

**MANONMANIAM
SUNDARANAR UNIVERSITY,**

TIRUNELVELI – 627 012

B.Sc. Physics Degree
(CHOICE BASED CREDIT SYSTEM)

**Learning Outcome Based
Curriculum**

Major & Allied Physics
(Effective from the academic year 2021-
2022 onwards)

MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI
UG COURSES – AFFILIATED COLLEGES

B.Sc. PHYSICS

(Choice Based Credit System)

(With effect from the academic year 2021-2022 onwards)

1. Vision of the University

To provide quality education to reach the un-reached

2. Mission of the University

- To conduct research, teaching and outreach programmes to improve conditions of human living.
- To create an academic environment that honours women and men of all races, caste, creed, cultures and an atmosphere that values intellectual curiosity, pursuit of knowledge, academic freedom and integrity.
- To offer a wide variety of off-campus educational and training programmes including the use of information technology, to individuals and groups.
- To develop partnership with industries and government so as to improve the quality of the work place and to serve as catalyst for economic and cultural development.
- To provide quality / inclusive education especially for the rural and un-reached segments of economically downtrodden students including women, socially oppressed and differently abled.

3. Vision of the Department

To promote active learning, critical thinking coupled with ethical values and produce globally competent physicists.

4. Mission of the Department

The Department is committed to impart quality education both in theoretical as well as experimental physics with special emphasis on 'learning by doing' for socio-economic growth.

5. Preamble

The Department of Physics provides instructional programs in introductory Physics to a broad range of students through an understandable and effective method that enables them to integrate this knowledge into their normal thought processes. The department provides a forward-looking curriculum to undergraduate Physics Major, involving not only traditional physics topics but also state-of-the-art instruction in experimental techniques, computational physics and the use of computers in data acquisition and analysis, as well as active involvement in professional research.

6. Programme Outcome

Upon completion of B.Sc degree programme, the graduates will be able to

PO. 1: acquire a fundamental concepts in the field of Physics and procedural knowledge that creates different types of professionals related to the subject area of Physics, including professionals engaged in research and development, teaching and government / public service.

PO. 2: demonstrate the ability to use skills in Physics and its related areas of technologies for formulating and tackling

Physics related problems.

PO. 3: inculcate innovative skills and teamwork among students to meet societal expectations.

PO. 4: perform analysis to assess, interpret and create innovative ideas through practical experiments.

PO. 5: facilitate to enter multidisciplinary path to solve day-to-day scientific problems.

PO. 6: carry out fieldworks and projects both independently and collaboration with others and to report in a constructive way.

PO. 7: improve communication ability and knowledge transfer through ICT aided learning integrated with Library resources.

PO. 8: attain competency in job market / entrepreneurship.

7. Programme Specific Outcome (PSO)

The student graduating with the degree B.sc (Physics) should be able to

PSO1: understand and experiment the basic concepts of Properties of Matter and Mechanics, Optics and Acoustics, Heat and Thermodynamics, Electricity and Electromagnetism, Instrumentation Physics, Space Physics, Basic Electronics, Spectroscopy, Atomic and Nuclear Physics, Communication Electronics, Quantum Mechanics, Digital Electronics, Solid State Physics, Energy Physics and Medical Physics.

PSO2: develop the skills on scientific programming through programming with C++ which will make them choose their career in wide spectrum of areas.

PSO3: students will have knowledge about the working of medical instruments, laser, super conductivity, electrical appliances, wiring and nano materials.

PSO4: students utilize their laboratory skills to take measurements in Physics laboratory, analyze the measurements and draw valid conclusions.

PSO5: students will be able to compile oral and written scientific communications and will prove that they can think critically and work independently.

PSO6: harness the scientific ideas to reduce pollution by promoting non-conventional and renewable energy sources.

PSO7: students will illustrate proficiency in mathematics and the mathematical concepts needed for the proper understanding of physics and can face competitive exams with ease.

PSO8: gain confidence and move to higher studies.

8. Eligibility for admission to the course and examination

Candidate shall be admitted to the course provided he / she has passed plus two examinations of the State or Central Board with Maths / Physics / Chemistry / Biology as one of the subject or any other science subject that may be considered as equivalent by the M.S. University.

9. Duration of the course

The students shall undergo the prescribed course of study for a period of not less than three academic years (six semesters). Each semester contains 90 working days.

10. Medium of instruction and examination

The medium of instruction as well as examinations will be in English.

11. Theory Examination

The external evaluation will be based on the examination to be conducted by the University at the end of each semester.

12. Practical Examination

Practical examinations will be conducted at the end of each semester.

13. Evaluation

A. Each paper carries an internal component

B. There is a pass minimum of 40% for external and overall components

Theory external: Internal assessment = 75:25

Practical External: Internal assessment = 50:50

C. Internal Assessment

Internal Marks for theory shall be allocated in the following manner

The average of the best two tests from three compulsory tests	20 Marks
Assignment	05 Marks
Total	25 Marks

Note: Each test will be of one hour duration

D. Practical

Internal marks for Practical shall be allotted in the following manner.

Experimental	20 Marks
Record	10 Marks
Model Test	20 Marks
Total	50 Marks

E. Project Work

Components	Marks
Project Report	75
Viva-Voce	25
Total	100

Note:

- i) Students should carry out group project in major subject.
- ii) Project report will be evaluated by central valuation and viva-voce will be conducted by both the External Examiner and the Guide at the end of the sixth semester.

F. The overall performance level of the candidates will be assessed by the following formulae:

$$\text{Cumulative weighted average of marks} = \frac{\sum(\text{marks} + \text{credits})}{\sum \text{credits}}$$

$$\text{Cumulative weighted average grade points} = \frac{\sum(\text{Grade points} \times \text{credits})}{\sum \text{credits}}$$

14. Grading System

The performance of the student is indicated by the Seven Points Scale Grading System as per the UGC norms given below

Grade	Grade point	Percentage of marks	Performance
O	9.5 and above	95-100	Outstanding
E	8.5 and above	85-94	Excellent
D	7.5 and above	75-84	Distinction
A	7 and above	70-74	Very Good
B	6 and above	60-69	Good
C	5 and above	50-59	Average
RA	0	Up to 49	Re-Appeal

15. The question paper pattern for all theory papers shall be as follows.

Duration of Exam: 3Hours

Section	Type of questions	Mark
Part-A	Multiple choice question (Two question from each unit compulsory)	1×10=10 Marks
Part-B	Internal Choice questions (One question from each unit: either/or)	5×5=25 marks
Part-C	Internal Choice questions (One question from each unit: either/or)	8×5=40 marks
	Total	75 Marks

16. The question paper pattern for all practical papers shall be as follows.

Duration of Practical Exam: 3 hours

1	AIM, Formula	10
2	Knowledge of the experiment	5
3	Observation and calculation	20
4	Accuracy of the result	05
5	Record	10
	Total	50 Marks

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UG COURSES – AFFILIATED COLLEGES

B.Sc. PHYSICS

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Course Structure

	Subject Part	Subject Title	Contact Hrs/week	Credits	Exam Hrs.	Marks		
						Int.	Ext.	Total
Semester – I	Part I	Tamil / Other Language	6	4	3	25	75	100
	Part II	Communicative English-I	6	4	3	25	75	100
	Part III	<u>Core Subject</u> 1. Properties of Matter & Mechanics	4	4	3	25	75	100
		Practical-I	2	2	3	50	50	100
		Professional English for Physical Sciences-I	4	4	3	25	75	100
		Allied Physics Paper-1	4	3	3	25	75	100
		Allied Practical-I	2	2	3	50	50	100
	Part IV	Common – Environmental Studies	2	2	3	25	75	100
		Total	30	25				
Semester – II	Part I	Tamil / Other Languages	6	4	3	25	75	100
	Part II	Communicative English-II	6	4	3	25	75	100
	Part III	<u>Core Subject</u> 2. Optics and Acoustics	4	4	3	25	75	100
		Practical-II	2	2	3	50	50	100
		Professional English for Physical Sciences-II	4	4	3	25	75	100
		Allied Physics Paper-2	4	3	3	25	75	100
		Allied Practical-II	2	2	3	50	50	100
	Part IV	Common – Value Based Education	2	2	3	25	75	100
		Total	30	25				

Semester – III

Subject Part	Subject Title	Contact Hr / Week	Credit	Exam Hrs	Marks		
					Int	Ext	Total
Part I	Tamil / Other Languages	6	4	3	25	75	100
Part II	English	6	4	3	25	75	100
Part III	<u>Core subject</u> 3. Electricity & Electromagnetism	4	4	3	25	75	100
	Practical-III	2	2	3	50	50	100
	<u>Allied Subject-I</u> (for allied subjects With theory and practical) 1.Theory-Paper-I	4	3	3	25	75	100
	2.Practical-1	2	2	3	50	50	100
	<u>Skill based subject</u> (Any one) a. Maintenance of Electrical appliances b. Instrumentation Physics – I	4	4	3	25	75	100
	<u>Non – Major Elective</u> (Any one) a. Basic Physics – I b. Applied Physics	2	2	3	25	75	100
	Common-Yoga*	2	2				
	Total	32	27				

Semester – IV

Subject Part	Subject Title	Contact Hr / Week	Credit	Exam Hrs	Marks		
					Int	Ext	Total
Part I	Tamil / Other Languages	6	4	3	25	75	100
Part II	English	6	4	3	25	75	100
Part III	<u>Core subject</u> 4. Heat & Thermodynamics	4	4	3	25	75	100
	Practical-IV	2	2	3	50	50	100
	<u>Allied Subject-II</u> (for allied subjects with theory and practical) 1.Theory-Paper-II	4	3	3	25	75	100
	2.Practical-II	2	2	3	50	50	100
	<u>Skill based subject</u> (Anyone) a. Maintenance of Electronic appliances b. Instrumentation Physics – II	4	4	3	25	75	100
Part IV	<u>Non – Major Elective - Paper - II</u> (Any One) a. Basic Physics – II b. Space Physics	2	2	3	25	75	100
	Common - Computer For Digital Era*	2	2	-	-	-	-
Part V	Extension activity	-	1	-	-	-	-
	Total	32	28				

	Subject Part	Subject Title	Contact Hr / Week	Credit	Exam Hrs	Marks		
						Int	Ext	Total
Semester V	Part III	<u>Core subject</u> 5.Basic Electronics	6	4	3	25	75	100
		6. Spectroscopy	5	4	3	25	75	100
		7.Atomic and Nuclear Physics	6	4	3	25	75	100
		<u>Major Elective</u> (any one) a.Programming in C++ b.Communication Electronics	5	4	3	25	75	100
		Practical – V - General Practical	3	3	3	50	50	100
		Practical-VI Electronics	3	3	3	50	50	100
	Part IV	<u>Skill based subject</u> (Common) Personality development / Effective Communication / Youth Leadership	2	2	3	25	75	100
		Total	30	24				
Semester VI	Subject Part	<u>Core Subject</u> 9. Quantum Mechanics	5	4	3	25	75	100
		10. Digital Electronics	5	4	3	25	75	100
		11. Solid State Physics	5	4	3	25	75	100
		<u>Major Elective</u> (any one) a.Energy Physics b.Medical Physics	5	4	3	25	75	100
		Project	4	4	3	50	50	100
		Practical-VII General Practical	3	3	3	50	50	100
		Practical-VIII Electronics	3	3	3	50	50	100
		Total	30	26				

MSU/2021-22/UG-Colleges/Part-III(B.Sc. Physics) /Semester-I

Core-1: PROPERTIES OF MATTER & MECHANICS

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	Define Stress, Strain, Poisson's ratio, Hooke's law, Torsion pendulum and determine the elastic constant by Searle's Method.	1	Re, Ap
CO-2	Understand the principle of elasticity through the study of young's Modulus and Rigidity Modulus.	1	Un
CO-3	Derive the Expression for the Bending Moment, Cantilever depression, Uniform and Non-Uniform Bending.	1,4	An
CO-4	Find the Young's Modulus of a bar by Uniform and Non-Uniform Bending Method.	1,3,4	Ca
CO-5	Analyse the different Molecular Forces that causes tension on the surface of liquid and determine the surface tension by Capillary rise method and Quincke's Method	3,4	An, Ev
CO-6	Determine the Coefficient of Viscosity of a liquid by Poiseuille's Method and apply the knowledge of viscosity in the field of lubrication	4	Ca, Un, Ap
CO-7	Understand the Analogy between translational and Rotational Motion, Angular Momentum, Angular Impulse, Moment of Inertia and Radius of gyration	1	Un
CO-8	Understand Newton's Second Law for rotation and determine the expression for rotational kinetic energy and power during rotation.	1	Un, E
CO-9	Analyse the centre of pressure on a rectangular and triangular lamina.	1	A
CO-10	Understand the law of floatation and determine the Meta Centric height of a ship and apply the principle of Bernoulli's Theorem in Pitot's tube and Venturimeter	1	Un, Ap

MSU/2021-22/UG-Colleges/Part-III(B.Sc. Physics) /Semester-I

Core-1: PROPERTIES OF MATTER & MECHANICS

PREAMBLE:

- To expose students to the fundamentals of Properties of Matter
- To identify the characteristics of solids and fluids in terms of their properties
- To know the principle of conservation of momentum, energy and their consequences

UNIT-I: ELASTICITY

Hooke's law - Stress-strain diagram - Elastic moduli-Relation between elastic constants - Poisson's Ratio-Expression for Poisson's ratio in terms of elastic constants – experimental determination of Poisson's ratio of rubber - Twisting couple on a cylinder -Work done in twisting a wire - Torsional pendulum- Determination of Rigidity modulus and moment of inertia- q , n and σ by Searles method-I-section girders

UNIT-II: BENDING OF BEAMS

Bending of beams - Expression for bending moment - Cantilever - Expression for cantilever depression and oscillations - theory and experiments. Uniform bending and Non-uniform bending- theory and experiments.

UNIT-III: FLUIDS

Surface Tension - Synclastic and anticlastic surfaces - Excess of pressure - application to spherical and cylindrical drops and bubbles - variation of surface tension with temperature - Jaeger's method. Capillary rise - Experimental determination of surface tension by capillary rise - angle of contact of mercury - Quincke's method. Viscosity - Rate flow of liquid in a capillary tube - Poiseuille's formula - Determination of coefficient of viscosity by capillary flow - Variations of viscosity of a liquid with temperature-lubricants.

UNIT-IV: DYNAMICS OF RIGID BODIES

Translational and rotational motion - Angular momentum and angular impulse - moment of inertia and radius of gyration—Compound pendulum-theory-equivalent simple pendulum - reversibility of centres of oscillation and suspension - determination of g and k -Newton's second law for rotation – torque, work, rotational kinetic energy and expression for power during rotation - Kinetic energy of rolling - Acceleration of a uniform body, rolling down an inclined plane. Precessional motion.

UNIT-V: HYDROSTATICS AND HYDRODYNAMICS

Pressure and thrust - Thrust on a plane surface immersed in a liquid - centre of pressure – centre of pressure on a rectangular lamina, a triangular lamina. Laws of floatation-determination of meta centric height of a ship - steady and streamline flow - equation of continuity-energy of a fluid-Bernoulli's theorem– proof-pitot's tube and venturimeter

Books for study

1. Properties of matter – Murugesan R, S Chand & Co.Pvt. Ltd., New Delhi
2. Mechanics-D.S.Mathur - S Chand & Co
3. Mechanics and mathematical physics-R.Murugesan - S Chand & Co. Pvt. Ltd., New Delhi.

Books for Reference

1. Elements of Properties of Matter – Mathur DS, Shyamlal Charitable Trust, New Delhi,1993
2. Fundamentals of General Properties of Matter – Gulati HR, R Chand & Co. New Delhi,1982
3. Fundamentals of Physics,-D Halliday, R Resnick and J Walker, Wiley NY2001.6th Edition
4. Mechanics–Berkeley Physics course: Charles Kittel-Tata McGraw Hill Publication

PRACTICAL - I

(6 experiments compulsory)

1. Young's modulus-non uniform bending - pin and microscope
2. Young's modulus – uniform bending - optic lever and telescope
3. Young's modulus – cantilever – depression
4. Torsional pendulum – Rigidity modulus and moment of inertia (with & without masses)
5. Compound pendulum – g and I
6. Co-efficient of viscosity -Stoke's method
7. Co-efficient of viscosity – Variable pressure head method
8. Surface tension – Drop weight method

ALLIED PHYSICS– I**Course Outcome:**

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	Define the fundamentals of elasticity, concept of stress, strain, bending moment and to solve the problems related.	1	Re, Ap
CO-2	Understand the principles of elasticity through the study of Young Modulus and modulus of rigidity.	1,4	Un
CO-3	Understand principles of surface tension and Viscosity	1	Un
CO-4	Describe the properties of fluids such as viscosity and surface tension and evaluate the value of coefficient of viscosity	1,3,4	An, Ev
CO-5	Explain the phenomena of simple harmonic motion and the properties of systems executing such motions.	1,4	An, Ev
CO-6	Determine the frequency of tuning fork by Melde's string experiment and apply the knowledge of simple harmonic motion.	1,3,4	Ca, Un, Ap
CO-7	Understand the laws of thermodynamics, concepts of transport phenomena.	1	Un
CO-8	Demonstrate the experiments to determine the thermal conductivity and specific heat capacity and apply the knowledge of transport phenomena.	1,4	An, E, Ap
CO-9	Acquire mastery of the fundamental principles and applications of interference, diffraction and polarization	1	Ac
CO-10	Demonstrate the experiments to find the wavelength of different colours of light by normal incidence using grating and apply the knowledge of diffraction principle.	1,3,4	An, Ap

ALLIED PHYSICS– I

PREAMBLE:

- To understand the concept of strength of materials, viscous properties of liquids, heat transformation from one place to another converting heat to do mechanical work and basic properties of light such as interference and diffraction

Unit I: Elasticity and bending moment

Hooke's law – Elastic moduli – Relation between elastic constants – Work done in stretching a wire–Expression for bending moment-uniform bending-Experiment to determine Young's modulus using pin and microscope-Twisting couple of a wire – Expression for couple per unit twist–Work done in twisting – Experimental determination of rigidity modulus of a wire using Torsion pendulum with theory

Unit II: Surface tension and Viscosity

Surface tension – Definition– Examples –Molecular interpretation– Expression for excess of pressure inside a synclastic and anticlastic surface-Application to spherical and cylindrical drops and bubbles

Viscosity: Coefficient of viscosity – Rate of flow of liquid in a capillary tube (Poisueuille's formula) –Analogy between liquid flow and current flow– Stokes' formula for highly viscous liquid (Dimension method) – Experimental determination of viscosity of highly viscous liquid (stokes' method)

Unit III: Sound

Simple harmonic motion – Free, damped, forced vibrations and resonance – Composition of two SHMs along a straight line and in perpendicular direction – Melde's string experiment – Determination of frequency of tuning fork (both longitudinal and transverse mode)

Unit IV : Thermal physics : Mean free path- Expression for mean free path (Zero order approximation) – Transport phenomena – Expression for viscosity and thermal conductivity – Conduction in solids – coefficient of thermal conductivity – Lee's disc method to determine thermal conductivity of a bad conductor –Wiedmann–Franz's law–Convection : Newton's law of cooling – Experimental verification – Radiation : Black body radiation – Distribution of energy in black body spectrum –Important features.

Unit V: Optics

Interference: Condition for interference-Air wedge-determination of thickness of a thin wire by air wedge method

Diffraction: Fresnel & Fraunhofer diffraction-Plane diffraction grating- theory and experiment to determine wavelength (normal incidence)

Polarization: Double refraction- half wave and quarter wave plate – Production and detection of plane, elliptically and circularly polarized light.

Books for study

1. Optics–Brijlal & Subramanian
2. Properties of matter – R.Murugesan
3. Heat & Thermodynamics – D.S.Mathur

Books for Reference

1. Heat and thermodynamics –Brijlal & Subramanian, S Chand & Co., New Delhi
2. Fundamentals of Optics by Jenkins A Francis and White E Harvey, McG Raw Hill Inc., New Delhi, 1976.
3. Elements of Properties of Matter by Mathur D S, Shyamlal Charitable Trust, New Delhi, 1993

ALLIED PRACTICAL - I

(6 experiments compulsory)

1. Youngs modulus – non uniform bending – pin and microscope
2. Youngs modulus – uniform bending – optic lever and telescope
3. Torsional pendulum – Rigidity modulus
4. Co-efficient of viscosity - Stoke's method
5. Thermal conductivity of a bad conductor -Lee's disc method.
6. Spectrometer–dispersive power
7. Spectrometer-grating—normal incidence method.
8. Airwedge – thickness of a wire

MSU/2021-22/UG-Colleges/Part-III(B.Sc. Physics)/Semester-II

Core-2: OPTICS AND ACOUSTICS

Course Outcome:

CO. No.	After completion of this course, students will be able to	PSO addressed	CL
CO-1	Understand the concepts of spherical aberration, chromatic aberration in lenses, refraction, deviation and dispersive power of a prism.	1	Un
CO-2	Acquire knowledge of the working principle of constant deviation spectroscopy and different types of eyepieces.	1	Un
CO-3	Discuss the theory of interference fringes and interference in thin films	1, 7	Un
CO-4	Apply the phenomenon of interference on optical experiments like air wedge, Newton's rings and Michelson's interferometer.	1,4	Ap
CO-5	Define diffraction, polarization, double refraction and optical activity	1	Re
CO-6	Understand the theory of diffraction by a single slit, diffraction by a circular aperture, theory of grating and theory of different types of polarized light.	1, 7	Un
CO-7	Acquire knowledge of simple harmonic motion, damped and forced vibrations, musical notes and musical scale.	1	Un
CO-8	Describe the principle and working of acoustic instruments like Helmholtz resonator, sonometer and Melde's apparatus.	1, 4	Un, Ev
CO-9	Understand the properties, applications, production and detection of ultrasonic waves	1	Un
CO-10	Derive Sabine's formula and apply it to design the acoustically good auditorium and architectures.	1, 7	Cr

MSU/2021-22/UG-Colleges/Part-III(B.Sc. Physics)/Semester-II

Core-2: OPTICS AND ACOUSTICS

PREAMBLE:

- To gain good knowledge of optics and understand the various optical instruments and making finer measurements of wave length of light using Newton's rings experiment, Fresnel and Fraunhofer Diffraction etc
- To understand the differences between interference, diffraction and polarization
- To understand the fundamentals and applications of sound and ultrasonics

UNIT-I: GEOMETRICAL OPTICS

Introduction – chromatic and spherical aberration in lenses and their removal - Dispersion of light - Refraction through a thin prism - Dispersive power of a prism-deviation without dispersion – dispersion without deviation - constant deviation spectroscope. Eyepieces - Huygen, Ramsden and Gauss eye pieces

UNIT-II: INTERFERENCE

Analytical treatment of interference – theory of interference fringes - interference in thin films due to reflected light - Air wedge - experiment to find thickness of a wire - Testing the plainness of surfaces – newton's rings-theory and experiment- Michelson's interferometer and applications.

UNIT-III: DIFFRACTION & POLARISATION

Fresnel and Fraunhofer Diffraction – comparison between Fresnel and Fraunhofer diffraction - Diffraction by single slit - Diffraction by circular aperture – plane transmission grating-diffraction at normal and oblique incidence Double refraction - Nicol Prism as polarizer and analyser - production and detection of plane, elliptically and circularly polarized light - Quarter and half wave plates – optical activity-Fresnel's theory of optical activity.

UNIT-IV: SOUND

Sound - Simple harmonic motion - free, damped, forced vibrations and resonance –Helmholtz resonator-laws of transverse vibration of strings – Sonometer - Determination of AC frequency using sonometer - Determination of frequency using Melde's apparatus. Decibels – Intensity levels-musical notes -musical scale.

UNIT-V: ULTRASONICS

Ultrasonics – production – piezo electric method - magnetostriction method – detection – properties – applications .Acoustics – Intensity level and loudness

Acoustics of buildings: Reverberation - reverberation time - derivation of Sabine's formula -determination of absorption coefficient - optimum reverberation time-factors affecting acoustics of buildings – sources of noises and its control - sound level meter.

Books for Study

1. Optics by Subramaniam N & Brij Lal, S Chand & Co.Pvt. Ltd., New Delhi,1990
2. Text book of sound – Brij Lal & Subramaniam, N Vikas Publishing House, New Delhi,1982

Books for Reference

1. Fundamentals of Optics by Jenkins A Francis and White E Harvey, McGraw Hill Inc., NewDelhi, 1976.
2. Fundamentals of Physics, 6th Edition, by D Halliday, R Resnick and J Walker. Wiley NY2001.
3. Waves & Oscillations- Subrahmanyam N & BrijLal, Vikas Publishing House Pvt. Ltd., New Delhi,1994
4. A Text book of Sound - Khanna DR & Bedi RS, Atma Ram & Sons, New Delhi 1985
5. Fundamentals of Physics, -D Halliday, R Resnick and J Walker, Wiley NY2001. 6th Edition
6. The Feynman Lectures on Physics, - R P Feynman, R B Leighton and M Sands, Narosa, New Delhi,1998. Vols.I, II and III

**MSU/ 2021-22 /UG-Colleges/Part-III (B.Sc.Physics)/Semester –II /
Major Practical - II**

PRACTICAL - II

(6 experiments compulsory)

1. Spectrometer – refractive index of solid prism
2. Newton's Rings – Refractive index of a lens
3. Spectrometer - grating – normal incidence
4. Airwedge - thickness of a wire
5. Verification of three laws of vibration - sonometer
6. Velocity of sound in air – Resonance column
7. Determination of AC frequency sonometer
8. Frequency of tuning fork - Melde's String

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester-II/Allied-II

ALLIED PHYSICS - II

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	Apply Ohm's Law and construct the resistors in series & parallel	3	Ap
CO-2	Analyse the conversion of Galvanometer into Ammeter and Voltmeter	2	Cr
CO-3	Analyse the properties of magnetism and to classify the Dia, Para and Ferromagnetic materials	2	U
CO-4	Analyse Faraday's Law of Electromagnetic Induction and to determine the mutual induction using BG	2	An
CO-5	Identify and analyse the uses of junction diodes and to analyse the characterization of Zener diode and transistors	2	Re
CO-6	Evaluate the basic logic gates such as NAND, NOR, EX-OR, and to prove De-Morgan's Law	2	Ev
CO-7	Analyse the classification of nuclei and the properties of nucleus	3	Ap
CO-8	Analyse and apply the fundamental laws of radioactivity	2	Ev
CO-9	Demonstrate the projectiles and to calculate the time of flight	1	U
CO-10	Analyse and apply Galilean and Lorentz transformation equations	3	Ap

ALLIED PHYSICS - II

PREAMBLE:

- To understand the basic principles and application of electricity
- To understand the basics concept of electromagnetism
- To understand the fundamental concepts of digital electronics, nuclear physics, mechanics and relativity

Unit I: Electricity

Current and current density – Expression for current density – Ohm's law – Resistors in series and in parallel – I-V characteristic of a resistor – Color coding – Conversion of a galvano meter into an ammeter and voltmeter – Kirchoff's laws – Application of Kirchoff's laws in Wheat stone network– sensitiveness of bridge.

Unit II: Electromagnetism

Magnetism: Definition of magnetic induction B, Magnetic field intensity H, Intensity of magnetization M – Properties of Dia, Para and Ferro magnetic materials. Electromagnetism: Faraday's law of electromagnetic induction–Lenz's law – Expression for induced current and charge–Self inductance–Self inductance of along solenoid – Mutual inductance – Coefficient of coupling – Determination of mutual inductance using BG.

Unit III: Electronics

Junction diodes - forward and reverse bias-diode characteristics - Zener diode –VI characteristic of a Zenerdiode – Transistors – Characteristics of a transistor (common emitter mode only). Digital Electronics: Decimal and binary numbers – binary to decimal and decimal to binary - Binary addition – Binary subtraction by 1's and 2's complement method – Basic logic gates OR,AND, NOT (Symbol, Boolean equation, truth table, circuit and working) – NAND, NOR, EX-OR(Symbol, Boolean equation, truth table only) – DeMorgan's theorem.

Unit IV: Nuclear physics

Introduction – Classification of nuclei – General properties of nucleus – Nuclear size, Nuclear mass, Nuclear density, Nuclear charge, Nuclear spin & Nuclear magnetic dipole moments–Mass defect – Binding energy – Binding energy curve – Nuclear forces – Properties – Fundamental laws of radioactivity

Unit V: Mechanics and Relativity

Projectiles – Time of flight – Range on the horizontal plane – Greatest height attained by the projectile–Path of the projectile–Relativity: Frames of references – Postulates of special theory of relativity – Galilean & Lorentz transformation equations – Length contraction – Time dilation.

Books for study

1. Electricity and Magnetism – R.Murugesan
2. Modern physics – R.Murugesan
3. Principle of Electronics – V.K.Mehta
4. Digital principles and applications - Albert Paul Malvino & Donald P.Leach
5. Mechanics – D.S.Mathur

Books for Reference

1. Modern Physics- Seghal Chopra & Seghal, Sultan chand 1998 Electricity and Magnetism -**K.K. Tiwari** (S.Chand&Co.)
2. Electronic fundamentals and applications – John D. Ryder–Prentice Hall
3. Electronic principles - Malvino
4. Electricity and Magnetism – Vasudeva

MSU/2021-22/UG-Colleges/Part-III (B.Sc.Physics)/Semester-II

ALLIED PRACTICAL-II

(6 experiments compulsory)

1. Potentiometer - calibration of voltmeter (low range)
2. Potentiometer – calibration of ammeter
3. Series resonance circuit
4. Parallel resonance circuit
5. Basic logic gates using discrete components – AND,OR,NOT
6. Zener diode - Diode characteristics
7. Absolute determination of mutual inductance–BG
8. Tangent galvanometer – Horizontal earth's magnetic induction

Core 3: ELECTRICITY & ELCTROMAGNETISM

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	Class level (CL)
CO-1	Understand the basics and applications of Coulomb's law, Gauss' law and thermoelectric effects	1	Un, Ap
CO-2	Explain the Kohlrausch's bridge method for determining the specific conductivity of an electrolyte.	1, 4	Ex, Ca
CO-3	Understand Ohm's law, Kirchoff's laws, growth and decay of current and charge in different circuits.	1	Un, Ap, Ev,
CO-4	Analyse LCR series resonance and LCR parallel resonance circuits with derivation.	1, 7, 8	An, Ev
CO-5	Understand the about magnetic vectors, B-H curve and Lorentz force.	1	Un, Rp
CO-6	Explain the construction, working and application of moving coil Ballistic galvanometer and DeSauty's bridge.	1, 4, 8	Ex, Ap, An
CO-7	Understand the concepts of Faraday's laws, Owen's bridge and coefficient of coupling.	1, 7	Un, Rp
CO-8	Use of Earth inductor for finding horizontal component and vertical component of the Earth's magnetic field	4, 7	Ap, Ca
CO-9	Derive the Maxwell's equations for material medium and for free space.	1, 8	Un, An
CO-10	Explain the concepts of Hertz experiment for production and detection of EM waves and to understand Poynting vector and displacement current.	1, 4, 8	Ex, Un, Cr

Core 3: ELECTRICITY & ELECTROMAGNETISM

Preamble: Objective of the paper is to provide the basic knowledge about electricity and electromagnetism. This paper does not require any special prerequisite except the basic ideas on electricity and magnetism at the school level. The learners are expected to gain the advanced knowledge in the fields of electricity, magnetism, electromagnetism and EM waves.

UNIT-I: Electricity Part I

Coulomb's law in vector form-Gauss's law-applications-Relation connecting electric field and potential-potential at a point due to point charge- Seebeck effect- measurement of thermo emf using potentiometer-Peltier effect-Thomson effect-thermoelectric coefficients-thermoelectric power diagram- Boy's radio micrometer-Faradays laws of electrolysis-Kohlrausch's bridge method for determining the specific conductivity of an electrolyte.

UNIT-II: Electricity Part II

Ohm's law in vector form-conversion of galvanometer into voltmeter and ammeter-Kirchoff's laws- Growth and decay of current in L-R circuit with DC voltage - growth and decay of charge in C-R circuit- High resistance by leakage –growth and decay of charge in LCR circuit- Alternating current- j operator method - LCR series resonance circuit - parallel resonance circuit -power in an AC circuit.

UNIT-III: Magnetism

Three magnetic vectors M, B, and H-relation between them- permeability and susceptibility-B-H curve - Energy loss- Magnetic flux and magnetic induction-relation between them- Biot Savart law- magnetic field inside a long solenoid-Lorentz force on a moving charge- torque on a current loop-Moving coil Ballistic galvanometer-charge sensitivity-absolute capacity-DeSauty's bridge.

UNIT-IV: Electromagnetism Part I

Faraday's laws of electromagnetic induction-self inductance of a long solenoid –determination of L by Owen's bridge-mutual induction-experimental determination of mutual inductance using BG-coefficient of coupling-eddycurrents- Earth inductor- measurement of horizontal component and vertical component of the Earth's magnetic field- induction coil.

UNIT-V: Electromagnetism Part II

Displacement current-Maxwell's equations for material medium and for free space (derivation)-Poynting vector (explanation only)-EM waves-Hertz experiment for production and detection of EM waves-Wave equations for electric field and magnetic field-Velocity of EM waves-Reflection and transmission at normal incidence-Polarization by reflection.

Books for study

1. Electricity and Magnetism -R. Murugesan (S.Chand & Co.)
2. Electricity and Magnetism -D.N.Vasudeva (Twelfth revised edition)

Books for Reference

1. Electricity and Magnetism - K.K.Tiwari (S.Chand & Co.)
2. Electricity and Magnetism - E.M.Pourcel, Berkley, Physics Course, Vol.2 (McGraw-Hill)
3. Electricity and Magnetism-Tayal (Himalalaya Publishing Co.)
4. Fundamentals of Physics, 6th Edition, by D Halliday, R Resnick and J Walker, Wiley, NY (2001).

PRACTICAL - III

(6 experiments compulsory)

1. Ballistic Galvanometer - Figure of merit
2. Ballistic Galvanometer – Comparison of Capacitance (C_1/C_2)
3. Series Resonance Circuit
4. Comparison of Magnetic Moments – Deflection Magnetometer (Tan A and Tan B position)
5. Parallel Resonance Circuit
6. Potentiometer – Calibration of Ammeter
7. Potentiometer – Calibration of low range Voltmeter
8. Owen's Bridge – Self - inductance of the coil

MSU/ 2021-22 / UG-Colleges / Part-III (B.Sc.Physics) / Semester – III

ALLIED PHYSICS– I

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	Define the fundamentals of elasticity, concept of stress, strain, bending moment and to solve the problems related.	1	Re, Ap
CO-2	Understand the principles of elasticity through the study of Young Modulus and modulus of rigidity.	1,4	Un
CO-3	Understand principles of surface tension and Viscosity	1	Un
CO-4	Describe the properties of fluids such as viscosity and surface tension and evaluate the value of coefficient of viscosity	1,3,4	An, Ev
CO-5	Explain the phenomena of simple harmonic motion and the properties of systems executing such motions.	1,4	An, Ev
CO-6	Determine the frequency of tuning fork by Melde's string experiment and apply the knowledge of simple harmonic motion.	1,3,4	Ca, Un, Ap
CO-7	Understand the laws of thermodynamics, concepts of transport phenomena.	1	Un
CO-8	Demonstrate the experiments to determine the thermal conductivity and specific heat capacity and apply the knowledge of transport phenomena.	1,4	An, E,Ap
CO-9	Acquire mastery of the fundamental principles and applications of interference, diffraction and polarization	1	Ac
CO-10	Demonstrate the experiments to find the wavelength of different colours of light by normal incidence using grating and apply the knowledge of diffraction principle.	1,3,4	An, Ap

ALLIED PHYSICS– I

PREAMBLE:

- To understand the concept of strength of materials, viscous properties of liquids, heat transformation from one place to another converting heat to do mechanical work and basic properties of light such as interference and diffraction

Unit I: Elasticity and bending moment

Hooke's law – Elastic moduli – Relation between elastic constants – Work done in stretching a wire–Expression for bending moment-uniform bending-Experiment to determine Young's modulus using pin and microscope-Twisting couple of a wire – Expression for couple per unit twist–Work done in twisting – Experimental determination of rigidity modulus of a wire using Torsion pendulum with theory

Unit II: Surface tension and Viscosity

Surface tension – Definition– Examples –Molecular interpretation– Expression for excess of pressure inside a synclastic and anticlastic surface-Application to spherical and cylindrical drops and bubbles

Viscosity: Coefficient of viscosity – Rate of flow of liquid in a capillary tube (Poisueuille's formula) –Analogy between liquid flow and current flow– Stokes' formula for highly viscous liquid (Dimension method) – Experimental determination of viscosity of highly viscous liquid (stokes' method)

Unit III: Sound

Simple harmonic motion – Free, damped, forced vibrations and resonance – Composition of two SHMs along a straight line and in perpendicular direction – Melde's string experiment – Determination of frequency of tuning fork (both longitudinal and transverse mode)

Unit IV : Thermal physics : Mean free path- Expression for mean free path (Zero order approximation) – Transport phenomena – Expression for viscosity and thermal conductivity – Conduction in solids – coefficient of thermal conductivity – Lee's disc method to determine thermal conductivity of a bad conductor –Wiedmann–Franz's law–Convection : Newton's law of cooling – Experimental verification – Radiation : Black body radiation – Distribution of energy in black body spectrum –Important features.

Unit V: Optics

Interference: Condition for interference-Air wedge-determination of thickness of a thin wire by air wedge method

Diffraction: Fresnel & Fraunhofer diffraction-Plane diffraction grating- theory and experiment to determine wavelength (normal incidence)

Polarization: Double refraction- half wave and quarter wave plate – Production and detection of plane, elliptically and circularly polarized light.

Books for study

1. Optics–Brijlal & Subramanian
2. Properties of matter – R.Murugesan
3. Heat & Thermodynamics – D.S.Mathur

Books for Reference

1. Heat and thermodynamics –Brijlal & Subramanian, S Chand & Co., New Delhi
2. Fundamentals of Optics by Jenkins A Francis and White E Harvey, McG Raw Hill Inc., New Delhi, 1976.
3. Elements of Properties of Matter by Mathur D S, Shyamlal Charitable Trust, New Delhi, 1993

ALLIED PRACTICAL - I

(6 experiments compulsory)

1. Youngs modulus – non uniform bending – pin and microscope
2. Youngs modulus – uniform bending – optic lever and telescope
3. Torsional pendulum – Rigidity modulus
4. Co-efficient of viscosity - Stoke's method
5. Thermal conductivity of a bad conductor -Lee's disc method.
6. Spectrometer–dispersive power
7. Spectrometer-grating—normal incidence method.
8. Airwedge – thickness of a wire

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester-III/

SKILL BASED ELECTIVE

(For Physics major students only)

(Any one)

PAPER 1.a

MAINTANANCE OF ELECTRICAL APPLIANCES

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO - 1	Understand the operations and safe handling of commonly used domestic appliances.	1	U
CO - 2	Understand the basic ideas about the components used in electrical appliances.	1	U
CO - 3	Understand a basic knowledge of electricity and magnetism.	1	U
CO - 4	Understand and apply knowledge to design and troubleshoot the electrical circuits.	1, 3	U, Ap
CO - 5	Understand the basic ideas about transformers and their types and working principles.	1, 4	U, An
CO - 6	Understand the concepts underlying the operation of AC and DC circuits.	1, 3	U
CO - 7	Describe the concept of household circuits and their wiring systems in detail.	1, 4	U, An
CO - 8	Understand the earthing and colour coding of the wires.	1, 3	U
CO - 9	Managing the appliances with safety precautions using switches and fuses.	1, 3	U, Ap
CO - 10	Understand the basic ideas behind inverters, motors, and generators.	1, 3	U

SKILL BASED ELECTIVE

(For Physics major students only)

(Any one)

PAPER 1.a

MAINTANANCE OF ELECTRICAL APPLIANCES

Preamble: This course enable the students to understand the operations and safety handling of certain commonly used domestic appliances. The paper needs a basic knowledge in electricity and magnetism and the learners are expected to gain knowledge to design and trouble shoot electrical circuits.

UNIT-I: Active & Passive Components

Resistance - capacitance - inductance and its units - electrical charge - current - potential - units and measuring meters - Ohm's law - Galvanometer, ammeter, voltmeter and multimeter. Electrical energy - power - consumption of electrical power.

UNIT-II: Transformers

Transformer - principle and working - classification of transformers - testing of transformers - Core, Shell and Berry types, auto transformer - construction and uses. Cooling of transformers - Losses in transformer.

Unit-III: Electrical appliances

Electric bulbs – Fluorescent lamps - Street Lighting - Electric Fans - Wet Grinder - Mixer - Water Heater - Storage and Instant types-electric iron box- microwave oven - Washing Machine - Stabilizer, Fridge and Air conditioner.

UNIT-IV: AC & DC electrical circuits

AC and DC- Single phase and three phase connections - RMS and peak values-house wiring - Star and delta connection - overloading - earthing - short circuiting - color code for insulation wires

UNIT-V: Relays & Switches

Electrical protection - Relays - Fuses - Electrical switches - Circuit breakers- ELCB - overload devices - ground fault protection - Inverter - UPS - generator and motor

Books for study and Reference

1. A text book in Electrical Technology - B L Theraja - S Chand &Co.
2. A text book of Electrical Technology - A K Theraja
3. Performance and design of AC machines - M G Say ELBS Edn.
4. Semiconductor Physics and Opto Electronics by P K Palanichamy
5. Basic Electronics - B L Theraja - S Chand &Co.
6. Principles of Communication Engineering - Arokh Singh and A K Chhabra - S Chand & Co.

MSU/2021-22/UG-Colleges/Part-III
(B.Sc. Physics)/Semester–III
Skill Based 1.b : INSTRUMENTATION PHYSICS - I

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	Name the Physical quantities and define its use.	1	Re
CO-2	Recall and recognize the units of physical quantities	1	Un
CO-3	Compare the different types of errors. Differentiate average & standard deviation	1,2	Un, Ap
CO-4	Calculate arithmetic mean & its deviation	2	Ap
CO-5	Classify the electrode materials & differentiate them	3,8	An, Ap
CO-6	Design the forms of electrodes	4	Cr
CO-7	Recall instruments used commonly in medical field Identify the instrument	1,8	Un
CO-8	Compare digital & analog instruments Distinguish EEG& ECG	7	Ap, An
CO-9	Classify the types of displays Design a simple circuit using LED	3,4	Un, Cr
CO-10	Infer the use of LCD Explain incandescent display.	5	Un, Ev

Skill Based 1.b : INSTRUMENTATION PHYSICS - I

Preamble: This course provides an understanding of basic electronic instrumentation and measurements techniques. The paper needs a basic knowledge in basic physics and technology

UNIT I: MEASUREMENT

Definition - Units of measurement; systems of units - Length, mass and time measurements - Accuracy and precision - Significant figures

UNIT II: ERROR

Definition - Types of error (Gross error, Systematic error, Random error) - Statistical analysis (Arithmetic mean, Deviation from the mean, Average deviation, Standard deviation) - Probability of errors (Normal distribution of errors, Probable error) - Limiting errors.

UNIT III: ELECTRODES

Electrode potential - Purpose of the electrode paste - Electrode material - Types of electrodes - Microelectrodes (metal microelectrode) - Depth and needle electrodes Surface electrodes

UNIT IV: SPECIALIZED IN MEDICAL INSTRUMENTS

Angiography - Digital thermometer - Endoscopes - EEG - ECG – Computed Tomography (CT scan)

UNIT V: DISPLAYS

Classification of displays - Display devices - Liquid Crystal Diode – Incandescent display -Liquid vapour display – Light Emitting Diode (LED)

Books for study:

1. Albert D. Helfrick and William D. Cooper, Modern Electronic Instrumentation and Measurement Techniques, Prentice-Hall of India Pvt. Limited, Reprint 2002.
2. M. Arumugam, Biomedical Instrumentation, Anuradha Agencies, Reprint 2002.
3. H.S.Kalsi, Electronic Instrumentation, Tata McGraw Hill Education Pvt. Limited, Reprint 2012.

Books for Reference:

1. P. Mani, A text book of Engineering Physics-I, Dhanam Publications, Reprint 2013.
2. G. Jose Robin and A. Ubald Raj, Applied Physics, Indira Publications, Marthandam, 1998

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester-III/

NON MAJOR ELECTIVE

PAPER 1.a / BASIC PHYSICS-I

Course Outcome:

CO.No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	Recall the definition of speed, velocity and acceleration	1	Re
CO-2	Apply the principle of work, power and energy in any one daily activity.	3	Ap
CO-3	List out the applications of Bernouille's theorem	3	Ap
CO-4	Analyse the functioning of aventurimeter and Pitot's tube	7	An
CO-5	Summarize the effect of reverberation in buildings	1	Un
CO-6	Create a method to produce and detect plane polarized light	7	Cr
CO-7	Enumerate the different types of resistances	1	Un
CO-8	Construct Wheatstone's bridge using Kirchoff's law	7	Cr

**MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester-III/
NON MAJOR ELECTIVE
PAPER 1.a BASIC PHYSICS-1**

Preamble: Objective of the paper is to provide a basic knowledge in Physics for students who do not study physics as major/allied subject

UNIT I: MECHANICS

Motion-speed, velocity, acceleration- force –equations of motion- Newton's laws - momentum - work, power and energy -conservation of energy and momentum.

UNIT II: PROPERTIES OF MATTER

Three states of matter - binding forces - fluid pressure and thrust - applications - Pascal law - Archimedes principle – surface tension-capillary action - Bernoulli's principle – Viscosity – venturi meter - pitot's tube.

UNIT III: HEAT AND SOUND

Measurement of heat and temperature - clinical thermometer - heat transfer - thermos flask - change of state - effect of pressure on boiling point and melting point - heat engines - steam engine and diesel engine-sound and music - reverberation - acoustics of building - recording and reproduction of sound in film.

UNIT IV: OPTICS

Reflection and refraction-concave and convex mirrors and lenses-dispersion- spectra-rainbow- interference-diffraction-polarization-concepts with examples- uses-double refraction-optical activity-quartz crystal

UNIT V: ELECTRICITY

Electric field - potential - Ohm's law - electrical energy and power - resistance - types of resistance - fixed resistance - variable resistance.- resistance in series and parallel -Kirchoff's laws

Books for study and Reference

1. Properties of matter by Murugesan R, S Chand & Co. Pvt. Ltd., New Delhi
2. Text book of sound by Brij Lal & Subramaniam, Vikas Publishing House, New Delhi,1982
3. Electricity and Magnetism - R. Murugesan. (S. Chand & Co.)
4. Heat and thermodynamics - Brijlal and Subramaniam, S Chand & Co.
5. Optics by Subramaniam N & Brij Lal, S Chand & Co. Pvt. Ltd., New Delhi,1990

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester-III/

NON MAJOR ELECTIVE

PAPER 1.b /APPLIED PHYSICS

Course Outcome:

CO.No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	Explain about the conventional energy Sources	1,7	Re,Un
CO-2	Illustrate about the world's reserve of conventional energy. To classify various forms of energy.	1	Un,An
CO-3	Summarize about fossil fuels such as coal, oil and natural gas and their availability, statistical details.	1	Re,Ev
CO-4	Explain about fossil fuel's application and to list out the merits and demerits.	1,6	An
CO-5	Illustrate about Bio mass energy and Biomass classification and to elaborate the Bio Mass Conversion process	1,5	Re,An
CO-6	Summarize about Dheena Bandhu Model gas plant. They can explain the importance of wood gasification, Also to list out the merits and demerits of Bio Mass	1,5	Un,Ev
CO-7	Demonstrate about the renewable energy resources Such as solar energy and their applications	1,6	Re
CO-8	Elaborate about solar pond, solar water heater, solar cookers, solar green house and solar cell	1,3	Un,An
CO-9	Illustrate about Geothermal energy and Geo thermal power plant. Summarize about the wind energy, wind farms and wind mill.	1,3	Re,Un
CO-10	Explain the process of producing energy from tides and energy from waves	1,3	Re

**MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester–III/
NON MAJOR ELECTIVE**

**PAPER 1.b.
APPLIED PHYSICS**

Preamble: This paper enables the students to understand variable energy sources and the need for finding alternate energy source.

UNIT-I: Conventional energy sources

Conventional energy sources –world’s reserve of conventional energy sources–various forms of energy-renewable and conventional energy systems- comparison

UNIT-II: Fossil fuels

Fossil fuels – coal, oil and natural gas-availability-statistical details- applications-merits and demerits

UNIT-III: Biomass energy: Biomass energy-biomass classification-biomass conversion process-biogas plants-Deena bandhu model gas plant-wood gasification-advantages and disadvantages of biomass

UNIT-IV: Renewable energy sources

Renewable energy sources-solar energy - importance - storage of solar energy - applications of solar energy -solar pond - solar water heater-solar crop dryers-solar cookers- solar green house - solar cell

UNIT-V: Geothermal energy

Geothermal energy-Geothermal power plant-wind energy and wind farms- wind mills - types – ocean thermal energy conversion - energy from tides-energy from waves

Books for study and Reference

1. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
2. Solar energy - M P Agarwal - S Chand & Co. Ltd.
3. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd., New Delhi.

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester-IV/

Core 4: Heat and thermodynamics

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	Class level (CL)
CO-1	Acquire the knowledge of Joule-Kelvin effect, liquefaction of hydrogen and helium gases and adiabatic demagnetization.	1	Ap, Un
CO-2	the practical applications of the low temperature concepts to refrigerator, air-conditioning machine and super fluidity.	1, 3	Ap, Ex
CO-3	Derive the expressions for pressure, gas laws, Maxwell's law of distribution of molecular velocities, viscosity and thermal conductivity.	1, 7, 8	Un, Rp, Ap
CO-4	Derive and determine the Vander Wall's constants and critical constants.	1, 7	Rp, Un
CO-5	Explain the heat experiments like Forbe's method and Lee's disc method for finding thermal conductivity.	1, 4	Ex, Ap, Ca
CO-6	Understand the concepts of black body radiation, Wien's law, Stefan's law and Newton's law of cooling.	1, 8	Un, Ap
CO-7	Acquire the knowledge of Zeroth law, I and II law of thermodynamics, gas equation and Carnot's theorem.	1, 7	Ap, Rp, Ex
CO-8	Apply the laws of thermodynamics to Carnot's engine, Otto engine and Diesel engine to find efficiency.	1, 7	Ap, Un, Ca
CO-9	Derive the Clausius-Clapeyron equation and second latent heat equation and specific heat relation.	1, 8	Un, Ex
CO-10	Understand the concepts of III law of thermodynamics, entropy and to derive Maxwell's thermo dynamical relations.	1, 7, 8	Un, Ap, Ex

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester-IV/

Core 4: Heat and thermodynamics

UNIT-I: LOW TEMPERATURE PHYSICS

Joule - Kelvin effect - liquefaction of hydrogen - liquefaction of helium-Kammerling - Onne's method-Helium I and II- Lambda point-production of low temperatures-a diabatic demagnetization - practical applications of low temperature - refrigerators and air-conditioning machines-super fluidity-application of super fluidity.

UNIT-II: KINETIC THEORY OF GASES

Kinetic theory of gases – Expression for pressure – gas laws - Maxwell's law of distribution of molecular velocities -Transport phenomena - Diffusion, viscosity and thermal conductivity of gases - Vander walls equation of state - Determination of Vander walls constant – Relation between Vander Wall's constant and critical constants.

UNIT-III: CONDUCTION & RADIATION

Thermal conductivity – rectilinear flow of heat – thermal conductivity of a good conductor – Forbe's method – thermal conductivity of a bad conductor – Lee's disc method – radiation – blackbody radiation – Wien's law – Stefan's law – Newton's law of cooling from Stefan's law – Solar constant – Pyrometer – Pyroheliometer

UNIT-IV: THERMODYNAMICS I

Zeroth law, I and II law of thermodynamics - isothermal process - adiabatic process - gas equation during adiabatic process – work done during adiabatic and isothermal process -Carnot's theorem - significance - thermodynamic scale of temperature - perfect gas scale of temperature - Carnot's engine – Otto engine and Diesel engine – working and efficiency.

UNIT-V: THERMODYNAMICS II

First latent heat equation (Clausius - Clapeyron equation) - effect of pressure on melting point and boiling point – second latent – heat equation – III law of thermo dynamics – concept of entropy - temperature entropy diagram - entropy of perfect gas - Maxwell's thermo dynamical relations – derivation - applications - Clausius - Clapeyron equation and specific heat relation

Books for Study

1. Heat and thermodynamics – Brijlal and Subramaniam, S Chand & Co.
2. Heat and Thermodynamics by D S Mathur, S Chand & Sons, New Delhi
3. Thermal Physics – R Murugesan and Kiruthiga Sivaprasad, S Chand & Co., New Delhi.

Books for Reference

1. Heat by Narayanamoorthy and Krishna Rao, Triveni Publishers, Madras
2. Thermal Physics – S C Garg, R M Bansal and C K Ghosh, Tata McGraw-Hill
3. Heat and thermodynamics – J B Rajam, S Chand & Co., New Delhi
4. Fundamentals of Thermodynamics by Carroll M. Leonard, Prentice-Hall India, New Delhi
5. Heat and Thermodynamics by J.B. Rajam and C.L. Arora, S. Chand, New Delhi
6. Heat and Thermodynamics by Zemansky, McGraw – Hill Book Co. Inc., New York
7. Principles of Thermodynamics by Jin Sheng Hsieh, 1st edition, McGraw – Hill

PRACTICAL - IV

(6 experiments compulsory)

1. Potentiometer -Specific resistance
2. Potentiometer – Thermo EMF
3. Lee’s Disc – Thermal conductivity of bad conductor
4. Determination of Specific heat capacity of liquid
5. Temperature Coefficient of Resistance - Carey Foster’s Bridge
6. Ballistic Galvanometer – Thermo EMF
7. Ballistic Galvanometer – Absolute capacity of a condenser
8. Newton's law of cooling – Verification

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester-IV/Allied-II

ALLIED PHYSICS - II

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	Apply Ohm's Law and construct the resistors in series & parallel	3	Ap
CO-2	Analyse the conversion of Galvanometer into Ammeter and Voltmeter	2	Cr
CO-3	Analyse the properties of magnetism and to classify the Dia, Para and Ferromagnetic materials	2	U
CO-4	Analyse Faraday's Law of Electromagnetic Induction and to determine the mutual induction using BG	2	An
CO-5	Identify and analyse the uses of junction diodes and to analyse the characterization of Zener diode and transistors	2	Re
CO-6	Evaluate the basic logic gates such as NAND, NOR, EX-OR, and to prove De-Morgan's Law	2	Ev
CO-7	Analyse the classification of nuclei and the properties of nucleus	3	Ap
CO-8	Analyse and apply the fundamental laws of radioactivity	2	Ev
CO-9	Demonstrate the projectiles and to calculate the time of flight	1	U
CO-10	Analyse and apply Galilean and Lorentz transformation equations	3	Ap

ALLIED PHYSICS - II

PREAMBLE:

- To understand the basic principles and application of electricity
- To understand the basics concept of electromagnetism
- To understand the fundamental concepts of digital electronics, nuclear physics, mechanics and relativity

Unit I: Electricity

Current and current density – Expression for current density – Ohm's law – Resistors in series and in parallel – I-V characteristic of a resistor – Color coding – Conversion of a galvanometer into an ammeter and voltmeter – Kirchhoff's laws – Application of Kirchhoff's laws in Wheatstone network – sensitiveness of bridge.

Unit II: Electromagnetism

Magnetism: Definition of magnetic induction B, Magnetic field intensity H, Intensity of magnetization M – Properties of Dia, Para and Ferro magnetic materials. Electromagnetism: Faraday's law of electromagnetic induction – Lenz's law – Expression for induced current and charge – Self inductance – Self inductance of a long solenoid – Mutual inductance – Coefficient of coupling – Determination of mutual inductance using BG.

Unit III: Electronics

Junction diodes - forward and reverse bias-diode characteristics - Zener diode – VI characteristic of a Zener diode – Transistors – Characteristics of a transistor (common emitter mode only). Digital Electronics: Decimal and binary numbers – binary to decimal and decimal to binary - Binary addition – Binary subtraction by 1's and 2's complement method – Basic logic gates OR, AND, NOT (Symbol, Boolean equation, truth table, circuit and working) – NAND, NOR, EX-OR (Symbol, Boolean equation, truth table only) – DeMorgan's theorem.

Unit IV: Nuclear physics

Introduction – Classification of nuclei – General properties of nucleus – Nuclear size, Nuclear mass, Nuclear density, Nuclear charge, Nuclear spin & Nuclear magnetic dipole moments – Mass defect – Binding energy – Binding energy curve – Nuclear forces – Properties – Fundamental laws of radioactivity

Unit V: Mechanics and Relativity

Projectiles – Time of flight – Range on the horizontal plane – Greatest height attained by the projectile – Path of the projectile – Relativity: Frames of references – Postulates of special theory of relativity – Galilean & Lorentz transformation equations – Length contraction – Time dilation.

Books for study

- 1.Electricity and Magnetism – R.Murugesan
- 2.Modern physics – R.Murugesan
- 3.Principle of Electronics – V.K.Mehta
- 4.Digital principles and applications - Albert Paul Malvino & Donald P.Leach
- 5.Mechanics – D.S.Mathur

Books for Reference

- 1.Modern Physics- Seghal Chopra & Seghal, Sultan chand 1998 Electricity and Magnetism -**K.K.** Tiwari (S.Chand&Co.)
- 2.Electronic fundamentals and applications – John D. Ryder–Prentice Hall
- 3.Electronic principles - Malvino
- 4.Electricity and Magnetism – Vasudeva

**MSU/ 2021-22 /UG-Colleges/Part-III
B.Sc.Physics)/Semester –IV / Major Practical - II**

PRACTICAL - II

(6 experiments compulsory)

1. Spectrometer – refractive index of solid prism
2. Newton’s Rings – Refractive index of a lens
3. Spectrometer - grating – normal incidence
4. Airwedge - thickness of a wire
5. Verification of three laws of vibration - sonometer
6. Velocity of sound in air – Resonance column
7. Determination of AC frequency sonometer
8. Frequency of tuning fork - Melde’s String

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester-IV/

SKILL BASED ELECTIVE

(Any one)

PAPER 2.a

MAINTANANCE OF ELECTRONIC APPLIANCES

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO - 1	Understand the basic ideas about the components we use in electronic appliances.	1	U
CO - 2	Recognize resistors, capacitors, and connection systems.	1, 3	U, C
CO - 3	Understand the fundamentals of measuring instruments.	1, 4	U, An
CO - 4	Understand oscilloscopes and their various types.	1, 3	U, An
CO - 5	Understand the classification of active and passive transducers and their types.	1	U, C
CO - 6	Understand about the transducer's applications, merits, and demerits.	1	U, Ap
CO - 7	Understand the basic concepts of communication devices and their working principles.	1, 5	U
CO - 8	Understand the principles of operation of modern technology communication devices.	1, 5	U
CO - 9	Learn about photography by using cameras and their accessories.	1, 3, 4	U, An
CO - 10	Learn about shutter speed, resolution, filters, and the use of various lenses in cameras.	1, 4	U, An

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester-IV/

SKILL BASED ELECTIVE

Any one)

PAPER 2.a

MAINTANANCE OF ELECTRONIC APPLIANCES

Preamble: Objective of this course is to provide a basic understanding of the commonly used electronic equipments

UNIT-I: ELECTRONIC COMPONENTS

Study of electronic components - resistors - types - characteristics - colour coding – wattage rating-potential divider arrangement-capacitors - type - characteristics --working voltage-star and delta connection of resistors and capacitors -soldering and desoldering techniques-Groove board, bread board and printed circuit board

UNIT-II: MEASURING INSTRUMENTS

Practical uses of Multimeter (analog and digital) - CRO - Block Diagram - measurement of voltage, frequency and phase - waveforms and Lissajoue's figures- Digital Storage Oscilloscopes- LCD display for instruments -A/F and R/F oscillators.

UNIT-III: TRANSDUCERS

Classification of transducers-basic requirements / characteristics of Transducers - active and passive transducers, resistive, Capacitive, Inductive & piezo electric transducers - Light transducers (photo resistors & photovoltaic cells).

UNIT-IV: COMMUNICATION DEVICES

Basic concepts of radio transmitter and receiver - TV antennas-resonance antennas and their characteristics - Dish antenna - DTH system - Mobile communication system – MODEM - Telephone systems-cellular Telephone systems-mobile phone-principle of operation-integrated services-digital networks (ISDN)

UNIT-V: Photography

Introduction to cameras - parts of camera and accessories — lens shutter – aperture - flash photography – filters – battery - tele and wide angle lens Digital formats - data transfer to computer - ISO speed-resolution

Books for Study and Reference

1. Principles of Electronics by V K Mehta, S Chand & Co., 5th edition 2001.
2. Functional Electronics by Ramanan.
3. Elements of Electronics by Bagde and Singh
4. Monochrome and Colour TV by Gulati
5. Basic Electronics, 6th edition by B Grob, McGraw Hill NY1
6. Integrated electronics-Millman and Halkias
7. Electronic principles - Malvino 6th edition
8. Operational amplifier – Gyakwar
9. Basic electronics B. Basavaraj, H.N. Shivasankar University press

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester-IV/

SKILL BASED ELECTIVE

(Any one)

PAPER 2.b Instrumentation Physics II

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	Recall the use of multimeters. Compare the analog & digital technique	1,2	Re, Un
CO-2	Deduct the use of measurements of frequency & time interval	2,4	Ev
CO-3	Categorize the various types of transducers. Make use of experiments using them	3,8	An, Ap
CO-4	Conclude the various uses of transducers	5	Ev
CO-5	Compare optical & electron microscope Define their uses	1,2	An, Re
CO-6	Conclude the uses of SEM & TEM	5	Ev
CO-7	Identify the X- Ray pattern Relate fluoroscopy & radiography	2,5	Re, Cr
CO-8	Experiment with computers in medicine	4	Ap
CO-9	Explain Oscilloscope List their uses	1	Un, An
CO-10	Formulate the features of CRT	5	Cr

SKILL BASED ELECTIVE

PAPER 2.b

INSTRUMENTATION PHYSICS - II

Preamble: This course provides an understanding of basic electronic instrumentation and measurements techniques. The paper needs a basic knowledge in basic physics and some advance technology in medical instruments

UNIT I: BASIC ELECTRONIC & DIGITAL INSTRUMENTS

Electronic multimeters – Q meters – Vector meters – RF voltage and power measurements - Comparison of analog and digital techniques – digital voltmeter – digital multimeters – frequency counters – measurement of frequency and time interval

UNIT II: TRANSDUCERS

Active transducers: Piezoelectric type transducers and Photovoltaic type transducer Passive transducer - Photoelectric type resistive transducers - Inductive transducer

UNIT III: MICROSCOPE

Optical and Electron microscope - Comparison between optical and electron microscope – Resolving power - Magnification power - Depth of focus - Types of electron microscope - TEM – SEM - Comparison between TEM and SEM.

UNIT IV: ADVANCES IN MEDICAL INSTRUMENTS

X-ray machine - Comparison of Fluoroscopy and Radiography - Computers in medicine - Lasers in medicine - Cryogenic surgery MRI (basics and instrumentation)

UNIT V: OSCILLOSCOPE

Oscilloscope - Basic principle - CRT features – Block diagram of oscilloscope - Simple cathode ray oscilloscope.

BOOKS FOR STUDY:

1. Albert D. Helfrick and William D. Cooper, Modern Electronic Instrumentation and Measurement Techniques, Prentice-Hall of India Pvt. Limited, Reprint 2002.
2. M. Arumugam, Biomedical Instrumentation, Anuradha Agencies, Reprint 2002.
3. H.S.Kalsi, Electronic Instrumentation, Tata McGraw Hill Education Pvt. Limited, Reprint 2012.

BOOKS FOR REFERENCE:

1. P. Mani, A text book of Engineering Physics-I, Dhanam Publications, Reprint 2013.
2. G. Jose Robin and A. Ubald Raj, Applied Physics, Indira Publications, Marthandam, 1998
3. David A. Bell, Electronic Instrumentation and measurements, Prentice Hall of India Pvt Ltd, 2003
4. B.C. Nakra and K.K. Choudhry, Instrumentation, Measurement and Analysis, 2nd Edition, TMH, 2004

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester-IV/

NON MAJOR ELECTIVE

PAPER 2.a / BASIC PHYSICS-II

Course Outcome:

CO.No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	Recall the structure of nuclei	1	Re
CO-2	Explain the properties of alpha, beta and gamma rays	1	Un
CO-3	Enumerate the applications of para, dia and diamagnetic materials	7	Ap
CO-4	Analyse the role of superconductors in the present technology	3	An
CO-5	Weigh the use of Laser technology in medicinal field	7	Ev
CO-6	Explain the postulates of special theory of relativity	7	Cr
CO-7	Differentiate between analog and digital circuits	3	An
CO-8	Design a logic circuit for the addition of two binary numbers	7	Cr

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester-IV/

NON MAJOR ELECTIVE

PAPER 2.a

BASIC PHYSICS-II

Preamble: Objective of the paper is to gain knowledge on Basic principles of Physics

UNIT I: NUCLEAR PHYSICS

Introduction - nuclear structure - properties of nucleus - packing fraction - binding energy - nuclear forces - Radio activity - properties of alpha, beta and gamma rays - radio carbon dating - nuclear fission - nuclear fusion

UNIT II: MAGNETIC MATERIALS

Classification of magnetic materials - para-dia and ferromagnetic materials - properties – applications - crystalline and amorphous materials – conductors – insulators – superconductors - properties – applications

UNIT III: LASERS

Introduction – absorption – spontaneous emission – stimulated emission - population inversion - general laser system – He - Ne laser - CO₂ laser - applications.

UNIT IV: RELATIVITY

Introduction - reference frames - postulates of the special theory of relativity - length contraction - time dilation (no derivation) - Quantum mechanics - dual nature of wave and radiation – de - Broglie waves

UNIT V: NUMBER SYSTEMS

Number systems in digital electronics-binary, decimal and hexadecimal numbers – inter conversions - binary addition and subtraction — binary coded decimal - logic gates

Books for study and Reference

1. Modern Physics - R.Murugesan, S. Chand & Co
2. Electricity and Magnetism - R. Murugesan (S. Chand & Co.)
3. Digital principles and applications - Albert Paul Malvino & Donald P. Leach
4. Mechanics and mathematical physics- R.Murugesan - S Chand & Co. Pvt. Ltd., New Delhi

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester-IV/

NON MAJOR ELECTIVE

PAPER 2.b / SPACE PHYSICS

Course Outcome:

CO.No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	Explain about universe planets. Also to imagine and classify interior and exterior planets	1	Re,Un,Ev
CO-2	Illustrate about Van Allen Belts and to summarize about auroro	1	Re,Un,Ev
CO-3	Classify and illustrate about comets, Meteors, Asteroids	1,5	Re,An
CO-4	Elaborate the salient features of asteroids, meteors and its uses.	1,5	Re,An
CO-5	Describe about sun. To list out the structure of photosphere, chromosphere, Corona.	1	Un
CO-6	Elaborate the satellites of planets their structure. Interpret the phases and features of moon	1	Un,Ev
CO-7	Explain about star constellation. Also to discuss about binary stars and their origin.	1	Un
CO-8	Classify the types of clusters, types of variable, types of galaxies.	1	Un,An
CO-9	Summarize the origin of universe.	1	Un,An
CO-10	Illustrate about the Big Bang Theory, Pulsating Theory, Steady state theory.	1	Re,Un

**MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester-IV/
NON MAJOR ELECTIVE**

**PAPER 2.b
SPACE PHYSICS**

Preamble: This course provides an understanding of celestial objects.

UNIT I : Universe

Planets - interior planets - exterior planets - crust, mantle and core of the earth - different region of earth's atmosphere - rotation of the earth - magnetosphere - Van Allen belts - Aurora.

UNIT II: Comets, Meteors, Asteroids

Composition and structure of comets - periodic comets - salient features of asteroids, meteors and its use.

UNIT III: Sun

Structure of photosphere, chromosphere, corona - sunspots - solar flares - solar prominence - solar plages - satellites of planets - structure, phases and their features of moon.

UNIT IV: Stars

Constellations - binary stars - their origin and types star clusters – Globular clusters - types of variable stars - types of galaxies.

UNIT V: Origin of Universe

Big bang theory - pulsating theory - steady state theory - composition of universe expansion

Books for study and Reference

1. K.D. Abyankar, Astrophysics of the solar system, University press, India.
2. Baidyanath Basu, An introduction to Astrophysics, Prentice Hall of India, New Delhi.
3. Prof. P. Devadas, The fascinating Astronomy, Published by Devadas Telescopes, 2, Charkrapani Road, Guindy, Chennai.
4. Elements of Space Physics – R.P. Singhal, PHI.

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester–V
Core 5: Basic Electronics

Course Outcome:

CO.No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO–1	Differentiate between constant voltage source and constant current source	3	An
CO–2	Explain Norton's theorem and Thevinin's theorem	1	Un
CO–3	Design a voltage regulator using Zener diode	7	Cr
CO–4	Construct a half wave bridge rectifier using diodes and capacitors	7	Cr
CO–5	Explain the forward bias and reverse bias action of a transistor	1	Un
CO–6	Analyse the circuit of astable and monostable multivibrator	3	An
CO–7	Explain the working of a Hartley and Colpitts Oscillator	1	Un
CO–8	Design the circuit for low and high pass filter and explain the frequency response curve	7	Cr

Core 5: BASIC ELECTRONICS

Preamble:

- This course provides the working of electronic devices, apply these techniques in practical circuits
- Understand the various characteristics pertaining to diodes and its applications
- Understand the transistor amplifiers, oscillators and wave shaping circuits
- Understand the functions of operational amplifiers

UNIT- I: LINEAR CIRCUIT ANALYSIS

Constant voltage source, constant current source, conversion of voltage source into current source - Maximum power transfer theorem - Thevenin's theorem - Norton's theorem - hybrid parameters – determination of h parameter - equivalent circuit – the h parameters of a transistor.

UNIT - II: SEMICONDUCTORS DIODES AND DEVICES

PN Junction - V – I characteristics of PN Junction - Crystal diode as a rectifier - Zener diode - V – I characteristics of Zener diode - Tunnel diode. Half wave rectifier, centre- tap full wave rectifier -Full wave bridge rectifier - Comparison of Rectifiers - Zener diode as voltage stabilizer.

UNIT - III: TRANSISTOR AMPLIFIERS

Transistor action - Transistor connections - common emitter - common base -common collector -Analysis of amplifiers using h- parameters - RC coupled amplifier - transformer coupled amplifier - power amplifier - classification of power amplifiers (Class A, Class B and Class C) - Push pull amplifier.

UNIT - IV: OSCILLATIONS AND WAVE SHAPING CIRCUITS

Feedback principle and Barkhausen criterion - Hartley, Colpitt's, and Phase shift oscillators using transistors – Astable - Monostable and Bistable multi vibrators using transistors - Schmitt trigger –clipping and clamping circuits – Differentiating circuit – Integrating circuit.

UNIT - V: OPERATIONAL AMPLIFIER

Op-Amp -pin diagram- characteristics of ideal Op - Amp - DC and A.C analysis of Op-Amp - Bandwidth of an Op-Amp - Slew rate - Frequency response - Op- Amp with negative feedback – applications –Inverting amplifier – Input and output impedance of Inverting amplifier – Non inverting amplifier- Voltage follower- Summing amplifier - Adder – Subtractor – Integrator – Differentiator – low pass, high pass and band pass filters

Books for study

1. Principles of Electronics -V.K. Mehta & Rohit Mehta - S. Chand & Co.
2. Electronic fundamentals and applications – John D. Ryder – Prentice Hall

Books for reference

1. Electronic principles - Malvino
2. Electronic devices and circuits – David Bell – Prentice Hall
3. Basic Electronics - B. Basavaraj, H.N. Shivashankar - 2nd edition – Universities press
4. Physics of semiconductor devices – Dilip K.Roy – Universities press

Core 6 : SPECTROSCOPY**Course Outcome:**

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	Explain different types of motion. Classify molecules according to rotational modes.	1,2	Un, An
CO-2	Discriminate the effect of isotopic substitution	5	An
CO-3	Discuss the 3 IR regions. Justify the interaction of rotations & vibrations on molecules.	1,8	Ev, Un
CO-4	Analyzed the IR techniques & explain its importance in research	1,4	An, Cr
CO-5	Distinguish Rayleigh & Raman scattering Categorize classical & quantum theory of Raman effect	2	An
CO-6	Validate the rule of mutual exclusion	5,8	Ev
CO-7	Formulate Lamber- Beer Law & Calculate transmission from absorbance	5,7	Cr, An
CO-8	Relate the use of UV spectrum in research	8	Ap
CO-9	Explain magnetic resonance & its principles.	1	Un
CO-10	List the uses of MRI Interpret NMR spectra	1,5	Re, Ap

Core 6: SPECTROSCOPY

Preamble: This course facilitates an understanding of atomic and molecular spectra and the instrumentations. The paper needs a basic knowledge about atomic structure and the learners are expected to gain knowledge to identify materials with the help of various spectra

UNIT I: MICROWAVE SPECTROSCOPY

Rotation of molecules – Classification of molecules – Rotation spectra of diatomic molecules – Intensities of spectral lines – Effect of isotopic substitution – Non-rigid rotator – Spectrum of a non-rigid rotator – Linear Polyatomic molecules -Techniques and Instrumentation – Chemical analysis by microwave spectroscopy

UNIT II: INFRARED SPECTROSCOPY

I.R. spectroscopy – Vibrating diatomic molecules – Simple Harmonic Oscillator - Anharmonic oscillator – Diatomic vibrating rotator -Interaction of rotations and vibrations – Vibration of polyatomic molecules – Analysis by IR techniques

UNIT III: RAMAN SPECTROSCOPY

Raman effect- Discovery – Quantum theory of Raman effect – Classical theory of Raman Effect –Pure rotational Raman spectra of Linear molecules – Raman spectrum of symmetric top molecules - Vibrational Raman spectra – Rule of mutual exclusion –Structure determination from IR and Raman spectroscopy

UNIT IV: ULTRAVIOLET SPECTROSCOPY

Introduction – Principle of Ultraviolet Spectroscopy – Transmittance and absorbance – Lamber - Beer law – UV spectrophotometer and spectrum recording – shifts of bands with solvents – Analytical uses of UV Spectroscopy

UNIT V: NMR SPECTROSCOPY

Introduction – Theory of NMR spectroscopy and origin of NMR signal – instrumentation for NMR spectroscopy – Techniques and principle of NMR – Application of NMR Spectroscopy – Magnetic resonance imaging (MRI) – interpretation of NMR spectra

Books for Study

1. Fundamentals Of Molecular Spectroscopy - Colin N Banwell Elaine- M Mccash Fifth Edition Book
2. Molecular structure and spectroscopy - G. Aruldas, PHI Learning Pvt. Ltd, India
3. Spectroscopy of Organic compounds – P.S. Kalsi, New Age International Publishers, 4th Edition

Books for Reference

1. Hand book of Analytical Instruments -R.S. Khandpur, Tata MC Grow Hill Ltd.

2. Spectroscopy - G.R. Chatwal and S.K. Anand, Himalaya publishing House, New Delhi

MSU/2021-22/UG-Colleges/Part-III (B.Sc. Physics) /Semester– V

Core 7: Atomic and Nuclear Physics

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	Class level (CL)
CO-1	Understand the concepts of free electron theory, band theory and positive rays.	1	Un, Ap, Ex
CO-2	Derive the expressions for electrical conductivity, thermal conductivity and to explain Hall effect and Hall coefficient.	1	Ex, Ca, Un
CO-3	Gain the vector atom model, coupling schemes and Zeeman effect.	1	Ex, Ap, Un
CO-4	Analyse the Stern and Gerlach experiment with derivation.	3, 4	An, Ap, Ca
CO-5	Understand the production, properties, usage of X-rays and various X-ray diffraction methods.	3,4	Un, Ap
CO-6	Explain the basics of primary and secondary cosmic rays, cosmic ray shower and Van Allen belts.	1	Ex, Ap, Un
CO-7	Describe the general properties of nucleus by using liquid drop model and shell model and to understand laws of radioactivity.	1, 7	Ca, Un, Rp
CO-8	Explain the construction, working and application of G.M.counter, Wilson cloud chamber, Cyclotron and betatron.	3	Ex, Ap, Un
CO-9	Apply the concepts of nuclear fission and fusion to atom bomb and hydrogen bomb.	1, 8	Ap, Cr, Ex
CO-10	Classify the elementary particles with examples and understand the concept of quark model.	1, 8	Un, Rp, Ap

Core 7: ATOMIC AND NUCLEAR PHYSICS

Preamble: The course provides an introductory account about the atomic and nuclear structures. This paper does not need any special prerequisite except the basic understanding of materials at the school level and the learners are expected to know about atomic models, nuclear models, X-rays, cosmic rays, nucleation reactions, detectors and accelerators etc.

Unit I: FREE ELECTRON THEORY, BAND THEORY AND POSITIVE RAYS

Free electron theory of metals – expressions for electrical conductivity – thermal conductivity -Hall effect- Classification of solids on the basis of band theory- Properties of positive rays - Thomson's parabola method - Aston's mass spectrograph.(12L)

Unit II: ATOMIC STRUCTURE

Vector atom model-Quantum numbers associated with the vector atom model- Pauli's exclusion principle-L-S coupling, j-j coupling - magnetic dipole moment due to orbital motion of the electron- Stern and Gerlach experiment- Normal Zeeman effect-theory and experiment-Anomalous Zeeman effect (Explanation only)-Stark effect. (12L)

Unit III: X-RAYS AND COSMIC RAYS

Production of X-rays – properties-absorption of X-rays-Bragg's X-ray spectrometer –Powder method – Laue's method – Rotating crystal method –Moseley's law- Cosmic rays-discovery-latitude, altitude and -north –south effects- primary and secondary cosmic rays- cosmic ray showers-Van Allen belt. (12L)

Unit IV: ATOMIC NUCLEUS, DETECTORS AND ACCELERATORS

General properties of the nucleus- binding energy curve- Liquid drop model - Shell model -Alpha,beta and gamma rays-properties- Laws of radioactive disintegration-half -life period – mean life period – α decay, β - decay - γ decay (Explanation only) -G.M.counter-Wilson cloud chamber-Cyclotron- betatron. (12L)

Unit V: NUCLEAR REACTIONS AND ELEMENTARY PARTICLES

Q-value of nuclear reaction- Nuclear fission-Chain reaction–energy released in fission- Nuclear reactor- Nuclear fusion –fusion reactor-Principle and action of atom bomb - hydrogen bomb-Classification of elementary particles - fundamental interaction- the quark model (12L)

Books for study

1. Modern Physics - R. Murugesan (S.Chand &Co.)
2. Atomic and Nuclear Physics - N.Subrahmanyam, Brijal, S. Chand & Co Ltd, New Delhi.

Books for Reference

1. Modern Physics - B.S.Agarwal, Kedarnath Ramnath, Meerut, Delhi.
2. Atomic and Nuclear Physics - Shatendra Sharma – Pearson Publications
3. Modern Physics - B.V.N Rao, Wiley Eastern Ltd, New Delhi
4. Modern Physics- Seghal Chopra & Seghal, Sultan Chand 1998
5. Perspective of Modern Physics-Arther Beiser –Tata-Mc Graw Hill Publishing Company

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester–V

MAJOR ELECTIVE

(any one)

a. PROGRAMMING IN C++

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO - 1	Understand the basics of C++ programming.	1	U
CO - 2	Understand the applications of C++ modules.	1, 2	U, Ap
CO - 3	Understand the basic techniques of numerical analysis.	1, 2, 7	U, C
CO - 4	Understand and apply computational techniques to physical problems.	1, 7	U, Ap
CO - 5	Understand the procedural and object-oriented paradigms with concepts like streams, classes, functions, and arrays.	1, 2, 8	U
CO - 6	Understand dynamic memory management techniques using member functions, classes, constructors, etc.	1, 8	U, C
CO - 7	Understand the concept of function overloading and operator overloading.	1	U, C
CO - 8	Understand inheritance and its types of inheritance.	1, 8	U, C
CO - 9	Managing the C++ streams with operations and classes	1, 2	U, Ap
CO - 10	Understand the fundamental C++ file operations for single and multiple files.	1, 2	U, Ap

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester–V

MAJOR ELECTIVE

(any one)

b. PROGRAMMING IN C++

Preamble: Objective of the course is to provide knowledge about the basics of Computer programming in C++ by writing programs. The paper does not need any special prerequisite and the learners are expected to come out with the ability to apply the computer language C++ to solve problems.

UNIT-I: WHAT IS C++

Introduction –comments –output operator-input operator-io stream file –tokens - keywords -identifiers and constants - declaration of variables - basic data types - operators in C++ -expressions and their type-hierarchy of arithmetic - control structures- a simple C ++ program (arithmetic operations using do while loop)

UNIT-II: ARRAYS AND FUNCTIONS IN C++

Introduction - one dimensional and two dimensional arrays - initialization of arrays – a simple matrix addition program. Functions - introduction - function prototyping - inline functions - function overloading –program to find the factorial of a number using function

UNIT-III: CLASSES AND OBJECTS

Introduction – specifying a class – defining member functions – creating objects - C ++ program with class - nesting of member functions - objects as function arguments - arrays within a class - friend functions-constructors –default constructors- parameterized constructors- copy constructor - multiple constructors

UNIT-IV: OPERATOR OVER LOADING AND INHERITANCE

Introduction – defining operator overloading-over loading unary operators –binary operators – rules for overloading operators-Inheritance - single inheritance - multiple inheritance –multi level inheritance-hybrid inheritance

UNIT-V: MANAGING CONSOLE I / O OPERATIONS

Introduction - C ++ stream - C ++ stream classes - formatted console I/O operations (width, precision, fill) - working with files - classes for file steam operations - opening and closing a file – detecting end of file - opening files using constructors and open –working with single and multiple files

Books for study

1. Object oriented Programming with C++ - E.Balagurusamy, Tata Mc Graw-Hill publishing company Ltd. New Delhi
2. Programming with C++ - D. Ravichandran, Tata Mc Graw-Hill publishing company Ltd. New Delhi

Books for reference

1. Object oriented Programming in C++- 4th Edn.Robert Lafore-Macmilan publishing company Ltd.
2. Fundamentals of Programming with C++ -Richard I. Halterman

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester–V

MAJOR ELECTIVE – b. COMMUNICATION ELECTRONICS

Course outcome:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO - 1	Analyse amplitude modulation and AM envelope. To explain AM frequency bandwidth and phasor representation of AM with carrier. To determine the coefficient of modulation or percentage modulation or modulation index.	1,4	Un, An
CO - 2	illustrate AM power distribution and AM current relation and efficiency. Elaborate emitter modulations or low power AM collector modulator. Classify low level transmitter and high level transmitter	1	An
CO - 3	Analyze the comparison of AM system and Quadrature amplitude modulation. To illustrate the Principles of AM detection and AM receivers	1,5	Re,An
CO - 4	Explain about tuned radio frequency receiver or straight receiver. To elaborate double frequency conversion AM receiver.	1	Re,Ev
CO - 5	Illustrate Frequency modulation and phase modulation. To determine phase modulation and modulation index.	4,5	Re,Un
CO - 6	Elaborate the conversion of FM to PM and they can picturize the phasor representation of FM and PM. To compare AM and FM	1	Ev
CO - 7	Explain and Analyze FM detectors and balanced slope detector	4	An
CO - 8	Illustrate the ratio detector and to elaborate the important features of FM super heterodyne receiver and FM noise suppression. Also to summarize about threshold extension by FMFB technique	5	An,Un
CO - 9	Elaborate about BFSK and to summarize about Binary phase shifting Key. The importance of Quadrature PSK and Differential PSK.	1,5	An,Un
CO - 10	Comparison of digital modulations can be done. to compare and classify correlative coding and Duo binary encoding.	1,4	Un,Ap

MAJOR ELECTIVE – b. COMMUNICATION ELECTRONICS

Preamble: This course enables the students to understand various modulation and demodulation techniques used for communication. The paper needs a basic knowledge in electronics and mathematics and the learners are expected to come out with the ability to choose proper modulation techniques.

UNIT-I: AMPLITUDE MODULATION AND TRANSMISSION

Introduction–amplitude Modulation–AM envelop–AM frequency spectrum and bandwidth–Phas or representation of AM with carrier – coefficient to f modulation or percentage modulation or modulation index – degrees of modulation – AM power distribution – AM Current relation and efficiency–modulation by complex information signal –double side band suppressed carrier AM - single side band suppressed carrier AM – Vestigial side band amplitude modulation – AM modulator circuits – emitter modulations or low power AM –collector modulator or medium and high power AM modulator - AM transmitters –Broadcast AM transmitters–Low level of AM transmitter–High level AM transmitter.

UNIT-II: AMPLITUDE MODULATION - RECEPTION

Comparison of AM system – Quadrature amplitude modulation – principles of AM detection – AM receivers – receiver parameters – Tuned radio frequency (TRF) receiver or straight receiver – principles of super hetrodyne – double frequency conversion AM receiver.

UNIT-III: ANGLE MODULATION – TRANSMISSION

Introduction – Frequency modulation – Phase modulation – Phase deviation and modulation index – Multi tone modulation – Transmission band width of FM –conversion of PM to FM or frequency modulator– conversion of FM to PM / phase modulators – commercial broadcast FM – phase or representation of an FM and PM – average power of an AM/FM wave – generation of FM – direct method of FM generation – reactance tube modulator– indirect method of FM wave generation – FM transmitters – indirect method – Comparison of AM and FM.

UNIT-IV: FM RECEPTION

FM detectors – Balanced slope detector – Foster seemly discriminator – ratio detector –FM super heterodyne receiver–FM noise suppression–threshold extension by FMFB technique.

UNIT-V: DIGITAL MODULATION TECHNIQUES

Introduction–BFSK–Binary phase shift keying – Quadrature PSK –Differential PSK – Performance comparison of digital modulation schemes - M ary FSK– correlative coding– Duo binary encoding.

Book For Study

1. Principles Of Communication Engineering - Dr. K.S.Srinivasan, Second Edition:2010.
2. Electronic communication systems – George Kennedy & Bernard Davis, Tata Mcgraw Hills, 4th edition, 2008

Books for reference:

1. Electronic communication systems – Blake, Joseph J Adams ki, Sun Yifeng, Delamer publication, 2nd edition, 2012 (Rupa Publication, India)
2. Fundamentals of Electrical engineering – Wayne tomasi

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester–V

PRACTICAL - V

GENERAL PRACTICAL

(6 Experiments compulsory)

- 1.** Conversion of Galvanometer into Voltmeter and Ammeter
- 2.** Spectrometer – Cauchy's Constants
- 3.** Young's Modulus – Elliptical Fringes
- 4.** Potentiometer – Calibration of Voltmeter (High Range)
- 5.** Potentiometer – Temperature Coefficient of Resistance
- 6.** Thevanin's and Norton's theorem – Verification
- 7.** Ballistic Galvanometer – High resistance by leakage
- 8.** Desauty's Bridge – Determination of C, C1 & C2 in series and parallel

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester–V

PRACTICAL-VI

ELECTRONICS

(6 experiments compulsory)

1. V-I Characteristics of Junction diode and Zener diode
2. Transistor characteristics
3. Colpitts Oscillator
4. Single stage amplifier – with and without feedback
5. Astable multivibrator using 555 timer
6. OPAMP – Adder & Subtractor
7. OPAMP – Differentiator & Integrator
8. OPAMP – Low Pass & High Pass Filter

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester–VI

Core 9: Quantum Mechanics

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	Class level (CL)
CO-1	Understand the quantum concepts of black body radiation, Planck's theory and photoelectric effect.	1	Un, Rp, Ex
CO-2	Apply the Bohr's quantization concept of angular momentum to hydrogen atom.	1, 7	Ap, Ca
CO-3	Acquire the knowledge of De Broglie's hypothesis and concepts of phase and group velocities.	1, 8	Rp, Ap
CO-4	Explain the concepts of diffraction and interference of electrons and wave packet	1	Ex, Cr
CO-5	Understand the Heisenberg's uncertainty principle and its proof between energy and time.	1, 7	Un, Ex
CO-6	Describe some thought experiments to explain the Heisenberg's uncertainty principle.	1, 4, 8	Ex, Ap
CO-7	Derive Schrodinger's time-dependent and time-independent wave equations.	1, 7	Ap, Un
CO-8	Understand the concepts of wave function, eigenfunction, eigen value, operators and postulates of quantum mechanics.	1	Un, Ca, Ex
CO-9	Apply the concepts of quantum mechanics to particle in one-dimensional box and to particle in a rectangular three-dimensional box	1, 7	Ap, Ca, An
CO-10	Acquire knowledge of application of quantum mechanics to simple harmonic oscillator and transmission across a potential barrier.	1, 8	Ap, Ev, Un

Core 9. QUANTUM MECHANICS

Preamble: This course includes Quantum theory, Wave properties of matter, Heisenberg uncertainty principle, schrodinger's wave equation and applications of quantum mechanics

Unit –I: ORGIN OF QUANTUM THEORY

Black body radiation – Failure of classical Physics to explain energy distribution in the spectrum of a black body - Planck's Quantum theory–photo electric effect - Einstein's explanation for photo electric effect – The Ritz combination principle in spectra – Stability of an atom – Bohr's quantization of angular momentum and its application to the hydrogen atom.

Unit –II: WAVE PROPERTIES OF MATTER

Wave particle duality - De Broglie Hypothesis for matter waves – Concept of group velocity - Phase and Group Velocity – velocity of De Broglie Waves – Diffraction of particles – Interference of electrons – Wave packet

Unit-III: HEISENBERG UNCERTAINTY PRINCIPLE

Uncertainty Principle - Elementary Proof of Heisenberg's Uncertainty Relation- Elementary Proof of the Heisenberg's Uncertainty Relation between energy and Time - Illustration of Heisenberg's uncertainty principle by Thought experiments - Consequences of the uncertainty relation

Unit –IV: SCHRODINGER'S WAVE EQUATION

Schrodinger's one dimensional time-dependent wave equation – One dimensional Time-independent Schrodinger's wave equation – Physical Interpretation of the Wave Function ψ – Operators in quantum Mechanics, Eigen Function, Eigen value and Eigen Value equation – Expectation values – Postulates of Quantum mechanics

Unit –V: APPLICATIONS OF QUANTUM MECHANICS

Particle in a one dimensional box – Particle in a rectangular three dimensional box – Simple harmonic oscillator – One dimensional simple harmonic oscillator in quantum mechanics – Reflection at a steep potential – Transmission across a potential barrier

Book for Study

1. Elements of Quantum Mechanics, Kamal Singh & S P Singh-Chand &Co
2. Mathews P.M. and Venkatesh K. Quantum Mechanics Tata McGraw Hill Publishing Ltd

Book for Reference

1. Gipta, Kumar, Sharma - Quantum Mechanics – Jai Prakash Nath Company
2. Quantum Mechanics- G.Arul Das-PHI Private Learning Ltd.
3. Quantum Mechanics- V.Murugan – Pearson publication
4. Quantum Mechanics- Mahesh C.Jain- PHI Private Learning Ltd

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester–VI

Core 10: Digital Electronics

Course Outcome:

CO.No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO–1	Define binary number	1	Re
CO–2	Differentiate the various codes in Binary system	3	An
CO–3	Construct the circuit for the basic logic gates	3	Cr
CO–4	Explain the half and full subtractor using logic gates	1	Un
CO–5	Draw the circuit for frequency divider	1	Un
CO–6	Analyse the circuit of a stable and monostable multivibrator	3	An
CO–7	Explain the function of a multiplexer and De- multiplexer	1	Un
CO–8	Differentiate A/d and D/A converter	3	An

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester–VI

Core 10: DIGITAL ELECTRONICS

Preamble: This course includes number systems , binary arithmetic and codes, logic gates and Boolean algebra, Arithmetic circuits, Flip-flop and multi-vibrators and Shift Registers and Counters

Unit I: Number systems, Binary arithmetic and Codes

Decimal, binary, Octal, decimal and hexadecimal number systems and their inter- conversions -Binary arithmetic - Binary addition - binary subtraction-1's and 2's complements -- BCD codes, ASCII code, Excess-3code, Gray code.

Unit II: Boolean algebra and Logic gates

Boolean algebra-De Morgan's theorem –Positive logic and negative logic systems-Basic logic gates, OR, AND, NOT (symbol, Boolean equation, truth table, circuit diagram and working) -NAND, NOR, EX-OR (symbol, Boolean equation, truth table only) - NAND and NOR as universal building blocks.

Unit III: Arithmetic circuits, Flip-flops and multi vibrators

Half and full adders – Half and full subtractors - RS Flip-flop-clocked RS Flip-flop, JK Flip-flop, JK master slave Flip-flop, D Flip-flop, T Flip-flop – 555 timer –Astable multivibrator, monostable multi vibrator -Frequency divider

Unit IV: Karnaugh map and combinational circuit applications

Karnaugh map - 2, 3 and 4 variables –simplification - SOP and POS form of Boolean functions - -Don't care conditions-Multiplexer, Demultiplexer, Encoder, Decoder, parity generator and checker.

Unit V: Shift Registers and Counters

Types of registers- Serial in –Serial out-Serial in-Parallel out- Parallel in- Serial out- Parallel in-Parallel out-Asynchronous counters and Synchronous counters- Ring counter- Binary counter- Up-Downcounter- Mod-5 counter-Mod-10 counter (decade counter) -A/D and D/A converters

Book for study

1. Digital principles and applications – Albert Paul Malvino & Donald P. Leach
2. Digital logic and computer design – Morris Mano - Prentice Hall of India, Pvt. Ltd

Book for reference

1. Gothmann W.H., Digital Electronics – Prentice Hall of India, Pvt. Ltd.
2. Metha V.K. Mehtha. R. Principles of electronics, S.Chand & Co.
3. Fundamentals of Digital Electronics and Microprocessors–Anokh Singh, A.K.Chhabra, S.Chand & Co

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester–VI

Core 11: Solid State Physics

Course Outcome:

CO.No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	Explain the seven classes of crystals and to illustrate about the Bravais lattice in three dimensions.	1	Re,An
CO-2	Imagine and elaborate about Simple cubic, Face centered cubic, Body centered cubic and Hexagonal closed packed structures. To make use of Braggs's law and reciprocal lattice to SCC, BCC and FCC lattices.	1,3	Un,An
CO-3	Illustrate Langevin's theory of Paramagnetism, Weiss Paramagnetism. To analyze the concept of Ferromagnetism and to summarize about domain theory of ferromagnetism and anti magnetism	5	An,Ev
CO-4	Elaborate about the different types of electric polarizations and to classify and compare about the ionic, orientation and space charge polarization	1,8	An,Ap
CO-5	Classify and about types of bonds in crystals. To illustrate about Vanderwaal's and hydrogen bonding. Comparison of ionic and covalent solids .	1,4	Un,An
CO-6	Elaborate about cohesive energy of ionic solids and the application towards Sodium chloride crystal and the evaluation of Madelung Constant for sodium chloride can be done.	1,5	An,Ev
CO-7	Interpret the general properties of Super conductors. Elaborate the effect of magnetic field and Meissner effect, current of effect.	1,4	An
CO-8	Illustrate about entropy. To list out the application of super conductors	5,8	Re,An
CO-9	Describe about the nano particles and synthesis and its classification. Explain the techniques used in synthesis of nanomaterials and about chemical vapour deposition techniques.	1,3	Re,Ev
CO-10	Classify and compare the properties of nano materials. Applications of nano materials can also be explained.	1,3	Ev,Ap

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester–VI
Core 11: SOLID STATE PHYSICS

Preamble: Objective of this paper is to introduce crystals and nano particles and to provide an understanding about different types of materials. The paper needs a basic knowledge of elements of modern physics and the learners are expected to get some ideas on Materials Research.

UNIT-I: CRYSTAL LATTICES

Introduction-seven classes of crystals - Bravais lattice in three dimensions -crystal structure -Simple cubic, Face centered cubic, Body centered cubic and Hexagonal close packed structure -Sodium Chloride, Zinc Blende and Diamond Structures. Miller Indices and crystal planes - procedure for finding Miller Indices -interplanar spacing - Diffraction of X-Rays - Bragg's Law

UNIT- II: BONDING IN SOLIDS

Types of bonds in crystals-Ionic, covalent, Metallic, Vanderwaal's and Hydrogen Bonding-Bond energy of sodium chloride molecule-Comparison between ionic and covalent solids - variation of inter atomic force with inter atomic spacing-cohesive energy-cohesive energy of ionic solids-application to sodium chloride crystal - evaluation of Madelung constant for sodium chloride.

UNIT - III: TYPES OF MAGNETIC MATERIALS

Introduction -classical theory of Diamagnetism - Langevin's theory of Para magnetism - Weiss Theory of Para magnetism - Domain theory of ferromagnetism – Anti ferro magnetism-Fundamental Definitions of Dielectrics - Different types of Electric Polarization- electronic, ionic, orientation and space charge Polarization - Dielectric Loss - Internal Field - Clausius– Mossotti Relation

UNIT-IV: SUPER CONDUCTIVITY

Introduction - General Properties of Superconductors - effect of magnetic field - Meissner effect - effect of current - thermal properties - entropy – specific heat-energy gap-isotope effect-London equations- AC&DC Joseph son effect - applications-Type–I and Type–II Super conductors-Explanation for the Occurrence of Super Conductivity- BCS theory- Application of Superconductors - High T_C superconductors.

UNIT-V: NANO TECHNOLOGY

Nanomaterials-synthesis and classification—techniques used in synthesis of nanomaterials-chemical vapour deposition-sol-gel technique-electro deposition method-ball milling method- characterization - properties and applications of nanomaterials-fullerene, graphene and carbon nano tubes

Books for Study

1. Solid State Physics -P.K. Palanisamy –SCITECH Publications Pvt. Ltd. Chennai
2. Nano-essentials and understanding - Pradeep.T.Mc-Graw-Hill Ltd.

Books for reference

1. Introduction to Solid State Physics - Kittel-Wiley and Sons, New Delhi
2. Material Science and Engineering- V. Raghavan - PHI
3. Introduction to Solids- Azaroff- TMH
4. Material Science-M. Arumugam – Anuradha Publishers
5. Solid State Physics - H.C.Gupta – Vikas publishing house Pvt. Ltd.
6. Principles of Nanoscience and technology - Shah M.A.Ahmed, Narosha Publishing House Pvt. Ltd.

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester–VI

Major Elective: a. Energy Physics

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO - 1	Understand the importance of conventional and non-conventional energy resources.	1, 6	U
CO - 2	Understand the applications, merits, and demerits of conventional and non-conventional energy resources.	1	U, Ap
CO - 3	Understand the basic aspects of solar energy.	1, 6	U, C
CO - 4	Understand solar energy appliances with their merits and demerits.	1	U
CO - 5	Understand the basic aspects of the photovoltaic principle.	1, 6	U, Kc
CO - 6	Learn about photovoltaic appliances and how they work.	1	C, Ap
CO - 7	Understand the solar cell with its applications and its types.	1, 6	U, Kc
CO - 8	Understand the basic ideas of biomass energy and recognise their merits and demerits.	1, 6	U, An
CO - 9	Understand the methods and classifications of biomass energy.	1	U
CO - 10	Understand the basic principles of wind energy conversion.	1, 6	U
CO - 11	Understand the fundamental concepts of oceans and chemical energy resources, as well as their benefits and drawbacks.	1, 6	U, Ap

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester–VI

MAJOR ELECTIVE

(any one)

a. ENERGY PHYSICS

Preamble: Objective of the course is to provide an understanding of the present energy crisis and various available energy sources. The paper does not need require any special prerequisite and the learners are expected to know the use of alternate energy sources

UNIT I: INTRODUCTION TO ENERGY SOURCES

World's reserve of Commercial energy sources and their availability-Variety of energy-renewable & non-renewable energy sources – Conventional & non-conventional energy sources–commercial & non-commercial energy sources, comparison –merits, demerits and applications of coal, oil and natural gas

UNIT II: SOLAR ENERGY

Solar energy – nature of solar radiation and its components -Basic Principles of Liquid flat plate collector –Materials for flat plate collector -Construction and working- Solar water heater - Solar crop dryer – Solar space cooling – solar ponds - solar cookers (box type) - merits and demerits of solar energy

UNIT III: PHOTOVOLTAIC SYSTEMS

Introduction – Photovoltaic principle - Basic Silicon Solar cell- Power output and conversion efficiency-Limitation to photovoltaic efficiency-Basic photovoltaic system for power generation-Advantages and disadvantages-Types of solar cells-Application of solar photovoltaic systems - PV Powered fan – PV powered area lighting system– A Hybrid System.

UNIT IV: BIOMASS ENERGY

Introduction-Biomass classification- Biomass conversion technologies-Bio-gas generation-Factors affecting bio-digestion -Working of biogas plant- floating and fixed dome type plant -advantages and disadvantage of -Bio-gas from plant wastes-Methods for obtaining energy from biomass-Thermal gasification of biomass-Working of down draft gasifier- Advantages and disadvantages of biological

conversion of solar energy.

UNIT V: WIND ENERGY AND OTHER ENERGY SOURCES

Wind Energy Conversion-Classification and description of wind machines, wind energy collectors- Energy storage-- Energy from Oceans and Chemical energy resources - Ocean thermal energy conversion-tidal power, advantages and limitations of tidal power generation-Energy and power from waves- wave energy conversion devices- Fuel cells- and application of fuel cells- batteries- advantages of battery for bulk energy storage- Hydrogen as alternative fuel for motor vehicles.

Books for study

1. Rai G. D, Non conventional Energy sources, 4th Edition, Khanna Publishers,2010
- 2.Solar Energy- Principles of thermal collection and storage - S.P.SUKHAME-Tata-McGraw-Hill Publishing Company Ltd.

Books for References

1. Chetan Singh Solanki, Solar Photovoltaics Fundamentals, Technologies and Applications, 2nd Edition, PHIL earning Private Limited, 2011.
2. Kothari D.P., K.C.Singal and Rakesh Ranjan, Renewable energy sources and emerging Technologies, Prentice Hall of India, 2008.
3. Jeffrey M. Gordon, Solar Energy: The State of the Art, Earthscan, 2013.
4. Kalogirou S.A., Solar Energy Engineering: Processes and Systems, 2nd Edition, Academic Press, 2013.
5. Zobaa A.F. and Ramesh Bansal, Hand book of Renewable Energy Technology, World Scientific, 2011

MSU/2021-22/UG-Colleges/Part-III
(B.Sc. Physics)/Semester–VI
Major Elective : b. MEDICAL PHYSICS

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	Define electromagnetic spectrum Sketch the X- ray tube design	1,2	Re, Ap
CO-2	Categorize half wave & full wave rectification	2	An
CO-3	Identify the sources of radio activity. Explain the units of radiation	1,3	Re, Un
CO-4	Measure the biological damage	4	Ev
CO-5	Discuss about CAT scanners, Identify transducers for biomedical applications	1	Ev, Un
CO-6	Estimate the computer analysis of ECG	5	Cr
CO-7	State radiography, Compare Ultrasound imaging & magnetic resonance imaging	1,3	Re,An
CO-8	Determine the uses of Gamma Camera	5	An
CO-9	Generalize the uses of lasers. Interpret the effect of laser radiation on tissues	5,8	Ap

CO-10	Justify laser as a beauticians tools	8	Ev
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MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester–VI

MAJOR ELECTIVE

b. MEDICAL PHYSICS

Preamble: This course facilitates an understanding of the basic concepts in Biomedical instrumentation and awareness regarding radiation hazards and safety.

UNIT-I: X-RAYS

Electromagnetic spectrum - production of x-rays - x-ray spectra –Brehms strahlung process
 - Characteristic x-ray - X-ray tubes - Coolidge tube - X-ray tube design - tube cooling - stationary mode - Rotating anode X-ray tubes -Tube rating - quality and intensity of X-ray. X-ray generator circuits - half wave and full wave rectification - filament circuit - kilo voltage circuit - high frequency generator- exposure timers- HT cables.

UNIT–II: RADIATION SAFETY AND HEALTH PHYSICS

Introduction to Radio activity - Artificial and natural - radioactivity –Physical features of radiation-units of radiation- conventional sources of radiation, Interaction of different types of radiation with matter -penetration power in living cells-radiation damage to the cell-effect of radiation on cells-measurement of ionizing radiation- measurement of biological damage-Linear energy transfer (LET)-radiation risk-radiation dosimetry-security of radio-active material- radio-active waste management

UNIT–III: BIOMEDICAL INSTRUMENTATION

Development of biomedical instrumentation-biometrics-introduction to the man-instrument system-components of man-instrument system-transducers for biomedical applications-biomedical computer applications-computer analysis of ECG-computerized axial tomography (CAT) Scanners

UNIT-IV: MEDICAL IMAGING PHYSICS

Radiological imaging - Radiography - Filters - grids - cassette - X-ray film –film processing
 – fluoroscopy - computed tomography scanner- principle function - display - generations –

mammography - ultrasound imaging - magnetic resonance imaging - thyroid uptake system - Gamma camera (Only Principle, function and display)

UNIT-V LASERSIN MEDICINE

Introduction to laser-principle and production of laser- effects of laser radiation on tissues - photo thermal effects- photo chemical effects –photo dynamic therapy-Laser applications in therapy and diagnosis-opthalmology - Fibre optic endoscopy and dentistry-Laser as a beautician's tool-laser hazards-biological effects.

Books for study and Reference

1. Basic Radiological Physics Dr. K. Thayalan - Jayapee Brothers Medical Publishing Pvt. Ltd. New Delhi (2003)
2. The essential physics of Medical Imaging: Bushberg, Seibert, Leidholdt and Boone Lippincot Williams and Wilkins, Second Edition (2002)
3. Biomedical instrumentation-Leslie Cromwell, Fred J. Weibel-Erich A. Pfeiffer-Pearson Publications
4. Lasersin Medicine- RW Wayanant, Plenum Publishing Co
5. Nuclear medicine physics: Chandra – Lippincot Williams and Wilkins (1998)

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester–VI
PROJECT

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	Design, build and assess the working of scientific models individually as well as in groups	5, 6	Cr, Ev
CO-2	Plan research works related to crystal growth	5, 6	Cr
CO-3	Synthesize Nano materials and compile the characteristics	3, 5, 6	Cr
CO-4	Assess the output of electronic projects	2, 5, 6	Ev
CO-5	Interpret the physical phenomena in theoretical projects	5, 6	Ap
CO-6	Analyse the various properties of atmosphere using available software	5, 6	An
CO-7	Design solar appliances	5, 6, 7	Cr
CO-8	Calculate the thickness of different hairs using air wedge apparatus	1, 5, 6	An

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester–VI

PROJECT

GUIDE LINES:

The objective of the course is to train the students to gain confidence to carry out independent work, group and get experience in handling of various equipments.

- It must be the Group Project
- Each group consists of maximum of five students
- Project must be related to the Physics subject
- Readymade projects not allowed
- Downloaded projects not allowed
- Both experimental and theoretical projects are allowed
- Field trip visit (maximum two days) related to project

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester–VI

PRACTICAL-VII

GENERAL PRACTICAL

(6 experiments compulsory)

1. Spectrometer - Hartmann's interpolation formula
2. Spectrometer - i_1 - i_2 curve
3. Spectrometer – i – d curve, critical angle of a prism
4. Self-inductance – Rayleigh's Bridge
5. Spectrometer – Dispersive Power of Grating - oblique incidence
6. Impedance and power factor – LR Circuit
7. Comparison of mutual inductance M_1 / M_2 - Ballistic Galvanometer
8. Moment of Magnet - Tan C position

MSU/2021-22/UG-Colleges/Part-III(B.Sc.Physics)/Semester–VI

PRACTICAL – VIII

ELECTRONICS

(6 Experiments compulsory)

1. Arithmetic and Logic Units (ALU)
 - a. Half Adder
 - b. Full Adder
2. Mono stable multi vibrator using 555 Timer
3. Combinational Logic – To convert a Boolean Expressions (any two) into Logic Gate Circuit and assemble it using logic gate IC's
4. Universal building block - NAND gate
5. Universal building block - NOR gate
6. Verification of Boolean Algebra (any four)
7. Verification of De-Morgan's laws
8. Hartley Oscillator

Model Question Paper

Reg. No. :

Code No. :

Sub Code:

B.Sc (CBCS) DEGREE EXAMINATION, APRIL 2022

Sixth Semester

Physics --- Core

DIGITAL ELECTRONICS

(For those who joined in July 2020 onwards)

TIME: THREE HOURS

MAXIMUM: 75 Marks

PART A – (10 X 1 = 10 MARKS)

Answer ALL Questions

1. The hexadecimal number corresponding to the binary number $(11110010)_2$ is

- | | |
|--------|--------|
| (a) F5 | (b) C2 |
| (c) F2 | (d) C5 |

2. The grey code corresponding to binary $(1100)_2$ is

- | | |
|----------|----------|
| (a) 1011 | (b) 1001 |
| (c) 0111 | (d) 1010 |

3. The Boolean equation $A + B + C$ is equivalent to

- | | |
|-------------------------------|----------------------------|
| (a) $A B C$ | (b) $A + B + C$ |
| (c) $\bar{A}.\bar{B}.\bar{C}$ | (d) $\overline{A + B + C}$ |

4. The most suitable gate for comparing two bits is

- | | |
|----------|------------|
| (a) AND | (b) OR |
| (c) NAND | (d) EX-NOR |

5. The flip flop which produces unpredictable output for the inputs 1, 1 is

- | | |
|--------------------|--------------------|
| (a) R – S flipflop | (b) J – K flipflop |
| (c) M – S flipflop | (d) D flipflop |

6. Circuit which consist of a quasistable state is called
 - (a) bistable circuit
 - (b) monostable circuit
 - (c) tristable circuit
 - (d) tristate circuit
7. Four adjacent '1' s in a Karnaugh map forms a
 - (a) Octet
 - (b) Singlet
 - (c) Pair
 - (d) Quad
8. A circuit that changes a code into a set of signals
 - (a) encoder
 - (b) decoder
 - (c) multiplexer
 - (d) data selector
9. A decimal counter has _____ states.
 - (a) 5
 - (b) 10
 - (c) 15
 - (d) 20
10. The error in the D/A converter output may be due to
 - (a) Errors in the values of resistors used
 - (b) Monotonicity
 - (c) Small resolution
 - (d) Its higher D/A speed

PART B – (5 X 5 = 25 Marks)

Answer ALL questions, choosing either (a) or (b)

Each answer should not exceed 250 words

11. (a) Encode the decimal number to excess - 3 code.
- (i) 46
 - (ii) 327.89
 - (iii) 20.305

Or

- (b) Determine the decimal numbers represented by the following binary numbers
- (i) 110101
(ii) 101101
(iii) 11111111
(iv) 00000000

12. (a) Describe the positive logic and negative logic systems

Or

(b) Explain EXOR gate with truth table

13. (a) Explain the full subtractor with circuit

Or

(b) discuss briefly 555 timer

14. (a) Explain product of sum (POS) form of logical expression

Or

(b) discuss don't care condition

15. (a) Define (i) shift register (ii) counter

Or

(b) Define (i) resolution and (ii) linearity of D.A convertor

PART C – (5 X 8 = 40 Marks)

Answer ALL questions, choosing either (a) or (b)

Each answer should not exceed 600 words

16. (a) perform the following subtraction using 2's complement method

- (i) 01000 – 01001
- (ii) 01100 – 00011
- (iii) 0011.1001 – 0001.1110

Or

(b) Explain ASCII code

17. (a) State and prove Demorgan's theorem

Or

(b) Explain NOR as universal building block

18. (a) Explain the operation of a JK flipflop

Or

(b) Explain monostable multivibrator

19. (a) Make k-map for the function
 $f = AB + A\bar{C} + C + AD + A\bar{B}C + ABC$

Or

(b) Explain multiplexer with a diagram

20. (a) Explain ring counter with a diagram

Or

(b) Explain term:

- (i) Resolution
- (ii) Conversion time of A/D convertor