"Dissemination of Education for Knowledge, Science and Culture"
- Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

Vivekanand College, Kolhapur (Autonomous)

DEPARTMENT OF PHYSICS

B.Sc. Part - III
Semester-V & VI

SYLLABUS

Under Choice Based Credit System

to be implemented from Academic Year 2020-21

Semester	Paper No.	Course Code	Course Title	No. of Credits
V	V	DSC-1001E1	Classical Mechanics and Quantum Mechanics	8
V	VI	DSC-1001E2	Nuclear and Particle Physics and Mathematical Physics	8
VI	VII	DSC-1001F1	Semiconductor Devices and Instrumentation and Elements of Modern Physics	8
VI	III	DSC-1001F2	Solid State Physics I and II	8
V	-	SEC-III	Basic Instrumentation Skill	2
VI	-	SEC-IV	Physics workshop Skill	2

PHYSICS Paper V

Discipline Specific Elective Course (DSE-1001E1)Classical Mechanics and Quantum Mechanics Theory: 72 Hours (90 Lectures of 48 minutes)

Marks -100 (Credits: 04)

CO's:

After completion, students are able to

CO_1: demonstrate and understand the knowledge of classical and quantum mechanics

CO_2: get a proficiency in solving problems in classical and quantum mechanics

CO_3: understand the basic concepts like Virtual work, D'Alembert's Principle, Lagrangian and Hamiltonian Principle, Euler's Theorem, Elastic and inelastic scattering, De-Broglie's Hypothesis, Schrodinger's Equations, Operators, Hydrogen Problems, Eigen's values and functions

CO_4: develop the critical skill in students to understand classical and quantum mechanics

Section I
Classical Mechanics

Unit	Syllabus	Lectures
Unit 1	**1. Rigid body motion** Motion of rigid body in space, Euler's theorem, Angular momentum and kinetic energy, Euler's equation of motion. **2. Non Inertial frames of systems** Coordinate systems moving with constant velocity, constant acceleration, uniformly rotating frames of references, Effects of Earths motion on acceleration due to gravity, Effect of Coriolis force, Motion of a particle on a earth, Focault's pendulum.	12
Unit 2	**1. Langrangian and Hamiltonian formulation:** Limitations of Newtonian formulation, Types of constraints, degrees of freedom, generalized coordinates, configuration space, D'Alembert's principle of virtual work, Langrangian equation from D'Alembert's principle, variational principle, cyclic coordinates, Configuration space, Phase space and State space, Hamilton's equations. **2. Scattering of particles** Elastic and inelastic scattering, Elastic scattering - Laboratory and centre of mass system. Scattering, Relation between scattering angles in laboratory and centre of mass system. Differential cross-section, impact Parameter, total cross-section, Rutherford scattering.	24

Section II Quantum Mechanics

Unit	Syllabus	Lectures
Unit 1	**1. Introduction to Quantum Mechanics** Origin of quantum mechanics, Review of black body radiation, Photoelectric effect, matter waves, De-Broiglie hypothesis , experimental evidence of de Broglie theory (Davisson and Germer experiment), wave particle duality, Heisenberg's uncertainty principle and different forms uncertainty principle	18

	Physical interpretation of wave function, Schrodinger's time dependent and independent equation (one and three dimensional) Requirements of wave function. Eigen value, Eigen function, Normalized orthogonal and orthonormal wave functions, Probability current density (Continuity equation). Examples on Normalization of wave function **3. Operator in Quantum Mechanics** Definition of an operator in quantum mechanics, commutation relation in quantum mechanics, position, momentum and angular momentum operator, Angular momentum operator in spherical polar coordinate system, Hamilton operator, Hamilton operator commutation relation between x' and p. Expectation value of an operator communication relation between L2 and components of L, Raising and lowering operator L+ and L-. Eigen values of L2 and L1. Concept of parity operator. Concept of Hermitian operator.	
Unit 2	**1. Applications of Schrodinger's Steady State Equation** Quantum mechanics treatment of particle in rigid box (1D and 3D). Step potential relation and transmission coefficient. Barrier potential- Tunnelling effect, α-decay, simple harmonic oscillator. 2. Quantum Theory of Hydrogen Atom Schrodinger's equation in spherical polar co-ordinates, Schrodinger's equation for hydrogen atom in spherical polar co-coordinators (r, θ, ϕ), separation of angular and radial part and their solution, quantum numbers. n, l, ml, ms and their significances.	18

Reference books :

1. Introduction to classical mechanics-R.G.Takwale and P.S.Puranik
2. Classical Mechanics, by H Goldstein (Addison Wesley 1980).
3. Classical Mechanics, by J.C. Upadhyaya (Himalaya Publishing House 2015).
4. Classical Mechanics, by N C Rana and P S Joag (Tata McGraw Hill 1991).
5. Classical Mechanics, by Gupta, Kumar and Sharma (Pragati Prakashan 2000).
6. Classical mechanics-J.C. Upadhyaya.
7. A Text book of Quantum Mechanics, P.M. Mathews & K. Venkatesan, 2nd Edn.,2010, Tata McGraw Hill,
8. Quantum Mechanics, Leonard I. Schiff, 3rdEdn. 2010, Tata McGraw Hill.
9. Quantum Mechanics Theor and Applications, A.K. Ghatak and S.Lokanathan,1995, Macmillan India Ltd.
10. Quantum MechanicsTheory and Applications,Ajoy Ghatak and S. Lokanathan, 5th Ed.,2017, Trinity.
11. Quantum Mechanics,Chatwal and Anand, Reprint 2010, Himalaya Publishing house
12. Quantum Mechanics, Gupta, Kumar, Sharma, Thirtieth Ed., 2011, Jai PrakashNath Publications.
13. Advanced Quantum Mechanics, SatyaPrakash, Reprint 2011, KedarNath Ram NathMeerut.
14. Advanced Quantum Mechanics, B. S. Rajput, Ninth Ed., 2009, PragatiPrakashan.

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14. Advanced Quantum Mechanics, B. S. Rajput, Ninth Ed., 2009, PragatiPrakashan.
15. Quantum Mechanics, B. N. Srivastava, Reprint 2011, PragatiPrakashan.
16. Quantum Mechanics, P. J. E. Peebles, 2003, Prentice Hall of India.
17. Quantum Mechanics, S. P. Singh,M. K. Bagde, Kamal Singh, S. Chand& company Ltd,New Delhi
18. Modern Physics, R. Murugeshan, 1997, S. Chand & Company Ltd.
19. Atomic Physics J. B. Rajam, S.Chand& Company Ltd.
20. Perspectives of Modern Physics, Arthur Beiser, McGraw Hill International Editions.
21. Concepts of Modern Physics,ArthurBeiser, ShobhitMahajan, S. RaiChoudhury, Sixth Edition, Tata McGraw Hill Education Private Ltd.
22. Modern Physics, S. L. Kakani and ShubhraKulkarni, 2006, Viva books Private Ltd.
23. Modern Physics, D. L. Sehgal, K. L. Chopra and N. K. Sehgal, Reprint 1995, Sultan Chand & sons.
24. Introduction to Modern Physics, F. K. Richtmyer, E. H. Kennard, John N. Cooper, Sixth Edition, Tata McGraw Hill Education Private Ltd.

PHYSICS Paper VI

Discipline Specific Elective Course (DSE-1001E2)
Nuclear and Particle Physics and Mathematical Physics
Theory: 72 Hours (90 Lectures of 48 minutes)
Marks -100 (Credits: 04)

CO's:

After completion, students are able to

CO_1: demonstrate and understand the knowledge of Nuclear and Particle Physics and Mathematical Physics

CO_2: get a proficiency in solving problems in Nuclear and Particle Physics and Mathematical Physics

CO_3: understand the basic concepts like properties of nucleus, nuclear forces, nuclear models, nuclear reactions, accelerators and detectors and various co-ordinate systems, Differential equations, complex numbers, Fourier series and integrals etc.

CO_4: develop the critical skill in students to understand Nuclear and Particle Physics and Mathematical Physics

Section I

Nuclear and Particle Physics

Unit	Syllabus	Lectures
Unit 1	**1. Basic static properties of nucleus** Nuclear composition, Intrinsic properties, Charge size, radius, density of nucleus, Angular momentum, magnetic moment, quadruple moment, parity	18

15. Quantum Mechanics, B. N. Srivastava, Reprint 2011, PragatiPrakashan.
16. Quantum Mechanics, P. J. E. Peebles, 2003, Prentice Hall of India.
17. Quantum Mechanics, S. P. Singh,M. K. Bagde, Kamal Singh, S. Chand& company Ltd,New Delhi
18. Modern Physics, R. Murugeshan, 1997, S. Chand & Company Ltd.
19. Atomic Physics J. B. Rajam, S.Chand& Company Ltd.
20. Perspectives of Modern Physics, Arthur Beiser, McGraw Hill International Editions.
21. Concepts of Modern Physics,ArthurBeiser, ShobhitMahajan, S. RaiChoudhury, SixthEdition, Tata McGraw Hill Education Private Ltd.
22. Modern Physics, S. L. Kakani and ShubhraKulkarni, 2006, Viva books Private Ltd.
23. Modern Physics, D. L. Sehgal, K. L. Chopra and N. K. Sehgal, Reprint 1995, Sultan Chand & sons.
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PHYSICS Paper VI

Discipline Specific Elective Course (DSE-1001E2)
Nuclear and Particle Physics and Mathematical Physics
Theory: 72 Hours (90 Lectures of 48 minutes)
Marks -100 (Credits: 04)

CO's:

After completion, students are able to

CO_1: demonstrate and understand the knowledge of Nuclear and Particle Physics and Mathematical Physics

CO_2 : Students will demonstrate a proficiency in solving problems in Nuclear and Particle Physics and Mathematical Physics

CO_3: understand the basic concepts like properties of nucleus, nuclear forces, nuclear models, nuclear reactions, accelerators and detectors and various co-ordinate systems, Differential equations, complex numbers, Fourier series and integrals etc.

CO_4: develop the critical skill in students to understand Nuclear and Particle Physics and Mathematical Physics

Section I

Nuclear and Particle Physics

Unit	Syllabus	Lectures
Unit I	**1. Basic static properties of nucleus** Nuclear composition, Intrinsic properties, Charge size, radius, density of nucleus, Angular momentum, magnetic moment, quadruple moment, parity and symmetry, mass defect, packing fraction, binding energy, stability of nucleus. **2. Nuclear models and Nuclear forces**	18

	Bhor-wheeler liquid drop model, semi empirical mass/BE formula, Nuclear shell model, magic numbers, Concept of nuclear force, properties of nuclear forces. Historical background of elementary particles, and their classification, particle interaction. **3. Particle Accelerator** Basic principles of acceleration, classification of acceleration, linear accelerator(introduction), cyclic accelerates, cyclotron, synchrocyclotron, betatron (Principle, working, theory)	
Unit 2	**1. Detectors** Gas filled ionization detectors, G-M tube (In details), solid state detectors, scintillation counter, Bubble chamber, Wilson cloud chamber, Cerenkov radiation. **2. Radioactivity and nuclear reactions** Natural and artificial Radioactivity, alpha decay (spectrograph, long rang α-ples), β-decay (spectrograph continuous nature of β-ray spectrum, Pauli's neutrino hypothesis), Gamma decay (origin, k-electron capture, existence of isomers), Applications of radio activity (Agriculture, industrial, medical field).	18

Section II
Mathematical Physics

Unit	Syllabus	Lectures
Unit 1	**1. Orthogonal curvilinear co-ordinates** Introduction to Cartesian, spherical, polar and cylindrical co-ordinates system, concept of orthogonal curvilinear co-ordinates, unit tangent vectors, arc length, area and volume elements in orthogonal curvilinear co-ordinates system, Expression for gradient, divergence, Laplacian and curl in Cartesian, spherical, polar and cylindrical co-ordinate system. **2. Partial differential equation** Partial differential equation, degree, order, linearity and homogeneity of differential equations, methods of separation of variables, Frobenius method of power series, solution of Legendre, Hermite and Bessel differential equation	18
Unit 2	**1. Complex analysis** Revision of complex numbers and their graphical representation, Euler's formula, DeMoiver's theorem, Roots of complex number, Functions of complex numbers, Analyticity and Cauchy- Reimann condition, examples of analytical function, Singular functions, Poles and branch points, order of singularity, Integration of function of complex variable, Cauchy's inequality, Cauchy's integral formula. **2. Fourier series and integrals** Fourier series and Fourier transform, Dirichlet condition, (Statement only) Properties of Fourier series: 1) convergence, 2) Integration 3) Differentiation. Physical applications of Fourier series 4) square wave (high frequencies) 5) full wave rectifier, Differentiation and integration of Fourier series, Fourier transform, Inverse functions.	18

Reference books:

1. Differential Equations with Modeling Applications (11th Edition); Dennis G.Zill.
3. Partial Differential Equations; Gupta Malik& Mittal.
4. Differential Equations; Gupta Malik& Mittal.
5. Differential Equations; RamachandraRao.H. R. Anuradha.
6. Partial Differential Equations; N. P. Bali.
7. Differential Equations; Dr. N. Ch. S. N. Iyenger (Ist edition 2000).
8. Mathematical Physics ; Dr. B. S. Rajput.
9. Introductory nuclear Physics by Kenneth S. Krane (Wiley India Pvt. Ltd., 2008).
10. Concepts of nuclear physics by Bernard L. Cohen. (Tata Mcgraw Hill, 1998).
11. Introduction to the physics of nuclei & particles, R.A. Dunlap. (Thomson Asia, 2004)
12. Introduction to Elementary Particles, D. Griffith, John Wiley & Sons
13. Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi
14. Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde (IOP-Institute of Physics Publishing, 2004).
15. Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, 2000).

Semester VI PHYSICS Paper VII

Discipline Specific Elective Course (DSE-1001F1) Semiconductor Devices and Instrumentation and Elements of Modern Physics

Theory: 72 Hours (90 Lectures of 48 minutes)

Marks -100 (Credits: 04)

CO's:

After completion, students are able to

CO_1: demonstrate and understand the knowledge of Semiconductor devices and modern physics

CO_2 : demonstrate a proficiency in solving problems in Semiconductor devices and modern physics

CO_3 : understand the basic concepts like transistor, diodes, SCR, Solar cell, Photocell, LRD, etc. and vector atom model, Zeeman effect, laser technology, etc.

CO_4: develop the critical skill in students to understand Semiconductor devices and modern physics.

Section I

Semiconductor Devices and Instrumentation

Unit	Syllabus	Lectures
Unit 1	**1. Semiconductor Devices and Amplifiers:** Semiconductor Diodes: p and n type semiconductors. Barrier Formation in PN Junction Diode. Qualitative Idea of Current Flow Mechanism in Forward and Reverse Biased Diode. PN junction characteristics. Static and Dynamic Resistance. Principle, construction and working of LEDs (2) Photodiode (3) Solar Cell. 2. **Instrumentations: Introduction to CRO**: Block Diagram of CRO. Applications of CRO: (1) Study of Waveform, (2) Measurement of Voltage, Current, Frequency, and Phase Difference. **3. Timer IC:** IC 555 Pin diagram and its application as Astable & Monostable Multivibrator	18
Unit 2	**1. Bipolar Junction transistors:**	18

	Current gains α and β. Relations between α and β. Load Line analysis of Transistors. DC Load line and Q-point. Active, Cutoff, and Saturation Regions. Voltage Divider Bias Circuit for CE Amplifier. h- parameter Equivalent Circuit. Analysis of a single-stage CE amplifier using Hybrid Model. Input and Output Impedance, Current, Voltage and Power Gains. **2. Operational Amplifiers (Black Box approach):** Introduction of differential amplifier and its types, symbol of Op Amp, different parameters of Op-Amp, Characteristics of Op-Amp (IC 741), Open-loop& Closed-loop Gain. CMRR, concept of Virtual ground. Applications of Op-Amps: (1) Inverting and Non-inverting Amplifiers	

Section II

Elements of Modern Physics

Unit	Syllabus	Lectures
Unit 1	**1. Atomic Physics** Quantum numbers , spatial quantization, vector atom model, Alkali Spectra, Optical spectral series, Spectral term spectral notation, energy level diagram of sodium, spin orbit interaction Zeeman effect, Explanation of Anomalous Zeeman effect on vector atom model, Anomalous Splitting of D1 and D2 Line 2. Molecular Physics Molecular system, type of bonds, diatomic molecule as a rigid rotator rotational states of diatomic molecule, Raman effect, Experimental study of Raman effect, classical theory of Raman effect, Applications of Raman effect.	18
Unit 2	**1. Laser Physics** Ordinary light and laser, spontaneous an stimulated emission, Einstein's coefficients, population inversion, Einstein's relation, directionality, mono-chromaticity, brightness, gain coefficient active medium, meta stable states, pumping scheme (optical and electrical), types of laser, solid state Laser, Ruby laser, Diode laser, Gas laser: He-Ne laser, CO2 laser, liquid laser: tunable dye laser, Laser applications (industrial, medical, nuclear science, optical) **2. Space science** Astronomical work, Ptolemy, Tychobrahe, Copernicus, Big bang theory, oscillation theory, steady state theory, Hubble law, Hubble constant, Age of observable universe, Cosmological tests, Milky way galaxy, Our solar system in milky way galaxy, Features of sun, interior, zones of sun, sun spots, Earth, Mars (Static characteristics)	18

Reference books:

1. Electronic devices and circuits, S. Salivahanan and N.Suresh Kumar, 2012, Tata Mc-GrawHill.
   • Microelectronic Circuits, M.H. Rashid, 2ndEdn.,2011, Cengage Learning.
2. Modern Electronic Instrumentation & Measurement Tech.,Helfrick&Cooper,1990, PHILearning
3. Digital Principles & Applications, A.P.Malvino, D.P.Leach & Saha, 7th Ed.,2011, TataMcGraw Hill
4. Fundamentals of Digital Circuits, A. Anand Kumar, 2nd Edition, 2009, PHI Learning Pvt. Ltd.
5. OP-AMP and Linear Digital Circuits, R.A. Gayakwad, 2000, PHI Learning Pvt. Ltd
6. Basic Electronics: A text lab manual, P.B.Zbar, A.P.Malvino, M.A.Miller, 1994, Mc-GrawHill

7. Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
8. Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill
9. Modern Physics, John R. Taylor, Chris D. Zafiratos, Michael A.Dubson,2009, PHI Learning
10. Six Ideas that Shaped Physics: Particle Behave like Waves, Thomas A. Moore, 2003, McGraw Hill
11. Quantum Physics, Berkeley Physics Course Vol.4. E.H. Wichman, 2008, Tata McGraw-Hill Co.
12. Modern Physics, R.A. Serway, C.J. Moses, and C.A.Moyer, 2005, Cengage Learning
13. Modern Physics, G. Kaur and G.R. Pickrell, 2014, McGraw Hill

Semester VI PHYSICS Paper VIII

Discipline Specific Elective Course (DSE-1001F2)

Solid State Physics

Theory: 72 Hours (90 Lectures of 48 minutes)

Marks -100 (Credits: 04)

CO's:

After completion, students are able to

CO_1: demonstrate and understand the knowledge of crystal structure, lattice theory, magnetic properties , etc. and band theory, dielectric properties, X-ray diffraction, etc.

CO_2 : demonstrate a proficiency in solving problems in solid state physics.

CO_3 : understand the basic concepts like crystal structure, types of crystal, miller indices, defects, lattice constants, etc. and superconductivity, Types of superconductors, etc.

CO_4: develop the critical skill in students to understand the basic theory of solid state physics which is useful for further higher studies.

Section I

Solid State Physics I

Unit	Syllabus	Lectures
Unit 1	**1. Crystal Structure** Types of the solids, Amorphous, crystalline, lattice, lattice translation vectors, lattice with basis (Central , non central elements) Unit cell , Examples of crystal structure NaCl, KCl, ZnS, Diamond, Miller Indices, Calculations of coordination number, lattice constant, reciprocal lattices, types of lattices, Brillouin Zones, Diffraction of X-rays, Bragg's law, atomic, geometrical factor, Bragg's X-ray spectrometer, **2. Lattice Vibration and Thermal Properties of Solid** Lattice vibrations, Phonons, normal modes of one dimensional and diatomic chain, Acoustical and optical phonons, Phonons spectrum in solids, Dulong Petit's law (Classical Theory), Einstein and Debye theories of specific heat of solids.	18
Unit 2	**1. Magnetic Properties of Materials** Magnetic materials, permeability, susceptibility, magnetization, magnetic moment, electron spin, Diamagnetic materials, Paramagnetic materials, ferromagnetic, ferromagnetic, classical theory of diamagnetism and paramagnetism, Curie law, Curie constant, Weiss theory of ferromagnetism, and ferromagnetic domain. Hysteresis loop for ferromagnetic materials	18

	2. Superconductivity Idea of superconductivity, Critical temperature, Critical magnetic field. Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth, Isotope effect	

Section II

Solid State Physics II

Unit	Syllabus	Lectures
Unit 1	**1. Elementary band theory** Introduction of free electron theory (Classical and Quantum mechanical) , Kronig Penny model, Effective mass of an electron, Band Gaps. Conductors, Semiconductors, and insulators. P and N type semiconductors. Conductivity of Semiconductors, mobility, Hall Effect, Hall voltage and Hall coefficient. **2. Dielectric Properties of Materials** Polarization. Local Electric Field at an Atom. Depolarization Field. Electric Susceptibility. Polarizability. Clausius Mosotti Equation. Classical Theory of Electric Polarizability. Normal and Anomalous Dispersion. Cauchy and Sellmeir relations. Langevin-Debye equation. Complex Dielectric Constant. Optical Phenomena. Application: Plasma Oscillations, Plasma Frequency, Plasmons. **3. X-Ray Diffraction** Reciprocal lattice and its properties, concept of Brillouin zone , diffraction of X-rays by crystals, Ewald construction, Bragg's law in reciprocal lattice, X-ray diffraction methods: 1) Laue method. 2) Rotating crystal 3) Powder method - Principle, Construction, Working , analysis of cubic crystal by powder crystal method	36

Reference books :

1. Introduction to classical mechanics-R.G.Takwale and P.S.Puranik
2. Classical Mechanics, by H Goldstein (Addison Wesley 1980).
3. Classical Mechanics, by J.C. Upadhyaya (Himalaya Publishing House 2015).
4. Classical Mechanics, by N C Rana and P S Joag (Tata McGraw Hill 1991).
5. Classical Mechanics, by Gupta, Kumar and Sharma (Pragati Prakashan 2000).
6. Classical mechanics-J.C. Upadhyaya.
7. A Text book of Quantum Mechanics, P.M. Mathews & K. Venkatesan, 2nd Edn.,2010, Tata McGraw Hill,
8. Quantum Mechanics, Leonard I. Schiff, 3rdEdn. 2010, Tata McGraw Hill.
9. Quantum Mechanics Theor and Applications, A.K. Ghatak and S.Lokanathan,1995, Macmillan India Ltd.
10. Quantum MechanicsTheory and Applications,Ajoy Ghatak and S. Lokanathan, 5th Ed.,2017, Trinity.

11. Quantum Mechanics.Chatwal and Anand, Reprint 2010, Himalaya Publishing house
12. Quantum Mechanics, Gupta, Kumar, Sharma, Thirtieth Ed., 2011, Jai PrakashNath Publications.
13. Advanced Quantum Mechanics, SatyaPrakash, Reprint 2011, KedarNath Ram NathMeerut.
14. Advanced Quantum Mechanics, B. S. Rajput, Ninth Ed., 2009, PragatiPrakashan.
15. Quantum Mechanics, B. N. Srivastava, Reprint 2011, PragatiPrakashan.
16. Quantum Mechanics, P. J. E. Peebles, 2003, Prentice Hall of India.
17. Quantum Mechanics, S. P. Singh,M. K. Bagde, Kamal Singh, S. Chand& company Ltd,New Delhi
18. Modern Physics, R. Murugeshan, 1997, S. Chand & Company Ltd.
19. Atomic Physics J. B. Rajam, S.Chand& Company Ltd.
20. Perspectives of Modern Physics, Arthur Beiser, McGraw Hill International Editions.
21. Concepts of Modern Physics,ArthurBeiser, ShobhitMahajan, S. RaiChoudhury, SixthEdition, Tata McGraw Hill Education Private Ltd.
22. Modern Physics, S. L. Kakani and ShubhraKulkarni, 2006, Viva books Private Ltd.
23. Modern Physics, D. L. Sehgal, K. L. Chopra and N. K. Sehgal, Reprint 1995, Sultan Chand & sons.
24. Introduction to Modern Physics, F. K. Richtmyer, E. H. Kennard, John N. Cooper, SixthEdition, Tata McGraw Hill Education Private Ltd

Skill Enhancement Course (SEC)-III *

ELECTRICAL CIRCUITS AND NETWORK SKILLS(SEC-SE)

(Credits: 02) (30 Lectures)

(The aim of this course is to enable the students to design and trouble shoots the electrical circuits, networks and appliances through hands-on mode)

Basic Electricity Principles **(3 hours)**

Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallelcombinations. AC Electricity and DC Electricity. Familiarization with multimeter, voltmeter and ammeter.

Understanding Electrical Circuits **(4 hours)**

Main electric circuit elements and their combination. Rules to analyze DC sourced electrical circuits. Current and voltage drop across the DC circuit elements. Single-phase and three-phase alternating current sources. Rules to analyze AC sourced electrical circuits. Real, imaginary and complex power components of AC source. Power factor. Saving energy and money.

Electrical Drawing and Symbols **(4 hours)**

Drawing symbols. Blueprints. Reading Schematics. Ladder diagrams. Electrical Schematics. Power circuits. Control circuits. Reading of circuit schematics. Tracking the connections of elements and

identify current flow and voltage drop.

Generators and Transformers **(3 hours)**

DC Power sources. AC/DC generators. Inductance, capacitance, and impedance. Operation of transformers.

Electric Motors **(4 hours)**

Single-phase, three-phase & DC motors. Basic design. Interfacing DC or AC sources to control heaters & motors. Speed & power of ac motor.

Solid-State Devices **(3 hours)**

Resistors, inductors and capacitors. Diode and rectifiers. Components in Series or in shunt. Response of inductors and capacitors with DC or AC sources

Electrical Protection **(4 Lectures)**

Relays. Fuses and disconnect switches. Circuit breakers. Overload devices. Ground-fault protection. Grounding and isolating. Phase reversal. Surge protection. Interfacing DC or AC sources to control elements (relay protection device)

Electrical Wiring **(5 hours)**

Different types of conductors and cables. Basics of wiring-Star and delta connection. Voltage drop and losses across cables and conductors. Instruments to measure current, voltage, power in DC and AC circuits. Insulation. Solid and stranded cable. Conduit. Cable trays. Splices: wirenuts, crimps, terminal blocks, split bolts, and solder. Preparation of extension board.

Reference Books:

1. A text book in Electrical Technology - B L Theraja - S Chand & Co.
2. A text book of Electrical Technology - A K Theraja
3. Performance and design of AC machines - M G Say ELBS Edn.

Skill Enhancement Course (SEC)-IV
APPLIED OPTICS
(Credits: 02)

(30 Lectures)

(Theory includes only qualitative explanation. Minimum five experiments should be performed covering minimum three sections)

Sources and Detectors (9 hours)

1. Lasers, Spontaneous and stimulated emissions, Theory of laser action, Einstein's coefficients, Light amplification, Characterization of laser beam, He-Ne laser, Semiconductor lasers.
2. Fourier Optics (6 hours)

Concept of Spatial frequency filtering, Fourier transforming property of a thin lens

Fourier Transform Spectroscopy

Fourier Transform Spectroscopy (FTS) is a powerful method for measuring emission and absorption spectra, with wide application in atmospheric remote sensing, NMR spectrometry and forensic science.

(ii) Holography (6 hours)

Basic principle and theory: coherence, resolution, Types of holograms, white light reflection hologram, application of holography in microscopy, interferometry, and character recognition

(iii) Photonics: Fiber Optics (9 hours)

Optical fibers and their properties, Principal of light propagation through a fiber, The numerical aperture, Attenuation in optical fiber and attenuation limit, Single mode and multimode fibers, Fiber optic sensors: Fiber Bragg Grating

Reference Books:

1. Fundamental of optics, F. A. Jenkins & H. E. White, 1981, Tata McGraw hill. 46
2. LASERS: Fundamentals & applications, K.Thyagrajan & A.K.Ghatak, 2010, Tata McGraw Hill
3. Fiber optics through experiments,M.R.Shenoy, S.K.Khijwania, et.al. 2009, Viva Books
4. Nonlinear Optics, Robert W. Boyd, (Chapter-I), 2008, Elsevier.

5. Optics, Karl Dieter Moller, Learning by computing with model examples, 2007, Springer.
6. Optical Systems and Processes, Joseph Shamir, 2009, PHI Learning Pvt. Ltd.
7. Optoelectronic Devices and Systems, S.C. Gupta, 2005, PHI Learning Pvt. Ltd.
8. Optical Physics, A.Lipson, S.G.Lipson, H.Lipson, 4th Edn., 1996, Cambridge Univ. Press

B.Sc.Part III Physics
Laboratory ExperimentsTotal Marks: 200
Credits: 08
Group I

1. Resonance pendulum
2. S.T. of soap solution
3. Surface tension of mercury by Fergusson modified method
4. Y and □ using Flat Spiral Spring
5. Y by Koenig's method
6. Y by Cornu's spiral
7. Measurement of susceptibility of given solution (Quinck's Tube Method)
8. Expt.1 (problem from Mathematical Physics theory course)
9. Expt.2 (problem from Mathematical Physics theory course)
10. Measurement of Heat Capacity of solids
11. Surface tension by drop weight method
12. Young's Modulus by vibration by using AFG

Group II

1. Cardinal points by turn table method
2. Cardinal points by Newton's method
3. Refractive index of glass by Brewster's law
4. Diffraction at a Single Slit
5. Diffraction at cylindrical obstacle
6. Lloyd's single mirror
7. Double refracting prism
8. Diameter of Lycopodium powder
9. Spherical aberration
10. Absorption spectrum of a liquid ($KMnO_4$ solution)
11. Refractive index by total internal reflection
12. Michelson Interferometer

Skill Enhancement Course (SEC)-IV
APPLIED OPTICS
(Credits: 02)

(30 Lectures)

(Theory includes only qualitative explanation. Minimum five experiments should be performed covering minimum three sections)

Sources and Detectors (9 hours)

1. Lasers, Spontaneous and stimulated emissions, Theory of laser action, Einstein's coefficients, Light amplification, Characterization of laser beam, He-Ne laser, Semiconductor lasers.
2. Fourier Optics (6 hours)

Concept of Spatial frequency filtering, Fourier transforming property of a thin lens

Fourier Transform Spectroscopy

Fourier Transform Spectroscopy (FTS) is a powerful method for measuring emission and absorption spectra, with wide application in atmospheric remote sensing, NMR spectrometry and forensic science.

(ii) Holography (6 hours)

Basic principle and theory: coherence, resolution, Types of holograms, white light reflection hologram, application of holography in microscopy, interferometry, and character recognition

(iii) Photonics: Fiber Optics (9 hours)

Optical fibers and their properties, Principal of light propagation through a fiber, The numerical aperture, Attenuation in optical fiber and attenuation limit, Single mode and multimode fibers, Fiber optic sensors: Fiber Bragg Grating

Reference Books:

1. Fundamental of optics, F. A. Jenkins & H. E. White, 1981, Tata McGraw hill. 46
2. LASERS: Fundamentals & applications, K.Thyagrajan & A.K.Ghatak, 2010, Tata McGraw Hill
3. Fiber optics through experiments,M.R.Shenoy, S.K.Khijwania, et.al. 2009, Viva Books
4. Nonlinear Optics, Robert W. Boyd, (Chapter-I), 2008, Elsevier.

Group-III

1. Self Inductance by Owne's Bridge
2. Self Inductance by Rayleigh's Method
3. Hall coefficient of semiconductor
4. Measurement of B_H, B_V and θ using Earth Inductor
5. Hysteresis by magnetometer
6. Mutual inductance
7. Calibration of wire using Carey Foster key
8. e/m of Electron By Thomson's Method
9. Measurement of Dielectric constant
10. Absolute capacity of condenser
11. Measurement of temperature using thermocouple
12. To measure the resistivity of a semiconductor (Ge) crystal with temperature by four probe method and determine its band gap

Group - IV

1. UJT As Voltage Sweep Generator.
2. To design an astable multivibrator of given specifications using 555 Timer.
3. To design a monostable multivibrator of given specifications using 555 Timer.
4. To study IV characteristics of PN diode, Zener and Light emitting diode
5. To design an inverting amplifier of given gain using Op-Amp 741 and study its frequency response.
6. OP-AM As Schmitt Trigger
7. I-V characteristics of Solar Cell
8. To design and assemble a CE amplifier of a given gain (mid-gain) using voltage divider bias and determination of input and output resistance and voltage gain.
9. To design a non-inverting amplifier of given gain using Op-Amp 741 and study it's Frequency Response.
10. Band gap energy of semiconductor using p-n junction
11. Determination of Plank's constant
12. Stair case generator

GroupV-A
Skill Enhancement Course (SEC-SE)
(ELECTRICAL CIRCUITS AND NETWORK SKILLS) (Any 10)

1. Electrical wiring of bulb, switch and plug for two and three phase.
2. Tracing of given electric circuit.(Electrical Drawing and Symbols)
3. Assembling of given electric circuit.
4. Measurement of resistance of galvanometer (Kelvin's method)
5. Determination of lattices constant using given XRD powder pattern
6. To measure current, voltage, power in DC and AC circuits.
7. To prepare wiring for a fluorescent tube light with switch control.
8. To wire for a stair case arrangement using a two-way switch.
9. Testing of electronic and electric components.
10. Measurement of active and reactive power in single phase A.C. Circuit.
11. To verify the Millman's Theorem.
12. To verify the Maximum Power Transfer theorem on DC and AC.

Group V-B
Skill Enhancement Course (SEC-SF)
APPLIED OPTICS (Any 10)

Experiments on Lasers:

1. Study of divergence of LASER beam
2. Measurement of wavelength of LASER using plane diffraction grating

4.Determination of the grating radial spacing of the Compact Disc (CD) by reflection using He Ne or solid state laser.

5. To find the width of the wire or width of the slit using diffraction pattern obtained by a He-Ne or solid state laser.
6. To find the polarization angle of laser light using polarizer and analyzer
7. Thermal expansion of quartz using laser

Experiments on Fourier Optics:

1. Optical image addition/subtraction
2. Optical image differentiation
3. Fourier optical filtering

4 Construction of an optical system

Experiments on Holography and interferometry:

1. To study the interference pattern from a Michelson interferometer as a function of mirror

separation in the interferometer.

2. Fabry Perot interferometer
3. Measuring the refractive index of air
4. Constructing a Sagnac interferometer
5. Constructing a Mach-Zehnder interferometer
6. White light Hologram.

Experiments on Photonics: Fiber Optics

1 To measure the numerical aperture of an optical fiber
2. To study the variation of the bending loss in a multimode fiber
3. To determine the mode field diameter (MFD) of fundamental mode in a single-mode fiber by measurements of its far field Gaussian pattern
4. To measure the near field intensity profile of a fiber and study its refractive index profile
5. To determine the power loss at a splice between two multimode fiber

4. Group VI: Assessment of Annual Work of a Student

1. Certified Laboratory Journal.
2. Study Tour Report.
3. Seminar Report (2 Seminars)
4. Project work.

Revised Scheme of Practical Examination for B. Sc. Part – III

1. Practical examination will be conducted annually. (200 marks.)
2. Practical examination will be conducted for three days per batch.
3. The examination will be conducted in two sessions per day and each session will be of three hours duration.
4. Every candidate should perform one experiment each from Groups I to IV and one experiment each from Group VA and Group VB (total 6 experiments).
5. Study tour anywhere in India is compulsory.
6. At least eighty percent practical should be completed by the student.
7. The marks distribution for practical is as below.

Practical groups	Marks
Group I	30
Group II	30
Group III	30
Group IV	30
Group VA-15, Group VB-15	30
Group VI I) Certified laboratory journal (certified Journal- 10 marks, neatness-5 marks, punctuality- 5 marks) II) Study Tour Report III) Seminar Report IV) Project Report	 20 10 10 10

Nature of Question Paper

Instructions: 1) All the questions are **compulsory**.
2). Figures to the right indicate **full** marks.

3) Draw neat labeled diagrams **wherever** necessary.

Time : 2 hours | Total Marks: 40

SECTION-I

Choose correct alternative. 8

i)
A) B) C) D)

ii)
A) B) C) D)

iii)
A) B) C) D)

ii)
A) B) C) D)

v)
A) B) C) D)

vi)
A) B) C) D)

vii)
A) B) C) D)

viii)
A) B) C) D)

Q:2) Attempt any two. 16

A.
B.
C.

Q.3. Attempt any four. 16

A.
B.
C.
D.
E.

SECTION-II

*same like section I

Instruction to paper setters: Equal weight age should be given to all units.