BHAKTA KAVI NARSINH MEHTA UNIVERSITY - JUNAGADH

Faculty: Science **Subject: Physics** **Semester- 5** **ACADEMIC YEAR-2020-21**

Sr. No	Level UG or PG	Sem ester	Course Group Core Elective -1 Elective -2/ Allied/SEC/DSE	Course (Paper) Title	Paper No.	Credit	Teaching Hours/Week	Internal Marks	External Marks	Practical Internal Marks	Practical External Marks	Total Marks
1	UG	5	Core	Mathematical Physics, Classical Mechanics & quantum Mechanics	P-501	4	6	30	70	-	-	100
2	UG	5	Core	Nuclear & Particle Physics	P-502	4	6	30	70	-	-	100
3	UG	5	Core	Spectroscopy and Optics	P-503	4	6	30	70	-	-	100
4	UG	5	Practical	Physics Practical	P-504	6	9	-	-	45	105	150

BHAKTA KAVI NARSINH MEHTA UNIVERSITY - JUNAGADH

Faculty: Science **Subject: Physics** **Semester- 6** **ACADEMIC YEAR-2020-21**

Sr. No	Level UG or PG	Semester	Course Group Core Elective -1 Elective -2/ Allied/SEC/DSE	Course (Paper) Title	Paper No.	Credit	Teaching Hours/Week	Internal Marks	External Marks	Practical Internal Marks	Practical External Marks	Total Marks
1	UG	6	Core	Electrodynamics & Relativity	P-601	4	6	30	70	-	-	100
2	UG	6	Core	Statistical Mechanics & Solid State Physics	P-602	4	6	30	70	-	-	100
3	UG	6	Core	Solid State Electronics	P-603	4	6	30	70	-	-	100
4	UG	6	Practical	Physics Practical	P-604	6	9	-	-	45	105	150
5	UG	6	Practical	Physics Project & Viva	P-605	4	6	-	-	-	100	100

B.Sc (PHYSICS)

Semester-5

Paper: Physics-501

(Mathematical Physics, Classical Mechanics & Quantum Mechanics)

Course duration:

Theory: 60 hours, 6 hours a week, Credit: 4

External Marks: 70, Internal Marks: 30, Total: 100

PAPER STYLE For paper 501

1. Syllabus of Physics paper 501 consists of 5 units:
2. All units carry 14 marks each.
3. There would be total 5 questions. One question from each unit.
4. Each question of 14 mark
5. Student can use the scientific (Non programmable) calculator.
6. Time duration:2.5 Hours

Question:1 from Unit 1 : Mark 14

Question:2 from Unit 2 : Mark 14

Question:3 from Unit 3 : Mark 14

Question:4 from Unit 4 : Mark 14

Question:5 from Unit 5: Mark 14

Each question should be divided in a and b sub questions as shown below.

(a) Answer the following questions (any two out of three) [10 Marks]

(b) Answer the following questions (any one out of two) [04 Marks] (Application / Example / Problem / Theory)

Paper: Physics-501

(Mathematical Physics, Classical Mechanics & Quantum Mechanics)

UNIT 1: (12 hours: 14 Mark)

Vector Analysis:, Gradient , The operator Del (∇), The Divergence, The Curl and their significance, Product rules, Integral Calculus – Fundamental theory for Gradient, Fundamental theorem for Divergences - Gauss's theorem, Fundamental theorem for Curls- Stokes theorem, Relations between fundamental theorems

Basic reference book : Introduction to electrodynamics By David J Griffiths, Publisher: PHI.

UNIT 2: (12 hour : 14 Mark)

Fourier Series: Definition, Evaluation of the Coefficients of Fourier Series, Cosine Series, Sine Series, Dirichlet's Theorem (Statement only), Extension of Interval, Complex form of Fourier series, Advantages of Fourier series, Properties of Fourier series, Physical Applications of Fourier series analysis (square wave, full wave rectifier, half wave rectifier, triangle wave), Fourier integrals, Fourier Transforms, Fourier sine and cosine Transforms, Numerical Problems.

Dirac-Delta Function: Introduction, Representation of the Dirac delta Function, derivative at a discontinuity, properties of Dirac delta function, the three dimensional Dirac delta function, Numerical Problems.

Reference books :

1. Mathematical Physics By Rajput, Publisher: Pragati Prakashan, Meerut.

UNIT 3: (12 hour : 14 Mark)

Lagrangian and Hemilton Formulation: Constraints, Generalised coordinates, D'Alembert's principle, Lagrange' equations of Motion, Some Applications of Lagrange' equation of Motion (linear Harmonic Oscillator, Simple Pendulum, Spherical Pendulum, Atwood mechine) Cyclic or ignorable coordinates, Rayleigh's dissipation function, ,Hamilton's principle, Equivalence of Lagrange's and Newton's equations, Lagrange's undetermined multipliers, Applications of the Lagrangian method of undetermined multiplies, Hamilton's equations of motion, Some applications of the Hamiltonian formulation(linear Harmonic Oscillator, Simple Pendulum, Compound Pendulum)

Basic reference book : Introduction to Classical Mechanics by Takwale and Puranik. (Tata McGraw Hill Pub Comp. Delhi).

UNIT 4: (12 hour : 14 Mark)

The Schrodinger equation and Stationary States: Schrodinger equation: A Free Particle in One Dimension generalization to Three Dimensions, The Operator Correspondence and the Schrodinger equation for a Particle subject to forces, Physical interpretation on □, Normalization and Probability interpretation, Non-Normalizable Wave Functions and Box Normalization, Conservation of Probability, Expectation Values, Ehrenfest's Theorem, Admissibility Conditions on the wave function, Stationary states: The Time Independent Schrodinger equation, A particle in a Square Well potential

UNIT 5 : (12 hour : 14 Mark)

General Formalism of Wave Mechanics: Schrodinger Equation and the Probability Interpretation for an N-Particle System, The Fundamental Postulates of Wave Mechanics, The Adjoint of an Operator, and Self Adjointness, The Eigen value Problem; Degeneracy, Eigen values and Eigen functions of Self-Adjoint Operators, The Dirac-Delta function.

Simple Harmonic Oscillator: The Schrodinger Equation and Energy Eigen Values, The Energy Eigen Function, Properties of Stationary States, The Abstract Operator method, Coherent States

Basic Reference Book for 4 & 5 : Text Book of Quantum Mechanics by Mathews and Venkateshan, (Tata McGraw Hill Pub. Comp.

<u>Other reference books</u>

1. Mathematical Physics By H K Dass & Dr. Rama Verma, ublisher:S.Chand
2. Mathematical Physics By P.K.Chattopadhyay
3. Mathematical methods in the Physical Science by Mary L. Boas :Wiley India Third Edition
4. Classical Mechanics by Herbert Goldstain
5. Foundation of Classical Mechanics by P.C. Deshmukh : Cambridge University Press
6. Quantum Mechanics by Ajoy Ghatak
7. Quantum Mechanics Concept and Applications by Nouredine Zettili : Wiley Publications

B.Sc. (Physics)
Semester -5 Paper: Physics502
(Nuclear & Particle Physics) Course duration:
Theory: 60 hours, 6 hours a week, Credit: 4
External Marks: 70, Internal Marks: 30, Total: 100

PAPER STYLE For paper 502

1. Syllabus of Physics paper 502 consists of 5 units:
2. All units carry 14 marks each.
3. There would be total 5 questions. One question from each unit.
4. Each question of 14 mark
5. Student can use the scientific (Non programmable) calculator.
6. Time duration:2.5 Hours

Question:1 from Unit 1 : Mark 14
Question:2 from Unit 2 : Mark 14
Question:3 from Unit 3 : Mark 14
Question:4 from Unit 4 : Mark 14
Question:5 from Unit 5: Mark 14

Each question should be divided in a and b sub questions as shown below.

(a) Answer the following questions (any two out of three) [10 Marks]

(b) Answer the following questions (any one out of two) [04 Marks]
(Application / Example / Problem / Theory)

Paper: Physics-502

(Nuclear & Particle Physics)

UNIT -1: (12 hour: 14 Mark)

General Properties of Nuclei & Nuclear Models: Rutherford's alpha Scattering Experiment, Rutherford's Atom Model, Constitute of nucleus and their intrinsic properties, qualitative facts about size, mass, Charge, density, Classification of Nuclei, Nuclear Stability, binding energy, main features of binding energy versus mass number curve, Nuclear Models: liquid drop model, Shell model: Evidence of Shell Model, Semi empirical mass formula and significance of various terms. Numerical Problems.

UNIT -2: (12 hour: 14 Mark)

Radioactivity: Natural Radioactivity, Properties of alpha, beta and gamma ray, The Law of Radioactive Decay, Half Life , Mean Life, Radioactive Series, Units of Activity, General Rule of Alpha and Beta Decay, Theory of alpha decay- Barrier Penetration, Beta Decay-Continuous beta ray spectrum- Difficulties in understanding it, Neutrino hypothesis and Fermi theory of Beta Decay, Gamma Decay – Gamma Ray emission, Nuclear isomerism, Internal Conversion, Application of Radio isotopes, Determination of the Age of Earth, Carbon Dating, Numerical Problems.

UNIT -3: (12 hour: 14 Mark)

Interaction of Nuclear Radiation with matter And Detector: Interaction between Energetic Particle and matter, Principle construction and working of - Ionization Chamber; Solid state Detector; Scintillation Counters, GM Counter, Plateau Curve.

Nuclear Reaction: Rutherford experiment for artificial transmutation, Q-value of Nuclear reaction, Type of Nuclear reactions, Energy balance in Nuclear reaction, Threshold energy of Endoergic reaction, Nuclear Transmutation, Numerical Problems.

UNIT -4: (12 hour: 14 Mark)

Particle Accelerator: Construction and working of – Linear Accelerator; Cyclotron, Formula of Cyclotron Frequency, Limitation of Cyclotron, Principle of Phase Stability,

Synchrocyclotron, Synchrotron - Proton Synchrotron; electron Synchrotron(Betatron).

Nuclear Fission: Discovery of Nuclear fission, Energy released in fission, Bohr & Wheeler's theory of fission, Chain reaction, Multiplication Factor, Critical Size, Atom bomb, Nuclear reactors,

Use of Nuclear Reactor Power Reactor, Breeder Reactor, Numerical Problems.

UNIT -5: (12 hour: 14 Mark)

Nuclear fusion: Nuclear fusion, Source of stellar energy,

Thermonuclear reactions, Hydrogen Bomb, Controlled Thermo Nuclear Reaction, Fusion Reactor, Plasma Confinement – Gravitation Confinement, Magnetic Bottle, Tokamak, Internal Confinement, Numerical Problems.

Elementary Particles: Introduction, Classification of Elementary Particles, Particles & Antiparticles, Antimatter, The fundamental Interactions, Elementary particle Quantum numbers, Conservation laws and symmetry, Quark model.

Reference Books:

1. Modern Physics By R.Murugeshan & Kiruthinga Sivaprasatha, Publication: S.Chand & Company Ltd.

Other Reference Books

1. Nuclear Physics: An Introduction By S.B. Patel Publisher: New Age International (P) Limited.
2. Nuclear Physics By D.C.Tayal Publisher: Himalaya Publishing House.
3. Concept of Nuclear Physics By B.L.Cohen Publisher:TMG
4. Nuclear Physics By Irving Kaplan Publisher: Narosa Publishing House.
5. Nuclear Physics in a Nutshell by Carlos A. Bertulani : Princeston University Press

B.Sc. (Physics)
Semester -5
Paper: Physics-503
(Spectroscopy and Optics) Course duration:
Theory: 60 hours, 6 hours a week, Credit: 4
External Marks: 70, Internal Marks: 30, Total: 100

PAPER STYLE For paper 503

1. Syllabus of Physics paper 503 consists of 5 units:
2. All units carry 14 marks each.
3. There would be total 5 questions. One question from each unit.
4. Each question of 14 mark
5. Student can use the scientific (Non programmable) calculator.
6. Time duration:2.5 Hours

Question:1 from Unit 1 : Mark 14
Question:2 from Unit 2 : Mark 14
Question:3 from Unit 3 : Mark 14
Question:4 from Unit 4 : Mark 14
Question:5 from Unit 5: Mark 14
Each question should be divided in a and b sub questions as shown below.

(a) Answer the following questions (any two out of three) [10 Marks]

(b) Answer the following questions (any one out of two) [04 Marks]
(Application / Example / Problem / Theory)

Paper: Physics-503
(Spectroscopy and Optics)

UNIT -1: (12 hour: 14 Mark)

Atomic Spectroscopy:

Production of Spectra, Type of Spectra- Emission Spectra, Absorption Spectra. Bohr's Theory of atom, Franck-Hertz Experiment, Shortcoming of Bohr Theory, Sommerfield Elliptical orbits (theoretical part only), The spinning electron, Space quantization, Quantum numbers and their physical interpretations, Magnetic moments of an Atom and Lande's g Factor.

Experimental study of Zeeman effect, Classical interpretation of Normal Zeeman effect, Vector atom model and Normal Zeeman effect, Vector atom model and Anomalous Zeeman effect, Paschenback effect, Stark effect.

Basic Reference Book: Elements of Spectroscopy By Gupta,
Kumar, Sharma Publisher: Pragati Prakashan Twenty-eight Edition 2016.

UNIT -2: (12 hour: 14 Mark)

Molecular Spectroscopy: Introduction, Experimental study, Theoretical explanation, Theory of pure rotational Spectra, Theory of rotational Vibrational Spectra, Theory of electronic band Spectra,

Basic Reference Book: Atomic Physics By J.B.Rajam. Publisher: S.Chand &Company Ltd.

Raman Spectra: Raman effect and its Salient features,

Observation of Raman Spectra, Classical theory of Raman effect, Quantum theory of Raman effect, Vibrational Raman Spectra, Pure Rotational Raman Spectra, Vibrational-Rotational Raman Spectra, Structure determination from Raman Spectroscopy, Applications and its importance.

UNIT -3: (12 hour: 14 Mark)

X-Rays and X-Ray Diffraction: Production of X-rays, Properties of X-rays, Continuous X-ray Spectrum, Characteristic Emission Spectrum, Explanation of Emission Spectra, Diffraction of X-ray, Brag's Law, Laue Spots, Bragg's Spectrometer, Spectra, Reciprocal lattice, Properties of reciprocal lattice, Bragg diffraction equation in reciprocal lattice, Brillouin zones, Atomic scattering factors, Structure factor**,** Experimental methods for X-ray Diffraction: Laue method, Rotating crystal method, Powder diffraction method.

Basic Reference Books:

1. Elements of Spectroscopy By Gupta,
   Kumar, Sharma Publisher: Pragati Prakashan Twenty-eight Edition 2016.

UNIT -4: (12 hour: 14 Mark)

Interference in Thin Film : Michelson's interferometer, Application of Michelson's interferometer, Twyman & Green interferometer, Mach-Zehnder Interferometer, Multipal beam interference ,fabry-perot interferometer and Etalon , Lummer and Gehrcke plate

Basic Reference Book: A Text Book of Optics N.Subrahmanyan, Brij Lal & M.N.Avadhanulu, Publisher: S.Chand &Company Ltd.

UNIT -5: (12 hour: 14 Mark)

Polarization: introduction to Polarization, Unpolarized and Polarized light, Types of Polarization, Production of Plane Polarized light, Polarizer and Analyzer, Malus Law, Anisotropic Crystal, Double refraction in Calcite Prism, Nicol Prism, Effect of Polarizer on light of different polarization, Application of Polarized light.

Other Reference Books:

1. A Text Book of Optics N.Subrahmanyan, Brij Lal & M.N.Avadhanulu, Publisher: S.Chand &Company Ltd.
2. Optics and Spectroscopy - R. Murugeshan & Kiruthiga Sivaprashatha. Publisher: S.Chand & Company Ltd.
3. Optical Electronics - A.K.Ghatak and K. Thyagarajan. Publisher: Cambridge Uni. Press.

B.Sc. Semester – 5 -504
Practical Credit 6

Each student will have to perform **three (3) experiments (one from each group)** in the University Examination.
Each Practical would be of 35 Marks and should be performed in a session of 3 Hours in practical exam. Total-150 marks (105 marks external+45 marks internal) Credit 6

There would be three sessions of 3 hours each for three experimental practical examination.

There shall be **batch of 15 students** for practical exam in university examination.

List of Experiments
Group A

1. Determine the "g" using Kater's Pendulum
2. Study of Damped Simple Harmonic Motion
3. Study of Fabry-Perot Etalon
4. Study of Lloyd's Mirror.
5. Study of Double Refraction in Calcite Prism
6. Young Modulus of beam by elevation method
7. To determine the thermal conductivity of cardboard (bad conductor) by Lee's Method.
8. To determine radius of curvature of a given lens and refractive index of glass using optical lever method.
9. To study Diffraction at Straight edge.
10. To study the elliptical polarization of light using babinet compensator.
11. To determine viscosity of liquid by log decrement method.
12. Study of Absorption spectra of Iodine

Group B

Comparison of Capacities by Mixture Method

1. Determine the constant of Ballistic Galvanometer
2. Determine the Self Induction of coils using Owen's Bridge
3. Determine the Mutual Induction of coils using Ballistic Galvanometer
4. Study of Transformer's coils using Bridge rectifier
5. Determine e/m using Magnetron Method.
6. Determine e/m using Helical Method
7. Study of Hysterisis loop of Ferromagnetic Material
8. Study of Hall Effect.
9. To determine the self inductance/ Mutual Inductance of a given coil by Rayleigh's method.
10. Absolute value of capacity of a capacitor by B.G.
11. To determine Permeability of Free space.

Group C

Study of h-Parameter of CE- Transistor.

1. Study of Single stage Transformer coupled Amplifier
2. Study of Complementary-Symmetry Power Amplifier
3. Study of Series Voltage Regulator using Transistor
4. Electronic voltmeter using FET
6. Study of Hartley Oscillator.
7. Study of RC phase shift Oscillator.
8. Study of Lissageous figure/Measurement of frequency and phase using CRO.
9. Study of X-OR Gate.
10. Study of X-NOR Gate.
11. Verification of De'Morgans Theorem.
12. To determine the capacitance or to compare capacitance by Wien Brideg.

Reference Books:

1. Practical Physics by C.L.Arora (S.Chand)
2. Advanced Practical Physics by Chauhan & Singh. (Pragati Prakashan)
3. B.Saraf et ai-Physics through experiments Vol.I & II
4. Electronic Laboratory Primer by Poorna Chandra & Sasikala, (S.Chand)
5. Practical Physics by Chattopadhyay, Rakshit & Saha.

B.Sc. (Physics)
Semester -6
Paper: Physics-601
(Electrodynamics and Relativity)
Course duration:
Theory: 60 hours, 6 hours a week, Credit: 4
External Marks: 70, Internal Marks: 30, Total: 100

PAPER STYLE For paper 601

1. Syllabus of Physics paper 601 consists of 5 units:
2. All units carry 14 marks each.
3. There would be total 5 questions. One question from each unit.
4. Each question of 14 mark
5. Student can use the scientific (Non programmable) calculator.
6. Time duration:2.5 Hours

Question:1 from Unit 1 : Mark 14
Question:2 from Unit 2 : Mark 14
Question:3 from Unit 3 : Mark 14
Question:4 from Unit 4 : Mark 14
Question:5 from Unit 5: Mark 14
Each question should be divided in a and b sub questions as shown below.

(a) Answer the following questions (any two out of three) [10 Marks]

(b) Answer the following questions (any one out of two) [04 Marks]
(Application /Example / Problem / Theory)

Paper: Physics-601
(Electrodynamics and Relativity)

UNIT 1: (12 hours: 14 Mark)

Electrostatic and Magnetostatics fields inside matter:

Dielectrics, Induced dipoles with examples, Alignment of Polar molecules, Polarization, The field of Polarized object: Bound charges, Physical interpretation of bound charges with examples, Field inside the dielectrics, The Electric displacement: Gauss's law in the presence of dielectrics, Susceptibility, Permittivity, and Dielectric Constant.

Magnetization: Diamagnets, Paramagnets, Ferromagnets, Torques and Forces on magnetic dipoles, Effect of magnetic field on atomic orbits, Magnetization, The field of magnetized objects: Bound currents, Physical interpretation of bound currents, The magnetic field inside matter, Ampere's law in magnetized materials, Magnetic Susceptibility & Permeability, Numerical Examples.

UNIT 2: (12 hour : 14 Mark)

Electrodynamics: Ohm's law, Electromotive force and motional emf, Faraday's law, The induced Electric field, inductance, energy in magnetic fields, Electrodynamics before Maxwell, Maxwell's modification of Ampere's law, Maxwell's equations, The continuity equation, Poynting's theorem, Newton's third law in Electrodynamics, Maxwell's stress tensor, conservation of momentum, Angular momentum, Numerical Problems.

UNIT 3: (12 hour : 14 Mark)

Electromagnetic Waves:

Waves in one dimension: Wave equation, sinusoidal waves, Boundary conditions: Reflection and Transmission, Polarization, Electromagnetic waves in vacuum: The wave equations for **E** and **B**, Monochromatic plane waves, Energy and Momentum in Electromagnetic waves, Numerical Problems.

UNIT 4: (12 hour : 14 Mark)

Potentials and Fields:

The Potential formulations: Scalar and Vector potentials, Gauge transformations, Coulomb Gauge and Lorentz Gauge, Retarded potentials, Jefimenko's equations, Point

charges: Lienard-Wiechert potentials, The fields of a moving point charge, Electric and Magnetic field of moving charge with constant velocity, Numerical Problems.

UNIT 5: (12 hour : 14 Mark)

Electrodynamics and relativity:

The special theory of relativity and Einstein postulates of it, The geometry of relativity, Lorentz transformations, structure of space-time, Proper time and Proper velocity, Relativistic momentum and relativistic energy, Relativistic Kinematics, Relativistic Dynamics, Numerical Problems.

Basic Reference book: Introduction to electrodynamics By David J Griffiths, Publisher: PHI.

Other Reference Books:

1. Electricity and Magnetism - Mahajan and Rangwala
2. Classical Electrodynamics - J.D.Jackson
3. Electricity and Magnetism - R. Murugeshan
4. Electromagnetics - B.B.Laud
5. Electricity and Magnetism - K.K.Tiwari
6. Electricity and Magnetism - Berkeley Physics Course, Vol. II
7. Electricity and Magnetisam By D.C. Tayal, Publisher: Himaliya publishing House.
8. Refresher Course in Physics Volume 1,2 & 3 By C.L.Arora

B.Sc. (Physics)
Semester -6
Paper: Physics-602
(Statistical Mechanics & Solid state physics)
Course duration:
Theory: 60 hours, 6 hours a week, Credit: 4
External Marks: 70, Internal Marks: 30, Total: 100

PAPER STYLE For paper 602

1. Syllabus of Physics paper 602 consists of 5 units:
2. All units carry 14 marks each.
3. There would be total 5 questions. One question from each unit.
4. Each question of 14 mark
5. Student can use the scientific (Non programmable) calculator.
6. Time duration:2.5 Hours

Question:1 from Unit 1 : Mark 14
Question:2 from Unit 2 : Mark 14
Question:3 from Unit 3 : Mark 14
Question:4 from Unit 4 : Mark 14
Question:5 from Unit 5: Mark 14
Each question should be divided in a and b sub questions as shown below.

(a) Answer the following questions (any two out of three) [10 Marks]

(b) Answer the following questions (any one out of two) [04 Marks]
(Application / Example / Problem / Theory)

Paper: Physics-602
(Statistical Mechanics & Solid state physics)

UNIT -1: (12 hour: 14 Mark)

Classical Distribution Law: Phase Space (till the derivation of dr> $=h^3$), Volume in Phase Space, Micro States and Macro States(number of microstates accessible to a macroscopic system onwards not included), Stirling's approximation, Thermodynamic Probability, Division of Phase Space into Cells, Classical Maxwell Boltzmann Distribution law. BoseEinstein and Fermi Dirac Statistics Derivation of the distribution law of Bose-Einstein Statistics, Derivation of the distribution law of Fermi Dirac Statistics, Comparison of the Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac Statistics, Numerical Problems.

Basic Reference Book: Elementary Statistical Mechanics by Gupta and Kumar, Publisher: Pragati Prakashan.

UNIT 2: (12 hour : 14 Mark)

Crystalography : introduction, Single and polycrystalline crystal, Symmetry Considerations, Periodicity in crystals, Unit cell, Lattice point per unit cell(Atomic radius, Number of atoms in unit cell Coordination number, Packing Factor) Representation of planes, Interplanar distance, Symmetry elements, Symmetry groups, Point groups, Space groups, Characteristics of Space group, Determination of space group, Bravais lattice in two and three dimensions, Some crystal structure(Hexagonal, fcc , bcc, sc, Diamond)

UNIT 3: (12 hour : 14 Mark)

Superconductivity: Experimental Aspects, Influence of external agents on Superconductivity, Meissner effect, Critical field of Small Specimens, Thermodynamic of Superconducting transition, Alloys & Compounds, London's theory, Josephson effects, BCS theory, Applications of Superconductivity, Numerical Problems.

UNIT 4: (12 hour : 14 Mark)

Bond Formation : Ionic bond, Stability consideration in ionic bond, Characteristic of Ionic bond, Covalent bond, Stability consideration in covalent bond, Characteristic of covalent bond, Molecular bond, Stability consideration in Molecular bond, Characteristic of Molecular bond, Metallic Bond, Characteristic of Metallic bond, Hydrogen bond.

Basic Reference books:

1. Fundamental of Solid State Physics By Saxena, Gupta, Saxena, Publisher: Pragati Prakashan
2. A text book of Solid State Physics By S.L.Kakani & C. Hemrajani, Publisher: S Chand

Liquid Crystal : Liquid Crystal, Thermotropic liquid crystal, Lyotropic liquid crystal, Applications, Glass, Glass transition temperature, Metallic glass, Quaci crystal.

UNIT 5: (12 hour : 14 Mark)

Nano Technology : Introduction, Nanoparticles, Metal nano clusters(Magic Numbers, Theoretical Model of Nanoparticles, Geometric Structure, Electronic Structure, Magnetic Clusters), Semiconducting Nanoparticles, Rare gas and Molecular structure, Carbon Clusters(small carbon clusters, Discovery of $C_{60,}$ Structure of C_{60} and its crystal, Alkali doped of C_{60} , Superconductivity in C_{60}), Carbon Nanotubes(Fabrication of Carbon Nanotubes, Structure of Carbon Nanotubes, Electrical Properties of Carbon Nanotubes, Vibrational Properties of Carbon Nanotubes, Mechanical Properties of Carbon Nanotubes), Applications of Carbon Nanotubes, Quantum Nanostructure, Preparation of Quantum Nanostructure, Applications of Quantum Nanostructure

Basic Reference Book

Modern Physics By R.Murugeshan & Kiruthinga Sivaprasatha, Publication: S. Chand & Company Ltd.

Other Reference Book for unit 5:

1. Nano Materials; Synthesis, Properties and Applications By A.S. Edelstein and R. C. Cammearata Bristol and Philadelphia ,1996

2. Nano Technology by Timp G Springer .1999

B.Sc. (Physics)
Semester -6
Paper: Physics-603
(Solid State Electronics)
Course duration:
Theory: 60 hours, 6 hours a week, Credit: 4
External Marks: 70, Internal Marks: 30, Total: 100

PAPER STYLE For paper 603

1. Syllabus of Physics paper 603 consists of 5 units:
2. All units carry 14 marks each.
3. There would be total 5 questions. One question from each unit.
4. Each question of 14 mark
5. Student can use the scientific (Non programmable) calculator.
6. Time duration:2.5 Hours

Question:1 from Unit 1 : Mark 14
Question:2 from Unit 2 : Mark 14
Question:3 from Unit 3 : Mark 14
Question:4 from Unit 4 : Mark 14
Question:5 from Unit 5: Mark 14
Each question should be divided in a and b sub questions as shown below.

(a) Answer the following questions (any two out of three) [10 Marks]

(b) Answer the following questions (any one out of two) [04 Marks]
(Application / Example / Problem / Theory)

Paper: Physics-603
(Solid State Electronics)

UNIT 1: (12 hour : 14 Mark)

Multi-stage Transistor Amplifiers: Multistage Transistor Amplifier, Role of Capacitors in Transistor Amplifiers, RC coupled Transistor Amplifier, Transformer Coupled Amplifier, Direct coupled Amplifier, Comparison of Different types of coupling, Numerical Problems.

Transistor Audio Power Amplifiers: Transistor Audio Power Amplifier, Difference between Voltage and Power amplifier, Performance Quantities of power amplifier, Classification of Power amplifier, Expression for Collector Efficiency, Efficiency of Class A Amplifier, Maximum Efficiency of Transformer Coupled Class A

Power amplifier, thermal Runaway, Heat sinks, Mathematical

Analysis, Push pull Amplifier, Complementary Symmetry Amplifier, Numerical Problems.

UNIT 2: (12 hour : 14 Mark)

Solid State Switching Circuits : Switch, Mechanical switch, Electronic Switches, Advantages of electronic switches, switching transistors, switching action of Transistor, Multivibrators, Types of Multivibrators, Transistor Astable Multivibrators, Transistor Monostable Multivibrators, Transistor Bistable Multivibrators,

Differentiating circuit, Integrating circuit, Clipping circuits, Application of Clippers, Basic idea of a clamper, clamping circuits, Numerical Problems.

UNIT 3: (12 hour : 14 Mark)

Regulated D.C. Power Supply: Ordinary D.C. power supply, Important terms, Regulated Power supply, Types of voltage regulators, Zener diode as a voltage regulator, Transistor series voltage regulator, Series feedback voltage regulator, Short-circuit protection, Transistor shunt voltage Regulator, Numerical Problems.

Integrated Circuits: Integrated Circuits, Advantages
&Disadvantages of ICs, Scale of Integration, Classification of ICs, Comparison between different ICs, IC Symbol,

UNIT 4: (12 hour : 14 Mark)

Operational Amplifier: introduction, Differential Amplifier, Basic circuit of Differential Amplifier, Operation of Differential Amplifier , Common-mode and Differential-mode signals, OP-AMP Applications, Inverting Amplifier, Non-Inverting

Amplifier, Voltage Follower, Summary of Op-Amp Configuration, Adder, Subtractor, Integrator, Differentiator, Comparator, Comparator Circuit.

UNIT 5: (12 hour : 14 Mark)

Electronic Instruments: Analog and Digital Instruments, Functions of Instruments, Electronic versus Electrical Instruments, Essentials of an Electronic Instrument, The Multimeter, Rectifier type AC meter, Electronic Voltmeter, Electronic voltmeter for Alternating currents, Digital voltmeter, Cathode Ray Tube, Cathode Ray Oscilloscope, Frequency Determination, Application of CRO.

Basic Reference Books for above units :

1. Principles of Electronics By V.K.Mehta & Rohit Mehta. Publisher:S. Chand &Company Ltd.
2. Basic Electronics By B.L.Theraja, Publisher:S. Chand & Company Ltd

Digital circuits & Applications:

Combinational logic circuits : Introduction, Half adder; Full adder; Multiplexer: 16 to 1 Multiplexer; The 74150; Multiplexer Logic; Bubbles on Signal Lines; Nibble Multiplexers, Demultiplexer: 1 to 16 Demultiplexer; The 74154, 1 of 16 Decoder, BCD To Decimal Decoders; The 7445, Encoder, The 74147.

Sequential logic circuits: Introduction, RS flip-flop, Clocked RS flipflop, D flip-flop, JK flip-flop JK Master- slave flip-flop.

IC 555 timer and its application as astable and monostable Multivibrator. Numerical Problems.

Basic Reference Book:

Digital Principles and Applications By Malvino & Leach, Publisher: Tata McGraw Hill Publishing Company Limited. 4^{TH} Edition.

Other Reference Books:

1. Electronic Devices & Circuits By Allen Mottershad, Publisher: Prentice-Hall of India Pvt. Ltd., Delhi
2. Electronic Devices & Circuits Theory by Boylestead & Nashelsky
3. Handbook of Electronics By Kumar & Gupta, Publisher: Pragati Prakashan, Meerut, India
4. Principal of Electronics By Malvino, Publisher: TMG

B.Sc. Semester – 6 – 604 Practical
Credit 6

Each student will have to perform **three (3) experiments (one from each group)** in the University Examination.

Each Practical would be of 35 Marks and should be performed in a session of 3 Hours in practical exam.

Total 150 marks (105 marks external & 45 marks internal)

There would be three sessions of 3 hours each for three experimental practical examination. Fourth session of 3 hours would be for the project work evaluation. (So, in total a student has to undergo four sessions (3 hours each) of practical +project evaluation examination)

There shall be **batch of 15 students** for practical exam in university examination.

List of Experiments
Group A

1. To Study of Resonance Pendulum.
2. To Determine the Young's Modulus by Koeing Method.
3. Determine the Elastic constants using Flat Spiral Spring.
4. Study of Platinum Resistance Thermometer.
5. Study of Searle's Goniometer.
6. Resolving power of Diffraction Grating.
7. To Study of Edser-Butler Plate.
8. To determine Planck's constant using Photocell.
9. Study of Temperature ON-OFF Controller with Thermistor.
10. To determine Young’s modulus(Y), modulus of rigidity (ɳ), Poission’s ratio (□) and bulk modulus (K) for the material of wire by Searl’s arrangement.
11. To measure the divergence of a given LASER source.
12. To determine wavelength of LASER by Diffraction Gratting. 13. To determine refractive index of liquid by Bi prism.

Group B

1. Photo Conductivity of Selenium cell
2. Characteristics of SCR.
3. Study of Linear Variable Differential Transformer (LVDT) Trainer.
4. To determine e/m by Thomson's method.
5. To verify the Thevnin's theorem.
6. To determine self inductance of a coil by Anderson's Bridge.
7. To study variation of thermo-electric emf with temperature for Thermo couple.
8. 'e' By Milikan's Method
9. e/K By Power Transistor
10. Convert a moving coil galvanometer into current meter& Voltmeter
11. Study of the Output Wave form Clipping circuit
12. Study of the Output Wave form Clamping circuit

Group C

1. Study of OP-AMP using IC 741.(adder and Subtractor)/(inverter and noninverter).
2. To study the working of an OP-AMP as integrator and differentiator.
3. Study of IC 555 Timer circuit.
4. Study of Multiplexer(4-1 line) using (Discrete components or using IC.
5. Study of Demultiplexer(1-4 line) using (Discrete components or using IC
6. Study of Encoder & Decoder Circuit.
7. Study of 4-bit Ripple Counter.
8. Study of Astable/Monostable Multivibrator.
9. Study of UJT as Relaxation Oscillator.
10. Study of RS, D & JK Flip-flop.
11. Study of Modulation
12. Study of Demodulation

Basic Reference Books:

1. Practical Physics by C.L.Arora (S.Chand)
2. Advanced Practical Physics by Chauhan & Singh. (Pragati Prakashan)

Other Reference Books:

1. B.Saraf et ai-Physics through experiments Vol.I & II
2. Electronic Laboratory Primer by Poorna Chandra & Sasikala, (S.Chand)
3. Practical Physics by Chattopadhyay, Rakshit & Saha.

605 : Project Work :
Credit 4

The project work will be assigned individually to all students

Preparation of the Working Model:

Student has to prepare one model (preferably working model) based on the principle of Physics. The model, along with a detailed write up (dissertation), explaining the principle, working and applications, should be submitted to the Practical-in-charge in two copies at the end of 6^{th} semester.

Project-in-charge should extend the guidance regarding the selection, preparation and troubleshooting of working model, and there would be one lecture per week per batch of students.

The Project work would be evaluated by the examiner based on the presentation of the report by students and conducting viva-voce and demonstration of the working model. The distribution of marks is as follows:

Model making : 40

Model presentation: 30

Viva voce : 30

The Evaluation of the project work will be done at the end of the sixth semester. For the Evaluation of the project work one session of three hours should be allocated during the practical examination.

There would be three sessions of 3 hours each for three experimental practical examination. Fourth session of 3 hours would be for the project work evaluation. (in total a student has to undergo four sessions (3 hours each) of practical +project evaluation examination)

There shall be batch of 15 students for project and viva.