



HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY

NAAC A (3.02) State University

PATAN – 384265

Faculty of Science

B.Sc. Physics

Sem 3 & 4

Syllabus /Scheme

With Semester / CBCS / Grading Pattern

W.E.F. June -2021 (and thereafter)

Recd.
→ 25-6-21
Phy

DATE : 09 / 06 / 2021

TOTAL PAGE – 23

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN
CBCS SEMESTER GRADING PATTERN
B. Sc. SEMESTER IV
(PHYSICS SYLLABUS: Effective from June - 2021)

CC - PHYSICS - 401

UNIT I CLASSICAL MECHANICS

Mechanics of a Single Particle and of System of Particles:

Equation of Motion (3.3), (a) Motion under Constant Force, (b) Motion under a Force which depends on Time only, (d) Case (1) Motion of a particle subjected to a Resistive Force, Case (2) Motion of particle falling under the action of Gravity near the surface of Earth.(3.3) Mechanics of system of particles (3.5), Angular Momentum of the system (3.5 a), Energy of the System(3.5 b), Kinetic Energy of the system(3.5 c), Motion of system with variable mass(3.6) *Related Examples, Problems, MCQ & Short Questions*

Special Theory Relativity:

Newtonian Relativity(14.1), Michelson-Morley experiment(14.2), Special theory of relativity(14.3), Lorentz Transformation(14.4), Consequences of Lorentz Transformation(14.5) - (a) Relativity of simultaneity (b) Lorentz-fit Gerald length Contraction (c) Time dilation, Addition of Velocities (14.6), Variation of mass with Velocity(14.7) Mass- energy relation (14.8) *Related Examples, Problems, MCQ & Short Questions*

Basic Reference:

Introduction to Classical Mechanics by R G Takwale & P S Puranik McGrawHill Education (India) Private Limited

Other References:

1. Concept of Modern Physics by Besier McGraw-Hill
2. Elements of Special Relativity by S.P. Singh & M.k.Bagde S. Chand & Co. New Delhi.
3. Properties of Matter by Brijlal, N.Subrahmanyam, S.chand.
4. Classical Mechanics by Goldstein Narosa Publishing House New Delhi
5. Classical Mechanics by Yashavant Waghmare
6. Classical Mechanics by N C Rana and P S Joag

UNIT II NUCLEAR PHYSICS

Detectors and Accelerators:

Introduction (1.1.1), Interaction between Particles and Matter (A brief survey) (1.1.2), Detectors for Nuclear Particles (1.1.3), (i) Proportional counter (iii) scintillation counter (iv) Solid State or Semiconductor detectors, **Particle Accelerators**(1.1.4); Need for an Accelerator of charged Particles : (ii) The Cyclotron, (iii) Synchrotron.

Radioactivity: (Review of Radioactive decay laws, half life, mean life time etc.)

Radioactive growth and decay (2.6), Ideal equilibrium (2.7), Transient equilibrium and secular equilibrium (2.8) Radioactive series (2.9) Determination of the age of the Earth (2.12), Carbon Dating-Archaeological Time Scale(2.13)

The Q-Equation:

Introduction (3.1), Types of Nuclear Reaction (3.2), The Balance of Mass and Energy in Nuclear Reaction (3.3), The Q-equation (3.4), solution of the Q-Equation (3.5)

Basic reference:

Nuclear Physics by S. B. Patel (New age International (p) Ltd. Publishers)

Other References:

1. Elements of Nuclear physics by M.L.Pandya & R.P.S. Yadav Kedarnath Rmnath Meerut
2. Nuclear Physics by Kaplan
3. Nuclear Physics by D C tayal, Himalaya Publishing House

UNIT III PLASMA PHYSICS

The Basic concepts of Plasma:

Introduction (1.1), Composition and Characteristics of a Plasma (1.2), Collisions (1.3), Elastic collisions (1.3.1), Inelastic collisions (1.3.2), Surface Phenomena (1.4), Transport Phenomena (1.5), Diffusion and Mobility (1.6) , Viscosity, Conductivity (1.7) , Recombination(1.8), Ohm's law (1.9), Gas Discharge (1.10), Composition of various natural and Man-made Plasma (1.11), Plasma Diagnostics (1.12), Plasma waves and Instabilities Confinement of Plasma (1.13), Space Plasma (1.14). *Related Examples, Problems, MCQ & Short Questions*

Motion of Charge and velocity in Magnetic and Electric Field

Introduction : Microscopic and Macroscopic approach (2.1), Maxwell's equation Equation of continuity (2.2), (i) Motion of charged particle in electric and magnetic field, (ii) Larmour Radius and Larmour Frequency, (iii) Kinetic Energy (2.3), Uniform magnetic Field and Oscilating electric field(2.4), Magnetic Trap and Double Mirror (2.9.1), Van Allen Radiation Belt(2.9.3) *Related Examples, Problems, MCQ & Short Questions*

Basic Reference :

Elements of Plasma physics by S.N. Goswami New Central book Agency (p) Ltd., Calcutta.

Other References:

1. Introduction to Plasma Physics and Controlled Fusion Vol-1 F.F.Chen.
2. Plasma physics by S.N.Sen

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UNIT I STATISTICAL MECHANICS

Statistical Mechanics : Microscopic & Macroscopic States:

Microscopic states (4.1) Macroscopic States (4.2) Phase Space (4.3) μ -Space (4.4), τ -Space, (4.5), Postulate of equal a priori probability(4.6)

Statistical ensemble :

Micro canonical ensemble (5.1), canonical ensemble(5.2), Alternative method for the derivation of canonical distribution(5.3) Mean Value and Fluctuations(5.4), Grand canonical ensemble(5.5), Alternative derivation of Grand canonical distribution(5.6), Fluctuations in the number of particle of a system in a grand canonical distribution(5.7), Reduction of Gibb's distribution to maxwell's and Boltzman distribution(5.8), Barometric formula (5.9), Experimental verification of the Boltzman distribution(5.10)

Related Examples, Problems, MCQ & Short Questions

Basic Reference :

Fundamentalas of Statistical Mechanics 2nd edition by B B LAUD, New Age International Publishers

Other Reference :

1. Statistical Mechanics and Properties of Matter by E.S.R. Gopal Mc Millan Co. of India Ltd.
2. Statistical Mechanics by B K Agarwal – Melvin Eisner, New Age Inte.Publication

UNIT II MATHEMATICAL PHYSICS AND QUANTAM MECHANICS

Fouries series:

Introduction (7.1), Periodic functions (7.2), Application of Fourier series (7.3), Average values of a function (7.4), Fourier Co-efficient (7.5), Diriclet's condition (7.6), Complex form of Fourier Series(7.7), Other Interval even and odd function(7.8), Parceval Theorem(7.11) *Related Examples, Problems, MCQ & Short Questions*

Basic Reference:

Mathematical method for physical sciences by M.L.Boss John wiley Publication.

Other References:

1. Mathematical method for Engineer and Physicist by L. A. Pipes Tata Mc-Graw Hill Publication
2. Mathematical Physics by B D Gupta

15

Schrodinger Equations and Stationary States:

A Free Particle in One Dimension(2.1), Generalization to Three Dimension(2.2), The Operator correspondence and the Schrodinger equation for a particle subject to forces(2.3), Normalization and Probability Interpretation(2.4), Non-Normalizable Wave functions and Box Normalization(2.5). Conservation of Probability(2.6), Expectation values, Ehrenfest's Theorem(2.7), Admissibility Condition on the Wave function(2.8), Stationary States- The time Independent Schrodinger Equation (2.9), Particle in a Square Well Potential, Bound States in a square well ($E < 0$) *Related Examples, Problems, MCQ & Short Questions*

Basic Reference: *A Text Book of Quantum Mechanics by Mathews and K.Venkatesan
Tata Mc-Graw Hill Publication*

Other reference:

Quantum Quantum Mechanics by John L. Powell and Bend Crasemann
Quantum Quantum Mechanics by Ghatak and Lokanathan
Quantum Quantum Mechanics by Schiff

UNIT III ELECTRONICS

Digital Electronics:

Introduction (21.1), Number system used in Digital Electronics (21.2), Decimal, Binary, Hexadecimal and Octal (21.2.1 to 21.2.4), Binary Codes-(A) BCD, (B) Gray, (C) Excess-3 Codes (21.4), Universal Gate -NAND Gate, Bubbled OR Gate, Universal Gate-NOR Gate, Bubbled AND Gate, To Prepare NOT, AND and OR Gate Using Univarsal Gate (NAND Gate), Arithmetic Circuits – Exclusive – OR Gate (21.9), Application of X-OR Gate: (i) Binary to Gray Code Converter (ii) A Parity Checker (iii) The Half Adder (iv) The Full Adder (v) Parallel Adder (vi) Half Subtractor, (vii) Full subtractor. *Related Examples, Problems, MCQ & Short Questions*

Basic Reference:

Hand book of Electronics by Gupta & Kumar 30th Revised Edi., 2002 Pragati Prakashan, Meerut.

Solid state Devices:

JFET (12.1 to 12.6), UJT (26.6, 26.6.1 to 26.6.3), SCR
Related Examples, Problems, MCQ & Short Questions

Basic Reference:

Electronics and Radio Engineering by M.L.Gupta (9th Edition -2002) D Raj & Sons.

(2)

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN
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(PHYSICS PRACTICAL SYLLABUS : Effective from June - 2021)
(PC - PHY - 401)
LABORATORY EXPERIMENT

- 1) To determine wavelength of bright lines of Mercury light using Grating.
ગ્રેટિંગની મદદથી મરુકપુરી પ્રકાશની તીવ્ર રેખાની તરંગલંબાઈ મેળવો.
- 2) To Find out of Resolving Power of Telescope.
ટેલિસ્કોપની વિભેદન શક્તિ શોધવી.
- 3) Study of X -ray diffraction using Powder pattern.
X-ray વિવર્તન ભાતનો અભ્યાસ પાવડર ભાતની રીત વડે મેળવો.
- 4) A Study of Decay of Temperature when body is allowed to cool (Thermocouple).
જ્યારે પદાર્થને ઠંડો કરવામાં આવે ત્યારે તાપમાનમાં થતો ક્ષય મેળવો.
- 5) To study elliptically polarized light using Photocell and quarter wave plate.
ફોટો સેલ અને ક્વાર્ટર વેવ પ્લેટની મદદથી દીર્ઘવૃત્તીય ધ્રુવીભૂત પ્રકાશનો અભ્યાસ કરવો.
- 6) To find out Activation energy of a Semiconductor.
અર્ધવાહકની સંક્રિયણ ઊર્જા શોધવી.
- 7) Numerical Analysis (Newton's Forward and Backward Interpolation Formula)
સંખ્યાત્મક પૃથ્થકરણ (આંતરેશન)
- 8) To Find out The Resolving Power of Prism.
પ્રીઝમની વિભેદન શક્તિ શોધવી.

ઉઠો, જાગો અને લક્ષ્યની પ્રાપ્તિ સુધી અવિરત પ્રયત્નશીલ રહો.

23

96

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN
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(PC – PHY - 402)

LABORATORY EXPERIMENT.

- 1) To Determine Current Sensitivity, Voltage Sensitivity, Figure of Merit and R_g of B.G.
B.G ની પ્રવાહ સંવેદિતા, વોલ્ટેજ સંવેદિતા, ફિગર ઓફ મેરીટ અને R_g મેળવો.
- 2) To Determine High Resistance by equal Deflection Method.
સમાન આવર્તનની રીત વડે ગુરુ અવરોધ મેળવો.
- 3) To Determine Low Value of 'C' using Schering Bridge.
શેરીંગ બ્રીજની મદદથી લકિંગ કેપેસિટ-સ'c' મેળવો.
- 5) Study of Characteristics of a Photodiode and Draw the Graph of $I_D \rightarrow V_D$.
ફોટોડાયોડની લાક્ષણિકતાઓ મેળવો અને $I_D \rightarrow V_D$ નો આલેખ દોરો.
- 6) Comparison of Capacity (C_1/C_2) by De-Sauty Method.
ડીસોટીની રીત વડે વીજકમતા (C_1/C_2) ની સરખામણી કરવી.
- 7) Low Resistance by Method of Projection.
પ્રક્ષેપનની રીત વડે લઘુ અવરોધ શોધવો.
- 8) Langrange's Forward Formula and Backward Formula (Interpolation)
લાગ્રાંજની ફોરવર્ડ ફોર્મુલા અને બેકવર્ડ ફોર્મુલા (આંતરેશન)
- 9) To find The H-Parameter's from The Transistor in Common Emitter Configuration.
કોમન એમીટર ટ્રાન્ઝિસ્ટરની લાક્ષણિકતાઓ પરથી એચ-પેરામીટર શોધવા.

સર્વ દિશાઓમાંથી ઉત્તમ અને સુંદર વિચારો પ્રાપ્ત થાઓ.