आज दिनांक 19.10..2011 को विश्वविद्यालय परिसर में निम्न विषय की पाठ्यक्रम समिति की एक आवश्यक बैठक हुई, जिसमें निम्न प्राध्यापकगण उपस्थित हुए :–

Date :- 19.10.2011 Subject :- Botany Committee Place :- Central Library

1. Dr. V. K. Tiwari
2. Dr. V. K. Bhatnagar
3. Dr. M. Rafiq Ahmad Jabri

Proposed Syllabus for B.Sc. Botany

B.Sc. I year

There will be Three theory papers and a practical examination as follows:

Paper I - Diversity of Viruses, Bacteria & Fungi M. M.: 50

Paper II - Diversity of Algae, Lichens, & Bryophytes M. M.: 50

Paper III - Diversity of Pteridophytes & Gymnosperms M. M.: 50

(There will be 9 questions in each paper and candidate has to attempt only 5 questions. Q.1 will be compulsory based on units I - IV. Two questions will be set from each unit of which one question has to be attempted. All questions will carry equal marks.

Practicals: Based on papers I - III M. M.: 50

The course detailes are as follows:-

Paper I: Diversity of Viruses, Bacteria, & Fungi M.M. 50

Unit-I

History, nature and classification of Viruses, Bacteria and Fungi.

History of virology and bacteriology; prokaryotic and eukaryotic cell structure (bacteria, mycoplasma and yeast); structure, classification and nature of viruses; structure (gram positive and gram negative) and classification (based on cell structure) of bacteria; classification, thallus organisation and reproduction in fungi; economic importance of fungi.

Unit-II

Viruses: Symptoms of virus infection in plants; transmission of plant viruses; genome organisation, replication of plant virus (tobacco mosaic virus); techniques in plant viruses - purification, serology and electron microscopy; structure and multiplication of bacteriophages; structure and multiplication of viroids.

Unit-III

Bacteria: Nutritional types of bacteria (based on carbon and energy sources), metabolism in different nutritional types (basics only) and nitrogen cycle; bacterial genome and plasmids; bacterial cell division, variability in bacteria - mutation, principles of genetic recombination; techniques in sterilisation, bacterial culture and staining; economic importance.

Unit-IV

Fungi: The characteristics and life cycles of the following:

Mastigomycotina: *Albugo, Pythium,;* **Ascomycotina**: *Saccharomyces, Aspergillus; Ascobolus;*
Basidiomycotina : *Ustilago, Puccinia, Polyporus, Agaricus;* **Deuteromycotina**: *Fusarium.*

Paper II - Diversity of Algae, Lichens, and Bryophytes M.M. 50

Unit-I

General characters. Range of thallus organization, classification, ultrastructure of eukaryotic algal cell and cyanobacterial cell, economic importance of algae. Lichens, classification, thallus organization, reproduction, physiology and role in environmental pollution.

Unit-II

The characteristics and life cycles of the following:-

Cyanophyta *Microcystis, Oscillatoria :***Chlorophyta** *Volvox*, *Hydrodictyon, Oedogonium, Coleochaete, Chara;* **Bacillariophyta** *Navicula;* **Xanthopyta** *Vaucheria;* **Phaeophyta**; *Ectocarpus*
Rhodophyta *Polysiphonia*

Unit – III

Bryophytes, general characters, classification, reproduction and affinities. Gametophytic and soporophytic organization of:

Bryopsida: *Pogonatum;* **Anthocerotopsida:** A*nthoceros*

Unit - IV

Gametophytic and sporophytic organization of ***Hepaticopsida*** : Riccia, *Marchantia.*

Paper III – Diversity of Pteridophytes, Gymnosperms and elementary Palaeobotany M.M. 50

Unit - I

Pteridophytes: General features, classification, stellar system and its evolution. Comparative study of morphology, anatomy, development, vegetative and reproductive systems of following:

Lycopsida - L*ycopodium, Selaginella;* ***Psilopsida-*** *Rhynia*

Unit – II

General and comparative account of gametophytic and sprophytic system in

Filicopsida -Pteridium*, Nephrolepis. Marsilea.*

Heterospory and seed habit.

Unit - III

Gymnosperms: General characters, classification. Comparative study of morphology, anatomy, development of vegetative and reproductive parts in:

Cycadales: *Cycas*

Unit –IV

Study of morphology, anatomy, development and reproductive parts in:

Coniferales – *Pinus* ; **Gnetales -** *Ephedra*

Affinities and relationship of Gymnosperms, evolutionary significance.

Elementary Palaeobotany: general account, types of fossils, methods of fossilization and geological time scale.

B.Sc. II year

Paper I:	Diversity of Angiosperms: Systematics, Development & Reproduction	M.M. 50
Paper II:	Cytology, Genetics, Evolution & Ecology	M.M. 50
Paper III:	Plant Physiology and Biochemistry	M.M. 50

(There will be 9 questions in each paper and candidate has to attempt only 5 questions. Q.1 will be compulsory based on units I - IV. Two questions will be set from each unit of which one question has to be attempted. All questions will carry equal marks)

Practicals: Based on papers I-III M.M. 50

Paper - I: Diversity of Angiosperms: Systematics, Development & Reproduction M.M. 50

Unit - 1

Systematics

Principles of classification, nomenclature; comparative study of different classification systems, viz. Linnaeus, Bentham & Hooker, Engler & Prantl, Hutchinson, and Cronquist. Herbarium techniques and important Botanic Gardens.

Unit – II

Taxonomic study of following families and their economic importance:

Dicots; Nymphaeaceae, Nelumbonaceae. Ranunculaceae, Malvaceae, Bombacaceae, Brassicaceae, Cucurbitaceac, Rosaceae, Leguminosacae, Myrtaceae, Rutaceae, Apiaceae, Apocynaceae, Solanaceae, Convolvulaceae, Cuscutaceae, Scrophulariaceae, Acanthaceae, Lamiaceae, Asteraceae, Rubiaceae, Euphorbiaceae, and Amaranthaceae.

Monocots: Cyperaceae, Poaceae, Arecaceae. Liliaceae.

Unit - III

External morphology of vegetative and floral parts; modifications – phyllodes, cladodes, and phylloclades.

Meristems-kinds study of tissue system - epidermal, ground, and vascular.

Anatomy of roots, stems, and leaves. Cambium - its function and anomalies in roots and stems.

Unit – IV

Structure and development of male and female gametophytes – microsporogenesis microgametogenesis, megasporogenesis, and megagametogenesis, embryo sac types. Double fertilization development of embryo, endosperm development and its morphological nature, apomixis and polyembryony.

Paper II: Cytology, Genetics, Evolution & Ecology M.M. 50

Unit - I

Cell structure, cell organelles, nucleus, chromosome structure, nucleosome and solenoid model, salivary gland, lampbrush and B chromosomes.

Cell division – mitosis, meiosis; their significance, chromosomal aberrations

Unit- II

Genetics, laws of inheritance; gene interaction; linkage and; cytoplasmic inheritance; sex determination.

Unit-III

Mutation- spontaneous, induced mutations, molecular mechanism and evolutionary significance; polyploidy- origin, kinds and role in evolution. Evidences and theories of evolution.

Unit - IV

Ecology, relation with other disciplines. Plant types: Hydrophytes - *Hydrilla, Eichhorina, Nymphaea, Typha.* Xerophytes – *Nerium, Casuarina, Saccharum, Begonia.* Plant succession – xeroseres, hydroseres. Ecosystems - concept, basic types, components, & functioning.

Paper III - Plant Physiology and Biochemistry. M.M. 5O

Unit - I

Plant and water relationship, colligative properties of water, free energy concept. Water uptake, conduction, transpiration, mechanism and its regulation by environmental variables.

Mineral nutrition : Macro, and micronutrients, their role, deficiency and toxicity symptoms, plant culture practices, mechanism of ion uptake and translocation.

Unit - II

Photosynthesis and Chemosynthesis : photosynthetic pigments, O_2 evolution, photophosphorylation, CO_2 fixation - C_3- C_4 and CAM plants.

Respiration : aerobic and anaerobic respiration, respiratory pathways glycolysis, krebs 'cycle, electron transport, oxidative phosphorylation, pentose phosphate pathway, photorespiration, cyanide resistant respiration. Lipid biosynthesis and its oxidation.

Unit - III

Nitrogen metabolism : atmospheric nitrogen fixation, nitrogen cycle, nitrogen assimilation,

Growth: general aspects of phytohormones, inhibitors-auxins. kinetin, gibberellins, and ethylene: action and their application; photoperiodisin and vernalization. Germination, growth movements, parthenocarpy, abscission and senescence.

Unit - IV

Biomolecules : Classification, properties and biological role of carbohydrates, Protein and lipids. Chemistry of nucleic acids.

Discovery and nomenclature. Characteristics of enzymes, concepts of holoenzyme, apoenzyme, coenzyme and cofactors. Regulation of enzyme activity, Mechanism of action.

B.Sc. III year

Paper I:	Plant resource utilisation, Palynology and Biostatistics	M.M. 75
Paper II:	Molecular biology & biotechnology	M.M. 75
Paper III:	Environment Botany and Plant Pathology	M.M. 75

(There will be 9 questions in each paper and candidate has to attempt only 5 questions. Q.1 will be compulsory based on Units I - IV. Two questions will be set from each unit of which one question has to be attempted. All questions will carry equal marks)
Practicals: Based on papers I-III M.M. 75

Paper I Plant Resource utilization, Palynology and Biostatistics 75 marks

Unit I

Centres of diversity of plants, origin of crop plants. Domestication and introduction of crop plants. Concepts of sustainable development; cultivation, production and uses of - wheat, rice, legumes, sugarcane

Unit II

A general account of plants yielding oils, spices, beverages. An account of major fiber, medicinal, petro, plants of Uttar Pradesh.

Unit III

Conservation of plants resources for agriculture and forestry.
In situ conservation santuaries, national parks, biosphere reserves, wetlands, ,mangroves.
Exsitu conservation; botanical gardens, field gene banks, seed banks, cryobanks.

Unit IV

An introductory knowledge to palynology, morphology, viability and germination of pollens.

Classification of data, mean, median and mode. Standard deviation, standard error, variance, co-relation, X^2 test and experimental designs

Paper II: Molecular biology and biotechnology M.M. 75

Unit – I

Nucleic acid as genetic material, nucleotides, structure of nucleic acids, properties of genetic code, codons assignments, chain initiation of codons mechanism of protein synthesis and its regulation.

Unit - II

Structure and properties polysaccharides, aminoacids, proteins, vitamins and harmones; Enzymes: active sites, specificity, mechanisms, factors, general aspects of enzyme kinetics. Bioenergetics: Laws of thermodynamics, concept of Gibb's free energy, high energy compounds.

Unit - III

Replication of DNA in prokaryotes and enkaryotes, gene expression and regulation. Hormonal control and second messengers Ca-+, Cyclic AMP, IP_3 etc.

Unit- IV

Introduction to biotechnology, recombinant DNA technology, plant tissue culture, methods of gene transfer, transgenic plants, biotechnology and healthcare, microbial and environmental biotechnology.

Paper III- Environmental botany and plant pathology M.M. 75

Unit - I

Mineral resources of planet earth, Conservation of mineral resources. soils; types, properties and various problem soils; water; the source of water, physico-chemical and biological properties of water. Sustainable management of water; energy resources in India; Forests: global forest wealth, importance of forests, deforestation.

Unit - II

Environmental pollution : air, water, soil, radioactive, thermal and noise pollutions, their sources, effects and control. (greenhouse effect, ozone depletion and acid rain). CO_2 enrichment and climate change.

Unit - III

Biodiversity and Phytogeography : biotic communities and populations, their characteristics and population dynamics. Natural vegetation of India, static and dynamic plant geography, basic principles governing geographical distribution of plants, endemism.

Unit - IV

Etiology of viral, bacterial, fungal and insect-pest diseases: mosaic diseases on tobacco, and cucumber, yellow vein mosaic of bhindi; citrus canker, potato scab, little leaf of brinjal; damping off of seedlings late blight of potato, red rot of sugarcane

Integrated pest disease management

Recommendation:

1. **B.Sc. I** : Provided syllabus B.Sc. I was read & discussed thoroughly and it has been approved with minorchanges. A copy of the syllabus provided with minor corrections is being submitted herewith.

2. **B.Sc. II:** Provided syllabus of B.Sc. II was also discussed critically & the following changes have beenmade;

Unit –I: approved as such

Unit-II: Eight families have been deleted, while one family e.i.

Asclipi has been includedUnit-III: approved as such

Unit-IV: In addition to the course mentioned Unit IVth of (Palynology) of Paper II (B.Sc.-III) have been addedas palynology in more befitting at this place.

Paper II: The title of paper is new; Plant Physiology:- This paper has been critically analysed & now it hasbeen fractionated in four units:

The provided syllabus has included biochemistry in paper III which has been shifted to B.Sc. III paper II,become chemistry is more relevant with molecular biology.

B.Sc. III:

The names of papers have been revised as per need &
scope of the subject.Paper I: Plant resource utilization
and Biostatics
Paper II: Molecular
biology and biochemistry
Paper III: Environment
botany and Biochemistry

Paper Ist: Units I, II, III hae been retained as such while a part of unit (IV) e.g. Palyonology- has been shifted toB.Sc. II paper Ist unit IV. E.g. Pollen morphology is closely related to that part.

Paper IInd : Unit I & II have been retained as such while unit 3rd & IV have been shifted to paper III. In place ofthese units IV of paper III class B.Sc. II (i.e. Biochemistry) has been included at the place of unit III & Unit IV.

Paper III: Unit I, II & III have been maintained as such while unit IV has been replaced with unit 3rd & uth ofpaper II (B.Sc. III).

Note: Syllabus of B.Sc. I comprising of paper I, II & III is being submitted with minor necessary corrections. Itmay be considered in the nearly by academic counsil for immediate implementations from the current session. i.e. 2011-12.

आज दिनांक 09.02..2012 को विश्वविद्यालय परिसर में निम्न विषय की पाठ्यक्रम समिति की एक आवश्यक बैठक हुई, जिसमें निम्न प्राध्यापकगण उपस्थित हुए :–

Date :- 09.02.2012 Subject :- Chemistry Committee Place :- Committee Hall

1. Dr. K. A. Gupta
2. Dr. C. P. Singh
3. Dr. S. K. Pandey
4. Dr. S. K. Agarwal

B.Sc. - FIRST YEAR

CHEMISTRY

There shall be three written papers and a practical examination as follows:

		Max. Marks
Paper – I	Inorganic Chemistry	50
Paper – II	Organic Chemistry	50
Paper – III	Physical Chemistry	50
	TOTAL	**150**
	PRACTICAL	50
	GRAND TOTAL	**200**

Candidate will be required to pass in Theory and Practical Separately.

B.Sc. – I Chemistry (Paper-I)

Inorganic Chemistry :

Unit – I

I. Atomic Structure:

Idea of de-Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrödinger wave equation, significance of Ψ and Ψ^2, quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s, p, d, orbitals, Aufbau and Pauli exclusion principles, Hund's multiplicity rule, Electronic configurations of the elements, effective nuclear charge.

II. Periodic Properties:

Atomic and ionic radii, ionization energy, electron affinity and electronegativity-definition, methods of determination or evaluation, trends in periodic table and applications in predicting and explaining the chemical behaviour.

Unit – II

III. Chemical Bonding:

(A) Covalent Bond – Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions, valence shall electron pair repulsion (VSEPR) theory to NH_3, H_3O^+, SF_4, ClF_3, ICl^-_2 and H_2O, MO theory, homonuclear and heteronuclear (CO and NO) diatomic molecules, multicenter bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electro-negativity difference.

(B) Ionic Solids – Ionic structures, radius ratio effect and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Born-Haber cycle, salvation energy and solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule, Metallic bond-free electron, valence bond and band theories.

(C) Weak Interactions – Hydrogen bonding, Vander Waals forces.

Unit – III

IV. s-Block Elements:

Comparative study, diagonal relationship, salient features of hydrides, solvation and complexation tendencies including their function in biosystems, an introduction to alkyls and aryls.

V. Chemistry of Noble Gasses:

Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.

Unit – IV

VI. p-Block Elements:

Comparative study (including diagonal relationship) of groups 13-17 elements, compounds like hydrides, oxides, oxyacids and halides of group 13-16, hydrides of boron-diborane and higher boranes, borazine, borohydrides, fullerenes, carbides, fluorocarbons, silicates (structural principle), tetrasulphur tetra nitride, basic properties of halogens, interhalogens and polyhalides.

B.Sc. – I Chemistry (Paper-II)

Organic Chemistry :

Unit – I

I. Structure and Bonding:

Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bonding, van der Waals interactions, inclusion compounds, clatherates, charge transfer complexes, resonances, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.

II. Mechanism of Organic Reactions:

Curved arrow notation, drawing electron movements with allows, half-headed and double-headed arrows, homolytic and heterolytic bond fission, Types of reagents – electrophiles and nucleophiles, Types of organic reactions, Energyconsiderations.

Reactive intermediates – Carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Assigning formal charges on intermediates and other ionic species.

Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies).

III. Alkanes and Cycloalkanes:

IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atom in alkanes, Isomerism in alkanes, sources methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and chemical reactions of alkanes, Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity.

Cycloalkanes – Nomenclature, methods of formation, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strain less rings. The case ofcyclopropane ring, banana bonds.

Unit – II

IV. Stereochemistry of Organic Compounds:

Concept of isomerism, Types of isomerism;
Optical isomerism – elements of symmetry, molecular chirality, enantiomers, stereogenic center, optical activity, properties of enantiomers, chiral and achiralmolecules with two stereogenic centers, disasteromers, threo and erythro diastereomers, meso compounds, resolution of enantionmer, inversion, retention and recemization.

Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature.

Geometric isomerism – determination of configuration of geometric isomers, E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds.

Conformational isomerism – conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives, Newman projection and Sawhorse

formulae, Fischer and flying wedge formulae, Difference between configurationand conformation.

Unit – III

V. Alkenes, Cycloalkenes, Dienes and Alkynes:

Nomenclature of alkenes, methods of formation, mechanisms of dehydration ofalcohols and dehydrohalogenation of alkyl halids, regioselectivity in alcohol dehydration, The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes.

Chemical reactions of alkenes – mechanism involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration- oxidation, oxymercuration-reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with $KMnO_4$, Polymerization of alkenes, Substitution at the allylic and vinylic positions of alkenes, Industrial applicationsof ethylene and propene.

Methods of formation, conformation and chemical reactions of cycloalkenes;

Nomenclature and classification of dienes : isolated, conjugated and cumulateddienes, Structure of allenes and butadiene, methods of formation, polymerization, chemical reaction – 1, 2 and 1, 4 additions, Diels-Alder reaction.

Nomenclature, structure and bonding in alkynes, Methods of formation,Chemical reactions of alkynes, acidity of alkynes, Mechanism of electrophilicand nucleophilic addition reactions, hydroboration-oxidation, metal-ammoniareductions, oxidation and polymerization.

Unit – IV

VI. Arenes and Aromaticity:

Nomenclature of benzene derivatives, The aryl group, Aromatic nucleus and side chain, Structure of benzene; molecular formula and kekule structure, stability and carbon-carbon bond lengths of benzene, resonance structure, MOpicture.

Aromaticity: The Huckle rule, aromatic ions.

Aromatic electrophilic substitution – general pattern of the mechanism, role of σ and π complexes, Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio, Side chain reactions of benzene derivatives, Birch reduction;

Methods of formation and chemical reactions of alkylbenzenes, alkynylbenzenes and biphenyl, naphthalene and Anthracene;

VII. Alkyl and Aryl Halides:

Nomenclature and classes of alkyl halides, methods of formation, chemical reactions, Mechanisms of nucleophilic substitution reactions of alkyl halides, S_N2 and S_N1 reactions with energy profile diagrams;

Polyhalogen compounds : Chloroform, carbon tetrachloride;

Methods of formation of aryl halides, nuclear and side chain reactions;

The addition-elimination and the elimination-addition mechanisms of nucleophilc aromatic substitution reactions;

Relative reactivities of alkyl halides vs allyl, vingl and aryl halides, Synthesis and uses of DDT and BHC.

B.Sc. – I Chemistry (Paper-III)

Physical Chemistry :

Unit – I

I. Mathematical Concepts and Computers:

(A) Mathematical Concepts:

Logarithmic relations, curve sketching, linear graphs and calculation of slopes, differentiation of functions like K_x, e^x, X^n, sin x, log x; maxima and minima, partial differentiation and reciprocity relations, Integration of some useful/relevant functions; permutations and combinations, Factorials, Probability.

(B) Computers:

General introduction to computers, different components of a computer, hardware and software, input-output devices; binary numbers and arithmetic's; introduction to computer languages, programming, operating systems.

Unit – II

II. Gaseous States:

Postulates of kinetic theory of gases, deviation from ideal behavior, Vander Waals equation of state;

Critical Phenomena : PV isotherms of real gases, continuity of states, the isotherms of vander Waals equation, relationship between critical constants and vander Waals constants, the law of corresponding states, reduced equation ofstate.

Molecular velocities : Root mean square, average and most probable velocities,Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter, Liquification of gases (based on Joule – Thomson effect).

III. Liquid State:

Intermolecular forces, structure of liquids (a qualitative description). Structural

differences between solids, liquids and gases;

Liquid crystals: Difference between liquid crystal, solid and liquid, Classification,structure of nematic and cholestric phases, Thermography and seven segmentcells.

Unit – III

IV. Solid States:

Definition of space lattice, unit cell;

Laws of crystallography – (i) Law of constancy of interfacial angles, (ii) Law of rationality of indices (iii) Law of symmetry, Symmetry elements in crystals.

X-ray diffraction by crystals, Derivation of Bragg equation, Determination ofcrystal structure of NaCl, KCl and CsCl (Laue's method and powder method).

V. Colloidal States:

Definition of colloids, classification of colloids;

Solids in liquids (sols): properties – kinetic, optical and electrical; stability ofcolloids, protective action, Hardy-Schulze law, gold number.

Liquids in liquids (emulsions) : types of emulsions, preparation, Emulsifier,

Liquids in solids (gels) : classification, preparation and properties, inhibition,general application of colloids, colloidal electrolytes.

Unit – IV

VI. 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 lifeand 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.

Catalysis, characteristics of catalysed reactions, classification of catalysis homogeneous and heterogeneous catalysis, enzyme catalysis, miscellanceousexamples.

B.Sc. – I (PRACTICAL) 180 hrs (6 Hrs/week)

Inorganic Chemistry :

Semi micro Analysis – cation analysis, separation and identification of ions from Grops I, II, III, IV, V and VI, Anion analysis.

Organic Chemistry :

Laboratory techniques;

***Calibration of Thermometer*:**

$80\text{-}82^0$ (Naphthalene), $113.5\text{-}114^0$ (Acetanilide)

$132.5\text{-}133^0$ (Urea), 100^0 (Distilled Water)

***Determination of melting point*:**

Naphthalene $80\text{-}82^0$, Benzoic acid $121.5\text{-}122^0$

Urea $132.5\text{-}133^0$, Succinic acid $184.5\text{-}185^0$

Cinnamic acid $132.5\text{-}133^0$, Sallicylic acid $157.5\text{-}158^0$

Acetanilide $113.5\text{-}114^0$, m-Dinitrobenzene 90^0

p-Dichlorobenzene 52^0, Aspirin 135^0

***Determination of boiling point*:**

Ethanol 78^0, Cyclohexane 81.4^0, Toluene 110.6^0, Benzene 80^0

***Mixed melting point determination*:**

Urea-Cinnamic acid mixture of various compositions (1:4, 1:1, 4:1)

***Distillation*:**

Simple distillation of ethanol-water mixture using water condenser,

Distillation of nitrobenzene and aniline using air condenser

***Crystallization*:**

Concept of induction of crystallization,

Phthalic acid from hot water (using fluted filter paper and steamless funnel)

Acetanilide from boiling

waterNaphthalene from

ethanol Benzoic acid from

water

***Decolorisation and crystallization using charcoal*:**

Decolorsation of brown sugar (sucrose) with animal charcoal using gravity filtration.

Crystallization and decolorisation of impure naphthalene (100g of naphthalene mixes with 0.3 g of Congo Red using 1g decolorizing carbon) from ethanol.

***Sublimation (Siple and Vacuum)*:**

Camphor, Naphtalene, Phthalic acid and succinic acid.

***Qualitative Analysis*:**

Detection of extra elements (N, S and halogens) and functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and anilide) in simple organic compounds.

Physical Chemistry :

Chemical Kinetics:

1. To determine the specific reaction rate of the hydrolysis of methylacetate/ethyl acetate catalyzed by hydrogen ions at rooms temperature.
2. To study the effect of acid strength on the hydrolysis of an ester.
3. To compare the strengths of HCl and H_2SO_4 by studying the kinetics of hydrolysis of ethyl acetate.
4. To study kinetically the reaction rate of decomposition of iodide by H_2O_4.

Distribution Law:

1. To study the distribution of iodine between water and CCl_4.
2. To study the distribution of benzoic acid between benzene and water.

Colloids:

1. To prepare arsenious sulphide sol and compare the precipitating power of mono-, bi- and trivalent anions.

Viscosity, Surface Tension:

1. To determine the percentage composition of a given mixture (noninteracting systems) by viscosity method.
2. To determine the viscosity of amyl alcohol in water at different concentration and calculate the excess viscosity of these solutions.
3. To determine the percentage composition of a given binary mixture by surface tension method (acetone & ethyl methyl ketone).

%%%%%

B.Sc. - SECOND YEAR

CHEMISTRY

There shall be three written papers and a practical examination as follows :

		Max. Marks
Paper – I	Inorganic Chemistry	50
Paper – II	Organic Chemistry	50
Paper – III	Physical Chemistry	50
	TOTAL	**150**
	PRACTICAL	50
	GRAND TOTAL	**200**

Candidate will be required to pass in Theory and Practical Separately.

B.Sc. – II Chemistry (Paper-I)

Inorganic Chemistry :

Unit – I

I. Chemistry of Elements of First Transition Series

Characteristic properties of d-block elements.

Binary compounds (hydrides, carbides and oxides) of the elements of the first transition series and complexes with respect to relative stability of their oxidation states, coordination number and geometry.

II. Chemistry of Elements of Second and Third Transition Series

General characteristics, comparative treatment of Zr/Hf, Nb/Ta, Mo/W in respect of ionic radii, oxidation states, magnetic behavior, spectral properties and stereochemistry.

Unit – II

III. Coordination Compounds

Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metalcomplexes.

Unit – III

IV. Chemistry of Lanthanide Elements

Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, ceric ammonium sulphate and itsanalytical uses.

V. Chemistry of Actinides

Electronic configuration, oxidation states and magnetic properties, chemistry ofseparation of Np, Pu and Am from U.

Unit – IV

VI. Oxidation and Reduction

Electrode potential, electrochemical series and its applications, Principlesinvolved in the extraction of the elements.

VII. Acids and Bases

Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concept of acids and bases.

VIII. Non-aqueous Solvents

Physical properties of a solvent, types of solvents and their general characteristics, Reactions in non-aqueous solvents with reference to liquid $NH_3$and Liquid SO_2.

B.Sc. – II Chemistry (Paper-II)

Organic Chemistry :

Unit – I

I. Electromagnetic Spectrum Absorption Spectra

Ultraviolet (UV) absorption spectroscopy – absorption laws (Beer-Lambert law); molar absroptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome, Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. U.V. spectra of conjugated enes and enones.

Infrared (I.R.) absorption spectroscopy – molecular vibrations, Hooke's law, selection rules, intensity and position of I.R. bands, measurement of I.R. spectrum, fingerprint region, characteristic absorptions of various functional groups and interpretation of I.R. spectra of simple organic compounds.

Unit – II

II. Alcohols

Classification and nomenclature,

Monohydric alcohols – nomenclature, methods of formation by reduction of Aldehydes, Ketones, Carboxylic acids and Esters, Hydrogen bonding, Acidic nature, Reactions of alcohols.

Dihydric alcohols - – nomenclature, methods of formation, chemical reactions ofvicinal glycols, oxidative cleavage [$Pb(OAc)_4$ and HIO_4] and pinacol-pinacolone rearrangement.

Trihydric alcohols - nomenclature, methods of formation, chemical reactions ofglycerol.

III. Phenols :

Nomenclature, structure and bonding, preparation of phenols, physical properties and acidic character, Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols – electrophilic aromatic substitution, acylation and carboxylation. Mechanisms ofFries rearrangement, Claisen rearrangement, Gatterman syntheis, Hauben- Hoesch reaction, Lederer-Manasse reaction and Reimer-Tiemann reaction.

Unit – III

IV. Ethers and Epoxides

Nomenclature of ethers and methods of their formation, physical properties, Chemical reactions – cleavage and autoxidation, Ziesel's method.

Synthesis of epoxides, Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.

V. Aldehydes and Ketones:

Nomenclature and structure of the carbonyl groups, synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid

chlorides, synthesis of aldehydes and ketones uses 1, 3-dithianes, synthesis of ketones from nitrites and from carboxylic acids, Physical properties.

Mechanism of nucleophillic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations, Condensation withammonia and its derivatives. Wittig reaction, Mannich reaction.

Use of acetals as protecting group, Oxidation of aldehydes, Baeyer-Villiger oxidation of Ketones, Cannizzaro reaction, MPV, Clemmensen, Wolff-Kishner, $LiAlH_4$ and $NaBH_4$ reductions. Halogenation of enolizable ketones An introduction to α, β unsaturated aldehydes and Ketones.

Unit – IV

VI. Carboxylic Acids:

Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength, Preparation of carboxylic acids, Reactions of carboxylic acids, Hell-Volhard-Zelinsky reaction, Synthesis of acid chlorides, esters and amides, Reduction of carboxylic acids, Mechanism of decarboxylation.
Methods of formation and chemical reactions of halo acids, Hydroxy acids: malic, trartaric and citric acids.
Methods of formation and chemical reactions of unsaturated monocarboxylic acids.
Dicarboxylic acids: methods of formation and effect of heat and dehydrating agents.

VII. Carboxylic Acid Derivatives

Structure and nomenclature of acid chlorides, esters, amides (urea) and acidanyhydrides.

Relative stability of acyl derivatives, Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution.

Preparation of carboxylic acid derivatives, chemical reaction. Mechanisms of esterificaton and hydrolysis (acidic and basic)

VIII. Organic Compounds of Nitrogen:

Preparation of nitroalkanes and nitroarenes, Chemical reactions of nitroalkanes. Mechanisms of nuclephilc substitution in nitroarenes and their reductions in acidic, neutral and alkaline media, Picric acid.

Halonitroarenes: reactivity, Structure and nomenclature of amines, physical properties, Stereochemistry of amines, Separation of a mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amines. Amine salts as phase-transfer catalysts, Preparation of alkyl and aryl amines (reduction of nitro compounds, nitrities), reductive amination of aldehydic and ketonic compounds, Gabriel-phthalimide reaction, Hofmann bromamide reaction. Reactions of amines, electrophilic aromatic substituton in aryl amines, reactions of amines with nitrous acid. Synthetic transformations of aryl diazonium salts, azo coupling.

B.Sc. – II Chemistry (Paper-III)

Physical Chemistry :

Unit – I

(Thermodynamics & Chemical Equilibrium)

I. Thermodynamics – I

Definitions of thermodynamic terms :

System, surroundings etc. Types of systems, intensive and extensive properties, State and path functions and their differentials, Thermodynamic processes, concept of heat and work.

First Law of Thermodynamics :

Statement, definition of internal energy and enthalpy, Heat capacity, heatcapacities at constant volume and pressure and their relationship, Joule's law – Joule-Thomson coefficient and inversion temperature. Calculation of w, q, dU & dH for the expansion of ideal gases under isotheral and adiabatic conditions forreversible process.

Thermochemistry :

Standard state, standard enthalpy of formation – Hess's Law of heat summation and its applications, Heat of reaction at constant pressure and at constant volume, Enthalpy of neutralization, Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy, Kirchhoff's equation

Unit – II

II. Chemical Equilibrium

Equilibrium constant and free energy, Thermodynamic derivation of law of massaction, Le Chatelier's principle

Reaction isotherm and reaction isochore – Clapeyron-clausius equation and its applications.

III. Thermodynamics – II

Second Law of Thermodynamics :

Need for the law, different statements of the law, Cornot's cycle and its efficiency, Carnot's theorem. Thermodynamic scale of temperature.

Concept of entropy:

Entropy as a state function, entropy as a function of V & T, entropy as afunction of P & T, entropy change in physical change, clausius inequality, entropy as a criteria of spontaneity and equilibrium, Equilibrium change in idealgases and mixing of gases.

Gibbs and Helmholtz functions:

Gibbs function (G) and Helmhotz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change, Variation of G and A with P, V and T.

Third Law of Thermodynamics:

Nernst heat theorem, statement and concept of residual entropy. Nernst distribution law – thermodynamic derivation, applications.

Unit – III (Electrochemistry – I & Solutions)

IV. Electrochemistry – I:

Electrical transport:- Conduction in metals and in electrolyte solutions, specific conductance molar and equivalent conductance, measurement of equivalent conductance, variation of molar equivalent and specific conductancewith dilution.

Migration of ions and Kohlrausch's law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law its uses and limitations, Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only), Transport number, definition and determination by Hittorf's method and moving boundary method.

Applications of conductivity measurements: determination of degree of dissociation, determination of K_a of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

V. Solutions:

Liquid – Liquid mixtures- Ideal liquid mixtures, Raoult's and Henry's law, Non-ideal system-azeotropes – HCl-H_2O and ethanol – water systems.

Partially miscible liquids- Phenol – water, trimethylamine – water, nicotine-watersystems, Immiscible liquids, steam distillation.

Unit – IV (Electrochemistry – II & Phase Equilibrium)

VI. Electrochemistry – II:

Types of reversible electrodes – gas-metal ion, metal-ion, metal- insoluble salt-anion and redox electrodes, Electrode reactions, Nernst equation,derivation of cell E.M.F. and single electrode potential, strandard hydrogen electrode-reference electrodes and their applications, standard electrode potential, sign conventions, electrochemical series and its significance.

Electrolytic and Galvanic cells–reversible and irreversible cells, conventional representation of electrochemical cells;

EMF of a cell and its measurements, Computation of cell EMF, Calculation of thermodynamic quantities of cell reactions (ΔG, ΔH and K)

Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations.

Definition of pH and pK_a, determination of pH using hydrogen, quinhydrone and

glass electrodes, by potentiometric methods;

Buffers – Mechanism of buffer action, Henderson-Hazel equation, application of buffer solution, Hydrolysis of salts

VII. Phase Equilibrium:

Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibb's phase rule, phase equilibria of one component system-water, 'CO_2' and 'S' systems

Phase equilibria of two component system – solid liquid equilibria simpleeutectic – Bi-Cd, Pb-Ag systems, desilverisation of lead.

Solid solutions – compound formation with congruent melting point (Mg-Zn) and incongruent melting point, ($FeCl_3$-H_2O) and ($CuSO_4$-H_2O) system

B.Sc. – II (Practical) 180 hrs. (6 hrs/week)

Inorganic Chemistry :

Calibration of fractional weights, pipettes and burettes, Preparation of standards solutions, Dilution – 0.1 M to 0.001 M solutions.

Quantitative Analysis:

Volumetric Analysis :

(a) Determination of acetic acid in commercial vinegar using NaOH.

(b) Determination of alkali content – antacid tablet using HCl.

(c) Estimation of calcium content in chalk as calcium oxalate by permanganometry.

(d) Estimation of hardness of water by EDTA.

(e) Estimation of ferrous and ferric by dichromate method.

(f) Estimation of copper using thiosulphate.

Gravimetric Analysis :

Analysis of Cu as CuSCN and Ni as Ni (dimethylgloxime).

Organic Chemistry :

Laboratory Techniques

A. Thin Layer Chromatography

Determination of R*f* values and identification of organic compounds:

(a) Separation of green leaf pigments (spinach leaves may be used).

(b) Preparation of separation of 2, 4-dinitrophenylhydrazones of acetone, 2-butanone, hexan-2, and 3-one using toluene and light petroleum (40:60)

(c) Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5:1.5).

B. Paper Chromatography: Ascending and Circular

Determination of R*f* values and identification of organic compounds:

(a) Separation of a mixture of phenylalanine and glycine, Alanine and aspartic acid, Leucine and glutamic acid, Spray reagent – ninhydrin.

(b) Separation of a mixture of D, L – alanine, glycine, and L-Leucine using n-butanol:acetic acid:water (4:1:5), Spray reagent – ninhydrin.

(c) Separation of monosaccharide – a mixture of D-galactose and D- fructose using n-butanol:acetone:water (4:5:1), spray reagent – aniline hydrogen phthalate.

Qualitative Analysis:

Identification of an organic compound through the functional group analysis, determination of melting point and preparation of suitable derivatives.

Physical Chemistry :

Transition Temperature

1. Determination of the transition temperature of the given substance by thermometric /dialometric method (e.g. $MnCl_2.4H_2O/SrBr_2.2H_2O$).

Phase Equilibrium

2. To study the effect of a solute (e.g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. phenol-water system) and to determine the concentration of that solute in the given phenol-water system.
3. To construct the phase diagram of two component (e.g. diphenylamine – benzophenone) system by cooling curve method.

Thermochemistry

1. To determine the solubility of benzoic acid at different temperatures and to determine ΔH of the dissolution process.
2. To determine the enthalpy of neutralization of a weak acid/weak base versus strong base/strong acid and determine the entrhalpy of ionization of the weak acid/weak base.
3. To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber Cycle.

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B.Sc. - THIRD YEAR

CHEMISTRY

There shall be three written papers and a practical examination as follows:

		Max. Marks
Paper – I	Inorganic Chemistry	75
Paper – II	Organic Chemistry	75
Paper – III	Physical Chemistry	75
	TOTAL	**225**
	PRACTICAL	75
	GRAND TOTAL	**300**

Candidate will be required to pass in Theory and Practical Separately.

B.Sc. – III Chemistry (Paper-I)

Inorganic Chemistry :

Unit – I

I. Metal-ligand bonding in Transition Metal Complexes

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

II. Thermodynamic and Kinetic Aspects of Metal Complexes

A brief outline of thermodynamics stability of metal complexes and factors affecting the stability, stability constants of complexes and their determination, substitution reactions of square planar complexes.

Unit – II

III. Magnetic Properties of Transition Metal Complexes

Types of magnetic behavior, 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.

IV. Electronic spectra of Transition Metal Complexes

Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, 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.

Unit – III

V. Organometallic Chemistry

Definition, nomenclature and classification of organometallic compounds,

Preparation, properties, bonding and applications of alkyls and aryls of Li, Al,Hg, Snl.

Metal carbonyls: 18 electron rule, preparation, structure and nature of bondingin the mononuclear carbonyls.

VI. Silicones and Phosphazenes

Silicones and phosphazenes as examples of inorganic polymers, nature ofbonding in triphosphazenes.

Unit – IV

VII. 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 ofhardness and softness, electro negativity and hardness and softness.

VIII. Bioinorganic Chemistry

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

B.Sc. – III Chemistry (Paper-II)

Organic Chemistry :

Unit – I

I. Spectroscopy

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

Unit – II

II. Organometallic Compounds

Organomagnesium compounds : the Grignard reagents, formation, structureand chemical reactions.

Organozinc compounds: formation and chemical reactions.

Organolithium compounds: formation and chemical reactions.

III. Organosulphur Compounds

Nomenclature, structural formation, methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and Sulphaguanidine.

IV. Hetrocyclic Compounds

Introduction : Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine, Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution, Mechanism of nucleophilic substitution reaction in pyridine derivatives, Comparison of basicity of pyridine, piperidine and pyrrole.

Introduction to condensed five and six membered heterocycles, Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Nepieralski synthesis, Mechanism of electrophilc substitution reactions of indole, quinoline and isoquinoline.

Unit – III

V. Carbohydrates

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

Structures of ribose and deoxyribose,

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

VI. Amino Acids, Peptides, Proteins and Nucleic Acids:

Classification, structure and stereochemistry of amino acids, Acid-base behaviour 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, Levels of protein structure, Protein denaturation/ renaturation;

Nucleic acids : Introduction, constituents of nucleic acids, Ribonucleosides and ribonucleotides, The double helical structure of DNA.

Unit – IV

VII. Fats, Oils 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.

VIII. 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, plyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes, Natural and synthetic rubbers, Elementary idea of organic conducting polymers.

IX. 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.

X. 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.Sc. – III Chemistry (Paper-III)

Physical Chemistry :

Unit – I

(Introductory Quantum Mechanics, Spectroscopy, Physical Properties and Molecular Structure)

I. Introductory Quantum Mechanics:

Black-body radiation, Planck's radiation law, photoelectric effect, heat capacityof solids, Bohr's model of hydrogen atom (without derivation) their solution of overall solution and its defects, Compton effect, de-Broglie's hypothesis, the Heisenberg's uncertainty principle, Hamiltonian Operator.

II. Spectroscopy:

Introduction : electromagnetic radiation, regions of the spectrum, basic features of different spectrophotometers, statement of the born-oppenheimer approximation, degrees of freedom.

III. Physical Properties and Molecular Structure:

Optical activity, polarization – (Clausius – Mossotti equation), orientation of dipoles in an electric field, dipole moment, induced dipole moment, measurement of dipole moment-temperature method and refractivity method, dipole moment and structure of molecules, magnetic properties- paramagnetism, diamagnetism and ferromagnetic, Magnetic susceptibility, its measurements and its importance.

Unit – II

IV. Elementary Quantum Mechanics:

Schrödinger wave equation and its importance, physical interpretation ofthe wave function, postulates of quantum mechanics, particle in a one dimensional box.

Schrödinger 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.

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 anti-bonding wave functions, concept of σ, σ^*, π, π^* orbitals and their characteristics, Hybrid orbitals – sp, sp^3, sp^2, calculation of coefficients of A.O's used in sp and sp^2 hybrid orbitals and interpretation of geometry.

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

Unit – III

V. 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.

Vibrational Spectrum :

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

Raman Spectrum : Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.

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

Qualitative description of σ, π and η M.O. their energy levels and the respectivetransition.

Unit – IV

(Photochemistry, Solutions, Dilute Solutions and Colligative Properties)

VI. 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 occurringin the excited state, qualitative description of fluorescence, phosphorescence, non- radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions – energy transfer processes (simple examples), Kinetics of Photo chemical reaction.

Solutions, Dilute Solutions and Colligative Properties:

Ideal and non-ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient.

Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination, Osmosis, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure, Elevation of boiling point and depression of freezing, Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods for determining variouscolligative properties.

Abnormal molar mass, Van't Hoff factor, Colligative properties of degree of dissociation and association of solutes.

B.Sc. – III (PRACTICAL) 180 hrs. (12 hrs./week)

Inorganic Chemistry :

Synthesis and Analysis:

(a) Preparation of sodium trioxalator ferrate (III), $Na_3[Fe(C_2O_4)_3]$ and determination of its composition by permagonometry.
(b) Preparation of Ni-DMG complex, $[Ni(DMG)_2]$
(c) Preparation of copper tetraammine complex. $[(Cu(NH_3)_4]SO_4$.
(d) Preparation of *cis*-and *trans*-bisoxalato diaqua chromate (III) ion.

Instrumentation:

Colorimetry

(a) Job's method (b) Mole-ratio method
Adulteration – Food stuffs.
Effluent analysis, water analysis

Solvent Extraction

Separation and estimation of Mg(II) and Fe(II)

Ion Exchange Method

Separation and estimation of Mg(II) and Zn(II)

Organic Chemistry :

Laboratory Techniques:

Steam Distillation

Naphtalene from its suspension in waterClove oil from cloves
Separation of *o*-and *p*-nitrophenols

Column Chromatography

Separation of fluorescein and methylene blue
Separation of leaf pigments from spinach leaves
Resolution of racemic mixture of (±) mandelic acid

Qualitative Analysis

Analysis of an organic mixture containing two solid components using water, $NaHCO_3$,
NaOH for separation and preparation of suitable derivatives

Synthesis of Organic Compounds

(a) Acetylation of salicylic acid, aniline, glucose and hydroquinone,
Benzoylation of aniline and phenol
(b) Aliphatic electrophlic substitution
Preparation of iodoform from ethanol and acetone
(c) Aromatic electrophilic substitution
Nitration

Preparation of m-dinitrobenzene

Preparation of p-nitroacetanilide

Halogenation

Preparation of p-bromoacetanilide
Preparation of 2, 4, 6-tribromophenol

(d) Diazotization/coupling
Preparation of methyl orange and methyl red

(e) Oxidation
Preparation of benzoic acid from toluence

(f) Reduction
Preparation of aniline from nitrobenzene
Preparation of m-nitroaniline from m-dinitrobenzene

Stereochemical Study of Organic Compounds via Models

R and S configuration of optical isomers
E, Z configuration of geometrical isomers
Coformational analysis of cyclohexanes and substituted cyclohexanes

Physical Chemistry :

Electrochemistry:

1. To determine the strength of the given acid conductometrically using standard alkali solution.
2. to determine the solubility and solubility of a sparingly soluble electrolyte conducometrically.
3. to study the saponification of ethyl acetate condutometrically.
4. To determine the ionization constant of a weak acid condutometrically.
5. To titrate potentiometrically the given ferrous ammonium sulphate solution using $KMnO_4/K_2Cr_2O_7$ as titrant and calculate the redox potential of Fe^{++}/Fe^{+++} system on the hydrogen scale.

Refractrometry, Polarimetry:

1. To verify law of refraction of mixtures (e.g. of glycerol and water) using Abbe's refractometer.
2. To determine the specific rotation of a given optically active compound.
3. To determine stoichiometry and stability constant of complexes.

Molecular Weight Determination:

1. Determination of molecular weight of a non-volatile solute by Rast method/ Beckmann freezing point method.
2. Determination of the apparent degree of dissociation of an electrolyte (e.g., NaCl) in aqueous solution at different concentrations byebullioscopy.

Colorimetry:

1. To verify Beer – Lambert Law for $KMnO_4/K_2Cr_2O_7$ and determining the concentration of the given solution of the substance from absorption measurement.

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संशोधोनों की सस्तुति

इस बैठक में पूरे प्रदेश में समान पाठ्यक्रम लागू किये जाने के उद्देश्य से सशोधन/सहमति हेतु एक पाठ्यक्रम का प्रारुप प्रस्तुत किया गया। उपस्थित सदस्यों ने प्रस्तुत (प्रस्तावित) पाठ्यक्रम के प्रारुप पर सम्यक विचार विमर्श किया। विचार विमर्श के उपरान्त सभी सदस्यों ने सर्वसम्मति से निर्णय लिया कि,

1. विश्वविद्यालय द्वारा प्राप्त बी.एस.सी. प्रथम, द्वितीय एव ं तृतीय के लिखित परीक्षा के पाठ्यक्रम पर सर्वसम्मिति व्यक्त की गई तथा इसे इसी सत्र अर्थात 2011–2012 से लागू करने का निर्णय लिया गया।

2. बी.एस.सी. (प्रथम वर्ष) की प्रयोगात्मक परीक्षा के लिए निम्न निर्णय लिए गये,

अधिकतम अकं 50

समय 06 घण्टे

a. chemistry — 15 marks

Ex. No. I Semi Micro Analysis Cation & Anion analysis (Total 5 radicals)

b. **Organic Chemistry** — 10 marks

Ex. No. II Lab technique, quantitative analysis of organic comp.

c. **Physical Chemistry** — 8+8=16 marks

Two experiments to be done from different topics

d. **viva voce** — 5 marks

e. **Practical Record** — 4 marks

बी.एस.सी. (द्वितीय वर्ष) की प्रयोगात्मक परीक्षा के लिए निम्न निर्णय लिए गये
अधिकतम अकं 60

a. समय 06 घण्टे **Inorganic Chemistry** 10+10= 20 marksEx. No.

I -One volumetric experiment

Ex. No. II -One Gravimetric experiment

b. **Organic Chemistry** 10 marks

Ex No. III -One experiment only

c. **Physical chemistry** 10 marksEx. No.

IV-One experiment only

d. **Viva voce** 5 marks

e. **Practical Record** 5 marks

f. बी.एस.सी. (तृतीय वर्ष) की प्रयोगात्मक परीक्षा के लिए निम्न निर्णय लिए गये।

g. अधिकतम अंक 75

h. समय 06 घण्टे कुल पांच प्रयोग करन` हागे` जिसम` एक प्रयागे प्दवतहंदपब बेमउपेजतल से, दा` प्रयागे व्तहंदपब

i. बीमउपेजतल स` तथा दा` प्रयोग चेलेपबंस बीमउपेजतल क` करन` हागे ।ं प्रत्यके प्रयागे 12 अकं ा` का हागे ा।

j. इस प्रकार कुल अकं ा` की सखं या 60 हुइ ं

k. b. Viva Voce 10 marks

c. Practical Record 05 marks

Total **75 marks**

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आज दिनांक 19.10..2011 को विश्वविद्यालय परिसर में निम्न विषय की पाठ्यक्रम समिति की एक आवश्यक बैठक हुई, जिसमें निम्न प्राध्यापकगण उपस्थित हुए :–

Date :- 19.10.2011 Subject :- Zoology Committee Place :- Committee

1. Prof. P. K. Mittal
2. Dr. Agam Dayal
3. Dr. R. K. Poowal
4. Dr. V. K. Tyagi

Unified Syllabus of Zoology for U.P.State Universities(B.Sc. I, II, & III year)

Following Major title of papers of B.Sc. I, II, and III were finalized with their contents:

Theory Paper's duration is of Three hours and duration of practicals is Four hours

B.Sc. I

Papers	Title of paper	Max. Marks
Paper I	Lower Non Chordata *(Protozoa- Helminths)*	50
Paper II	Higher Non Chordata *(Annelida-Echinodermata)*	50
Paper III	Cell Biology and Genetics	50
Practical	Practical Syllabus based on theory papers	50

B.Sc. II

Papers	Title of paper	Max. Marks
Paper I	Chordata	50
Paper II	Animal distribution, Evolution and Developmental Biology	50
Paper III	Physiology and Biochemistry	50
Practical	Practical Syllabus based on theory papers	50

B.Sc. III

Papers	Title of paper	Max. Marks
Paper I	Applied and Economic Zoology	75
Paper II	Biotechnology, Immunology, Biological Tools & Techniques and Biostatistics	75
Paper III	Ecology, Microbiology, Animal Behavior, Pollution and Toxicology	75
Practical	Practical Syllabus based on theory papers	75

Unified Syllabus of Zoology for U.P.State Universities
Subject- Zoology
B.Sc. - First Year
Practical

1-	Dissection (Major)	12 Marks
2-	Dissection (Minor)	05 Marks
3-	One Temporary Mount	03 Marks
4-	One Permanent Mount	05 Marks
5-	Cytology & Genetics Preparation/Prepared slides	05 Marks
5-	Identify and Comment upon spots (1-10)	10 Marks
6-	*Viva-Voce*	05 Marks
7-	Practical class record	05 Marks
	Total	**50**

Marks

Unified Syllabus of Zoology for U.P.State Universities
Subject- Zoology
B.Sc. -Second Year
Practical

1-	Dissection (Major)	10 Marks
2-	Permanent Mount	05 Marks
3-	Comment upon Physiology Apparatus	05 Marks
4-	(i) Suitable preparation of Hemin crystals from the blood (ii) Detect the Sugar /albumin / acetone from urine sample	05 Marks
5-	Stained Preparation of (i) Striped or Unstriped muscles (ii) Cartilage (hand cut Section) (iii) Blood film/Aereolar tissue	05 Marks
5-	Identify and Comment upon spots (1-10)	10 Marks
6-	*Viva-Voce*	05 Marks
7-	Practical class record	05 Marks
	Total	**50**

Marks

Unified Syllabus of Zoology for U.P.State Universities
Subject- Zoology B.Sc. - Third YearPractical

1-	Dissection (Major)	12 Marks
2-	Permanent Mounting	06 Marks
3-	Temporary Mounting	05 Marks
4-	Identify and Comment upon Spots (1-8)	16 Marks
5-	Economic Zoology *(Comments on a suitable Specimen/ life cycle of Silk worm, Honey bee, Lac insect & Food Fishes)* (02)	06 Marks
6-	Biological Tools and Techniques *(Comment)*	06 Marks
7-	Biostat / Microbiology / Immunology / Behavior	06 Marks
8-	Ecology/ Pollution/ Toxicology (Exercise or Comment	06 Marks
9-	*Viva-voce*	06 Marks
10-	Practical Class record / Project / Collection	06 Marks

Total **75 Marks**

There will be three written papers and one practical examination.

Question No. 1 in each class will be compulsory & comprehensive based on units I to IV and of short Answer type. This will carry 40% of total marks *(i.e. 20 marks in I & II year and 30 marks in III year).* There will be two questions from each unit carrying 60% of the marks, of which one question from each unit has to be attempted.

B.Sc. Part I

Paper I- Lower Non Chordata (*Protozoa to Helminths*)

The habits, morphology, physiology, reproduction, development (in outline) and classification of thefollowing groups of animals including a detailed study of the types given in each:

Unit-I

Protozoa - *Euglena*, *Monocystis* and *Paramecium.*

Unit-II

Porifera - *Sycon*

Unit-III

Coelenterata - *Obelia* and *Aurelia*
Ctenophora - Salient features

Unit-IV

Platyhelminthes - *Fasciola* (liver fluke) and *Taenia* (tape worm)
Nematehelminthes - *Ancylostoma* (hook worm)

Paper II- Higher Non Chordata (*Annelida to Echinodermata*)

The habits, morphology, physiology, reproduction, development (in outline) and classificationof the following groups of animals including a detailed study of the types given in each:

Unit-I

Annelida - *Nereis*

Unit-II

Arthropoda - *Palaemon* (prawn)

Unit-III

Mollusca -*Pila* (apple-snail)

Unit-IV

Echinodermata -*Pentaceros* (excluding development)

Paper III- Cell Biology & Genetics

Unit-I

Cell Biology I: Structure and function of cell, Ultra structure of Plasma membrane

Unit-II

Cell Biology II: Structure and function of cell organelles with special emphasis on mitochondria,golgi bodies, nucleus, ribosome and endoplasmic reticulum.

Unit-III

Genetics-I: Structure of Chromosomes, Watson & Crick Model of DNA, Differences between DNA & RNA, Cell Division: Mitosis and Meiosis. Mendel's principles of heredity onchromosomal basis, Monohybrid cross, test cross, dihybrid cross, back cross incomplete dominance, Multiple Alleles, Blood group inheritance. Linkage and crossing over, interaction of genes. The role of DNA in heredity.

Unit-IV

Genetics II: Sex determination, sex differentiation, prenatal detection of genetic diseases (amniocentesis), Sex-linked characters, Genetic diseases and abnormalities, chromosomal aberrations, Eugenics.

B.Sc. Part I

ZOOLOGY PRACTICAL SYLLABUS

PROTOZOA

(a) **Amoeba :** Examination of culture. Prepared Slide *Amoeba proteus* and *A. verrucosa*.

(b) **Euglena :** Culture examination for *Euglena.* Prepared slides.

(c) **Monocystis** : Examination of contents of seminal vesicles of *Pheretima* or *Eutyphoeus* for different life- history stages and permanent preparation. Prepared slides.

(d) **Plasmodium :** Preparation of blood film (Leishmen's stain). Prepared slides showing the parasites.

(e) ***Paramecium***

Culture examination.

(f) Demonstration of ciliary movements in *Paramecium.*

Addition to mucilage to restrain active movement. Treatment with Methyl green for staining. Feeding experiment with Congo Red and Yeast. Trichocysts (discharged), Prepared slides for structure, binary division and conjugation.

(g) Examination of pond water for different kinds of protozoa with special reference to *Arcella* and *Vorticella.*

(h) Study of prepared slides **:**

Polystomella, Gregarina, Trypanosoma and Noctiluca.

(i) Examination of rectal protozoans *Opalina, Balantidium* and *Nyctotherus.*

PORIFERA

(a) ***Sycon***

General characters

Spicules glycerine preparation.

Transverse and longitudinal sections-prepared slides.

(b) Gemmule of *Spongilla* permanent preparation.

(c) Different kinds of spnge spicules and sponging fibres of *Euspongia*-prepared slides.

(d) *Euplectella* (Venus,s flower-basket) *Spongilla* (fresh-water sponge), *Euspongia* (bath sponge).

COELENTERATA

(a) ***Hydra***

Live specimens.
Prepared slides of entire specimens.
Longitudinal and transverse sections-prepared slides.

(b) ***Obelia***

Clolony-prepared slide.Medusa-prepared slide.

(c) ***Aurelia***

General morphology.
Tentaculocyst-prepared slide.
Prepared slides and models of life-history stages.

(d) ***Physalia*** (Portguese man of war), *Corallium* (red coral), *Fungia* (Mushroom coral), *Madrepora* (staghom coral), *Pennatula* (sea pen), *Sagartia* of *Metridium* (sea anaemone)

PLATHYHELMINTHES :

(a) ***Fasciola***

Specimens *in situ* and prepared slides. Transverse sections and prepared slides.Larval forms-prepared slides.

(b) ***Taenia*** **:** Prepared slides of scolex, mature and gravid proglottids and transverse section of mature proglottid.

(c) *Planaria, Polystomum, Paramphistomum, Schistosma, Echinococcus* and *Dipylidium* Cysticercus (Bladder worm) and Cysticercoid.

(d) Examination of type worms of pigeon of fowl *in situ*

(e) Permanent preparation of mature and gravid proglottids of *Cotugnia* and *Raellietina.* **:**

NEMATHELMINTHES

(a) *Ascaris*

External characters.
Dissected specimens of male of female.
Transverse section of male and female-prepared slides.

(b) *Ascaris lumbricoides* (from man) specimens *Enterobius vermicularisi* (from man). Ancylostoma duodenale *(from man)* prepared slides.

ANNELIDA

(a) *Nereis*

External characters.
Dissected specimens.
Parapodium-permanent preparation.
Transverse sections-prepared slides.

(b) *Pheretima*

External characters.
Dissection.
Glycerine preparations of setae *in situ* and brain.
Permanent preparations of ovary and septal
nephridia.
Prepared slides of transverse section through various regions.

(c) *Heteronereis, Arenicola, Aphrodite, Eutypoeus, Dero, Branchellion, Haemadipsa, Bonellia* (female).

ARTHROPODA

(a) *Palaemon*

External characters; Examination of appendages.
Dissections.
Glycerine preparation of hastate plate.
Permanent and glycerine preparations of statocysts.

(b) *Periplaneta*

External characters. Differences between nmale and female.
Dissections.
Cirulation of blood in the wing of cockroach.
Glycerine preparation of mouth appendages, salivary glands and trachea.
Permanent preparations of salivary glands, Malpighian tubules, ovaries and testes.

(c) ***Anopheles* and *Cules***

Glycerine preparation of mouth parts of male and female. Wings-prepared slides.Life history-prepared slides.
Difference between *Anopheles* and *Culex*

(d) *Musca*

External characters.
Glycerine preparation of proboscis

(e) *Daphnia, Cyclops, Balanus, Eupagurus* (hermit crab) *Scylla* (crab), *Sacculina* (on crab). Larval forms Nauplius, Zoaea), *Lepisma* (Silver fish), *Schistocerca* (locust), O*dontotermes*
(white ant), Cimex (bed bug), Pediculus (louse), *Papilio* (butterfly), *Bombyx* (Silk moth), *Apis* (honey- bee), Polistes (wasp), *Camponotus* (Black ant), *Xenopsylla* (rat flea), or *Ctenocephalus* (dog flea), *Thyroglutus* (millipede), *Scolopendra* (centipede). Lycosa (wolf-spider), *Lxodes* (trick), *Limulus* (King carb).

MOLLUSCA

(a) *Lamellidens*

External characters
Dissection
Permanent preparations of gill lamella.
Transverse section through middle region of body-prepared slides.Glochidium (larva) prepared slides.

(b) *Pila*

External characters.
Dissection.
Permanent preparations of gill lamella and osphradium.

(c) Chiton, *Teredo, Turbinellai* (Shankh), *Laevicaulis* (slug), *Doris, Aplysia, Dentalium Nautilus, Sepia* and *Margaritifera* (Pearl Oyster).

ECHINODERMATA

(a) *Pentaceros:*

External characters
Dissected specimens.
Pedicellaria-prepared
slides.
Transverse section of arm-prepared slide.

(b) ***Echinus*** (Sea urchin), *Ophiothrix* (brittle star), *Holothuria* (sea cucumber) and *Antedon* (feather star).

CYTOLOGY

(a) Cell-Structure – Prepared slides

(b) Cell Division – Prepared slides

(c) Preparation of giant chromosomes

(d) Preparation of onion root tip for the stages of mitosis

B.Sc. Part II (THEORY) Zoology

There will be three written papers and one practical examination. The following courses areprescribed.

Paper I: Chordata

Unit- I

Hemichordata: Classification and detailed study (habit, morphology, anatomy, physiology and development) of *Balanoglossus*

Cephalochordata: Classification and detailed study (habit, morphology, anatomy and physiology) of *Branchiostoma* (*Amphioxus).*

Unit -II

Urochordata: Classification and detailed study (habit, morphology, anatomy, physiology and postembryonic development) of *Herdmania*

Unit-III

Classification of different classes of vertebrates (**Pisces, Amphibia, Reptilia**,) up to order with characters and examples. Poisonous and non poisonous snakes and biting mechanism. Neoteny

Unit-IV

Classification of different classes of vertebrates (**Aves and Mammalian**) up to order with characters and examples. Dentition in mammals.

Paper II: Animal distribution, Evolution and Developmental Biology

Unit-I

Animal distribution: Geological and geographical distribution with their characteristic fauna; fossils.

Unit-II

Origin of Life, concept of species (classical & modern concept)

Evolution: Evidences (including physiological and serological); Theories of evolution (including Neo-Lamarckism, Darwin-Wallace theory of natural selection, Neo-Darwinism, Modernsynthetic theory). Evolution of Man. Mutation

Unit-III

Developmental Biology I:Aims and scope of Developmental Biology.
Gametogenesis, Fertilization, Egg: structure and types.
Types & patterns of cleavage

Unit-IV

Developmental Biology II: Process of Blastulation & Gastrulation. Fate Map. Development of Chick up to formation of Primitive streak and mammal (*in out line*)Extra embryonic membranes of chick.
Placentation and types of Placenta.

Paper III: Physiology and Biochemistry

General physiology (in outline) with special reference to mammals

Unit-I

Physiology of digestion, respiration, and blood and circulation

Unit-II

Physiology of excretion and osmoregulation, neural transmission, muscles

Unit-III

Physiology of endocrine system, thermoregulation

Unit-IV

General chemistry and classification of carbohydrates, lipids and proteins; Enzymes

B.Sc. Part II

ZOOLOGY PRACTICAL SYLLABUS

Urochordata

(a) Herdmania

(i) External characters
(ii) Dissection
(iii) (a) Permanent preparation of branchial wall
(b) Section of test and glycerine prepration of spicules.
Glycerine and permanent prepration on neural gland complex (neuralgland, nerve ganglion and dorsal tubrcele).
(iv) Larva and metamorphosis- prepared slides.

(b) (i) Thaliacea : *Pyrosoma, Doliolum*
(ii) Larvacea : *Oikopleura* .

Cephalochordata

Branchistoma *(Amphioxus)*

(i) General features
(ii) (a) Permanent prepration of the pharyngeal wall
(b) Oral hood and velum- prepared slides
(c) Transverse section through the body – prepared slides.
(d) Models illustrating development

Cyclostomata

Petromyzon (Lamprey) - External characters

Chondrichthyes

(a) Fish

(i) External characters
(ii) Exo-skeleton Glycerine and permanent preparation of placoid scales
(iii) Myotomes
(iv) Endoskeleton

(1) Axial skeleton
(a) skull
(b) Visceral Skeleton
(c) Vertebral column

(2) Appendicular skeleton
(a) Pectoral girdle and fins
(b) Pelvic girdle, fins and claspers
(c) Median fins
(v) Dissection
(a) Digestive system
Examination of the folds of stomach and " scroll valve"
(b) Vascular system

Heart, ventral aorta, dorsal aorta, arterial arches (afferent and efferent)(c) Gills

(d) Urinogenital system
(e) Nervous system : Cranial nerves
(f) Internal ear
(g) Eye muscles
(h) Permanent preparation of ampullae of Lorenzini
(i) Section through various regions of the body of adult and embryo
(j) Embryo with yolk-sac placenta

(b) *Pritis* (Saw fish), *Astrape* (Indian electric ray) *Chimaera* (rabbit fish) Slide showingdevelopment of placoid scales.

Osteichthyles

(a) *Labeo rohita* (rohu)- General morphology and dissected specimen.
(b) *Acipenser* (sturgeon), *Lepiodosteous* (gar-pike), *Hippocampus* (sea hourse) *Antennarius* (Indian angler), *Angulla* (eel), *Pleuronectes* (sole), *Exocoetus* (flying fish), *Clarius* (cat fish), *Anabas* (climbing perch) and *Neoceratodus* (lungfish).
(c) Different kinds of scales- prepared slides

Amphibia

(a) *Rana tigrina* (The Indian bull-frog)
Development of frog from modles
(b) Urodela :
Necturus, Ambystoma and Axolotal larva
(c) Anura :
Bufo, Rhacophorus (tree frog), *Alytes* (midwife toad).
(d) Gymnophiona : *Ichthyopnis*

Reptillia

(a) *Varanus*
(i) External characters
(ii) Skeleton

(1) *Axial Skeleton*

(a) Skull
(b) Vertebral column
(c) Ribs and sternum

(2) *Appendicular Skeleton*

(a) Pectoral girdle and fore-limb.
(b) Pelvic girdle and hind-limb.

(b) ***Lacertilla***
Varanus (Indian monitor), *Holoderma* (poisonous lizard) *Hemidactylus* (wall lizard),*Chamaeleon* (garden lizard) *Draco* (flying lizard).

(c) ***Ophidia***
Difference between poisonous and non-poisonous snakes, *Naja* (cobara), *Vipera* (viper), *Typhlops* (burrowing snake) and *Python*. Biting mechanismof a poisonous snake (model).

(d) Chelonia : Derman armature
(e) Crocodilia : Difference between Alligator, Crocodile and Gavialis.
(f) Extinct reptiles, Models (five)
Dimetrodon, Diplodocus, Pteranodon, Tyrannosaurus* and *Ichthyosaurus

Aves

(A) *Columba livia intennedia* (pigeon)

(i) Esternal Characters. Structure of Feather. Varieties of feathers. Developments of feather-prepared slide.

(ii) Skeleton of fowl Axial skeleton:

(a) Skull
(b) Vertebral column
(c) Ribs and sternum

(2) Appendicular skeleton.

(a) Pectoral girdle and fore-limb
(b) Pelivic girdle and hind-limb.

(B) (i) Archaeornithes-Archaeopteryx (cast)

(ii) Neornithes:

(a) Palaeognathae: ***Struthio*** (ostrich);
(b) Neognathae: ***Gallus*** (fowl), ***Anser*** duck, ***Corvus*** (crow) , ***Psuttacuka*** (parrot) and ***Pavo*** (peacock).

Perching mechanism:
ModelSkulls and Beaks
of Birds.
Feet of birds: Models

(C) Embryonic membrances-whole mount of 72 hour's chick embryo

Mammalia

(A) (i) Prototheria: *Ornithorhynchus* (Platypus)

(ii) Metatheria *: Macropus* (Kangaroo).

(iii) Eutheria :

(a) Edentata: *Dasypus* (Armadillo)
(b) Pholidota: *Manis* (Scaly ant-eater).
(c) Cetacea: *Platanista* (Ganges dolphin).
(d) Perissodactyla: *Equus cabalus* (horse), *Equus vulgaris* (ass), *Equus zebra* (zebra), *Rhinoceros unicornis* (rhinoceros).
(e) Artictyla: *Camelus dromedaries* (A rabian camel), *Giraffa camelopardalis* (giraffe) Box (ox), *Ovis* (sheep), *Capra* (goat), *Cervus* (deer), *Sus* (dog).
(f) Proboscidea: *Elephas indicus* (elephant).
(g) Carnivora: *Felis domesticus* (Cat), *Panthera leo* (lion), *Acinonyx tigris* (Cheetah), C*anis familiari* (dog), *Ursus* (bear) *Hyaena* (hyanea), *Phoca* (seal)
(h) Rodentia: *Mus* (domestic rat), *Hystrix* (Porcupine)
(i) Lagomorpha: *Lepus* and *Oryctolagus* (hare and rabbit)
(j) Insectivora: *Erinaceu*s (hedge-hog), *Crocidura* (chhachhundar)
(k) Chiroptera: *Pteropus* (Flying-fox).
(l) Primates: *Macaca* (rhesus monkey), *Hylobates* (gibbon), *Simia* (Orang-utan), *Anthropo pithecus* (chimpanzee), *Gorilla, Homo sapiens* (man).

Histology

(i) Tissues: Preparation of the following
(a) Epithelia:
(i) Squamous (ii) Ciliated and (iii) Stratified
(b) Muscular:
(i) Striped muscles (ii) Unstriped muscles.
(c) Connective
(i) Areolar tissue (ii) Tendon the leg muscles of frog (tease and examine in glycerine)
(ii) Adipose tissue from insect and frog (iv) cartilage (free hand sections of frogs hyoid and suprascapula, train with haematoxyline and (v) Bone (Decalcified).
(d) Blood; Preparation of Vertebrate blood film, stain with Leishmann's stain.
(e) Nervous: Neurons
(f) Histology of various organs-prepared slides.

Physiology

(i) Experiments to be performed by candidates: Test for amylase. Osmolarity of blood, Hemin crystals and test for sugar and acetone in urine Determination ofhaemoglobin % in blood sample (s).
(ii) Detection of amino acids in blood of an animal by paper chromatography.

General :
Candidates will be required, to show knowledge of the method of microscopic techniques and to examine, describe or dissect the types prescribed.
Candidates willalso be required to submit their notebooks containing a complete record of laboratory work initiated and dated by the teacher for the determination of result of examination.

B. Sc. Part III (THEORY) Zoology

There will be three written papers and one practical examination. The following courses are prescribed.

PAPER-I Applied and Economic Zoology

Unit-I

Parasitology:

(a) Structure, life cycle, pathogenicity, including diseases, causes, symptoms and control of the following parasites of domestic animals and humans: *Trypanosoma, Giardia and Wuchereria,*

Unit-II

Vectors and pests: Life cycle and their control of following pests:
Gundhi bug, Sugarcane leafhopper, Rodents.
Termites and Mosquitoes and their control

Unit-III

Animal breeding and culture: Aquaculture, Pisciculture, Poultry, Sericulture, Apiculture, Lac-culture.

Unit-IV

Wild Life of India: Endangered species. Important sanctuaries; national parks of India; Different projects launched for the preservation of animal species; *in-situ* and *ex-situ* conservation ofwild life.

PAPER-II Biotechnology, Immunology, Biological Tools and Techniques and Biostatistics

Unit-I

Biotechnology: Genetic Engineering (concept and recombinant DNA technology) and its application in agriculture & medical areas and energy production. Biotechnology of food-processing, pharmaceuticals (e.g. use of microbes in insulin production) and fermentation.

Unit-II

Immunology. Concepts of immunity, types of immunity, Antigen and Antibodies, vaccines ofdifferent diseases and immunological reactions.

Unit-III

Biological Tools and Techniques: Principles and uses of instruments: pH Meter, Calorimeter, Microtome, Spectrophotometer & Centrifuge.
Microscopy (light, transmission and scanning electron microscopy)Chromatography and Electrophoresis.

Unit-IV

Biostatistics: Sampling, Measures of central tendency (mean, median and Mode) and dispersion(variance, standard deviation and standard error); Correlation and Regression

PAPER-III Ecology, Microbiology Animal Behavior and Pollution and Toxicology.

Unit- I

Ecology: Ecosystem: Concept, components, fundamental operations, energy flow, food-chain, foodwebs and trophic levels, ecological niche, abiotic and biotic factors. Population: Characteristics and regulation. Ecological succession. Adaptation: Aquatic, terrestrial,aerial and arboreal.

Unit-II

Microbiology: Morphology, physiology and infection (outline) of bacteria and viruses. Bacterial and viraldiseases.

Unit-III

Animal Behavior: Introduction to Ethology, Patterns of behavior (taxes, reflexes, instinct andmotivation); biorhythms; learning and memory, Migration of fishes & birds.

Unit-IV

Pollution and Toxicology: Concept, sources, types (air, water, soil, noise & radiation), and control ofenvironmental pollution. Exposure of toxicants (routes of exposure, and duration and frequency of exposure); dose -response relationship categories of toxic effects.

B.Sc. Part III
ZOOLOGY PRACTICAL SYLLABUS

- Permanent Preparation of: *Euglena*, *Paramecium* and rectal protozoans from frog.
- Stool examination for different intestinal parasites.
- Study of prepared slides/ specimens of *Entamoeba, Giardia, Leishmania, Trypanosoma, Plasmodium, Fasciola, Cotugnia, Taenia, Rallietina, Polystoma Paramphistomum, Schistosoma, Echinococcus, Dipylidium, Enterobius, Ascaris and Ancylostoma*;
- Permanent Preparation of *Cimex* (bed bug)/ *Pediculus* (Louse), *Haematopinus* (cattle louse), fresh water annelids, arthropods; and soil arthropods.
- Larval stages of helminths and arthropods.
- Permanent mount of wings, mouth parts and developmental stages of mosquito and house fly. Permanent preparation of ticks/ mites, abdominal gills of aquatid insects viz. Chironomus larva, dragonfly and mayfly nymphs, preparation of antenna of housefly.
- Collection and identification of pests.
- Life history of silkworm, honeybee and lac insect.
- Different types of important edible fishes of India.
- Prepared slides of plant nematodes.
- Demonstration of counting of cells (blood and protozoan) by haemocytometer, haemoglobinometer, pH meter, Colorimeter
- Microbiological Techniques: Media Preparation and sterilization, inoculation and Monitoring.
- Study of an aquatic ecosystem, its biotic components and food chain.
- Preparation of chromosomes, Test for carbohydrate Photochemical demonstration of proteins and lipids, using hand sections using hand sections, endocrine glands (Neurosecretory cells) of cockroach.
- Demonstration of developmental stages of chick.
- Project Report/ model chart making.
- ***Dissections*** *:*
- **Cockroach** : Central nervous system
- ***Wallago*** : Afferent and efferent branchial vessels, Cranial nerves, Weberian ossicles.
- Practical exercises based on Biostatistics, Microbiology, Immunology, Biotechnology, Animal Behavior, Pollution & Toxicology.

Recommendation

The unified syllabus is well-knit and is passed as such. However, following minor corrections should be added;

1. B.Sc. Part I

Paper I- Lower nonchordata (Protozoa -Helminthes).- The habits, morphology, physiology reproduction, development (in outline) and classification upto orders of the following groups of animals-
Unit-I : Protozoa- Euglena and Paramecium Unit-II : Sycon, Canal system in sponges.
Rest as such.

Paper II- Higher Non-chordate (Annelida to Echinodermata)- The habits, morphology, physiology, reproduction, development (in outline) and classification upto orders of the following groups of animals.
Unit-I : Annelida-HirudeniariaUnit-II : as such
Unit-III :as such
Unit-IV : Echinodermata-Asterias (sea-star) (excluding development)

Paper III- Call Biology & Genetics

Unit-I : Cell Biology : Structure and function of cell, ultra structure and function of plasmamembrane.
Unit-II : as such
Unit-III : Differences between DNA & RNA, cell division should be like this differences betweenDNA, & RNA, cell cycle and cell division. Rest as such.

Unit-IV : Geneties II Ist 2 times as such. + Genetic diseases and syndromes, structural and numerical aberrations- Deficiency duplication, translocation, inversion, euploidy, aneuploidy, monosomic, nullisomic, trisomic etc.
Last Eugenics- should be cancelled.

B.Sc. II

Paper I- as such
Paper II- as

suc
h
Paper II- Physiology and Biochemistry
Unit -I : Physiology of digestion, Breathing and internal respiration and blood: strucutre, junctionand clotting, physiology of heart beat.

Uni
t-II
: as
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IV:
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B.Sc. III

Paper I- Applied & Economic zoology
Unit-I : Parasitology-Giaradia should be cancelled. Rest as such.Unit-II: as such
Unit-III: as such
Unit IV: Wild life of India: Endanagered species. Important sanctuaries, national parks, biosphererereserves, hot spots of India. Different projects as such. Paper II
Un
it-I
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ch
Un
it-
II
:as
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ch
Unit-III : pH meter, colorimeter. Rest as such

Unit IV :In the second line:- correlation and Regression can be cancelled. Graphical representation ofdata- may be added.

Paper III

Uni
t-I
:as
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III
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Unit-IV :In the last line- categories of toxic effects- Teratogenic, careinogenic and mutagenic effects,Antidotes.

Practical Syllabus is passed as such.

आज दिनांक 17.11.2011 को विश्वविद्यालय परिसर में निम्न विषय की पाठ्यक्रम समिति की एक आवश्यक बैठक हुई, जिसमें निम्न प्राध्यापकगण उपस्थित हुए :–

Date :- 17.11.2011 Subject :- Physics Committee Place :- Central Librar

1. Dr. S. K. Agarwal
2. Dr. Veer Pal Singh
3. Dr. Neeraj Rathore
4. Dr. Pramod Kumar Verma
5. Dr. Avinash Agarwal

PROPOSED UNIFORM SYLLABUS FOR

U.P. STATE UNIVERSITIES

Three Years Degree Course

PHYSICS

B.Sc.- FIRST YEAR

		Max. Marks
PAPER I	MECHANICS AND WAVE MOTION	50
PAPER II	KINETIC THEORY AND THERMODYNAMICS	50
PAPER III	CIRCUIT FUNDAMENTALS AND BASIC ELECTRONICS	50
PRACTICAL	TWO PRACTICALS (30 MARKS) + VIVA (10 MARKS) + RECORD (10 MARKS)	50
TOTAL		200

Candidate must obtain minimum pass marks in Theory and Practical Examinations separately.

PAPER I - MECHANICS AND WAVE MOTION

UNIT-I

Inertial reference frame, Newton's laws of motion, Dynamics of particle in rectilinear and circular motion, Conservative and Non -conservative forces, Conservation of energy, liner momentum and angular momentum, Collision in one and two dimensions, cross section.

UNIT -II

Rotational energy and rotational inertia for simple bodies, the combined translation and rotational and motion of a rigid body on horizontal and inclined planes, Simple treatment of the motions of a top. Relations between elastic constants, bending of Beams and Torsion of Cylinder.

UNIT - III

Central forces, Two particle central force problem, reduced mass, relative and centre of mass motion, Law of gravitation, Kepler's laws, motions of planets and satellites, geo-stationary satellites.

UNIT IV

Simple harmonic motion, differential equation of S. H. M. and its solution, uses of complex notation, damped and forced vibrations, composition of simple harmonic motion.

Differential equation of wave motion, plane progressive waves in fluid media, reflection of waves, phase change on reflection, superposition, stationary waves, pressure and energy distribution, phase and group velocity.

Text and Reference Books

EM Purcell, Ed: "Berkeley Physics Course, Vol. 1, Mechanics" (McGraw-Hill). RP Feymman, RB Lighton and M Sands; "The Feymman Lectures in Physics", Vol. 1 (BI Publications, Bombay, Delhi, Calcutta, Madras).

J.C. Upadhyay: 'Mechanics'.

D.S, Mathur “Mechanics”,
P.K. Srivastava: “Mechanics” (New Age International).

PAPER II- KINETIC THEORY AND THERMODYNAMICSUNIT-I

Ideal Gas: Kinetic model, Deduction of Boyle’s law, interpretation of temperature, estimation of r.m.s. speeds of molecules. Brownian motion, estimate of the Avogadro number. Equipartition of energy, specific heat of monatomic gas, extension to di- and triatomic gases, Behaviour at low temperatures. Adiabatic expansion of an ideal gas, applications to atmospheric physics.

Real Gas: Vander Waals gas, equation of state, nature of Van der Waals forces, comparison with experimental P-V curves. The critical constants, gas and vapour. Joule expansion of ideal gas, and of a Vander Waals gas, Joule coefficient, estimates of J-T cooling.

UNIT -II

Liquefaction of gases: Boyle temperature and inversion temperature. Principle of regenerative cooling and of cascade cooling, liquefaction of hydrogen and helium. Refrigeration cycles, meaning of efficiency.

Transport phenomena in gases: Molecular collisions, mean free path and collision cross sections. Estimates of molecular diameter and mean free path.

Transport of mass, momentum and energy and interrelationship, dependence on temperature and pressure.

UNIT - III

The laws of thermodynamics: The Zeroth law, various indicator diagrams, work done by and on the system, first law of thermodynamics, internal energy as a state function and other applications. Reversible and irreversible changes, Carnot cycle and its efficiency, Carnot theorem and the second law of thermodynamics. Different versions of the second law, practical cycles used in internal combustion engines. Entropy, principle of increase of entropy. The

thermodynamic scale of temperature; its identity with the perfect gas scale. Impossibility of attaining the absolute zero;
third law of thermodynamics. Thermodynamic relationships: Thermodynamic variables; extensive and intensive, Maxwell's general relationships, application to Joule-Thomson cooling and adiabatic cooling in a general system, Van der Waals gas, Clausius-Clapeyron heat equation. Thermodynamic potentials and equilibrium of thermodynamical systems, relation with thermodynamical variables. Cooling due to adiabatic demagnetization, production and measurement of very low temperatures.

UNIT -IV

Blackbody radiation: Pure temperature dependence, Stefan-Boltzmann law, pressure of radiation, spectral distribution of Black body radiation, Wien's displacement law, Rayleigh-Jean's law, Plank's law the ultraviolet catastrophy.

Text and Reference Books

G.G. Agarwal and H.P. Sinha "Thermal Physics"
S.K. Agarwal and B.K. Agarwal "Thermal Physics"

PAPER III - CIRCUIT FUNDAMENTALS AND BASIC ELECTRONICS

UNIT-I

Growth and decay of currents through inductive resistances, charging and discharging
in R.C. and R.L.C. circuits, Time constant, Measurement of high resistance.
A.C. Bridges, Maxwell's and Scherings Bridges, Wien Bridge.
THINLY, NORTON and Superposition theorems and their applications.

UNIT -II

Semiconductors, intrinsic and extrinsic semiconductors, n-type and p-type semiconductors, unbiased diode forward bias and reverse bias diodes, diode as

a rectifier, diode characteristics, zener diode, avalanche and zener breakdown, power supplies, rectifier, bridge rectifier, capacitor input filter, voltage regulation, zener regulator.

Bipolar transistors, three doped regions, forward and reverse bias, DC alpha, DC beta

transistor curves.

UNIT - III

Transistor biasing circuits: base bias, emitter bias and voltage divider bias, DC load line.

Basic AC equivalent circuits, low frequency model, small signal amplifiers, common emitter amplifier, common collector amplifiers, and common base amplifiers, current and voltage gain, R.C. coupled amplifier, gain, frequency response, equivalent circuit at low, medium and high frequencies, feedback principles.

UNIT-IV

Input and output impedance, transistor as an oscillator, general discussion and theory of Hartley oscillator only.

Elements of transmission and reception, basic principles of amplitude modulation and demodulation. Principle and design of linear multimeters and their application, cathode ray oscillograph and its simple applications.

Text and Reference Books

B.G. Streetman; “Solid State Electronic Devices”, IInTdi Edition (Prentice Hall of India, New Delhi, 1986).

W.D. Stanley: “Electronic Devices, Circuits and Applications” (Prentice-Hall, New TTC’A 1flOO\ JL4y, JJI. 1OO).

J.D. Ryder, “Electronics Fundamentals and Applications”, lI’’ Edition(Prentice-Hall of India, New Delhi, 1986).

J Millman and A Grabel, “Microelectronics”, International Edition (McGraw Hill Book Company, New York, 1988).

PRACTICALS

Every institution may add any experiment of the same standard in the subject.

Mechanics

1. Study of laws of parallel and perpendicular axes for moment of inertia.
2. Study of conservation of momentum in two dimensional oscillations.

Oscillations

1. Study of a compound pendulum.
2. Study of damping of a bar pendulum under various mechanics.
3. Study of oscillations under a bifilar suspension.
4. Potential energy curves of a 1-Dimensional system and oscillations in it for various amplitudes.
5. Study of oscillations of a mass under different combinations of springs.

Properties of matter

1. Study of bending of a cantilever or a beam.
2. Study of torsion of a wire (static and dynamic methods)

Kinetic theory of matter

1. Study of Brownian motion.
2. Study of adiabatic expansion of a gas.
3. Study of conversion of mechanical energy into heat.
4. Heating efficiency of electrical kettle with varying voltages.

Thermodynamics

1. Study of temperature dependence of total radiation.
2. Study of temperature dependence of spectral density of radiation.
3. Resistance thermometry.

4. Thermo-emf thermometry
5. Conduction of heat through poor conductors of different geometries.

Circuit fundamentals

1. Charging and discharging in R.C. and R.C.L. circuits.
2. High resistance by leakage.
3. A.C. Bridges.
4. Half wave and full wave rectifiers.
5. Characteristics of a transistor in CE,CB and CC configurations
6. Frequency response of R.C. coupled amplifier.

Waves

I. Speed of waves on a stretched string.
2. Studies on torsional waves in a lumped system.
3. Study of interference with two coherent sources of sound.

Text and reference books

D.P. Khandelwal, "A laboratory manual for undergraduate classes" (Vani Publishing
House, New Delhi).
S.P. Singh, "Advanced Practical Physics" (Pragati Prakashan, Meerut).
Worsnop and Flint- Advanced Practical physics for students.

PHYSICS

B.Sc.- SECOND YEAR

		Max. Marks
PAPER I	PHYSICAL OPTICS AND LASERS	50
PAPER II	ELECTROMAGNETICS	50
PAPER III	ELEMENTS OF QUANTUM MECHANICS, ATOMIC AND MOLECULARS SPECTRA	50
PRACTICAL	TWO PRACTICALS (30 MARKS) + VIVA (10 MARKS) + RECORD (10 MARKS)	50
TOTAL		200

Candidate must obtain minimum pass marks in Theory and Practical Examinations separately.

PAPER I - PHYSICAL OPTICS AND LASERS

UNIT-I

Interference of a light: The principle of superposition, two-slit interference, coherence requirement for the sources, optical path retardations, lateral shift of fringes, Rayleigh refractometer and other applications. Localised fringes; thin films, applications for precision measurements for displacements.

Haidinger fringes: Fringes of equal inclination. Michelson interferometer, its application for precision determination of wavelength, wavelength difference and the width of spectral lines. Twymann Green interferometer and its uses. Iriensity distribution in multiple beam interference, Tolansky fringes, Fabry-Perrot interferometer and etalon.

UNIT -II

Fresnel diffraction: Fresnel half-period zones, plates, straight edge, rectilinear propagation.

Fraunhoffer diffraction: Diffraction at a slit, half-period zones, phasor diagram and integral calculus methods, the intensity distribution, diffraction at a circular aperture and a circular disc, resolution of images, Rayleigh criterion, resolving power of telescope and microscopic systems, outline of phase contrast microscopy.

Diffraction gratings: Diffraction at N parallel slits, intensity distribution, plane diffraction grating, reflection grating and blazed gratings. Concave grating and different mountings. Resolving power of a grating and comparison with resolving powers of prism and of a Fabry-Perrot etalon.

UNIT - III

Polarization, Double refraction in uniaxial crystals, Nicol prism, polaroids and retardation plates, Babinet's compensator. Analysis of polarised light.

Optical activity and Fresnel's explanation, Half shade and Biquartz polarirneters.

Matrix representation of plane polarized waves, matrices for polarizers, retardation plates and rotators, Application to simple systems.

UNIT-IV

Laser system: Purity of a special line, coherence length and coherence time, spatial coherence of a source, Einstein's A and B coefficients, spontaneous and induced emissions, conditions for laser action, population inversion.

Application of Lasers: Pulsed lasers and tunable lasers, spatial coherence and directionality, estimates of beam intensity; temporal coherence and spectral energy density.

Text and Reference Books

A K Ghatak, "Physical Optics" (Tata McGrew Hill).

D P Khandelwal; "Optics and Atomic Physics" (Himalaya, Publishing House, Bombay, 1988).

F Smith and JH Thomson; "Manchester Physics sries; Optics" (English Language Book Society and Joh Wiley, 1977).

Born and Wolf; "Optics"

KD Moltey; "Optics" (Oxford University Press).

Sears; "Optics".

Jonkins and White; "Fundamental of Optics" (McGraw-Hill).

Smith and Thomson; "Optics" (John Wiley and Sons).

B.K; Mathur; "Optics".

P.K. Srivastava; "Optics" (CBS).

B.B. Laud; "Lasers" (New Age).

PART II- ELECTROMAGNETICS

UNIT-I

Electrostatics

Coulomb's law, Electric Field and potentials, Field due to a uniform charged sphere, Derivations of Poisson and Laplace Equations, Gauss Law and its application: The Field of a conductor. Electric dipole, Field and potential due to an electric dipole, Dipole approximation for an arbitrary charge distribution, Electric quadruple, Field due to a quadruple , Electrostatic Energy of a charged uniform sphere, Energy of a condenser.

Magnetostatics

Magnetic field, Magnetic force of a current, Magnetic Induction and Biot-Savart Law, Lorentz Force, Vector and Scalar Magnetic potentials, Magnetic Dipole, Magnetomotive force and Ampere's Circuital theorem and its applications to calculate magnetic field due to wire carrying current and solenoid.

UNIT-II

Electromagnetic Induction

Laws of Induction, Faraday's laws and Lanz's Law. Mutual and Self Induction, Vector potential in varying Magnetic field, Induction of current in continuous media, Skin effect, Motion of electron in changing magnetic field , Betatron , Magnetic energy in field, Induced magnetic field (Time varying electric field), Displacement current, Maxwell's equations, Theory and working of moving coil ballistic galvanometer.

UNIT-III

Dielectrics

Dielectric constant, polarization, Electronic polarization, Atomic or ionic Polarization Polarization charges, Electrostatic equation with dielectrics, Field, force and energy in Dielectrics.

Magnetic Properties of Matter

Intensity of magnetization and magnetic susceptibility, Properties of Dia, Para and Ferromagnetic materials, Curie temperature, Hysteresis and its experimental determination.

UNIT -IV

Electromagnetic Waves

The wave', equation satisfied .by E and B, plane electromagnetic waves in vacuum, Poynting's vector, reflection at, a plane boundary of dielectrics, polarization by reflection and total internal reflection, Faraday effect; waves in a conducting medium, reflection and refraction by the ionosphere

Text and Reference Books

Berkeley Physics Course; Electricity and Magnetism, Ed. E.M. Purcell (Mc GrawHill). Halliday and Resnik; "Physics", Vol 2.

D J Griffith; "Introduction to Electrodynamics" (Prentice-Hall of India). Reitz and Milford; "Electricity and Magnetism (Addison-Wesley).

A S Mahajan and A A Rangwala; "Electricity and Magnetism" (Tata McGraw-Hill). A M Portis; "Electromagnetic Fields".

Pugh and Pugh; "Principles of Electricity and Magnetism" (Addison-Welsley).

Panofsky and Phillips; "Classical Electricity and Magnetism" (India Book House). S S Atwood; "Electricity and Magnetism" (Dover).

PART III - ELEMENTS OF QUANTUM MECHANICS, ATOMIC AND MOLECULAR SPECTRA

UNIT-I

Matter Waves

Inadequacies of classical mechanics, Photoelectric phenomenon, Compton effect, wave particle duality, de- Broglie matter waves and their experimental verification, Heisenberg's Uncertainty principle, Complementary principle, Principle of superposition, Motion of wave packets.

UNIT -II

Schrodinger Equation and its Applications

Schrodinger wave equation Interpretation of wave function, Expectation values of dynamical variables, Ehrenfest theorem, Orthonormal properties of wave functions, One dimensional motion in step potential, Rectangular barrier, Square well potential, Particle in a box, normalization Simple Harmonic Oscillator.

UNIT - III

Atomic spectra

Spectra of hydrogen, deuteron and alkali atoms, spectral terms, doublet fine structure, screening constants for alkali spectra for s, p. d, and f states, selection rules. Singlet and triplet fine structure in alkaline earth spectra, L-S and J-J couplings. Weak spectra: continuous X-ray spectrum and its dependence on voltage, Duane and Haunt's law. Characteristics X-rays, Moseley's law, doublet structure and screening parameters in X-ray spectra, X-ray absorption spectra.

UNIT -IV

Molecular spectra

Discrete set of electronic energies of molecules, quantisation of vibrational and rotational energies, determination of internuclear distance, pure rotation and rotation- vibration spectra, Dissociation limit for the ground and other

electronic states, transition rules for pure vibration and electronic vibration spectra.

Text and Reference Books

H S Mani and G K Mehta; "Introduction to Modern Physics" (Affiliated East-West Press 1989). A Beiser, "Perspectives of Modern Physics".

H E White; "Introduction to Atomic Physics".

Barrow; "Introduction to Molecular Physics".

R P Feymann, R B Leighton and M Sands; "The Feyrnann Lectures on Physics, Vol. III (B I Publications. Bombay. Delhi, Calcutta, Madras).

T A Littlefield and N Thorley; "Atomic and Nuclear Physics" (Engineering Language Book Society).

Eisenberg and Resnik; "Quantum Physics of Atoms, 'Molecules, Solids, Nuclei and Particles" (John Wiley).

D P Khandelwal: "Optics and Atomic Physics", (Himalaya Publishing House, Bombay, 1988).

PRACTICALS

Every institution may add any experiment of the standard in the subject.

Physical optics

1. Study of interference of light (biprism or wedge film).
2. Study ofF-P etalon fringes.
3. Study of diffraction at a straight edge or a single slit.
4. Use of diffraction grating and its resolving limit.
5. Resolving limit of a telescope system.
6. Polarization of light by the reflection.
7. Study of optical rotation for any system.

Electrostatics

1. Characteristics of a ballistic galvanometer.
2. Setting up and using an electroscope or electrometer.

Moving charges and magnetostatics

1. Use of a vibration magnetometer to study a field.
2. Study of field due to a current.
3. Measurement of low resistance by Carey-Foster bridge or otherwise.
4. Measurement of inductance using impedance at different frequencies.
5. Measurement of capacitance using impedance at different frequencies.
6. Study of decay of currents in LR and RC circuits.
7. Response curve for LCR circuit and resonance frequency and quality factor.

Varying fields and electromagnetic theory

1. Sensitivity of a cathode-ray oscilloscope.
2. Characteristic of a choke.
3. Measurement of inductance.
4. Study of Lorentz force.
5. Study of discrete and continuous LC transmission lines.

Atomic Physics

1. Study of spectra of hydrogen and deuterium (Rydberg constant and ratio of masses of electron to proton).
2. Absorption spectrum of iodine vapour.
3. Study of alkali or alkaline earth spectra using a concave grating.
4. Study of Zeeman effect for determination of Lande g-factor.

Molecular Physics

1. Analysis of a given band spectrum.
2. Study of Raman spectrum using laser as an excitation source

Lasers

1 Study of laser as a monochromatic coherent source

2 Study of divergence of a laser beam

Text and Reference Books

D.P. Khandelwal, “A Laboratory Manual for Undergraduate Classes (Vani Publishing

House, New Delhi).

S.P. Singh, “Advanced Practical Physics” (Pragati Prakashan, Meerut).

Worsnop and Flint- Advanced Practical physics for students.

PHYSICS

B.Sc.- THIRD YEAR

		Max. Marks
PAPER I	RELATIVITY AND STATISTICAL PHYSICS	75
PAPER II	SOLID STATE AND NUCLEAR PHYSICS	75
PAPER III	SOLID STATE ELECTRONICS	75
PRACTICAL	TWO PRACTICALS (50 MARKS) + VIVA (15 MARKS) + RECORD (10 MARKS)	75
TOTAL		300

Candidate must obtain minimum pass marks in Theory and Practical Examinations separately.

PAPER I - RELATIVITY AND STATISTICAL PHYSICS

UNIT-I

Relativity

Reference systems, inertial frames, Galilean invariance and conservation laws, propagation of light, Michelson-Morley experiment; search for ether.

Postulates for the special theory of relativity, Lorentz transformations, length contraction, time dilation, velocity addition theorem, variation of mass with velocity, mass-energy equivalence, particle with a zero rest mass.

UNIT -II

Statistical physics

The statistical basis of thermodynamics: Probability and thermodynamic probability, principle of equal a prior probabilities, probability distribution and its narrowing with increase in number of particles. . The expressions for average properties. Constraints; accessible and inaccessible states, distribution of particles with a given total energy into a discrete set of energy states.

UNIT - III

Some universal laws: The ji- space representation, division of i- space into energy sheets and into phase cells of arbitrary size, applications to one-dimensional harmonic oscillator and free particles. Equilibrium before two systems in thermal contact, bridge with macroscopic physics. Probability and entropy, Boltzmann entropy relation. Statistical interpretation of second law of thermodynamics. Boltzmann canonical distribution law and its applications; rigorous form of equipartition of energy.

UNIT -IV

Maxwellian distribution of0 speeds in an ideal gas: Distribution of speeds and of velocities, experimental verification, distinction between mean, r.m.s. and most probable speed values. Doppler broadening of spectral lines.

Transition to quantum statistics: 'h' as a natural constant and' its implications, cases of particle in a one-dimensional box and one-dimensional harmonic oscillator, Indistinguishability of particles and its consequences, Bose-Einstein, and Fermi-Dirac distributions, photons in black body chamber, free electrons in a metal, Fermi level and Fermi energy.

Text and Reference Books

A. Beiser, "Concepts of Modern Physics" (McGraw-Hill).

B B Laud, "Introduction to Statistical Mechanics" (Macmillan 1981).

F Reif, "Statistical Physics" (McGraw-Hill 1988).

K Haung, "Statistical Physics" (Wiley Eastern, 1988).

PAPER II- SOLID STATE AND NUCLEAR PHYSICS

UNIT-I

Crystal Structure

Lattice translation vectors and lattice, Symmetry operations, Basis and Crystal structure, Primitive Lattice cell, Two-dimensional lattice types, systems, Number of lattices, Point groups and plane groups, Three dimensional lattice types, Systems, Number of Lattices, Points groups and space groups. Index system for crystal planes Miller indices, Simple crystal structures, NaCI, hcp, diamond, Cubic ZnS; and hexagonal , Occurrence of Nonideal crysal structures, random stacking of polyprism, glasses.

Crystal Diffraction and Reciprocal Lattice

Incident beam, Bragg law, Experimental diffraction method, Laue method, Rotating crystal method, Powder method, Derivation of scattered 'wave amplitude, Fourier analysis, Reciprocal lattice vectors, Diffraction conditions, Ewald method, Brillion zones, Reciprocal lattice to sc, bcc and face lattices , Fourier analysis of the basis and atomic form factor.

UNIT -II

Crystal Bindings

Crystal of inert gases, Van der Walls-London interaction, repulsive interaction, Equilibrium lattice constants, Cohesive energy, compressibility and bulk modulus, ionic crystal, Madelung energy, evaluation of Madelung constant, Covalent crystals, Hydrogen-bonded crystals, Atomic radii.

Lattice Vibrations

Lattice Heat capacity, Einstein model, Vibrations of monatomic lattice, derivation of dispersion relation, First brillouin zone, group velocity, continuum limit, Force constants, Lattice with two atoms per primitive cell, derivation of dispersion relation, Acoustic and optical modes, Phonon momentum. Free electron theory, Fermi energy, density of states, Heat capacity of electron gas, Paramagnetic susceptibility of conduction electrons, Hall effect in metals. Origin of band theory, Qualitative idea of Bloch theorem, Kronig-Penney model, Number of orbitals in a band, conductor, Semi-conductor and insulators, Effective mass, Concept of holes.

UNIT - III

Nuclear Physics

1. **General Properties of Nucleus:**

   Brief survey of general Properties of the Nucleus, Mass defect and binding energy, charges, Size, Spin and Magnetic moment, Bainbridge mass spectrograph.

2. ***Nuclear Forces:***

   Saturation phenomena and Exchange forces, Deutron ground state properties.

3. ***Nuclear Models:***

   Liquid drop model and Bethe Weiszacker mass formula, Single particle shell model (only the level scheme in the context of reproduction of magic numbers).

4 Natural Radioactivity:

Fundamental laws of radioactivity, Soddy-Faj an's displacement law and law of radioactive disintegration, Basic ideas about α, β and ϒ decay.

UNIT-IV

1. *Nuclear Reactions:*

Nuclear reactions and their conservation laws, Cross section of nuclear reactions, Theory of fission (Qualitative), Nuclear reactors and Nuclear fusion.

2. *Accelerators and detectors:*

Vande Graff, Cyclotron and Synchrotron, Interaction of charged particles and gamma rays with matter (qualitative), GM counter, Scintillation counter and neutron detectors.

3. *Elementary Particles:*

Basic classification based on rest mass, Spin and half life, particle interactions (gravitational, Electromagnetic, week and strong Interactions).

Text and Reference Books

Pun and Babbar, "Solid State Physics" (S. Chand).

C. Kittel, "Introduction to Solid State Physics"- Vth Edition (John Wiley & Sons). H.S. Mani and G.K. Mehta, "Introduction to Modern Physics" (Affiliated East-West Press— 1989).

A. Beiser, "Perspectives of Modern Physics".

T.A. Littlefield and N. Thoreley, "Atomic and Nuclear Physics" (Engineering Language Book Society). Eisenberg and Resnik, "Quantum Mechanics of Atoms, Molecules, Solids, Nuclei and Particles" (John Wiley).

Ghoshal S.N.- Nuclear Physics - S. Chand & Co.

PAPER III - SOLID STATE ELECTRONICS

UNIT-I

Diffusion of minority carriers in semiconductor, work function in metals and semiconductors Junctions between metal and semiconductors, Semiconductor and semiconductor, p.n. Junction, Depletion layer, Junction Potential Width of depletion layer, Field and Capacitance of depletion layer, Forward A.C. and D.C. resistance of junction, Reverse Breakdown.

Zener and Avalanche diodes, Tunnel diodes, Point contact diode, their importance at High frequencies, LED photodiodes, Effect of temperature on Junction diode Thermistors.

UNIT -II

Transistor parameters, base width modulation, transit time and life-time of minority carriers, Base- Emitter resistance Collector conductance, Base spreading resistance, Diffusion capacitance, Reverse feedback ratio, Equivalent circuit for transistors, Basic model, hybrid model and Y parameter equivalent circuit, Input and output impedances.

UNIT III

Current and Voltage gain, Biasing formulae for transistors, Base bias, emitter bias and mixed type bias and mixed type biasing for small and large signal operation. Transistor circuit application at law frequencies, their AC and DC equivalent for three different modes of operation, Large signal operation of transistors, Transistor Power amplifiers, Class A and B operation, Maximum power output Effect of temperature, heat sinks, thermal resistance Distorsion in amplifiers, cascading of stages, Frequency response, Negative and positive feedback in transistor amplifiers.

UNIT -IV

Field effect transistors and their characteristics, biasing of FET, use in preamplifiers , MOSFET and their simple uses.

Power Supplies:

Electronically regulated low and high voltage power supplies, Inverters for battery operated equipments.

Miscellaneous:

Basic linear integrated circuits, phototransistors, Silicon Controlled rectifiers, Injunction transistor and their simple uses.

Text and Reference Books

B G Streetman; “Solid State Electronic Devices”, UK Edition (Prentice-Hall of India. New Delhi, 1986).

W D Stanley; “Electronic Devices, Circuits and Applications” (Prentice-Hall, New Jersey, USA. 1988).

J D Ryder; “Electronics Fundamentals and Applications” 1jnd Edition\(Prentice-Hall of India. New Delhi, 1986). I Miliman and A Grabel; “Microelectronics”, International. Edition (McGraw-Hill Book Company, New York, 1988).

PRACTICAL

NOTE:

This is a suggested list. Every institution may add any experiment of same standard in the same subject area.

Statistical Physics

1. Data from n-option systems of several relative weightages to be examined and interpreted.
2. Plotting F-D distribution in the neighbourhood of Fermi energy for different temperature values.
3. Solar wind as a thermal expansion of solar corona at one million Kelvin.
4. Study of dilute gas for experimental verification of Maxwell-Boltzman statistics.
5. Number of microscopic states of perfect gas (Gibbs-paradox).

Solid State Physics

1. Goniometric study of crystal faces.
2. Determination of dielectric constant.
3. Hysteresis curve of transformer core.
4. Hall-probe method for measurement of magnetic field

Solid State Devices

1. Specific resistance and energy gap of a semiconductor
2. Characteristics of a transistor
3. Characteristics of a tunnel diode

Electronics

1. Study of voltage regulation system
2. Study of, a regulated power supply
3. Study of Lissajuous figures using a CR0
4. Study of VTVM

5. Study of RC and TC coupled amplifiers
6. Study of AF and RF oscillators

Nuclear Physics

1. Study of absorption of alpha and beta rays.
2. Study of statistics in radioactive measurement.

Text and Reference Books

B.G. Strechman, "Solid State Electronic Devices". II Edition (Prentice-Hall of India, New Delhi, 1986).
W.D. Stanley, "Electronic Devices, Circuits and Applications" (Prentice-Hall, New Jersey, USA, 1988).
D.P. Khandelwal, "A Laboratory Manual for Undergraduate Classes (Vani Publishiing House, New Delhi). S.P. Singh, "Advanced Practical Physics" (Pragati Prakashan, Meerut).

Instructions for Paper Setting

All questions carry equal marks.

Section A: One compulsory question with four parts. One part (numerical orshort answer type) from each unit.

Section B: Two questions (long answer or numerical type) from each unit butonly one question from each unit is to be attempted.

संशोधनों की सस्तुति

इस बैठक में पूरे प्रदेश में समान पाठ्यक्रम लागू किये जाने के उद्देश्य से सशोधन/सहमति हेतु एक पाठ्यक्रम का प्रारुप प्रस्तुत किया गया। उपस्थित सदस्यों ने प्रस्तुत(प्रस्तावित) पाठ्यक्रम के प्रारुप पर सम्यक विचार विमर्श किया। विचार विमर्श के उपरान्त सभी सदस्यों ने सर्वसम्मति से निर्णय लिया कि,

1. समान पाठ्यक्रम के प्रस्तुत प्रारुप का लागू करने हेतु बाडे ऑफ स्टडीज सहमति पद्र ान करती है।
2. उपराक्त पाठय् क्रम को प्रतियोगी परीक्षाओं को ध्यान में रखते हुये संशोधित व उच्चीकृत किये जाने की आवश्यकता है।

आज दिनांक 21.10..2011 को विश्वविद्यालय परिसर में निम्न विषय की पाठ्यक्रम समिति की एक आवश्यक बैठक हुई, जिसमें निम्न प्राध्यापकगण उपस्थित हुए :–

Date :- 21.10.2011 Subject :- Mathematics Committee Place :- Committee Hall

1. Prof. S. K. Vaish
2. Dr. P. K. Shukla
3. Dr. Updesh Kumar
4. Dr. Satishchandra
5. Dr. Sanjeev Kumar Saxena

RECOMMENDED UNIFIED SYLLABUS OFMATHEMATICS

For B.A./B.Sc. Classes

(From 2011-12 onwards)

B.A./B.Sc. I

Paper I : ALGEBRA and TRIGONOMETRY M.M. : 33/65

Algebra

Unit 1. Sequence and its convergence (basic idea), Convergence of infinite series, Comparison test, ratio test, root test, Raabe's test, Logarithmic ratio test, Cauchy's condensation test, DeMorgan and Bertrand test and higher logarithmic ratio test. Alternating series, Leibnitz test, Absolute and conditional convergence, Congruence modulo *m* relation, Equivalence relations and partitions.

Unit 2. Definition of a group with examples and simple properties, Permutation groups, Subgroups, Centre and normalizer, Cyclic groups, Coset decomposition, Lagrange's theorem and its consequences.

Unit 3. Homomorphism and isomorphism, Cayley's theorem, Normal subgroups, Quotient group, Fundamental theorem of homomorphism, Conjugacy relation, Class equation, Direct product.

Unit 4. Introduction to rings, subrings, integral domains and fields, Characteristic of a ring, Homomorphism of rings, Ideals, Quotient rings.

Trigonometry

Unit 5. Complex functions and separation into real and imaginary parts, Exponential, direct and inverse trigonometric and hyperbolic functions, logarithmic function, Gregory's series, Summation of series.

Paper II : CALCULUS M.M. : 33/65

Differential Calculus

Unit 1. ε–δ definition of the limit of a function, Continuous functions and classificationof discontinuities, Differentiability, Chain rule of differentiability, Rolle's theorem, First and second mean value theorems, Taylor's theorems with Lagrange's and Cauchy's forms of remainder, Successive differentiation and Leibnitz's theorem.

Unit 2. Expansion of functions (in Taylor's and Maclaurin's series), Indeterminate forms, Partial differentiation and Euler's theorem, Jacobians.

Unit 3. Maxima and Minima (for functions of two variables), Tangents and normals (polar form only), Curvature, Envelopes and evolutes.

Unit 4(*a*). Asymptotes, Tests for concavity and convexity, Points of inflexion, Multiple points, Tracing of curves in Cartesian and polar co-ordinates.

Integral Calculus

Unit 4(*b*). Reduction formulae, Beta and Gamma functions.

Unit 5. Qudrature, Rectification, Volumes and surfaces of solids of revolution, Pappus theorem, Double and triple integrals, Change of order of integration, Dirichlet's andLiouville's integral formulae.

Paper III : GEOMETRY and VECTOR CALCULUS M.M. : 34/70

Geometry

Unit 1. General equation of second degree, Tracing of conics, System of conics, Confocal conics, Polar equation of a conic and its properties.

Unit 2. Three dimensional system of co-ordinates, Projection and direction cosines, Plane, Straight line.

Unit 3. Sphere, cone and cylinder.

Unit 4. Central conicoids, Reduction of general equation of second degree, Tangent plane and normal to a conicoid, Pole and polar, Conjugate diameters, Generating lines, Plane sections.

Vector Calculus

Unit 5. Vector differentiation and integration, Gradient, divergence and curl and their properties, Line integrals, Theorems of Gauss, Green and Stokes and problems based on these.

B.A./B.Sc. II

(From 2012-13 onwards)

Paper I : LINEAR ALGEBRA and MATRICES M.M. : 33/65

Linear Algebra

Unit 1. Vector spaces and their elementary properties, Subspaces, Linear dependence and independence, Basis and dimension, Direct sum, Quotient space.

Unit 2. Linear transformations and their algebra, Range and null space, Rank and nullity, Matrix representation of linear transformations, Change of basis.

Unit 3. Linear functionals, Dual space, Bi-dual space, Natural isomorphism, Annihilators, Bilinear and quadratic forms, Inner product spaces, Cauchy-Schwarz's inequality, Bessel's inequality and orthogonality.

Matrices

Unit 4. Symmetric and skew-symmetric matrices, Hermitian and skew-Hermitian matrices, Orthogonal and unitary matrices, Triangular and diagonal matrices, Rank of a matrix, Elementary transformations, Echelon and normal forms, Inverse of a matrix by elementary transformations.

Unit 5. Characteristic equation, Eigen values and eigen vectors of a matrix, Cayley- Hamilton's theorem and its use in finding inverse of a matrix, Application of matrices to solve a system of linear (both homogeneous and non-homogeneous) equations, Consistency and general solution, Diagonalization of square matrices with distinct eigen values, Quadratic forms.

Paper II : DIFFERENTIAL EQUATIONS and INTEGRAL TRANSFORMS

M.M. : 33/65

Differential Equations

Unit 1. Formation of a differential equation (D.E.), Degree, order and solution of a D.E., Equations of first order and first degree : Separation of variables method, Solution of homogeneous equations, linear equations and exact equations, Linear differential equations with constant coefficients, Homogeneous linear differential equations,

Unit 2. Differential equations of the first order but not of the first degree, Clairaut's equations and singular

solutions, Orthogonal trajectories, Simultaneous linear differential equations with constant coefficients, Linear differential equations of the second order (including the method of variation of parameters),

Unit 3. Series solutions of second order differential equations, Legendre and Bessel functions (P_n and J_n only) and their properties.

Order, degree and formation of partial differential equations, Partial differential equations of the first order, Lagrange's equations, Charpit's general method, Linear partial differential equations with constant coefficients.

Unit 4(*i*). Partial differential equations of the second order, Monge's method.

Integral Transforms

Unit 4(*ii*). The concept of transform, Integral transforms and kernel, Linearity property of transforms, Laplace transform, Inverse Laplace transform, Convolution theorem,Applications of Laplace transform to solve ordinary differential equations.

Unit 5. Fourier transforms (finite and infinite), Fourier integral, Applications of Fourier transform to boundary value problems, Fourier series.

Paper III : MECHANICS

Dynamics M.M. : 34/70

Unit 1. Velocity and acceleration along radial and transverse directions, and along tangential and normal directions, Simple harmonic motion, Motion under other laws of forces, Earth attraction, Elastic strings.

Unit 2. Motion in resisting medium, Constrained motion (circular and cycloidal only). **Unit 3.** Motion on smooth and rough plane curves, Rocket motion, Central orbits and Kepler's law, Motion of a particle in three dimensions.

Statics

Unit 4. Common catenary, Centre of gravity, Stable and unstable equilibrium, Virtual work.

Unit 5. Forces in three dimensions, Poinsot's central axis, Wrenches, Null line and null plane.

B.A./B.Sc. III

(From 2013-14 onwards)

Paper I : REAL ANALYSIS M.M. : 36/75

Unit 1. Axiomatic study of real numbers, Completeness property in R, Archimedean property, Countable and uncountable sets, Neighbourhood, Interior points, Limit points, Open and closed sets, Derived sets, Dense sets, Perfect sets, Bolzano-Weierstrass theorem.

Unit 2. Sequences of real numbers, Subsequences, Bounded and monotonic sequences, Convergent sequences, Cauchy's theorems on limit, Cauchy sequence, Cauchy's general principle of convergence, Uniform convergence of sequences and series of functions, Weierstrass M-test, Abel's and Dirichlet's tests.

Unit 3. Sequential continuity, Boundeness and intermediate value properties of continuous functions, Uniform continuity, Meaning of sign of derivative, Darboux theorem.

Limit and continuity of functions of two variables, Taylor's theorem for functions of two variables, Maxima and minima of functions of three variables, Lagrange's method of undetermined multipliers.

Unit 4. Riemann integral, Integrability of continuous and monotonic functions, Fundamental theorem of integral calculus, Mean value theorems of integral calculus, Improper integrals and their convergence, Comparison test, μ-test, Abel's test, Dirichlet's test, Integral as a function of a parameter and its differentiability

and integrability.

Unit 5. Definition and examples of metric spaces, Neighbourhoods, Interior points, Limit points, Open and closed sets, Subspaces, Convergent and Cauchy sequences, Completeness, Cantor's intersection theorem.

Paper II : COMPLEX ANALYSIS M.M. : 36/75

Unit 1. Functions of a complex variable, Concepts of limit, continuity and differentiability of complex functions, Analytic functions, Cauchy-Riemann equations (Cartesian and polar form), Harmonic functions, Orthogonal system, Power series as an analytic function.

Unit 2. Elementary functions, Mapping by elementary functions, Linear and bilinear transformations, Fixed points, Cross ratio, Inverse points and critical points, Conformal transformations.

Unit 3. Complex Integration, Line integral, Cauchy's fundamental theorem, Cauchy's integral formula, Morera's theorem, Liouville theorem, Maximum Modulus theorem, Taylor and Laurent series.

Unit 4. Singularities and zeros of an analytic function, Rouche's theorem, Fundamental theorem of algebra, Analytic continuation.

Unit 5. Residue theorem and its applications to the evaluation of definite integrals, Argument principle.

Paper III : NUMERICAL ANALYSIS and PROGRAMMING IN *C*

Numerical Analysis M.M. : 36/75

Unit 1. Shift operator, Forward and backward difference operators and their relationships, Fundamental theorem of difference calculus, Interpolation, Newton-Gregory's forward and backward interpolation formulae.

Unit 2. Divided differences, Newton's divided difference formula, Lagrange's interpolation formula, Central differences, Formulae based on central differences : Gauss, Striling's, Bessel's and Everett's interpolation formulae, Numerical differentiation.

Unit 3. Numerical integration, General quadrature formula, Trapezoidal and Simpson's rules, Weddle's rule, Cote's formula, Numerical solution of first order differential equations : Euler's method, Picard's method, Runge-Kutta method and Milne's method, Numerical solution of linear, homogeneous and simultaneous difference equations, Generating function method.

Unit 4. Solution of transcendental and polynomial equations by iteration, bisection, Regula-Falsi and Newton-Raphson methods, Algebraic eigen value problems : Power method,Jacobi's method, Given's method, Householder's method and *Q-R* method, Approximation : Different types of approximations, Least square polynomial approximation, Polynomial approximation using orthogonal polynomials, Legendre approximation, Approximation with trigonometric functions, exponential functions, rational functions, Chebyshev polynomials.

Programming in C

Unit 5. Programmer's model of computer, Algorithms, Data type, Arithmetic andinput/out instruction, Decisions, Control structures, Decision statements, Logical and conditional operators, Loop case control structures, Functions, Recursion, Preprocessors,Arrays, Puppetting of strings Structures, Pointers, File formatting.

OPTIONAL PAPER

Any one of the following papers : M.M. : 42/75**Paper IV(a) : NUMBER THEORY and CRYPTOGRAPHY**

Unit 1. Divisibility : gcd, lcm, prime numbers, fundamental theorem of arithmetic, perfect numbers,

floor and ceiling functions, Congruence : properties, complete and reduced residue systems, Fermat's theorem, Euler functions, Chinese remaineder theorem.

Unit 2. Primality testing and factorization algorithms, Pseudo-primes, Fermat's pseudo- primes, Pollard's rho method for factorization.

Unit 3. Introduction to cryptography : Attacks, services and mechanisms, Security services, Conventional encryption - Classical techniques : Model, Stegnanography, Classical encryption technique, Modern techniques : DES, cryptanalysis, block cipher principles and design, Key distribution problem, Random number generation.

Unit 4. Hash functions, Public key cryptography, Diffie-Hellmann key exchange, Discrete logarithm-based crypto-systems, RSA crypto-system, Signature schemes, Digital signature standard (DSA), RSA signature schemes, Knapsack problem.

Unit 5. Elliptic curve cryptography : Introduction to elliptic curves, Group structure, Rational points on elliptic curves, Elliptic curve cryptography, Applications in cryptography and factorization, Known attacks.

Paper IV(b) : LINEAR PROGRAMMING

Unit 1. Linear programming problems, Statement and formation of general linear programming problems, Graphical method, Slack, and surplus variables, Standard and matrix forms of linear programming problem, Basic feasible solution.

Unit 2. Convex sets, Fundamental theorem of linear programming, Simplex method, Artificial variables, Big-M method, Two phase method.

Unit 3. Resolution of degeneracy, Revised simplex method, Sensitivity Analysis.

Unit 4. Duality in linear programming problems, Dual simplex method, Primal-dual method Integer programming.

Unit 5. Transportation problems, Assignment problems.

Paper IV(c) : DIFFERENTIAL GEOMETRY and TENSOR ANALYSIS

Differential Geometry

Unit 1. Local theory of curves- Space curves, Examples, Plane curves, tangent and normal and binormal, Osculating plane, normal plane and rectifying plane, Helices, Serret- Frenet apparatus, contact between curve and surfaces, tangent surfaces, involutes and evolutes of curves, Intrinsic equations, fundamental existence theorem for space curves, Local theory of surfaces- Parametric patches on surface curve of a surface, surfaces of revolutions, Helicoids, metric-first fundamental form and arc length.

Unit 2. Local theory of surfaces (Contd.), Direction coefficients, families of curves, intrinsic properties, geodesics, canonical geodesic equations, normal properties of geodesics, geodesics curvature, geodesics polars, Gauss-Bonnet theorem, Gaussian curvature, normal curvature, Meusneir's theorem, mean curvature, Gaussian curvature, umbilic points, lines of curvature, Rodrigue's formula, Euler's theorem.

Unit 3. The fundamental equation of surface theory – The equation of Gauss, the equation of Weingarten, the Mainardi-Codazzi equation, Tensor algebra : Vector spaces, the dual spaces, tensor product of vector spaces, transformation formulae, contraction, special tensor, inner product, associated tensor.

Unit 4. Differential Manifold-examples, tangent vectors, connexions, covariant differentiation. Elements of general Riemannian geometry-Riemannian metric, the fundamental theorem of local Riemannian Geometry, Differential parameters, curvature tensor, Geodesics, geodesics curvature, geometrical interpretation of the curvature tensor and special Riemannian spaces.

Tensor Analysis

Unit 5. Contravariant and covariant vectors and tensors, Mixed tensors, Symmetric and skew-symmetric tensors, Algebra of tensors, Contraction and inner product, Quotient theorem, Reciprocal tensors, Christoffel's symbols, Covariant differentiation, Gradient, divergence and curl in tensor notation.

Paper IV(d) : PRINCIPLES OF COMPUTER SCIENCE

Unit 1. Data Storage - Storage of bits, main memory, mass storage, Information of storage, The binary system, Storing integers, stroring fractions, communication errors.

Data Manipulations - The central processing unit, The stored program concept, Programme execution, Other Architectures, arithmetic/logic instructions, Computer – peripheral communication.

Unit 2. Operating System and Network – The evolution of operating system, Operating system architecture, Coordinating the machine's activates, Handling competition amongprocess, networks, network protocol.

Unit 3. Algorithms - The concept of an algorithm, Algorithm representation, Algorithm, Discovery, Iterative structure, Recursive structures, Efficiency and correctness, (algorithm tobe implemented in C++).

Unit 4. Programming Languages - Historical perspective, Traditional programming Concepts, Program units, Languages implementation, Parallel computing, Declarative computing.

Unit 5. Software Engineering - The software engineering discipline, The software life cycle, Modularity, Development, Tools and techniques, Documentation, Software ownership and liability. **Data Structures -** Array, Lists, Stack, Queues, Trees, Customised data types, Object-oriented.

Paper IV(e) : DISCRETE MATHEMATICS

Unit 1. Propositional Logic - Proposition logic, basic logic, logical connectives, truth tables, tautologies, contradiction, normal forms (conjunctive and disjunctive), modus ponens and modus tollens, validity, predicate logic, universal and existential quantification.

Method of Proof - Mathematical induction, proof by implication, converse, inverse, contrapositive, negation, and contradiction, direct proof by using truth table, proof by counterexample.

Unit 2. Relation - Definition, types of relation, composition of relations, domain and range of a relation, pictorial representation of relation, properties of relation, partial orderingrelation.

Posets, Hasse Diagram and Lattices - Introduction, ordered set, Hasse diagram of partially ordered set, isomorphic ordered set, well ordered set, properties of lattices, and complemented lattices.

Boolean Algebra - Basic definitions, Sum of products and product of sums, Logic gates and Karnaugh maps.

Unit 3. Graphs - Simple graph, multi graph, graph terminology, representation of graphs, Bipartite, regular, planar and connected graphs, connected components in a graph, Euler graphs, Hamiltonian path and circuits, Graph colouring, chromatic number,isomorphism and homomorphism of graphs.

Tree - Definition, Rooted tree, properties of trees, binary search tree, tree traversal.

Unit 4. Combinatorics - Basics of counting, permutations, combinations, inclusion- exclusion, recurrence relations (n^{th} order recurrence relation with constant coefficients, Homogeneous recurrence relations, Inhomogeneous recurrence relations), generating function (closed form expression, properties of G.F., solution of recurrence relation using,G.F, solution of combinatorial problem using G.F.).

Unit 5. Finite Automata - Basic concepts of automation theory, Deterministic finite automation (DFA),

transition function, transition table, Non deterministic finite automata (NDFA), Mealy and Moore machine, Minimization of finite automation.

Paper IV(f) : MATHEMATICAL STATISTICS

Probability Theory

Unit 1. Three definitions of probability (Mathematical, Empirical & axiomatic). Dependent, independent and compound events.

Addition and multiplication theorems of probability, conditional probability. Bionomial and multinomial theorems of probability, Baye's theorem, Mathematical expectation and its properties, Moment generating functions (m.g.f.) and cumulants.

Distributions

Unit 2. Discrete distributions – Binomial & Poisson distributions and their properties. **Continuous distributions –** Distribution function, Probability density function (Pdf), Cauchy's distribution, rectangular distribution, exponential distribution, Beta, GammaNormal distributions and their properties.

Fitting of the Curves by method of least square – Straight line, parabola andexponential curves.

Correlation and Regression

Unit 3. Bivariate population, Meaning of correlation & regression. Coefficient of Correlation, rank correlation, lines of regression. Properties of regression coefficients, Partialand multiple correlation and their simple Properties.

Sampling Theory

Unit 4. Types of population, Parameters & Statistics, Null Hypothesis, Level ofSignificance, critical region. Procedure for testing Hypothesis. Type I & Type II error,

χ^2 - distribution and its properties.

Unit 5. Simple and random sampling. Test of significance for large samples. Sampling distribution of Mean. Standard error, Test of significance based onbased on t,F & Z distribution, ANOVA.

संशोधनों की संस्तुति

इस बैठक में पूरे प्रदेश में समान पाठ्यक्रम लागू किये जाने के उद्देश्य से सेशोधन/सहमति हेतु एक पाठय् क्रम का प्रारुप प्रस्तुत किया गया। उपस्थित सदस्यों ने प्रस्तुत (प्रस्तावित) पाठ्यक्रम के प्रारुप पर सम्यक विचार विमर्श किया। विचार विमर्श के उपरान्त सभी सदस्यों ने सर्वसम्मति से निर्णय लिया कि,

1. बी.ए./बी.एस.सी प्रथम वर्ष (तीनो प्रश्न पच) के लिये विश्वविद्यालय द्वारा प्रस्तावित पाठ्यक्रम यथावत लागू करने की संस्तुति की गयी।

2. प्रदेश के अधिकाश विश्वविद्यालयों एव इस विश्वविद्यालय के कई विषयों में स्नातक अन्तिम वर्ष में मौखिकी परीक्षा का प्रावधान है इसलिए बी.ए./बी.एस.सी. तृतीय वर्ष गणित विषय के पाठ्यक्रम में मौखिकी परीक्षा कराने की प्रबल संस्तुति की गयी। जिसके बाद प्रश्न पत्रों एवं मौखिकी परीक्षा क` पणू ार्कं ा` का विभाजन निम्न प्रकार करने की संस्तुति की गयी। बी.ए. बी.एस.सीप्रथम

प्रश्न पत्र 30 60

द्वितीय प्रश्न पत्र 30 60

तृतीय प्रश्न पत्र 30 60

मौखिकी परीक्षा 30 60

यागेगे 150 400