.**

Module:9	**2 hours**
Magnetic Data Storage Devices: Basics of magnetic materials and their parameters - Memory concepts	
Module:10	**2 hours**
Magnetic surface storage devices-magnetic Disc Memories	
Module:11	**2 hours**
Flexible disc storage systems-Floppy disks- Magnetic Tapes and drives-Magnetic Bubble materials	
Module:12	**2 hours**
Rare earth garnets-Magnetic Bubble memories - Charge Couple devices – Applications**.**	
Module:13	**2 hours**
Optical Data Storage Devices: Principle-Disc data storage- Structure and operating principle of CD-ROM.	
Module:14	**2 hours**
Magneto-optical storage system (recording and reading) - Data storage and retrieval methods.	
Module:15	**2 hours**
Holography data storage-principle-storing and retrieving digital data-Applications of Holography.	
Total Lecture hours	**30**

Text Book(s)	
1	Semiconductor Physics and Optoelectronics, V.Rajendran, J.Hemalatha, M.Stalin Mano Gibson, Vikas Publishing House PVT Ltd, (2003).
2	A Text book of Material Science, K.G.Aswani, S. Chand & Company ltd, (2001).
Reference Books	
1	Material science, O.P.Khanna, Dhanpat Rai Publications, (2004).
2	Semiconductor Physics and Optoelectronics, M.Arumugam, Anuradha Agencies,(2003).
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.slideshare.net/mobile/thesaifeye/material-handling-storage-system
2	https://www.slideshare.net/mobile/jerinmartin/display-devices-44886026
Course designed by: **BoS - Physics CA**	

The distribution of marks for CIA and CEE theory (core / elective) subjects is as given under:

Paper	Maximum Marks	Marks for		Components for CIA		
		CIA	CEE	Tests	Assignment	Seminar /Others*
Theory (Core / Elective)	50	20	30	10	05	05
Theory (Core / Elective)	75	20	55	10	05	05
Theory (Core / Elective)	100	25	75	15	05	05

*Components for 'others' may include the following:
Class Participation, Case Studies Presentation, Field Work, Field Survey, Group Discussion, Term Paper, Workshop / Conference Participation, Presentation of Papers in Conferences, Quiz, Report / Content Writing, etc.

- The distribution of marks for CIA and CEE for practical (core / elective) subjects isas given under:

Paper	Maximum Marks	Marks for		Components for CIA		
		CIA	CEE	Tests	ObservationNote	Record Note
Practical (Core / Elective)	50	20	30	10	05	05
Practical (Core / Elective)	75	30	45	20	05	05
Practical (Core / Elective)	100	40	60	20	10	10

- Three tests (Test 1, Test 2 and Test 3) for continuous internal assessment for each core / elective / supportive papers offered in a semester shall be conducted in the following manner:
  - Test 1 and Test 2 may be the unit-based tests
  - Test 3 may be the model test.
  - 25% weightage to each of Test 1 and 2, and 50% weightage to Test 3
  - It is mandatory for every student to attend at least one test in every subject.
- The average of two or three assignments for continuous internal assessment for each core / elective papers offered in a semester shall be taken as the marks for the assignment component.
- At least one seminar / one component in 'others' category shall be considered to arrive at the marks for seminar / others component.

QUESTION PAPER PATTERN

The following question paper patterns shall be followed for OBE pattern syllabi for the candidates admitted from the academic year 2023-24 wherever applicable otherwise provided in syllabi itself.

Maximum 55 Marks – wherever applicable			
Section A	Multiple choice questions with four options	10*1=10	10 questions – 2 from each unit
Section B	Short answer questions of either / or type	5*3=15	5 questions – 1 from each unit
Section C	Essay-type questions of either / or type	5*6=30	5 questions – 1 from each unit

Maximum 75 Marks – wherever applicable			
Section A	Multiple choice questions with four options	10*1=10	10 questions – 2 from each unit
Section B	Short answer questions of either / or type	5*5=25	5 questions – 1 from each unit
Section C	Essay-type questions of either / or type	5*8=40	5 questions – 1 from each unit

The General Awareness paper to have multiple-choice questions (with four options) to be evaluated by using OMR. For other courses in Part IV namely, Environmental Studies, Value Education – Human Rights, Yoga for Human Excellence and Women's Rights the question paper pattern should be 5 out of 10. Each question carries 10 marks.