Rajarshi Shahu Mahavidyalaya, Latur
(Autonomous)

Department of Physics and Electronics

SYLLABUS FOR B.Sc.-III PHYSICS

(w.e.f. Academic Year 2019-20)

Under Choice Based Credit System (CBCS)

SEMESTER PATTERN

JUNE -2019

Rajarshi Shahu Mahavidyalaya Latur

(Autonomous)

Department of Physics (w.e.f. 2019-20)

Structure of B.Sc. III Physics Syllabus

Sr. No	Course Code	Title	Credits	Periods /Week	Marks		
		Sem V			In Sem	End Sem	Total
1	DSEE-I U-PHY-541	Quantum Mechanics-IX	2	3	20	30	50
2	DSEE-II U-PHY-542	Solid State Physics -XA Or Nano Materials and Applications –XB	2	3	20	30	50
3	SEC III	Physics Workshop Skill (SEC)-III	2	2	20	30	50
4	DSEEP-I U-PHY-543	Physics Laboratory Course VII	2	3		50	50
5	DSEEP-II U-PHY-544	Physics Laboratory Course VIII Or Physics Laboratory Course- VIII (Based on Nano Materials and Applications -XB)	2	3		50	50
		Sem VI					
6	DSEE-I U-PHY-641	Atomic, Molecular and statistical Physics-XI	2	3	20	30	50
7	DSEE-II U-PHY-642	Fundamentals of Digital Electronics-XIIA Or Astronomy and Astrophysics XIIB	2	3	20	30	50
8	SEC IV	Renewable Energy Harvesting Skill (SEC)-IV	2	2	20	30	50
9	DSEEP-I U-PHY-643	Physics Laboratory Course IX	2	3		50	50
10	DSEEP-II U-PHY-644	Physics Laboratory Course X Or Physics Laboratory Course-X (Based on Astronomy and Astrophysics -XIIB)	2	3		50	50
11		Project	2	-		50	50
12		Total			-	-	550

SEC: Skill Enhancement Course

B.Sc– III, Semester V

U-PHY-541 Quantum Mechanics-IX

Periods/Week: 3, Credits: 2,

TotalPeriods:45

Marks: 50, End Sem.: 30 & In Sem.:20 (UT: 15 &AT: 05)
(Under CBCS)

Learning objectives:

(1) To understand the key features of QuantumMechanics,

(2) To know the wave function and understand its physical significance.

(3) To understand both the time-independent and time-dependent Schrödinger equations and to develop an understanding how they are used.

(4) To identify the unique features of the hydrogen atom that makes it important for calculations in quantum mechanics

Course Outcomes:

Upon successful completion, students will be able to:

(1) Understand concept of wave mechanics;

(2) know the concept of operators in quantum mechanics;

(3) Perform calculations on wavefunctions, and solve the Schrödinger equation for simple potential problems;

(4) Apply Schrodinger's equation to Hydrogen atom and understand quantization of angular momentum.

Unit I: Origin of Quantum Mechanics: [12 periods]

Introduction, Photoelectric Effect, Quantum Theory of Light, Black Body Radiation, The Compton Effect, De Broglie Waves, De Broglie Wave Velocity, Wave and Group Velocities, G. P. Thomson's Experiment for Electron Diffraction, The Uncertainty Principle, Elementary Proof of Uncertainty Principle, Applications of Uncertainty Principle, The Wave Particle Duality. [Book 1 Chap. 3-4, Book 2Chap. 1]

Unit II: Schrödinger's Wave Equation and Operators: [10 Periods]

Introduction, Wave Function and its Physical Interpretation, Wave Equation, Schrödinger's Wave Equation: Time Dependent Form (One Dimension and Three Dimension), Probability Current Density and its Physical Significance, Expectation Values, Schrödinger's Wave Equation: Time

Independent (Steady-State) Form, Operators, Eigen Values and Eigen Functions. [Book 1 Chap. 7, Book 2 Chap. 3]

Unit III: Applications of Schrödinger's Steady-State Equation: [11 Periods]

Introduction, the Particle in a Box: Energy Quantization, The Particle in a Box: Wave Functions, The

Particle in a Box: Momentum Quantization, The Harmonic Oscillator, The

Harmonic Oscillator-Energy Level, The Particle in a Three Dimensional Box: Energy Quantization. [Book 1 Chap. 8, Book 2 Chap. 4-6]

Unit IV: Quantum Theory of Hydrogen Atom: [12 Periods]

Schrödinger's Equation for the Hydrogen Atom in Spherical Polar Co-Ordinates, Separation of Variables, Quantum Numbers–Total Quantum Number, Orbital Quantum Number, Magnetic Quantum Number, angular momentum, spin quantum number Electron Probability Density. [Book 1 Chap. 9, Book 2 Chap. 7]

Recommended Books:

1. Arthur Beiser, Perspectives of Modern Physics- (McGraw-Hill International Editions)1969.

2. S. L. Kakani and H. M. Chandaliya, Quantum Mechanics ,Theory and Problems, (S. Chand & Sons) (2004).

Reference Books:

3. R. Murugeshan, Modern Physics (S. Chand and Co. XIthRevised Edition)

4. AjoyGhatak and S. Lokanathan, Quantum Mechanics Theory and Applications, Published By Mc. Millan (2012).

5. Leonard I. Schiff, Quantum Mechanics McGraw-Hill 1968 (International Series in Pure and Applied

Physics)

6. J. M. Cassels, Basic Quantum Mechanics, McGraw –Hill Publishers (1970)

7. P.M. Mathews and K. Venkatesan, A Text Book of Quantum Mechanics Tata McGraw –Hill

Publishers (2002).

8. G. R. Chatwal, S. K. Anand, Quantum Mechanics, Publisher, Himalaya Publishing House, (1988)

9. Fundamentals of Quantum Mechanics - P. V. Pathak

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B.Sc. – III, Semester V
U-PHY-542 Solid State Physics -XA
Periods/Week: 3, Credits: 2, Total Periods: 45
Marks: 50, End Sem.: 30 & In Sem.:20 (UT: 15 &AT: 05)
(Under CBCS)

Learning Objectives:

(1) Review of the crystal representation in terms of space lattice, basis, unit cell and lattice parameters,

(2) Develop knowledge among the students about crystal systems and Bravais lattices,

(3) Develop understanding about symmetry elements and symmetry operations of simple cubic systems,

(4) To inculcate the idea of atomic arrangements in space lattice of few representative solids.

(5) To develop an understanding of relation between band structure and the electrical/optical properties of a material

Course Outcomes: After completion of the course student will:

(1) Have a basic knowledge of crystal systems and spatial symmetries,

(2) Be able to perform structure determination of simple structures,

(3) know the significance of Brillouin zones,

(4) know Bloch's theorem and what energy bands are,

(5) know the fundamental principles of semiconductors, including pn-junctions, and be able to estimate the charge carrier mobility and density,

(6) Be able to account for what the Fermi surface is and how it can be measured.

Unit I: Crystal structure: [12 Periods]

Introduction, Crystal Lattices, bases and Translation vectors, Unit cell, Representation of Planes: Miller Indices, Spacing of Planes in Crystal lattice, Point group, space group, classification of crystals, Bravais lattice in two and three dimensions, Simple crystal structure: HCP, FCC, BCC, SC, Structure of Diamond, ZnS, NaCl. Numerical Problems.

[Book no.-1, Chapter-1]

Unit II: Free Electron Theory of Metals: [10 Periods]

Introduction, Outstanding properties of metals, Drude-Lorentz theory, Electrical conductivity, Thermal conductivity, Widemann-Franz relation, Somerfield model, Momentum space, Fermi Dirac distribution, Quantum theory of free electron in a box, Free electron concentration: non-degenerate and degenerate cases

[Book no-1,Chapter-8]

Unit III: Band Theory of Solids: [12 Periods]

Introduction, splitting of atomic energy levels in to bands, Origin of band structure, Periodic potential in crystal, Bloch theorem, Origin of energy gap, Valence band, Conduction band and forbidden band, Behavior of conductors, insulators and semiconductors on the basis of band theory, Effect of impurity on conductivity of semiconductors and effective mass of an electron.

[Book-2, Ch-23]

Unit IV: Applications of Band Theory: **[11 Periods]**

Kronig Penny model,mobility, Hall Effect, Hall coefficient ,introduction to superconductivity andits types, basics of cryogenics. [Book-1, Ch-23]

Recommended Books:

1. Solid State Physics – Saxena, Gupta, Saxena (PragatiPrakashan Meerut)
2. Physics for degree students-C.L.Arora and P.S. Hemesic (S.Chand 1st Edition2014)
3. Introduction to Nanotechnology-K.K. Chattopadhyay and A.N. Banergy.
4. Nanoscience and Technology-V.S.Murlidharan, A. Subramania.

Reference Books:

5. Solid State Physics and Electronics – R. K.Puri& V. K. Babar (S.chand& Co.)
6. Solid State Physics – Puri& Babar (S.chand& Co.)
7. Introduction to Solid State Physics -by Kittel, Wiley and Sons, 7th Edition.
8. Solid state Physics – R.L.Singhal (KedarNath Ram Nath Co., Meerut)
9. Modern physics – R. Murugeshan. (S.Chand& Co. XIth Revised edition)
10. Solid state physics- A.J.Dekkar(Macmillan India Ltd.2000)
11. Nanotechnology: Principles and Practices by Sulbha K Kulkarni, Capital Publishing Co. New Delhi.
12. Introduction to Nanotechnology, C.P. Poole Jr. and F.J. Ownes, Wiley Publication.
13. Origin and Development of Nanotechnology, P. K. Sharma, Vista International Publishing House
14. Developments in Nanotechnology-K. Krishna Reddn.
15. Solid State Physics - M. A. Wahab

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B.Sc– III, Semester V Course Code: U-PHY-542
Nano Materials and Applications- XB
Periods/Week: 3, Credits: 2, Total

Periods: 45

Marks: 50, End Sem.: 30 & In Sem.:20 (UT: 15 &AT: 05)
(Under CBCS)

Credits: 02 **Total Periods: 45**

Learning Objective:

This course aims to provide a comprehensive overview of nanomaterials in terms of the synthesis, characterization, and applications.

Course Outcomes:

After successful completion of the course the students will be able to:

1) Understand processing techniques for nanomaterials
2) Analyze the crystal structure of nanoparticles
3) Understand important applications of nanomaterials

Unit I: Nanoscale Systems **[10 Periods]**

Length scales in physics, quantum tunneling effect, types of Nanostructures and their merits and demerits (1D, 2D and 3D), Band structure based on surface area and size.

Unit II: Synthesis of Nanostructure Materials **[10 Periods]**

Top down and Bottom up approaches, Physical methods: Chemical vapor deposition (CVD), Physical vapor deposition (PVD), Thermal evaporation, E-beam evaporation, Chemical Methods: Electro-deposition, Spray pyrolysis.

Unit III: Characterization techniques **[12 Periods]**

X-Ray Diffraction methods, Optical Microscopy:Scanning Tunneling Microscopy, Atomic Force Microscopy, Scanning Electron Microscopy, UV-Vis Spectroscopy.

Unit IV: Applications **[11Periods]**

Photonic devices: LED, Solar cells, Battery, photocatalysis, Sensors,thin film transistors, magneto resistance, biogenenic applications, optical switching and optical data storage.

Reference books:

1. C.P. Poole, Jr. Frank J. Owens, Introduction to Nanotechnology (Wiley India Pvt. Ltd.).
2. S.K. Kulkarni, Nanotechnology: Principles & Practices (Capital Publishing Company)
3. K.K. Chattopadhyay and A. N. Banerjee, Introduction to Nanoscience andTechnology (PHI Learning Private Limited).
4. Richard Booker, Earl Boysen, Nanotechnology (John Wiley and Sons).
5. M. Hosokawa, K. Nogi, M. Naita, T. Yokoyama, Nanoparticle Technology Handbook (Elsevier, 2007).
6. Bharat Bhushan, Springer Handbook of Nanotechnology (Springer-Verlag, Berlin, 2004).

B.Sc– III, Semester V Course Code: U-PHY-.....
Skill Enhancement Course -III
Physics Workshop Skill
Periods/Week: 3, Credits: 2, Total

Periods: 45

Marks: 50, End Sem.: 30 & In Sem.:20 (UT: 15 &AT: 05)
(Under CBCS)

Credits: 02 **Total Periods: 45**

Theory: 30 Periods

Learning Objective:

The aim of this course is to enable the students to familiar and experience with various mechanical and electrical tools through hands-on mode.

Course Outcomes:

After successful completion of the course the students will be able to:

1) Measure the dimensions of various bodies,
2) Measure resistance R, L and C.
3) Solder the electrical components on PCB.

[30 Periods]

Introduction, Measuring units, Conversion to SI and CGS. Familiarization with meter scale, Vernier calliper, Screw gauge and their utility. Measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, etc. Use of Sextant to measure height of buildings, mountains, etc.

Electrical Skills: DC Power sources. AC/DC generators. Inductance, capacitance, and impedance. Response of inductors and capacitors with DC or AC sources. (8 Periods)

Electrical and Electronic Skill: Use of Multimeter. Soldering of electrical circuits having discrete components (R, L, C, diode) and ICs on PCB. Operation of oscilloscope. Making regulated power supply.

Details about logic Gates with a demo of IC,

Laboratory Exercises (Any Five of the following): **[15 Periods]**

1. Measure dimensions of solid blocks of different sizes using Vernier Calliper
2. Measure the diameter of a thin wire,
3. Measure the height of buildings/tower using Sextant.
4. Designing and constructing a transistorized regulated power supply.
5. Soldering and de-soldering of circuits using discrete components (R, L, C, Diodes, transistors, etc).
6. Designing and making of printed circuit boards (PCBs).
7. Soldering of ICS on PCB.
8. Verification of logic gates
9. Wiring of simple circuits using Bread Board.

Reference Books:

1. A text book in Electrical Technology - B L Theraja – S. Chand and Company.
2. Performance and design of AC machines – M.G. Say, ELBS Edn.
3. Mechanical workshop practice, K.C. John, 2010, PHI Learning Pvt. Ltd.
4. Workshop Processes, Practices and Materials, Bruce J Black 2005, 3rd Edn., Editor Newnes [ISBN: 0750660732]
5. New Engineering Technology, Lawrence Smyth/Liam Hennessy, The Educational Company of Ireland [ISBN: 0861674480]

B.Sc. III Year, Semester-V
U-PHY-543 Physics Laboratory Course-VII
Credits: 2 No of periods / Wk: 3
Marks: 50, End Sem.: 30 & In Sem.:20 (RB-10&AT: 10)
(Under CBCS)

Learning Objectives:

The objectives of present lab work are;

(1) To inculcate the equipment handling skills related to optical instruments such as spectrometer, polarimeter,

(2) To provide training to the students for using equipment's related to electricity and magnetism,

(3) To develop understanding of electronic oscillators.

Course Outcomes:

After successful completion of the course the students will be able to:

(1) Handle optical and magnetic equipment's with ease,

(2) Make use of CRO for measurement of Oscillator parameters,

(3) Determine specific rotation of sugar like solution,

(4) Understand the charge to mass ratio for electron.

List of Experiments

1. Dispersive Power of Prism.
2. Dispersive Power of grating.
3. Determination of dielectric constant.
4. Hall-probe method for measurement of magnetic field.
5. Temperature of flame.
6. Electrical conductivity of Graphite rod.
7. Study of RC Phase shift Oscillator.
8. Specific rotation by Laurent's half shade polarimeter.
9. e/m by Thomson's method.
10. Study of Wein- Bridge oscillator

* Note: Minimum six experiments should be performed, by each student.

B.Sc. III Year, Semester-V

U-PHY-544 Physics Laboratory Course-VIII

Credits: 2 No of periods / Wk: 3

Marks: 50, End Sem.: 30 & In Sem.:20 (RB-10&AT: 10)

(Under CBCS)

Learning Objectives:

The objectives of present lab work are;

(1) To train the students to make use of spectrometer for determination of Refractive index,

(2) To imbibe the calibration skills of the measuring bridges/ equipment's,

(3) To develop understanding of band gap of semiconductor,

(4) To develop the measuring skill of frequency of an electronic oscillator,

Course Outcomes:

After successful completion of the course the students will be able to:

(1) Determine refractive indices of prism materials,

(2) make the calibration of given unknown bridge wire,

(3) find the bandgap of semiconductor diode,

(4) Trace out the sine waveforms of the oscillator and calculate its frequency.

List of Experiments

1. Cauchy's constant Using spectrometer.
2. Absorption spectra of iodine vapours.
3. Calibration of bridge wire using carry fosters bridge.
4. Temperature coefficient of thermistor.
5. Study of energy band gap of semiconductors.
6. Variation of thermoemf with temperature.
7. Study of Hartley oscillator.
8. Study of Colpitt's Oscillator.
9. Absolute capacity of condenser.
10. Study of solar cell: determination of fill factor and efficiency

* Note: Minimum six experiments should be performed, by each student.

B.Sc. III Year, Sem-VI
U-PHY- Physics Laboratory Course-VIII
(Based on Nano Materials and Applications –XB)
Credits: 2 No of periods / Wk: 3
Marks: 50, End Sem.: 30 & In Sem.:20 (RB-10&AT: 10
(Under CBCS)

PRACTICALS-DSE LAB: Nano Materials and Applications

Synthesis of metal nanoparticles by chemical route.

1. Synthesis of semiconductor nanoparticles.
2. Synthesis of SnO_2 nanoparticles by SILAR.
3. Surface Plasmon study of metal nanoparticles by UV-Visible spectrophotometer.
4. Determination of crystal structure of nanomaterials from XRD pattern.
5. Estimation of particle size from XRD pattern of nanomaterials.
6. Study transmittance spectra of nanomaterials in UV-Visible region.

Reference Books:

8. C.P. Poole, Jr. Frank J. Owens, Introduction to Nanotechnology (Wiley India Pvt. Ltd.).
9. S.K. Kulkarni, Nanotechnology: Principles & Practices (Capital Publishing Company).
10. K.K. Chattopadhyay and A.N. Banerjee, Introduction to Nanoscience & Technology (PHI Learning Private Limited).
11. Richard Booker, Earl Boysen, Nanotechnology (John Wiley and Sons).

B.Sc. – III, Semester VI

U-PHY-641 Atomic, Molecular Physics and Statistical Physics-XI Periods/Week: 3, Credits: 2, Total Periods: 45
Marks: 50, End Sem.: 30 & In Sem.:20 (UT: 15 &AT: 05)

(Under CBCS)

Learning Objectives:

(1) To introduce to the fundamentals of Atomic, Molecular and Statistical Physics,

(2) To understand the rotational, electronic and Vibrational spectra of atoms and molecules,

(3) To inculcate the idea about effects of electric and magnetic field on atoms and molecules.

(4) To imbibe the concept of classical and quantum statistics.

Course Outcomes:

Upon successful completion of this course student will be able to:

(1) Describe the vector atom model ,

(2) Know and understand the normal and anomalous Zeeman effect, Paschen Back effect and Stark effect as well as Raman Effect ,

(3) Define and discuss the concepts of microstate and macrostate of a model system,

(4) Define and discuss the Boltzmann distribution and the role of the partition function,

(5) Define the Fermi-Dirac and Bose-Einstein distributions; state where they are applicable.

Unit I Atomic Spectra: [12 periods]

Introduction, Drawbacks of earlier models,Vector atom model, Quantum numbers associated with the vector atom model, Coupling schemes: L-S and j-j coupling. Pauli Exclusion Principle and its applications, Magnetic dipole moment due to orbital motion and spinning of electron, Stern-Gerlach experiment, Spin-orbit coupling, Optical spectra.

Atoms in external fields: Larmor's theorem, Zeeman effect (normal and anomalous), Paschen-Back effect and Stark effect, Problems. [Book-1, Chapter-6]

Unit II: Molecular Spectroscopy [11 Periods]

Introduction, Diatomic molecule, molecular spectra, Types of molecular spectra, Rotational spectra, Vibrational spectra, Vibrational rotational spectra, P.E curve, Electronic spectra of dia and polyatomic molecules, Luminescence, Basics of Raman effect.

` ` [Book-2,Chapter-11,12]

Unit III: Maxwell-Boltzmann Statistics: [12 Periods]

Phase space, Macro state, microstate, Thermodynamic probability, Statistical ensembles, Entropy and probability.Maxwell-Boltzmann energy distribution law, Partition function, Applications of Maxwell-Boltzmann distribution law to mono-atomic gases.

[Book-3, Chapter- 9, 10, 11]

Unit IV: Quantum statistics: [10 Periods]

Needof quantum statistics, Bose-Einstein distribution law, photon gas, Planck's radiation law, Fermi-Dirac distribution law, Free electrons in metal, Fermi energy and Fermi level, comparison of three statistics.

[Book-3, Chapt.12]

Recommended Books:

1. Modern Physics by R. Murugeshan and KiruthigaSivaPrasanth. S.Chand& Co.

2. Physics for Degree students: C.L. Arora, Dr. P. S. Hemne., S. Chand &Co.

3. Heat, Thermodynamics and Statistical Physics by Brijlal, Dr. N. Subrahmanyam, P. S.Hemne

Reference books:

4. Introduction to Atomic spectra- White.

5. Fundamentals of Molecular spectroscopy - C. N. Banwell& Mc Cash

6. Molecular spectroscopy –G. M. Barrow

7. Spectroscopy- Atomic and Molecular by Gurudeep R. Chatwal and ShyamAnand-Himalaya Publishing House.

8. Atomic Physics by J.B. Rajam.

9. Atomic and molecular spectroscopy- Mool Chand Gupta.

10. Statistical Mechanics- B. B. Laud

11. Thermodynamics & Statistical physics – Sharma, Sarkar.

12.Thermodynamics and statistical physics- S.L Kakani.

13. Statistical and thermal physics - Loknathan and Gambhir

B.Sc. – III Year Semester-VI
U-PHY-642 Fundamentals of Digital Electronics-XII-A
Periods/Week: 3, Credits: 2, Total Periods: 45
Marks: 50, End Sem.: 30 & In Sem.: 20 (UT: 15 &AT: 05)
(Under CBCS)

Learning Objectives:

(1) To develop understanding about number systems.

(2) To equip students with problem solving skill including Binary arithmetic 1's and 2's Complement.

(3) To imbibe the idea of Digital codes such as BCD,Gray and Excess-3.

(4) To acquaint students with concepts of Logic gates.

(5) To inculcate the idea of Boolean algebra.

(6) To develop knowledge of combinational and sequential logic circuits.

Course Outcomes:

After successful completion of above said course students will be able to

(1) Get knowledge about various number system and codes.

(2) Able to understand logic gates.

(3) Differentiate between ordinary algebra and Boolean algebra.

(4) Define and discuss Algebraic and K-map simplification methods.

(5) Be able to understand Flip-Flops.

Unit I: Number Systems and Codes: [10 Periods]

Introduction, Decimal numbers, Binary numbers, Octal Numbers, Hexadecimal numbers, Binary arithmetic, 1's and 2's complements, Inter-conversions of number systems.
Digital Codes: Binary coded decimals (BCD), Gray code, Excess-3 code,Problems.
[Book-1, Chapter-2 and 3]

Unit II: Logic Gates: [10 Periods]

Introduction, AND Operation, OR operation, NOT operation.
Basic Gates: NOT gate, OR gate, AND gate (Symbol, truth tables & circuit diagram using diodes and transistors),
Universal Gates: NAND gate, NOR gate, Universal Property of NAND and NOR gates, EX-OR and EX-NOR gates (Symbols & truth tables) [Book-1, Chapter- 4,5]

Unit III: Boolean algebra: **[12 Periods]**

Introduction, Boolean operations, logic expressions, Laws of Boolean algebra, DeMorgan'sTheorems, Simplification of Boolean expressions using Boolean algebra Techniques, SOP and POS form of Boolean expressions for logic network, K-map, Simplification of Boolean expressions using Karnaugh map (2-variables, 3-variables and 4 variables), problems.

[Book-1, Chapter-4,6]

Unit IV: Combinational and Sequential Logic Circuits: **[13 Periods]**

Half adder, Full adder, Four-bit parallel binary adder, half Substractor, Full Substractor with suitable examples.

Flip-flops: S-R- Latch using NAND and NOR Gate, Clocked S-R Flip flop, J-K-Flip Flop, D- Type Flip Flop, T- Type Flip Flop, Preset and Clear Operations, Race-around condition, Master Slave JK flip-flop.

Types of counters, Modulus of a counter, Mode-8, Mod-8 Asynchronous counter, Synchronous counter**.** [Book-1, Chapter-5,7 and 8]

Recommended Books:

1. Digital Principles and Applications- A. P. Malvino, McGraw Hill International Editions (Third Edition)

2. Modern Digital Electronics- R.P. Jain, Tata McGraw Hill Pub. Company
(Fourth Edition)

3. Digital Principles and Circuits- Dr. C.B. Agarwal, Himalaya Publications.

Reference Books:

4. Digital Fundamentals-Thomas L. Floyd, Universal Book Stall

5. Digital Electronics with Practical Approach- G. N. Shinde, Shivani Pub., Nanded

6. Digital Electronics: An Introduction to Theory and Practice-William H.Gothmann, PHI

7. Digital principles and applications By Donald P. Leach & Albert Paul
Malvino, (Glencoe, 1995)

B.Sc. – III, Semester VI

U-PHY-642

Astronomy and AstrophysicsXII-B

Periods/Week: 3, Credits: 2, Total Periods: 45

Marks: 50, End Sem.: 30 & In Sem.:20 (UT: 15 &AT: 05)

(Under CBCS)

Learning Objectives:

To imbibe the concepts of astronomy and astrophysics to the students.

Course Outcomes:

The students will be able to understand the important concepts of astronomical objects and will be in a position to provide fundamental connections between different fields of the science in general and physics in particular.

Unit I: Fundamentals of Astronomy: [10 Periods]

Brief history of astronomy (geocentric universe, heliocentric universe), co-ordinate systems (celestial sphere, horizon, equatorial co-ordinate systems), Greenwich Sideral time, Local Sideral time, Zonal time, Hour angle and mean solar time, Astronomical Distance, astronomical unit (AU), light year, parsec, distance measurement in astronomy-stellar parallax

Unit II: The Solar Family: [10 Periods]

Kepler's laws of planetary motion, the Earth's orbit and spin, the Moon's orbit and spin. the planets in the solar system - the terrestrial and Jovian planets, structure, composition and atmospheres of the planets, ring systems and satellites of the planets, asteroids, meteors and meteorites, comets and their origin, solar and lunar eclipses, Origin of the Solar System: The Nebular hypothesis.

Unit III: Astronomical Techniques: [15 Periods]

Photon and non-photon astronomy, Photons (electromagnetic waves), Wavelength and frequency, Photon energy, Temperature, electromagnetic frequency bands – windows in astronomy Black body radiation- Planck laws, Wien displacement law, Brightness, Radiant Flux and Luminosity.

Magnitude systems: Apparent and absolute magnitudes, Distance Modulus; Determination of Temperature and Radius of a star Atmospheric effects (absorption, seeing) - Basics of

telescopes - Noise and statistics - Photon detectors - Basics of photometry - Spectroscopy and polarimetry.

Unit IV: The sun as a star: [10 Periods]

The Sun as a star, Solar Parameters, Solar Atmosphere, Solar Photosphere, Chromosphere, Corona, Solar Activity, Sunspots and sunspot cycle, solar limb darkening, solar neutrino puzzle.

Reference Books:

1. Modern Astrophysics – B.W. Carroll and D.A. Ostlie, 1996, Addison-Wesley Publishing Co., Inc.

2. The Physical Universe: An Introduction to Astronomy – Frank H. Shu, 1982, University Science Books, Sausalito, California

3. Astrophysics by BaidyanathBasu

4. Introduction to Astrophysics by K D Abhyankar

B.Sc. Physics III (Semester V)

Course Code: U-PHY-.....

Skill Enhancement Course -III

Renewable Energy Harvesting Skill-III

Periods/Week: 3, Credits: 2, Total Periods: 45

(Under CBCS)

Theory: 30 Periods

Learning Objectives:

1) The objective of this course is to acquire basic understanding of process, limitations of fossil fuels (coal, petroleum and natural gas) and necessity of harnessing alternate energy sources such as solar, wind, biomass etc.

2) To initiate Non- conventional energy conversion system with solar, wind, biomass, fuel cell etc.

3) To commerce inter connection of energy source to grid, stand alone and hybrid system.

Course Outcomes:

Upon successfully studying this course, students will:

1) Know about the energy demand of the world, nation and available resources to fulfill them.

2)Apply solar energy in thermal and electrical power generation considering energy crisis, environmental and social benefits.

3)Understand the operation of electrical energy generation using biomass, tidal, wind, solar and interconnection with grid.

4)Find the importance of wind based energy generation along with its design, analysis and comparison.

Unit-I Energy: [10 Periods]

Energy, man and energy, importance of energy in 21^{st} century energy trend, and conversion of energy form different source into electrical energy.Types of renewable energy sources: Solar energy, bio energy, hydrothermal energy, wind energy, ocean energy, nuclear energy

Unit II: Solar Energy: [10 Periods]

Systems of solar energy, parameters to be expected, calibration of solar spectrum (solar radiation at the surface of earth), applications of solar energy: solar photovoltaic system, merits and limitation of solar photovoltaic system, solar cooker, solar water heater.

Unit-III: Energy storage: **[10 Periods]**

Battery, supercapacitor, fuel cells (principle, operation, and formulae therein), photocatalysis, Electro catalysis.

Laboratory Exercises(Any Five of the following): **Practical: 15 Periods**

1) To study I-V Characteristics of Solar cell.

2) To study Solar cell colour sensitivity.

3) To determine Solar constant.

4) To study Characteristics of Solar cooker.

5) To study the effect of Dust Accumulation on PV Panel.

6) To study Characteristics of Solar Collector.

7) Measurement of energy and power density of capacitor

8) Estimation of ORE and HRE over potentials of given electrode material.

Reference Books:

1] Energy technology, Non-Conventional renewable and conventional-S. Rao and Dr. Parulkar.

2] Non-conventional energy sources –G.D.Rai

3] Solar energy: Principal of thermal collection and storage- S.P. Sukhatme

B.Sc. III Year, Semester-VI

U-PHY-643

Physics Laboratory Course-IX

Credits: 2 No of periods / Wk: 3

Marks: 50, End Sem.: 30 & In Sem.:20 (RB-10 & AT: 10)

(Under CBCS)

Learning Objectives:

The objectives of present lab work are;

(1) To develop understanding of the concepts of thermal conductivity, viscosity, Surface tension etc,

(2) To imbibe the phenomena of interference and diffraction,

(3) To develop understanding of acceleration due to gravity using Kater's pendulum,

Course Outcomes:

After successful completion of the course the students will be able to:

(1) Determine refractive index and viscosity of liquids and thermal conductivity of bad conductors,

(2) Measure thickness of thin slide/ blade/wire,

(3) find the wavelength of given unknown light source,

(4) Estimate the value of constants such as acceleration due to gravity and Planck's constant.

List of Experiments:

1. Thermal conductivity of rubber tube.
2. Determination of thermal conductivity by Forbes Method.
3. Viscosity by oscillating disc method.
4. Hartman's dispersion relation.
5. Thickness of thin wire –Air wedge method.
6. R.I. of liquid using hollow prism.
7. Diffraction at straight edge: Determination of wavelength.
8. g –by Kater's pendulum.
9. Planck's constant h by LED.
10. Diffraction at cylindrical obstacle: Determination of wavelength.
11. Surface tension of a liquid using laser.

* Note: Minimum six experiments should be performed, by each student.

B.Sc. III Year, Sem-VI

U-PHY-644

Physics Laboratory Course-X-A

Credits: 2 No of periods / Wk: 3

Marks: 50, End Sem.: 30 & In Sem.:20 (RB-10&AT: 10)

(Under CBCS)

Learning Objectives:

(1)To acquire the knowledge of logic circuits.

(2) To develop understanding of the basic, universal and derived logic gates.

(3) To inculcate the knowledge of the Boolean Algebra.

(4) To acquaint students about the construction of Combinational circuits.

Course Outcomes:

After successful completion of the course the students will be able to:

(1) Explain concepts and terminology of digital electronics,

(2) To construct Combinational Circuits

(3) Simplify Boolean expressions.

(4) Construct Basic logic gates using universal logic gates.

List of Experiments

1. Study of basic gates.
2. Study of basic gate using NAND gate.
3. Construction and study of Half and Full adder.
4. Verification of De Morgan's theorems.
5. Implementation of Boolean expression from the given truth table using K-Map.
6. Study of half and full Substractor.
7. Study of S-R, J-K and D Flip-flops.
8. Study of NAND and NOR gates.
9. Construction of Ex-OR and Ex-NOR gates using basic gates.
10. Study of Mod – 8 Asynchronous Counter.

* Note: Minimum six experiments should be performed, by each student on bread board only.

`B.Sc. III Year, Sem-VI

U-PHY-644

Physics Laboratory Course-X-B

(Based on Astronomy and AstrophysicsXII-B)
Credits: 2 No of periods / Wk: 3

Marks: 50, End Sem.: 30 & In Sem.:20 (RB-10&AT: 10)

(Under CBCS)

Learning Objectives:

To acquire the basic knowledge of Astronomy and Astrophysics,

Course Outcomes:

After successful completion of the course the students will be able to:

1) Study radiation pattern of the Sun.

2) Measure brightness of sky

3) Determine the temperature of an artificial star

List of Experiments

1. To study radiation pattern of the Sun and hence estimate effective surface temperature and luminosity of the Sun.
2. Estimating first-order atmospheric extinction of starlight using given data
3. Measuring sky brightness using solid state photometer
4. Studying solar limb darkening effect
5. Temperature of an artificial star
6. Measuring distance to Moon by parallax method.
7. Identifying and measuring diameters of Craters on the Moon surface.
8. Measurement of distance of star clusters by main sequence fit method
9. Observing sun-spots and measuring their diameters.