Tamil Nadu Open University
Regulations and Overview for B.Sc., Physics (Semester) in ODL System

[w.e.f Academic Year 2020-2021]

Department of Physics
School of Science
Tamil Nadu Open University
Chennai- 600 015

Bachelor of Science in Physics

1. Introduction

Bachelor of Science in Physics Programme has been designed to provide in basic knowledge in Physics to those students who are not having opportunity to study in regular mode and for drop-out students from rural and urban areas of Tamil Nadu. The main Objective of this Programme is to enable the students to understand the basic knowledge of matter and energy and make them relevant to society. While studying this programme, the learner will be

2. Programme's Objectives

PO 1: Utilizing the physics concepts in the day-to-day life for better living. Applying the physics theories in the workplaces and homes to make better decision and choice.

PO 2: Succeed in obtaining employment appropriate to their interests, education and will become a valuable physicist

PO 3: Technical Proficiency- Succeed in obtaining employment appropriate to their interests, education and will become valuable physicist.

PO 4" Professional Growth-Continue to develop professionally through life-long learning, higher education, research and other creative pursuits in their areas of specialization.

PO 5: Management Skills-Improve leadership qualities in a technical and social Response through innovative manner.

3. Programme Specific Outcomes – B.Sc., Physics

While after completing this Programme the learner, shall be able to

PSO 1: Interpret the knowledge of the consequences of physics to manage projects in multidisciplinary environment.

PSO 2: Apply the principles of physics to solve problems in interdisciplinary fields of science.

PSO 3: Classify various opportunities associated with applications of Laws of Physics.

PSO 4: Develop the awareness to be professionally and ethically responsible in the scientific domain.

PSO 5: Acquiring a rigorous knowledge in fundamental areas of Physics.

PSO 6: Application of knowledge to real-life problems.

4. Programme Learning Outcomes

PLO 1: **Science Knowledge:** Apply pure and interdisciplinary science knowledge for the solution of various scientific and engineering problems.

PLO 2**: Problem analysis**: Identify, formulate, review research literature, and Analyze scientific problems reaching validated conclusions using basic principles of sciences.

PLO 3: **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis, and interpretation of data, and synthesis of the information to provide valid conclusions.

PLO 4: **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern IT tools including prediction and modeling to complex scientific activities with an understanding of the limitations.

PLO 5: **The science and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional practice.

PLO 6: **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the scientific practice.

PLO 7: **Individual and teamwork**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PLO 8: **Communication:** Communicate effectively on various activities with the Science community and with society at large, such as being able to

comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.

PLO 8: **Science projects and funding:** Demonstrate knowledge for writing and managing scientific projects in various disciplines and apply these to its own work, as a member and leader in a team, manage funds for scientific projects from various funding agencies and NGOs.

PLO 9: **Lifelong learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

5. Eligibility for admission:

Candidates should have passed the Higher Secondary Examination (10+2 pattern) conducted by the Board of Higher Secondary Education, Government of Tamilnadu or any other examination (10+3 pattern) accepted by Syndicate, as equivalent thereto, with Physics as one of the subjects in the above said patterns.

6. Scheme of Examinations:

The scheme of examinations of different year shall be as follows:

S. No	Course Code	Course Title	Category	Credits	Marks Distribution		
					CIA*	TEE**	Total
I Year- Semester – I							
1	BFTMS-11	Tamil	Language	3	30	70	100
2	BFEGS-11	Foundation in English	Language	3	30	70	100
3	BPHYS-11	Properties of Matter and Sound	CC	3	30	70	100
4	BMSSA-11	Allied Mathematics – 1	GE	3	30	70	100
I Year- Semester -II							
5	BFTMS-21	Tamil	Language	3	30	70	100
6	BFEGS-21	Foundation in English	Language	3	30	70	100
7	BPHYS-21	Mechanics	CC	3	30	70	100
8	BMSSA-22	Allied Mathematics – 2	GE	3	30	70	100
9	BPHYS-P1	Practical – I	SEC	4	30	70	100
II Year-Semester – III							
10	BFTMS-31	Tamil	Language	3	30	70	100
11	BFEGS-31	Foundation in English	Language	3	30	70	100

12	BPHYS-31	Optics and Spectroscopy	CC	3	30	70	100
13	BPHYS-32	Heat and Thermodynamics	CC	3	30	70	100
14	BCHESA-31	Allied chemistry-1	GE	3	30	70	100
II Year- Semester – IV							
15	BFTMS-41	Tamil	Language	3	30	70	100
16	BFEGS-41	Foundation in English	AECC	3	30	70	100
17	BPHYS-41	Electricity and Magnetism	CC	3	30	70	100
18	BPHYS-42	Basic Electronics	CC	3	30	70	100
19	BCHESA-42	Allied Chemistry-1	GE	3	30	70	100
20	CCES	Environmental Studies	AECC	2	30	70	100
21	BPHYS-P2	Practical- II	SEC	4	30	70	100
III Year-Semester – V							
22	BPHYS-51	Atomic Physics	CC	3	30	70	100
23	BPHYS-52	Relativity and Quantum Mechanics	CC	3	30	70	100
24	BPHYS-53	Digital electronics	CC	3	30	70	100
25	BPHYS-54	Mathematical Methods	CC	3	30	70	100
26	BPHYSE-51A / BPHYSE-51B	Energy Physics / Problems solving skills in Physics	DSE	3	30	70	100
III Year- Semester -VI							
27	BPHYS-61	Solid state Physics	CC	3	30	70	100
28	BPHYS-62	Nuclear Physics	CC	3	30	70	100
29	BPHYSE-62A / BPHYSE-62B	Nano Physics / LASER Physics	DSE	3	30	70	100
30	BPHYS-P3	Practical – III	SEC	4	30	70	100
31	BPHYS-P4	Practical –IV	SEC	4	30	70	100
Total- [(I+II+III) Year]				**96**	**930**	**2170**	**3100**
Courses for Other Departments							
1	BPHYSA 11	Allied Physics – I	GE	3	30	70	100
2	BPHYSA 22	Allied Physics – II	GE	3	30	70	100
3	BPHYS-NE1	Basic Principle of Physics	GE	2	30	70	100
4	BPHYS-NE2	Energy Physics	GE	2	30	70	100

* Continuous Internal Assessment (CIA)

Term End Examination (TEE)

CC- Core Courses

GE- Generic Electives

DSE- Discipline Specific Electives SEC- Skill Enhanced Courses

AECC- Ability Enhancement Compulsory Courses

Question Pattern for Theory Examinations:

Max. Marks: 70 Time: 3 hours

PART - A (3 × 3 = 9 marks)
Answer any Three questions out of Five questions in 100 words
All questions carry equal marks

1. From Unit - I
2. From Unit - II
3. From Unit - III
4. From Unit - IV
5. From Unit - V

PART - B (3 × 7 = 21 marks)
Answer any Three questions out of Five questions in 200 words
All questions carry equal marks

6. From Unit - I
7. From Unit - II
8. From Unit - III
9. From Unit - IV
10. From Unit - V

PART - C (4 × 10 = 40 marks)
Answer any Four questions out of Seven questions in 500 words.
All questions carry equal marks.

11. From Unit - I
12. From Unit - II
13. From Unit - III
14. From Unit - IV
15. From Unit - V
16. From any unit
17. From any unit

Pattern of Question Paper for Practical Examinations;

Each set of question paper should contain SEVEN questions and the candidate has to choose one by lot.

Awarding of marks for Practical examinations.

Total Marks: 100 (External Practical 70 Marks +Internal (Record 20 Marks + Practical Counselling Class Attendance 10 Marks)

Distribution for 70 Marks:

Formula, circuit diagram and tabular column: 20 Marks

Observation: 35 Marks

Result: 5 Marks

Presentation: 10 Marks

Total: 70 Marks

Passing Minimum:

For Theory Examination: The candidate shall be declared to have passed the examination if the candidate secures not less than 25 marks in the University examination in each theory paper and overall 40 percent in both Term End Examination and Continuous Internal Assment (Assignment) taken together.

Continuous Internal Assessment (CIA)		Term End Examination (TEE)		Overall Aggregated Marks	Maximum Marks
Minimum Pass Mark	Maximum Mark	Minimum Pass Mark	Maximum Mark	CIA + TEE	
13	30	25	70	40	100

For Practical Examination: The candidate shall be declared to have passed the examination if the candidate secures not less than 30 marks in the External Practical Examinations and secures not less than 10 marks in the Continuous Internal Assessment (CIA) (Record Marks + Practical Counselling Class Attendance) and overall aggregated marks is 40 marks in both external and internal taken together. However submission of record notebook is a must.

B.Sc., Physics - Syllabus – I year – I Semester (Distance Mode)

COURSE TITLE : PROPERTIES OF MATTER AND SOUND

COURSE CODE : BPHYS- 11

COURSE CREDIT : 3

COURSE OBJECTIVES

While studying the **PROPERTIES OF MATTER AND SOUND**, the Learner shall be able to:

CO 1: Explain the elastic properties of materials and their use in various fields and its application in manufacturing technology.

CO 2: Evaluate the basic properties of liquids like surface tension and viscosity.

CO 3: Describe harmonic motion and its characteristics.

CO 4: Establish the mathematical formulation of SHM and Discuss the basic characteristics of sound and its application in various fields.

CO 5: Describe the production of Ultrasonics and its application in various fields.

Course Syllabus

BLOCK – I: Elasticity

Elasticity –- Hooke's law – Elastic moduli – Poisson's ratio- Beams – bending of beams – Expression for bending moment – Cantilever- Theory of uniform and non – uniform bending - Determination of young's modulus -Koenig's method – Torsion of a body – Expression for couple per BLOCKtwist – Work done in twisting a wire – Torsional oscillations of a body - Rigidity modulus by dynamic torsion method (Torsional pendulum) and static torsion method.

BLOCK II: Surface Tension

Surface tension – definition – Molecular forces – Explanation of surface tension on kinetic theory- Surface energy – work done in increasing the area of a surface – Excess pressure inside a curved liquid surface – Excess pressure inside a spherical

and cylindrical drops- Determination of Surface Tension- bubbles-drop weight method- - angle of contact- Quincke's method - Application of Surface Tension-variation of surface tension with temperature-experimental determination-Jaegar's method.

BLOCK III: Viscosity

Viscosity – Co efficient of viscosity – Streamlined and turbulent motion – critical velocity –

Capillarity- Rate of flow of liquid in a capillary tube – Poiseuille's formula-Determination of Viscosity- viscosity of highly viscous liquid-terminal velocity-stoke's method-Ostwald Viscometer-Viscosity of gas-Mayer's formula-Rankine 's method

BLOCK IV: Sound

Simple Harmonic Motion –Composition of two S.H.M in a straight line-at right angles-Lissajous's figures- Types of Vibration-Free, Damped, Forced vibrations - Resonance -Fourier theorem-application-Laws of transverse vibration of strings - Sonometer-Determination of AC frequency using sonometer – Determination of frequency using Melde's apparatus-Decibels - Intensity levels - decibel-noise pollution.

BLOCK V: Ultrasonics and Acoustics

Ultrasonics –Production – Piezoelectric crystal method - Magnetostriction method-Properties and Applications of Ultrasonics-Acoustics of building – Reverberation-Sabine's Reverberation formula (No derivation) – Factors affecting acoustics of building- Sound distribution in an auditorium- Requisites for good acoustics.

Book for Study:

1. Elements of properties of matter – D.S. Mathur – S. Chand & Co., 2004.
2. Properties of matter – R. Murugesan – S. Chand & Co., 2004.

3. Properties of matter – Brijlal and Subramanian S. Chand & Co., 2006.
4. Textbook of Sound, D.R.Khanna and R.S. Bedi, Atmaram and sons, 1969.
5. A Text Book of Sound, N.Subrahmanyam and BrijLal, Vikas Publishing House - Second revised edition,1995.

Books for reference:

1. Fundamentals of General Properties of Matter by H.R.Gulati, S. Chand & Co., NewDelhi (1982).
2. Fundamental of Physics, D. Hallidary , Resnick and J Walker, 6th Edition, Wiley, New York 2001.

Web Resources

1. https://www.generationgenius.com/properties-of-matter-for-kids/
2. https://Physics.info/elasticity/
3. https://www.nasa.gov/specials/X59/science-of-sound.html
4. NPTEL :: Physics - NOC:Waves and Oscillations

COURSE LEARNIN OUTCOMES

After completion of the **PROPERTIES OF MATTER AND SOUND**, the Learner will be able to:

CLO 1: Distinguish and interpret the elastic nature of the materials

CLO 2: Describe the real-life experiences of Surface tension and variation of surface tension with temperature

CLO 3: Identify the most and least viscous fluids and Capillarity of liquids.

CLO 4: Analyze types of vibration and noise pollution

CLO 5: Distinguish the methods of producing ultrasonic waves and Design and operate acoustic systems

B.Sc., Physics - Syllabus – I year- II Semester (Distance Mode)

COURSE TITLE	**:**	**MECHANICS**
COURSE CODE	**:**	**BPHYS 21**
COURSE CREDIT	**:**	**3**

COURSE OBJECTIVES

While studying the **MECHANICS**, the Learner shall be able to:

CO 1: Describe the Laws of Motion and Collision

CO 2: Explain dynamics of rigid body and compare M.I of a circular ring, disc, solid Sphere

CO 3: Classify the laws of gravitation and Acceleration due to gravity

CO 4: Discuss Central Force Motion and its application

CO 5: Distinguish Static and Fluid dynamics

Course Syllabus

BLOCK I: Laws of Motion

Laws of conservation of energy, linear momentum and angular momentum - Work energy theorem - work done by gravitational force - work done by spring force. Potential energy - conservative and non-conservative forces - potential energy curve. Collision – Elastic and inelastic collision – (Fundamental laws of impact) – Newton's law of impact – coefficient of restitution - Impact of a smooth sphere on a fixed plane – Direct impact between two smooth spheres. Oblique impact between two smooth spheres – Calculation of final velocities of the spheres – Loss of K.E due to impact.

BLOCK II: Dynamics of Rigid body

Moment of inertia – Theorems of perpendicular and parallel axes- M.I of a circular ring, disc, solid sphere- M.I of a hollow sphere and cylinder about all axes. Compound pendulum – theory – equivalent simple pendulum- Reversibility of centers of oscillation and suspension – determination of g and k

BLOCK III: Gravitation

Newton's law of gravitation – Kepler's laws of gravitation – Universal Constant G by Boy's method – Mass and density of earth - Acceleration due to gravity – Variation of g with altitude, depth and rotation of earth - Value of g at poles and equator. Gravitational field – Gravitational potential – Gravitational potential due to spherical shell – Gravitational potential due to a solid sphere (inside and outside)

BLOCK IV: **Central Force Motion**

Angular velocity, angular momentum and K.E of rotation. Torque and angular acceleration – Relation between them – Expression for acceleration of a body rolling down an inclined plane without slipping. Center of mass –velocity and acceleration of centre of mass – determination of motion of individual particle. System of variable mass - Rocket motion- Satellite

BLOCK V: **Statics and Hydrodynamics**

Friction-laws of friction-angle of friction-cone of friction. Centre of gravity-solid and hollow tetrahedron-solid and hollow hemisphere –Centre of pressure – vertical rectangular lamina – vertical triangular lamina.

Hydrodynamics - Equation of continuity– Pitot's tube and Venturimeter – Euler's equation of unidirectional flow – Torricelli's theorem – Bernoulli's theorem and its applications.

Books for Study:

1. Mechanics – Part I and II by Narayanamoorthy, National Publishing Company.
2. Mechanics by D.S.Mathur, S.Chand& Co., 2nd Edition (2001).
3. Mechanics by P. Duraipandian, Laxmi Duraipandian, MuthamizhJayapragasam,
4. S.Chand& Co., New Delhi (1988).
5. Properties of Matter by R.Murugeshan, S. Chand & Co., New Delhi (2001).

Books for Reference:

1. Fundamentals of Physics by D. Halliday, R.Rensick and J. Walker, 6th edition, Wiley,NY (2001).

Web Resource

1. NPTEL :: Basic courses-Sem 1 and 2 - Classical Physics
2. The Feynman Lectures on Physics Vol. I Ch. 10: Conservation of Momentum (caltech.edu)
3. Conservation of energy (video) | Khan Academy
4. NPTEL :: Mechanical Engineering - Dynamics of Machines

COURSE OUTCOMES

After completion of the **MECHANICS**, the Learner will be able to:

CLO 1: Analyze conservative and non-conservative forces and Elastic and inelastic Collision

CLO 2: Estimate the moment of inertia of rigid bodies and describe compound Pendulum

CLO 3: Apply Kepler's law to describe the motion of planets and satellites in circular orbit, through the study of the law of Gravitation.

CLO 4: Distinguish the Torque and angular acceleration and estimate acceleration of a body rolling down an inclined plane without slipping,

CLO 5: Interpret laws of friction, angle of friction and cone of friction, and discuss Bernoulli's theorem and its applications.

B.Sc., Physics - Syllabus – II year – III Semester (Distance Mode)

COURSE TITLE	**:**	**OPTICS AND SPECTROSCOPY**
COURSE CODE	**:**	**BPHYS 31**
COURSE CREDIT	**:**	**3**

COURSE OBJECTIVES

While studying the **OPTICS AND SPECTROSCOPY**, the Learner shall be able to:

CO 1: Describe the concept of lens and prism

CO 2: Explain the Theory and applications of Interference of light

CO 3: Discuss fundamentals of diffraction and Resolving Power

CO 4: Explain the phenomena of polarization along with its applications

CO 5: Classify the types of spectroscopies

Course Syllabus

BLOCK I: Geometrical optics

Lens – Spherical aberration in lenses – Methods of minimizing spherical aberration. Chromatic aberration in lenses – condition for achromatism of two thin lenses (in and out of contact) –Aplanatic lens – Dispersion – Angular and Chromatic dispersion – combination of prisms to produce i)dispersion without deviation ii) deviation without dispersion. Direct vision spectroscope –Eyepieces – Ramsden's and Huygens's eyepieces –simple microscope (magnifying glass) – compound microscope.

BLOCK II: Interference

Conditions for interference – Theory of interference fringes – interference due to reflected light (thin films) -colours of thin films – Wedge shaped thin film - Air wedge– theory – determination of diameter of a thin wire by Air wedge – test for optical flatness. Newton's rings by reflected light – Determination of wavelength of light. Michelson's Interferometer – theory and its Application (Measurement of wavelength) – Jamin's interferometers – determination of refractive index of gases.

BLOCK III: Diffraction

Fresnel's and Fraunhofer diffraction –Rectilinear propagation of light – zone plate –action of zone plate -diffraction at circular aperture – opaque circular disc – Fraunhofer diffraction at single slit – Double slit. Plane diffraction grating – theory of plane transmission grating - experiment to determine wavelength (Normal incidence method). Resolving power– Rayleigh's criterion for resolution – resolving power of a telescope – resolving power of a microscope – resolving power of a prism - resolving power of grating.

BLOCK IV: Polarisation

Double refraction –Nicol Prism – Nicol Prism as polarizer and analyzer - Huygens's explanation of double refraction in uniaxial crystals– Plane, elliptically and circularly polarized light. Quarter wave plates and Half wave plates – Production and detection of plane, circularly and elliptically polarized light. Optical activity– Fresnel's explanation of optical activity – Specific rotatory power –Laurent's half shade polarimeter.

BLOCK V: Spectroscopy

Infrared spectroscopy – sources and detector – uses. Ultraviolet spectroscopy – sources – quartz spectrograph - applications. Raman Spectroscopy **–** Quantum theory of Raman effect – applications - Nuclear magnetic resonance –Nuclear quadrupole resonance -– Electron spin resonance spectroscopies- (Qualitative study)

Books for Study:

1. A text book of Optics – Subramanyam and Brijlal, S. Chand and co.., 25th Edition, New Delhi 2004.
2. Optics and Spectroscopy – R.Murugeshan, S. Chand and co., 6th Edition, New Delhi, 2008.
3. Elements of Spectroscopy – S.L. Gupta, V.Kumar and R.C.Sharma Pragati Prakashan, 13th Edition, Meerut, 1997.
4. Molecular structure and spectroscopy – G.Aruldhass, PHI Pvt Ltd, , II Edition, New Delhi, 2007.

Books for Reference:

1. Optics – Sathyaprakash, Ratan Prakashan Mandhir, VIIth Edition, New Delhi, 1990.
2. Introduction to Molecular Spectroscopy –C.N.Banewell,TMH publishing co. IV Edition, New Delhi, 2006.
3. Ajoy Ghatak, *Optics*, (TMH), New Delhi, Fourth edition, 2009.
4. *Optics and Atomic Physics*, Singh & Agarwal, Pragati Prakashan Meerut,Nineth edition, 2002.
5. Fundamentals of Physics, by D.Halliday, R. Resnick and J. Walker, Wiley, 6thEdition, New York (2001).

Web Resources

1. https://rb.gy/pfsd4a
2. https://rb.gy/p1tnhi
3. https://rb.gy/eq4tba
4. https://rb.gy/lkyewf
5. https://rb.gy/jpasef
6. https://rb.gy/d1bwpf
7. https://rb.gy/lsuwii
8. https://open.umn.edu

COURSE OUTCOMES

After completion of the **OPTICS AND SPECTROSCOPY**, the Learner will be able to:

CLO 1: Interpret the Methods of minimizing spherical aberration, Chromatic aberration in lenses and Angular and Chromatic dispersion in prism.

CLO 2: Analyze the interference due to reflected light and determine the wavelength of light and thickness of thin film using Michelson's interferometer.

CLO 3: Distinguish resolving power of a microscope, prism and grating.

CLO 4: Differentiate the different types of polarized light and Describe Optical Activity

CLO 5: Compare Infrared spectroscopy, Ultraviolet spectroscopy, and Raman Spectroscopy and its applications

B.Sc., Physics - Syllabus – II year – III Semester (Distance Mode)

COURSE TITLE	**:**	**HEAT AND THERMODYNAMICS**
COURSE CODE	**:**	**BPHYS 32**
COURSE CREDIT	**:**	**3**

COURSE OBJECTIVES

While studying the **HEAT AND THERMODYNAMICS**, the Learner shall be able to:

CO 1: Describe the fundamentals of Thermometry and Calorimetry

CO 2: Explain Low Temperature Physics and its applications

CO 3: Discuss the basics of Transmission of Heat and its applications

CO 4: Interpret the Kinetic Theory of gases.

CO 5: Classify the laws of thermodynamics and its applications

Course Syllabus

BLOCK I : Thermometry and Calorimetry

Platinum resistance thermometer - Calendar and Griffith's bridge. Thermoelectric effect – Seebeck effect - Thermoelectric thermometers- International temperature scale – Thermistor.

Specific heat capacity of solids – Regnault's method of mixtures(solid) – specific heat capacity of liquids – Callendar and Barnes method – Specific heat capacity of gases – C_p and C_v – Meyer's relation – C_v by Joly's differential steam calorimeter method – C_p by Regnault's method.

BLOCK II : Low Temperature Physics

Joule - Kelvin effect - Liquefaction of Air-Linde's Process. liquefaction of hydrogen - liquefaction of helium-Kammerling - Onne's method - Helium I and II. Lambda point - production of low temperatures - adiabatic demagnetization. Practical applications of low temperature - refrigerators and air-conditioning machines - super fluidity - application of super fluidity.

BLOCK III: Transmission of Heat

Conduction – coefficient of thermal conductivity – Rectilinear flow of heat along a bar - Convection – lapse rate – Stability of the atmosphere –Newton's law of cooling – determination of specific heat capacity of liquid – Radiation - black body – Kirchhoff's law – Stefan – Boltzmann law - energy distribution in black body spectrum - Wien's law – Rayleigh Jean's law. Planck's law - Solar constant – water flow pyroheliometer.

BLOCK IV: Kinetic Theory of Gases

Kinetic Theory of gases- assumptions - Molecular collisions – mean free path – expression for mean free path – Transport phenomenon. Brownian motion and its features - expression for viscosity, Diffusion and thermal conductivity of gas. Experimental verification -Vander walls equation of state - Determination of Vander walls constant - Relation between Vander Wall's constant and critical constants.

BLOCK V: Thermodynamics

Zeroth and first law of thermodynamics – reversible and irreversible processes. - Isothermal process-adiabatic process-gas equation during adiabatic process - work done during adiabatic and isothermal process - Second law of thermodynamics – Carnot's engine – its efficiency. Entropy – change of entropy in reversible and irreversible processes – temperature – entropy diagrams – physical significance of entropy - change of entropy when ice converted into steam. Third law of thermodynamics – Extensive and Intensive thermodynamic variables – distinction between them. Maxwell thermodynamical relations – derivation and application – Clausius - Clapeyron equation and specific heat relation .

Books for Study:

1. Heat and Thermodynamics – Brijlal and Subramanyam, S.Chand & Co, 16th Edition New Delhi, 2005.

2. Heat and Thermodynamics – D.S. Mathur, Sultan Chand & Sons, 5th Edition, New Delhi, 2014.
3. Thermal Physics – R. Murughesan and Kiruthiga Sivaprasath, S.Chand & Co, II Edition, New Delhi, 2008

Books for Reference:

1. Heat & Thermodynamics – J.B. Rajan, SC Publisher, New Delhi, 1985.
2. Concepts of Physics Volume I and II – H.C. Varma, Bharati Bhawan Publishers, New Delhi, 2015
3. M. Narayanamoorthy and N. Nagarathinam, Heat, National publishing Co,Chennai, Eight edition, 1987.

Web Resources

1. https://nptel.ac.in/courses/115/106/115106090/
2. https://nptel.ac.in/courses/115/106/115106090/
3. https://nptel.ac.in/courses/115/106/115106090/
4. https://nptel.ac.in/courses/115/106/115106090/
5. https://nptel.ac.in/courses/115/106/115106090/
6. https://nptel.ac.in/courses/115/106/115106090/
7. https://www.youtube.com/watch?v=1_InUUX5-LE
8. https://www.youtube.com/watch?v=E9cOAMhFUz0
9. https://www.youtube.com/watch?v=qKMsG6WrR0s
10. https://www.youtube.com/watch?v=XooN0w8SDZo
11. https://www.youtube.com/watch?v=4RX_lpoGRBg
12. https://www.youtube.com/watch?v=mb8LqNlHeLY
13. https://www.youtube.com/watch?v=mb8LqNlHeLY
14. https://www.youtube.com/watch?v=kSuXS_zqRec&t=55s
15. https://www.youtube.com/watch?v=N-hWsLSC9Ms
16. https://www.youtube.com/watch?v=WTtxlaeC9PY

COURSE OUTCOMES

After completion of the **HEAT AND THERMODYNAMICS**, the Learner will be able to:

CLO 1: Compare Thermoelectric effect, Seebeck effect and determine the Specific

heat capacity of gases using Joly's differential steam calorimeter method

CLO 2: Discuss the Practical applications of low temperature - refrigerators and air-conditioning machines

CLO 3: Differentiate Conduction, Convention and Radiation. Determine the specific heat capacity of liquid using Newton's Law of Cooling

CLO 4: Explain the fundamentals of Kinetic Theory of gases, Brownian motion and its Features.

CLO 5: Apply and analyze Second and Third Laws of Thermodynamics and describe Maxwell thermodynamical relations and their applications

B.Sc., Physics - Syllabus – II year – IV Semester (Distance Mode)

COURSE TITLE	**:**	**ELECTRICITY AND ELECTROMAGNETISM**
COURSE CODE	**:**	**BPHYS 41**
COURSE CREDIT	**:**	**3**

COURSE OBJECTIVES

While studying the **ELECTRICITY AND ELECTROMAGNETISM**, the Learner shall be able to:

CO 1: Explain the concept of magnetic effect of electric current

CO 2: Discuss the thermal and chemical effect of electric current

CO 3: Classify electromagnetic induction and applications

CO 4: Interpret AC and DC Circuits

CO 5: Describe Maxwell's Equation and Propagation of Electromagnetic Waves

Course Syllabus

BLOCK I: MAGNETIC EFFECT OF ELECTRIC CURRENT

Magnetic flux and magnetic induction- Biot Savart law- magnetic induction at a point due to a straight conductor carrying current - magnetic induction at a point on the axis of a circular coil carrying current- Amperes circuital law-magnetic field inside a long solenoid -toroid- Lorent'z force on a moving charge- direction of force-torque on a current loop in a uniform magnetic field. Moving coil Ballistic galvanometer-theory -experiment to find charge sensitivity and absolute capacity of a capacitor-De-sauty's bridge

BLOCK II: THERMAL AND CHEMICAL EFFECT OF ELECTRIC CURRENT

Thermoelectricity- Seebeck effect- laws of thermo e.m.f - measurement of thermo e.m.f using potentiometer-Peltier effect-demonstration— Thomson effect-demonstration - thermodynamics of thermo couple –thermo electric diagram –uses-applications-thermopile-Boy's radio micrometre –thermo-milli ammeter - Faradays laws of electrolysis- electrical conductivity of an electrolyte-specific conductivity-Kohlrausch's bridge method of determining the specific conductivity of an

electrolyte. Arrhenius theory of electrolytic dissociation- –-mobility of ions- Secondary cells- Gibbs –Helmholtz equation for a reversible cell

BLOCK III: ELECTROMAGNETIC INDUCTION

Faraday's laws of electromagnetic induction-self induction –self inductance of a long solenoid - self inductance of toroidal solenoid- determination of L by Anderson's and Rayleigh's methods-Owen's bridge. Mutual induction-mutual inductance between two co-axial solenoids- experimental determination of mutual inductance –-co-efficient of coupling- energy stored in a coil. Eddy currents-uses - Earth inductor-uses-search coil- induction coil and its uses

BLOCK IV: AC AND DC CIRCUITS

Growth and decay of current in LC,LR and CR circuits with d.c.voltages - determination of high resistance by leakage –growth and decay of charge in LCR circuit-conditions for the discharge to be oscillatory –frequency of oscillation.

Alternating Current- j operator method –use of j operator in the study of AC circuits-Resistance in an AC circuit-Inductance in an AC circuit. Capacitance in an AC circuit-AC through an inductance and resistance in series- capacitance and resistance in series – LCR series resonance circuit -sharpness of resonance-parallel resonance circuit -power in an AC circuit-power factor.

BLOCK V: MAXWELL'S EQUATION & ELECTROMAGNETIC WAVES

Introduction- Maxwell's equations- -Displacement current- Poynting vector- Electromagnetic waves in free space-Hertz experiment for production and detection of EM waves. Wave equations for Electric field and Magnetic field-monochromatic plane waves. EM waves in a matter-Reflection and Transmission at normal incidence and oblique incidence-Polarization by reflection.

Books for study:

1. Electricity and Magnetism, R. Murugeshan, S Chand & Co, New Delhi,2008
2. Electricity and Magnetism, BrijLal & Subramanyam, Ratan Prakashan Mandir Publishers, Agra, 2005
3. Electricity & Magnetism, M.Narayanamurthy & N.Nagarathnam, NPC pub.,

Revised edition.

Books for Reference:

1. Electricity and Magnetism -D.N.Vasudeva (Twelfth revised edition)
2. Electricity and Magnetism - K.K.Tiwari ,S.Chand &Co.
3. Electricity and Magnetism -E.M.Pourcel,Berkley Physics Cource, Vol.2 (Mc Grraw-Hill)
4. Electricity and Magnetism - Tayal (Himalalaya Publishing Co.)
5. Electicity and Magnetism ,D.Halliday, R.Resnick and J.Walker, Fundamentals of Physics, Wiley India,Pvt Ltd,2011.
6. Introduction to Electrodynamics, David J. Griffith, PHI, New Delhi, 2012

Web Resources

1. https://www.thoughtco.com/introduction-electricity-and-magnetism-4172372
2. http://web.mit.edu/sahughes/www/8.022/
3. http://orca.phys.uvic.ca/~tatum/elmag.html
4. https://phys.libretexts.org/Bookshelves/Electricity_and_Magnetism
5. https://www.electricityforum.com/electricity-and-magnetism
6. https://openpress.usask.ca/Physics155/

COURSE OUTCOMES

After completion of the **ELECTRICITY AND ELECTROMAGNETISM**, the Learner will be able to:

CLO 1: Determine the magnetic induction at a point on the axis of a circular coil carrying current using Biot Savart law

CLO 2: Demonstrate Thermoelectricity and measure thermo e.m.f using potentiometer using the principle of Seebeck effect, Peltier effect and Thomson effect.

CLO 3: Interpret Self and Mutual Induction and explain the applications of Eddy Current

CLO 4: Apply and Analyze the Growth and decay of current in LC,LR and CR circuits With D.C.voltages

CLO 5: Apply the concepts of electrodynamics to describe the behaviour of EM waves in different media

B.Sc., Physics - Syllabus – II year – IV Semester (Distance Mode)

COURSE TITLE	**:**	**BASIC ELECTRONICS**
COURSE CODE	**:**	**BPHYS 42**
COURSE CREDIT	**:**	**3**

COURSE OBJECTIVES

While studying the **BASIC ELECTRONICS**, the Learner shall be able to:

CO 1: Analyze basic simple circuits using network theorems and describe the fundamental principles of semiconductors

CO 2: Discuss biasing of transistor and the application of transistor as amplifiers

CO 3: Classify the types of oscillators and Multivibrator

CO 4: Explain Special Semiconductor Devices and their applications

CO 5: Illustrate the characteristics of an operational amplifier along with its applications

Course Syllabus

BLOCK I: Linear circuit analysis and semiconductor diodes

Constant voltage source - constant current source - Maximum power transfer theorem- **Thevenin's** theorem - procedure for finding Thevenin Equivalent circuit. PN junction theory - V-I characteristics of a PN junction diode - Half wave rectifier - Bridge rectifier – Efficiency. Filters - Shunt capacitor filter – pi filter - Zener diode - equivalent circuit - voltage regulator. LED - V-I characteristics – advantages - applications - photo diode - characteristics -applications.

BLOCK II: Transistor Amplifier

Transistor - Different modes of operations-CB mode &CE mode - Two port representation of a transistor- h parameter. AC equivalent circuit using h parameters- analysis of amplifiers using h parameters (CE only). RC coupled amplifier - transformer coupled amplifier – Power amplifier -classification of amplifiers - Class A, Class B and Class C - Push pull amplifier – Emitter follower.

BLOCK III: Oscillators and Multivibrator

Feedback principle -effect negative feedback-and Barkhaussen criterion - Phase shift and Wien Bridge oscillators using transistors –Expression for frequency. Multivibrators- Astable and Monostable multi vibrators. Bistable multi vibrators using transistors - Schmitt trigger.

BLOCK IV: Special Semiconductor Devices

Clipping and clamping circuits. - Differentiating circuit - Integrating circuit - Field effect Transistor FET-MOSFET- UJT. SCR -characteristics - FET as a VVR-UJT relaxation oscillator-SCR as a switch and rectifier

BLOCK V: Operational Amplifier

Operational Amplifier- characteristics-parameters-applications- Inverting amplifier - Non inverting amplifier - Voltage follower- Adder - Subtractor- Integrator – Differentiator- Solving simultaneous equations. Comparator -square wave generator -Wien bridge oscillator -Schmitt trigger

Books for Study:

1. Hand Book of Electronics by Gupta and Kumar - PragatiPrakashan – Meerut,2002.
2. Principles of Electronics by V.K. Mehta, Rohit Mehta S. Chand & Co.,2006.
3. Electronics by M. Arul Thalapathi, ComptekPublishers,2005.
4. Elements of Electronics by M.K.Bagde and Singh S.P., S. Chand & Co., NewDelhi,1990.
5. Applied Electronics by A. Subramanyam – National Publishing Co.,1997.
6. OP - AMPs and Linear Integrated Circuits by Ramakant A. Gayakwad, PrenticeHall of India(1994).

Books for Reference:

1. Electronic Devices by Mittal.G.K., G.K. Publishers Pvt. Ltd., 1993.
2. Basic Electronics by B.L. Theraja, S. Chand & Co., 2008.
3. Solid State Electronics by Ambrose and Vincent Devaraj, Meera Publication.
4. Applied Electronics by R.S. Sedha, S. Chand & Co.1990.

Web Resource

1. https://nptelvideos.com/lecture.php?id=9125
2. https://nptelvideos.com/lecture.php?id=9116

3. https://nptelvideos.com/lecture.php?id=958
4. https://nptelvideos.com/lecture.php?id=987
5. https://nptelvideos.com/lecture.php?id=974
6. https://nptelvideos.com/lecture.php?id=975
7. https://nptelvideos.com/lecture.php?id=978
8. https://nptelvideos.com/lecture.php?id=9348
9. https://nptelvideos.com/lecture.php?id=9347

COURSE LEARNING OUTCOMES

After completion of the **BASIC ELECTRONICS**, the Learner will be able to:

CLO 1: Apply and Solve complex circuits using network analysis (Thevenin's theorem) and explain the characteristics and applications of PN Junction diodes

CLO 2: Demonstrate the basic concept behind the working process of transistor amplifier and classify types of power Amplifier.

CLO 3: Explain the Feedback principle and design the Phase shift and Wien Bridge oscillators using transistors

CLO 4: Illustrate the Characteristics of FET,MOSFET, UJT and SCR

CLO 5: Perform the mathematical operation like summing, difference and Solving simultaneous equations by constructing circuit using operational amplifier.

B.Sc., Physics - Syllabus – III year – V Semester (Distance Mode)

COURSE TITLE : ATOMIC Physics

COURSE CODE : BPHYS 51

COURSE CREDIT : 3

COURSE OBJECTIVES

While studying the **ATOMIC PHYSICS**, the Learner shall be able to:

CO 1: Discuss the band theory of solids and their classification

CO 2: Explain the Positive rays and its applications

CO 3: Demonstrate the fundamental principles governing the structure of the atom and atom models.

CO 4: Describe the fine structure of spectral lines and the angular momentum coupling Schemes

CO 5: Provide an introductory account about the impact of X-rays and Photoelectric Effect

Course Syllabus

BLOCK I: BAND THEORY OF SOLIDS

The free electron theory of metals – expressions for electrical conductivity. Thermal conductivity – Wiedman-Franz's law. Hall effect-magneto resistance-determination of electronic charge – Millikan' s oil drop method – electron microscope. Band theory of solids – classification of solids on the basis of band theory.

BLOCK II: POSITIVE RAYS:

Discovery-properties- analysis – Thomson's parabola method. Aston's mass spectrograph- Bainbridge's mass spectrograph. Dempster's mass spectrograph-Dunnington's method of determining e/m.

BLOCK III: ATOMIC STRUCTURE

Early atomic spectra-Thomson model-Alpha particle scattering-Rutherford 's nuclear model-drawbacks. Bohr atom model –Bohr's interpretation of the Hydrogen spectrum-correction for nuclear motion-evidences in favour of Bohr's theory- Ritz combination principle-correspondence principle-Sommerfield's relativistic atom

model-drawbacks. The vector atom model – Quantum numbers associated with the vector atom model - The Pauli's exclusion principle – periodic classification of elements

BLOCK IV: FINE STRUCTURE OF SPECTRAL LINES

Coupling schemes-L-S Coupling-j-j Coupling- Hund rules- magnetic dipole moment due to orbital motion of the electron- due to spin of the electron - Stern and Gerlach experiment-spin-orbit coupling. Optical spectra-spectral terms-spectral notation-selection rules- intensity rules- interval rule- fine structure of sodium D line-hyperfine structure- Normal Zeeman effect- theory and experiment- quantum mechanical explanation - Larmor's theorem -Anomalous Zeeman effect- Paschen – Bach effect-Stark effect.

BLOCK V: X-Rays and Photo Electric Effect

Production of X-rays – properties-absorption of X-rays – X-ray absorption edges. Bragg's law – Bragg's X-ray spectrometer –the powder crystal method –Laue's method. Rotating crystal method –X-ray spectra- continuous spectra- characteristic spectra-Moseley's law -importance–width of spectral lines-Doppler broadening-collision broadening. X-ray Detectors-scintillation detector-semiconductor detectors - Compton effect- theory and experimental verification.

Photo Electric Effect: Einstein's photoelectric equation-photoelectric cells-photo emissive cells-photovoltaic cells-photoconductive cells-applications of photoelectric cells

Books for Study:

1. Modern Physics by R. Murugeshan, KiruthigaSivaprasath, S. Chand & Co., New Delhi, 2008.
2. Modern Physics by D.L.Sehgal, K.L.Chopra and N.K.Sehgal. Sultan Chand & Sons Publication, 7th Edition, New Delhi,1991.
3. Atomic Physics by J.B. Rajam, S. Chand & Co., 20thEdition, New Delhi,2004.
4. Atomic and Nuclear Physics by N. Subrahmanyam and BrijLal, S. Chand & Co. 5th Edition, New Delhi,2000.

Book for Reference:

1. Modern Physics by J.H. Hamilton and Yang, McGraw-Hill Publication, 1996.
2. Concepts of Modern Physics by A. Beiser, Tata McGraw-Hill, New Delhi 1997.
3. Fundamentals of Physics by D.Halliday, R.Resnick and J. Walker, Wiley,
4. 6thEdition, New York,2001.
5. Modern Physics by Kenneth S.Krane, John Willey & sons, Canada, 1998.

Web resource

1. Atomic and Nuclear Physics – a quick review (utoronto.ca)
2. phy008_lecturenotes_v1 (sheffield.ac.uk)
3. NuclearPhysics.dvi (bhattadevuniversity.ac.in)
4. Basic Nuclear and Atomic Physics (tamu.edu)
5. Atomic Structure - | Positive Rays | - YouTube
6. Band Theory of Solids - Energy Bands in Solids, Explanation with Illustrations (byjus.com)
7. 13 Band Theory of Solids part 1) - YouTube
8. Atomic Structure - YouTube
9. FINE STRUCTURE OF HYDROGEN SPECTRUM || PART - 1 || HYDROGEN FINE SPECTRA || WITH EXAM NOTES || - YouTube
10. Describing the photoelectric effect and X-rays (20 of 41) - YouTube

COURSE LEARNING OUTCOMES

After completion of the **ATOMIC PHYSICS**, the Learner will be able to:

CLO 1: Determine the electrical and Thermal conductivity of metals on the basis of free electron theory

CLO 2: Design and determine the mass of isotopes using Bainbridge's mass Spectrograph

CLO 3: Interpret the Thomson model, Bohr atom model and Vector atom model.

CLO 4: Distinguish between Normal and Anomalous Zeeman effect and Explain the L-S Coupling and j-j Coupling

CLO 5: Compare powder crystal method, Laue's method and Rotating crystal method of X ray Diffraction.

B.Sc., Physics - Syllabus – III year – V Semester (Distance Mode)

COURSE TITLE : RELATIVITY AND QUANTUM MECHANICS

COURSE CODE : BPHYS 52

COURSE CREDIT : 3

COURSE OBJECTIVES

While studying the **RELATIVITY AND QUANTUM MECHANICS**, the Learner shall be able to:

CO 1: Discuss the fundamental of Relativity and frame of reference

CO 2: Describe the Wave Nature of Matter

CO 3: familiarize the students to the new mathematical tools such as operators and linear vector space required for venturing into the realm of quantum mechanics and to introduce Schrodinger wave equation.

CO 4: Explain the Angular Momentum in Quantum Mechanics

CO 5: Demonstrate the use of Schrodinger wave equation through some simple one-dimensional problems and their solutions.

Course Syllabus

BLOCK-I Relativity

Frames of reference - Galilean transformation - Michelson - Morley experiment - Postulates of special theory of relativity - Lorentz transformation - length Contraction – time dilation. Relativity of simultaneity - addition of velocities - variation of mass with velocity. Mass energy relation - Elementary ideas of general relativity.

BLOCK II: Wave Nature of Matter

Phase and group velocity - wave packet - expression of De Brogile's wave length. Davisson and Germer's experiment - G.P.Thomson's experiment - Heisenberg's uncertainty principle and its consequences.

BLOCK III: Schrodinger Equation

Inadequacy of classical mechanics - Basic postulates of quantum mechanics - Schrodinger equation. Properties of wave function - Probability interpretation of wavefunction – linear operators - self adjoint operators - expectation value - eigenvalues and eigenfunctions - commutativity and compatibility.

BLOCK IV: Angular Momentum in Quantum Mechanics

Orbital angular momentum operators and their commutation relations – Separation of three dimensional Schrodinger equation into radial and angular parts. Elementary ideas of spin angular momentum of an electron - Pauli matrices.

BLOCK V: Solutions of Schrodinger Equation

Free particle solution - Particle in a box - Potential well of finite depth (one dimension) - linear harmonic oscillator - rigid rotator and hydrogen atom.

Books for Study:

1. A Text book of Quantum mechanics by P.M.Mathews and S.Venkatesan, TataMcGraw - Hill, New Delhi,2005.
2. Quantum Mechanics by V.K.Thankappan, New Age International (P) Ltd.Publishers, New Delhi,2003.
3. Quantum mechanics by K.K.Chopra and G.C. Agrawal, Krishna PrakasamMedia(P) Ltd., Meerut First Edition,1998.
4. Modern Physics by R. Murugeshan and KiruthigaSivaprasath, S. Chand &Co.,2008.

Books for Reference:

1. Mechanics and Relativity by Brijlal Subramanyam, S.Chand& Co., New Delhi, 1990.
2. Concepts of modern physics by A.Beiser. Tata McGraw - Hill, 5thedition, NewDelhi,1997.
3. Introduction to quantum mechanics by Pauling and Wilson, McGraw – Hill.
4. Quantum mechanics by A.Ghatak and Loganathan, Macmillan India Pvt. Ltd.

Web Resource

1. https://onlinecourses.nptel.ac.in/noc20_cy27/preview
2. https://nptel.ac.in/courses/115/101/115101107/
3. https://nptel.ac.in/courses/115/102/115102023/

4. https://www.azoquantum.com/video-details.aspx?VidID=9
5. https://nptel.ac.in/courses/115/106/115106066/
6. http://www.iiserpune.ac.in/~sdube/phy202/threeD.pdf

COURSE LEARNING OUTCOMES

After completion of the **RELATIVITY AND QUANTUM MECHANICS**, the Learner will be able to:

CLO 1: Interpret Lorentz transformation, length Contraction and time dilation.

CLO 2: Explore the context of development of quantum mechanics and the dual nature of physical world and importance of Schrodinger wave equation to solve problems using uncertainty principle and operator algebra.

CLO 3: Discuss the Basic postulates of quantum mechanics and Properties of wave function

CLO 4: Modify orbital angular momentum formalism to suit spin angular momentum observations.

CLO 5: Set up and solve Schrodinger wave equation for one dimensional problems and identify the quantum features such as discreteness of the observables of the systems.

B.Sc., Physics - Syllabus – III year – V Semester (Distance Mode)

COURSE TITLE	**:**	**DIGITAL ELECTRONICS**
COURSE CODE	**:**	**BPHYS 53**
COURSE CREDIT	**:**	**3**

COURSE OBJECTIVES

While studying the **DIGITAL ELECTRONICS**, the Learner shall be able to:

CO 1: Acquire knowledge on number system and the fundamental concepts of logic gates and K map

CO 2: Develop skill to build and troubleshoot combinational digital circuits and Sequential Logic

CO 3: Interpret Modulation and Demodulation

CO 4: Discuss the Digital and Satellite Communication

CO 5: Explain the fundamentals of Fibre Optic Communication

Course Syllabus

BLOCK I: Digital Fundamentals

Number Systems and Conversions - BCD Code - Gray code - 1's and 2's complements. Basic logic gates - NAND, NOR and EX-OR gates - NAND and NOR as Universal Building blocks. Laws and theorems of Boolean algebra –- NAND-NAND circuits – Karnaugh's map- SOP and POS- applications

BLOCK II : Sequential Logic

Flip-flop -RS, Clocked RS, D flip-flop - J-K and J-K Master-Slave Flip-flop. Shift registers and Counters- Multiplexers and Demultiplexers. Decoders and Encoders - Memory Circuits -D/A and A/D converters

BLOCK III: Modulation and Demodulation

Amplitude modulation - Frequency modulation, Phase Modulation and Pulse Width

Modulation.

Detectors of AM, FM, Detectors of PM and PWM, PLL - Noise in Communication Systems

BLOCK IV: Digital and Satellite Communication

ASK, FSK, PSK Modulation and Demodulation, Advantages and disadvantages of digital communication. Communication Satellite Systems - Telemetry - Tracking and Command System. Satellite Links - Commonly Used frequency in Satellite Communication - Multiple access - Error Detection.

BLOCK V : Fibre Optic Communication

Basic Fibre Optic System - Advantages of Fibre Optic System.- Propagation of light through fibre - Numerical aperture - Acceptance angle – Losses and distortion in optical fibres. Basic fibre Optical communication and links - Special applications

Books for Study:

1. Digital Principles and Application by Malvino Leach, Tata McGraw Hill, 4thEdition(1992).
2. Digital Fundamentals by Thomas L. Floyd, Universal Book Stall, New Delhi(1998).
3. Introduction to Integrated Electronics by V.Vijayendran, S. Viswanathan (Printersand Publishers) Pvt. Ltd., Chennai(2005).

Books for Reference:

1. Digital Electronics by Practice Using Integrated Circuits - R.P.Jain - Tata McGrawHill(1996).
2. Linear Integrated Circuits by D. Roy Choudhury and Shail Jain - New AgeInternational (P) Ltd.(2003).
3. Electronics - Analog and Digital by I.J. Nagrath - Prentice - Hall of India, NewDelhi(1999).
4. Integrated Electronics by J.Millman and C.Halkias, Tata McGraw Hill, New Delhi(2001)

Web Resource

1. https://circuitglobe.com/rs-flip-flop.html

2. http://hyperPhysics.phy-astr.gsu.edu/hbase/Electronic/jkflipflop.html
3. https://circuitglobe.com/half-adder-and-full-adder-circuit.html
4. https://programmerbay.com/construct-4-to-1-multiplexer-using-logic-gates/
5. https://www.electronicshub.org/demultiplexerdemux/
6. https://www.elprocus.com/designing-of-2-to-4-line-decoder/
7. https://www.electricaltechnology.org/2018/05/bcd-to-7-segment-display-decoder.html

COURSE LEARNING OUTCOMES

After completion of the **DIGITAL ELECTRONICS**, the Learner will be able to:

CLO 1: Discuss the structure of various number system and basic logic gates and design and solve the Boolean Algebra simplification and Karnaugh Maps.

CLO 2: Analyze the sequential circuits and to design shift registers and counters,

CLO 3: Classify AM, FM and PM modulation and demodulation techniques

CLO 4: Explain the working principle of satellite communication system

CLO 5: Describe the basic concepts of fiber optics communications and interpret Numerical aperture, Acceptance angle, Losses and distortion in optical fibres

B.Sc., Physics - Syllabus –III year -V Semester (Distance Mode)

COURSE TITLE	**:**	**MATHEMATICAL METHODS**
COURSE CODE	**:**	**BPHYS 54**
COURSE CREDIT	**:**	**3**

COURSE OBJECTIVES

While studying the **MATHEMATICAL METHODS** , the Learner shall be able to:

CO 1: Introduce the Basics of Errors and Root of Equations

CO 2: Discuss the Matrix and Linear Equations

CO 3: Describe the basics of Interpolation and Approximation

CO 4: Examine the Numerical Differentiation and Integration

CO 5: Solve the Differential Equations and their physical applications

Course Syllabus

BLOCK I: Errors and Root of Equations

What is Numerical analysis-numbers and their accuracy. Errors-measurement of errors-round off error-truncation error-absolute error-relative error-percentage error-inherent error-accumulated error-general error formulae -convergence - Roots of equations-Iteration method-Maclaurin's series method. Newton-Raphson method-Von-Moises formula-Bisection method.

BLOCK II: **Matrix and Linear Equations**

Introduction- pivotal condensation method- system of linear equations. Gauss Elimination method- Gauss Seidal Iteration method. Gauss Jordan elimination method- Matrix Inversion method .

BLOCK III: **Interpolation and Approximation**

Linear Interpolation –Quadratic Interpolation. - Lagrange's Interpolation. Richardson's Extrapolation - Aitken's iterated Interpolation

BLOCK IV: Numerical Differentiation and Integration

Numerical differentiation-approximation of derivatives using interpolation polynomials- Taylor series method. Numerical Integration - trapezoidal rule-simpson's 1/3 and 3/8 rules.

BLOCK V: Differential Equations

Introduction-Euler's method (Adams Bashforth first order method)- Backward Euler method- Taylor' s series method. Runge-kutta method - Predictor corrector methods

Books for study and Reference:

1. Introductory methods of numerical analysis – S.S. Sastry, Prentice Hall of India, New Delhi ,2000.
2. Numerical methods – A. Singaravelu, Meenakshi Agency, Chennai,2001.
3. Numerical method in Science and Engineering – M.K. Venkataraman, PHI – New Delhi ,1997.
4. Mechanics and Mathematical methods, R. Murugesan, S. Chand & Co, NewDelhi ,1999.
5. Numerical methods by P. Kandasamy, K. Thilagavathy and K. Gunavathy, S.
6. Chand & Co. 2002.

Web Resource

1. https://www.youtube.com/watch?v=oY1F9QGLdTY
2. https://www.youtube.com/watch?v=GLSdCEwP2LI
3. https://www.youtube.com/watch?v=LjfACk-ugas
4. https://www.youtube.com/watch?v=q87L9R9v274
5. https://www.youtube.com/watch?v=o9MUMlWA5IE

COURSE LEARNING OUTCOMES

After completion of the **MATHEMATICAL METHODS**, the Learner will be able to:

CLO 1: Identifying suitable mathematical tool for solving problems using numerical methods and Error analysis

CLO 2: Illustrate the Gauss Elimination method and Gauss Seidal Iteration method.

CLO 3: Apply and analyze Lagrange's Interpolation and Richardson's Extrapolation

CLO 4: Perform numerical integration using Trapezoidal and Simpson's method.

CLO 5: Solve algebraic or transcendental equations, numerical solutions of differential equations using Euler, Modified Euler and Runge Kutta methods

B.Sc., Physics - Syllabus –III year -V Semester (Distance Mode)

COURSE TITLE	**:**	**ENERGY PHYSICS**
COURSE CODE	**:**	**BPHYSE -51A**
COURSE CREDIT	**:**	**3**

COURSE OBJECTIVES

While studying the **ENERGY PHYSICS**, the Learner shall be able to:

CO 1: Discuss the Introduction to Energy Sources and their merits and demerits.

CO 2: Describe Solar Thermal Energy and their application

CO 3: Introduce the Photovoltaic Systems and its types

CO 4: Explain the basics of Biomass Energy and their classification

CO 5: Interpret the Wind Energy and Other Energy Sources

Course Syllabus

BLOCK I: Introduction to Energy Sources

World's reserve of Commercial energy sources and their availability- India's production and reserves. Conventional and non-conventional sources of energy, comparison – Coal- Oil and natural gas. Conventional and non-conventional energy applications - merits and demerits.

BLOCK II: Solar Thermal Energy

Solar constant -Solar spectrum-Solar radiations outside earth's atmosphere –at the earth surface- on tilted surfaces – Solar Radiation geometry-Basic Principles of Liquid flat plate collector –Materials for flat plate collector – Construction and working- Solar distillation–Solar disinfection - Solar drying. Construction and working of Solar cooker(box type)-Solar water heating systems – Swimming pool heating.

BLOCK 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.

BLOCK 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 downdraft gasifier- Advantages and disadvantages of biological conversion of solar energy.

BLOCK 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. Renewable energy sources and emerging Technologies,Kothari D.P., K.C. Singal and Rakesh Ranjan, Prentice Hall of India, 2008.
2. Solar Energy-principles of thermal collection and storage-S.P.SUKHAME-tata-McGraw-Hill publishing company ltd.

Books for References:

1. Solar Photvoltaics Fundamentals, Technologies and Applications,Chetan Singh Solanki, 2ndEdition, PHI Learning Private Limited, 2011.
2. Non conventional Energy sources, Rai G. D, 4th Edition, Khanna Publishers, 2010.
3. Solar Energy: The State of the Art, Jeffrey M. Gordon, Earthscan, 2013.
4. Solar Energy Engineering: Processes and Systems Kalogirou S.A., , 2nd Edition, Academic Press, 2013.
5. Handbook of Renewable Energy Technology,Zobaa A.F.and Ramesh Bansal, World Scientific, 2011.

Web Resources

1. Sources of Energy — Vikaspedia
2. Introduction to Energy Sources - YouTube
3. Solar thermal energy - Appropedia
4. Solar Thermal Energy - YouTube
5. Lecture - 15 Solar Thermal Energy Conversion - YouTube
6. Fundamentals of Solar Photovoltaic Systems - YouTube
7. Solar Photovoltaic (PV) Systems, Scope, NEC 2020 - [690.1], (39min:21sec) - YouTube
8. Biomass crops are energy efficient and climate friendly | ERC (europa.eu)
9. Biomass Energy Basics | NREL
10. Wind Energy Basics | NREL
11. Sources of Energy — Vikaspedia
12. Wind energy facts, advantages, and disadvantages | Caltech Science Exchange
13. Fuel Cell - Definition, Working, Types, and Applications of fuel cell. (byjus.com)
14. Energy 101: Fuel Cells - YouTube

COURSE LEARNING OUTCOMES

After completion of the **ENERGY PHYSICS**, the Learner will be able to:

CLO 1: Distinguish between the Conventional and non-conventional sources of Energy and their applications

CLO 2: Demonstrate the Construction and working of cooker(box type) and Solar water heating systems

CLO 3: Design and develop photovoltaic system for power generation and discuss their Advantage and disadvantage.

CLO 4: Discuss Biomass conversion technologies and develop biogas plant from waste

CLO 5: Describe Wind Energy Conversion, Oceans and Chemical energy resources and design develop Fuel cells for energy storge

B.Sc., Physics - Syllabus –III year -V Semester (Distance Mode)

COURSE TITLE	**:**	**PROBLEMS SOLVING SKILLS IN PHYSICS**
COURSE CODE	**:**	**BPHYSE-51B**
COURSE CREDIT	**:**	**3**

COURSE OBJECTIVES

While studying the **PROBLEMS SOLVING SKILLS IN PHYSICS**, the Learner shall be able to:

CO 1: Solve Newtonian mechanics problems

CO 2: Apply thermodynamical concepts into real world problems

CO 3: Introduce the basic properties of charges and enable the students to apply in physical situations

CO 4: Describe the quantum mechanical principles and solve quantum mechanical problems.

CO 5: Demonstrate to plot any functions and calculate the error involved in a physical Measurement

Course Syllabus

BLOCK I: Problems in Mechanics

Newton laws of motion for various systems (1, 2 and 3 dimension), Conservation laws and collisions, Rotational mechanics, central force, Harmonic oscillator, special relativity

BLOCK II: Problems in Thermal Physics

Kinetic theory- MB distribution-Laws of thermodynamics–Ideal Gas law-Various Thermodynamic process- Entropy calculation for various process-Heat engine-TS and PV diagram-Free energies various relations

BLOCK III: Problems in Electricity & Magnetism

Electrostatics- calculation of Electrostatic quantities for various configurations-Conductors,Magneto statics- Calculation of Magnetic quantities for various configuration, Electromagnetic induction, Poynting vector, Electromagneticwaves.

BLOCK IV: Problems in Quantum mechanics

Origin of Quantum mechanics- Fundamental Principles of Quantum mechanics-potential wells and harmonic oscillator- Hydrogen atom.

BLOCK V: Problems in General Physics& Mathematics

Plotting the graphs for various elementary and composite functions-Elasticity-Viscosity and surface tension- fluids-Buoyancy-pressure-Bernoulli's theorem-applications-waves and oscillations, Errors and propagation of errors.

Text book for reference:

1. Mechanics(in SI units) by Charles Kittel, Walter D knight etc. (Berkeley Physics course-volume 1), Tata McGraw Hill publication ,second edition.
2. Thermal physics by S.C.Garg,RM Bansal &CK Ghosh. (Tata McGraw Hill Publications), 1st edition.
3. Electricity & magnetism(in SI units) by E.M.Purcell, Tata Mcgraw hill Publication, 2nd Edition.
4. Quantum mechanics by N.Zettili, Wiley Publishers, second edition.
5. Introduction to quantum mechanics by David. J.Griffith, Pearson Publications, second edition.
6. Fundamentals of Physics by Halliday & Resnick, Wiley Publications, 8th Edition.
7. Advanced level physics by Nelkon and Parker,CBS publishers, 7th edition
8. Play with graphs by Amith Agarwal, Arihant Publications.
9. Properties of matter by D.S.Mathur, S.Chand Publications, 11th Edition.

Web resource

1. https://rb.gy/1qlsgf
2. https://www.youtube.com/watch?v=KOKnWaLiL8w&list=PLFE3074A4CB751B2B
3. SOLVED PROBLEMS ON METHOD OF RESOLUTION AND COMPOSITION OF FORCES (PART-1) | ENGINEERING MECHANICS - YouTube
4. Thermal Physics - Problems - YouTube
5. Electricity & Magnetism | Important Problems | JAM 2021 | Physics | Mohd Mubashir | Unacademy Live - YouTube
6. 5 STEPS TO SOLVING PROBLEMS IN QUANTUM MECHANICS - THE PARTICLE IN A BOX - YouTube
7. problems on quantum mechanics from csir-net exam - YouTube
8. Physics Help: Problem Solving in Physics - YouTube

COURSE LEARNING OUTCOMES

After completion of the **PROBLEMS SOLVING SKILLS IN PHYSICS**, the Learner will be able to:

CLO 1: Recollect and extend various concepts in mechanics, thermodynamics, quantum mechanics, electricity & magnetism

CLO 2: Apply and articulate the concepts in various types of competitive exam problems.

CLO 3: Solve and illustrate the solutions for these problems

CLO 4: Evaluate the methods of obtaining solutions for various concept

CLO 5: Construct similar problems and develop method of solutions for these problems

B.Sc., Physics - Syllabus –III year -VI Semester (Distance Mode)

COURSE TITLE	**:**	**SOLID STATE PHYSICS**
COURSE CODE	**:**	**BPHYS -61**
COURSE CREDIT	**:**	**3**

COURSE OBJECTIVES

While studying the **SOLID-STATE PHYSICS**, the Learner shall be able to:

CO 1: Describe the Bonding in Solids and their types

CO 2: Introduce the concept of crystal structure and determination of the same through X-ray diffraction

CO 3: Discuss the variety of magnetic materials with reference to their response to external magnetic fields and temperature

CO 4: Develop first principle calculations on the band theory of solids and apply it to distinguish between different types of materials and study in detail the dielectric behavior.

CO 5: Introduce the exiting phenomena of superconductivity, the associated phenomena, the recent developments and their applications.

Course Syllabus

BLOCK I: Bonding in Solids

Types of bonds in crystals - Ionic, covalent, Metallic, Vander waal's and Hydrogen Bonding - Bond energy of sodium chloride molecule - 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.

BLOCK II: Crystal Structure and Crystal Diffraction

Crystal Lattice -Primitive and UNIT Cell-seven classes of crystal-Bravais Lattice-Miller Indices - Structure of crystals-Simple cubic, Face centered cubic, Body centered cubic and Hexagonal close packed structure -Sodium Chrloride, Zinc Blende and Diamond Structures. Crystal Diffraction – Bragg's law-Experimental

methods-Laue method, powder method - Rotating crystal method-Reciprocal lattice- Intensity and structure factor.

BLOCK III: Magnetic Properties

Spontaneous Magnetization – Weiss Theory – Temperature dependence of Magnetization –

Classical Theory of Diamagnetism – Weiss theory of Para magnetism. Ferromagnetic domains – Bloch wall – Basic ideas of anti-ferromagnetism. Ferrimagnetisms – Ferrites in computer Memories.

BLOCK IV: Dielectric Properties

Band theory of solids –classification of insulators, Semiconductors, conductors – intrinsic and extrinsic semiconductor. Carrier concentration for electron - Barrier Potential Calculation – Rectifier Equation. Dielectrics - Polarization – frequency and temperature effects on polarization-dielectric loss- Local field-Clausius Mosotti relation-determination of dielectric constants.

BLOCK V: 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 Josephson effects – applications. Type–I and Type–II Superconductors - Explanation for the Occurrence of Super Conductivity - BCS theory. High T_C superconductors- Application of Superconductors.

Books for Study:

1. Materials Science by M.Arumugam, Anuradha Agencies Publishers.,2002.
2. Solid State Physics by R L Singhal, Kedarnath Ram Nath& Co., Meerut 2003.
3. Introduction to Solid State Physics by Kittel, Willey Eastern Ltd.,2003.
4. Materials Science and Engineering by V. Raghavan, Prentice Hall of India PrivateLimited, New Delhi,2004.

Books for Reference:

1. Solid State Physics by S.O.Pillai, New Age International (P) Ltd.,2002.
2. Solid State Physics by A. J.Dekker, Macmillan India,1985.
3. Solid State Physics by HC Gupta, Vikas Publishing House Pvt. Ltd., New Delhi 2001.

Web Resource

1. https://youtu.be/XQk25fSJkL8
2. https://youtu.be/93gcZEtmL7s
3. https://youtu.be/Wii1C2uVmEs
4. https://youtu.be/_ttDy8XoMes
5. https://youtu.be/t_heX7jaEfE
6. https://youtu.be/MvNAQFBppM4
7. https://youtu.be/iUM7dWWqeeY
8. https://youtu.be/QQzvQooUtJo
9. https://youtu.be/e4hS9CijS9U
10. https://youtu.be/3hB1pSjZa6c
11. https://youtu.be/DDLljK1ODeg
12. https://youtu.be/8luE9L8bj4Y
13. https://youtu.be/l0nvIh34eug
14. https://youtu.be/vnQ4uovIwR8
15. https://youtu.be/ptUPen8U5yE
16. https://youtu.be/vnQ4uovIwR8

COURSE LEARNING OUTCOMES

After completion of the **SOLID-STATE PHYSICS**, the Learner will be able to:

CLO 1: Illustrate Types of bonds in crystals and determine the variation of inter atomic force with inter atomic spacing of crystal

CLO 2: Examine the symmetries in 3D solids and the experimental methods to unfold the same.

CLO 3: Analyze and classify magnetic materials based on their field and temperature response.

CLO 4: Differentiate between the variety of the electrical behavior of solids and determine dielectric constants of solids.

CLO 5: Demonstrate magnetic levitation; an application of superconductivity

B.Sc., Physics - Syllabus –III year -VI Semester (Distance Mode)

COURSE TITLE	**:**	**NUCLEAR PHYSICS**
COURSE CODE	**:**	**BPHYS -62**
COURSE CREDIT	**:**	**3**

COURSE OBJECTIVES

While studying the **NUCLEAR PHYSICS**, the Learner shall be able to:

CO 1: Discuss the overview of nucleus, its types, constituent particles and binding energy

CO 2: Explain the different modes of decay and interaction of nuclear radiations with matter

CO 3: Introduce an origin of nuclear energy and to discuss nuclear fission and fusion along with some of their applications.

CO 4: Describe the principle and construction of Nuclear Detectors and Particle Accelerators.

CO 5: Discuss the introduction to elementary particles, their classification, interactions, conservation laws, the associated symmetries and efforts in the direction of unification of interactions.

Course Syllabus

BLOCK I: Properties and structure of Nuclei

General properties of nucleus- binding energy – BE/A curve - significance **-** proton electron theory- proton neutron theory. Nuclear forces –characteristics –Meson theory of nuclear forces – Yukava Potential- Nuclear models.

BLOCK II: Radio Activity

Fundamental laws of radio activity -theory of α ,β and ϒ decay- properties of alpha, beta and gamma rays. Neutrino and its properties-electron capture. - nuclear isomers. Mossabauer effect - applications- Radio carbon dating- radio isotopes – uses.

BLOCK III: Nuclear Reactions

Kinematics of nuclear reaction-Nuclear fission- Nuclear reactor- atom bomb uses.- Nuclear fusion –hydrogen bomb-fusion reactor –plasma confinement. Artificial transmutation-Q value of nuclear reaction-types of nuclear reaction

BLOCK IV: Nuclear Detectors and Particle Accelerators

Neutron sources and properties- Detectors-G.M.Counter-scintillation counter-bubble chamber-Wilson cloud chamber. Accelerators-cyclotron-synchrocyclotron-betatron-synchrotrons

BLOCK V: **Cosmic Rays and Elementary Particles**

Cosmic rays-introduction-discovery-latitude, altitude and azimuth effects-longitudinal effect-north –south effect-seasonal and diurnal changes. Primary and secondary cosmic rays-nature of cosmic rays- cosmic ray showers-Van Allen belt-origin of cosmic radiation. Elementary particles-introduction-particles and antiparticles-antimatter-the fundamental interaction-elementary particle quantum numbers. Conservation laws and symmetry-the quark model

Books for Study:

1. Atomic and Nuclear Physics by N. Subrahmanyam and Brijlal, S Chand & Co.,New Delhi,1996.
2. Nuclear Physics by Tayal D.C., Himalaya Publishing House, Mumbai,2006.
3. Nuclear Physics by R.C.Sharma, K.Nath& Co., Meerut, 2000
4. Nuclear Physics by Irving Kaplan, Narosa Publishing house, New Delhi.

Books for Reference :

1. Nuclear Physics by R.R.Roy and B.P.Nigam, New Age International (P) Ltd., NewDelhi,1997.
2. Fundamentals of Elementary Particle Physics by Longo, McGraw-Hill.
3. Nuclei and Particles by Serge., W.A. Benjamin, USA
4. Elements of Nuclear Physics by ML Pandya and RPS Yadav, Kedarnath Ram Nath, Meerut.

Web Resources

1. Atomic and Nuclear Physics – a quick review (utoronto.ca)
2. phy008_lecturenotes_v1 (sheffield.ac.uk)
3. NuclearPhysics.dvi (bhattadevuniversity.ac.in)
4. intro-nuclear-particle-Physics.pdf (bilkent.edu.tr)
5. Basic Nuclear and Atomic Physics (tamu.edu)
6. NPTEL :: Physics - Nuclear Physics: Fundamentals and Applications
7. 11. III BSc 5th Sem- PHYSICS- MODERN PHYSICS - General Properties of NucleI, Basic Ideas of Nucleus - YouTube
8. BASIC PROPERTY OF NUCLEUS (PART-1) - YouTube
9. Radioactivity - Modern Physics (Part-5) | Revision Checklist 51 for JEE Main and NEET Physics - YouTube
10. .III BSc 5th Sem - PHYSICS - MODERN PHYSICS - Radioactivity Decay, Gamow's Theory of Alpha Decay - YouTube
11. NUCLEAR REACTION | TYPES OF NUCLEAR REACTION | NUCLEAR REACTION AND IT'S TYPES | PART - 1 | NOTES | - YouTube
12. Nuclear Reaction - Definition, Examples | Part-2 | Nuclear Physics BSc- 3 year - YouTube

COURSE OUTCOMES

After completion of the **NUCLEAR PHYSICS**, the Learner will be able to:

CLO 1: Distinguish between different classes of nuclides and Determine the Stability of nuclides from binding energy values. describe the Meson theory of nuclear forces and nuclear models

CLO 2: Describe radioactivity and estimate the age of antiquities by applying radioactive dating.

CLO 3: Calculate the nuclear energy released during nuclear fission and nuclear fusion. Point out the harmful effects of nuclear reactor

CLO 4: Design and demonstrate particle accelerator (cyclotron, synchrocyclotron, betatron and synchrotrons)

CLO 5: Categorize elementary particles and summarize the types of interaction between them. Specify the different conservation laws and relate it with underlying symmetries

B.Sc., Physics - Syllabus –III year -VI Semester (Distance Mode)

COURSE TITLE	**:**	**NANOPHYSICS**
COURSE CODE	**:**	**BPHYSE-62A**
COURSE CREDIT	**:**	**3**

COURSE OBJECTIVES

While studying the **NANOPHYSICS**, the Learner shall be able to:

CO 1: Describe basics of nanoscale systems and industry revolution by Nanotechnology

CO 2: Discuss the classification of 0D/1D/2D/3D nanostructures with examples

CO 3: Identify the techniques suitable for nanomaterial synthesis

CO 4: Demonstrate the various characterization techniques and its significance

CO 5: Apply and analyze the properties of nanomaterials to its effective Engineered applications.

Course Syllabus

BLOCK I: Introduction to Nanoscience and Nanotechnology

Introduction- Nano and Nature- Scientific Revolution, Definition of Nanotechnology, Emergence of Nanotechnology- Bulk to Nano Transition- Nanosize Effects - Size Dependent Phenomena - Bohr Exciton radius-Quantum Confinement

BLOCK II: Types of Nanostructures and Functional Nanomaterials

Definition of a Nano System - Types of Nanocrystals-One Dimensional (1D)-Two Dimensional (2D) -Three Dimensional (3D) Nanostructured Materials – Quantum Dots (0 D) - Quantum Wire - Core/Shell Structures. Carbon (Fullerene, CNT, Graphene), Noble Metals (Au, Ag), Metal Oxides (Tio_2, Sno_2, Zno), Semiconductors (Cds, Cdse, Cdte), Magnetic Nanoparticles, Semiconductor Nanocomposites (Si:Ge):

BLOCK III: Synthesis of Nanomaterials

Physical Method: Ball Milling, Sputter Deposition, Ion Beam Techniques. Chemical Method: Wet Chemical Synthesis – Sol-Gel Processing, Co- Precipitation, Hydrothermal, Chemical Bath Deposition - Vapour Method: Thermal Evaporation - Chemical Vapor Deposition (CVD)

BLOCK IV: Characterization Techniques

Powder X-Ray Diffraction - UV-Vis Absorption Spectroscopy-Photo Luminescence - Scanning Electron Microscopy (SEM) - Transmission Electron Microscopy (TEM).

BLOCK V: Applications of Nanomaterials

Applications in Physics: Nanoelectronics, Quantum Dot and Dye Sensitized Solar Cells, Photovoltaics, Photocatalytic Applications, CNT Based Transistor and Field Emission Display - Applications in Other Fields of Science: Nanosensors, Nanomedicine, Nanocoatings, Nanopaints

BOOKS FOR STUDY

1. Nanostructures and Nanomaterials. GuoZhong Cao., Imperial College Press, U.K, 2004.
2. Nano Materials. Viswanathan. B. Narosa, India,2010.
3. Nano: The Essentials. Pradeep T. Tata Mcgraw Hill, New Delhi, 2007.

BOOKS FOR REFERENCE

1. A Hand Book on Nanophysics. John D. Miller. Dominant, India, 2008.
2. Introduction to Nanotechnology. Charles P. Poole, Jr., Frank J. Owens. Wiley, New Delhi, 2009.
3. Nanotechnology- Basic Science and Emerging Technologies, Mick Wilson, Kamalikannangora Geoff Smith, Michelle Simmons, Burkhard Raguse, Overseas, New Delhi,2005.

Web Resources

1. https://en.wikipedia.org/wiki/Nanotechnology
2. https://ec.europa.eu/jrc/en/research-topic/nanotechnology
3. http://www.hse.gov.uk/nanotechnology/
4. https://www.nano.gov/nanotech-101/
5. http://www.crnano.org/whatis.htm
6. http://www.nnci.net

7. https://ec.europa.eu/programmes/horizon2020/en/h2020-section/nanotechnologies
8. http://www.research.ibm.com/pics/nanotech/defined.shtml
9. https://www.nsf.gov/crssprgm/nano/

COURSE OUTCOMES

After completion of the **NANOPHYSICS**, the Learner will be able to:

CLO 1: Interpret the Definition of Nanotechnology and Emergence of Nanotechnology and integrate and assess the chemical and physical properties of materials into nanoscale dimension.

CLO 2: Analyze and differentiate micro and nano structured materials based on Mechanical, Electrical, Optical and Dielectric properties.

CLO 3: Explain the synthesis of nanoparticles through simple, facile and cost-effective approach.

CLO 4: Design and demonstrate the various characterization techniques to estimate the size and shape of as prepared nanomaterials

CLO 5: Simulate the role of nanomaterials in medicine for diagnosis, Energy conversion and photo-degradation.

B.Sc., Physics - Syllabus –III year -V Semester (Distance Mode)

COURSE TITLE	**:**	**LASER PHYSICS**
COURSE CODE	**:**	**BPHYSE-62B**
COURSE CREDIT	**:**	**3**

COURSE OBJECTIVES

While studying the **LASER PHYSICS**, the Learner shall be able to:

CO 1: Discuss the basics of Theory of LASER Action

CO 2: Explain the importance of Rate Equations and Solid-State Lasers

CO 3: Demonstrate the working principle of Gas and Liquid Lasers

CO 4: Describe the construction and working of Semiconductor Laser and Holography

CO 5: Categorize the applications of laser in Industry and Medicine

Course Syllabus

BLOCK I: Basic Theory

Quantum Nature of Light – Energy Levels – Thermal Equilibrium - Population- Population Inversion - Absorption – Spontaneous and Stimulated Emission – Condition for Stimulated Emission- Einstein's Coefficients – Relation Between Them – Schawlow -Towne's Threshold Condition for Laser Oscillations in Terms of Population Difference - Basic Components of a Laser- Active Medium- Pumping Agents- Different Pumping Methods- Optical Resonator- Action of Optical Resonator- Optical Resonator – Cavity Configuration - Plane Parallel Cavity- Confocal Cavity- Hemispherical and Long Radius Cavity

BLOCK II: Rate Equations and Solid State Lasers

Laser Rate Equation- Two Level System- Three Level System- Four Level System (Qualitative Treatment Only)-Qualitative Explanation of Line Broadening Mechanism - Classification of Lasers (on the Basis of Active Medium) - Solid State Laser -Nd: YAG Laser–General Description-Structure- Energy Level Diagram –

Working - Laser Beam Characteristics – Introduction- Directionality-Divergence-Coherence- Temporal and Spatial Coherence- Monochromaticity

BLOCK III: Gas and Liquid Lasers

Gas Lasers–Molecular Gas Laser (Helium Neon laser and Carbon Dioxide Laser)-General Description-Structure - Energy Level Diagram – Working - Liquid Laser – Dye Laser - Description - Energy Level Diagram – Working - Chemical Laser– HCl Laser- HF Laser

BLOCK IV: Semiconductor Laser and Holography

Semiconductor Laser – Intrinsic Semiconductor Laser - Doped Semiconductor Laser - PN Junction– Population Inversion-Energy Level Diagrams- Homojunction Laser-Diode Laser Operation- Advantages of Laser Diodes over LED. Introduction to Holography –Recording and Reconstruction of the Image - Characteristics – Applications in Holography

BLOCK V: Applications

Laser in Industry – Drilling - Cutting – Welding – Laser Printing - Lasers in Nuclear Energy – Isotope Separation – Nuclear Fusion- Lasers in Defense-Lidar – Precision Length Measurement – Velocity Measurement. Lasers in Medicine – Cancer Therapy– Laser Eye Surgery- Laser Angioplasty- Lasers in Consumer Electronics Industry –Bar Code Scanners - Lasers in Communications-Block Diagram-Basic Principles of Optical Computers-Laser Ablations.

Books for study:

1. N. Avadhanulu , An introduction to LASERS, S. Chand & Company,2001.

Books for References:

1. William T. Silfvast, Laser fundamentals, University Press, Published in South Asia by Foundation books, New Delhi, 1998

2. K. Thyagarajan and A.K. Ghatak, LASER Theory and Application, Mc Millan, India Ltd, 1984.

Web Resources

1. Quantum Nature of Light - YouTube
2. The laser principle - YouTube
3. Type of Pumping Process in LASER - YouTube
4. Lec 21: Laser rate equation: Steady State solution1 - YouTube
5. Laser rate equations - YouTube
6. Optical Instrumentation | Gas and Liquid LASER | AKTU Digital Education - YouTube
7. Semiconductor Laser - I Device Structure - YouTube
8. Quantum Well Laser - YouTube
9. Applications of LASER-Holography - YouTube
10. APPLICATIONS OF LASER IN THE FIELD OF INDUSTRY || APPLICATIONS OF LASER || WITH EXAM NOTES || - YouTube
11. Lasers in Medical Sciences - YouTube

COURSE OUTCOMES

After completion of the **LASER PHYSICS**, the Learner will be able to:

CLO 1: Interpret the Condition for Stimulated Emission and analyze the Einstein's Coefficients and Relation between them

CLO 2: Differentiate various types of lasers and their means of excitation

CLO 3: Describe the construction and working of various gas laser (Helium Neon laser and Carbon Dioxide Laser) and their applications

CLO 4: Introduce to Holography and discuss the Recording and Reconstruction of the Image of Hologram and its Characteristics and Applications

CLO 5: Summarize the application of Laser in various fields (Medicine, Industry, Defence and communications)

B.Sc., Physics - Syllabus –I year -II Semester (Distance Mode)

COURSE TITLE	**:**	**PRACTICAL - I**
COURSE CODE	**:**	**BPHYS -P1**
COURSE CREDIT	**:**	**4**

ANY TWELVE EXPERIMENTS ONLY

COURSE OBJECTIVES

While studying the **PRACTICAL - I,** the Learner shall be able to:

CO 1: Describe the Measurement of surface tension, viscosity and heat capacity of liquids.

CO 2: determine the Modulus of elasticity measurement by dynamic methods.

CO 3: Verify the three laws of transverse vibrations in stretched strings.

CO 4: Demonstrate the principle and working of Spectrometer hence find refractive index of a material.

CO 5: Calibrate low range ammeter using potentiometer

List of Experiments

1. Viscosity by Capillary flow method
2. Compound Pendulum – Determination of g and K.
3. Sonometer – Frequency of A.C.
4. Spectrometer – Refractive index of the prism.
5. Newton's law of cooling – Specific heat capacity of the liquid.
6. Newton's rings-determination of radius of curvature of the lens R.
7. Meter bridge – determination of specific resistance.
8. Young's modulus – Uniform – Scale and telescope.
9. Young's modulus – Uniform – Pin and microscope.
10. Surface tension by capillary rise method.
11. Comparison of surface tension by capillary rise method.
12. Lee's disc –specific heat capacity of the bad conductor.

13. Focal length – Concave lens – Combination method (Two types)
14. Spectrometer –Dispersive Power of the prism.
15. Potentiometer – Internal resistance of cells.
16. Air Wedge – Thickness of Wire.
17. Moment of magnet – Tan C Position
18. Melde's Strings – Frequency of Vibrator.

Web Resources

1. https://vlab.amrita.edu/?sub=1&brch=280&sim=1518&cnt=4
2. https://rb.gy/9e5mrd
3. https://rb.gy/m7aiog
4. http://htv – au.vlabs.ac.in/heat
5. thermodynamics/Newtons_Law_of_Cooling/experiment.html
6. https://rb.gy/isiyfm
7. https://rb.gy/ysfsgv
8. Coefficient of Viscosity of Water | Poiseuille's method | Experiment - YouTube
9. PHY 104 | Physics Lab | Exp-04 | Determination of the value of g, by means of a compound pendulum - YouTube
10. SONOMETER EXPERIMENT || FREQUENCY OF AC MAINS USING SONOMETER || SONOMETER PRACTICAL | WITH PDF FILE - YouTube
11. Physics Lab Demo: Refractive Index of the Prism - YouTube
12. Determination of specific heat of a liquid by Newton's laws of cooling - YouTube
13. Experiment-Newton's Rings Method (Radius of Curvature of Lens) - YouTube
14. Meter Bridge Determination Of Specific Resistance Experiment Edunovus Online Smart Practicals - YouTube
15. Youngs Modulus Uniform Bending - YouTube
16. Youngs Modulus (Uniform Bending) - YouTube
17. Surface Tension of liquid by capillary rise method| Bsc Physics lab experiment - YouTube
18. Lee's' Disc Method Experiment - Physics Practical - YouTube
19. Dispersive power of Prism Experiment - YouTube
20. To find the Focal Length of a Concave Lens with the help of a Convex Lens - YouTube
21. Potentiometer experiment(Internal resistance of a cell using potentiometer)by Anshu

kapoor - YouTube

22. Air wedge experiment - Thickness of the thin wire. - YouTube
23. Deflection Magnetometer - YouTube
24. Melde's experiment - standing waves on a vibrating string - YouTube

COURSE LEARNING OUTCOMES

After completion of the **PRACTICAL - I**, the Learner will be able to:

CLO 1: Define the aim of the experiment and explain the various parameters in the formula that is used to estimate the physical property of a material. Identify the equipment and get the accessories.

CLO 2: Arrange and assemble the gadgets and carryout the experiment.

CLO 3: List the observations and repeat the experiment to find the average and Hence determine the physical quantity by making use of the required formula.

CLO 4: Interpret and report the result and classify the materials based on the Measurement (or) verify a given law. Sketch the variations wherever required.

CLO 5: Analyze the results of the experiment with an aim to construct or design an equipment or a device for use in project work/research work.

B.Sc., Physics - Syllabus –II year -IV Semester (Distance Mode)

COURSE TITLE	**:**	**PRACTICAL -II**
COURSE CODE	**:**	**BPHYS -P2**
COURSE CREDIT	**:**	**4**

ANY TWELVE EXPERIMENTS ONLY

COURSE OBJECTIVES

While studying the **PRACTICAL - II,** the Learner shall be able to:

CO 1: Determine the value of acceleration due to gravity at a given place.

CO 2: Measure the elastic property such as Young's modulus of a material.

CO 3: Determine the refractive index of a solid prism using spectrometer.

CO 4: Determine the High Resistance using Balastic Galvonameter.

CO 5: Demonstrate the Characteristics of Zener Diode

List of Experiments

1. Rigidity Modulus – Torsional Pendulum – With & Without symmetrical masses
2. Quincke's method – Surface Tension and Angle of Contact of Mercury
3. Specific heat capacity – Newton's law of cooling – Spherical calorimeter
4. Spectrometer – Hollow prism – Refractive index of the Prism
5. Determination of MH and BH
6. Zener diode - Characteristics
7. Spectrometer – (i – i') curve
8. Newton's rings – Refractive index of a lens
9. Reduction factors of a Tangent Galvanometer - BG
10. Comparison of Mutual Inductance - BG
11. Spectrometer – Grating – Minimum deviation & Normal Incidence
12. Young's Modulus – Koenig's Method – Non Uniform bending
13. Young's Modulus – Koenig's Method – Uniform bending
14. Spectrometer – Cauchy's constant

15. Spectrometer – Dispersive Power
16. Spectrometer – Narrow Angled Prism
17. Carey Foster's Bridge – Temperature Coefficient
18. Potentiometer – EMF of a thermocouple
19. B.G - Absolute Capacity
20. B.G – Determination of High Resistance

Web Resources

1. https://vlab.amrita.edu/index.php?sub=1&brch=280&sim=210&cnt=2
2. https://vlab.amrita.edu/?sub=1&brch=280&sim=1509&cnt=1
3. https://rb.gy/m7bgb1
4. https://vlab.amrita.edu/?sub=1&brch=192&sim=847&cnt=1
5. http://vlabs.iitb.ac.in/vlabs – dev/labs/physics – basics/labs/carey – foster – bridge – iitk/simulation.html
6. https://academo.org/demos/logic – g ate –simulator/
7. http://ov – au.vlabs.ac.in/optics/Spectrometer_Refractive_Index/
8. http://amv – au.vlabs.ac.in/advanced mechanics / Compound Pendulum/experiment.html

COURSE LEARNING OUTCOMES

After completion of the **PRACTICAL - II**, the Learner will be able to:

CLO 1: Define the aim of the experiment and explain the various parameters in the formula that is used to estimate the physical property of a material. Identify the equipment and get the accessories.

CLO 2: Arrange and assemble the gadgets and carryout the experiment.

CLO 3: List the observations and repeat the experiment to find the average and Hence determine the physical quantity by making use of the required formula.

CLO 4: Interpret and report the result and classify the materials based on the Measurement (or) verify a given law. Sketch the variations wherever required.

CLO 5: Analyze the results of the experiment with an aim to construct or design an equipment or a device for use in project work/research work.

B.Sc., Physics - Syllabus –III year -VI Semester (Distance Mode)

COURSE TITLE	**:**	**PRACTICAL - III**
COURSE CODE	**:**	**BPHYS -P3**
COURSE CREDIT	**:**	**4**

ANY TWELVE EXPERIMENTS ONLY

COURSE OBJECTIVES

While studying the **PRACTICAL - III,** the Learner shall be able to:

CO 1: Design a RC coupled amplifier and analyze its frequency response.

CO 2: Design and demonstrate Regulated Power Supply using Discrete components

CO 3: Construction of basic gates using discrete components.

CO 4: Design and demonstrate types of oscillators

CO 5: Demonstrate the Characteristics of LDR and UJT

List of Experiments

1. Bistable Multivibrator
2. R.C. Coupled Amplifier – Transistor single stage
3. Hartley Oscillator – Solid State
4. Colpitt's Oscillator – Solid State
5. Tuned Plate Oscillator
6. Tuned Grid Oscillator
7. Astable Multivibrator
8. Series and Parallel resonance circuits
9. Differential Circuit and Integrating Circuit
10. Clipping and Clamping Circuits
11. Study of Solar Cell

12. Logic Gates – Discrete components
13. Emitter Follower
14. IC – Regulated Power Supply
15. Transistor – Regulated Power Supply
16. Dual Power Supply
17. Square wave generator using 555 IC
18. Study of LDR
19. UJT Characteristics
20. Bridge rectifier with voltage regulation

Web Resources

1. Bistable Multivibrator using Transistor - YouTube
2. Bistable Multivibrator Using Timer IC 555 - YouTube
3. Single Stage RC Coupled Amplifier Trainer - YouTube
4. Hartley Oscillator: Experiments - YouTube
5. #38: LC tank circuits and the Colpitts oscillator - YouTube
6. RC phase shift oscillator lab experiment - YouTube
7. About Radio ... Part 14 Local oscillator for the AM frequencies by Andy Davies - YouTube
8. Astable Multivibrator Using 555 Timer - YouTube
9. Experiment 5: Astable Multivibrator experiment (using op-amp) #astablemultivibrator - YouTube
10. Series and Parallel LCR Circuit Experiment - YouTube
11. lec51 - Experiment: To study op-amp based integrator and differentiator - YouTube
12. Experiment No 3 Clipper Circuits - YouTube
13. SOLAR CELL EXPERIMENT || TO STUDY CHARACTERISTICS OF SOLAR CELL || WITH PDF FILE LINK || - YouTube
14. Making Logic Gates From Discrete Components - The Learning Circuit - YouTube
15. AMC Lab | Emitter Follower Experiment |Simulation in LTspice| Part 2 -

YouTube

16. How to make a Regulated Power Supply - YouTube
17. Regulated Power Supply 7805 - YouTube
18. V-I Characteristics Of Light Dependent Resistor (Material Science Experiment 6.3) - YouTube
19. UJT characteristics - YouTube
20. Full Wave Bridge Rectifiers - YouTube

COURSE LEARNING OUTCOMES

After completion of the **PRACTICAL - III**, the Learner will be able to:

CLO 1: Define the aim of the experiment and explain the various parameters in the formula that is used to estimate the physical property of a material. Identify the equipment and get the accessories.

CLO 2: Arrange and assemble the gadgets and carryout the experiment.

CLO 3: List the observations and repeat the experiment to find the average and hence determine the physical quantity by making use of the required formula.

CLO 4: Interpret and report the result and classify the materials based on the Measurement (or) verify a given law. Sketch the variations wherever required.

CLO 5: Analyze the results of the experiment with an aim to construct or design an equipment or a device for use in project work/research work.

B.Sc., Physics - Syllabus –III year -VI Semester (Distance Mode)

COURSE TITLE	**:**	**PRACTICAL -IV**
COURSE CODE	**:**	**BPHYS -P4**
COURSE CREDIT	**:**	**4**

ANY TWELVE EXPERIMENTS ONLY

COURSE OBJECTIVES

While studying the **PRACTICAL - IV,** the Learner shall be able to:

CO 1: Explore the fundamental digital concept by establishing NAND and NOR gates as Universal building blocks.

CO 2: Design and demonstrate Regulated Power Supply using Discrete components

CO 3: Construction of basic gates using discrete components.

CO 4: Coding and execution for Addition and subtraction in various modes of addressing using Microprocessor 8085.

CO 5: Apply and analyze the De Morgan's theorem and their verification

List of Experiments

1. Verification of Truth tables of IC gates: OR, AND, NOT, XOR, NOR and NAND.
2. NAND as universal building block- AND, OR, NOT
3. Verification of De Morgan's theorem.
4. Boolean Algebra –problem solving
5. Study of RS Flip-Flop.
6. Study of Shift –Registers –Serial in Parallel out.
7. Decade counter using 7490.
8. Half adder.
9. Full adder
10. Half Subtractor and Full Subtractor.

11. 4 BIT – Binary Adder & Subtractor using 7483.
12. Code converter (Binary to gray and vice versa) & Seven segment Decoder
13. Binary Counter using 7493.
14. Parity check logic.
15. Up/Down Counter using 74190
16. 8085 ALP for 8 bit Addition and Subtraction
17. 8085 ALP for One's Complement, Masking off most significant 4 bits and setting bits.
18. 8085 ALP for Two's compliment Addition and Subtraction

Web Resources

1. Verify the Truth Tables of Logic Gates using Integrated Circuits | 12th Physics Practical - YouTube
2. Electronics Lab experiment-1 : Realization of NOT, AND, OR & X-OR gates using NAND gates (IC-7400) - YouTube
3. De Morgan's First Theorem | EXPERIMENT | By CBR - YouTube
4. Logic Gates, Truth Tables, Boolean Algebra AND, OR, NOT, NAND & NOR - YouTube
5. SR and D flip flop | EXPERIMENT | LOGIC CIRCUIT | BY CBR - YouTube
6. Exp 9, Study of Shift Register IC 7495 for SISO,SIPO,PISO,PIPO, Shift Right & Shift Left Operation - YouTube
7. Decade counter lab experiment ic 7490 - YouTube
8. Decade counter IC 7490 | LAB | V H Mankar - YouTube
9. 19ECL37-DEC Lab- Experiment 2- Half Adder, Full adder, Half subtractor, full subtractor - YouTube
10. 4-Bit binary Adder / Subtractor, BCD Adder using 7483 IC | Simulations | DE Lab VLect 7 | Malayalam - YouTube
11. Design and Implementation of Binary to Gray Code Converter - YouTube
12. Expt No: 6 Adders, Subtractors, Binary to Gray & Vice-Versa Using IC74139 III-Sem, DSD LAB 18ECL38 - YouTube
13. The 7493 IC Binary Counter - YouTube
14. Parity Generator and Checker | ECE | Unacademy Live - GATE - YouTube

15. EXPERIMENT 13: ASYNCHRONOUS 4 BIT BINARY UP / DOWN COUNTER USING IC 74192 - YouTube
16. addition of two 8 bit numbers using memory in 8085 microprocessor. 8085 programming - YouTube
17. Masking of upper 4 bits from 8 bit number - YouTube
18. 2's complement of an 8 bit number in 8085 microprocessor - YouTube
19. 1's and 2's complement of 8 bit data and 16 bit data in 8085|8085 ALP to find 1s and 2s complement - YouTube

COURSE LEARNING OUTCOMES

After completion of the **PRACTICAL - IV**, the Learner will be able to:

CLO 1: Define the aim of the experiment and explain the various parameters in the formula that is used to estimate the physical property of a material. Identify the equipment and get the accessories.

CLO 2: Arrange and assemble the gadgets and carryout the experiment.

CLO 3: List the observations and repeat the experiment to find the average and hence determine the physical quantity by making use of the required formula.

CLO 4: Interpret and report the result and classify the materials based on the Measurement (or) verify a given law. Sketch the variations wherever required.

CLO 5: Analyze the results of the experiment with an aim to construct or design an equipment or a device for use in project work/research work.

Allied Course Offered by the Department of Physics to Students of Mathematics and Chemistry

COURSE TITLE	**:**	**ALLIED PHYSICS-1**
COURSE CODE	**:**	**BPHYSA- 11**
COURSE CREDIT	**:**	**3**

COURSE OBJECTIVES

While studying the **ALLIED PHYSICS - I**, the Learner shall be able to:

CO 1: Describe the basics of Waves and Oscillations and their application

CO 2: Discuss the fundamentals of Properties of matter and their day to day Applications

CO 3: Explain the concept of thermal physics

CO 4: apply and analyze the basics of Electricity and Magnetism

CO 5: Demonstrate the working principle of Geometrical optical instruments

Course Syllabus

BLOCK I: Waves and Oscillations

Simple harmonic motion – composition of two simple harmonic motion at right angles (periods in the ratio 1:1) – Lissajou's figures – uses. laws of transverse vibrations of strings – Melde's string – transverse and longitudinal modes - Sonometer- determination of a.c frequency using sonometer (steel and brass wires). Ultrasonics – production – application and uses – reverberation – factors for good acoustics of hall and auditorium.

BLOCK II: Properties of matter

Elasticity : Elastic constants – bending of beam – Young's modulus by non- uniform bending.

Energy stored in a stretched wire – torsion in a wire – determination of rigidity

modulus by torsional pendulum – static torsion. Viscosity: Coefficient of viscosity – Poissuelle's formula – comparison of viscosities - burette method – Stoke's law – terminal velocity – viscosity of highly viscous liquid – lubrication. Surface tension: Molecular theory of surface tension – excess of pressure inside a drop and bubble – variation of surface tension with temperature – Jaeger's method.

BLOCK III : Thermal Physics

Joule-Kelvin effect – Joule-Thomson porous plug experiment – theory and application. - liquefaction of gasses – Linde's process – Helium I and II – adiabatic demagnetization. Thermodynamic equilibrium – laws of thermodynamics – entropy change of entropy in reversible and irreversible processes.

BLOCK IV: Electricity and Magnetism

Capacitor – energy of a charged capacitor - loss of energy due to sharing of charges – Magnetic field due to a current carrying conductor – Biot Savart's Law – Field along the axis of the coil carrying current. AC current: peak, average and RMS values of ac current and voltage – power factor and current values in an ac circuit. Circuit control and protective devices - switch and its types – fuses circuit breaker and relays.

BLOCK V: Geometrical optics

Refraction – Refractive index by microscopy – air cell – refraction at grazing incidence and grazing emergence in prisms – Dispersion- combination of two small angled prisms to produce dispersion without deviation and deviation without dispersion – direct vision prism – constant deviation prism – defects of images – coma – distortion. Lens: spherical and chromatic aberration in lenses.

Books for study

1. Allied Physics by R. Murugesan, S.Chand & Co, New Delhi(2008).
2. Waves and Oscillations by Brijlal and N. Subramanyam, Vikas Publishing

house,New Delhi.

3. Properties of Matter by Brij Lal and N.Subramaniam, S. Chand & Co., New Delhi(1994).
4. Heat and Thermodynamics by J.B.Rajam and C.L.Arora, S.Chand & Co., 8th edition, New Delhi(1976).
5. Optics and Spectroscopy by R. Murugesan, S.Chand & Co, New Delhi, (2005).

Books for Reference

1. Fundamentals of Physics by Resnick Halliday and Walker, John Willey and Sons, Asia Pvt.Ltd., 6th edition, Singapore.

2. Text book of Sound by V.R.Khanna and R.S.Bedi, Kedharnaath Publish & Co, 1st edition, Meerut (1998).

3. Electricity and Magnetism by N.S. Khare and S.S. Srivastava, Atma Ram & Sons, 10th Edition, New Delhi (1983).

4. Optics by D.R. Khanna and H.R. Gulati, S. Chand & Co., New Delhi (1979).

Web Resources

1. Simple harmonic motion - https://www.youtube.com/watch?v=pujd7oFvO-8
2. Composition of two SHM at right angles - https://www.youtube.com/watch?v=-tcWmw2Ktok
3. Lissajous figure - https://www.youtube.com/watch?v=xrejP8ZG9Hs
4. Law of transverse vibration of string - https://www.youtube.com/watch?v=bVLiJ9qMH2o
5. Melde's experiment - https://www.youtube.com/watch?v=fqhek1wT5-s
6. Production of ultrasonics - https://www.youtube.com/watch?v=Wbnic_2Yr9U
7. Magnetostriction method - https://www.youtube.com/watch?v=8c2ZXnobKhs
8. Piezoelectric effect - https://www.youtube.com/watch?v=mD1Vyh9FMq0
9. Inverse piezoelectric effect - https://www.youtube.com/watch?v=pnvpsl3bzwQ
10. Application of ultrasonic - https://www.youtube.com/watch?v=T_ibVBBAxwI
11. Reverberation - https://www.youtube.com/watch?v=kL6AyX0FXRs
12. Reverberation time - https://www.youtube.com/watch?v=94NzKCse4N0
13. Sabines formula - https://www.youtube.com/watch?v=EGUrtKe9seM
14. Factors affecting acoustics of building - https://www.youtube.com/watch?v=slCLMbE_6vo
15. Stress and strain - https://www.youtube.com/watch?v=3sgcb7ImNFw
16. Hooke's law - https://www.youtube.com/watch?v=BGQKjmgRjQs

17. Different moduli of elasticity - https://www.youtube.com/watch?v=TMP0degeWvg
18. Poisson's ratio - https://www.youtube.com/watch?v=I4UkkQEUUMI
19. Energy stored in stretched wire - https://www.youtube.com/watch?v=pBSfQ2HjZVQ
20. Bending of beams - https://www.youtube.com/watch?v=1WwpzH02ujs
21. Theory of non uniform bending - https://www.youtube.com/watch?v=WN9k_lRTQQw
22. Determination of young's modulus - https://www.youtube.com/watch?v=x4AI3bWk61w
23. Torsion of a wire - https://www.youtube.com/watch?v=mhRH96SA7M4
24. Determination of rigidity modulus - https://www.youtube.com/watch?v=wWW9rRWqbTc
25. Coefficient of viscosity - https://www.youtube.com/watch?v=97a_ZOUtNo8
26. Streamline flow - https://www.youtube.com/watch?v=nDBhCFS7ggw
27. Turbulent flow - https://www.youtube.com/watch?v=1C1jP4ksiRw
28. Reynolds number - https://www.youtube.com/watch?v=FdpPabyn6Ig
29. Poiseuilles law - https://www.youtube.com/watch?v=jHg2G77P40c
30. Stokes law - https://www.youtube.com/watch?v=ybEMFkPaXeQ
31. Molecular theory of surface tension - https://www.youtube.com/watch?v=gP4_Y0lAjkM
32. Excess pressure inside a liquid drop - https://www.youtube.com/watch?v=A3kvpLOtzsc
33. Jaegar's method - https://www.youtube.com/watch?v=hDXoCYSeut4
34. Kinetic theory and its postulates - https://www.youtube.com/watch?v=o3f_VJ87Df0
35. Vanderwaal's equation of state - https://www.youtube.com/watch?v=XcJtXTTZiGc
36. Derivation of critical constant - https://www.youtube.com/watch?v=tJABZMr6JpM
37. Joule – Kelvin effect - https://www.youtube.com/watch?v=y8fAdT97ahA
38. Porous plug experiment - https://www.youtube.com/watch?v=xuCcqtm1OVc
39. Linde's process - https://www.youtube.com/watch?v=HmGDnaKZxxU
40. Adiabatic demagnetization - https://www.youtube.com/watch?v=fLrCtXwhDMU
41. Helium I and II - https://www.youtube.com/watch?v=lJiFxyKpXBU
42. Zeroth law of thermodynamics - https://www.youtube.com/watch?v=10LJ1yqRx6U
43. First law of thermodynamics - https://www.youtube.com/watch?v=f4Qzpq-0cs0
44. Reversible and irreversible process - https://www.youtube.com/watch?v=hpur62rjYuw
45. Third law of thermodynamics - https://www.youtube.com/watch?v=L3HECVXhLZI
46. Carnot engine - https://www.youtube.com/watch?v=1havV-LB0dA
47. Entropy in carnot cycle - https://www.youtube.com/watch?v=-dcVMGNfCpk
48. Capacitance of a conductor - https://www.youtube.com/watch?v=3c7XrhZaUk8
49. Energy of a charged capacitor - https://www.youtube.com/watch?v=2TOU50Wz4o8
50. Energy loss due to sharing of capacitors - https://www.youtube.com/watch?v=Tp6A98i3uJ0

51. Maxwell's screw rule - https://www.youtube.com/watch?v=gg45fXtpWeE
52. Biot savart's law - https://www.youtube.com/watch?v=DjYn5_6K4hY
53. Emf due to rotation of coil - https://www.youtube.com/watch?v=wPIucuBFHeA
54. Rms, effective value - https://www.youtube.com/watch?v=-nITJzYEsd8
55. Mean, average value of A.C - https://www.youtube.com/watch?v=QBQBdSwh8k4
56. Power in A.C circuit - https://www.youtube.com/watch?v=tK9AwJPq9jI
57. Wattless current - https://www.youtube.com/watch?v=yakLG6Pu6dg
58. Circuit breaker and isolators - https://www.youtube.com/watch?v=8QLVvyNfEgc
59. Relay coil - https://www.youtube.com/watch?v=n9renPKEtUc
60. Refraction - https://www.youtube.com/watch?v=v5SuSB_93FM
61. Refractive index - https://www.youtube.com/watch?v=4heHz65oVsI
62. Critical angle - https://www.youtube.com/watch?v=5bkiQob8ikc
63. Application of refraction of light - https://www.youtube.com/watch?v=0TtFwGH55EI
64. Refraction through a prism - https://www.youtube.com/watch?v=-1Zes_RGP5I
65. Deviation without dispersion - https://www.youtube.com/watch?v=_M4aXmx9cvI
66. Direct vision spectroscope - https://www.youtube.com/watch?v=64C7e3bATgQ
67. Constant deviation prism - https://www.youtube.com/watch?v=lHJJc4r_z20
68. Comatic aberration - https://www.youtube.com/watch?v=8wlJJd4J7_k
69. Spherical aberration - https://www.youtube.com/watch?v=hQ4jJrXZS84

COURSE OUTCOMES

After completion of the **ALLIED PHYSICS-I**, the Learner will be able to:

CLO 1: Demonstrate conceptual understanding of the fundamental Physics principles.

CLO 2: Explain the concept of elasticity and identify the materials suitable for a application

CLO 3: Apply analyze the laws of Thermodynamics and their practical applications

CLO 4: Demonstrate the working principle of Field along the axis of the coil carrying current using – Biot Savart's Law

CLO 5: Construct and demonstrate combination of two small angled prisms to produce dispersion without deviation and deviation without dispersion

Allied Course Offered by the Department of Physics to Students of Mathematics and Chemistry

COURSE TITLE	**:**	**ALLIED PHYSICS-II**
COURSE CODE	**:**	**BPHYSA-22**
COURSE CREDIT	**:**	**3**

COURSE OBJECTIVES

While studying the **ALLIED PHYSICS - II**, the Learner shall be able to:

CO 1: Discuss the fundamental properties of light

CO 2: Describe the structure of atom with various atom models

CO 3: Interpret the overview of nucleus, its types, constituent particles, binding energy and the nuclear process of radioactivity.

CO 4: Explain the basics of Elements of relativity and quantum mechanics

CO 5: Discuss the fundamentals of Electronics and their applications.

Course Syllabus

BLOCK I : Physical Optics

Velocity of light – Michelson's method. Interference: Colours of thin films –air wedge – determination of diameter of a thin wire by air wedge – test for optical flatness – Diffraction – Fresnel's explanation of rectilinear propagation of light – theory of transmission grating – Normal incidence. Polarization – double refraction - optical activity – polarimeter.

BLOCK II : Atomic Physics

Atom model – vector atom model – electron, spin, quantum numbers – Pauli's exclusion principle – Electronic configuration of elements and periodic classification of elements – various quantum numbers – **Magnetic** dipole moment of electron due to orbital and spin motion – Bohr magneton – spatial quantisation – Stern and Gerlach experiment.

BLOCK III : Nuclear Physics

Nuclear model – liquid drop model – magic numbers - shell model – Nuclear energy – mass defect – binding energy. Radiation detectors – ionization chambers – GM Counter – Fission Controlled and Uncontrolled chain reaction – nuclear reactor – Thermonuclear reactions – stellar energy.

BLOCK IV: Elements of relativity and quantum mechanics

Postulates of theory of relativity – Lorentz transformation equations – derivation – length contraction – Time dilation- Mass energy equivalence – uncertainty principle – Postulates of wave mechanics – Schrodinger's equation – application to a particle in a box.

BLOCK V: Electronics

Basic Electronics: Zener diode – voltage regulator – LED – Transistor RC coupled amplifier – feedback principle – condition for oscillation – phase shift oscillator – Wein's bridge oscillator.

Digital Electronics: NAND and NOR gates – Universal building blocks. Boolean algebra – Demorgan's theorem – verification – elementary ideas of ICs – SSI , MSI, LSI and VLSI – Half adder, Full adder, Half Subtractor and Full subtractor.

Books for study

1. Allied Physics by R. Murugesan, S.Chand & Co, New Delhi(2008).
2. Allied Physics by K. Thangaraj and D. Jayaraman, Popular Book Depot, Chennai(2004).
3. Text book of Optics by Brijlal and N. Subramanyam, S.Chand & Co, New Delhi(2002).
4. Modern Physics by R. Murugesan, S.Chand & Co, New Delhi (2005).
5. Applied Electronics by A. Subramaniyam, National Publishing Co., 2nd Edition, Chennai(2001).

Books for Reference

1. Fundamentals of Physics by Resnick Halliday and Walker, John Willey and Sons, Asia Pvt.Ltd., 6th Edition, Singapore.
2. Optics by D.R. Khanna and H.R. Gulati, S. Chand & Co., New
3. Delhi (1979).
4. Concepts of Modern Physics by A.Beiser, Tata McGraw Hill Publication, New Delhi(1997).
5. Digital Fundamentals by Thomas L.Floyd, Universal Book Stall – New Delhi (1998).

Web Resources

1. https://ncert.nic.in/ncerts/l/leph201.pdf
2. https://books.google.co.in/
3. https://rb.gy/orlmk8
4. https://www.analog.com/
5. http://www.ee.surrey.ac.uk/
6. https://digitalcommons.unl.edu/
7. https://www.khanacademy.org/
8. https://open.umn.edu

COURSE LEARNING OUTCOMES

After completion of the **ALLIED PHYSICS-II**, the Learner will be able to:

CLO 1: Demonstrate and determine the optical activity of materials using the properties of light (Polarization)

CLO 2: Classify the elements on the basics of electronic configuration and periodic classification of elements

CO 3: Identify different types of nuclides. Estimate binding energy of the nucleons from mass defect and. Calculate the nuclear energy released during nuclear fission and nuclear fusion. Point out the harmful effects of nuclear reactor.

CO 4: Explain the Postulates of wave mechanics and discuss the Schrodinger's equation and their application.

CLO 5: Design and demonstrate the Zener diode as a voltage regulator and design logic circuits for simplified Boolean expressions

NON-MAJOR ELECTIVE COURSE TO OTHER MAJOR STUDENTS

COURSE TITLE	**:**	**BASIC PRINCIPLE OF PHYSICS**
COURSE CODE	**:**	**BPHYS-NE1**
COURSE CREDIT	**:**	**2**

COURSE OBJECTIVES

While studying the **BASIC PRINCIPLE OF PHYSICS**, the Learner shall be able to:

CO 1: Explain the fundamentals of mechanics.

CO 2: Discuss and demonstrate applications of heating principle.

CO 3: Describe the basics of Sound and Optics

CO 4: Interpret the application of Geophysics and Medical Physics

CO 5: Analyze the applications of Space science and Communication.

Course Syllabus

BLOCK I : Mechanics

Force – Weight – Work – Energy – Power – Horsepower – Centrifuge – Washing machine.

BLOCK II : Heat

Variation of boiling point with pressure – Pressure cooker – Refrigerator – Air conditioner – Principle and their capacities – Bernoulli principle – Aero plane

BLOCK III : Sound and Optics

Sound waves – Doppler effect – Power of lens – Long sight and short sight – Microscope – Telescope – Binocular – Camera

BLOCK IV : Geophysics and Medical Physics

Earthquake – Richter scale – thunder and lightning – Lightning arrestors – Cosmic showers – X-rays – Ultrasound scan – CT scan – MRI scan

BLOCK V : Space science and Communication

Newton's law of gravitation – Weather forecasting and communication satellites –

Indian satellites – Electromagnetic spectrum – Radio waves – AM and FM transmission and reception

Books for Study

1. The Learner's series – Everyday science – Published by INFINITY BOOKS, New Delhi
2. The Hindu speaks on Science, Vol I & II, Kasturi & Sons, Chennai.

Books for Reference

1. Fundamentals of Physics by D. Halliday, R.Rensick and J. Walker, 6th edition, Wiley, NY (2001).
2. Physics, Vols I, II, III by D.Halliday, R.Resnick and K.S.Krane, 4th Edition, Wiley, New York (2001).
3. The Feymann Lectures on Physics Vols I, II, III by R.P. Feynmann, R.B. Leighton & M. Sands,Narosa, New Delhi(1998).

Web Resources

1. What is mechanics? - YouTube
2. Heat and Thermodynamics | A-Level Physics | Doodle Science - YouTube
3. Light wave vs Sound wave - YouTube
4. What is Geophysics? - YouTube
5. What is Medical Physics? - YouTube
6. Basic Sciences in Space, Science Communication & Computational Physics - YouTube

COURSE OUTCOMES

After completion of the **BASIC PRINCIPLE OF PHYSICS**, the Learner will be able to:

CLO 1: Demonstrate conceptual understanding of the fundamental Physics principles.

CLO 2: Discuss the working principle of Refrigerator and Air conditioner using laws of thermodynamics

CLO 3: Construct and Demonstrate the working principle of Microscope and Telescope

CLO 4: Apply and analyze the applications of Ultrasound scan, CT scan and MRI Scan

CLO 5: Classify the working principle of AM and FM transmission and reception

COURSE TITLE : **ENERGY PHYSICS**

COURSE CODE : **BPHYS- NE1**

COURSE CREDIT : **2**

COURSE OBJECTIVES

While studying the **ENERGY PHYSICS**, the Learner shall be able to:

CO 1: Classify the various types of energy

CO 2: Identify the importance of conservation of energy and the need for alternate source of energy

CO 3: List out the merits and demerits of Conventional Energy sources

CO 4: Discuss the fundamentals and applications of Wind energy

CO 5: Interpret the needs of other energy sources

Course Syllabus

BLOCK I: Solar energy

Conventional Energy sources – Renewable Energy sources- solar energy – solar radiation and its measurements- solar energy collectors- parabolic collector- storage of solar energy

BLOCK II: Applications of solar energy

Solar water heater- solar driers- solar cells- solar electric power generation- solar distillation- solar pumping – solar cooking

BLOCK III: Wind energy

Basic principles of wind energy conversion- power in the wind – forces in the Blades- wind energy conversion- Advantages and disadvantages of wind energy conversion systems (WECS) Energy storage- Applications of wind energy

BLOCK IV: Oceanic energy

Energy from the oceans- Energy utilization- Energy from tides- Basic principle of tidal power – Utilization of tidal energy

BLOCK V: Energy from other sources

Chemical energy – Nuclear energy - Energy storage and distribution

Books for study

1. Non-conventional sources of energy by G.D. Rai, 4th edition, Khanna Publishers, New Delhi (1996).
2. Solar Energy, Principles of thermal collection and storage by S.P.Sukhatme 2nd edition, Tata McGraw-Hill Publishing Co. Ltd., New Delhi (1997).

Book for reference

1. Energy Technology by S.Rao and Dr. Parulekar

Web Resources

1. Solar Energy Basics | NREL
2. Applications of Solar Energy - YouTube
3. Wind Energy Basics | NREL
4. Ocean Energy | Minesto
5. Forms of Energy - YouTube

COURSE LEARNING OUTCOMES

After completion of the **ENERGY PHYSICS**, the Learner will be able to:

CLO 1: Describe what energy and work mean in Physics and how they are related to each other.

CLO 2: Describe the environmental impact of the fossil fuels and the need for cleaner sources of energy.

CLO 3: Summarize about all proposed renewable energy technologies

CLO 4: Explain the production of electricity from renewable sources of energy

CLO 5: Apply and analyze the aware of the importance of sustainable energy.

Mapping the Curriculum

Mapping of curriculum for B.Sc., Physics
Core Course

	BPHYS-11	BPHYS-21	BPHYS-31	BPHYS-32	BPHYS-41	BPHYS-42	BPHYS-51	BPHYS-52	BPHYS-51	BPHYS-53	BPHYS-54	BPHYS-61	BPHYS-62
Fundamental understanding of the field	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Application of basic Physics concepts	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Linkages with related disciplines	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Procedural knowledge for professional subjects	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Skills in related field of specialization	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ability to use in Physics problem	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Skills in Mathematical modeling	✓	✓	✓	-	✓	✓	✓	✓	✓		✓	-	✓
Skills in performing analysis and interpretation of data	✓	✓	✓	-	-	✓-	✓	✓	✓	✓	✓	✓	✓
Develop investigative Skills	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Skills in problem solving in Physics and related Discipline	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Develop Technical Communication skills	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Developing Analytical skills and popular communication	✓	✓	✓	✓	✓	✓	✓	✓-	✓	-	✓	-	✓-
Developing	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

ICT skills													
Demonstrate Professional behaviour with respect to attribute like objectivity, ethical values, self reading, etc	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
Local	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
National	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Regional	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
International	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Mapping of curriculum for B.Sc., Physics

GE- Generic Electives /DSE- Discipline Specific Electives /SEC- Skill Enhanced Courses

	BMSSA-11	BMSSA-22	BCHESA-41	BCHESA-42	BPHYSE-51A	BPHYSE-51B	BPHYSE-62A	BPHYSE-62B	BPHYS-P1	BPHYS-P2	BPHYS-P3	BPHYS-P4
Fundamental understanding of the field	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Application of basic Physics concepts	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Linkages with related disciplines	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Procedural knowledge for professional subjects	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Skills in related field of specialization	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ability to use in Physics problem	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	✓
Skills in Mathematical modeling	✓	✓	✓	✓	-	✓-	✓	✓	-	-	-	-
Skills in performing analysis and interpretation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

of data												
Develop investigative Skills	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Skills in problem solving in Physics and related Discipline	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	✓
Develop Technical Communication skills	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Developing Analytical skills and popular communication	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Developing ICT skills	✓	✓	-	-	-	✓	✓	✓	✓	✓	✓	✓
Demonstrate Professional behaviour with respect to attribute like objectivity, ethical values, self reading, etc	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Local	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
National	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Regional	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
International	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓