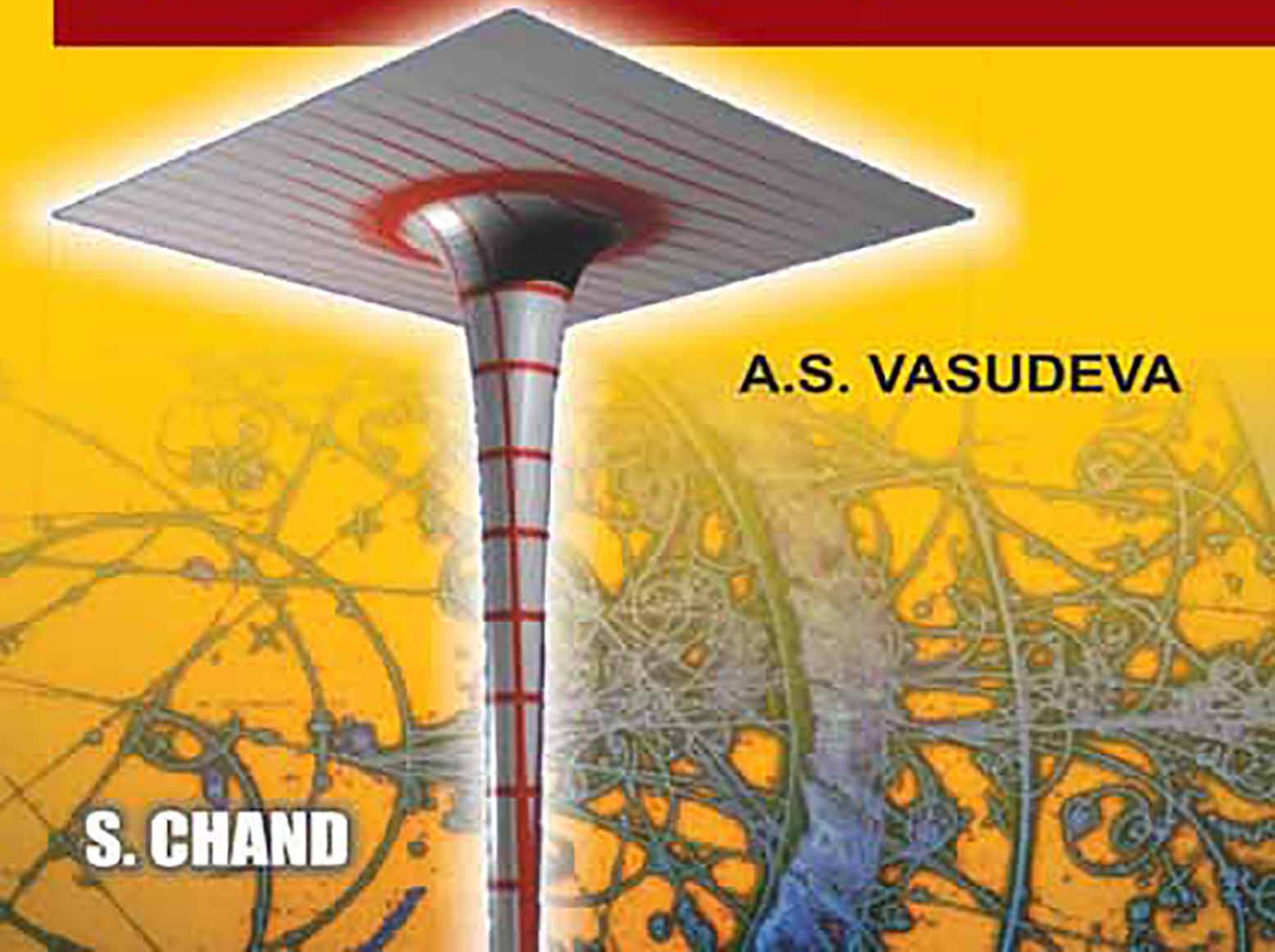
ESSENTIALS OF ENGINEERING PHYSICS

For the Students of B.E. / B.Tech. of
Rajasthan Technical University, Kota (Rajasthan)



A.S. VASUDEVA

S. CHAND

ESSENTIALS OF ENGINEERING PHYSICS

For the Students of B.E./B.Tech. of Rajasthan Technical University, Kota

A. S. VASUDEVA

Prof. and Head, Deptt. of Physics
Rayat Institute of Engineering & Information Technology
Rail Majra, Distt. Nawanshahar
(Punjab)
Former Head, Deptt. of Physics and Applied Sciences
Guru Nanak Dev Engineering College, Ludhiana
(Punjab)

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PATNA : 104, Citicentre Ashok, Govind Mitra Road, **Patna** - 800 004, Ph: 2300489, 2302100, patna@schandgroup.com

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RAIPUR : Kailash Residency, Plot No. 4B, Bottle House Road, Shankar Nagar, **Raipur -** 492 007, Ph: 09981200834, raipur@schandgroup.com

RANCHI : Flat No. 104, Sri Draupadi Smriti Apartments, East of Jaipal Singh Stadium, Neel Ratan Street, Upper Bazar, **Ranchi** - 834 001, Ph: 2208761, ranchi@schandgroup.com

VISAKHAPATNAM: Plot No. 7, 1st Floor, Allipuram Extension, Opp. Radhakrishna Towers, Seethammadhara North Extn., **Visakhapatnam** - 530 013, (M) 09347580841, visakhapatnam@schandgroup.com

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PREFACE

The warm response received from the students and teachers for the author's book **'Modern Engineering Physics'** encouraged the author to bring out a book that may exclusively cover the syllabi of various institutes affiliated to Rajasthan Technical University, Kota. The author tried his best to arrange the matter in such a way that all the students and teachers of different universities may not find any difficulty to get the topics of their particular courses of reading without much effort. Many topics have been re-arranged and many more examples have been included to make the various articles and examples more lucid and care has been taken to include all the examples that have been set in various university examinations.

The author is highly thankful to Mrs. Nirmala Gupta, CMD; Mr. Navin Joshi, Vice-President (Publishing), Mr. R.S. Saxena, Mr. Shishir Bhatnagar (Editorial & Pre-Press Manager) and the whole staff of M/s. S. Chand & Company Ltd. for their kind co-operation for the speedy preparation of the book. The author is also indebted to all his friends, colleagues and family members who have helped him at every stage of the preparation of the book.

Though every care has been taken to avoid any misprints, omissions and errors; yet the same might have left in due to oversight. The author will personally thank the persons who bring to his notice any shortcomings and the same will be taken care of, for the future editions of the book to make it more useful for the readers.

A.S. VASUDEVA

NEW SYLLABUS

B.Tech. I YEAR (SEMESTER I)

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

UNIT – I

Interference of light

- Michelson's Interferometer : Production of circular & straight line fringes. Determination of wavelength of light. Determination of wavelength separation of two nearby wavelengths.
- Newton's rings and measurement of wavelength of light.
- Interference of Optical technology : elementary idea of anti reflection coating and interference filters.

UNIT – II

Polarisation of light

- Plane circular and elliptically polarized light on the basis of electric (light) vector Malus law.
- Double Refraction : Qualitative description of refraction phase retardation plates, quarter and half wave plates construction working and use of these in production and detection of circular and elliptically polarized light.
- Optical Activity : Optical activity and law of optical rotation, specific rotation and its measurement using the half shade and bi quartz device.

UNIT – III

Diffraction of light

- Single slit diffraction : Quantitative description of single slit, position of maxima/minima and width of central maximum, intensity variation.
- Diffraction Grating : Construction and theory Formation of spectrum by plane transmission grating, Determination of wavelength of light using plane transmission grating.
- Resolving power : Geometrical & spectral, Releigh criterion, Resolving power of diffraction grating.

UNIT – IV

Special Theory of Relativity

- Postulates of special theory of relativity, Lorentz transformations relativity of length, Mass and time.
- Relativistic velocity addition, mass-energy relation.
- Relativistic Energy and momentum.

NEW SYLLABUS

B.Tech. I YEAR (SEMESTER II)

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

UNIT – I

Applications of Schrodinger's Equation

- Particle in three-dimensional boxes. Degeneracy
- Barrier penetration and tunnel effect.
- Tunneling probability, Alpha Decay.

Summerfield's Free electron gas model

- Postulates, Density of energy states, Fermi energy level.
- Band Theory of solids

UNIT – II

Lasers

- Theory of laser action : Einstein's coefficients. Components of a laser. Threshold conditions for laster action.
- Theory, Design and application of He-Ne and semiconductor lasers.
- Elementary ideas of Q-switching and mode locking.

Holography

- Holography versus photography, Basic theory of holography. Basic requirement of a holographic laboratory.
- Application of holography in microscopy and interferometer.

UNIT – III

Coherence

- Spatial and temporal coherence, Coherence light, Coherence time and 'Q' factor for light
- Visibility as a measure of coherence.
- Spatial Coherence and size of the source.
- Temporal coherence and spectral purity.

Optical Fibers

- Optical fiber as optical wave-guide.
- Numerical aperture and maximum angle of acceptance.

UNIT – IV

Nuclear Radiation Detectors and Dielectries

- Characteristics of gas filled detectors : general considerations.
- Construction, Working and properties of : Ionization chamber, proportional Counter. G.M. Counter and Seintillation Counter.
- Dielectries : Electric break down and measurement

UNIT – V

Electro Dynamics

- Scalar and Vector fields
- Definitions of gradient Divergence and curl
- Maxwell's Equations
- Boundary Conditions
- Wave equation and its solution for free space
- Nature of E.M. Waves. Poynting vector

FUNDAMENTAL CONSTANTS

Physical Quantity	Symbol	Value
Atomic mass unit	(u)	$1.660\ 540\ 2 \times 10^{-27}$ kg 931.494 32 MeV/c^2
Avogadro's number	N_A	$6.022\ 136\ 7 \times 10^{23}$ particles/mol
Bohr magneton	$\mu_B = \frac{e\hbar}{2m_e}$	$9.274\ 015\ 4 \times 10^{-24}$ J/T
Bohr radius	$a_0 = \frac{\hbar^2}{m_e e^2 k_e}$	$5.291\ 772\ 49 \times 10^{-11}$ m
Boltzmann's constant	$k_B = R / N_A$	$1.380\ 658 \times 10^{-23}$ J/k^o
Compton wavelength	$\lambda_C = \frac{h}{m_e c}$	$2.426\ 310\ 58 \times 10^{-12}$ m
Coulomb constant	$k_e = \frac{1}{4\pi\varepsilon_0}$	$8.987\ 551\ 787 \times 10^9$ N · m^2/C^2
Deuteron mass	m_d	$3.343\ 586\ 0 \times 10^{-27}$ kg 2.013 553 214 u
Electron mass	m_e	$9.109\ 389\ 7 \times 10^{-31}$ kg $5.485\ 799\ 03 \times 10^{-4}$ u 0.510 999 06 MeV/c^2
Electron-volt	eV	$1.602\ 177\ 33 \times 10^{-19}$ J
Elementary charge	e	$1.602\ 177\ 33 \times 10^{-19}$ C
Gas constant	R	8.314 510 J/K mol
Gravitational constant	G	$6.672\ 59 \times 10^{-11}$ N · m^2/kg^2
Hydrogen ground state energy	$E_1 = \frac{e^2 k_e}{2a_0}$	–13.605 698 eV
Josephson frequency-voltage ratio	$2e / h$	$4.835\ 976\ 7 \times 10^{14}$ Hz/V
Magnetic flux quantum	$\Phi_0 = \frac{h}{2e}$	$2.067\ 834\ 61 \times 10^{-15}$ T · m^2
Neutron mass	m_n	$1.674\ 928\ 6 \times 10^{-27}$ kg 1.008 664 994 u 939.565 63 MeV/c^2

Nuclear magneton	$\mu_n = \frac{e\hbar}{2m_p}$	$5.050\ 786\ 6 \times 10^{-27}$ J/T
Permeability of free space	μ_0	$4\pi \times 10^{-7}$ T · m/A
Permittivity of free space	$\varepsilon_0 = 1/\mu_0 c^2$	$8.854\ 187\ 817 \times 10^{-12}$ $C^2/N \cdot m^2$
Planck's constant	h	$6.626\ 075 \times 10^{-34}$ J·s
	$\hbar = h/2\pi$	$1.054\ 572\ 66 \times 10^{-34}$ J·s
Proton mass	m_p	$1.672\ 623 \times 10^{-27}$ kg
		1.007 276 470 u
		938.272 3 (28) MeV/c^2
Rydberg constant	R_H	$1.097\ 373\ 153\ 4 \times 10^7$ m^{-1}
Speed of light in vacuum	c	$2.997\ 924\ 58 \times 10^8$ m/s

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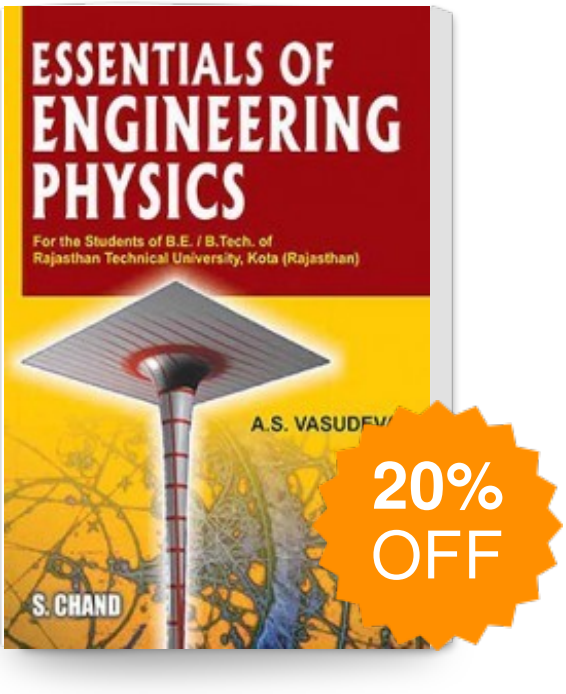
VOLUME – I

(SEMESTER I)

Essentials Of Engineering Physics



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