Punyashlok Ahilyadevi Holkar Solapur University, Solapur

NAAC Accredited-2015
'B' Grade (CGPA 2.62)

Name of the Faculty: Science & Technology

Choice Based Credit System (CBCS)

Syllabus: Physics

Name of the Course: B. Sc. III (Sem.–V & VI)

(Syllabus to be implemented with effect from June 2021-22)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Syllabus
For B.Sc. III Physics
Choice Based Credit System (CBCS) Pattern
To be implemented from Academic Year 2021-22

1. Preamble:

Bachelor of Science (B.Sc.) in Physics is the course disseminating knowledge of the subject from fundamental concepts to state-of-technologies. Indeed, the curriculum encompasses knowledge of various themes such as Mathematical Physics, Classical Mechanics, Atomic & Molecular Physics Materials Science, Quantum Mechanics, and Electronics etc. The Choice Based Credit System (CBCS) is implemented for this course. Out of 4 theory papers, in each semester, 3 papers are of core. However, students have to opt one paper from DSE papers. Also one Add on Skill enhance course is included as SEC. In the practical course of 400 marks there are compulsory experiments for practical course IV, V, VI and VII (Project/ Internship). Moreover, project work is also mandatory in curriculum at last semester to ensure better practical knowledge and hence better job opportunities in Research & industrial sector. The details are mentioned in the syllabus.

2. Objectives of the course:

The aim of the course is to generate trained manpower with adequate theoretical and practical knowledge of physics domain. Due care is taken to inculcate conceptual understanding in basic phenomena, materials, appropriate practical skills suitable for research and industrial needs. Objectives are

- To design the syllabus with specific focus on key Learning Areas.
- To equip student with necessary fundamental concepts and knowledge base.
- To develop specific practical skills.
- To impart training on circuit design, analysis, building and testing.
- To prepare students for demonstrating the acquired knowledge.
- To encourage student to develop skills for accepting challenges of upcoming technological advancements.

3. Nature of theory question paper

The nature of theory question paper is as per university common model.

Total Marks 80.

	Q. 1 Multiple choice questions (One mark each)	16
	Q. 2 Short answer question (Any eight)	16
	Q. 3 A. Short answer question (Any four)	12
	B. Short answer question (one compulsory)	04
	Q. 4 Short answer question (Any four)	16
	Q. 5 Long answer question. (Any two)	16
OR	Q. 5 Answer the following.	16
	A.	
	B.	

5. Distribution of Practical Marks (400):

Sr. No.	**UA (320)**		**CA (80)**	
1.	Practicals (50 x 4 Practicals)	200	Experiment Test (10 + 10)	20
2.	Project (Project-60, Report-10, Oral-10, Presentation-10, Idea/Theme-10)	100	Practical Test (20 + 20)	40
3.	Journal	20	Seminar	10
4.			Industrial visit/ Industrial Case Study / Visit to industrial exhibition /Participation in Conference/ Workshop/ Seminars	10
	Total	320	**Total**	80
			Total	400

A) University Assessment (320):

Practical Marks (50 X 4=200) may be as given below.

- Flexibility should be given to the students to draw diagrams of respective experiments.
- **Project:** Every student should take up a project and submit the report of the work carried out. The project work will be assessed independently at the time of practical examination.
- It is mandatory for the students to produce certified journal at the time of practical examination.

B) College Assessment (80):

- **Experiment Test:** 02 Experiment diagram tests, each of 10 marks.
- **Practical Test:** 02 Practical tests, semester-wise, each of 20 marks.
- **Seminar:** Every student of B.Sc. III, Physics will have to deliver one seminar of at least 10 minutes on any advanced topic in Physics using ICT (power point presentation) and submit the report of presentation, for 10 marks.
- **Industrial visit / Local industry case study / Job training/ Visit to industrial exhibition/Participation in the Conference/ Workshop/seminars** : In order to give the exposure of industry/ Research Institute and advances in the field of Physics, industrial visit should be arranged and submit the report. OR he should submit the report of the case study of local industry or on job training (minimum four days) OR he may visit to an industrial/ Science exhibition OR participate in conference / Seminar / workshop and produce certificate of participation, for 10 marks.

C) Skill Enhancement Course (SEC):

Student has to complete min one of this activity on his own resources and has to produce the certificate of the same. If any official documentation is necessary from institute, it will be provide, e.g. consent letter, etc. The Internship/Industrial Training must have minimum of 240 hours.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Faculty of Science & Technology
Choice Based Credit System (CBCS)
(w.e.f. 2021-22)
B. Sc.-III Physics

Course Structure:

Subject/ Core Course	Type	No. and Name of Papers/ Practical	Hrs /week			Total Marks Per Paper	UA	CA	Credits
			L	T	P				
Class :	**B.Sc.- III Semester - V**								
Ability Enhancement Course (AEC)	AEC 5.1	English (Business English)	4	--	--	100	80	20	4.0
Core Course(CC)	CC 5.1	**Paper IX :** Mathematical Physics and Statistical Physics	4	--	--	100	80	20	4.0
	CC 5.2	**Paper X :** Solid State Physics	4	--	--	100	80	20	4.0
	CC 5.3	**Paper XI:** Classical Mechanics	4	--	--	100	80	20	4.0
Discipline Specific Elective (DSE)	DSE 5.1	**Paper XII:** Nuclear Physics **Paper XII: Energy Studies**	4	--	--	100	80	20	4.0
Skill Enhancement Course (SEC)	SEC	**Paper XIII:** Add-on-self learning (On-line Platform: MOOC/SWAYAM Course/ Skill Course)	4	--	--	100	80	20	4.0
Grand Total			**24**	**--**	**--**	**600**	**480**	**120**	**24**
Class :	**B.Sc.- III Semester -VI**								
Ability Enhancement Course (AEC)	AEC 6.1	English (Business English)	4	--	--	100	80	20	4.0
Core Course (CC)	CC 6.1	**Paper XIV:** Electrodynamics	4	--	--	100	80	20	4.0
	CC 6.2	**Paper XV :** Materials Science	4	--	--	100	80	20	4.0
	CC 6.3	**Paper XVI :** Atomic Physics, Molecular Physics and Quantum Mechanics	4	--	--	100	80	20	4.0

Discipline Specific Elective (DSE)	DSE 6.1	**Paper XVII:** Electronics **Paper XVII:** Instrumentation	4	--	--	100	80	20	4.0
Skill Enhancement Course (SEC)	SEC	**Paper XVIII :** Add-on-self learning (On-line Platform: MOOC/SWAYAM Course/ Skill Course)	4	--	--	100	80	20	4.0
Total (Theory)			**24**	**--**	**--**	**600**	**480**	**120**	**24**
Practicals	P IV	Practical IV	--	--	5	100	80	20	4.0
	P V	Practical V	--	--	5	100	80	20	4.0
	P VI	Practical VI	--	--	5	100	80	20	4.0
	P VII	Practical VII (Project / Internship)	--	--	5	100	80	20	4.0
Total (Practicals)					**20**	**400**	**320**	**80**	**16**
Grand Total			**48**		**20**	**1600**	**1280**	**320**	**64**

Summary of the Structure of B.Sc. Programme as per CBCS pattern

Class	**Semester**	**Theory**		**Practical**		**Total credits**
		Marks	**Credits**	**Marks**	**Credits**	
B.Sc.-III	V	600	24	--	--	24
	VI	600	24	400	16	40
Total		1200	48	400	16	64
Grand Total	**1200(T) +400 (P) = 1600**					

Abbreviations:

L : Lectures
T : Tutorials
P : Practicals
UA : University Assessment
CA : College Assessment
CC : Core Course
AEC : Ability Enhancement Course
DSE : Discipline Specific Elective
SEC : Skill Enhancement Course
GE : Generic Elective

List of Skill Enhancement Courses

1) Thin film deposition and Characterization Techniques
2) Scientific Research Paper Writing and Publication
3) Medical Physics
4) Testing and Repairs of Electric Appliances
5) Solar Panel Installation and Maintenance
6) Laboratory Safety and Disaster Management

B.Sc. III, Physics, Semester-V

CC 5.1

Paper-IX: Mathematical Physics and Statistical Physics

Credits: 04

1. Vector theorems and introduction to partial differential equation (10)

1.1 Gauss's theorem
1.2 Green's theorem
1.3 Stoke's theorem
1.4 Differential equation
1.4.1 Types of differential equation
1.4.2 Degree,Order, Linearity, Homogeneity of differential equation
1.4.3 Concept of singular points of differential equation
1.5 Frobenius method of solving differential equation
1.5.1 Legendre differential equation (without solution)
1.5.2 Bessel differential equation (without solution)
1.5.3 Hermite differential equation (with solution)

2. Orthogonal Curvilinear Coordinates (10)

2.1 Introduction to Cartesian, Spherical polar and Cylindrical Coordinate system
2.2 Concept of Orthogonal Coordinate system
2.3 Gradient in Orthogonal Coordinate system
2.4 Divergence in Orthogonal Coordinate system
2.5 Curl in Orthogonal Coordinate system
2.6 Laplacian Operator in Orthogonal Coordinate system
2.7 Extension of Orthogonal Coordinate system in Cartesian, Spherical polar and Cylindrical Coordinate system

3. Basic Concept in Statistical Physics (10)

3.1 Micro and Macro States
3.2 Micro canonical and Canonical Ensemble
3.3 Phase Space
3.4 Accessible microstates
3.5 A Priory Probability
3.6 Thermodynamic Probability
3.7 Probability Distribution
3.8 Entropy and Probability

4. Maxwell Boltzmann Statistics (10)

4.1 Maxwell Boltzmann Distribution Law
4.2 Evaluation of constants α and β
4.3 Molecular Speeds
4.4 Thermodynamic functions in terms of partition function

5. Quantum statistics - I **(12)**

5.1 Bose Einstein Statistics
5.2 Bose Einstein Distribution Law
5.3 Experimental study of black body radiation
5.4 Derivation of Plank's radiation formula
5.6 Deduction of Wein's Formula from Plank's radiation formula
5.7 Deduction of Rayleigh's Jeans Law from Plank's radiation formula
5.8 Deduction of Wein's Displacement Law from Plank's radiation formula
5.9 Stefan's Law from Plank's radiation formula

6. Quantum Statistics - II **(08)**

6.1 Fermi Dirac Distribution Law
6.2 Application to free electrons in metals
6.3 Electron energy Distribution
6.4 Fermi Energy
6.5 Comparison of M.B., F.D. and B.E. statistics

Reference Books: -

1. Theory and problems of vector analysis- Schaum outline series- Murray R, Spiegel
2. Mathematical methods for physics – George Arfken
3. Thermodynamics and statistical physics – Sharma, Sarkar
4. Statistical Mechanics –B.B. Laud
5. Statistical and thermal physics – S. Loknathan
6. Statistical Mechanics – SatyaPrakash, J.P. Agrawal
7. Elementary Statistical Mechanics – Kumar, Gupta
8. An approach to Statistical Physics – Debi Prasad Ray

B.Sc. III, Physics, Semester-V

CC 5.2

Paper- X: Solid State Physics

Credits: 04

1. **Crystallography** **(10)**
   - 1.1 Lattice and Basis
   - 1.2 Unit cell
   - 1.3 Bravais lattices (2-D, 3-D)
   - 1.4 Inter-planer spacing
   - 1.5 Miller indices
   - 1.6 Packing fraction and co-ordination number for SC, BCC, FCC & HCP structures
2. **X-ray Diffraction by Crystals** **(10)**
   - 2.1 Production of X-rays and its properties
   - 2.2 Reciprocal Lattice and its properties
   - 2.3 Bragg's law in reciprocal lattice
   - 2.4 Powder method of X-ray diffraction for crystal structure
3. **Free Electron Theory** **(12)**
   - 3.1 Properties of metals
   - 3.2 Free electron model (Drude and Lorentz model)
   - 3.3 Electrical, Thermal conductivity of metals and Wiedemann-Franz relation
   - 3.4 Sommerfeld's theory
   - 3.5 Fermi-Dirac distribution
   - 3.6 Fermi energy, degeneracy and non-degeneracy of metals.
4. **Band Theory of Solids** **(12)**
   - 4.1 Formation of bands in solids (PE, KE and total energy of electron in an isolated atom)
   - 4.2 Formation of energy bands (Valence band, conduction band and forbidden energy gap)
   - 4.3 Motion of electron in one dimensional periodic potential (Kronig-Penney model)

4.4 Effective mass of electron

4.5 Difference between metals, semiconductors and insulators

4.6 Hall Effect and its applications

5. Magnetic Materials (08)

5.1 Magnetic terminology

5.2 Classification of magnetic materials

5.1.1) Diamagnetic materials

5.1.2) Paramagnetic materials

5.1.3) Ferromagnetic materials

5.1.4) Anti-ferromagnetic materials

5.1.5) Ferri-magnetic material and ferrites

5.3 Energy loss in the hysteresis

6. Superconductivity (08)

6.1 Superconductor

6.2 Type I and type II superconductors

6.3 Critical temperature

6.4 Effect of magnetic field

6.5 Meissner effect

6.6 Josephson effect

6.7 Applications of superconductors

Reference Books:

1. Introduction to Solid State Physics – Charles Kittel (Wiley)
2. Solid State Physics – S. O. Pillai (NEW AGE INTERNATIONAL PUBLISHERS)
3. Solid State Physics – A. J. Dekker (Laxmi Publications)
4. Solid State Physics – R. K. Puri, V.K. Babbar (S. Chand)
5. Solid State Physics – R. L. Singhal (KNRN Publication)
6. Fundamentals of Solid State Physics – Saxena B. S. and Gupta R.C. (Pragati Prakashan)

B.Sc. III, Physics, Semester-V

CC 5.3

Paper – XI: Classical Mechanics

Credits: 04

1. Mechanics of a particle and system of particles (10)

1.1 Mechanics of a particle using vector algebra and vector calculus
1.2 Conservation theorems for linear momentum, angular momentum and energy of a particle
1.3 Mechanics of a system of particles, concept of centre of mass
1.4 Conservation theorems for linear momentum, angular momentum and energy of a system of particles
1.5 Application of Newton's law of motion - Projectile motion in resistive medium
1.6 Problems

2. Lagrangian Formulation (12)

2.1 Limitations of Newtonian Formulation
2.2 Introduction of Lagrangian Formulation
2.3 Constraints
2.4 Degrees of freedom
2.5 Generalised coordinates
2.6 Principle of virtual work
2.7 D' Alembert's Principle
2.8 Lagrange's equation from D' Alembert's Principle
2.9 Application of Lagrange's equation to
  i) A particle in space (Cartesian coordinates)
  ii) Atwood's Machine and
  iii) A bead sliding on uniformly rotating wire
  iv) Simple Pendulum
  v) Simple harmonic Oscillator
2.10 Problems

3. Moving Coordinate systems (10)

3.1 Moving origin of coordinates
3.2 Pseudo forces
3.3 Rotating coordinate systems
3.4 Coriolis force
3.5 Foucault's pendulum
3.6 Effects of Coriolis force in nature
3.7 Effect of Coriolis force on freely falling body
3.8 Problems

4. Techniques of Calculus of Variation (10)

4.1 Hamilton's principle
4.2 Deduction of Lagrange's equations from Hamilton's principle
4.3 Applications:
  i) Shortest distance between two points in a plane
  ii) Brachistochrone problem
  iii) Minimum surface of revolution

5. Coupled Oscillations **(10)**

5.1 Frequencies of coupled oscillatory system
5.2 Normal modes and normal coordinates
5.3 Energy of coupled oscillations
5.4 Energy transfer in coupled oscillatory system
5.5 Problems

6. Motion of rigid body **(08)**

6.1 Motion of rigid body in space
6.2 Euler's theorem
6.3 Angular momentum and energy
6.4 Euler's equations of motion

Reference Books:

1. Classical Mechanics: Herbert Goldstein
2. Classical Mechanics: N. C. Rana and P.S. Jog
3. Introduction to classical Mechanics: R. G. Takawale and P.S. Puranic
4. Classical Mechanical: Gupta, Kumar and Sharma
5. Classical Mechanics: P.V. Panat

B.Sc. III, Physics, Semester-V

DSE 5.1 (Elective)

Paper-XII: Nuclear Physics

Credits: 04

1. Nuclear Structure and Properties (12)

1.1 Composition of nucleus
1.2 Nuclear radius
1.3 Nuclear spin
1.4 Nuclear magnetic moment
1.5 Electric quadrupole moment
1.6 Mass defect
1.7 Binding energy
1.8 Packing fraction
1.9 Liquid drop model of nucleus
1.10 Semi-empirical mass formula

2. Nuclear Reactions (08)

2.1 General scheme of nuclear reactions
2.2 Q-value of nuclear reactions
2.3 Threshold energy
2.4 Cross-section of nuclear reactions (Qualitative)
2.5 Stripping reactions
2.6 Pick-up reactions

3. Particle Accelerators (10)

3.1 Need of accelerator
3.2 Cyclotron
3.3 Limitations of cyclotron
3.4 Phase stable orbit
3.5 Betatron

4. Nuclear Radiation Detectors (10)

4.1 Classification of detectors
4.2 Geiger-Muller counter
i. Construction and working
ii. Dead time, recovery time and resolving time
iii. Self quenching mechanism
4.3 Wilson Cloud chamber
4.4 Scintillation counter

5. Nuclear Energy Levels **(10)**

5.1 Alpha decay- α disintegration energy
5.2 α particle spectra
5.3 Nuclear energy levels
5.4 Beta decay- Experimental study of β decay
5.5 Continuous β - ray spectrum
5.6 Pauli's neutrino hypothesis
5.7 Nuclear energy levels from β decay

6. Elementary particles **(10)**

6.1 Introduction of elementary particles
6.2 Types of interactions
6.3 Classification of elementary particles,
6.4 Properties of particles
6.5 Introduction of quarks,
6.6 Different types of quarks.

Reference Books:

1. Nuclear Physics: Irving Kaplan (Addison Wesley)
2. Nuclear Physics : S.N. Ghoshal (S. Chand Publishing Co.)
3. Nuclear Physics : D.C. Tayal (Himalayan Publishing House)
4. Nuclear Physics : J.B. Rajam (S. Chand Publishing Co.)
5. Concepts of Modern Physics : Arthur Beiser (Tata McGraw Hill Publishing)
6. Atomic and Nuclear Physics : N. Subhramanyam & Brijlal (S. Chand Pub. Co.)
7. Concepts of Nuclear Physics : B.L. Cohen (Tata McGraw Hill Publishing)
8. Nuclear Physics- an Introduction: W.E. Barcham

B.Sc. III, Physics, Semester-V

DSE – 5.1 (Elective)

Paper-XII: Energy Studies

Credits: 04

1. **Energy** **(10)**
   - 1.1 Forms of energy
   - 1.2 Production of energy
   - 1.3 Energy and environment
   - 1.4 Energy and thermodynamics
   - 1.5 Conventional and non-conventional energy sources
   - 1.6 Energy resources
   - 1.7 Classification of energy resources
   - 1.8 Renewable and non-renewable energy sources

2. **Solar energy** **(10)**
   - 2.1 Natural effects of solar energy
   - 2.2 Solar energy plant
   - 2.3 Subsystems in solar energy plant
   - 2.4 Solar energy chains
   - 2.5 Solar constant, clarity index, solar insolation
   - 2.6 Solar photovoltaic cell or solar cell
   - 2.7 Solar photovoltaic systems
   - 2.8 Merits and demerits of solar PV panel system
   - 2.9 IV characteristics of photovoltaic cell
   - 2.10 Efficiency of solar cell

3. Wind energy **(10)**
   - 3.1 Wind
   - 3.2 Energy chains for wind energy
   - 3.3 Wind energy quantum
   - 3.4 Applications of wind energy
   - 3.5 Wind power density
   - 3.6 Wind turbine
   - 3.7 Efficiency factor of wind turbine (P-H) graph
   - 3.8 Types of wind turbine generator unit
   - 3.9 Horizontal Axis Wind Turbine (HAWT)
   - 3.10 Wind farm

4. Biomass energy **(10)**
   - 4.1 Origin of biomass
   - 4.2 Biomass energy resources
   - 4.3 Biomass conversion processes
   - 4.4 Direct conversion of biomass
   - 4.5 Thermochemical conversion of biomass (Pyrolysis)
   - 4.6 Biochemical conversion of biomass

5. Ocean Energy **(10)**

5.1 Introduction
5.2 Ocean energy resources
5.3 Off shore and on shore ocean energy conversion technologies
5.4 Advantages and limitations of ocean energy conversion technologies
5.5 The guidelines of ocean energy conversion plants
5.6 Ocean energy routes.

6. Atmosphere and energy **(10)**

6.1 Introduction
6.2 Energy transport in the atmosphere and to the poles
6.3 Vertical structure of the atmosphere
6.4 Vertical motion of humid air
6.5 The diabetes
6.6 Cumulus cloud formation
6.7 Horizontal motion of air
6.8 Geostrophic flow
6.9 Origin of pressure difference

Reference books:

1. Energy technology: S. Rao, Dr. B.B. Parulekar
2. Energy: A textbook: Howard C. Hayden
3. Solar energy and rural development- S. H. Pawar, C.D. Lokhande and R. N. Patil.
4. Environmental Science (physical Principals and Applications)- Egbert Boeker, Reenk Van Grondelle

B.Sc. III, Physics, Semester VI
CC 6.1

Physics Paper- XIV: Electrodynamics

Credits: 04

1. Electrostatics and Charged particle dynamics (10)

1.1 Coulomb's law

1.2 Gauss law in differential form

1.3 Poisson's and Laplace's equations

1.4 Applications of Poisson's and Laplace's equation to spherical systems

1.5 Motion of charged particle in constant electric (E) field

1.6 Motion of charged particle in constant magnetic (B) field

1.7 Motion of charged particle in constant crossed uniform electric and magnetic fields

2. Time varying fields (10)

2.1 Electromotive force

2.2 Electromagnetic induction-Faraday's laws

2.3 Lenz's law

2.4 Integral & Differential forms of Faraday's laws

2.5 Self inductance

2.6 Application of self-inductance to solenoid

2.7 Mutual inductance

2.8 Application of mutual inductance to transformer

3. Maxwell's equations (12)

3.1 Magnetic Susceptibility and permeability

3.2 Biot - Savart law

3.3 Derivation of $\nabla.\vec{B} = 0$

3.4 Ampere's law

3.5 Derivation of $\nabla \times \vec{B} = \mu_0 J$ or Differential form of Ampere's law

3.6 Equation of continuity

3.7 Displacement current density

3.8 Maxwell's correction to Ampere's law

3.9 Maxwell's equations for time dependent electric and magnetic fields in vacuum

3.10 Maxwell's equations for time dependent electric and magnetic fields in material medium

3.11 Physical significance (Integral form) of Maxwell's Equations

4. Electromagnetic waves (10)

4.1 Conservation of energy in electromagnetic fields and Poynting's theorem

4.2 Conservation of momentum in electromagnetic fields

4.3 Wave equations for electric and magnetic fields in vacuum

4.4 Plane wave solutions, orthogonality of $\vec{E}$, $\vec{B}$ and propagation vector $\vec{k}$

4.5 Plane E. M. waves in dielectric

4.6 Plane E. M. waves in conductors, Attenuation of wave in metal (skin depth)

5. Reflection and Refraction of E.M. waves (10)

5.1 Boundary conditions for E. M. field vectors ($\vec{D}, \vec{B}, \vec{E}$ & $\vec{H}$)

5.2 Reflection and refraction of E. M. waves at a boundary of two dielectrics (Normal incidence only)

5.3 Reflection from a conducting plane – normal incidence

5.4 Total internal reflection.

6. Radiation from Electric Dipole (08)

6.1 Electric dipole

6.2 Retarded time and retarded potential

6.3 Electric dipole radiation

6.4 Radiation reaction for electric dipole

Reference Books:

1. Introduction to Electrodynamics (second edition) – David J. Griffiths
2. Introduction to Electrodynamics (third edition) – David J. Griffiths
3. Classical Electrodynamics – J. D. Jackson
4. Classical Electrodynamics – S. P. Puri
5. Electrodynamics – B. B. Laud
6. Foundations of Electromagnetic theory – Reitz and Milford

B.Sc. III –Physics, Semester-VI

CC 6.2

Paper XV: Materials Science

Credits: 04

1. Materials and their properties: **(10)**

- 1.1 Classification of materials
- 1.2 Organic, inorganic and biological materials
- 1.3 Properties of materials
  - 1.3.1 Mechanical properties
  - 1.3.2 Thermal properties
  - 1.3.3 Optical properties
  - 1.3.4 Electrical properties
  - 1.3.5 Magnetic properties

2. Polymer materials: **(10)**

- 2.1 Polymers
- 2.2 Polymerization mechanism
  - 2.2.1 Additional polymerization
  - 2.2.2 Condensation polymerization
  - 2.2.3 Homo-polymer
  - 2.2.4 Co-polymer
- 2.3 Degree of polymerization
- 2.4 Defects in the polymers
- 2.5 Mechanical properties of polymers, deformation, reinforced polymers
- 2.6 Applications of polymers.

3. Ceramic Materials: **(10)**

- 3.1 Classification of ceramic materials
- 3.2 Structure of ceramics
- 3.3 Ceramic possessing
- 3.4 Properties of Ceramics
- 3.5 Applications of Ceramics

4. Composite Materials: **(8)**

- 4.1 Fabrication of composites
- 4.2 Mechanical properties of composites
- 4.3 Particle-Reinforced Composites
- 4.4 Fiber-Reinforced composites
- 4.5 Applications of composites

5. Biomaterials: **(08)**

- 5.1 Bio-Mechanism
- 5.2 Classification of Biomaterials
- 5.3 Processing of Biomaterials
- 5.4 Properties of Biomaterials
- 5.5 Applications of Biomaterials

6. Nanomaterials: (14)

6.1 Introduction to nano-sized materials and structures
6.2 Brief history of nanomaterials and challenges in nanotechnology
6.3 Significance of nano-size and properties
6.4 Classification of nano structured materials
6.5 Methods of synthesis of nanomaterials
6.5.1 Bottom-up and Top-down approaches
6.5.2 Physical methods: High energy ball milling, Physical vapors deposition, sputter deposition, Ultrasonic spray pyrolysis etc.
6.5.3 Chemical methods: colloidal method, co-precipitation and sol-gel method
6.5.4 Hybrid method: Electrochemical and chemical vapors deposition.

Reference Books:

1. Material science by S.L. Kakani, Amit Kakani, New age international publishers.
2. Materials science and engineering, V. Raghavan, 5th edition, PHI
3. Materials science by R.S. Khurmi, S. Chand
4. Materials science, G.K. Narula, K.S. Narula, V.K. Gupta, Tata McGraw-Hill.
5. Semiconductor physics and devices by S.S. Islam, Oxford university press, 1st edition
6. Nanotechnology: An Introduction to Synthesis, Properties and Applications of Nanomaterials, by Thomas Varghese & K.M. Balakrishna, Atlantic publication
7. Introduction to nanoscience and nanotechnology, by Chattopadhyay K.K., Banerjee A.N., PHI
8. Materials science – V. Rajendran & A. Marikani (TMHl).
9. Elements of material Science & engineering.- I.H.Van Vlack (4th Edition.).
10. Nanotechnology: Principles and Practices by Sulbha Kulkarni, Capital Publishing Co.New Delhi.
11. Introduction to nanotechnology, by C. P. Poole Jr. and F. J. Ownes, Willey Publications.
12. Origin and development of nanotechnology by P. K. Sharma, Vista International publishing house.
13. Nanostructure and nanomaterials synthesis, Properties and applications, by G. Cao, Imperials College Press, London.

B.Sc. III –Physics, Semester-VI

CC 6.3
Paper -XVI: Atomic Physics, Molecular Physics and Quantum Mechanics

Credits: 04

1. Atomic Spectra (10)
1.1 Review of quantum numbers
1.2 Electronic configuration of alkali metals
1.3 Spectral notations with examples
1.4 Alkali spectra
1.5 Doublet fine structure of alkali metals
1.6 Spectrum of Sodium
1.7 Selection rules
1.8 Intensity rules

2. Effects of Magnetic and Electric fields on Atomic Spectra (10)
2.1 Anomalous Zeeman effect and its explanation from vector atom model
2.2 Paschen Back effect
2.3 Paschen Back effect in principal series doublet
2.4 Selection rules for Paschen Back effect
2.5 Stark effect of hydrogen
2.6 Weak field Stark effect in hydrogen
2.7 Strong field Stark effect in hydrogen

3. Molecular Spectra and Raman Effect (12)
3.1 Molecular bond
3.2 Rotational energy levels and Rotational spectra
3.3 Vibrational energy levels and Vibrational spectra
3.4 Vibration-Rotation spectra
3.5 Electronic spectra of a diatomic molecule
3.6 Franck-Condon principle
3.7 Raman effect
3.8 Characteristic properties of Raman lines
3.9 Classical theory of Raman effect

4. Quantum Mechanics (08)
4.1 Heisenberg's uncertainty principle (Statement) and its similarity with concept of matter waves
4.2 Physical significance of ψ
4.3 Time dependent and time independent Schrödinger wave equations
4.4 Eigen values and Eigen functions
4.5 Probability current density

5. Application of Schrodinger's time independent wave equation (10)

5.1 Particle in a Box (one and three dimensional cases), its Eigen values and Eigen functions.

5.2 Step Potential (Statement, boundary conditions, Schrodinger's equations in different regions and discussion of results)

5.3 Potential Barrier (Statement, boundary conditions, Schrodinger's equations indifferent regions and discussion of results)

5.4 Potential Well (Statement, boundary conditions, Schrodinger's equations in different regions and discussion of results)

5.5 Linear Harmonics Oscillator – Eigen values and Eigen functions

5.6 Zero point energy

6. Operators (10)

6.1 Operators in quantum mechanics

6.2 Expectation values and properties

6.3 Angular momentum operators

6.4 Commutation properties for components Lx, Ly, Lz

6.5 Commutation for L^2 and Lz operators and their Eigen values

6.6 Schrodinger's equation for hydrogen atom

6.7 Separation of radial and angular parts

Reference Books:

1. Atomic Spectra – H.E. White
2. Molecular Spectroscopy - Banwell
3. Molecular Spectroscopy – Hertzberg
4. Quantum Mechanics – Mathews and Venkateshan
5. Introduction to Quantum Mechanics - Pauling and Wilson
6. Elements of Quantum Mechanics - Kamal Singh and S.P. Singh.
7. Perspectives of Modern Physics – Arthur Beiser
8. Quantum Mechanics – Chatwal Anand
9. Quantum Mechanics – I , The fundamentals- S. Rajasekar, R. Velusamy

B.Sc. III –Physics, Semester-VI
DSE 6.1 (Elective)
Paper- XVII: Electronics

Credits: 04

1. Operational Amplifier: (10)

1.1 Block diagram of OP-AMP
1.2 Characteristics of OP-AMP
1.3 OP-AMP parameters
1.4 OP-AMP as inverting amplifier
1.5 OP- AMP as non- inverting amplifier
1.6 Applications of OP-AMP
- 1.6.1 Adder
- 1.6.2 Subtractor
- 1.6.3 Differentiator
- 1.6.4 Integrator
- 1.6.5 Comparator
- 1.6.6 Schmitt's trigger

2. Timer: (08)

2.1 Functional Block diagram of IC 555, its Pin connections
2.2 Operating modes
- 2.2.1 Monostable
- 2.2.2 Astable

2.3 Applications of timer IC 555
- 2.3.1 Linear ramp generator
- 2.3.2 Square wave generator
- 2.3.3 Voltage to frequency converter

3. Silicon Controlled Rectifier (SCR) (10)

3.1 Four-layer PNPN diode
3.2 SCR construction and working
3.3 Characteristics of SCR
3.4 Turn ON and Turn OFF methods of SCR
3.5 Applications of SCR to control the speed of DC motor

4. Diac and Triac (08)

4.1 Construction, working and characteristics of Diac
4.2 Applications of Diac
- 4.2.1 Lamp dimmer
- 4.2.2 Heat control

4.3 Construction, working and characteristics of Triac
4.4 Applications of Triac
- 4.4.1 High power lamp switch
- 4.4.2 Electronic change over power transformer

5. Display Devices **(12)**

5.1 Classification of Displays
5.2 Light emitting Diode displays
5.3 Liquid Crystal Displays and its Important Features
5.4 Other displays
5.4.1 Gas Discharge plasma Displays
5.4.2 Electrophoretic Image Displays (EPID)
5.4.3 Liquid Vapour Display (LVD)

6. Field Effect Transistor **(12)**

6.1 Review of JFET
6.2 Metal Oxide Semiconductor FET (MOSFET)
6.2.1 Schematic symbols and Types of MOSFET-a) D-MOSFET and b) E-MOSFET
6.3 D-MOSFET
6.3.1 Circuit Operation
6.3.2 Transfer Characteristic
6.3.3 Transconductance and input impedance
6.4 E-MOSFET
6.4.1 Circuit Operation
6.4.2 Transfer Characteristic
6.4.3 Transconductance and input impedance

Reference Books:

1. Electronic Principles – Malvino & Leech
2. Basic Electronic – Grob
3. Electronic Circuits and Devices – Allan Mottershed
4. Linear Op-Amp – Ramakanth Gaikwad
5. Principles of Electronics (Eleventh Edition)– V. K. Mehta (S Chand and Co. Ltd.)
6. Basic Electronics Solid State – B. L. Thereja. (S Chand and Co. Ltd.)
7. Electronic Instrumentation – H. S. Kalsi

B.Sc. III –Physics, Semester-VI
DSE 6.1 (Elective)
Paper- XVII: Instrumentation

Credits: 04

1. Transducers and Sensors (10)

1.1 Transducers and Sensors (Working principle, efficiency, applications):
1.2 Active and passive transducers.
1.3 Characteristics of Transducers.
1.4 Transducers as electrical element and their signal conditioning.
1.5 Temperature transducers: RTD,
1.6 Thermistor.
1.7 Position transducer: Strain gauge, piezoelectric transducer.
1.8 Inductance transducer: Linear variable differential transformer (LVDT),
1.9 Capacitance transducer.
1.10 Magnetoresistive transducer.
1.11 Sensor - Dry reed relay
1.12 Servomotor sensors

2. Characterization techniques-I (Electron Microscopy) (10)

2.1 Resolution and Magnification of Electron microscope
2.2 Construction, working of SEM
2.3 Application of SEM
2.4 Construction and working of TEM
2.5 Application of TEM
2.6. Difference between optical and electron microscopy.

3. Characterization techniques-II (Spectroscopic techniques) (10)

3.1 UV-Visible spectroscopy
- 3.1.1 Principle
- 3.1.2 Construction and working of ultra-visible (UV) spectrophotometer
- 3.1.3 Application of UV-Visible spectroscopy

3.2 Infra Red (IR) Spectroscopy
- 3.2.1 Principle
- 3.2.2 Construction and working of IR spectrophotometer
- 3.2.3 Application of IR spectroscopy

3.3 Raman spectroscopy
- 3.3.1 Principle
- 3.3.2 Construction and working of Raman Spectrometer
- 3.3.3 Application of Raman Spectroscopy

3.4 X-ray photoemission spectroscopy (XPS)
- 3.4.1 Principle
- 3.4.2 Construction and working of X-ray photoemission Spectrometer
- 3.4.3 Application of XPS.

4. X-ray Diffraction **(10)**

4.1 Principle
4.2 Construction and working of X-ray diffractometer
4.3 Application of X-ray diffraction.
4.4 X-ray Fluorescence (XRF).

5. Mossbauer Spectroscopy **(10)**

5.1 Principle
5.2 Construction and working of Mossbauer spectrometer
5.3 Application of Mossbauer Spectroscopy.

6. Bio-medical Instruments **(10)**

6.1 Electro Cardio Gram (ECG)
    6.1.1 Principle
    6.1.2 Construction and working of ECG
    6.1.3 Application of ECG.
6.2 Electro Encephala Graph (EEG)
    6.2.1 Principle
    6.2.2 Construction and working of EEG
    6.3.3 Application of ECG.
6.3 Magnetic Resonance Imaging (MRI)
    6.3.1 Principle
    6.3.2 Construction and working of MRI
    6.3.3 Application of MRI.

Reference Books:

1. Electronic Instrumentation - H.S. Kalsi
2. Handbook of Biomedical Instrumentation- R.S. Khandpur and Raghbir Khandpur.
3. Biomedical instruments and measurements- M. L. Cromwell.
4. Introduction to Biomedical Instruments: Barbara Christ
5. Fundamentals of molecular spectroscopy- Colin N. Banwell & E. M. McCash, 4th Edition.
6. Basic Electronics Solid State – B. L. Thereja. (S Chand and Co. Ltd.)
7. Instrumentation devices and system- Rangan, Sarma, Mani, (Tata Mc Graw Hill.)
8. Instrumentation measurements and analysis- Nakra, Chaudhari, (Tata Mc Graw Hill.)
9. Sensor and Transducers- Patrandis (PHI)
10. Elements of X-ray diffraction-B. D. Cullity

B. Sc. Part III Physics Practical

Group-I

1. S.T. of a Soap film
2. S.T. by Ferguson's modified method
3. S.T. by ripple method
4. Modulus of rigidity of a wire by Maxwell's needle
5. Y and η using Flat Spiral Spring
6. Y by Koenig's method
7. Stefan's fourth power law
8. Viscosity of a given liquid by logarithmic decrement.
9. Motion of Spring and calculate (a) Spring Constant and (b) Value of G
10. Thermal conductivity by Lee's method
11. Velocity of sound by CRO
12. Thermocouple: To study Seebeck and Peltier effect

Group-II

1. Crystallography and study of XRD pattern
2. Hall effect
3. Hysteresis by magnetometer
4. High resistance by leakage method
5. Resistivity and band gap of semiconducting material by four probe method.
6. Thin film preparation by any chemical method
7. Self inductance by Owen's bridge
8. Measurement of B_H, B_V and q using Earth Inductor
9. Thermo-electric power of thin film
10. Calibration of bridge wire by Carey Foster's bridge method.
11. Absolute capacitance of condenser by BG method.
12. Phase Diagram

Group-III

1. Cardinal points by Newton's method
2. Cardinal points by turn method
3. Lloyd's single mirror
4. Transverse and spherical aberration of thick lens
5. Diameter of a Lycopodium powder
6. Resolving power of prism
7. Elliptically and circularly polarized light
8. e/m by Thomson method
9. Diffraction due to straight edge.
10. Dispersive Power of grating
11. Y by Cornu's method
12. Resonating pendulum

Note: At least 10 experiments must be completed from each group (Group-I to Group-III).

Group-IV

(A) Nuclear Physics and Computer

1) Estimation of efficiency of GM counter
2) Determination of Beta particle range and maximum energy
3) To create resume by MS word and worksheet of student mark sheet by MS Excel. Convert resume and worksheet into PDF. Mail this PDF document and take its print.
4) Plot graph using origin, calculate slope and make calculations
5) Create poster of your seminar presentation by power point presentation.
6) Create documents in IEEE format by using mathematical model, mathematical functions, various signs and symbols

(B) Energy studies

1) To study photo response of given solar cell.
2) To study the current-voltage characteristic of solar cell under illumination.
3) Study of sensible heat storage using liquid.
4) Thermal efficiency of liquid – flat plate collector.
5) Study of box type solar cooker.
6) Determination of instantaneous thermal efficiency of parabolic collector.

(C) Electronics

1) Astable Multivibrator using IC555
2) OP-AMP as inverting amplifier
3) OP-AMP as comparator –Schmitt's trigger
4) RS and JK flip flops
5) FET as VVR
6) Study of mono-stable operation of IC 555

(D) Instrumentation

1) Study IR, UV and XPS pattern of the material.
2) Determination of Crystal structure by XRD and study of microstructure by SEM/TEM pattern.
3) Study of ECG/EEG/MRI pattern
4) Study of Mossbauer XPS Pattern
5) Temperature sensor: NTCR/PTCR
6) LDR

Note: Group-IV is DSE type.

Student can choose any two sub-groups from Group-IV as per her/his selected DSE theory papers (Physics paper-XII and Physics Paper-XVII). At least 05 experiments must be completed from each sub-group (Group-IV).

References:

1) B .Sc Practical Physics- Harnam Singh, P.S. Hemane (S Chand and Comp. Ltd.)

2) Advanced Practical Physics –Nelkon

3) Practical physics - Rajopadhye and Purohit

4) Practical Physics – P R Sasi Kumar

5) Physics Practical- Subramanayam and Brijlal

6) Physics Practical – Worsnop Flint.

7) B.Sc. Physics Practical- C. L. Arora

List of Skill Enhancement Courses

SEC 1) Thin film deposition and Characterization Techniques
SEC 2) Scientific Research Paper Writing and Publication
SEC 3) Medical Physics
SEC 4) Testing and Repairs of Electric Appliances
SEC 5) Solar Panel Installation and Maintenance
SEC 6) Laboratory Safety and Disaster Management

Skill Enhancement Course

SEC 1

Add-on-self learning (On-line Platform: MOOC/SWAYAM Course/ Skill Course)

Credits: 04

Paper Name: Thin film deposition, substrate cleaning and characterization techniques
Credits- 4 (Theory: 2; Lab: 2) Theory: 30 Lectures

Course Objective:

To understand the role of thin film in society. To enable the students to familiar and experience with various cost-effective thin film deposition techniques

Chapter 1. Thin film preparation techniques (6)

1.1 Introduction
1.2 Role of thin film in various sectors
1.3 Properties and applications of thin films
1.4 Top-down and bottom-up approaches
1.5 Thin film deposition techniques
1.6 Advantages and disadvantages of preparation techniques

Chapter 2. Chemical deposition techniques for thin film (9)

2.1 Introduction
2.2 Chemical bath deposition method (CBD)
2.3 Successive Ionic Layer Adsorption and reaction (SILAR) deposition technique
2.4 Spray Pyrolysis technique
2.5 Sol-Gel technique
2.6 Advantages and Disadvantages of chemical techniques over physical techniques

Chapter 3. Materials choosing and substrate cleaning techniques (9)

3.1 Introduction
3.2 Material choosing for various application
3.3 Substrate cleaning equipments and techniques
3.4 Conductive and non-conducting substrate cleaning
3.5 Effect of substrate cleaning in thin film preparation
3.6 Environmental effect on substrate cleaning process

Chapter 4. Thin film Characterization techniques (6)

4.1 Introduction
4.2 X-ray diffraction Technique
4.3 Electrical Resistivity
4.4 Water Contact angle
4.5 Scanning Electron Microscopy
4.6 Optical band gap

Lab: (Credits= 2) (30 hrs)

1. Prepare thin film ZnO thin film by Chemical bath deposition (CBD) technique
2. Prepare thin film ZnO thin film by SILAR technique
3. Prepare a thin film of PbS thin film by CBD method

4. Prepare a thin film of PbS thin film by SILAR method
5. To study any two characterizations of given thin film sample

Course Outcomes:

To create new innovative ideas of developing thin films materials for various energy storage applications.

References books:

1) Materials Science by S.L. Kakani
2) Materials Science by R.S. Khurmi, S. Chand
3) Nanotechnology: Principals and practices by Sulbha Kulkarni, Capital Publishing Co. New Delhi.
4) Hand book of thin film deposition processes and techniques by Krishna Seshan

Skill Enhancement Course

SEC 2

Add-on-self learning (On-line Platform: MOOC/SWAYAM Course/ Skill Course)

Credits: 04

Paper Name: Scientific Research paper writing and Publications
Credits- 4 (Theory:2; Lab:2) Theory: 30 Lectures

Course Objective:

The major purpose of this course is to provide you with technical knowledge and skills necessary to write and to publish professional papers.

Chapter 1. Scientific writing (7)

1.1 Structure and competent of scientific reports
1.2 Types of reports
1.3 Technical reports and project writing
1.4 Different steps in preparation, layout
1.5 Illustration and tables
1.6 Bibliography, referencing and footnotes
1.7 Need of scientific words with examples

Chapter 2. Technical writing (7)

2.1 Introduction to origin software
2.2 Defining origin command, Channing the type style, symbols from other languages
2.3 Equation representation: Formulae and equations
2.4 Figures and other flowing bodies, Lining in columns
2.5 Generating tables of contest, making an index
2.6 Fonts, pictures, colors

Chapter 3. Scientific graphics and data analysis (6)

3.1 Creating a chart in MS-Excel
3.2 Types of Charts- Column, Pie, Line, bar, area, scatter, surface charts
3.3 Chart elements: Style, filter, fine tuning of chart
3.4 Chart designing tools- Design and format
3.5 Nonlinear fitting, Custom fitting functions
3.6 Templets and themes

Chapter 4. Scientific graphics and data analysis (10)

4.1 Discussions
4.2 Required readings in texts and journals
4.3 Analysis and overview of journals in your field or area of specialization
4.4 Preparation and submission of a manuscript for publication including: Title page and Abstract, Scientific paper written according to style of requirements, cover letter to editor
4.5 Peer-review of class member's manuscripts
4.6 Power point presentation or poster presentation

Lab: (Credits=2) (30 hrs)

1. Writing an essay of research paper in own scientific language.
2. Prepare an abstract for a conference with the given instructions.
3. Prepare a poster presentation for conference with the given instructions.
4. Make a power point presentation of your scientific work.
5. Make a chart, graph, table with given data in origin and Microsoft excel.
6. Prepare a draft manuscript of your own scientific work.

Course Outcomes:

Students will be able to identify and different parts of research paper, write article, projects, power point presentation, poster presentation using Microsoft office and origin software.

References books:

1) Technical writing: A practical guide for engineers and scientist by Phillip A. Laplante
2) A scientific approach to writing for engineers and scientist by Robert E. Berger
3) The scientist guide to writing by Stephen B. Heard
4) MOS study guide for Microsoft power point Exam MO-201 by Paul McFedries
5) https://www.originlab.com/do

Skill Enhancement Course

SEC 3

Add-on-self learning (On-line Platform: MOOC/SWAYAM Course/ Skill Course)

Credits: 04

Paper Name: MEDICAL PHYSICS

Paper Objectives

* Develop basic understanding of concepts of medical physics,

* Develop problem-solving and critical-thinking skills,

* Learn the skills of handling and maintaining instruments,

* Develop scientific communication skills.

Unit 1-Computers in Medical Imaging (10)

Storage and transfer of data in computers- number systems, decimal and binary number systems, Components and operation of computers, CPU - input/output bus and expansion slots, memory devices, storage devices , keyboard and printer, Performance of Computer systems, Computer Software - Storage, Processing and display of digital Images.

Computer Networks - basic principles - local area network, large area network and network linking, network security, images, network for image and data transfer, storage of images, display of images.

Unit 2 - X-ray Generators for medical use (10)

Discovery, Production and Properties of X-rays, Characteristic and Continuous X-ray spectra, Design of hot cathode X-ray tube, Basic requirements of Medical diagnostics, Rotating anode tubes, safety devices in X-ray tubes, X-Ray proof and shock proof tubes, Insulation and cooling of X-ray tubes, Current and Voltage stabilizers, Automatic exposure control, Automatic Brightness control, Measuring instruments- measurement of kV and mA,

Unit 3- Applications of Ultrasonics in medicine (10)

Characteristics of sound - propagation of sound - wavelength, frequency and speed, Pressure, intensity and dB scale. Interactions of Ultra sound waves with body tissues, Production of ultrasonics, acoustic coupling, Image formation , reflection, refraction, scattering, attenuation, Transducers**,** Piezoelectric materials, resonance transducers, damping block, matching layer Acoustic coupling, Image data acquisition.

Unit 4: Applications of Optics and Lasers in Medicine (10)

Various types of optical radiations - UV, visible and IR , Lasers: Theory and production of medical lasers, Laser Surgical Systems, Measurement of fluence from optical sources, Optical properties of tissues – theory and experimental techniques-interaction of laser radiation with tissues, photothermal, photochemical, photoablation and electromechanical effects, Basic laser safety – eye hazards, skin hazards, electrical hazards, fire and flood hazards, safety measurements.

Unit 5- Magnetic Resonance Imaging (MRI) (10)

Magnetization properties, Magnetic resonance image, Proton density, Generation and detection of MR signal-free induction decay T_1 and T_2 relaxation, Pulse sequences - Spin Eco T_1 weighting, spin density weighting, T_2 weighting; Inversion Recovery, Gradient recalled Eco, Signal from flow, Magnetization transfer contrast, Localization of the MR Signal, magnetic field gradients, slice select gradient, frequency encode gradient, phase encode gradient, safety and Bio effects.

Unit 6 -Radiation detection and dosimeters (10)

Principles of Radiation detection, properties of dosimeters, Theory of gas filled Detectors, Ion chamber dosimetery systems, free air ion chamber, parallel plate Chamber, ionization chamber, GM counter, condenser type chambers, working and different applications, film dosimetery, Luminescence dosimetry, semiconductor dosimeter, Gel dosimetry, radiographic and radiochromic films, scintillation detections.

Reference Books

1. Curry, T. S. Dowdey, J. E. Murry, R. C, (1990), Christensen's Introduction to the Physics of diagnostic radiology, 4th edition
2. Hendee, W. R. & Ritenour, R. (1993) Medical Imaging Physics, 3rd edition
3. E. Seeram, X-ray imaging equipment, An introduction
4. Ramesh Chandra, Nuclear Medicine Physics 5th edition , Lea & Febiger, Philadelphia
5. J. T. Bushberg, J. A. Seibert, E. M. Leidholdt Jr. and J. M. Boone, The essential Physics of Medical Imaging, (Lippincott, Williams & Wilkins, Philadelphia, 2012).
6. K. Thayalan, The Physics Of Radiology And Imaging (Jaypee Brothers Medical Publishers, 2014)
7. B. H. Brown, R. H. Smallwood, D. C. Barber, P.V. Lawford and D. R. Hose, Medical Physics and Biomedical Engineering (CRC Press, 1998
8. Markolf H. Neimz, Laser-Tissue Interactions, Springer Verlag, Germany, 1996.
9. MRI – Perry Sprawls – Medical Physics Publishing, Madison, Wisconsin-2000
10. Advances in Diagnositc Medical Physics – Himalaya Publishing House-2006.

Practicals

1. Quality assurance of diagnostic x-ray machine
2. Verification of inverse square law
3. Determination of plateau and resolving time of a GM counter and its application in measurement of beta source activity
4. Range of beta particles measurement
5. Calibration of survey instruments and pocket dosimeters
6. Filtering and removal of artifacts in Biosignals
7. To stimulate Biopotential amplifier
8. To simulate Electrocardiogram(ECG) waveform

Skill Enhancement Course

SEC 4

Add-on-self learning (On-line Platform: MOOC/SWAYAM Course/ Skill Course)

Credits: 04

Paper Name: Testing and Repairs of Electric Appliances
(Total Credits: 02 and Contact Hrs. 30)

1. Basic Introduction of Electricity	1.1 Safety Rule 1.2 Basic Introduction of Electricity 1.3 Conductors and Insulators 1.4 Types of testing 1.5 Wires and Their Types 1.6 Electrical Quantities and Their Units 1.7 Earthing 1.8 Fuses	**08**
2. Electrical Appliances 1	Working Testing andrepairs of 2.1 Laws of Resistance and Resistors 2.2 Electrical Circuits and Ohms Law 2.3 Effects of Electric Currents 2.4 Electric Iron 2.5 Automatic Iron 2.6 Geyser 2.7 Toaster	**07**
3 Electrical Appliances 2	Working, Testing and repairs of 3.1 Magnet and Electromagnet 3.2 Electric Door Bell 3.3 Ceiling fans 3.4 Table fans 3.5 Hair dryer 3.6 Geyser- Instant and Storage Type	**08**
4 Electrical Appliances 3	Study of different parts, fault finding repairs and testing of parts of 4.1 Tungsten Filament Lamp, Mercury and Sodium Vapor Lamps 4.2 Tube light 4.3 Mixer 4.4 Air cooler 4.5 Emergency light 4.6 Fridge	**07**

Practical Paper: Testing and Repairs of Electric Appliances
(Total Credit 1 and Contact Hrs. 30)

1. Prepare a test lamp and testing
2. Wire continuity testing and connection according to color coding.
3. Actual earthing making and testing.
4. Replacement of fuse.
5. Study of electric Iron and automatic iron
6. Checking of different parts of tube light and repairs
7. Study assembly and repairs of hair dryer
8. Checking and repairs of regulator and fan connections
9. Checking and repairs of fan motor winding
10. Testing of capacitor and replacement.
11. Study of different parts of mixer, fault finding and repairs
12. Fault finding repairing and testing of Air Cooler
13. Study of different parts, circuit diagrams, fault finding and repairs of Emergency light.
14. Study of different parts, repairing of toaster
15. Fault Finding, Repairing and Testing of Freeze

Field work and project: Testing and Repairs of Electric Appliances

(Total Credits: 1)

The Project may be on laboratory works/Field work/Industrial visit for 20 marks. Its report should be submitted at the time of university practical examination for 01 credit.

Reference Books

1. Modern Electronic Instrumentation and Measurement — Albert D. Helfrick and William David Cooper
2. Electrical and Electronic Measurements and Instrumentation — A K Sawhney
3. Basic electrical engineering — M. L. Anwani
4. Basic electrical engineering Vol. I, II, III, IV. — P. P. Shah
5. Basic electrical engineering Vol.I,II,III,IV. — B. L. Theraja
6. Electrical Mechanics — V. K. Mehta
7. Subodh Vidyutshatra — Trambak Waghmare