

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

B.Sc. III Year Physics Syllabus (Semester Pattern)

Semester V & VI

(Revised New Syllabus Effective from June 2011)

Course Title	Paper	Semester	Periods	Marks	
				External	Internal
PHY301: Quantum Mechanics (Compulsory paper)	XII	V	45	40	10
PHY302: Solid State Physics (Elective Paper)	XIII-A	V	45	40	10
PHY303: Astrophysics (Elective Paper)	XIII-B	V	45	40	10
PHY304: Atomic , Molecular & Mathematical Physics (Compulsory paper)	XIV	VI	45	40	10
PHY305: Digital Electronics (Elective Paper)	XV-A	VI	45	40	10
PHY306: Solar Energy (Elective Paper)	XV-B	VI	45	40	10
PHY307: Practical Course (Compulsory paper)	XVI	V & VI	80	50	-----
PHY308: Practical Course in Solid state physics & Digital electronics (Elective Paper)	XVII-A	V & VI	80	50	-----
PHY309: Practical Course in Astrophysics & Solar Energy (Elective Paper)	XVII-B	V & VI	80	50	-----

Note: The choice of Elective paper in V&VI semester is as follows.

- 1) A student who is offered Solid state physics in semester V and Digital Electronics in semester VI has to offer practical paper XVII-A
- 2) A student who is offered Astrophysics in semester V and Solar Energy in semester VI has to offer practical paper XVII-B
- 3) Internal marks should be given for student's performance in Unit test, Tutorial, oral exam, seminar etc.

B.Sc.III Year PHYSICS

Semester - V

Paper –XII

PHY301: Quantum Mechanics (Compulsory paper)

Periods: 45

Marks: 40 External + 10 Internal

Unit I: Matter Waves: (Book 1, 2)

(12 Periods)

Introduction, Compton Effect, de Broglie wave length, Wave function, Relation between Wave and Group velocity, Davisson and Germer's experiment, G.P.Thomson's experiment, Heisenberg's uncertainty principle and its applications.

Unit II: Wave Mechanics: (Book 1, 2)

(12 Periods)

The Wave function and its physical significance, The wave Equation, Schrödinger's Time dependent form equation, Probability current, Operators, Schrödinger's time independent (Steady-state form) equation, Eigen values and Eigen functions.

Unit III: Applications of Quantum Mechanics: (Book 1, 2)

(09 Periods)

The particle in a box – energy quantization, wave functions, Momentum Quantization, The particle in a three dimensional box.

Units–IV: Quantum Theory of Hydrogen Atom (Book 1 and 2)

(12 Periods)

Schrödinger's equation for the hydrogen atom, separation of variables, Quantum numbers –Total quantum number, Orbital quantum number, Magnetic quantum number.

Books Recommended:

1. Perspectives of Modern Physics-Arthur Beiser (McGraw-Hill Int.Edition)
2. Modern physics – R. Murugesan.(S.Chand & Co.XIth Revised edition)
3. Text Book of Quantum mechanics – Kakani & Chandaliya ((S.Chand & sons)
4. Quantum Mechanics – Chatwal and Anand (Himalaya Publishing)
5. Quantum Mechanics- Ghatak and Loknathan.

B.Sc.III Year PHYSICS

Semester - V

Paper –XIII-A

PHY302: Solid state Physics (Elective paper)

Periods: 45

Marks: 40 External + 10 Internal

Unit I: Crystal structure: (Book 1, 6)

(12 Periods)

Introduction, Periodicity in lattices, Lattices and bases, Translation vectors, Unit cell, symmetry operations, Point groups, space group, Bravais lattice, Simple crystal structure((SC, BCC, FCC, CsCl, NaCl),Miller indices.

Unit II: Bonding & Thermal properties of Solids: (Book 1, 6)

(10 Periods)

Introduction, Ionic bonds, covalent bond, metallic bonds, Vander wall's force and hydrogen bond.

Classical theory of Specific heat of solids, Einstein's theory of specific heat, Debye's theory of specific heat of solids, Dulong-Petit's law. Limitations of Debye model.

Unit III: Dielectrics (Book 1 and 6)

(08 Periods)

Introduction, Electric polarization, Effect of frequency and temperature on polarization, Local electric field, Clausius - Mosotti relation, Determination of dielectric constant.

Unit IV: Free electron theory of metals and Band theory of solids: (Book 1)

(15Periods)

Drude-Lorentz theory, Thermal conductivity, Electrical conductivity, Widemann-Franz relation, Thermionic Emission, Escape of electrons from metals, Hall Effect, Hall coefficient, Mobility and Hall angle, Distinction between metals, semiconductors and insulators.

Books Recommended:

1. Solid State Physics – Saxena,Gupta, Saxena (Pragati Prakashan Meerut)
2. Solid State Physics – Puri & Babar (S.chand & Co.)
3. Solid State Physics & Electronics – R.K.Puri & V.K.Babar (S. chand & Co)
4. Solid state Physics – R.L.Singhal (Kedar Nath Ram Nath Co., Meerut)
5. Modern physics – R. Murugesan.(S.Chand & Co.XIth Revised edition)
6. Solid state physics- A.J.Dekkar(Macmillan India Ltd.2000)
7. Introduction to Solid State Physics by Kittel, Wiley and Sons, 7th Edition.
8. Material Science by M. Arumguarn, Anuradha Publishers.

B.Sc.III Year PHYSICS

Semester - V

Paper –XIII-B

PHY303: Astrophysics (Elective paper)

Periods: 45

Marks: 40 External + 10 Internal

Unit I: Stellar physics:

(15 Periods)

Electromagnetic spectrum, Transmission of radiations through atmosphere, Black body radiation and Wien's law, Physical properties of astronomical objects, Spectral classification of stars, H-R diagram, luminosity classification of stars, distance measurement by Parallax method.

The Sun: Photosphere, chromospheres and corona.

Unit II: The Solar System:

(10 Periods)

Kepler's Laws of Planetary Motion, Structure, composition and atmosphere of our solar system (all nine planets), Comets, Asteroids, Meteors, Meteoroids.

Unit-III: Cosmology

(Book 6 and 7)

(08 Periods)

The Big-Bang universe, the steady state cosmology, the oscillating cosmology, the Hubble law and cosmological test.

Units-IV: Milky Way Galaxy and Solar System: (Book 6 and 7)

(12 Periods)

The Milky Way galaxy, inter –stellar medium, inter-stellar molecules, origin of solar system, condensation theory, arguments for and against the theory, early history of planets, planetary properties of Mars, evidence of geological activities, prospects for life on Mars, surface of the Sun, Sunspots, the Sunspot cycle.

Books Recommended:

1. Astrophysics(Stars and Galaxies) – K.D. Abhyankar (University Press Hyderabad)
2. Observational Astrophysics – Robert C. Smith (Cambridge University Press)
3. Astrophysics- A Modern Perspective- K.S. Krishna Swamy (New Age International)
4. Stars- Life, Death and Beyond – A.K.kimbhavi, J.V.Narlikar (IUCAA-Pune)
5. An Introduction to astrophysics- Baidynath Basu (PHI)
6. Astronomy – Fundamentals and Frontiers – Robert jastrow and M. H. Thompson(Chap. 9, 12, 14, 15, and 19) Edition, 2nd ed. Publication, Link New York : John Wiley & Sons
7. Astronomy – Frank Bash Harper & Row publishers, 1977

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B.Sc.III Year PHYSICS

Semester - VI

Paper –XIV

PHY304: Atomic, Molecular and Mathematical physics (Compulsory paper)

Periods: 45

Marks: 40 External + 10 Internal

Unit I: Vector Atom Model. (Book 1, 2)

(15 Periods)

The vector atom model, Quantum numbers associated with the vector atom model, L-S and J-J coupling, The Pauli's exclusion Principle, Selection rules, Intensity rules, Interval rule, Normal Zeeman effect, Anomalous Zeeman effect, Stark effect.

Unit II: Molecular Spectra: (Book 1, 2)

(08 Periods)

Theory of pure rotational spectra, Theory of rotation-vibration spectra, Raman Effect, Experimental study, Raman Effect in solids, liquids and gases.

Unit III: Complex variables (Book 9, 10)

(10 Periods)

Definition, complex algebra (Addition, Subtraction, Multiplication, Division, conjugate complex number), graphical representation of Sum, Difference, product and Quotient of complex number, Extraction of Roots, Properties of moduli, arguments and geometry of complex numbers.

Unit IV: Fourier Series (Book 9, 10)

(12 Periods)

Definition, Evaluation of the coefficients of Fourier series, Cosine series, Sine series, Dirichlet's Theorem, Graphical representations of even and odd functions, properties of Fourier series (convergence, Integration, Differentiation), Physical applications of Fourier series analysis, Square wave, Saw tooth wave, Forced vibrations, Half wave rectifier.

Books Recommended:

1. Modern physics- R. Murugesan, Kruthigaprasath. (S.Chand & Co.)
2. Atomic physics – J.B.Rajam. (S.Chand & Co.)
3. Introduction to Atomic Spectra: H E White, McGraw Book Company, Inc.
4. Fundamental of molecular spectroscopy: C N Banwell, Tata McGraw hill, 3rd edition.
5. Spectra of Diatomic Molecules: G Hertzberg, D Van Nastrand company, Inc., NewYork.
6. Perspectives of Modern Physics: Arthur Beiser, McGraw Hill Kogakusha Ltd, Tokyo.
7. Atomic spectra and molecular spectra: Raj kumar, Kedarnath Ramnath Prakashan.
8. Molecular Structure & Spectroscopy – G. Aruldas (PHI Ltd.)
9. Mathematical Physics- B.S.Rajput
10. Mathematical Physics- B.D. Gupta (Vikas publishing House)

B.Sc.III Year PHYSICS

Semester - VI

Paper –XV-A

PHY305: Digital Electronics (Elective paper)

Periods: 45

Marks: 40 External + 10 Internal

Unit I: Number Systems and Codes

(08 Periods)

Decimal numbers, Binary numbers, Binary arithmetic, 1's and 2's complements, Octal Numbers, Hexadecimal numbers, Inter-conversions of number systems.

Digital codes: Binary coded decimal (BCD), Gray code, Excess-3 code

Unit II: Logic Gates

(07Periods)

NOT gate, OR gate, AND gate (Symbol, truth table, circuit diagram for basic gates using Diodes and transistors), NAND gate, NOR gate, EX-OR and EX-NOR gates, Universal properties of NAND & NOR gates.

Unit III: Boolean algebra

(10 Periods)

Boolean operations, logic expressions, Laws of Boolean algebra, DeMorgan's theorems, Simplification of Boolean expressions using Boolean algebra Techniques, SOP and POS form of Boolean expressions for logic network, Simplification of Boolean expressions using Karnaugh map (up to 4 variables).

Unit IV: Arithmetic circuits:

(20 Periods)

Half adder, Full adder, Four-bit parallel binary adder, Multiplexer and Demultiplexers with suitable example, BCD to 7-segment decoder.

Sequential Logic:

Flip-flops: Clocked S-R, J-K-Flip Flop, D- Type FF, T- Type FF, Preset and Clear operation, Race-around condition, Master Slave JK flip-flop.

Shift registers: Serial-in-serial-out, serial-in-parallel-out, parallel-in-serial-out, parallel-in- parallel-out (4- bit only).

Counters: Asynchronous counter (3-bit), Synchronous counter (3-bit), Decade counter.

Books Recommended:

1. Modern Digital Electronics- R.P. Jain, Tata McGraw Hill Pub. Company (Third Edition)
2. Digital Fundamentals-Thomas L. Floyd, Universal Book Stall
3. Digital Principles and Applications- A. P. Malvino, McGraw Hill International Editions(Fourth Edition)
4. Digital Electronics with Practical Approach- G. N. Shinde, Shivani Pub., Nanded
5. Digital Electronics: An Introduction to Theory and Practice-William H.Gothmann, Prentice Hall of India.
6. Digital principles and applications By Donald P. Leach & Albert Paul Malvino, (Glencoe, 1995).

B.Sc.III Year PHYSICS

Semester - VI

Paper –XV-B

PHY306: Solar Energy (Elective paper)

Periods: 45

Marks: 40 External + 10 Internal

Unit I: Solar Energy:

(12 Periods)

Solar constant, solar radiation at the Earth's surface, solar energy collectors: physical principle of the conversion of solar radiation in to heat.

Types of collectors: Parabolic collectors, Mirror strip reflector, Fresnel lens collector, Compound parabolic concentrators (CPC).

Unit II: Application of Solar Energy

(11Periods)

Solar Water Heating, Heating and Cooling of Buildings, Thermo electric conversion, Power generation, PV cells, Solar distillation, Pumping, Cooking, Hydrogen production

Unit III: Energy from Biomass

(10 Periods)

Conversion technology, Factors affecting gas generation, classification of biogas plants, Advantages and disadvantages of different types of plants, Problems

Unit IV: Fuel Cells

(12 Periods)

Design and Principle of operation, Classification, Types, Advantages and disadvantages, Conversion efficiency, Types of electrodes, Work output and EMF of Fuel Cells, Applications of Fuel Cells.

Books Recommended:

1. Non-Conventional Energy Sources – G.D. Rai (Khanna Publishers, Delhi)
2. Solar energy utilization - G.D.Rai ,(Ed,V.1995)
3. Solar Energy – S.P.Sukhatme (II nd edition Tata McGraw-Hill).
4. Fundamentals of Renewable Energy Systems - D. Mukherjee and S. Chakrabarti, (New Age International Publishers.)
5. Non Conventional Energy Resources - D.S. Chauhan and S.K.Srivastava, (New Age International Publishers)

Semester – V & VI

B.Sc.III Year PHYSICS
PHY307: Practical Course
(Compulsory Paper)

Paper –XVI

Periods: 80

Marks: 50

Note: Perform at least twelve experiments

1. 'Y' by Koenig's Method
2. Coefficient of viscosity by oscillating disc method
3. Determination of Stefan's constant
4. Determination of Rydberg's constant
5. Hartmann's dispersion formula
6. Temperature of flame
7. Cauchy's constant by using spectrometer
8. Diffraction at straight edge. Determination of wavelength
9. Diffraction at cylindrical obstacle. Determination of wavelength
10. Diffraction Grating. Determination of wavelength (Minimum deviation method)
11. Resolving Power of Prism
12. Conductivity by Forbe's method
13. Determination of dispersive power of prism
14. Planck's constant (h) by LED
15. e / m by Thomson's method
16. Thermal conductivity of rubber tube
17. Surface Tension by soap bubble method
18. Thermal conductivity of an insulator by Lee's disc method.
19. Wavelength of light by Michelson's interferometer.
20. To study Hysteresis curve of transformer core.
21. To study absorption spectrum of iodine vapours.
22. Determination of Planck's constant using solar cell.
23. Characteristics of Photovoltaic cell.
24. Modulus of rigidity by torsional oscillations
25. Study of diode as clipping and clamping device.

B.Sc.III Year PHYSICS

Semester – V & VI

Paper –XVII-A

PHY308: Practical Course in Solid state physics & Digital electronics

(Elective Paper)

Periods: 80

Marks: 50

Note: Perform at least twelve experiments

1. Calibration of bridge wire using Carrey – Foster’s bridge
2. Efficiency of a transformer
3. Variation of thermo e.m.f.with temperature
4. Study of CRO:Measurement of frequency and voltage sensitivity
5. Transistorized regulated power supply using Zener diode
6. Power supply using π type filter (Half wave rectifier)
7. Power supply using π type filter (Full wave rectifier)
8. Ionic conductivity of NaCl
9. Measurement of resistivity by two probe method
10. Measurement of resistivity by four probe method
11. Determination of Curie temperature of Ferrite
12. Determination of Specific heat of graphite at different temperatures
13. Determination of Hall coefficient of a given sample.
14. To study characteristics of thermistors
15. Analysis of Given XRD pattern (Lattice parameters).
16. Determination of dielectric constant
17. Verification of truth table of basic gates (AND, OR, NOT) using ICs.
18. Construction of basic gates (AND, OR, NOT) using NAND gates.
19. Construction and study of half adder using NAND gates.
20. Construction and study of full adder using NAND gates.
21. Implementation of Boolean expression from the given truth table using K-map.
22. Verification of De Morgan’s First & Second theorem.
23. Construction and study of JK, T-type and D-type flip-flops using IC 7476.
24. BCD to 7-segment decoder
25. Study of decade counter using IC 7490.
26. Construction and study of Serial in – Serial out shift register using IC 7495.
27. Mod-16 asynchronous counter using IC 7493.
28. Implementation of given expression using a 16:1 MUX.
29. To study of Multiplexer circuit and Demultiplexer circuit

B.Sc.III Year PHYSICS

Semester – V & VI

Paper –XVII-B

PHY309: Practical Course in Astrophysics & Solar Energy

(Elective Paper)

Periods: 80

Marks: 50

Note: Perform at least twelve experiments

1. Estimation of mass of the Jupiter
2. Astronomical photometry
3. Distance of star cluster by main sequence fit
4. Solar spectrum
5. Observing the Sun: Sun spots
6. Sun spectrum: Fraunhofer lines
7. Locating objects in the sky
8. Studying features of the moon surface
9. Observing Jovian planet: Jupiter and its satellites
10. Characteristics of solar cell
11. Characteristics of solar cooker
12. Study of Power versus load characteristics of Solar Photovoltaic panel.
13. Study of Series combination of Solar Photovoltaic panels
14. Study of Parallel combination of Solar Photovoltaic panels
15. Determination of Calorific value of Coal/Cow dung
16. Study of Solar Hot water system.