B.SC. PT. III PHYSICS EXAMINATION

PHYSICS

Scheme of examination:

Three Theory Papers		**Min. Pass Marks 54**	**Max. Marks 150**
Paper-I	**Quantum Mechanics and Spectroscopy**	3 hrs. duration	50 marks
Paper-II	**Nuclear Physics**	3 hrs. duration	50 marks
Paper-III	**Solid State Physics**	3 hrs. duration	50 marks
Practicals	5 hrs. duration	Min. marks 27	Max. marks 75

Note: There will be two experiments of 5 hrs. Duration. The distribution of 75 marks will be as follows:

Two experiments (one-from each group) eadh of 25 marks	50
Viva	15
Record	10
Total	75

Work load:

Each paper must be given 2 hrs. per week for theory Practical must be given 4 hrs. per week. This gives 60 hours for each theory paper with 30 weeks of teaching every session and 120 hours for practicals and laboratory tutorials work every session. For laboratory work-each batch must not be more than 20 students.

PAPER-I QUANTUM MECHANICS AND SPECTROSCOPY

NOTE - Question paper will have three part viz. Part-A (10 marks), Part-B (10 Marks) and Part-C (30 Marks). Students are required to answer, all ten very short type questions (20 words each) in Part-A. Each question carry equal marks.

Part-B, answer all five short type questions (50 words each). Internal choice has been given to each question. Each question carry equal marks.

In Part-C, candidates are required to attempt all three essay type questions (400 words each). Internal choice has been given to each question. Each question carry equal marks.

Unit I

Origin of Quantum theory : Failure of classical Physics to explain the phenomenon such as black body spectrum, Planck's radiation law, photoelectric effect and Einstein explanation, Compton effect deBroglie hypothesis, evidence for diffraction and interference of particles. Uncertainty principle and its consequences gamma ray microscope, diffraction at a single slit, Application of uncertainty principle, (i) Non existence of electron in nucleus. (ii) Ground state energy of H-atom (iii)

Ground state energy of harmonic oscillator, Energy-time uncertainty.

Schrodinger equation – time dependent and time independent form, Physical significance of the wave function and its interpretation, probability current density, operators in quantum mechanics, linear and Hermitian operators, Expectation values of dynamical variables, the position, momentum, energy.

Unit II

Fundamental postulates of quantum mechanics, eigen function and eigen value, degeneracy , orthogonality of eigen functions, commutation relations . Ehrenfest theorem, concept of group and phase velocities, wave packet.

Simple Solutions of Schrodinger equation : Time independent Schrodinger equation and stationary state solution, Boundary and continuity conditions on the wave function, particle in one dimensional box , eigen function and eigen values , discrete energy levels, extension of results for three dimensional case and degeneracy of levels. Potential step and rectangular potential barrier , calculation of reflection and transmission coefficient, Qualitative discussion of the application to alpha decay(tunnel effect), square well potential problem, calculation of transmission coefficient.

Bound State Problems : Particle in one dimensional infinite potential well and finite depth potential well, energy value and eigen functions.

Unit III

Simple harmonic oscillator (one dimensional) eigen function, energy eigen values, zero point energy. Schrodinger equation for a spherically symmetric potential, Separation of variables, Orbital angular momentum and its quantisation, spherical harmonics, energy levels of H-atom, shape of n=1, n=2 wave functions, comparison with Bohr model and Correspondence principle.

Elementary Spectroscopy : Quantum features of one electron atoms, Frank-Hertz experiment and discrete energy states, Stern and Gerlach experiment, Spin and Magnetic moment, Spin Orbit coupling and qualitative explanation of fine structure. Atoms in a magnetic field, Zeeman effect, Zeeman splitting.

Qualitative features of molecular spectroscopy, Rigid rotator, discussion of energy eigenvalues and eigenfunctions, Rotational energy levels of diatomic molecules, Rotational spectra, Vibrational energy levels of diatomic molecules, Vibrational spectra, Vibrational Rotational spectra, Raman effect.

Text and Reference Books

1. H. S. Mani and G.K.Mehta, Introduction to modern Physics, (Affl. East West Press1989)
2. A. Beiser, Prospective of modern Physics

4. Barrow, Introduction to Molecular Physics.
5. D.P.Khandelwal, Optics and Atomic Physics (Himalaya Pub. House Mumbai 1988).

PAPER – II NUCLEAR PHYSICS

NOTE - Question paper will have three part viz. Part-A (10 marks), Part-B (10 Marks) and Part-C (30 Marks). Students are required to answer, all ten very short type questions (20 words each) in Part-A. Each question carry equal marks.
Part-B, answer all five short type questions (50 words each). Internal choice has been given to each question. Each question carry equal marks.
In Part-C, candidates are required to attempt all three essay type questions (400 words each). Internal choice has been given to each question. Each question carry equal marks.

Unit-I

Nuclear Properties : Rutherford's Theory of a Particle Scattering, Properties of Nuclei : Quadrupole Moment and Nuclear Ellipticity, Quadrupole Moment and Nuclear Spin, Parity and Orbital Angulr Momentum, Parity and Its Conservation, Nuclear Mass and Mass Spectroscopy, Nuclear Energy, Explanation of the fact that Electrons Cannot Exist with-in a Nucleus, Discovery of Neutron and Proton-Neutron Hypothesis, Neutron to Proton Ratio (N/Z), The Nuclear Potential, Nuclear Mass, Atomic Mass Unit (a.m.u.), Mass Defect and Binding Energy, Nuclear Forces, Theory of Nuclear Forces, The Liquid Drop Model.

Cosmic Rays : Discovery of Cosmic Rays, Nature of Cosmic Rays, soft and hard, components, variation in cosmic rays—

(1) Latitude Effect

(2) East-West Asymmetry or Directional Effect

(3) Altitude Effect

Detection of Cosmic Ray Particles, Origin of Cosmic Rays.

Unit-II

Nuclear Fission : The Discovery of Nuclear Fission, The Energy Release In Fission, The Fission products, Mass Distribution of Fission Products, Fission Cross Section and Threshold, Neutron Emission In Fission, The Prompt Neutron and Delayed Neutrons, Energy of Fission Neutrons, Theory of Nuclear Fission and Liquid Drop Model, Barrier Penteration-Theory of Spontaneous Fission, Nuclear Energy Sources, Nuclear Fission as a Source of Energy, The Nuclear Chain Reaction, Condition of Controlled Chain Reaction, The Principle of Nuclear Reactors, Classification of Reactors, Typical Reactors, Power of Nuclear Reactors, Critical size of Thermal Reactors, The Breeder Reactors, Reprocessing

of the Spent Fuel, Radiation Damages and Fission Products Poisoning, Uses of Atomic Energy.

Nuclear Fusion : The Sources of Stellar Energy, The Plasma : The Fourth State of The Matter, Fusion Reaction, Energy Balance and Lawson Criterion, Magnetic Confinement of Plasma, Classical Plasma Losses from the Magnetic Container, Anomalous Losses, Turbulence and Plasma Instabilities, The Laser Fusion Problem, Fusion Reactor.

Unit-III

Elementary Particles : Classification of Elementary Particles, Fundamental Interactions, Unified Approch (Basic ideas), The Conservation Laws, Quarks (Basic ideas), Charmed and Colour Quarks.

Accelerators : Ion Sources. CockCroft-Walten High Voltage Generators, VanDeGraff Generators, Drift Tube, Linear Accelerators, Wave Guide Accelerator, Magnetic Focusing in Cyclotron, Synchrocyclotron, Betatron : The Electromagnetic Induction Accelerator, Electron Synchrotron, Proton Synchrotron.

Particle and Radiation Detectors : Ionisation Chamber, Region of Multiplicative Operation, Proportion Counter, Geiger-Muller Counter, Scintillation counter, Cloud Chamber.

Text and Reference Books

1. H. S. Mani and G.K.Mehta, Introduction to modern Physics, (Affl. East West Press 1989)
2. A. Beiser, Prospective of modern Physics
3. H.A.Enge, Introduction to Nuclear Physics.

PAPER - III SOLID STATE PHYSICS

NOTE - Question paper will have three part viz. Part-A (10 marks), Part-B (10 Marks) and Part-C (30 Marks). Students are required to answer, all ten very short type questions (20 words each) in Part-A. Each question carry equal marks.
Part-B, answer all five short type questions (50 words each). Internal choice has been given to each question. Each question carry equal marks.
In Part-C, candidates are required to attempt all three essay type questions (400 words each). Internal choice has been given to each question. Each question carry equal marks.

Unit-I

Crystal Binding and Crystal Structure : Crystal Bonding, Ionic Bond, Binding Energy of Ionic Crystal, Determination of the Repulsive Exponent, Covalent Bonding, Metallic Bonding, Molecular or Vander Waal's Bonding, Hydrogen Bonding. Space Lattice and Crystal Structure, Bravis Lattice, Miller Indices and Crystal Structure, Spacing of Planes in Crystal Lattice, Atomic packing, Simple Cubical L attice Structure, Face

Centered Cubic Lattice Structure, Body Centered Cubic Lattice Structure, Hexagonal Closed Packed Structure, Pervoskite Structure, X-ray Diffraction and Bragg's Law, Laue equation of X-ray diffraction.

Thermal Properties of the Solids : Concepts of Thermal Energy and Phonons, Internal Energy and Specific Heat, The Various Theories of Lattice Specific Heat of Solids: The Einstein Model, Vibrational Modes of Continuous medium, Debye Model, Electronic Contribution of the internal Energy hence to the Specific Heat of Metals, Thermal Conductivity of the lattice.

Unit-II

Band Theory of Solids : Formation of Bands, Periodic Potential of a Solid, Wave Function in a Periodic Lattice and Bloch Theorem, Number of States in a Band, Kronig Penny Model, Velocity of the Bloch electrons and Dynamical Effective Mass, Momentum, Crystal Momentum and Physical Origin of the Effective Mass, Negative Effective Mass and concept of Holes, The distinction between metals, insulators, and intrinsic semiconductors.

Electrical Conductivity : Drude-Lorentz Theory of Electrical Conductivity, Boltzmann Transport Equation, Sommerfield Theory of Electrical Conductivity, Mathiessen's Rule, Thermal Conductivity and Wildemann-Franz's Law, The Hall Effect.

Unit-III

Superconductivity : Introduction, Experimental Features of Superconductivity, The Isotope Effect and Electron-Phonon Interaction, The Effect of the Superconducting Transition on Properties of superconductors, Special Features of Superconducting Materials, Theoretical Survey (Basic Ideas), Flux Quantisation, BCS Theory of Superconductivity: Cooper Pairs, High Temperature Superconductors (Basic Ideas)

Magnetic Properties : Classification of Magnetic Materials, Origin of Atomic Magnetism, Dynamics of Classical Dipole In Magnetic Field, Magnetic Susceptibility, phenomenon of Diamagnetism, Para magnetism susceptibility of Ionic Crystal, Ferromagnetism, Temperature Dependence of Saturation of Spontaneous Magnetization, The Paramagnetic Region, The Nature of Ferromagnetism, Nature and Origin of Weiss Molecular Field, Heisenberg's Exchange Interaction, (Quantum Theory of Ferromagnetism), Relation Between Exchange Integral and Weiss Constant, Ferromagnetism Domains, Magnetostriction.

Text and Reference Books

1. C Kittel, Introduction to Solid State Physics.
2. J.S.Blackmore, Solid State Physics(Cambridge Univ. Press)
3. H.C. Gupta , Solid state Physics, Vikas Publication. Delhi
4. R. L. Singhal, Solid state Physics, Kedar Nath Publication, Merut.

PHYSICS PRACTICALS

Duration: 5 hrs **Min. Pass Marks 27** **Max. Marks 75**

In addition to experiments listed below few more experiments may be set at institution level, at par with the Standard of B.Sc. Part III. Total number of experiments to be performed by the students during the session should be 16, selecting any eight from each section. In examination two experiments are to be performed taking at least one from each section. The lab tutorials are to be done in lab. classes, so that these may be applied in regular lab work.

SECTION: A

1. Determination of Planck's constant by photo-cell (retarding potential method using optical filters. Preferably five filters).
2. Determination of Planck's constant using solar cell.
3. Determination of Stefan's constant.
4. Study of the temperature dependence of resistance of semi-conductor (four-probe method).
5. Study of iodine spectrum with the help of grating and spectrometer using ordinary bulb light.
6. Study of the characteristics of a G M counter and verification of inverse square law for the same strength of a radioactive source.
7. Study of absorption in a foil using G M counter.
8. To find the magnetic susceptibility of paramagnetic solution using Quinck's method. Also find the ionic molecular susceptibility of the ion and magnetic moment of the ion in terms of Bohr magneton.
9. Determination of coefficient of rigidity as a function of temperature using torsional oscillators (resonance method).
10. Study of polarization by reflection from a glass plate with the help of Nicol prism and photo cell and verification of Brewsters law and law of Malus.
11. e/ m measurement by Helical method.
12. Measurement of magnetic field using ballistic galvanometer and search coil study of variation of magnetic field of an electro magnet with current.
13. Measurement of electronic charge by Millikan's oil drop method.

SECTION: B

1. Study of a R-C transmission line at 50 Hz.
2. Study of a L-C transmission line
   (i) at fixed frequency.
   (ii) at variable frequency.
3. Study of resonance in an LCR circuit (using air core inductance and damping bymetal plate) :
   (i) at fixed frequency by varying C, and
   (ii) by varying frequency
4. (i) Recovery time of junction diode and point contact diode.

आयन की आयनिक आणविक प्रवृति तथा बोर –मैग्नेटोन के पदों में चुम्बकीय आघूर्ण का मान ज्ञात करना।

9. ऐंठनी दोलक की सहायता से दृढ़ता गुणांक का ताप के साथ अध्ययन करना।
10. निकॉल प्रिज्म एवं फोटो सेल की सहायता से किसी कॉच की पट्टिका से परावर्तन द्वारा ध्रुवण का अध्ययन करना एवं ब्रुस्टर एवं मालस नियमों का सत्यापन करना।
11. हैलीकल विधि से मध्य का मान ज्ञात करना।
12. प्रक्षेपधारामापी (बैलेस्टिक गैल्वेनोमीटर) एवं अन्वेषी कुण्डली की सहायमा से चुम्बकीय क्षेत्र का मापन एवं विद्युत–चुम्बक के चुम्बकीय क्षेत्र का धारा के परिवर्तन के साथ अध्ययन करना।
13. मिलिकन की तेल बूंद विधि से विद्युत आवेश का मापन करना।

खण्ड 'ब'

1. R-C संचरण लाईन का 50 हर्ट्ज आवृति पर अध्ययन करना।
2. एक L-C संचरण लाईन का (i) नियत आवृति पर (ii) परिवर्ती आवृति पर अध्ययन करना।
3. L-C-R परिपथ में अनुनाद का अध्ययन करना। (वायु कोर प्रेरकत्व एवं धात्विक प्लेट द्वारा अवमंदन का प्रयोग करते हुए)
   (i) नियत आवृत्ति पर C में परिवर्तन करके
   (ii) निश्चित L एवं C पर आवृति के परिवर्तन के साथ
4. (i) संधि डायोड एवं बिन्दु समर्पित डायोड के पुनः प्राप्ति काल (recovery time) ज्ञात करना।
   (ii) कार्यकारी आवृति एवं स्विचित धारा (Switching current) के फलन के रूप में पुनः प्राप्ति काल का अध्ययन करना।
5. जेनर नियमक षक्ति प्रदायक का निर्माण एवं विभिन्न लोड. के साथ वोल्टता नियमन का अध्ययन।
6. क्षेत्र प्रभावी ट्रांजिस्टर के अभिलाक्षणिकों का अध्ययन एवं नियत लब्धता के प्रवर्धक का निर्माण एवं उसका अध्ययन।
7. किसी ट्रान्जिस्टर प्रवर्धक की आवृत्ति अनुक्रिया का अध्ययन करना एवं प्रर्वधक की निवेषी, निर्गत प्रतिबाधा ज्ञात करना।
8. एक R-C कला विस्थापन (phase shift) दोलित्र का निर्माण एवं अध्ययन करना।
9. प्रत्यावर्ती विभव से उच्च. दिष्ट विभव प्राप्त करने के लिए वोल्टता संवर्धक परिपथ का अध्ययन करना।
10. विभिन्न अवयवों के प्रयोग से OR, AND, NOT तार्किक द्वारों का अध्ययन करना एवं इनकी समाकलित परिपथों (IC's) से बने द्वारों के साथ तुलना करना।
11. संक्रियात्मक प्रवर्धक निम्न पर अनुप्रयोग (कम से कम दो)
    (1) प्रतिलोमित प्रवर्धक (2) अप्रतिलोमित प्रवर्धक
    (3) अवकलक, समाकलक (4) संकलक प्रवर्धक

Text and Reference books:

1. Raj Kumar - practical Physics.
2. Dr. S.P. - Singh practical Physics.
3. Dr. V.P. Arora - Advance practical Physics.
4. Practical Physics by CBH Jaipur.
5. Practical Physics by RBD Jaipur.

CHEMISTRY

B.SC. PART III EXAMINATIONB.SC. PART III

Scheme:

Paper	Duration	Max. Marks	Min. Pass Marks
Paper I	3 hrs.	50	18
Paper II	3 hrs.	50	18
Paper III	3 hrs.	50	18
Practical	6 hrs.	75	27
Total Marks		225	81

Note: Each theory paper is divided into three independent units. The question paper is divided into three parts Part -A, Part -B and Part –C. Part A (10 marks) is compulsory and contains 10 questions (20 words) at least three questions from each unit, each question is of one mark. Part –B (10 marks) is compulsory and contains five questions at least one from each unit. Candidate is required to attempt all five questions. Each question is of two marks (50 words). Part –C (30 marks) contains six questions two from each unit. Candidate is required to attempt three questions one from each Unit. Each question is of ten marks (400 words).

PAPER-I INORGANIC CHEMISTRY

Time : 3 Hours Max. Marks:50

Unit-I

A. Metal-ligand Bonding in Transition Metal Complexes

Limitations of valence bond theory, an elementary idea of crystal-field theory, crystal field splitting in octahedral , tetrahedral and square planar complexes, factors affecting the crystal-field parameters.

B. Thermodynamic and Kinetic Aspect of Metal Complexes

A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar and octahedral complexes.

C. Magnetic Properties of Transition Metal Complexes

Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of μ_s and μ_{eff} values, orbital contribution to magnetic moments, application of magnetic moment data for 3d-metal complexes.

Unit-II

A. Electronic Spectra of Transition Metal Complexes

Types of electronic transition, selection rules of d-d transitions, spectroscopic ground state, spectrochemical series. Orgel-energy level diagram for d^1 and d^9 states, discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion

B. Organometallic Chemistry

Definition, nomenclature and classification of organometallic compounds. Preparation, properties, bonding and applications of alkyls and aryls of Li, Al, Hg, Sn and Ti, a brief account of metal-ethylenic complexes and homogeneous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls.

Unit-III

A. Basics of Bioinorganic Chemistry

Essential and trace elements in biological processes, metallporphyrins with special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Ca^{2+}. Nitrogen fixation.

B. Hard and Soft Acids and Bases(HSAB)

Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.

C. Silicones and Phosphazenes

Silicones and phosphazenes as examples of organic polymers, nature of bonding in triphosphazenes.

PAPER-II ORGANIC CHEMISTRY

Time : 3 Hours Max. Marks:50

UNIT-I

Spectroscopy

A. Nuclear Magnetic resonance (NMR) spectroscopy.

Proton magnetic resonance(^{1}H NMR) spectroscopy, nuclear shielding and dishielding chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2,-tribromoethane, ethyl acetate, toluene and acetophenone. Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques.

B. Organometallic Compounds

Organomagnesium compounds: the Grignard reagents-formation, structure and chemical reaction.

Organozinc compounds:formation and chemical reactions.

Organolithium compounds: formation and chemical reactions.

UNIT-II

A. Organic Synthesis via Enolates

Acidity of α-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate.

Alkylation of 1,3-dithianes. Alkylation and acylation of enamines.

B. Carbohydrates

Classification and nomenclature. Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erithro and threo diastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers and esters. Determination of ring size of monosaccharides. Cyclic structure of D(+)- glucose. Mechanism of mutarotation.

Structure of ribose and deoxyribose.

An introduction to disaccharides(maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

C. Amino Acids, Peptides, Proteins and Nucleic Acids

Classification, structure and stereochemistry of amino acids. Acid base behavior, isoelectric point and electrophoresis. Preparation and reactions of α-amino acids.

Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid-phase peptide synthesis. Structures of peptides and proteins, level of protein structure. Proteins denaturation/ renaturation.

Nucleic acids: introduction, Constitution of nucleic acids. Ribnonucleosides and ribonucleotides. The double helical structure of DNA.

UNIT-III

A. Synthetic Polymers

Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers.

Condensation or step growth polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes.

Natural and synthetic rubbers.

B. Synthetic Dyes

Colour and constitution (electronic concept). Classification of dyes. Chemistry and synthesis of Methyl orange, Congo red, malachite green, Crystal violet, Phenolphthalein, Fluorescein, Alizarin and indigo.

C. Fats, Oil and Detergents

Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, iodine value, acid value. Soaps, synthetic detergents, alkyl and aryl sulphonates.

PAPER-III PHYSICAL CHEMISTRY

Time : 3 Hours Max. Marks:50

UNIT-I

A. Elementary Quantum Mechanics

Black-body radiation, Planck's radiation law, photoelectric effect, Bohr's model of hydrogen atom (no derivation) and its defects, Compton effect.

de Brogile hypothesis, the Heisenberg's uncertainty principle. Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates, of quantum mechanics, particle in a one dimensional box.

Schrodinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions.

B. Molecular orbital theory

Basic ideas- criteria for forming M.O from A.O. construction of M.O's by LCAO-H_2^+ ion, calculation of energy levels from wave functions, physical picture of bonding and antibonding wave functions, concept of σ, σ^*,π, π^* orbitals and their characteristics. Hybrid orbitals-sp. sp^2, sp^3 calculation of coefficients of A.O.'s used in these hybrid orbitals.

Introduction to valence bond model of H_2, comparison of M.O. and V.B. models.

UNIT-II

A. Electronic Spectrum

Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Frank-Condon principle.

Qualitative description of σ, π- and n M.O., their energy levels and the respective transitions.

B. Spectroscopy

Introduction : electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom.

C. Rotational Spectrum

Diatomic molecules, Energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect.

D. Vibrational Spectrum

Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.

Raman Spectrum concept of polarizability, pure rotational and pure vibrational Raman Spectra of diatomic molecules, selection rules.

UNIT-III

A. Photochemistry

Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus-Drapper law, Stark-Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluroscence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions- energy transfer processes (simple examples)

B. Chemical Kinetics and Catalysis

Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction- concentration, temperature, pressure, solvent, light, catalyst. Concentration dependence of rates, mathematical characteristics of simple chemical reactions-zero order, first order, second order, pseudo order, half life and mean life. Determination of the order of reaction- differential method, method of integration, method of half life period and isolation method.

Radioactive decay as a first order phenomenon.

Experimental methods of chemical kinetics: conductometric, potentiometric, optical methods, polarimetry and spectrophotometer.

Theories of chemical kinetics: effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy.

Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis) Expression for the rate constant based on equilibrium constant and thermodynamic aspects. Complex reaction kinetics, parallel reaction, reversible reaction and conjugative reactions.

PAPER-IV- PRACTICALS

Time: 6 Hours **Max. Marks: 75**

(A) Instrumentation

Colorimetry

(a) Job's method (b) Mole-ratio method

Adulteration- Food stuffs.

Effluent analysis, water analysis.

OR

Solvent Extraction: Separation and estimation of Mg(II) and Fe(II)

Ion Exchange Method: Separation and estimation of Mg(II) and Zn(II).

(B) Synthesis of (Any six)

(a) Sodium trioxalato ferrate (III), $Na_3[Fe(C_2O_4)_3]$

(b) Ni-DMG complex,$[Ni(DMG)_2]$

(c) Copper tetrammine complex $[Cu(NH_3)_4]SO_4$.

(d) Cis-and trans-bisoxalato diaqua chromate (III) ion.

III	**Any one of the following**				
(a)	**MATHEMATICAL STATISTICS**	4	3	7	68
(b)	**LINEAR PROGRAMMING AND OPTIMIZATION TECHNIQUES**	4	3	75	68
(c)	**THEORY-NUMERICAL ANALYSIS AND PROGRAMMING IN C**	4	3	50	45
(c)	**PRACTICALS -**	2	2	25	23
		Max. Marks		225	200
		Max. Pass Marks		81	72

PAPER-I
REAL ANALYSIS

Duration: 3Hrs. **Max.Marks:75(Science) 66(Arts)**

Note 1. Common paper will be set for both the faculties of Social sciences and Science. However the marks obtained by candidates in the faculty of Social sciences will be converted according to the ratio of the maximum marks of the paper in two faculties.

Note 2. The paper is divided into three independent units. The question paper is divided into Three parts Part-A, Part-B and Part-C.

Part A- (15 Marks) is *compulsory* and contains **10** questions **(50 words)** at least **3** questions from each unit, each question is of **1.5** marks.

Part B- (15 Marks) is *compulsory* and contains **5** questions **(100 words)** at least one question from each unit, each question is of **3** marks.

Part C- (45 Marks) contains **6** questions two from each unit. The candidate is required to attempt **3** questions one from each Unit. Each question is of **15** marks **(400 words).**

UNIT-I

Real number system as a complete ordered field: The point set theory, open and closed sets, limit point of a set, neighborhoods, Bolzano-Weierstrass theorem, Heine-Borel theorem, compactness, connectedness, cantor's ternary set, ε-δ definition of the limit of a function, basic properties of limits, continuous functions and classification of discontinuities, sequential continuity, properties of continuous functions defined on closed intervals, limit and continuity of functions of two variables.

UNIT-II

Differentiability, properties of differentiability, mean value theorems and their geometrical interpretation, Darboux's intermediate value theorem for derivatives, Taylor's theorem for functions of two variables, definition of a

sequence, theorems on limits of sequences, bounded and monotonic sequences, Cauchy's convergence criterion.

UNIT-III

Infinite series of non-negative terms, its convergence, different tests of convergence of infinite series *i.e.* comparison tests, Cauchy's integral tests, Ratio tests, Raabe's, Logarithmic, D.Morgan and Bertrand's tests (without proof), Alternating series test, Leibnitz's theorem, absolute and conditional convergence, Fourier series, Fourier expansion of piecewise monotonic functions, uniform convergence of series of functions, Wirestrass M-test, Abel's test and Dirichlet's test.

PAPER-II
COMPLEX ANALYSIS

Duration: 3Hrs. Max.Marks:75(Science) 66(Arts)

Note 1. Common paper will be set for both the faculties of Social sciences and Science. However the marks obtained by candidates in the faculty of Social sciences will be converted according to the ratio of the maximum marks of the paper in two faculties.

Note 2. The paper is divided into three independent units. The question paper is divided into Three parts Part-A, Part-B and Part-C.

Part A- (15 Marks) is *compulsory* and contains **10** questions **(50 words)** at least **3** questions from each unit, each question is of **1.5** marks.

Part B- (15 Marks) is *compulsory* and contains **5** questions **(100 words)** at least one question from each unit, each question is of **3** marks.

Part C- (45 Marks) contains **6** questions two from each unit. The candidate is required to attempt **3** questions one from each Unit. Each question is of **15** marks **(400 words).**

UNIT- I

Complex numbers as ordered pairs, complex plane, geometrical representation of complex numbers, conjugate complex numbers, connected and compact sets, curves and region in the complex plane, statement of Jordan curves theorem, extended complex plane and stereographic projection, complex valued functions, limit and continuity, convergence, differentiability in the extended plane, analytic functions, Cauchy -Riemann equations (Cartesian and polar form), complex equation of a straight line and circle, polynomials, multiple valued functions, harmonic functions.

UNIT- II

Mapping or transformations, Jacobian of a transformation, conformal mapping, necessary and sufficient conditions for $w = f(z)$ to represent conformal mapping, some elementary transformations, bilinear transformation and its properties, fixed points, cross ratio, inverse point, elementary maps- $F(z) = z^2$, $\bar{z}$, $\frac{1}{2}(z + 1/z)$, $\sin z$, $\log z$.

UNIT- III

Sequences and series of functions, power series, complex line integral, reduction of complex integrals to real integrals, properties of complex integrals, Cauchy's fundamental theorem, Cauchy's integral formula, derivative of an analytic function, Morera's theorem, Liouville's theorem, Poisson's integral formula, expansion of analytic functions as power series, Taylor's and Laurent's theorems.

PAPER-III (a)
MATHEMATICAL STATISTICS

Duration: 3Hrs. Max.Marks:75(Science) 66(Arts)

Note 1. Common paper will be set for both the faculties of Social sciences and Science. However the marks obtained by candidates in the faculty of Social sciences will be converted according to the ratio of the maximum marks of the paper in two faculties.

Note 2. The paper is divided into three independent units. The question paper is divided into Three parts Part-A, Part-B and Part-C.

Part A- (15 Marks) is *compulsory* and contains **10** questions **(50 words)** at least **3** questions from each unit, each question is of **1.5** marks.

Part B- (15 Marks) is *compulsory* and contains **5** questions **(100 words)** at least one question from each unit, each question is of **3** marks.

Part C- (45 Marks) contains **6** questions two from each unit. The candidate is required to attempt **3** questions one from each Unit. Each question is of **15** marks **(400 words).**

UNIT- I

Measures of dispersion, moments, central moments, skewness, kurtosis, Pearson's coefficients, probability, law of total and compound probability, conditional probability, independent events, Bay's theorem, random variable, probability distribution of a discrete random variable, mathematical expectation, expectation and variance of a linear combination of random variables, moment generating of function, cumulates and its properties.

UNIT- II

Discrete distributions: Binomial and Poission, properties of these distributions and moments up to fourth order, fittings of Binomial and Poission distributions.

Continuous distributions: Rectangular and normal distributions, properties of these distribution and moments up to fourth order.

UNIT- III

Bivariate data, Scattered diagram, correlation coefficient, rank correlation coefficient, Principal of least square, fitting of a line and quadratic curves, Simple linear regression correlation, correlation versus regression,properties

of regression coefficients.

Index numbers: Concepts, construction, uses and limitations of simple and whished index numbers, Lispeyer's, Peaches' and Fisher's index numbers, criterions of a good index numbers, Fisher's index as an ideal index number.

PAPER-III (b)
LINEAR PROGRAMMING ANDOPTIMIZATION TECHNIQUES

Duration: 3Hrs. Max.Marks:75(Science) 66(Arts)

Note 1. Common paper will be set for both the faculties of Social sciences and Science. However the marks obtained by candidates in the faculty of Social sciences will be converted according to the ratio of the maximum marks of the paper in two faculties.

Note 2. The paper is divided into three independent units. The question paper is divided into Three parts Part-A, Part-B and Part-C.

Part A- (15 Marks) is *compulsory* and contains **10** questions **(50 words)** at least 3 questions from each unit, each question is of **1.5** marks.

Part B- (15 Marks) is *compulsory* and contains **5** questions **(100 words)** at least one question from each unit, each question is of **3** marks.

Part C- (45 Marks) contains **6** questions two from each unit. The candidate is required to attempt **3** questions one from each Unit. Each question is of **15** marks **(400 words).**

UNIT- I

Formulation of linear programming problems, graphical solution, convex set and its properties, feasible solution, basic solution, optimal solution, simplex method, Big M-method, Two phase method.

UNIT- II

Degeneracy in simplex method and it's resolution, revised simplex method, concept of duality in linear programming problem, formulation of dual problems, elementary theorems of duality.

UNIT- III

Introduction to allocation problems, Assignment problems, Hungarian method, minimum row cover method, unbalanced assignment problems.

Transportation problem, North-West corner method, lowest cost entry method, Vogel's approximation method, degeneracy and optimal solution of transportation problem.

Game theory: Mini-Max principle,saddle point, dominance rule, graphical method for solution of $2xn$ and $mx2$ games, solution of a rectangular game by simplex method.

PAPER-III (c) THEORY
NUMERICAL ANALYSIS AND PROGRAMMING IN C

Duration: 3Hrs. Max.Marks:50(Science) 45(Arts)

Note 1. Common paper will be set for both the faculties of Social sciences and Science. However the marks obtained by candidates in the faculty of Social sciences will be converted according to the ratio of the maximum marks of the paper in two faculties.

Note 2. The paper is divided into three independent units. The question paper is divided into Three parts Part-A, Part-B and Part-C.

Part A- (10 Marks) is *compulsory* and contains **10** questions **(50 words)** at least **3** questions from each unit, each question is of **1** marks.

Part B- (10 Marks) is *compulsory* and contains **5** questions **(100 words)** at least one question from each unit, each question is of **2** marks.

Part C- (30 Marks) contains **6** questions two from each unit. The candidate is required to attempt **3** questions one from each Unit. Each question is of **10** marks **(400 words).**

UNIT-I

Difference operators and factorial notation, relation between difference and derivatives, difference of polynomial, Newton's formulae for forward and backward interpolation for equal intervals,divided difference, relation between divided differences and simple differences, Newton's general interpolation formula, Lagrange's interpolation formula.

UNIT-II

Gauss central difference formula, Stirling and Bessel interpolation formulae,inverse interpolation.

Numerical differentiation and integration. Trapezoidal rule, Simpson's *1/ 3, 3/8* rules, Weddle's rule, solution of algebraic and transcendental equations, Bi-section method, Regula-Falsi method, Newton-Raphson method.

UNIT - III

Programmer's model of a computer .algorithms, flow charts,data types, arithmetic and input/output instructions, decision control structures.decision statements,logical and conditional operators , precedence. associativity and priorarity of operators ,input and output statement, decision making statement, loop and branching, case control structures, functions, recreations, pre processors, arrays, puppetting of strings.

PAPER-III (c)
PRACTICALS

Duration: 2 hrs. **Max. Marks: 25(Science) 23 (Arts)**

Note: Distribution of marks is as follows:

		Science	Arts
A.	**Two programmes (one from each section)**	7+8	6+7
B.	**Practical Record**	05	05
C.	**Viva Voce**	05	05

Make one programme from each section.

SECTION-A

(1) To solve quadratic equation.
(2) To solve equation by bisection method.
(3) To solve equation by Newton- Raphson method.
(4) To solve equation by Regula-Falsi method.
(5) To solve equation by secant method.

SECTION-B

(1) To find interpolate value by Newton forward interpolation formula.
(2) To find interpolate value by Lagrange's interpolation formula.
(3) To solve integral by Trapezoidal rule.
(4) To solve integral by Simpson 1/3 rule.
(5) To solve integral by Simpson 3/8 rule.

बी.एस.सी. भाग तृतीय - परीक्षा
गणित (2017-18)

योजना

प्रश्न पत्र	शीर्षक	शिक्षण घंटे / सप्ताह	परीक्षा अवधि (घंटे)	पूर्णांक	
				विज्ञान	कला
I	वास्तविक विश्लेषण	4	3	75	66
II	सम्मिश्र विश्लेषण	4	3	75	66
III	(निम्न में से कोई एक)	4	3	75	66
	(अ) गणितीय सांख्यिकी	4	3	75	66
	(ब) रैखिक प्रोग्रामन एवं इष्टतमकारी प्रविधियां	4	3	75	66
	(स) संख्यात्मक विश्लेषण एवं C में प्रोग्रामन	4	3	50	45
	प्रायोगिक	2	2	25	23
			पूर्णांक	**225**	**200**
			न्यूनतम उत्तीर्णांक	**81**	**72**

प्रश्न पत्र - I वास्तविक विश्लेषण

समय : 3 घण्टे अधिकतम पूर्णांक : 75 (विज्ञान) 66 (कला)

नोट 1 विज्ञान एवं सामाजिक विज्ञान दोनों संकायों के लिए एक ही प्रश्न-पत्र होगा। यद्यपि सामाजिक विज्ञान संकाय के परीक्षार्थियों के प्राप्तांक दोनों संकायों के अधिकतम पूर्णांक के अनुपात के अनुरूप परिवर्तित किये जाएंगे।