



**Year 2017**

# **Ordinance & Syllabus- B.Sc.(H) Biomedical Science**





### **ORDINANCE**

- A. There shall be B.Sc. (Hons) in Biomedical Science offered by the Department of Biomedical Science at Institute of Biomedical Sciences of the University.
- B. The courses shall run on regular basis.
- C. Subject to overall control of the Academic Council of University, B.Sc. (Hons) Biomedical Sciences in the Department will be administered by a course committee consisting of Director of Institute (Chairman), course coordinators and all the members of the department.

This committee shall

- ✓ Invite, scrutinize applications and make admissions to the B.Sc. courses
- ✓ Design courses and prepare syllabi for the same.
- ✓ Organize lectures, Seminars and supervise the dissertation work.
- ✓ Constitute of Board of Studies for the department.
- ✓ Arrange and conduct theory and practical examination, including seminars, tests, viva-voce etc as per Board of Studies (BoS) guidelines.

### **Duration of the course**

The duration of B.Sc. (Hons) Programme in Biomedical Science will be of 03 calendar years.

### **Procedure for admission**

- 1) The students shall be admitted to B.Sc. (Hons) programme on the basis of direct admission (DA) merit list prepared according to weightages and reservations given as per the University/ State Government rules/norms.
- 2) The direct admission (DA) applications shall be invited by the University through wide notification in news papers and the website.
- 3) A candidate will be eligible for admission if he / she have passed intermediate science with biology or equivalent examination with 45% marks.

### **Normal Intake**

The maximum intake for B.Sc. (Hons) Biomedical Sciences in Biomedical Sciences will be sixty (60). However, the University may modify the normal intake as per needs. Statutory reservation, as applicable, shall be given as per University/ State Government rules/norms.

### **Medium of Instruction**

Medium of instruction and examination shall be English.

### **Method of teaching**

Method of teaching in the academic programme will consist of class lectures by the regular faculty of the department, faculty members from other departments of the University and visiting/guest faculty from other academic Institutions. Seminars, training in other Institutions,



project works shall be essential component of the curriculum. Quality study materials will also be supplied besides computer aided instruction and audio-visual teaching methods. Educational tours to various academic and research institutions shall be organized once in every academic year.

### **Attendance**

Minimum attendance required being eligible to appear in the internal assessments & semester examination for each paper shall be as following:

- (a) *First Internal Assessment:* 45% of all class lectures (Theory and Practical both).
- (b) *Second Internal Assessment:* 55% of all class lectures (Theory and Practical both).
- (c) *Third Internal Assessment:* 65% of all class lectures (Theory and Practical both).
- (d) *Final Annual Examination:* 75% of all class lectures (Theory and Practical both).

In case a student is short of attendance due to illness, participation in sports, extracurricular activities etc the following rules shall be applied.

- A shortage of attendance up to 10% can be condoned by the Head/Coordinator on the specific recommendation of the subject teacher.
- A shortage of attendance up to 25% can be condoned by the Hon'ble Vice Chancellor on medical grounds on the specific recommendations of Head/Coordinator.
- Students shall be allowed to go for training for a specific time period at various research institutions all over India with due permission from the Head/Coordinator. The training period duly certified by the HOD/Director of the concerned Institution (where training was done) shall be considered as normal attendance of the student. Students who will be willing to go for training during summer/winter holidays will have to take prior written permission from the Head/Coordinator to join the training where they are allowed.
- Students who are unable to obtain the minimum attendance after considering all the above clauses will have to re-register for that particular paper in which they are short of the minimum required attendance as and when the paper is offered by the department.

### **Examination**

B.Sc. (Hons) programme in Biomedical Science will have following examinations.

#### **Theory Examinations**

##### **(a) Annual Examinations**

They shall be conducted by the University as per the academic calendar of the department. The question paper will be set by examiners appointed by the Hon'ble Vice-Chancellor on the basis of recommendation of the board of studies. The pattern of the question paper shall be decided by the University. The weightage of this examination will be 70%. The duration of each theory exam will be 03 hours.

##### **(b) Sessionals (Internal assessment)**



Sessional examinations shall be conducted by the department on regular intervals during the whole session. The number of sessional examination to be conducted per session and policy for averaging the marks, providing grace marks shall be decided by the Departmental Committee (DC) including all teachers of the department. The weightage of this examination will be 30 % (30 marks out of 100) of each paper. Out of 30 marks, each sessional examination will be conducted for 15 marks only. Remaining 15 marks shall be trifurcated in 5-5 marks each for a) class seminar b) Group Discussion (GD) and c) Punctuality Discipline and Sincerity (PDS) of the student. The question paper pattern of the sessional examination shall be MCQ type/as decided by the DC/university.

### **Practical Examinations**

Practical examination will be conducted in those papers, where it is given in the course structure. The examiners for the same will be appointed by the Hon'ble VC on the basis of recommendations of the board of studies. The maximum marks for each practical examination will be 100 marks.

### **Maximum marks**

Maximum marks for each theory and practical paper of B.Sc. will be 100 marks.

**Minimum passing marks:** 40% of each theory and practical papers and project work. It will be required to obtain minimum 40% marks in each theory (annual, sessional and practical paper separately) to promote to the subsequent year.

### **Back Paper Examination and Improvement**

The student shall be required to pass at least 02 theory papers out of 04 and a practical examination for promotion to subsequent year. In case a candidate fails to pass two theory papers and all practical examination he/she will be declared failed and will have to reappear with subsequent annual examination as ex-student. Students having back paper in one or two papers may appear in back paper examination in subsequent annual examination. The candidate may also be allowed to improve his/her marks in maximum 02 papers of previous years, the examinations of which shall be conducted along with subsequent annual examination.

A student will have to clear all the papers by the end of the final year in order to be eligible for the award of the relevant degree by the university. The maximum time allowed for passing all paper required for the award of degree shall be double time of the duration of the course i.e. 06 years. In case students are unable to clear all the papers by the end of the last year, he/she may be allowed to reappear in subsequent examinations, as an ex student, without undergoing a repeat of the regular academic program.

A special back paper examination may also be conducted for such students. The date of such examinations will be decided by the V.C. on the recommendations of Head/Coordinator of the department.



### **Results and Divisions for theory, practical**

A student shall be declared passed if he secures the minimum passing marks in all theory and practical examination separately. The aggregate marks obtained will be counted for the award of divisions.

- (a) *Second Division:* 50% or more but less than 60%
- (b) *First Division:* 60% or more but less than 75%
- (c) *Distinction:* (75% or above)

### **Practical/Summer training**

Student may undergo practical/summer training during the months of June and July. However, these trainings will not be a part of curriculum. The student should submit a report duly signed by the supervisor from the industry/institution in which he/she has undertaken the training.

### **Final award of division's degree**

The students will be declared passed in a particular division after considering the average of marks obtained in all theory, practical examinations and project work.

### **Discontinuation**

A candidate who has discontinued the academic programme during any year with permission from Head/Coordinator will be permitted by the Hon'ble Vice- Chancellor to take readmission in the academic programme at the beginning of the year concerned, in a subsequent year, however not beyond a gap of 06 years. Fee once paid shall not be refunded or adjusted during subsequent admission.

**Fees:** The course fees and examination fee shall be decided by the University from time to time and have to be deposited by the candidate, as and when asked for.

**Academic collaboration:** The academic programme may be conducted in collaboration with any other Institutes where necessary facilities are available.

### **Amendment of rules**

The above rules are subjected to change by appropriate authorities of the University from time to time, as and when deemed necessary.

### **Revision of course structure**

If needed the course structure may be altered or updated by the Board of Studies, or a committee appointed by the hon'ble Vice Chancellor for the same.

### **Award of Degree**

On completion of all academic requirements and on the recommendations of Head/Coordinator, the University shall award degree to the student.



**COURSE CURRICULUM  
B.Sc.(H) Biomedical Science**

**I year**

| <b>Paper no.</b> | <b>Paper code</b> | <b>Paper title</b>                            | <b>Max. Marks</b> |
|------------------|-------------------|---|-------------------|
| Paper-I          | BBMS-101/1211     | General Biology                               | 100               |
| Paper-II         | BBMS-102/1212     | Cell Biology                                  | 100               |
| Paper-III        | BBMS-103/1213     | Basic Chemistry                               | 100               |
| Paper-IV         | BBMS-104/1214     | Biochemistry                                  | 100               |
| Paper-V          | BBMS-105/10215    | Practical-I (General Biology & Cell Biology)  | 100               |
| Paper-VI         | BBMS-106/10216    | Practical-II (Basic Chemistry & Biochemistry) | 100               |

**Max. Marks- 600**

**II Year**

| <b>Paper no.</b> | <b>Paper code</b> | <b>Paper title</b>  | <b>Max. Marks</b> |
|------------------|-------------------|---|-------------------|
| Paper-VII        | BBMS-201/2211     | Medical Microbiology  | 100               |
| Paper-VIII       | BBMS-202/2212     | Medical Biochemistry  | 100               |
| Paper-IX         | BBMS-203/2213     | Biochemical Techniques  | 100               |
| Paper-X          | BBMS-204/2214     | Organic Chemistry   | 100               |
| Paper-XI         | BBMS-205/20215    | Practical-III (Medical Microbiology and Medical Biochemistry) | 100               |
| Paper-XII        | BBMS-206/20216    | Practical-IV (Biochemical Techniques and Organic Chemistry)   | 100               |

**Max. Marks- 600**

**III Year**

| <b>Paper no.</b> | <b>Paper code</b> | <b>Paper title</b>   | <b>Max. Marks</b> |
|------------------|-------------------|--|-------------------|
| Paper-XIII       | BBMS- 301/3211    | Human Physiology   | 100               |
| Paper-XIV        | BBMS-302/3212     | Pathology  | 100               |
| Paper-XV         | BBMS-303/3213     | Genetics & Biotechnology   | 100               |
| Paper-XVI        | BBMS-304/3214     | Pharmacy & Pharmaceuticals   | 100               |
| Paper-XVII       | BBMS-305/30215    | Practical-V (Human Physiology and Pathology)                           | 100               |
| Paper-XVIII      | BBMS-306/30216    | Practical-VI (Genetics & Biotechnology and Pharmacy & Pharmaceuticals) | 100               |

**Max. Marks- 600**

**Total Max. Marks-**

**I Year 600+II Year 600+ III Year 600 = 1800**

**Suggested Norms for Credit Assignment****Teaching:** Annual System – 180 Days**Lectures/Tutorials:** 1 Credit = 15 Hours*(If 45 hours teaching is assigned for a course of study/paper during a semester, the same will stand for 3 credits)***Practical/Lab Work:** 1 Credit = 2 Hours' Practical for 15 days**Field Study/Study Tour (Study Tour Report based on Field Study/Study Tour):** 1 Credit = 3 Hours × 15 days (+1 Credit for Viva Voce/Presentation)**Summer Training/Industrial Training including Training Report):** 1 Credit = 3 Hours × 15 days (+1 Credit for Viva Voce/Presentation)**Dissertation:** 6 Credits (1 Hours × 90 days/ 15) + Viva Voce: 2 Credits = 6+2 = 8 Credits**Proposed Structure for Choice Based Credit System (CBCS)**

| Courses/Papers                  |  | First Year Credit | Second Year Credit | Third Year Credit |
|---------------------------------|--|-------------------|--------------------|-------------------|
| <b>Core Papers</b>              | <b>Theory (4 papers/year)</b><br><i>Calculated for 90 Hrs lectures per paper @ 1 Credit = 15Hsr. Lectures/Tutorial</i>                 | 6x4= 24           | 6x4= 24            | 6x4= 24           |
|                                 | <b>Practical (2 papers/ year)</b><br><i>Calculated for 30 days, 3 Hrs. practical per paper @ 1 Credit =2 Hr. practical for 15 days</i> | 6x2=12            | 6x4= 24            | 6x4= 24           |
| <b>Elective/Optional Papers</b> |  | NA                | NA                 | NA                |
| <b>Self-Study Courses</b>       |  | NA                | NA                 | NA                |
| <b>Total Credits</b>            |  | <b>36</b>         | <b>36</b>          | <b>36</b>         |



## Detailed Syllabus of B.Sc. I Year

Paper-I      BBMS-101/1211      General Biology

### Biological systems, Evolution and Biodiversity

#### 1. Introduction to Biology

Definition and characteristic of life, Whittaker's 5 kingdom of classification, Kingdoms of Life -Prokaryotes, Eukaryotes, Archaea. General account of various classes of living organisms like animals, plants, and viruses. Difference in structural organization and function of animal, plant and bacterial cells.

Introduction to different branches of biology.

#### 2. Evolutionary history of life

Early earth and the origin of life, Major events in the history of life, Mechanism of Macroevolution, Phylogeny and the tree of life. Darwin's theory of evolution; The evolution of populations; Concepts of species; Mechanism of Speciation.

#### 3. Introduction to Plant Kingdom

Classification of plant kingdom, General characteristics and economic importance of Fungi, Algae Lichen, Bryophytes, Pteridophytes, Angiosperm, and Gymnosperms.

#### 4. Introduction to Animal Kingdom

Classification of animal kingdom, General characteristics and economic importance of Protozoa, Porifera, Coelenterate, Helminthes, Annelida, Arthropoda, Mollusca, and Echinodermata.

General characteristics and economic importance of Amphibia, Aves, Reptiles and Mammals.

#### 5. Genetic approach to Biology

The science of heredity, Chromosomal and extra chromosomal theories of inheritance, Mendel's laws of Inheritance, The molecular basis of genetic information, concept of central dogma of biology.

### Books Recommended:

1. Campbell, N.A. and Reece, J.B. (2008) *Biology 8th edition*, Pearson Benjamin Cummings, San Francisco.
2. Raven, P.H et al (2006) *Biology 7th edition* Tata McGrawHill Publications, New Delhi
3. R. L. Kotpal (2015) *Modern Text Book of Zoology INVERTEBRATES*, Rastogi Publications, New Delhi
4. R. L. Kotpal (2015) *Modern Text Book of Zoology VERTEBRATES*, Rastogi Publications, New Delhi
5. AC Dutta (2000) *A Class Book of Botany, 17th Edition*, Oxford University Press, New Delhi.





**Paper-II**      **BBMS-102/1212**      **Cell Biology**

**The Cell:** Historical background, significant landmarks, cell theory. Eukaryotes and Prokaryotes.

**Cellular Chemistry:** Inorganic and organic constituents, macromolecules of life, sugars, amino acids, types of bonding.

**Cell Membrane:** Organization, composition, movement of substances, junction complexes.

**Cell Organelles:** Study of various cell organelles, structure and their functional significance.

**Nucleus:** Nuclear membrane, Nucleolus, chromatin material, Nucleocytoplasmic interaction.

**Chromosome structure:** Organization, morphology, differentiation, polytene and lampbrush chromosomes, sex chromosomes and sex determination.

**Cytoskeletal elements:** Microtubules, micro filaments, intermediate filaments.

**Artificial Membrane:** Liposomes.

**Microscopy:** Principles of different types of optical systems, basics of electron microscopy.

**Cytochemistry:** Chemistry of fixation, staining, cytochemistry of cellular constituents, tissue culture method, autoradiography, cell fractionation.

**Cell Division:** Mitosis, Meiosis, movement of chromosomes and their significance.

**Cell Cycle** and its regulation

**Cell Physiology:** Cellular respiration, endocytosis, role of endosomes, lysosomes, exocytosis, cellular motility, aging and death.

**Books Recommended:**

1. *Cell Biology by De Robertes*
2. *Cell Biology by Bruce Albert.*
3. *Cell Biology by C.B.Powar.*



**Paper-III**

**BBMS-103/1213**

**Basic Chemistry**

**Section A: Physical Chemistry**

**Colloids**

Lyophilic And Lyophobic Sols Of Colloids, Characteristics Of Lyophilic And Lyophobic Sols, Preparation Of Sols, Dispersion Method, Aggregation Method, Purification Of Sols, Dialysis, Optical Properties Of Sols, Brownian Of Sols, Tyndall Effect, Kinetic Properties Of Sols, Brownian Movement, Electrical Properties Of Sols, Associated Colloids, Cleansing Action Of Soaps And Detergents, Emulsion, Gels, Application Of Colloids, Determination Of Molecular Weights Of Macromolecules.

**Catalysis**

Types Of Catalysis, Homogeneous Catalysis, Heterogeneous Catalysis, Characteristics Of Catalytic Reactions, Promoters, Catalytic Poisoning, Autocatalysis, Negative Catalysis, Activation Energy And Catalysis, Theories Of Catalysis, Intermediate Compound Formation Theory, Adsorption Theory, Hydrogenation Of Ethene In Presence Of Nickel, Acid Base Catalysis, Mechanism Of Acid Catalysis, Enzyme Catalysis, Mechanism Of Enzyme Catalysis, Characteristics Of Enzyme Catalysis.

**Section B: Inorganic Chemistry**

**Atomic Structure**

Quantum Numbers, Significance Of Quantum Numbers, Orbital Angular Momentum And Quantum Numbers, Shapes Of S, P, D And F Atomic Orbitals, Nodal Planes, Discovery Of Spin Quantum Number[S] And Magnetic Spin, Quantum Number (Ms), Rules For Filling Electrons In Various Orbitals, Electronic Configurations, Pauli's Exclusion Principle, Hund's Rule, Aufbau Principle.

**Chemical Bonding**

Ionic Bonding- General Characteristics Of Ionic Bonding, Polarizing Power And Polarizability, Fajan's Rules, Ionic Character In Covalent Compounds.

Covalent Bonding- General Characteristics Of Covalent Bond, Hybridization With Suitable Examples Of Linear (BeF<sub>2</sub>/C<sub>2</sub>H<sub>2</sub>), Trigonal Planar (BF<sub>3</sub>/C<sub>2</sub>H<sub>4</sub>), Tetrahedral (CH<sub>4</sub>/NH<sub>3</sub>), Hydrogen Bond.

**Section C: Bioinorganic Chemistry**

Essential And Non-Essential Elements, Role Of Na<sup>+</sup>, K<sup>+</sup>, Mg<sup>++</sup>, Ca<sup>++</sup>, Fe<sup>3+</sup>, Cu<sup>++</sup> And Zn<sup>++</sup> In Biological Systems, Effect Of Excess Intake (Toxicity) Of Metal Ions, Role Of Metal Chelates, Chlorophyll, Mechanism Of Photosynthesis, Haemoglobin, Nitrogen Fixation And Nitrogen Cycle.

**BOOKS RECOMMENDED:**

1. *Inorganic Chemistry- RL Madan & GD Tuli (S. Chand Publication)*
2. *Physical Chemistry- Arun Bahl, BS Bahl & GD Tuli (S. Chand Publication)*



**Ionic equilibrium:** Physical properties and structure of water, solvent properties of water, fitness of the aqueous environment for living organisms, ionic product of water and the pH scale. Acid base indicators, buffer solutions, physiological buffers.

**Carbohydrates:** Structure of monosaccharide- reactions of aldehyde and ketone groups, ring structure and anomeric forms, mutarotation, reaction of sugar due to hydroxyl groups, important derivatives of monosaccharide, and their biological importance. Oligosaccharides- disaccharides and trisaccharides, structure, occurrence and biological importance of oligosaccharides. Polysaccharides e.g. Cellulose, chitin, agar, algenic acids, pectin, proteoglycans, sialic acids, glycogen and starch. Glycoproteins.

**Lipids:** Definition and classification. Fatty acids: introduction, classification, nomenclature, structure and properties of saturated and unsaturated fatty acids, essential and non-essential fatty acids. Triacylglycerol: nomenclature, physical properties, chemical properties. Characterization of fats-hydrolysis, saponification value, rancidity of fats. Biological significance of fats. Glycerophospholipids (lecithins, lysolecithins, cephalins, phosphatidyl serine, phosphatidyl inositol, plasmalogens), sphingomyelins, glycolipids- cerebrosides and gangliosides. Properties and function of phospholipids.

**Proteins:** Introduction, classification based on solubility, shape, composition and functions. Amino acids: common structural features, classification and structures of standard amino acids as zwitterion in aqueous solution, physical and chemical properties. Structure and formation of peptide bonds. Protein structure: primary structure of proteins, secondary structure of proteins- helix and pleated sheets, tertiary structure of proteins, forces stabilizing the tertiary structure and quaternary structure of proteins. Denaturation and renaturation of proteins. Behavior of proteins in solutions- salting-in and salting-out of proteins. Structure and biological functions of hemoglobin and myoglobin.

**Enzymes:** History, general characteristics, nomenclature, IUB enzyme classification (rationale, overview and specific examples). Significance of numbering system. Definitions with examples of holoenzyme, apoenzyme, coenzymes, cofactors, activators, inhibitors, active site (identification of groups excluded), metallo-enzymes, specific enzymes, isoenzymes, monomeric enzymes, oligomeric enzymes and multi-enzyme complexes. Units of enzyme activity. Enzyme specificity. Basic concepts of enzyme catalysis.

**Nucleic acids:** Nature of genetic material; evidence that DNA is the genetic material, Composition of RNA and DNA, features of DNA double helix. Denaturation and annealing of DNA structure. Different types of RNA and DNA.

**BOOKS RECOMMENDED:** *Principle of Biochemistry: Lehninger by Nelson & Cox*



**General Biology:**

1. Preparations charts for different systems of classification.
2. The use of dissecting microscope for the study of structures.
3. The use of compound microscope is studying the structures.
4. The principle of positive and negative staining.
5. The Study of vegetative structures of different classes of plant kingdom by specimen or permanent slides.
  - a. Fungi
  - b. Algae
  - c. Lichen
  - d. Bryophytes
  - e. Pteridophytes
  - f. Gymnosperms
  - g. Angiosperm
6. The Study of vegetative structures of different classes of animal kingdom by specimen or permanent slides.
  - a. Protozoa
  - b. Porifera
  - c. Coelenterate
  - d. Helminthes
  - e. Annelida
  - f. Arthropoda
  - g. Mollusca
  - h. Echinodermata
  - i. Amphibia
  - j. Aves
  - k. Reptiles
  - l. Mammals

**Cell Biology**

1. Study of various parts of dissecting and compound microscope.
2. Microscopic identification of plant and animal cell.
3. Measurement of cell size using ocular and stage micrometer.
4. Microscopic examination of bacterial cell using suitable stain.
5. To perform plasmolysis and deplasmolysis in plant cell.
6. Mitotic squash preparation of root tip of onion and identification of various divisional stages.
7. Study of permanent slides.



**Basic Chemistry**

**Section A: Inorganic Chemistry**

**Volumetric Analysis**

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Estimation of oxalic acid by titrating it with  $\text{KMnO}_4$ .
3. Estimation of water of crystallization in Mohr's salt by titrating with  $\text{KMnO}_4$ .
4. Estimation of Fe(II) ions by titrating it with  $\text{K}_2\text{Cr}_2\text{O}_7$  using internal indicator.
5. Estimation of Cu(II) ions idometrically using  $\text{Na}_2\text{SO}_4$ .
6. Estimation of (i)  $\text{Mg}^{2+}$  or (ii)  $\text{Zn}^{2+}$  by complexometric titration using EDTA.

**Section B: Physical Chemistry**

1. **Surface tension measurement** (use of organic solvents excluded). Determination of the surface tension of a liquid or a dilute solution using a stalagmometer.
2. **Viscosity measurement** (use of organic solvents excluded) Determination of the relative and absolute viscosity of a liquid dilute solution using an Ostwald's viscometer.
3. **Kinetic studies** Study of the kinetics of the following reaction by integrated rate method: Acid hydrolysis of methyl acetate with hydrochloric acid volumetrically.

**Biochemistry**

1. Preparation of molar, modal and percentage solution
2. Preparation of w/w, w/v, and v/v solutions.
3. Preparation of buffer solution and measurement of pH by pH strip.
4. Detection of starch in potatoes by color reaction.
5. Estimation of carbohydrate by colorimeter.
6. Estimation of proteins by colorimeter.
7. Activity of salivary amylase enzyme.



## Detailed Syllabus of B.Sc. II Year

|                  |                      |                             |
|------------------|----------------------|-----------------------------|
| <b>Paper-VII</b> | <b>BBMS-201/2211</b> | <b>Medical Microbiology</b> |
|------------------|----------------------|-----------------------------|

- 1. General Microbiology:** History of Microbiology, Classification of Microorganism, Microscopic Methods for observing Microorganisms, Culture and Nutrient of Microorganisms, Sterilization and Disinfection.
- 2. Microbial Biology:**
  - a) Viruses:** Introduction, Historical background, Classification, Isolation, Origin, Nature, Structure, Morphology, Composition, Animal, Plant and Bacterial Virus, Bacteriophages, Multiplication Cycles, Interferon, Physical Properties.
  - b) Bacteria:** Classification, Morphology, Structure, Chemical Composition, Plasmids, Microsomes, Cytoplasmic Inclusion, Growth and Reproduction, Microbial Ecology.
  - c) Algae, Fungi and Protozoa:** Growth, Structure, Function, Reproduction, Classification and Economic Importance.
- 3. Applied Microbiology:**
  - a) Microbes in economic use:** Beneficial activities in Antibiotics, Vitamins, Pesticides, Petroleum, Fermentation Industry, and in Environment Protection.
  - b) Microbial Diversity:** Microorganisms in Soil, Water, Air and Food. Normal Human Micro Flora. Microbial Role in Cycling of Nitrogen, Phosphorus, Sulphur, and Carbon.
  - c) Microbial Diseases:** Anthrax, Whooping Cough, Botulism, Tetanus, Diphtheria, Tuberculosis, Dysentery, Leprosy, Diarrhea, Pneumonia, Malaria, Leishmaniasis, Sleeping Sickness, AIDS, Cholera, Dengue, Hepatitis, Measles.
- 4. Immunology:** Antigen, Antibody, Immunoglobulins, Lymphocytes, Humoral and Cell Mediated Immunity, Complement, Interaction of T & B Lymphocytes, Macrophages. Immunology in relation to human health- an overview. Immunity to Infection, Immunotherapy, RIA.

### **Books Referred:**

- 1. Text book of Microbiology - by Prescott*
- 2. Text book of Microbiology - by Anant Narayan & Paniker*
- 3. Text book of Microbiology - by Pelzar*



**Paper-VIII      BBMS-202/2212      Medical Biochemistry**

**Metabolism & Metabolic disorders**

- **Carbohydrate Metabolism** (Glycolysis, Aerobic Respiration, Krebs's Cycle, Oxidative phosphorylation, Glyoxylate Pathway, Pentose Phosphate Pathway, Gluconeogenesis, Glycogenesis, Glycogenolysis) and related diseases i.e. Diabetes Mellitus, Galactosuria, Fructosuria, Hunter's Syndrome and Glucose Tolerance Test, Glucose Storage Diseases.
- **Lipid Metabolism** (Lipogenesis, Fatty Acid Synthesis, Fatty Acid Oxidation, Biosynthesis and Degradation of Cholesterol, Formation of Ketone Bodies) and related diseases i.e. Gaucher's disease, Tay-Sacch's disease, Hypercholesterolemia, Fatty Liver, Obesity, Atherosclerosis.
- **Protein Metabolism** (Biosynthesis of Amino Acids, Amino Acids Catabolism, Nitrogen Excretion and Urea Cycle) and related diseases i.e. Albinism, Phenylketonuria, Alkaptonuria, Maple-Syrup Urine Disease (MSUD).
- **Nucleic Acid Metabolism** (*Nucleotide Synthesis*- Salvage Pathway and de novo Pathway, *Nucleotide Degradation*- Formation of Uric Acid) and related diseases i.e. Lesch-Nyhan Syndrome, Van-Gierke's disease, Gout).
- **Porphyrimetabolism** (Biosynthesis and Degradation of Heme) and related diseases- i.e. Jaundice-types, diagnosis and treatment, Porphyrias.
- **Mineral Metabolism** (Macro elements and Microelements) and related diseases i.e. Anemia, Cushing's syndrome, Rickets, Osteoporosis, Menke's disease, Wilson's disease, Fluorosis.

**Biochemical changes in body fluids-**

- a. **Blood-** composition, alteration in pathological conditions.
- b. **Urine-** composition, alteration in pathological conditions.
- c. **Cerebrospinal Fluid-** composition, alteration in pathological conditions.

**Organ function tests:**

- a. Renal function tests
- b. Liver function tests.
- c. Gastric function tests.

**Cancer Biochemistry-**

Benign and Malignant Tumor, Properties of Tumor Cells, Molecular basis of Cancer, Carcinogens, Oncovirus, Tumor Markers, Treatment and Prevention of Cancer.

**Books Referred:**

1. Text Book of Biochemistry with clinical Correlation by: Thomas M Devlin
2. Lecture Notes on Clinical Biochemistry by Beckett, Walker, Rae and Ashby
3. Principle of Biochemistry: Lehninger by Nelson &Cox



**Paper-IX**

**BBMS-203/2213**

**Biochemical Techniques**

**Water, Acids and Bases**

Physical properties and structure of water, solvent properties of water, ionic product of water and the pH scale, ionization of acids and bases, salt hydrolysis, pH changes in acid base titrations (weak and strong), Hasselbach-Henderson equation, buffer solutions, buffer index, buffer capacity. Principles of glass and reference electrodes, types of electrodes.

**Microscopy**

Basic principles and application of light, phase contrast, dark field, fluorescence, interference, polarizing scanning and transmission electron microscopy, Freeze fracture, fixation and staining.

**Centrifugation**

Basic Principles of sedimentation different types of centrifuges and their uses analysis of subcellular fractions.

**Chromatography**

General principle of separation and classification of Chromatography. Principles of adsorption, partition, size exclusion and ion exchange chromatography. Thin layer, Gas, supercritical and High performance liquid chromatography.

**Spectroscopy**

Basic concepts and application of UV-Visible, fluorescence, IR, NMR, X-ray diffraction, CD, ORD spectroscopy, mass spectrometry in structure determination of biomolecules.

**Electrophoresis**

Basic principles, instrumentation and applications, moving boundary and zonal electrophoresis including paper and gel (SDS PAGE and Agarose) electrophoresis, isoelectric focusing, PFGE and Capillary electrophoresis

**Radioisotopic techniques**

Principles and application of tracer techniques in biology, radioactive isotopes and half life of isotopes, liquid scintillation, GM counter. Effect of radiation on biological system, radio-active labeling of biological macromolecules, autoradiography and radiation dosimetry.

**Immunological Techniques**

Immunodiffusion, radioimmunosay, ELISA.

**Books referred:**

1. *Biophysical Chemistry, Principles and Techniques* by Upadhyay, Upadhyay & Nath
2. *Principles and Techniques of Biochemistry and Molecular Biology* by Wilson & Walker.





**(ALLIPHATIC COMPOUNDS)**

- 1. Nomenclature of organic compounds-** Orbital picture of Ethane, Ethene, Ethyne. Elementary idea of Electrophilic and Nucleophilic reagents, Carbanium and Carbonium ions, Inductive effect, Electromeric effect, Mesomeric effect and effect on electron displacement.
- 2. Preparation, Properties and uses of the following compounds:**  
Halogen derivatives- Thylene and Ethylenedene, Vinyl and Allyl halides. Dehydrohalogenation of alkyl halides. Grignard reagent preparation and its synthetic uses. Glycerol- preparation, properties, uses, structure on the basis of physical and chemical properties. Mechanisms of dehydration of monohydric alcohol.
- 3. Amines-** Basic character of primary, secondary and tertiary amines, preparation and properties. Urea- preparation, properties and uses. Thio alcohol- Mustard gas, ethane thiol
- 4. Carbonyl compounds-** Aldehyde and Ketones, mechanism of Aldol Condensation and Haloform Reaction. Carboxylic acids- Substituted acids with halogen, hydroxyl, amino acids, lactic acid and glycine. Nitroalkanes and alkyl nitrite
- 5. Preparation properties and synthetic uses of the reactive methylene compounds-** malonic ester, acetoacetic ester and Cyanoacetic ester.
- 6. Poly acids and their substituted acids-** Malonic, succinic acid, malic acid, maleic acid, fumaric acid, tartaric acid, citric acid.

**(AROMATIC COMPOUNDS)**

- 1. Basic Processes in organic chemistry**
  - (a) Coal tar distillation, Benzene and Toulene.
  - (b) Resonance, Aromatic substitution. Directive influence of group present in nucleus.
  - (c) Aryl Halogen compounds, preparation, properties and uses of Chlorobenzene, Gammexane and D.D.T.
- 2. Preparation, Properties and Uses of the following compounds**
  - (a) Aromatic Nitrogen compounds- Nitrobenzene, T.N.T.
  - (b) Aromatic Amines- Aniline, Toulidines, Benzyl Amine.
  - (c) Aromatic Diazo compounds- Benzene Diazonium Chloride, its synthetic uses and structure.
  - (d) Aromatic Hydroxyl compounds- Phenol, Resorcinol, Quinol, and Benzyl alcohol, T.N.P.
  - (e) Aromatic Carbonyl compounds- Benzaldehyde, Salicylic Aldehyde, acetophenone.
  - (f) Aromatic carboxylic acid- Benzoic Acid, Phthalic Acid, Benzoyl Chloride, Dicarboxylic Acids.
  - (g) Hydroxy acids- Salicylic Acid, Aspirin, Salol, Iodex (oil of winter green).
  - (h) Aromatic sulphonic acid- B.S.A., Benzene Sulphonamide, Saccharin, Chloroamine-T.
  - (i) Polynuclear Hydrocarbons- structure of Naphthalene, Alpha and Beta Naphthols, and Naphthylamine.
- 3. Important name reaction used in synthesis of medicated compounds**
  - (a) Benzoin condensation
  - (b) Coupling reaction
  - (c) Kolbe's reaction
  - (d) Friedal craft reaction
  - (e) Cannizarro's reaction
  - (f) Electrophilic Substitution reaction

**BOOKS REFERRED:** *O.P. Aggarwal (Natural product Vol. I&II- Textbook of Organic Chemistry*



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| <b>Paper-XI</b> | <b>BBMS-205/20215</b> | <b>Practical-III (Medical Microbiology and Medical Biochemistry)</b> |
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**Medical Microbiology**

1. Demonstration of various sterilization techniques used in laboratory.
2. Aseptic culture preparation.
3. Microscopic examination and identification of bacteria
4. Microscopic examination and identification of fungus.
5. Identification of fruiting bodies of *mucor*, *penicillium* and *rhizopus*.
6. Staining of *conidia*.
7. Preparation of minimal media for culture of bacteria.
8. Culture of bacteria and development of bacterial colony
9. Permanent slides.
10. Agglutination test

**Medical Biochemistry**

1. Collection of blood sample by finger prick method for blood test.
2. Colorimetric measurement of blood sugar
3. Measurement of total protein from blood
4. Detection of protein amount in urine sample
5. Estimation of urine sugar.
6. Detection of pus cells in urine sample.
7. Preparation and study of charts of different metabolic disorder.



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| <b>Paper-XII</b> | <b>BBMS-206/20216</b> | <b>Practical-IV (Biochemical Techniques and Organic Chemistry)</b> |
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### **Biochemical Techniques**

1. Calibration of pH meter and measurement of given solution.
2. Measurement of pH of different water samples collected from various water reservoirs of Jhansi.
3. Measurement of pKa of acetic acid.
4. To analyze different amino acids by paper chromatography and TLC
5. Separation of pigments from leaves by paper chromatography and TLC
6. Demonstration of centrifuge machine.
7. Centrifugation of RBCs from blood.
8. Demonstration of Agarose Gel Electrophoresis.
9. Demonstration of SDS-PAGE.
10. Extraction and estimation of chlorophyll by spectrophotometer.

### **Organic Chemistry**

1. Find out the elements which are present in the given organic compound (Element detection test)
2. Determine the functional group test in various organic compounds: Urea, Thiourea, Acetamide, Tartaric acid, Benzoic Acid, Oxalic acid, Citric acid.
3. Find out the b.p. & m.p. of the given organic compound.
4. Volumetric analysis (Titration Method)
5. Separation of organic compound by sublimation.
6. Separation of mixture of organic compound by distillation.
7. Preparation of picric acid.
8. To crystallize the given sample of benzoic acid from water.



## Detailed Syllabus of B.Sc. III Year

### Paper-XIII | BBMS- 301/3211 | Human Physiology

Functional organization of human body, control of internal environment.

**Physiology of Digestion:** Anatomy of alimentary canal, movement of food and secretory functions, digestion, absorption, regulation of secretions and motility, basal metabolic rate, nutrition, dietary balances.

**Body fluids:** Blood, Blood Cells, lymph, composition and functions, erythropoiesis, blood groups, Rh factors, Blood coagulation, Blood Pressure, regulation of blood pressure.

**Cardiovascular physiology:** Physiology of cardiac muscle, structure and function of heart, circulation, origin and conduction of cardiac impulses, cardiac cycle, cardiac output, ECG, Heart sounds, angiography.

**Nerve physiology:** Nervous system, structure of nerve cells, Origin and conduction of membrane potential, excitation of nerve fiber, basic functions of synapses, saltatory nerve transmission.

**Respiration:** Mechanism of breathing, transport of gases, regulatory mechanism, O<sub>2</sub> dissociation curves, chloride shift, Bohr effect, Haldane effect, artificial respiration.

**Excretion:** Structure of excretory organs, urine formation, counter current principle, controlling factors, micturition, regulation of body fluids and acid base balance.

**Muscle Physiology:** Physiology and anatomy of skeletal muscle, molecular mechanism of muscle contraction, Excitation-contraction coupling, abnormalities.

**Endocrine glands:** Structure and physiology of pituitary, thyroid, parathyroid, pancreas, adrenal, pineal gland, gonads and hypothalamus, feedback mechanism, control of endocrine secretion.

**Reproduction:** Structure and function of reproductive organs, hormonal regulation of ovulation, fertilization, implantation, gestation, parturition and lactation, oogenesis, spermatogenesis.

**Sense Organs:** Structure of skin, eye and ear, physiology of vision, hearing, taste, smell and touch. Regulation of body temperature.

#### Books Referred:

1. *Text Book of Medical Physiology by Guyton and Hall*
2. *Text book of Physiology by Ganong and by Tortora*



Historical background, important discoveries, general aspects, pathogenicity.

- **Disorders of cells and tissues:** Hypoplasia, Hyperplasia, Hypertrophy, Metaplasia Neoplasia.
- **Disorders of blood cells and heart:** WBC and RBC disorders, Hemorrhagic diseases, Abnormal Hemoglobin, Arteriosclerosis, Embolism, Heart diseases, Hypertension, Hemorrhage and Hemorrhage Shock.
- **Disorders of respiratory tract:** Tonsillitis, Bronchitis, Asthma, Emphysema, Cough, CO poisoning, Hypoxia.
- **Disorders of digestive tract:** Gastritis, Ulcers, diseases of pancreas and liver, Constipation and Diarrhea.
- **Disorders of excretory system:** Nephritis, Acidosis, and Disorders of Urination.
- **Disorders of nervous system:** Sclerosis, Migraine, Depression, Schizophrenia, Neurosis, Epilepsy, Parkinsonism.
- **Disorders of reproductive system:** Impotency, Infertility, Abortions, Menopause and other abnormalities.
- Disorders of bones, joints and cartilages.
- Autoimmune Disorders
- Cancer

**Books referred:**

1. *Text Book of Pathology by Harsh Mohan*
2. *Text Book with clinical Correlation by Thomas M Devlin*



**Paper-XV      BBMS-303/3213      Genetics & Biotechnology**

**GENETICS**

1. History of Genetics Pre and Post Mendelian concepts.
2. Mendel's laws of Inheritance. Deviations from Mendel's laws.
3. Gene Interactions: Incomplete dominance, Co- dominance, Epistasis (dominant and recessive), Complementary genes. Allelic and non-allelic concept, multiple alleles, pseudo alleles.
4. Polygenic Inheritance, Cytoplasmic Inheritance.
5. Chromosomal theory of inheritance, Recombination. Linkage and linked groups, types of linkage, arrangement and significance.
6. Mutation: Somatic, germinal, reverse, forward mutation, frame shift mutations, substitution mutations.
7. Chromosomal Aberrations: Inversion, Translocation, Position effects. Variations in chromosome number.
8. Sex Determination and sex linked inheritance.
9. Basis of heredity, identification of genetic material.
10. Biochemical basis of gene action, one gene-one enzyme and one gene- one polypeptide concept, basic idea of transcription, translation, genetic control of protein synthesis, genetic code.
11. Human genetics- disorders, normal and abnormal karyotype.

**BIOTECHNOLOGY**

1. **Introduction to basic Biotechnology-** scope and importance.
2. **Central dogma**
  - a) DNA replication in *E. coli* and Eukaryotes (origin of replication, semi conservative hypothesis, bidirectional, structure and function of DNA polymerases, role of Replisome, Primosome, Okazaki fragments, helicase, primase, gyrase, topoisomerase and other proteins).
  - b) Transcription (structure & function of RNA polymerases, intorn & exon). Translation
3. **DNA Repair**, Disease associated with repair mechanisms
4. **Recombinant DNA Technology**
  - a) Restriction enzymes and their functions.
  - b) Statement vectors- prokaryotic and eukaryotic.
  - c) Transformation. Selection of specific cloned DNA
  - d) Detection and identification of cloned DNA sequences.
  - e) Application of recombinant DNA technology. Polymerase chain reaction.
5. Diseases linked with gene expression.
6. Gene Therapy and Gene Bank.
7. **Enzyme Immobilization-** methods and advantages.
8. Monoclonal antibodies, Hybridomas, HAT technique.
9. Fermentation technology: Commercial production.
10. Molecular basis of Diagnosis of diseases, and Diagnostic Kits.

**BOOKS RECOMMENDED:** *Text book of Genetics by Russell 2. Genetics by P.K. Gupta*



**Paper-XVI      BBMS-304/3214      Pharmacy & Pharmaceuticals**

- Definition and scope of Pharmacy, Pharmacy as a career. Role of pharmacy in human health.
- Introduction to Pharmacopoeias with special reference to Indian Pharmacopoeia, B.P., U.S.P. and International Pharmacopoeia.
- Introduction to different branches of pharmacy with special emphasis on pharmacology, pharmacognosy and pharmaceuticals, their scope and interrelations with each other. Basic concepts of Discovery and development of new drugs, sources of new drugs and role of pharmacy in drug development. NDA (New drug application) and clinical trials.
- Introduction to Pharmacology, Sources of drugs, Dosage forms and routes of administration, Absorption, Distribution, Metabolism and Excretion of drugs.
- Introduction to pharmacognosy, scope of Pharmacognosy including indigenous system of medicine. Various system of classification of drugs of natural origin. Adulteration and drug evaluation, Brief outline of occurrence, distribution outline of isolation, identification tests, therapeutic effects and pharmaceutical applications of plant alkaloids, glycosides.

**Introduction to Toxicology:**

Definition of poison, general principles of treatment of poisoning. Definition of different branches of toxicology. Role of toxicology in drug development.

**Books Recommended:**

1. *A Text Book of Pharmacology by K.D. Tripathi*
2. *Text Book of Pharmacology & Toxicology by Goodman & Gillman*
3. *Text Book of Pharmacology & Toxicology by Barar*
4. *Pharmacology by Kulkarni*
5. *Text book of Pharmacology by S.D. Seth and V.Seth*



### **Human Physiology**

1. Study of different human system using torso model.
2. Blood group detection.
3. Measurement clotting time and Bleeding time (CT&BT) of blood by duke method.
4. To perform Total Leukocyte Count (TLC).
5. To perform Total RBC Count.
6. Measurement of blood pressure.
7. Measurement of body temperature.
8. Preparation of heamin crystals.
9. To perform Pulmonary Function Tests.
10. To perform cardiac Efficiency Test.

### **Pathology**

1. Estimation of ESR by wintrob's method.
2. Estimation from blood.
  - a. Sugar
  - b. Urea
  - c. Creatinine
  - d. Cholesterol
  - e. Billrubin
3. Estimation from urine
  - a. Urea
  - b. Bacterial contamination
  - c. Ketone bodies
  - d. Blood
  - e. Bile pigment
  - f. Creatinine
  - g. Urobilinogen





**Paper-XVIII**

**BBMS-306/30216**

**Practical-VI (Genetics & Biotechnology and Pharmacy & Pharmaceuticals)**

### **Genetics**

1. Study of various phenotypic characters of pea plant.
2. Study of various body parts of fruitfly (*Drosophila*) by hand lens.
3. Study of gene interactions:
  - Dominant and Recessive
  - Incomplete dominance
  - Co-dominance
  - Epistasis (Dominant and recessive)
  - Complementary
4. Study of various stages of meiosis from another and grass hoper testes
5. Study of various phenotypic characters in human population.

### **Biotechnology**

1. Isolation of genomic DNA from given bacterial sample using phenol chloroform
2. Agarose Gelo Electrophoresis of isolated DNA
3. Precipitation of Proteins from given sample and its quantitative estimation.
4. Preparation and study of chars of different cloning vector.
5. Fermentation of milk by lactic acid bacteria

### **Pharmacy & Pharmaceuticals**

1. Study of different preparation of crude drugs.
  - a. Powder
  - b. Aqueous extract
  - c. Organic extract
  - d. Paste
2. Study of different type of capsule & tablets.
3. Demonstration of different mode of drug introduction in chosen animal model.
4. Study of adulteration in different crude drugs.
5. Study of different toxins in laboratory and preventive measures to avoid exposure to toxicants