# B.Sc.(Voc.) in BIOTECHNOLOGY– I$^{st}$ Sem.

## K.A.(P.G.) College, Kasganj

## Subject - Biotechnology

## Title – Bio Chemistry

## Course – I

**(Max. Marks-20)**

Nature of biological material.
General properties of organic and Inorganic Compounds.
Suitability of organic compounds for generation of structure, storage of energy and information.
Hydrophilic and Hydrophobic groups in biological molecules.
Classification of bio molecules based on their role in bioprocesses.
i. Molecules involved in generation of mechanical stability - Pepetidoglycans, Polysaccharides an membrane lipids.
ii. Molecules involved in information storage and retrieval - the Nucleic acid.
iii. Molecules executing mediator and catalytic functions- the Proteins.
iv. The Signal molecules.
Perspectives of biological macromolecules: the repeating units in nucleic acids and Proteins, Helicity, Bending, looping, pleats, salt bridges etc and their determinants. The Asis for Intermolecular interaction e.g., enzyme-substrate and antigen-antibody recognition.
Nature of Biochemical reactions underlying bio synthesis and degradation. Role of Enzymes in such reaction. Protein and non-protein enzymes. Kinetics of enzyme catalyzed reactions.
In Vitro activity, of purified enzymes and their applications in industry. Various uses of enzymes- enzymes in food processing, medicine, diagnostics and production of new compounds.
Enzymes as research tools- Elisa methods, modification of biological compounds with the help of enzymes.

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B.Sc.(Voc.) in BIOTECHNOLOGY– I$^{st}$ Sem.

K.A.(P.G.) College, Kasganj

**Subject - Biotechnology**

**Title – Maths and Computers**

**Course – II** **(Max. Marks-20)**

The set theory properties of subsets.
Linear and geometric functions, derivatives of functions.

- The binomial theorem.
- Logarithm.

Differentiation

- Integration.
- Probability calculations.
- Methods of sampling, confidence level.
- Measurement of central tendencies.
- Measurements of deviations.

Computers: General introduction to computers, organization of computers, digital and analogue computer, computer algorithm.
Computer in online monitoring and automation.
Application of computers in co-ordination of solute concentration, $p^H$ and temperature etc. of a fermenter in operation.
Demo station of the above utilities (along with the above lectures).

**Practical (Max. Marks – 25)** – To Perform Colour tests of Proteins by Colorimeter, colour tests for carbohydrate (reducing and Non – reducing sugar ). Lipids tests, Elisa test. Visit to Computer lab. Introduction to various components of a computer. A simple documentation, preparation and printing, uses of printer and other components. Calculate Mean, Median, Mode and standard exercise.

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# B.Sc.(Voc.) in BIOTECHNOLOGY– I$^{st}$ Sem.

## K.A.(P.G.) College, Kasganj

## Subject - Zoology

## Title – Lower Non-Chordate

## Course – I

**(Max. Marks-20)**

(a) General Characteristics and outline classification up to orders with Suitable examples of the following phylum.

(i) Protozoa (ii) Porifera (iii) Coelenterata (iv) Platyhelminthes

(v) Nemathelminthes.

(b) Habit, Habitat, Morphology, Anatomy and Life history of the following.

(i) Paramecium (ii) Sycon including Canal System of Sponges

(iii) Obelia (iv) Fasciola.

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B.Sc.(Voc.) in BIOTECHNOLOGY– I$^{st}$ Sem.

K.A.(P.G.) College, Kasganj

**Subject - Zoology**

**Title – Higher Non-Chordate**

**Course – II** **(Max. Marks-20)**

(a) General Characteristics and outline classification up to orders with Suitable examples of the following phylum.

(ii) Annelida, (ii) Arthropoda (iii) Mollusca (iv) Echinodermata

(v) Hemichordata.

(b) Habit, Habitat, Morphology, Anatomy and Life history of the following.

(i) Nereis (ii) Hirudianaria

(iii) Palaemon (iv) Pila.

**Practical (Max. Marks – 25)** – Identification and comments of the specimen of lower non chordate. Identification and comments of the specimen of Higher non chordate.

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B.Sc.(Voc.) in BIOTECHNOLOGY– I[st] Sem.

K.A.(P.G.) College, Kasganj

**Subject - Chemistry**

**Title – Inorganic Chemistry-I**

**Course – I** **(Max. Marks-20)**

a) Classification of elements on the basis of electronic configuration of elements, with respect to s, p, d and f electronic states.

b) General trend in periodicity of properties , Atomic and ionic-radii . Ionization potential, electron affinity and electro negativity with their bearing on periodic- table.

c) lattice solution energy. Born Haber-cycle, Inert pair effect.

d) Valence bond theory of covalent bond.

e) **Stereo chemistry of Inorganic molecules:** Valence-sheet electron pair repulsion theory. Hybridization of s, p, and d orbital. Geometry and shape of following In-organic molecules, Beryllium chloride. Boron-trifluoride, Ammonia, Water, Phosphorous-penta chloride, Sulphur hexafluoride and lodine heptafluoride.

f) A comparative study of p-Block elements from the point of view of the Periodic classification.

g) Chemistry of Extraction and Isolation of the following elements :Li, Be, Ra, B, Ge and Isolation of flourine.

h) Chemical compounds of Noble gases. Organo-metallic compounds of lithium and zinc. Silica, per-acids of phosphorous and sulphur. Inter-halogen compounds.

i) Quantum Numbers, Dual nature of matter, de Broglie equation and its verification Hisenberg's uncertainty principle.

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# B.Sc.(Voc.) in BIOTECHNOLOGY– I$^{st}$ Sem.

## K.A.(P.G.) College, Kasganj

## Subject - Chemistry

## Title – Organic Chemistry-I

## Course – II

**(Max. Marks-20)**

a) Nomenclature of aliphatic compounds-IUIPAC System

b) (i) Hybridization (Sp, $Sp^2$, $Sp^3$)
(ii) Types of Organic reactions and Mechanism, Nucleophilic and Electrophilic reagents, Carbonium, free radicals.

c) **(i) ALKANES:** Mechanism of Helogenation.
**(ii) ALKANES:** Mechanism of addition of halogens, halogen acids and water.
**(iii) ALKANES:** Mechanism of addition of halogens, HCL, HCN, water.
**(iv) ALKYLHALIDES:** Mechanism of substitution and elimination reaction.

d) **(i) Monohydric Alcohols:** Classification, Distinction of primary, Secondary, and tritiary alcohols, mechanism of dehydration.

**(ii) Polyhydric alcohols:** Preparation, properties, structure and user of Ethylen Glycol and Glycerol, Industrial preparation of glycerol. Preparation of glycerol.

**e) STERO CHEMISTRY:** Conformation of ethane and n-butane, Geometrical isomerism of compounds containing one or two similar asymmetric carbon atoms (lactic and Tartaric Acid), Relative and absolute configuration, Resolution and Recemisation (excluding mechanism).

**f) Carbonyl Compounds:** Mechanism of addition reaction of sodium- Bisulphite and Ammonia, Polymerisation of formaldehyde and Aceteldehyde.

g) **(A) Carboxylic Acids:** Structure of Carboxylic group acid, strength of formic. Acetic, Propionic and Chloroacetic acid, Mechanism of esterification.

(B) **Hydroxy Acids:** Preparation, properties and structure of Lactic acid. Tartaric and Citric acid, Tartaric and Citric acid, Distinction of and hydroxyl acids.

(C) **Grignard regents:** Prepartion and synthetic Uses.

**Practical** **(Max. Marks – 25)** – Extract and Isolate in the given Inorganic compound . To Determine Strength of given solution by NaoH using potassium, To determine the Concentration of Acetic Acid. Detection of the elements and functional groups in the given compound. synthesis of Aspirin from salicylic acid.

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**B.Sc.(Voc.) in BIOTECHNOLOGY– II$^{nd}$ Sem.**

**K.A.(P.G.) College, Kasganj**

**Subject:- Biotechnology**

**Title - Cell Biology & Genetics**

**Course – III** **(Max. Marks-20)**

Cell as a basic unit of living systems. The Cell theory Precellular evolution, artificial creation of "cells".

**Broad classification of cell types :** PPLO's Bacteria, Eukaryotic Microbes, Plant and 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 cells in high Altitude, Sediments, Aractic, Hotspring, arid, brackish and fresh water environments.

Bio chemical composition of cells (Proteins, Lipids, Carbohydrates, Nucleic acids and Metabolic pool).

Ultra structure of cell membrane.

Structure and function of cell organales, ultra structure of cell membrane, Cytosole, Golgibodies, Endoplasmic reticulum (Rough and smooth), Ribosomes Cytoskeletal structures (Actin, Microtubules, etc.), Mitochondria, Chloroplasts, Lysosomes, Nucleus (nuclear membrane, nucleoplasm, nucleolus,chromtin).

Cell division and cell cycle (incl. cell synchrony & its applications).

Cell- cell interaction.

Cell locomotion (amoeboid, flagellar & ciliar).

Muscles and nerve cells.

Cell senescence & death.

Cell Differentiation in plants and animals.

-Nature of genetic material, nucleic acids, DNA replication.

Mendelism, low of inheritance, gene interactions.

Sex determination in plants and animals, sex linkage, non disjunction as a proof of chromosomal theory of inheritance.

Linkage, mapping genes, interference, coincidence in pro and eukaryotes.

**Chromosomes:** Chemical composition, structural organization of chromatids, centrosomes, telomeres, Chromatin, Nucleosome, organization, Euchromatin and Heterochromatin, special Chromosomes (Polytene & lamp brush chromosomes), bending pattern in human chromosomes.

Structural & numerical aberrations involving chromosomes, evolution of wheat, cotton& rice, hereditary defects (klinefelter, turner, cri-du-chat & down syndromes).

Mutations: spontaneous and induced, chemical & Physical mutagens, induced mutations in plants, animals and microbes for economics benefit of man.

Basic microbial genetics, Conjugation, Transduction, Transformation, Isolation of Auxotrophs, Replica plating techniques, analysis of mutations in biochemical path ways, one gene one enzyme hypothesis.

Extra chromosomal inheritance, mitochondrial & chloroplast genetic system.

Population genetics: Hardy Weinberg equilibrium, gene and genotype frequencies.

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B.Sc.(Voc.) in BIOTECHNOLOGY– II$^{nd}$ Sem.

K.A.(P.G.) College, Kasganj

**Subject:- Biotechnology**

**Title - Microbiology**

**Course – IV** **(Max. Marks-20)**

Development of Microscopy (Optical, Tem, Sem.).

Pasteures experiments disproving spontaneous generation.

The concept of sterilization. Methods of sterilization (Dry heat, wet heat, radiation, chemical and filtration etc.).

Concept of Microbial species and strains. The various forms of micro organisms PPLO's Cocci, Bacelli and Spirillum.

Genetic Homogenicity in clonal population.

Spontaneous and induced variation arising in microbial population. Gene transfer in micro organisms. Nature of the microbial cell surface, gram positive and gram negative Bacteria. Kind of flagella, serotypes.

Prokaryotic and Eukaryotic Microbial cells. Nutritional classification of micro organisms.

Microbes in extreme environments, the thermopiles against micro organisms.

Symbiosis and antibiosis among microbial population, $N_2$ fixing microbes in agriculture.

Microbial metabolism. Fermentation products. A survey of products from micro organism.

Strain improvement by enrichment, selection and recombinant DNA methods.

Production of Heterologous proteins of interest in micro organisms.

**Practical (Max. Marks-25)** – Cell and cell organales (Golgibodies, endoplasmic reticulam, mitochondria, chloroplast ,nucleus). Permanent slide Preparation for cell division (mitosis and meiosis) Genetics exercise (monohybrid and dihybrid cross). Inheritance of sex-linked genes exercise. To Prepare a bacterial slide using gram's stain. To study the bacteria present in a milk. To determine the total bacterial population in water. Study of bacteria present in curd. To study some common bacteria with help of permanent slides.

**On the Job Training Viva ( Max. Marks - 25)** - One Months Job Training in Pathological lab, Dairy Industries, Baking Industries, Food processing Industries.

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B.Sc.(Voc.) in BIOTECHNOLOGY – II[nd] Sem.

K.A.(P.G.) College, Kasganj

**Subject:- Zoology**

**Title- Lower Non – Chordate & Microbiology**

**Course – III** **(Max. Marks-20)**

(a) Habit, Habitat, Morphology, Anatomy and life history of the following
(i) Taenia (ii) Ancylostoma.

(b) (i) Basic Knowledge of Microscopy, Stains, Staining Procedure.
(ii) Micro-organism, General Characteristics and their systematic position.
(iii) Structure of Prokaryotic cell and their structural variations.

(c) (i) Microbial physiology, Enzuymes, Aerobic and Anaerobic Respiration.
(ii) Elementry Knowledge of Pathogenecity, Virulence, Antigen, Antibodies.
(iii) Microbiology of waters, Sewage, Air and Milk Products,
(iv) Elementry Knowledge of Antibiotics.

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B.Sc.(Voc.) in BIOTECHNOLOGY– II[nd] Sem.

K.A.(P.G.) College, Kasganj

**Subject:- Zoology**

**Title - Higher Non – Chordate & Ecology**

**Course – IV** **(Max. Marks-20)**

(a) Habit, Habitat, Morphology, Anatomy and life history of the following.
(i) Astreas, (ii) Balanoglossus with special reference to its affinities.

(b) (i) Definiation, Scope and branches of Ecology.
(ii) Environment and its factors (Abiotic-Biotic).
(iii) Ecosystem, Food chain and Ecological Niches.

(c) (i) Animal Population, Mortality, Natality, Density and its Growth.
(ii) Animal Community, Structure, Stratification and its growth.
(iii) Pollution its agencies and effects.

**Practical** (Max. Marks – 25) - Graham's staining procedure of microorganism and type of bacteria. Study of Different Ecosystems and food chains .

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B.Sc.(Voc.) in BIOTECHNOLOGY– II$^{nd}$ Sem.

K.A.(P.G.) College, Kasganj

**Subject: CHEMISTRY**

**Title - INORGANIC CHEMISTRY- II**

**Course – III** **(Max. Marks-20)**

(a) Qualitative Analysis of Anions including Interfering radicals (Fluoride, Borate, phosphate and oxalate) and combination of Acid redicals.

(b) Dry taste: Borax boat test, cobalt, Nitrate test Charcoal cavity test.

(c) Theory and chemical principles involving the following types of volumetric analysis: (i) Redox - titrations (A) By external Indicator Method, (B) Iodomtric method, (ii) Precipitations titrations.

(d) IUPAC- Nomenclature of complex compounds.
Werner coordination theory and its electron Interpretation.
Valence- Bond theory of metal Ligand bonding, Isomerism in complex compound, concept of effective atomic Number, Chelation and inner complexes.

(e) Molecular orbital theory of covalent bond, M, energy Level Diagram of following diatomic Molecules; $H_2$, $Li_2$ ,$O_2$ ,$N_2$ ,$F_2$ ,Co and No. Bond order and stability of molecules.

(f) Hydrogen Bonding.

(g) Odd electron Bond.

(h) Electron deficient molecules.
Study of d-block elements with respects of their general characteristics, trends and variation of properties including spectal, magnetic, oxidation states, complex formation Colour and catalytic properties.

(i) General study of Lanthanides with reference to their electronic structure, Oxidation state, Magnetic and spectral properties, Lanthanide contraction, separation of Lanthanides.

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# B.Sc.(Voc.) in BIOTECHNOLOGY– II$^{nd}$ Sem.

## K.A.(P.G.) College, Kasganj

## Subject: CHEMISTRY

## PHYSICAL CHEMISTRY- I

## Course – IV

**(Max. Marks-20)**

(a) Distribution of molecular velocities (Qualitative discussion of Max Bell's distribution law), root mean- square average and most provable velocities collision between molecules, collision frequency and mean free path, kinetic energy of Gas, heat capacities of gases, molecular basis of heat capacity, molecular rotations and vibrations. Real gases, deviations from ideal behaviour, the Bandar Waal's equation, critical behaviour of gases (isotherms of real gases like Co.). Continuity of state, critical constants, principle of corresponding states, limitations of Vander wall equation, Elementary idea of other equations of state (Dieterici, Berthelot, Kammerlingh- onnes equations- derivations).

(b) Definition of terms (System, surroundings, boundry etc.), properties and variables of system. Reversible and irreversible processes, Zeroth and First law of thermodynamics, thermodynamic reversibility and maximum Work Enthalpy of a system – its dependence on variables, Enthalpy change in chemical reactions.

Heat of reaction at constant pressure and constant volume, Variation of heat of reaction with temperature (Kirchhoff's Equation). Standard Enthalpy of formation and bond energy.

Heat capacity at constant volume and constant pressure, Thermodynamic relation between $C_p$ and CV, work done in reversible isothermal and adiabatic expansion of ideal gas, Joule- Thomson effect and Joule- Thomson coefficient. Inversion temperature.

(c) Reaction rate, Molecularity and order of reaction (for elementary and complex reactions) Integrated forms of Zeroth, 1$^{st}$ , 2$^{nd}$,3$^{rd}$ order rate equations and Pseudo unimolcular reactions, Determination of order of reaction, Factors affecting the rate of reaction. Energy of activation, collision theory of bi-molecular gas phasereaction.

**Practical (Max. Marks – 25) -** Mixture Analysis. Detection of Acetic and basic radicals given in Inorganic mixture. To determine the Biochemical oxygen demand of the given water. To Determine the Viscosity of given solution using Ostwald's Viscometer. To determine the surface tension of given solution using Stalgmometer. To determine the molecular weight of the volatile liquid.

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B.Sc.(Voc.) in Biotechnology – IInd Sem.
Syllabus for Three Year Degree Course
K.A.(P.G.) College, Kasganj

**Subject- Foundation Course**
**Qualifying Paper** **(Max. Marks- 40)**
**Content of the Syllabus.**

The syllabus will contain the following subjects.

1. General Knowledge.
2. Indian History.
3. Current Affairs.
4. Computer Awareness.
5. Environmental Study.
6. Indian Culture.

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# B.Sc.(Voc.) in Biotechnology – III[rd] Sem
## Subject:- Biotechnology
## Title - Biophysics
## Course – V

**(Max. Marks -20)**

Energetics of a living body ,Sources of heat limits of temperature. Heat dissipation and conservation.

Lambert –Beer law Spectrophotometry and Colorimetry.

Primary event in Photosynthesis.

Strategies of light reception in microbes, plants and animals

Correction of Vision faults.

Electrical properties of biological compartments.

Electricity as a potential signal

Generation and reception of sonic vibrations . Hearing aides.

Intra –and intermolecular interactions in biological system. Spatial and charge compatibility as determinant of such interactions.

Physical method applied to find out molecular structures :

X-ray crystallography and NMR

General Spectroscopy –UV-vis fluorescence, atomic absorption ,IR spectra.

Physical method of imaging intact biological structures :

- Ultrasound
- Optical Filters
- X-ray
- CAT scan
- ECG
- NMR imaging.

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# B.Sc.(Voc.) in Biotechnology – III[rd] Sem

## Subject:- Biotechnology

## Title – Molecular Biology

## Course – VI

**(Max. Marks -20)**

Molecular basic of life.

Structure of DNA.

DNA replication both prokaryotes and eukaryotes.

DNA recombination molecular mechanisms prokaryotic and eukaryotic.

Insertion elements and transposons.

Structure of prokaryotic genes.

Prokaryotic transcripton.

Prokaryotic translation.

Prokaryotic gene expressions (lac, his, trp, catabolic repression)

Structure of eukaryotic genes.

Eukaryotic transcription.

Eukaryotic translation.

Eukaryotic gene expression transcription factors etc.

Gene expression in yeast.

Gene expression in protozoan parasites.

Gene organization and expression in mitochondria chloroplasts

Post translation regulation of gene expression

Development and environmental regulation of gene expression.

**Practical (Max. Marks – 25) –** Lambert – beer law spectrophotometry , process of photosynthesis, X- ray crystallography. Experiments of bacteriophase infection , RNA is the genetic materials, Double helix model of DNA, Semi- conservative model of DNA replication. The Lac- operon model.

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# B.Sc.(Voc.) in Biotechnology – III[rd] Sem

## Subject:- Zoology

## Title - Chordate Type

## Course – V

**(Max. Marks -20)**

(a) Habit ,Habitat, Morphology, Anatomy and Systematic position of the following

(i) Herdmania (ii) Branchiostoma

(b) Habit ,Habitat, Morphology, Anatomy and Systematic position of Scoliodon.

(c) (i) General Characteristics Of Chordata And Outline Classification Upto Order

(ii) Poisonous And Nonpoisonous Snake, Biting Mechanism Of Snakes

(iii) Adaptation In Bird

(iv) Migration Of Bird.

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# B.Sc.(Voc.) in Biotechnology– III$^{rd}$ Sem

## Subject:-Zoology

## Title - Evoluation and Embryology

## Course – VI

**(Max. Marks -20)**

(a) (i) Evidences of organic Evolution.
(ii) Theories Of Organic Evolution.

(b) (i) Outlines Of Zoogeography Including Zoogeographical Realms And Fauna Of Oriental And Australian Regions.

(ii) Palaentology – formation of fossils and type of fossils.

(c) (i) Embryology of Herdmania.
(ii) Embryology of Branchiostoma.
(iii) Chick Embryology up to primitive streak, Foetal Membrances.
(iv) Placentation in mammals.

**Practical (Max. Marks – 25)** – Identification and Comments of the Specimen of different chordate groups. – Development of Chick :- (i) Chick Embryo – whole mount 4 hours of Incubation. (ii) Chick Embryo – whole mount 16 hours of Incubation . Study from the Permanent slide.

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# B.Sc.(Voc.) in Biotechnology – III[rd] Sem
## Subject:- Chemistry
## Title – Organic Chemistry -II
## Course – V

**(Max. Marks -20)**

a) **Reactive Methylene Compounds :** Preparation And synthetic uses of diethyl malonate and ethylacetoacetat.

b) **(i) AMINES** : Distinction and separation of primary ,secondary and tertiary amines ,Basic character of amines.

(ii) Nitroalkanes and alkylnitrites, alkylcyanides and isocyanides, their preparation and distinction .

c) **Carbohydrates :** Classification ,preparation, properties and structure of glucose and fructose (open chain and cycle ), their configurations and ring size, mechanism of osazene formation ,inter conversions of glucose and fructose ,Ascent and desent in sugars (Kilant's and ruff's reactions)

d) **Aromatic Hydrocarbons** : structure of benzene including orbital concept.
Aromaticly , huckel's rule mechanism of eletrophilic substitution
(halogenations, nitration, sulphontion ,alkylation and acylation)

Orientation of distrustited benzene derivatives, Directive influence of groups.

**Aromatic Nito compound** : Prepration and reaction of nitrobenzene, m-disnitrobenzene and trinitrotoluenes ,Reduction of Nitrobenzene.

e) (A) **Aromatic amines :** Prepration and reaction of analine. Toluidine, benzylamine dimethylaniline and their basic character.

(B) **Diozonium compounds:** Diazotisation ,preparation and synthetic applications of benzene diazonium chloride, coupling reaction.

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## B.Sc.(Voc.) in Biotechnology – III$^{rd}$ Sem
## Subject:- Chemistry
## Title – Physical Chemistry -II
## Course – VI

**(Max. Marks -20)**

(a) **(i) Colloids :** Electrical properties of colloids, Origin of change on colloids, concept of ionic – double layer and Zeta potential and stability of colloids, Micells, macro molecules and their molecular weights, determination of molecular weights of macro molecules by osmometry, Viscosity and light- scattering methods.

(ii) Nernst's distribution law and its limitation, modification of distribution law under different conditions and its applications to association, dissociation and extraction.

(b) **Solid State :** Crystalline and amorphous substancs, isotropy, anisetropy, Elements of symmetry, Crystal system, law of constancy of interfacial angles, wiells and Miller indices, law of rational indices.

Diffraction of x- rays from crystal, Bragg's equation, x – rays examination of crystals by : (i) Bragg's method , (ii) Rotating method , (iii) Powder method.

Crystal structure of Kcl, Nacl, diamond and graphite.

(c) **Thermodynamics:** Spontaneous processes and second law of thermodynamics the carnot cycle. The efficiency of heat engine , concept of entropy, entropy change in isolated systems in ideal gases and in face transitions. Dipendence of entropy of variables.

Entropy Change in chemical reaction, free energy and work function, change in free energy and work function with temperature and pressure, change in free energy in irreversible and reversible processes. Gibbs Helmholtz equation.

(d) **Electrical conductance :** Specific, Equivalent and molecular conductances and effect of dilution on them, experimental determination of cunductances, cunducatances ratio, migration of ions and ionic mobility. Transference number, determination of transference number (Hittor for method, moving boundry method and E.M.F. method.)

Kohlrausch law of independent migration of ions and its applications, determination of absolute velocity of ions, solubility of sparingly solublesalts. Ionic product of water, Equivalent conductance of infinite dilution of weak electrolytes. Relation between ionic conductance and ionic mobility/ conductmetric titrations.

**Practical (Max. Marks – 25)** – Analysis the given organic mixture. Detection the elemental and functional groups in a given organic mixture. To differentiate reducing and non-reducing sugar. To determine the viscosity of the given organic liquid (benzene) with the help of Ostwald's viscometer. To determine the surface tension of the given organic liquid (benzene) with the help of stalgmometer. To find out the percentage composition of the given liquid mixture containing two constituents alcohol and water by stalgmometer.

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# B.Sc.(Voc.) in BIOTECHNOLOGY – IV$^{th}$ Sem.

## K.A.(P.G.) College, Kasganj

### Subject:- Biotechnology

### Title- Immunology & Animal cell culture

### Course – VII (Max. Marks-20)

## IMMUNOLOGY

The immune system and immunity along with perspective antigen, antibody and their structure.
The organs and the cells of the immune system and their functions, antigen, antibody interaction.
Humeral and cell medicated immunity (role of MHC and genetic restriction).
Origin of diversity in the immune system.
Effecter mechanism.
Immunity to infectious diseases, vaccines.

## ANIMAL CELL CULTURE

History of development of cell cultures.
The natural surroundings of animal cells.
Metabolic capacities of animal cells.
Simulating natural condition for growing animal cells.
Importance of growth factors of the serum.
Primary cultures: 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 characteristics.
Growth kinetics of cells in culture.
Applications of animal cell culture for studies on gene expression.

**Organ Culture:** Transfection of animal cells, selectable markers, HAT selection, anti biotic resistance etc.
Cell fusion.
Transplantation of cultured cells.
Differentiation of cells.

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# B.Sc.(Voc.) in BIOTECHNOLOGY – IV$^{th}$ Sem.

## K.A.(P.G.) College, Kasganj

**Subject:- Biotechnology**

**Title- Recombination DNA Technology**

**Course – VIII** **(Max. Marks-20)**

What is gene cloning and why do we need to clone a gene?

Tools and techniques, plasmids and other vehicles, genomic DNA, RNA, cDNA, RT enzymes and other reagents, techniques, laboratory requirement.

Safety measures and regulations for recombinant DNA works, choice and selection of the tools and techniques.

## Vehicles:

Phasmids and Bacteriophages available Phagemids, Cosmids, Viruses.

Purification of DNA from bacterial, plant and animal cells.

Manipulation of purified DNA.

Introduction of DNA into living cells.

Cloning vectors for E-coli.

Cloning vectors for organisms other then E-coli, Yeast, Fungi, Plants, Agrobacterium, plant virus & animal viruses.

Application of cloning in gene analysis.

How to obtain a clone of a specific gene.

Studying gene expression.

Gene cloning and expression of foreign DNA (clone gene) in research and biotechnology.

Production of protein from cloned gene.

Gene cloning in medicine.

Pharmaceutical compounds.

Artificial insulin gene.

Recombinant vaccine.

Diagnostic reagent.

**Practical (Max. Marks – 25)** – Antigen and antibody Interaction. Organ and cell of Immune system, Blood test. Study of bacteriophage, purification of DNA from plant . Gene Cloning method.

**On the Job Training Viva ( Max. Marks - 25)** - Visit to a Research lab, Fertilizer Industries for Training purpose.

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B.Sc.(Voc.) in BIOTECHNOLOGY – IV$^{th}$ Sem.

K.A.(P.G.) College, Kasganj

**Subject:- Zoology**

**Title- Comprative Anatomy**

**Course – VII** **(Max. Marks-20)**

(a) (i) Integument and its derivatives.
(ii) Digestive System (Alimetary Canal).
(iii) Circulatory System (Heart & Aortic arches).

(b) (i) Skeletal System.
(ii) Respiratory System.
(iii) Urinogenital System.
(iv) Nervous System (the Brain).

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# B.Sc.(Voc.) in BIOTECHNOLOGY – IV$^{th}$ Sem.

## K.A.(P.G.) College, Kasganj

## Subject:- Zoology

## Title - Physiology

## Course – VIII

**(Max. Marks-20)**

(a) (i) Physiology of Digestion, Classes of Food, Digestive Enzymes & Hormones. Energy requirement Basal Metabolic Rate (BMR).
(ii) Physiology of Excretion, working of kidney, Nitrogenous Metabolism. Excretion of Ammonia, Urea, Uric acid and clearance test.
(iii) Celluler respiration and exception.

(b) (i) Physiology of Circulation, Blood Composition & Function, Coagulation of Blood & Heart beat.
(ii) Physiology of respiration, Gaseous Exchange, Transport of Gases, Glycolysis and Kreb's Cycles.
(iii) Basic Knowledge of Endocrine Glands.

**Practical (Max. Marks – 25)** – Comparative study of skin of Frog and mammals, Reptile and Aves. Physiology experiment – Qualitative Estimation of Protein, Carbohydrate and Lipid.

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# B.Sc.(Voc.) in BIOTECHNOLOGY – IV$^{th}$ Sem.

## K.A.(P.G.) College, Kasganj

## Subject:- Chemistry

## Title- Inorganic Chemistry- III

## Course – VII

**(Max. Marks-20)**

(a) (i) Extraction and Isolation of following elements : Titanium, Vanadium, Chromium, Nickel, Platinum and Gold (outlines only).

(ii) Preparation, properties and use of following compounds : Oxides of Titanium potassium dichromate, hexa-cyanoferrate .(II) and (III) Prussian blue, Chloroplatinic acid and purples of Cassius.

(b) (i) Chemistry of Gravimetric estimation of Ag, Ba, and pb.
Supersaturation Co-precipitation and post precipitation.

(ii) Analytical application of Ceric salt, potassium bromated, Potassium Io-date and EDTA.

(c) Metallic Bond: Free electron theory, Resonance and band theory matallic bonding and their correlation with metallic-properties such as metallic luster, malleability, ductility, Electrical and thermal conductivity,
Semi conductors, Crystal defect, Non-stoichiometric compounds.

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# B.Sc.(Voc.) in BIOTECHNOLOGY – IV$^{th}$ Sem.

## K.A.(P.G.) College, Kasganj

## Subject:- Chemistry

## Title- Organic Chemistry- III

## Course – VIII

**(Max. Marks-20)**

(a) **(i) Aromatic Acids:** Preparation and reactions of benzoic acid, Pthalic acid, salicylic acid and Cinnamic acid.

**(ii) Sulphonic Acids:** Aromatic Sulphonic acids of Benzene and toluene. Saccharine and Chloramine -T.

**(b)** **(i) Phenols and Aromatic Alcohols:** Acidic character preparation and reaction of phenol, resorcinol, quinol, pyrogallor, Benzyl alcohol.

(ii) Aromatic Carbonil compounds: preparation and reaction of benzaldehyde, Selicyleldehyde acctophenone benzophenone, P-benzoquinone.

(c) (i) Five and Six membered heterocyclic compounds preparation and reaction of furan, Pyrrole, Thiophene, preparation, reaction basicity and structure of pyridine.

(ii) Condensed six membered heterocyclic compounds, preparation, reaction and structure of quinoline and isoquinoline.

(d) **(i) Polynuclear Hydrocarbons:** Preparation, reaction and structure of Napthaline, Napthaline derivatives: , Naphthols and Naphthylamines.

**(ii) Cyloperaffins:** Nomenclature properties of alicyclic compounds, Baeyer's strain theory, theory of strainless rings, conformation of cyclohexane and decalin.

**Practical (Max. Marks – 25)** – To Isolate and extract the elements in the given Inorganic mixture. To Prepare Tetramine cupric sulphate. To Prepare Nickel-dimethylglyoxime. Detection of elements and functional group in a given organic mixture. Synthesized and characterized of Iodeform. To synthesize benzoic acid from benzyl chloride.

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**B.Sc.(Voc.) in BIOTECHNOLOGY – V$^{th}$ Sem.**

**K.A.(P.G.) College, Kasganj**

**Subject:- Biotechnology**

**Title- Animal Cell & Plant Biotechnology**

**Course – IX** **(Max. Marks-20)**

General metabolism.

Special Secondary Metabolites/Products(Insulin, Growth hormone, Interferon, t-plasminogen, Activator, factor VIII etc).

Expressing cloned protein in animal cells. Over production and processing of chosen protein.

The need to express in animal cells.

Production of vaccines in animal cells.

Production of monoclonal antibodies.

Growth factors promoting proliferation of animal cells (EGF, FGF, PDGF,IL-1,IL-2, NGF, Erythropoietin etc.)

Bioreactors for large scale culture of cells.

Transplanting cultured cells.

Introduction to in vitro methods. Terms and definitions. Use of growth regulators.

Beginning of in vitro cultures in our country (ovary and ovule culture, in vitro pollination and Fertilization).

Embryo culture, embryo rescue after wide hybridization and its applications.

Introduction to the processes of embryogenesis and organogenesis and their practical applications clonal multiplication of elite species.

Micropropagation auxillary bud, shoot-tip and meristem culture.

Haploids and their applications. Somaclonal variations and applications (Treasure your captions).

Endosperm culture and production of triploids.

Practical application of tissue and organ culture (summarizing the practical applications of all the above mentioned techniques).

Single-cell Suspension cultures and their applications in selection of variants/mutants with or without mutagen treatment (of haploid cultures preferably).

Introduction to protoplast isolation: principles and applications.

Testing of viability of isolated protoplasts.

Various steps in the regeneration of protoplasts.

Somatic hybridization- an introduction.

Various methods for fusing protoplasts. Chemical, electrical.

Use of markers for selection of hybrid cells.

Practical applications of somatic hybridization (hybrids vs cybrids).

Use of plant cell, protoplasts and tissue culture for genetic manipulation of plants. Introduction to A. Tumefaciens.

Tumor formation on plants using A. tumefaciens (Monocots vs Dicots).

Root- formation using A. rhizogenes.

Practical application of genetic transformation.

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**B.Sc.(Voc.) in BIOTECHNOLOGY – V$^{th}$ Sem.**
**K.A.(P.G.) College, Kasganj**
**Subject:- Biotechnology**
**Title- Environmental Biotechnology**
**Course – X** **(Max. Marks-20)**

Renewable and Non-renewable Resources.
What is renewable should be Bioassimilable / biodegradable.
Major consumer items : Food, fuel and fibres.
Conventional fuels and their environmental impacts:

- Firewood
- Plant and animal wastes
- Coal
- Gas
- Animal oils

Modern fuels and their Environmental; impacts:

- Methogenic bacteria and biogas
- Microbial hydrogen production
- Conversion of sugars to ethanol. The gasohol experiment
- Solar energy converters- Hopes from the photosynthetic pigments.
- Plant based petroleum industry?
- Cellulose degradation for combustible fuel.

Biotechnological inputs in producing good quality natural fibres.

Transgenic sheep and transgenic plants.

Microbiological quality of food and water.

Treatment of municipal waste and industrial effluents.

Degradation of pesticides and other toxic chemicals by microorganism.

Thuringiensis toxin as a natural pesticide.

Biological control of other insects swarming the agriculture fields.

Enrichment of ores by microorganism.

Bio fertilizers, Nitrogen fixing microorganinsms enrich the soil with assimilable nitrogen.

**Practical(Max. Marks – 25)** – Callus tissue culture, methodology of tissue culture. Isolation of protoplast from different tissues. Study of ovule culture, Embryo culture. Meristem culture. Biological control of pests, Nitrogen cycle , Microbial study of water and food. Biogas production.

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**B.Sc.(Voc.) in BIOTECHNOLOGY – V$^{th}$ Sem.**

**K.A.(P.G.) College, Kasganj**

**Subject:- Zoology**

**Title – Cytogenetics - I**

**Course – IX** **(Max. Marks-20)**

(a) Ultra structure of animal cell & a brief account of structure and function of the following Organales.

(i) Plasma membrane, (ii) Endoplasmic reticulum,
(iii) Mitochondria, (iv) Golgi bodies,
(v) Lysosomes, (vi) Ribosomes,
(vii) Centrioles and centrosomes.

(b) (i) Structure and function of Nucleic acids (DNA& RNA).
(ii) Structure and function of Chromosomes.
(iii) Special type of Chromosomes.
(iv) Genetic Code.
(v) Protein Synthesis.

(c) (i) Cell division (Mitosis & Meiosis).
(ii) Carcinogenesis & Radiation effects.

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## B.Sc.(Voc.) in BIOTECHNOLOGY – V$^{th}$ Sem.
## K.A.(P.G.) College, Kasganj
## Subject:- Zoology
## Title – Economic & Applied Zoology - I
## Course – X (Max. Marks-20)

(a) Morphology, Pathogenecity & Preventive measures of parasites of Domestic Animals.
(b) Morphology, Pathogenecity & Preventive measures of Human Parasites.
(c) General morphology and Anatomy of Cyprinid fish.

**Practical (Max. Marks – 25)** – To study the different stages of Mitosis in root tip of onion. To study the different of Mitosis in onion flower. External characters, Pathogenecity & Preventive measures of Parasites of domestic animals (Ticks or Mites).
External Characters, Pathogenecity & Preventive measures of Human Parasites ( Taenia solium or Trypanosoma or Fasciola hepatica).

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## B.Sc.(Voc.) in BIOTECHNOLOGY – V$^{th}$ Sem.
## K.A.(P.G.) College, Kasganj
## Subject:- Chemistry
## Title – Inorganic Chemistry- IV
## Course – IX (Max. Marks-20)

(a) (i) Extraction and Isolations of Th. And U.
(ii) Carboranes, Borazines, Zeolites and other silicates, Pseudohalgones and polyhalides.

(b) (i) Modern concept of acid and base including hard and soft acides & bases.
SHAB principle. Principle of Solvation and Solvolysis.
(ii) Chemistry of Non- Aqueous solvents, study of reaction in Liquid sulphur oxide and Liquid ammonia.

(c) (i) **Actinides:** Electronic Configuration, Oxidation state spectral and magnetic properties and Complex formation, comparission with lamthanides.
(ii) Organic Reagents as spot reagents in Inorganic Analysis.

(d) **Nuclear Chemistry :** Mass defect and Binding Energy, packing fraction, Nuclear reaction, Practical applications of Nuclear Fission and Nuclear Fusion.
Stability of Nucleus application of Radio Active and Non- Radioactive isotopes in chemistry, medicine, Agriculture and Industry.

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## B.Sc.(Voc.) in BIOTECHNOLOGY – V$^{th}$ Sem.
## K.A.(P.G.) College, Kasganj
## Subject:- Chemistry
## Title – Physical Chemistry- III
## Course – X (Max. Marks-20)

(a) **Ionic Equilibria** : Ostwald dilution law, Ionization constant of weak acid and weak bases. Experimental determination of ionization constants. Ionic product of water PH and P Buffer solution (Henderson's Education). Indicators, Choice of indicators and theories of acid-base indicators.

Bronsted concept of acids and bases, solubility product and its applications to qualitative and quantitative systems. Salt hydrolysis, Relation between degree of hydrolysis, Relation between degree and hydrolysis and hydrolysis constants and also relation between hydrolysis constants and ionization constants of acids and bases in different types of salts.

(b) Limitations of dilution law. The inter-ionic attraction theory (qualitative treatment). Distinction between activity and concentration, qualitative introduction to the concept of activity and activity coefficients of strong electrolytes, lonic strength.
Viscosity, surface tension ,dipole moment, refractive index, the experimental.
Determination and application of these properties to chemical constitution.

(c) Statement of phase rule, definitions and meaning of terms involved. Application of phase rule to one component systems (Water, carbondioxide and sulphur systems) and two component system involving simple eutectics: Lead – Silver, Zinc – Cadmium, KI – Water systems.

(d) Thermodynamic criteria of Equilibrium, partial molor quantites, Chemical potential, derivation of law of mass action and Raoult's law. Vant- half reaction isotherm and isochore. Clapeyrom- clausius equation and its application evulliscopic and crysocopic contants.

**Practical (Max. Marks – 25)** – To Detect and measure Radioactivity of a given sample. To Determine the difference in Penetrating power b/w different ratio active particle. To Prepare Borazine from Amonium Sulphate and Borahydride. To Find out the Tranisition Termprature $SrBr_2 . 2H_2O$ by dilactometer method. To Determine PH of the given solution.

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# B.Sc.(Voc.) in BIOTECHNOLOGY– VI$^{th}$ Sem.

## K.A.(P.G.) College, Kasganj

## Subject:- Zoology

## Title – Cytogenetics II

## Course – XI

**(Max. Marks-20)**

(a) (i) Mendal's law, (ii) Linkage & Crossing over. (iii) Sex Determination.

(iv) Sex Linked inheritance.

(b) (i) Charomosomes aberration & Mutation.

(ii) Inborn Diseases In Man.

(iii) Cytoplasmic inheritance.

(iv) Eugenics and Euthenics.

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# B.Sc.(Voc.) in BIOTECHNOLOGY– VI$^{th}$ Sem.
## K.A.(P.G.) College, Kasganj
## Subject:- Zoology
## Title – Economic and Applied Zoology II
## Course – XII (Max. Marks-20)

(a) (i) Pisciculture Fundamentals.
(ii) Molluscan fisheries and Pearl Culture.

(b) (i) General Morphology and Anatomy of Grasshopper.
(ii) Elementary Knowledge of beneficial insects and their culture Apiculture. Sericulture, Lac-culture.
(iii) Elementary Knowledge of harmful insects and their control.

(c) (i) Habit, Habitat and behavior of wild Animals.
(ii) Ecological importance of wild life. Endangered species and their protection.
(iii) Management of sanctuaries, Zoos and National Parks, Ecological Hazards and Economic Values.

**Practical (Max. Marks – 25)** – Study of Different stages of cell Division form Permanent slide of Mitosis or Meiosis. Life History of Honey bee or Lac Insect. Different type of edible fishes of India.

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# B.Sc.(Voc.) in BIOTECHNOLOGY– VI$^{th}$ Sem.
## K.A.(P.G.) College, Kasganj
## Subject:- CHEMISTRY
## Title – ORGANIC CHEMISTRY - IV
## Course – XI (Max. Marks-20)

**(a) (i) Amino acids and proteins:-** Synthesis and Properties and of Amino acids Zwitterions and Isoelectric points. Peptides and peptide linkage. General characteristics classification and importance of proteins, relation of proteins with amino acids.

**(ii) Carbohydrates:** Disaccharides: Industrial Preparation, reaction and structure of sucrose, polysaccharides: preparation, reactions and uses of starch and cellulose.
**(b) (i) Drugs:** Preparation and uses of the following.
**(a) Anteseptic:** H-hexyl resorcienol, chloramiime-T.
**(b) Ananlgesic and Antipyretics:** Aspirin, paracetamol,
**(c)** Sulpha drugs sulphanilamide, sulphadiazine.
**(d)** Insecticides and pesticides: DDT, BHC.
**(ii)** Basic Principles and applications of the following Techniques.
**(a) chromatography:** column; Thin layer and paper.
**(b)** Ion Exchange.
**(c)** solvent extraction.
**(c) (i)** Dyes Classification according to their application, simple theories of colour and constitution. Preparation and use of : Azodyes. Methyl orange, congo Red triphenylmethane dyes: malachito green, pararosaniline, phthalein dyes : Phenylphalcin, flurorescoin.
**(ii) Polymers:** Mechanism and General treatment of attraction and condensation Polymerisation: synthesis and uses of: polyethylene, Teflon, polystyrene, polyvinyl chloride, nylon and terelene.

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# B.Sc.(Voc.) in BIOTECHNOLOGY– VI$^{th}$ Sem.
# K.A.(P.G.) College, Kasganj
## Subject:- CHEMISTRY
## Title – PHYSICAL CHEMISTRY - IV
## Course – XII

**(Max. Marks-20)**

(a) **Photo Chemistry:** Laws of photo chemistry (Grotthus - Draper, Lambert, Beer and Stark- Einstein, Quantam Yield (Reason for low and high yield), Experimental, determination of quantam yield. Photo chemical kinetics of Hydrogen- chlorine and Dimerisation of Anthracene.

Phosphorescence, Chemilumnescence and Fluorescence.

(b) Basic Principle of Quantam theory, Postulates of quantam. Mechanics, Schrodinger wave eqation, physical interpretation of wave function( Nature of significance of psi), Elementary idea of operators, normalization of wave function, solution of schrodinger wave equation for (i) The free practical, (ii) practical in one dimensional box, and three dimensional box.

(c) Chemical and Galvanic cells, cell reaction, Reversible and irreversible cells, E.M.F. and its measurement, E.M.F. of a cell and free energy change, single electrode potentials, effect of concentration on electrode potential, Nernst equation (no derivation) Types of electrode – Metal- metal – ion, hydrogen, calomel and glass electordes, Concentration cells with or without transference. Liquid junction potential. Application of e.m.f. measurement: determination of $P_h$ ionic product of water and solubility of sparingly soluble salts. Potentiometric titrations.

(d) **(i) Adsorption:** Molar heat of adsorption, physical adsorption and Chemisorption, freundlich adsorption isotherm and Languir adsorption isotherm.

**(ii) Surface reaction:** Kinetics of surface reaction (unimolecular and bimolecular surface reaction) Reaction in hibition, temperature dependence of surface reaction.

**Practical (Max. Marks – 25)** - Synthesis of Aspirin form salicylic Acid. Preparation of Osazone formation. Seperation and Identification of Amino Acid. To Determine the surface tension of given solution using stalgmometer. Conductometric titration of an unknown solution using a standard base solution.

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# B.Sc.(Voc.) in BIOTECHNOLOGY– VI$^{th}$ Sem.
# K.A.(P.G.) College, Kasganj

**Subject:- Biotechnology**

**Project Viva – Voce (Max. Marks- 50)** – Prepare to Project choice any one topic - Recombinant DNA Technology, Gene cloning , Vector, Vaccine Production, Protein synthesis ,Immune System, Transgenic Animals , Transgenic Plant .

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