

CIRCULAR :-

A reference is invited to the Ordinances, Regulations and syllabi relating to the B.Sc. degree course vide this office Circular No.UG/118 of 2003 dated 10th March, 2003 and the Principals of the affiliated colleges in Science are hereby informed that the recommendation made by the Board of Studies in Physics at its meeting held on 6th October, 2008 has been accepted by the Academic Council at its meeting held on 15th December, 2008 vide item No.4.6 and that, in accordance therewith, the syllabus in the subject of Physics at the S.Y.B.Sc. examination (Theory and Practical) is revised as per **Appendix** and that the same has been brought into force with effect from the academic year 2009-2010.

MUMBAI-400 032
17th January, 2009

PRIN K VENKATARAMANI
REGISTRAR

To,
The Principals of the affiliated colleges in Science.

A.C./4.6/15.12.2008

No.UG/ 31 - A of 2009, MUMBAI-400 032

17th January, 2009

Copy forwarded with compliments for information to: -

- 1) The Dean, Faculty of Science
- 2) The Chairman, Board of Studies in Physics.
- 3) The Controller of Examinations,
- 3) The Co-Ordinator, University Computerization Centre,

(D.H. KATE)

DEPUTY REGISTRAR
U.G./P.G SECTION

Copy to: -

The Director, Board of College and University Development, the Deputy Registrar (Eligibility and Migration Section), the Director of Students Welfare, the Executive Secretary to the Vice-Chancellor, the Pro-Vice-Chancellor, the Registrar and the Assistant Registrar, Administrative sub-center, Ratnagiri for information.

The Controller of Examinations (10 copies), the Finance and Accounts Officer (2 copies), Record Section (5 copies), Publications Section (5 copies), the Deputy Registrar, Enrolment, Eligibility and Migration Section (3 copies), the Deputy Registrar, Statistical Unit (2 copies), the Deputy Registrar (Accounts Section), Vidyanagari (2 copies), the Deputy Registrar, Affiliation Section (2 copies), the Director, Institute of Distance Education, (10 copies) the Director University Computer Center (IDE Building), Vidyanagari, (2 copies) the Deputy Registrar (Special Cell), the Deputy Registrar, (PRO) the Assistant Registrar, Academic Authorities Unit (2 copies) and Assistant Registrar, Executive Authorities Unit (2 copies). They are requested to treat this as action taken report concerned resolution adopted by the Academic Council referred to in the above Circular and that, no separate Taken Report will be sent in this connection. the Assistant Registrar Constituent Colleges Unit (2 copies), BL copy), the Deputy Account. Unit V(1 copy), the In-charge Director, Centralize Computing Facility (1 copy), the Secretary MUASA (1 copy), the Superintendent,

UNIVERSITY OF MUMBAI



Revised Syllabus
at the S.Y.B.Sc Examination
(Theory & Practicals)
in
Physics

(With effect from the academic year 2009-2010)

Revised Syllabus in Physics
(Theory & Practical)
Second Year B. Sc. 2009 – 2010.

The revised syllabus in Physics for the S. Y. B. Sc. Course will be implemented from the academic year 2009 – 2010. The scheme of examination for the revised course in Physics at the Second Year B. Sc. Examination will be as follows.

Theory	Title	Examination	Maximum Marks	Maximum Marks after conversion
Paper-I	Mechanics. Theory of errors, Optics.	First Term	60	30
		Second Term	60	30
Paper-II	Electricity. Magnetism and Electronics.	First Term	60	30
		Second Term	60	30
Paper - III	Thermodynamics, Introduction to Special Theory of Relativity, Wave Mechanics and Material Science.	First Term	60	30
		Second Term	60	30
Practical Paper - I	Experiments from Group - A		30	30
Practical Paper - II	Experiments from Group - B		30	30
Practical Paper - III	Experiments from Group - C		30	30
Certified Journal *	Regular + Skill + Demonstration Experiment		15	15
Practical	Viva - voce		15	15
Total Marks	Theory :			180
	Practical :			120
Total				300

The paper is divided into six units. Unit – 1, 2, 3 of each paper are to be taught during first term and units – 4, 5, 6 to be taught during second term.

For practical examination, the candidates will be examined in three experiments (one from each group). Each experiment will be of three hours duration. In all minimum 8 experiments from each group, minimum 4 from demonstration experiments and all skill experiments are required to be completed compulsorily. Students are required to report all these experiments in the journal.

* A candidate will be allowed to appear for the examination only if the candidate submits a certified journal of S. Y. B. Sc. Physics or a certificate from the Head of the Department / Institute to the effect that, the candidate has completed the practical course of S. Y. B. Sc. Physics, as per the minimum requirements.

S. Y. B. Sc. PHYSICS
PAPER – I
(Mechanics, Theory of errors and Optics)

UNIT – I

(15 Lectures)

Damped Vibrations : Decay of free vibrations of a simple harmonic oscillator due to the damping force proportional to the first power of velocity, types of damping, Energy of a damped oscillator, logarithmic decrement, relaxation time and Quality factor.

HP : 9.3, 9.4.

Forced Vibration and Resonance : Forced damped harmonic oscillator, Special cases : low driving frequency, high driving frequency, Resonance. Quality factor of a driven oscillator.

HP : 9.6, 9.7.

Compound pendulum : Expression for period, Maximum and minimum time periods, Centers of suspension and oscillation, Reversible compound pendulum, Kater's reversible pendulum. Advantages of a compound pendulum over a simple pendulum.

HP : (pages 279 to 284)

UNIT - II

(15 lectures)

Theory of errors : Significant Digits – Dropping of non-significant digits, Rounding of numbers, Absolute and relative errors, Relative errors and significant digits, Errors of computation, Accuracy of a function.

Elementary theory of errors: Introduction, Various kinds of errors, Different ways of measuring random errors, Uncertainty and Significant digits, Fractional uncertainty and significant digits, Significance of Uncertainty.

The estimation of errors: The normal distribution, The average or mean value of measurements, Average errors, Standard errors, Probable errors, The practical determination of errors and Peter's formula(without proof), Error in a single measurement, The error in the mean, Reliability of measurement.

JCP: 1.2, 1.3, 1.4, 1.5, 1.6, 2.1, 2.2, 2.3, 2.7, 2.7(a), 2.9, 3.4, 3.5, 3.6, 3.6(a), 3.6(b), 3.10, 3.10(a), 3.11.

UNIT - III :

(15 Lectures)

Diffraction:

Fresnel's Diffraction : Introduction, Huygens – Fresnel's theory, Fresnel's assumptions, Distinction between Interference and Diffraction, Fresnel and Fraunhofer types of diffraction, Diffraction due to a straight edge, Position of maximum and minimum intensity, Intensity at a point inside a geometrical shadow, Diffraction due to a narrow slit, Diffraction due to a narrow wire.

Fraunhofer diffraction : Introduction, Fraunhofer diffraction at a single slit, Intensity distribution in diffraction pattern due to a single slit, Fraunhofer diffraction at a double slit, Distinction between single slit and double slit diffraction patterns, Plane diffraction grating, Theory of plane transmission grating, Width of principal maxima, Prism and grating spectra.

SBA : 17.1, 17.2, 17.3, 17.6, 17.7, 17.10, 17.10.1, 17.10.2, 17.11, 17.12, 18.1, 18.2, 18.2.1, 18.4, 18.4.2, 18.7, 18.7.1, 18.7.2, 18.7.8. [(i) to (v)]

UNIT - IV

(15 Lectures)

Collisions: Introduction, types of collisions, Laboratory and centre of mass systems, Relationship between displacements and velocities, relationship between angles.

H. P : 7.1, 7.3, 7.3.1, 7.3.2.

Bending of beams : Bending moment, Basic assumptions for theory of bending, Cantilever, Beam supported at its ends and loaded in the middle, I-section Girders, Determination of Y by bending. Determination of elastic constants by Searle's method.

BS : 10.16, 10.17, 10.18, 10.19, 10.20, 10.22, 10.23, 10.26.

UNIT-V

(15 Lectures)

Polarization: Introduction, The wire grid polarizer and the Polaroid, Polarization by Reflection, Polarization by double Refraction, Malus' Law, Superposition of two disturbances, The mathematical Analysis, The phenomenon of double refraction. Quarter wave plates and half wave plates.

AG : 19.1, 19.2.1, 19.2.2, 19.2.3, 19.3, 19.4, 19.4.1, 19.5, 19.6.

UNIT-VI

(15 Lectures)

Michelson Interferometer: Principle, Construction, Working, Circular fringes, Localized Fringes, White light fringes, Visibility of fringes.

Applications of Michelson Interferometer.

- a) Measurement of wavelength.
- b) Determination of the difference in the wavelength of the two waves.
- c) Thickness of a thin transparent sheet.
- d) Standardization of the meter

Fabry – Perot Interferometer and Etalon:

Formation of fringes Determination of wavelength, Measurement of difference in wavelength.

SBA : 15.7, 15.7.1, to 15.7.7, 15.8, 15.8.1, 15.8.2, 15.8.3, 15.8.5, 15.12, 15.12.1, 15.12.2, 15.12.3.

Resolving Power :

Introduction, Rayleigh's criterion, Resolving power of optical instruments, criterion for resolution according to Lord Rayleigh's, Resolving power of a telescope, Resolving power of a prism, Resolving power of a plane transmission grating.

SBA : 19.1, 19.2, 19.5, 19.6, 19.7, 19.11, 19.12.

Note : A good number of numerical examples are expected to be covered during the prescribed lectures.

References :

- H. P. : Mechanics – H. S. Hans and S. P. Puri, Tata McGraw Hill
(2nd Ed.)
- B. S. : Mechanics and Electrodynamics. – Brij Lal, N. Subramanyam,
Jivan Seshan, S. Chand (Revised and Enlarged Edition 2005)
- JCP. : The theory of errors in Physical Measurements J. C. Pal, New
Central Book agency, Reprint 2008.
- SBA.: A text book of Optics – Subramanyam, Brij Lal, Avadhanulu –
S. Chand & Co. Multicoloured Ed. 2007.
- AG. : Optics – Ajoy Ghatak (3rd Ed) Mc. Graw Hill Co.

Additional References:

1. Fundamental of Vibrations and Waves.
S P Puri. (Tata Mc Graw Hill)
2. Mechanics – K R Symon : [Addition & Wesley (3rd Ed)]
3. Mechanics – D. S. Mathur (S Chand & Co.)
4. Text book of Mechanics : Bhargava and Sharma.
5. Error of observation and their treatment – J Topping (Institute of
Physics Monographs for students Series.)
6. An introduction to error Analysis : John R Taylor,
University Science Books : Mill Valey California
7. Optics – Eugene Hecht (4th Ed) Pearson Ed. Publishers.

**S. Y. B. Sc. PHYSICS
PAPER – II**

(Electricity, Magnetism and Electronics)

UNIT – I :

(15 Lectures)

Charged particle dynamics

Kinetic Energy of a charged particle in an Electric field, motion of a charged particle in a constant Electric field, Charged particle in an alternating electric field, Force on a charge in a Magnetic field, Charge particle in a uniform and constant magnetic field. The cyclotron.

Motion of a charged particle in combined electric and magnetic field :

Case 1 : Parallel electric and magnetic field

Case 2 : Crossed electric and magnetic field

Velocity selector.

HP : 13.1, 13.2, 13.3, 13.4, 13.5, 13.5.1, 13.6, 13.6.1

UNIT – II

(15 Lectures)

[Review of CE amplifiers, load line, operating point]

- 1. Transistor biasing,** Inherent variations of transistor parameters, stabilization, Essentials of transistor biasing circuit, Stability factor, Methods of transistor biasing, Base resistor method, Biasing with feedback resistor (Collector to base bias), Voltage divider bias method, Mid-point biasing, Silicon versus Germanium.

MM : 12.2, 12.3, 12.4, 12.5, 12.6, 12.7, 12.8, 12.9, 12.10, 12.12, 12.14.

- 2. General Amplifier Characteristics :**

Concept of Amplification, Amplifier notations, Current gain, Voltage Gain, Power gain, Input resistance, Output resistance. Decibels and Frequency Response: General theory of feedback, Reasons for Negative Feedback, Loop Gain. Practical circuit of transistor amplifier, Phase reversal.

AM : 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 17.0, 17.1, 17.2, 17.3.

SC : 9.3, 9.4.

MM : 13.4, 13.5.

UNIT – III

(15 Lectures)

1. Number System :

Decimal, Binary, Hexadecimal number systems and their mutual conversions, Binary Arithmetic, Representation of Binary Numbers, Addition and subtraction using 2's compliment.

2. Implementation of Logic circuit from truth tables :

Sum of products method, Product of sums method

3. Flip Flops and Counters : R-S flip flops, clocked RS flip flop, D flip flop, Edge triggered D flip flop, Edge triggered J K flip flop, Master slave flip flop, T flip flop, D flip flop using J K flip flop, 4 bit binary ripple up counter, 4 bit binary ripple down counter.

SC : 1) 15.3, 15.3.1, 15.3.2, 15.3.4, 15.3.5, 15.3.6,

2) 15.7, 15.7.1, 15.7.2

3) 15.11, 15.11.1, 15.11.2, 15.11.3, 15.11.4, 15.11.5,
15.11.6, 15.11.7, 15.11.8, 15.12.2.

UNIT – IV :

(15 - Lectures)

Triple products, The ∇ operator, The gradient, divergence and the curl, product rules. The fundamental theorem of gradient divergence and curl, Spherical polar coordinates, cylindrical co-ordinates, One dimensional and three dimensional Dirac-delta function.

DG : 1.1.3, 1.2.3, 1.2.2, 1.2.4, 1.2.5, 1.2.6, 1.3.3, 1.3.4, 1.3.5, 1.4.1,
1.4.2, 1.5.2, 1.5.3.

UNIT – V

(15 Lectures)

1. The work done in moving a charge, The energy of a point charge distribution, the energy of continuous charge distribution, comment on electrostatic energy.
2. The Biot – Savart law, Applications of Biot – Savart Law :
Magnetic field due to a current carrying straight wire, circular loop, Helmholtz coils and solenoid.

DG : 1) 2.4.1, 2.4.2, 2.4.3, 2.4.4.

CR : 2) 8.7, 8.8.

1) Oscillators :**(15 Lectures)**

Introduction, Effect of Positive feedback, Requirements for oscillations, Phase shift oscillator, Wien Bridge oscillator, Colpitt's oscillator.

AM : 18.0, 18.1, 18.2, 18.3, 18.5, 18.6.

2) Operational Amplifiers :

Symbol, Ideal Op – Amp, Op Amp IC Architecture, Inverting Amplifier, Non-inverting Amplifier, Frequency Response and slew rate, Op-Amp Applications :

Summing Amplifier, Difference Amplifier, Integrator, Differentiator, Emitter coupled Differential amplifier.

SC: 11.1, 11.2, 11.3, 11.4, 11.5, 11.8.2, 11.8.3, 11.9, 11.9.1, 11.9.2, 11.9.3, 11.9.4.

M : 17.1 (for Differential Amplifier)

Note : A good number of numerical examples are expected to be covered during the prescribed lectures.

References:

1. HP : Mechanics – H.S. Hans and S. P. Puri
Tata Mc. GrawHill (2nd Ed.)
2. MM : Principles of Electronics – V. K. Mehta & Rohit Mehta.
(S. Chand – Multicoloured illustrative edition)
3. AM : Electronic devices and circuits – An introduction Allan
Mottershead (PHI Pvt. Ltd. – EEE – Reprint – 2007)
4. SC : A textbook of electronics – Santanu Chattopadhyay
New Central Book Agency. 2006 Ed.
5. M : Electronic principles – A. P. Malvino – TMH (6th Ed.).
6. DG : Introduction to Electrodynamics – David J. Griffiths
Prentice Hall India (EEE) 3rd Ed.
7. CR : Electricity and Magnetism - D. Chattopadhyay and
P. C. Rakshit Books and allied (P) Ltd.
Reprint 2000 (4th Ed.)

Additional References:

- UNIT – I : Mechanics and Electrodynamics
& V Brij Lal, Subrahmanyam, Jivan Sesan, (S. Chand)
(Revised & Enlarged ED. 2005)
- UNIT – II : Electronics Fundamental and applications (8th Ed.)
D. Chattopadhyay & P. C. Rakshit (New Age
International)
- UNIT–III : Digital Principles and applications
Malvino and Leach
- UNIT-IV : Introduction to Electrodynamics
A. Z. Capri and P. V. Panat (Narosa Pub. House)
- Unit-VI : Electronic Devices and Circuit theory
Robert Boylestand & Louis Nashelsky (PHI)

S. Y. B. Sc. PHYSICS

PAPER – III

(Thermodynamics, Introduction to the theory of Relativity,
Wave Mechanics and Material Science)

UNIT – I

(15 Lectures)

1. Reversible and irreversible process, Heat Engines, Definition of Efficiency, Carnot's Ideal Heat Engine, Carnot's cycle, effective way to increase Efficiency, Carnot's Engines and refrigerator, Coefficient of performance. Second law of Thermodynamics, Carnot's theorem. Clapeyron's Latent Heat equation using Carnot's cycle and its applications.
2. Steam Engine, Otto Engine, Petrol Engine, Diesel Engine

BS : 1) 4.20, 4.21, 4.22, 4.23, 4.24, 4.25, 4.26, 4.27, 4.28, 4.29,
6.11.

2) 4.30, 4.31, 4.32, 4.33.

UNIT – II

(15 Lectures)

Experimental background of special Relativity, Galilean transformation, Newtonian Relativity, Electromagnetism and Newtonian Relativity, Attempts to locate absolute frame: Michelson – Morley Experiment, Attempts to preserve the concept of a preferred ether frame: Lorentz Fitzgerald contraction and ether drag hypothesis. Attempt to modify electrodynamics, Postulates of the special theory of relativity.

RR : 1.1 to 1.9

UNIT – III

(15 Lectures)

Quantum Mechanics, Wave equation, Schrödinger equation- time dependent form, Linearity and superposition, Expectation values, operators, Schrödinger equation – steady state form. Worked out examples and problems.

AB : 5.1 to 5.7

UNIT – IV

(15 Lectures)

Concept of Entropy, Change in Entropy, Change in Entropy in Adiabatic Process, Change in Entropy in Reversible cycle, Principle of increase of Entropy, Change in Entropy in Irreversible Process, T – S diagram, Physical Significance of Entropy, Entropy of a perfect gas, Kelvin's thermodynamic Scale of temperature, (Omit alternative method using Carnot cycle), The size of a Degree, Zero of Absolute scale, Identity of perfect Gas Scale and Absolute scale. Third Law of thermodynamics, Zero point energy, Negative temperatures (Not possible), Heat Death of the Universe.

BS : 5.1 to 5.9, 5.11 to 5.18.

UNIT – V

(15 Lectures)

Material Science:

1. **Classification and selection of Materials:** Classification of materials, Organic, Inorganic and Biological Materials
Semiconductor materials, Current trends and advances in materials. Material structure and examination, Selection of materials.
 2. **Crystal Geometry and structure:** Crystals, Single crystal, Whiskers, Lattice point and space lattice. Unit cell, Primitive cell, Atomic radius, Density of crystal, Direction lattice planes, Miller indices, Interplaner spacing, Crystal planes in cubic unit cell, Common planes in simple cubic structure, Co-ordination number, Crystal growth
1. KK : Chapter 1 (3 to 9, 11)
 2. KK: Chapter 3 (1 to 18, 33)

UNIT – VI

(15 Lectures)

Free states : The free particle, potential step, the rectangular potential barrier – The tunnel effect, Emission of α particle for a radioactive element, square well potential, free states.

Bound States : Particle in one dimensional box, Particle in a rectangular three dimensional box.

Worked out examples and problems.

SPS : 5.1 to 5.6, 6.1 to 6.3.

Note : A good number of numerical examples are expected to be covered during the prescribed lectures.

References:

1. BS : Heat, Thermodynamics and statistical Physics
Brij Lal, Subrahmanyam, Hemne (S. Chand
(Revised Multicoloured Ed. 2007)
2. RR : Introduction to Special Theory of Relativity
Robert Resnick (Wiley Eastern Ltd)
3. KK : Material Science – S. K. Kakani and Amit Kakani
New Age International (P) Ltd. – Reprint 2004.
4. SPS: Quantum Mechanics – S P Singh, M K Bagade, Kamal Singh, - S. Chand : 2004 Ed.
5. AB : Concepts of Modern Physics – A. Beiser (6th Ed.)
Tata McGraw Hill.

Additional References :

UNIT - I and IV:

1. Basic Thermodynamics – Evelyn Guha (Narosa Publications)
2. Thermal Physics – Philip M. Morse
(W. A. Benjamin Inc, New York)
3. Heat & Thermodynamics – Robert and Miller (E LBS)
4. A treatise of Heat – Saha and Srivastava.

UNIT – II

Special theory of Relativity – A P French – Thomas Nelson and Sons.

UNIT – III and VI.

1. Perspectives of Modern Physics – A. Beiser (Mc Graw Hill International Edition)
2. Introduction to quantum Mechanics – P T Mathews
3. Concepts of Modern Physics – A Beiser (6th Ed.) Tata McGraw Hill
4. Modern Physics : Hans, C. Chanian – Prentice – Hall of India .

UNIT – V

1. Solid State Physics – Ajay Kumar Saxena.
Macmillian India Ltd. (2006 Ed)
2. Material Science _ R. S. Khurmi & R. S. Sedha
(S. Chand & Co. Ltd.) 5th Rev. & Enlarged Ed-2007.
3. Material Science and Metallurgy – O P Khanna
Dhanpat Rai Publication (XI Reprint)
4. Modern Physics : Hans. C. Chanian – Prentice – Hall of India.
5. Atomic Physics : D S Murty, V. Laxminarayana, Bangar Raju.
Tata Mc. Graw Hill Publication co. Ltd.

REVISED SYLLABUS IN S. Y. B. Sc. PHYSICS PRACTICALS

Group - A

1. Surface Tension by Jaeger's Method.
2. Bar Pendulum : Determination of g .
3. Resonance pendulum.
4. Y by bending.
5. Searle's experiment : Determination of η , Y , σ .
6. Logarithmic decrement.
7. Optical lever : Determination of μ .
8. Determination of Cauchy's constants.
9. Cylindrical obstacle : Determination of λ .
10. Fresnel's biprism : Determination of λ .
11. Resolving power of telescope.
12. Brewster's Law : Determination of μ .

Group - B

1. CE Amplifier : Determination of Bandwidth.
2. CE Amplifier : Variation of gain with load.
3. Op - amp : Inverting Amplifier.
4. Op - amp : Non - inverting amplifier and voltage follower.
5. Op - amp : Difference Amplifier.
6. Op - amp : Integrator.
7. Op - amp : Differentiator.
8. Wein bridge oscillator (transistorised).
9. Colpitt's oscillator.
10. Bridge rectifier : Ripple, Load regulation (with and without C filter)
11. Half adder and Full adder (7486, 7408)
12. Study of MS - JK flip flop and divide by 2 counter.

Group - C

1. Figure of merit of a Mirror Galvanometer.
2. High Resistance by Mirror Galvanometer.
3. Determination of Absolute Capacitance using BG.
4. Passive Low pass filter.
5. Passive High pass filter.
6. Passive Band pass filter.
7. Verification of Stefan's Law (Electrical method)
8. C_1 / C_2 by de - Sauty's method.
9. Series Capacitance Bridge.
10. LCR parallel resonance.
11. LCR transients
12. Verification of Maximum Power Transfer theorem..

Skill Experiment :

1. Wiring of a simple circuit using bread board.
2. Use of Oscilloscope.
3. Travelling microscope (Radius of a capillary bore)
4. Spectrometer : Mean μ of yellow doublet of Mercury source.
5. Component Testing, Colour code of resistors, capacitors etc.
6. Drawing graph on semi logarithmic / logarithmic scale.

Demonstration Experiment :

1. Laser Experiments : Straight edge, Single slit, Ruler grating
2. Optical fiber : Transmission of signal
3. Concept of beats
4. Coupled oscillations and Resonance
5. Error analysis of a given experiment
6. Wave form generator using Op – amp.
7. PC simulations : Graph, curve fitting etc.
8. Straight edge Fresnel diffraction.
9. Double refraction.
10. First order Active filter.

REFERENCES

1. Advanced course in Practical Physics D. Chattopadhyaya, PC. Rakshit & B. Saha. (6th Edition) Book & Allied Pvt. Ltd.
2. BSc Practical Physics – Harnam Singh S. Chand & Co. Ltd. – 2001
3. A Text book of advanced Practical Physics – Samir Kumar Ghosh, New Central Book Agency – (3rd edition)
4. B Sc. Practical Physics – CL Arora (1st Edition) – 2001 S. Chand & Co. Ltd.
5. Practical Physics – CL Squires – (3rd Edition) Cambridge University Press.
6. University Practical Physics – D C Tayal. Himalaya Publication.
7. Advanced Practical Physics – Worsnop & Flint.

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