ANUGRAH NARAYAN COLLEGE , PATNA

AFFILIATED: MAGADH UNIVERSITY, BODHA GAYA

BSC-BIOTECHNOLOGY

SYLLABUS

BSC-BT Part I Hons. **Paper 1 (75 Marks)**

Biochemistry

- Introduction to Biotechnology
- Nature of Biological Material
- Brief mention of various micro bimolecular.
- General properties of organic & inorganic compound
- Molecules involved in generation of mechanical stability: peptidoglycans, polysaccharides & membrane lipids.
- Molecules involved in information storage & retrieval : nucleic acid.
- Molecules executing mediator & catalytic function: the proteins
- The signal molecules.
- Enzyme: introduction, classification, protein & non protein enzymes , role of enzymes in biosynthetic & degradative cellular function , mechanism and mode of action of enzymes, inhabitation & regulation of enzyme action, Enzyme Kinetics, In vitro activity of purified enzymes, application of enzymes in industry , food processing and medicine.

Cell biology

- Cell as basic unit of living system. The cell theory
- Precellular evolution : Artificial creation of "cell"
- Broad classification of cell types: PPLOs, Bacteria, eukaryotic microbes, plant & animal cells. A detailed classification of cell types within an organism. Cell ,tissue, organ and organism as different levels of organization of otherwise genetically similar cells.
- Ecological amplitude of cell in high altitude, sediments, arctic, hot spring, arid, brackish and fresh water environment.
- Biochemical composition of cells: protein, Lipids, Carbohydrates, nucleic acids and the metabolic pool.
- Ultra structure of the cell membrane.
- Structure and function of cell organelles, ultra structure of cell membrane, cytosol,golgi bodies, endoplasmic reticulum(rough and smooth), ribosomes, cytoskeleton structure(actin, microtubules etc.) mitochondria , chloroplast, lysosomes, peroxysomes, nucleus(nucleus membrane, nucleoplasm, nucleolus, chromadn).
- Cell-cell interaction; Cell locomotion : amoeboid, flagellar and ciliar.
- Muscle & nerve cells
- Cell senescence and death
- Cell differentiation in plants and animals.

Microbiology

- Development of microscopy(optical, TEM and SEM)
- Contribution of eminent Microbiologists.
- Concept and methods of sterilization.
- Different types of bacteria & bacterial cell structure
- Nature of microbial cell surface.
- Gene transfer in microorganism.
- Archaebacteria & rickettsial

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- PPLOs.
- Reference to phages
- Prokaryotic and eukaryotic a microbial cells
- Nutritional classification of bacteria.
- Microbes in extreme environment : thermophiles and alkalophiles.
- Pathogenic microorganism
- Symbiosis and antagonism among microbial populations.
- N2- fixing microbes in agriculture- (Rhizobiam)
- Microbial metabolism (Respiration & Photosynthesis)
- Fermentation products of bacteria.
- Significance of bacteria.

Paper II (75 Marks)

Genetics (40 marks)

- Nature of genetic material, nucleic acids, DNA replication.
- Mendelian laws of inheritance, gene interactions.
- Sex determination in plants & animals, sex linkage, non disjunction as a proof of chromosome theory of inheritance.
- Linkage: mapping genes, interference and coincidence in pro and Eukaryotic.
- Chromosome : chemical composition , structural organization of chromatics , centromere , telomeres, chromatin, nucleosome organization, chromatin and heterochromomatin/ special chromosome (e.g. polytene and lampbrush chromosome banding patterns in human chromosomes.)
- Structural and numerical aberration involving chromosome / evolution of wheat, cotton, and rice/Hereditary defects. Kleinefelter , Turner, cri-du-char and down's syndromes.
- Mutations: spontaneous and induced, chemical and physical mutagens induced mutation in plants, animals and microbes for economics benefits of man.
- Basic microbial genetics, conjunction, transduction, transformation, isolation of auxotrophs, replica plating techniques, analysis of mutation in biochemical pathways, one gene one enzyme hypothesis.
- Extra chromosomal inheritance mitochondria and chloroplast genetics system.
- Population genetics hardy-Weinberg equilibrium , gene & genotypic frequencies.

Math and computer (35 marks)

- The set theory : properties of subsets.
- Linear and geometrics function limits & diversion of function.
- The binomial theorem , logarithm, differentiation & Integration Probability & deviations.
- Methods of sampling, confidence level, measurement of central tendencies and deviations.

Computer:

- General introduction of computer, organization of computer, digital & analog computers, computer algorithm.
- Computers in online monitoring and automation.

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Computer:

- General introduction of computer, organization of computer, digital & analog computers, computer algorithm.
- Computers in online monitoring and automation.
- Application of computer in coordination of solute concentration, pH and temperature etc. of a fermented in operation.
- Demonstration of the above utilities (along with above lecture).

Biochemical Techniques Practical (50 Marks)

- Quantitative estimation of sugar in given solutions & sugar in biological samples.
- Extraction and separation of liquids, estimation of proteins, estimation of DNA/RNA.
- Isolation and purification of protein, essay of enzyme activity.
- Kinetic study of enzyme, chromatographic methods of separation of macromolecules.

Microbiological Techniques

- Cleaning of glassware.
- Preparation of media, cotton plugging and sterilization
- Personal hygiene-microbes from hands, tooth scum and other body parts.
- Isolation of microorganisms from air, water and soil samples, dilution and pour plating, colony purification.
- Enumeration of microorganisms. Total Vs viable counts.
- Identification of isolated bacteria, gram staining other staining methods, metabolic characterization (e.g. IM Vic test)
- Growth curve of microorganism. Antibiotic sensitivity of microbes, use of antibiotic discs.
- Testing of water quality test for antibodies against given bacteria.
- One step growth of bacteriophage, culture from body fluids, stool, urine, blood
- Alcoholic and mixed acid fermentation.

*****The students are to undergo one month "on-the-job training in a clinic/ a fermentation plant/ brewery of bakery after completion of classes/exams. They would have to submit its reports. A certificate would be issue by the department with grading from the institution providing training.***

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BSC-BT PART II HONS

PAPER III (75 Marks)

Molecular Biology

- Molecular basis of life
- Structure DNA
- DNA replication of prokaryotes & eukaryotes
- DNA replication in prokaryotes & eukaryotes.
- DNA recombination molecular mechanism in prokaryotes & eukaryotes.
- Insertion elements and transposons.
- Structure of prokaryotic genes.
- Prokaryotic transcription.
- Prokaryotic translation.
- Prokaryotic gene expression (lac, his, trp, catabolic replication).
- Structure of eukaryotic genes.
- Eukaryotic transcript. Eukaryotic gene expression. Transcription factors and translation factors.
- Gene expression in yeast.
- Gene expression in protozoan parasites.
- Gene organization and expression in mitochondria and chloroplasts.
- Post translation regulation of gene expression.
- Developmental & environmental regulation of gene expression.

Recombinant DNA Technology

- Gene cloning and need to clone a gene.
- Tools and techniques , plasmids and other vehicles, genomic DNA, handling of DNA, RNA and c-DNA, RT enzymes and other regents technology, laboratory requirement.
- Safety measures and regulation for recombinant DNA work.
- Choice and selection of tools and techniques.
- Vehicles: Plasmids and bacteriophages, available phagemids, Cosmids, Viruses.
- Purification of DNA from bacterial, plant and animal cells.
- Manipulation of purification DNA.
- Introduction of DNA into living cells.
- Cloning vector for E.*coli.*
- Cloning vectors for organisms such as yeast, fungi for plants- *Agrobacterium* sp. And plant viruses, animal viruses.
- Application of cloning in gene analysis (How to obtain a clone of a specific gene? Studying gene location and structure, studying gene expression.).

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- Gene cloning in medicine (pharmaceutical) compounds, artificial insulin genes, recombinant vaccine, diagnostic reagents.

Paper IV 75- Marks

BIOPHYSICS

- Energetic of living body. Source of heat limits of temperature. Heat dissipation and conservation.
- Lambert- Beer Law. Spectrophotometry and calorimetric. Primary events in photosynthesis. Strategies of light reception in microbes, plant and animals.
- Correction of vision faults.
- Electrical properties of biological compartments. Electricity as potential signal.
- Generations and reception of sonic vibration. Hearing aids.
- Intra and intermolecular interactions in biological systems. Spatial and charge compatibility as determinants of such interactions.
- Physical methods applied to find out molecular structure: X-ray crystallography and NMR.
- Physical methods of imaging intact biological structure. Ultrasound, optical filters, X-ray, CAT scan,ECG, EEG, NMR imaging.

IMMUNOLOGY

- The immune system and immunity along with historical prospective.
- Antigens and antibodies and heir structure.
- The organs and the cells of the immune system and their function.
- Antigen-antibody interaction.
- Humoral and cell mediated immunity (role of MHC and genetic restriction.).
- Original of diversity in the immune system.
- Effectors mechanisms.
- Immunity to infectious diseases and vaccines.

PRACTICAL (50 MARKS)

IMMUNOLOGICAL METHODS

- Purification of antigens.
- Raising polyclonal antibodies.
- Purification of antibodies.
- Conjugation of antibodies.
- Enzyme linked immunoassay.

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- Radio immunoassay.
- Radial immunodiffusion analysis.
- Generation of ascetic fluids.
- Diagnosis of and infection dieses by immunoassay.

CELLULAR BIOLOGY

- Cytological preparations:
  - Fixation, dehydration and staining
  - Squash in stain.
  - Embedding and sectioning.
- Cell counting methods: the hemocytometer and other aids.
- Measurements with the aid of light microscope:
  - Calibration of ocular micrometer
  - Finding out average cell size
  - Chromosome lengths.
- Separation of cell types from blood.
- Separation of cell organelles:
  - Methods for cells lysis: rupture/ osmotic/ chemical/ enzymatic lysis of cells followed by centrifugation. Monitoring cells lysis by release of cellular material and change in light scattering etc.
  - Mechanical rupture of cells: Ultrasound vibration, French pressure cell following by centrifugation for cell organelles.

*****One month (Summer) "on-the job training in an immunology/ veterinary/ virology institute. Report by the students will have to submit. Certificate to be issued by the department with grading from the institution providing by training.***

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BSC-BT(HONS) ***PART-III***

PAPER – V ***(75 Marks)***

ANIMAL CELL CULTURE

- History of development of cell cultures.
- The natural surroundings of animal cells.
- Metabolic capabilities of animal cells.
- Simulating natural condition for growing animal cells.
- Importance of growth factors of the serum.
- Primary culture. Anchorage dependence of growth. Non-anchorage dependent cells.
- Secondary cultures. Transformed animal cells: established/ continuous cell lines.
- Commonly used animal cell lines- their origin and characteristic.
- Growth kinetics of animal cell in culture.
- Applications of animal cell culture for studies on gene expression.
- Organ culture.
- Transfection of animal cells: selectable market, HAT selection, antibiotic resistance etc.
- Cell fusion.
- Transplantation of culture cells.
- Differentiation of cells.

ANIMAL CELL BIOTECHNOLOGY

- General metabolism
- Special secondary metabolites / products: Insulin, growth hormones, interferon, t-plasminogen activator factor VIII etc.
- Expressing cloned protein in animal cells. Over production and processing for chosen protein.
- The need to express in animal cells.
- Production of monoclonal antibodies.
- Growth factors promoting proliferation of animal cells: EFG, EGF, PDGF, IL-1, IL-2, NGF, erythroprotien etc.
- Bioreactors for large scale culture of cells.
- Transplanting cultured cells.

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PAPER VI ***(Marks 100)***

PLANT BIOTECHNOLOGY

- Introduction to in vitro methods. Terms & definitions. Use of growth regulators.
- Beginning of in *vitroi* culture in our country: ovary and ovule culture, in vitro pollination and fertilization.
- Embryo culture, embryo recues after wide hybridization and its application.
- Introduction to processes of embroyologenesis and organogenesis and their practical applications.
- Clonal multiplication of elite species (micropropogation), auxillary bud, shoot tip and meristem culture.
- Haploid and their applications. Somaclonal variations and applications (Teasure your exception).
- Endosperm culture and production of triploids.
- Proactical applications of tissue and organ culture (Summarization the practical application of all the above techniques).
- Single cell suspension cultures and their application in selection of variants/ mutants with or without mutagen treatment (of haploid culture preferable).
- Introduction to protoplast isolation: principles and applications.
- Tastings of viability of isolated protoplast.
- Somatic hybridization- an introduction.
- Various methods for fusing protoplast: chemical, electrical.
- Use of markers for selection of hybrid cells.
- Practical applications of somatic hybridization : hybrid vs. cybirds.
- Use of plant cells, protoplasts and tissue culture for genetic manipulation of plants introduction to *A.tumefaciens.*
- Tumor formation in plants using *A.tumefacience. (*monocots vs. dicots)
- Root formation using *A. rizogene.*
- Practical application of genetic transformation.

PAPER VII **(MARKS 100)**

ENVIROMENTAL BIOTECHNOLOGY

- Renewable and non-renewable resources.
- What is renewable should be bioassimilable/ biodegradable.
- Major consumer item: food, fuel and fibers.
- Conventional fuels and their environmental impact: firewood, plant/animal wastes, coal, gas and animal oils.

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- Modern fuels and their environmental impact: methanogenic bacteria and biogas, microbial hydrogen production, conversion of sugar to ethanol- the gasohol experiment solar energy converters –hopes from the photosynthesis pigments, plant based petroleum industry, cellulose degradation for combustible fuel.
- Biotechnological inputs in producing good quality natural fibers: transgenic sheep and transgenic plants.
- Microbiological quality of food & water.
- Treatment of municipal waste and industrial effluents.
- Degradation of pesticides and other toxic chemicals by microorganisms.
- Thuringiensis toxin as natural pesticides.
- Biological control of other insects swarming the agricultural field.
- Enrichment of ores by microorganisms.
- Biofertilizer, nitrogen-fixing microorganisms enrich the soil with assimmilble nitrogen.

PAPER VIII **Practical** **(Marks 100)**

Molecular & Cellular Biology

- Separation of cell types from blood.
- Separation of cell organelles: Methods for cell lysis: osmotic /chemical/ enzymatic lysis of cells followed by centrifugation, monitoring cell lysis by release of cellular material and change in light scattering etc.
- Mechanical rupture of cells ultrasonic vibration, French pressure cell followed by centrifugation for cell organelles.
- Separation of constituent molecules of the extract in aqueous buffer, gel filtration, ion exchange chromatography.
- Thin layer chromatography of extracted material.
- Isolation of chromosomal and plasmid DNA from bacteria.
- Restriction digestion of DNA and assigning restriction sites. (may be done as a demonstration).
- Making complete *E.coli* .
- Transfection of plasmid DNA and selection for transformants.

Culture Methods

- Initiating plant tissue culture: differentiation of explants.
- Growth of plant cell into undedifferentiated mass.
- Large cultivation of plant cells in suspension.

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- Induction of differentiation by modulating the hormonal balance.
- Culture of lymphyocytes from blood samples: prepration of media, filter sterilization, monitoring microbial contamination (bacteria, fungi and mycoplasma), cloning of animal cells by cell and colony purification.
- Fusion of cultured cells with myeloma cells.
- Production of monoclonal antibodies at a large scale.
- Demonstration/ operation of large-scale fermenter.

PROJECT WORK

The students will be assigned to generate data on certain research project and or compile available information from literature on a given topic of biotechnological relevance under a chosen faculty member over a period of six months. (Equivalent to one semester.)

ENTREPRENEURSHIP

The students will be delivered lectures on how to select for a product line, design and develop process, economics on material and energy requirement, stocks the product and release the same for marketing etc. they should also be apprised of basic regulation of excise.

Practical and Project Draft: Students will also be asked to survey the demand for a given product, feasibility of its production under the given constraints of raw material, energy, input , financial situation export potential etc. procedure details on how to select process, how to move for loans, how to operate and how to repay the loasns in a phase manner should also be highlighted. The year would end with submission of a draft project by the students.

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CURRICULUM: SUBSIDIARY PAPER

The subsidiary course will be common with that of other Honors course and the syllabus to be followed would be the one provided by Magadh University, Bodha Gaya.

BSC- PART 1 Hons

BOTANY I Theory (Marks- 75)

Students are required to answer five questions out of total ten.

1. **Microbiology :** A general account of bacteria, viruses and their economic importance. Role of microbes in fermentation and nitrogen fixation.
2. **Thallophyta:** structure , function and diagnostic features:
    a. **Algae:** *Nostoc, Oedogonium, Chara, Vaucheria, Fucus and Batrachospermum.*
    b. **Fungi:** *Albugo, Peziza and Puccinia.*
    c. **Lichen:** *General account and economic important.*
3. **Bryophyta:** Structure and life history of *Marchantia, Anthocerous and Sphagnum.*
4. **Pterodophyta :** Structure and life history of *Salaginella, Equisetum and Marsilea.*
5. **Gymnosperm :** Structure and life history of *Pinus.*
6. Cytology, Genetics and Plant breeding:
    a. Structure of cell as seen under an electron microscope.
    b. Mitosis and meiosis
    c. Structure of chromoseome, crossing over and mutation.
    d. Nature, structure and replication of genetic material (DNA)
7. Economic Botony:
    a. Cereal: Wheat, Maize, rice
    b. Oils : Mustard, groundnut, linseed.
    c. Sugar: Sugarcane
    d. Spices: Coriander, Chilli, turmeric
    e. Beverages: tea
    f. Drugs: Rauwolfia
    g. Fibers: cotton, Jute

Botany practical (Marks 25)

1. Morphology and structural detail of algae, fungi and bryophytes included in the syllabus and their temporary stained microscopic slides (6 Marks).
2. Morphological and anatomical study of pterodophytes/ gymnosperm included in the syllabus and their microscopic preparation temporary (8 Marks).
3. To identify and comment upon spots (6 marks).
4. Class records. (5 marks).

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CHEMISTRY I THEORY **(MARKS 75)**

Group A: PHYSICAL CHEMISTRY

1. **The states:**
   a. **Gaseous state:** Kinetic Theory of gases, derivation of kinetic gas equation, deduction of gas laws, calculation of gas constants and kinetic energy.
   b. Types of Solids, crystal force, law of constancy of angles, seven crystal systems law of rational indices . Bragg's Law, Lattice enrgy, Born Haber Cycle.
2. Thermo Chemistry:
   a. Heat in chemical reaction enthalpy and standard enthalpy changes, Hess law, Kirchoff Law, bond energies and determination.
3. Ionic equilibrium:
   a. Ionic product of water pH, pK_a, and pK_w, buffer solution, idea of buffer solution in day to day life.
   b. Solubility product and its application in salty analysis, common ion effect, conductance specific, equivalent and molar.
   c. Chemical Kinetics: Rate of reaction, order and molecularity, expression for specific rate constant of first order reaction, half life period and unit.
   d. Colligative properties: Colligative properties, Osmosis, Osmotic pressure and its determination, Vapour pressure , Roult's law of lowering of vapour pressure, relation between osmotic pressure and lowering of vapour pressure.

Group B: INORGANIC CHEMISTRY

1. Atomic structure and bonding:
   Feature of H-spectra and Bohr's theory , shapes of orbitals and their labellings, idea of quantam number, Pauli,s exclusion principle, Hund's rules, Aufban principles, electrons configuration of elements . Idea of ionic and covalent bonds, I.P.E.N. and E.A., Fajan's rule
2. Chemistry of the following elements:
   Li, sn, Flouride, Chlorine, Iodine.
3. Principles involved in the volumentric and gravimetric estimation of Cu^{++} and iron.
4. Isotops : Brief idea of detection and separation, tracer techniques, radiocarbon dating.

(ORGANIC CHEMISTRY)

1. Structure and mechanism:

   Hybridization,bond angle, bond length, idea of bonds, inductive effect, electromeric effect, monomeric effect, bond fission and fission products, elementary idea of reagents and types of reactions.

2. Nomenclature:

   Acquintance with IUPAC nomenclature of aliphatic and aromatic compounds.

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3. (a) Alcohols: monohydric .
(b) Grignard's reagent.

4. Idea of purification of compounds: Criteria of purity , Chromatography.

CHEMISTRY PRACTICAL (25 marks)

1. Volumetric analysis:
(a)Acidimetry and alkalimentry.
(b)Use of potassium permagnate and potassium dichromate, iodmetry. **:12 marks**

2. Organic detection: detection of nitrogen, sulphur and halogens organic compounds , detection of the following functional groups compounds : (i) OH (phenolic) (ii) CHO, (iii) C==O , (iv) COOH, (v) NH_2 , and (vi) NO_2 **: 8 marks**

3. Records of class work and viva – voice. **: 5 marks**

B.SC. Part II Hons.Subsidary
Botany II Theory (75 marks)

Students are required to answer two questions from group A and group B each and one from group c out of total ten (four from group A and group B each and two from group C)

Group A: (ANGIOSPERMS)

(A) Morphology and taxonomy: Importance of classification of Angiosperm with reference to Bentham and Hooker and Hutchinson systems. Naming of genus and species . Diagnostic features affinities and economic importance of Ranunculaceae , Cucurbitaceae, Amaranthaceae, Lamiaceae, poaceae and Cyperaceae.

(B) Anatomy: Cell structure and tissue systems. Meristems. Root stem Transition. Initiation and activity of cambium including abnormal behavior , primary and secondary growth in roots and stems .

(C) Embryology: Life cycle of a typical flowering plant based on the major events in the development of another microspore , ovule , embryo sac, fertilization endosperm, embryo and seed.

Group B: (PLANT PHYSIOLOGY)

- Water relation , absorption of water and salts.
- Transpiration.
- Mineral nutrition- Role of major and minor elements.
- Enzymes- nature , properties and classification.
- Photosynthesis-photophorylation, Calvin cycle and factors affecting photosynthesis
- Translocation of organic substances
- Respiration- glycolysis, Kreb's cycle and factors affecting respiration.
- Nitrogen metabolism- Nitrogen fixation and protein synthesis.

Group C (ENVIRONMENTAL BIOLOGY)

- Pollution

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- Soil- types , water holding capacity, reclamation.
- Plant communities and ecosystem.
- Succession (Hydrosere and Xerosere)

BOTANY PRACTICAL (25 Marks)

1. To comment upon a plant physiology experiment set up from the following experiments. **5 marks**

- T / A ratio
- Ganong's photometer: rate of transpiration.
- Farmer's photometer: rate of transpiration
- Unequal transpiration by $Cacl_2$ method
- Oxyten evolution during photosynthesis.
- Rate of photosynthesis by Wilmott's bubbler.
- Moll's experiments ., Anaerobic respiration

2. Description and Identification of plants of families studied (5 marks)
3. Microscopic preparation of anatomical specimens (5 marks)
4. To identify and comment upon spots covering the courses (5 marks)
5. Practical recods based on class work and field studies.(5 marks)

CHEMISTRY II Theory (75 marks)

Group A (physical Chemistry)

1. States of matter:
(a)Gaseous state: Vander wall equation (no derivation), critical constants, collision number , collision frequency,mean free path.
(b)Solid State : Bravis lattices and lattice planes, elementary idea of types of lattices , stoichiometric and non- stoichiometric defects in simple ionic solids

2. Thermodynamics: Definition of terms : system , extensive properties , first and second law of thermodynamics, carnot theorem and carnot cycle.

3. (a) Ionic equilibrium: Ostwald's dilution law, conductance measurement of dissociation constant of acetic acid, salt hydrolysis , idea of theory of acid- base indicators.
(b) Phase rule : Terms, equation (no derivation required), H_2O system , S- system.

4. Chemical kinetics: Second order reaction , expression for specific rate contant of second order reaction, half life period and its unit , effect of temperature on reaction rate , Arrhenius equation , idea of catalytic activity at surface and catalytic processes such as hydrogenation, oxidation, cracking and reforming.

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Group –B (INORGANIC CHEMISTRY)

1) (a) Atomic structure and bonding: Idea of quality and matter waves, de Broglie relation , Schrondinger equation (no derivation) and idea of its application , idea of orbital overplan , hybridization of orbital, Vander walls forces, metallic bonding .
(b) Idea of complex formation :doubles salts and complex , werner's postulates.

2) Introduction transition metal chemistry :Generals feathers including variable oxidation states , idea of complexes, magnetism of transition metals.

3) Chemistry of group 14 elements : C, Si, basic introduction to fullerences and Zeolites, idea of major chemical pollutants in environment.

4) Chemistry of the following elements and their important compounds
a) Fe , Co , Ni (b) Cr (c) Mn

Group – C (ORGANIC CHEMISTRY)

1. Structure and mechanism : Different Types of isomerism, idea of E-Z notations , electrophilic substitution in benzene nucleus and mechanism of nucleophillic substitution of saturated carbon (general Idea).

2. Natural products:
(a) Carbohydrates: Nomenclature, classification ,non – detailed structure of glucose and fructose, elementary idea of glycosides.
(b) Elementaryidea of alkaloids and terpenes (no structural elucidation needed)

3 . (a) Structure of benzene, preparation and uses of benzene diazonium chloride.

(b) Lastic acid, citric acid.

4. (a) Test of common functional groups.

(b) Brief idea of polymers, resins proteins and sulfa drugs.

CHEMISTRY PRACTICAL

1) Qualitative inorganic of mixture containing four radicals.
Basic radicals; Ag^{+} , Hg_2^{+2} , Ph^{+2} ,Cu^{+2} ,Hg^{+2},Bi^{+3} ,Sn^{+4} ,Fe^{+3} , Al^{+3} ,Cr^{+3}, Ni^{+2}, Co^{+2} , Zn^{+2} , Mn^{+2} ,Ca^{+2} , Ba^{+2} ,Sr^{+2} , mg^{+2} , Na^{+} , K^{+} , NH_4^{+} .
Acid radicals: CO_3^{-2} , SO_3^{-2} ,S^{-2} ,SO_4^{-2} ,NO_2 , NO_3^{-} and halides. **(12 marks)**

2) Organic preparation: Preparation of organic compounds by using the following reaction. **(8 marks)**
a) Acentyation of aniline and p- toludine.
b) Nitration of nitrobenzene.
c) Oxidation of benezaldehyde.
d) Hydrolysis of esters like ethyl benzoate and methyl salicylate.

3) Record of class –Work and Viva –voce. **(5 marks)**

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