

Sant Gadge Baba Amravati University, Amravati

Faculty: Science and Technology

Programme: B.Sc. (Bio-chemistry)

POs:

Students of undergraduate general degree programme at the time of graduation would be able to

PO1. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO7. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

PSOs:

Upon completion of the programme successfully, Student would be able to -

1. Understand structure, energy value and function of Biomolecules.
2. Prepare buffers of different pH, can perform chromatography of plant pigments and separate biomolecules by electrophoresis, perform structural analysis of substances using NMR and ESR.

3. Apply knowledge of biomolecule metabolism to diagnose various diseases and their root causes.
4. Formulate and design various biomedical enzyme-based marker kits and apply in winery, leather, dairy and detergent industry.
5. Analyze unknown DNA samples using molecular biology techniques and perform plant tissue culture of medicinally important endangered plant species.
6. Interpret reason of abnormal blood reports, probable cause and effects on human health.

Employability Potential of the Programme:

Biochemistry is the branch of science which deals with study of chemistry of living organisms. Biochemistry focuses on processes happening at molecular level. It focuses on what happening inside our cells, studying components like proteins, lipids, carbohydrates, nucleic acid, vitamins and hormones. The cumulative demand for trained and skilled manpower in the area of Biochemistry requires in depth functional knowledge of modern biology through hands-on training to the students.

The degree of Bachelor of Science in Biochemistry (Choice Based Credit System) aims to introduce various aspects of Biochemistry and interdisciplinary subjects to the students. The program in Biochemistry as one of the core subjects is designed to cultivate a scientific attitude and interest towards the modern areas of Biochemistry in particular and life science in general. This will help the students to become critical and curious in their outlook.

The courses are designed to impart the essential basics in Biochemistry at the initial level of graduation. The basic courses are infused with application in modern life sciences, and awareness on Biochemistry and its influence in human life. The integration of various courses in the program is aimed to develop proficiency in the theory as well as practical experiments, common equipment, laboratory, along with the collection and interpretation and presentation of scientific data in proper manner.

Beside this, the students will be equipped with knowledge in the newer areas of Biochemistry and its application in medical science, agriculture, industry, proteomics, genomics, metabolomics, bioinformatics, nano-biotechnology etc. This will create awareness about Biochemistry and contribution of Biochemistry among the society. At the end of the course, the

students are expected to have good working knowledge in the field of Bio-chemistry and in addition knowledge gained from courses of interdisciplinary in nature.

Students will surely have an urge to continue higher studies in Biochemistry and contribute significantly in the development. The present syllabus is restructured anticipating the future needs of Biochemistry with more emphasis on imparting hands-on skills. The main thrust is laid on making syllabus compatible with developments in Education, Research and Industrial sectors. The Theory and Practical course in new restructured course will lead to impart skill-set essentials to further Biochemistry.

Biochemistry is the molecular basis of life. Degree program in Biochemistry teaches students how inanimate, lifeless chemicals combine to produce a functional living organism. A significant attraction of the course is the ability to combine in-depth scientific knowledge with practical laboratory skills and the career opportunity in all sectors. After successful completion of three years degree course in Biochemistry, student will be well versed with laboratory skills and transferable skills.

Laboratory Skills:

Students are trained in

- Laboratory safety practices
- Accurate weighing and reagent preparation
- Skillful handling of basic and advanced instruments
- Calibration of basic instruments like pH meter, micropipettes etc
- Advanced techniques like:
 1. Chromatography
 2. Electrophoresis
 3. Spectrometry
 4. Polymerase Chain Reaction (PCR)
 5. Plant Tissue Culture
 6. Animal Tissue Culture
- Logical thinking
- Analysis and interpretation of results
- Collection, organization and presentation of data

Transferable Skills:

During the course student will develop skills other than laboratory skills that are transferable across the number of career areas. These are:

- Analytical skill
- Report writing skill
- Presentation skill
- Time management
- Creative thinking
- Problem solving
- Planning
- Observational skill

Job Opportunities: After successful completion of B.Sc. in Biochemistry, student may continue further studies like M.Sc. in Biochemistry and then Ph.D. in Biochemistry and make career in research field. Students have opportunities in private as well as public sectors.

Private Sector: Biochemist can work in quality control, quality assurance and R & D divisions of companies like- Biotech companies, Pharmaceutical companies, Chemical manufacturing companies, Food and Drink (includes brewing), Health and Beauty Care, Medical Instrument companies, Agricultural companies, Research Companies and Laboratories etc.

Public Sectors: Blood Service, Cancer research institutes, Environmental Pollution Control, Forensic Science, Hospitals, National Blood Services, Overseas Development, Public Health Entities, Public Health Laboratories, Agriculture and fisheries etc.

Government Sector: Syllabus has been design keeping in view that students can apply for various government post filled by Maharashtra Public Service Commission (MPSC), Union Public Service Commission (UPSC), Food Corporation of India, Forensic department, Health department and Food and Drug Administration. These departments recruit successful candidates for the post of Food safety officers in food and drug administration, Assistant Chemical Analyzers in forensic laboratories of Maharashtra and other states all over India, Laboratory Technicians in Clinical pathology laboratories Health department and Food Corporation of India, Sanitary inspectors for schools etc.

Job profiles: Biochemist, Biologist, Biomedical Scientist, Biotechnologist, Chemical Examiners, Chemist, Clinical Scientist, Food Scientist, Forensic Scientist, Laboratory Technician, Microbiologist, Research Associates, Research Officers, and Research Scientist etc.

Thus syllabus has been prepared anticipating the requirements of B.Sc. Biochemistry students under CBCS Program. The contents have been drawn to accommodate the widening horizons of the Biochemistry discipline and reflect the changing needs of the students.

Hence, Board of Studies in Biochemistry (Including Microbiology and Food Science) in its meeting held on 29 /05/2024 resolved to accept the revised syllabus for B. Sc. III Sem. V and VI (Bio-chemistry) based on Choice Based Credit System (CBCS) as per UGC guidelines. The detailed syllabus for each paper is appended with a list of suggested readings.

Sant Gadge Baba Amravati University Amravati
Scheme of teaching, learning & Examination leading to the Degree Bachelors of Science (Choice Based Credit System)

(Three Years Six Semesters Degree Programme- C.B.C.S)

(B.Sc. Part-III) (Semester-V) BIOCHEMISTRY

| Sr. No | Subjects | Subject Code | Teaching & Learning Scheme | | | | | | | Duration of Exams Hrs. | Examination and Evaluation Scheme | | | | | | |
|--------|--|--------------|----------------------------|---|---|-------|---------|-----------|-------|------------------------|---|-----------------------------------|-----------|----------|-----------------|-------|-------|
| | | | Teaching Period Per week | | | | Credits | | | | Maximum Marks | | | | Minimum Passing | | |
| | | | L | T | P | Total | Theory | Practical | Total | | Theory + MCQ External | Skill Enhancement module Internal | Practical | | Total Marks | Marks | Grade |
| 1 | BCM (5S) Molecular Biology and Biotechnology (Theory) | BCM (5S) T | 6 | | | 6 | 4.5 | | 4.5 | 3 hours | 80 | 20 | Internal | External | 100 | 40 | p |
| 2 | BCM (5S) Practical | BCM (5S)Pr | | | 6 | 6 | | 2.25 | 2.25 | 3 hours | | | 25 | 25 | 50 | 25 | p |
| 3 | Mini-Project/Hands on Training/workshop/DIY related to Subject-Phase I | | | | 6 | 6 | | 2.25 | 2.25 | 2 hours | Internal Assessment by College/Institute/department | | | | 50 | 25 | p |
| 4 | Total | | 6 | | 6 | 18 | 4.5 | 4.50 | 9.0 | 8 hours | 80 | 20 | 25 | 25 | 200 | 90 | P |

Syllabus Prescribed for 2024-2025 UG Programme

Programme: UG in Biochemistry

Semester-V

| Code of the Course /Subject | Title of the Course/Subject | Total Number of Periods |
|--|--|--------------------------------|
| BCM (5S) T | Molecular Biology and Biotechnology | 90 |

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After completion of the course, students will be able to:

1. To analyze the experiments carried out by various scientists to prove that DNA is the genetic material.
2. To explain the structure and properties of DNA;
3. To narrate the mechanisms of DNA replication, transcription and translation in prokaryotes.
4. Explain how various cellular molecular processes are highly coordinated.
5. Understand fundamental principles of animal and plant Biotechnology.
6. Understand principal and application of Recombinant DNA technology.

| COURSE MODULE | UNIT | CONTENT |
|--------------------------|--|--|
| DSC | Unit-I Basic Concepts of Genetic Information | <p>a. Basic concepts about the secondary structures of DNA, 5' → 3' direction, anti parallel strands, base composition, base equivalence, base pairing and base stacking in DNA molecule. Watson and Crick model, A, B and Z types of DNA. Physical properties of DNA: Denaturation and Hyperchromic effect, T_m and its significance, Renaturation and hypochromic effect, Chargaff's experiments and Law.</p> <p>b. Nucleic acids as genetic information carriers, experimental Evidence e.g. bacterial genetic transformation, Avery, McCleod and McCarty experiment Hershey-Chase experiment, Central dogma of molecular genetics - current version.</p> |

| | | |
|--|---|--|
| | | <p>c. Salient features of eukaryotic, prokaryotic and viral genomes; highly repetitive, moderately repetitive and unique DNA sequences, retroviruses and reverse transcription.</p> <p style="text-align: right;">(15 Periods)</p> |
| | <p>Unit-II Replication and Transcription</p> | <p>a. DNA Replication in prokaryotes-conservative, semiconservative and dispersive types, experimental evidence for semiconservative replication.</p> <p>b. DNA polymerases, other enzymes and protein factors involved in replication. Mechanism of replication. Inhibitors of DNA replication.</p> <p>c. Transcription in prokaryotes, RNA polymerase, promoters, initiation, elongation and termination of RNA synthesis, inhibitors of transcription, Reverse transcriptase, posttranscriptional processing of RNA in eukaryotes.</p> <p style="text-align: right;">(15 Periods)</p> |
| | <p>Unit-III Translation and Regulation of Gene Expression</p> | <p>a. Genetic code: Basic features of genetic code, biological significance of degeneracy. Wobble hypothesis, gene within genes and overlapping genes.</p> <p>b. Mechanisms of translation : Ribosome structure, A and P sites, charges tRNA, f-met-rRNA, initiator codon, Shine-Dalgarno consensus sequence(AGGA), formation of 70S initiation complex, role of EF-Tu, EF-Ts, EF-G and GTP, non-sense codons and release factors, RF-1 and RF-2.</p> <p>c. Regulation of Gene Expression in prokaryotes : Enzyme induction and repression, operon concept, Lac operon, Trp operon .</p> <p style="text-align: right;">(15 Periods)</p> |
| | <p>Unit-IV Basic Animal Biotechnology</p> | <p>a. Introduction to cell and tissue culture: Preparatory techniques – cleaning, sterilization, sterile handling , tissue culture laboratory requirements, Design of tissue culture laboratory: Equipments and purpose.</p> <p>b. Cell types (Primary and secondary) and cell lines, Cell proliferation measurements, Cell viability testing: Dye inclusion and dye exclusion tests. Culture media: composition, preparation and sterilization, macro and micro nutrients, Importance of serum and limitation with serum media, cell harvesting methods.</p> |

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|------------|---|--|
| | | <p>c. The biology of stem cell: overview; different types of stem cells – embryonic stem cells, fetal tissue stem cells, adult stem cells, stem cell nuclear transfer; somatic cell nuclear transfer, Animal cloning, Organ culture. (15 Periods)</p> |
| | <p>Unit-V Basic Plant Biotechnology</p> | <p>a. Tissue cultures, introduction and history. Media preparation and compositions. Totipotency and cell suspension culture.</p> <p>b. Use of growth regulators. Practical applications of tissue culture, In-vitro techniques in tissue culture. Induction of callus, ovary and ovule cultures, invitro pollination and fertilization.</p> <p>c. Practical applications of genetic transformation in plants (15 Periods)</p> |
| SEM | <p>Recombinant DNA technology</p> | <p>a. Restriction Enzymes: Types and uses of restriction endonuclease, classification Restriction mapping. DNA modifying enzymes: Nucleases, Polymerases, Phosphatases and ligases.</p> <p>b. Vectors. Plasmid vectors, Bacteriophage, expression vectors, other vectors, Construction of genomic and c-DNA libraries, Joining of DNA Fragments to vectors, cohesive and blunt end Ligation, adaptors, and linkers</p> <p>c. Methods of Transformation, codon optimization, host engineering. Strategies of gene delivery, in vitro translation, expression in bacteria, yeast, expression in insects and mammalian cells</p> <p>d. Principle of hybridization. Northern blotting, Southern blotting, Polymerase chain reaction, selection and screening of recombinants. (15 Periods)</p> |
| | | <p>COs</p> <p>By the end of this module, the students will be able to:</p> <ol style="list-style-type: none"> 1. Explain role of DNA modifying enzymes in recombinant DNA technology. 2. Explain the different steps of recombinant DNA technology. 3. Explain tools and techniques of recombinant DNA technology such as vectors , southern blotting etc |

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| **Activities for SEM | 1. Class test 2. Assignment 3. Educational Visit to tissue culture laboratory /Group discussion /Seminars/ Projects/Any innovative activity | (10M) (5M) (5M). |
|----------------------|--|------------------------|

Syllabus Prescribed for 2024-2025 UG Programme

Programme: UG in Biochemistry

Semester-V

| Code of the Course /Subject | Title of the Course/Subject | Total Number of Periods |
|--------------------------------|-----------------------------|--------------------------|
| BCM (5S) Pr | BCM (5S) Practical | 06 / per week /per batch |

COs

Upon completion of the course, the student would be able to:

1. Perform extraction of DNA and RNA.
2. Estimation of DNA, RNA and alcohol.
3. Production of alcohol by immobilization of yeast cells.
4. Perform agarose gel electrophoresis of DNA.

Practical: 5S Biochemistry

List of Practical/Laboratory Experiments/Activities etc.

A) Molecular Biology :

1. Extraction of RNA
2. Estimation of RNA by Orcinol method.
3. Extraction of DNA
4. Estimation of DNA by Diphenylamine method.

B) Biotechnology:

1. Estimation of alcohol by Iodometric method.
2. Preparation and sterilization of Media for Plant Tissue Culture.
3. Development of plant tissue callus.
4. Demonstration of agarose gel electrophoresis of DNA

The distribution of marks for the practical examination shall be as follows:

| External Examination | | Internal Examination | |
|------------------------------------|----------|-----------------------------------|----------|
| Performance of any two experiments | 20 marks | Attendance & students performance | 10 Marks |
| Viva-voce | 05 marks | Practical Record book | 10 Marks |
| | | MCQ/ Objective test | 05 Marks |
| Total | 25 Marks | Total | 25 Marks |

List of Books Recommended:

- 1) Molecular Biology of Gene (Latest Edition) by J.D.Watson Hopkins Robertis, Stertz, Weiner.
- 2) Genetics by Sandhya Mitra (TMH Publication)
- 3) Gene VII by Lewis (Oxford)
- 4) Gene Structure and Expression by John D. Hawkins (Cambridge)
- 5) Plant Biotechnology S.Ignacimuthu S.J. (Oxford & IBH)
- 6) Gene Structure by Hawkins (Cambridge.)
- 7) Biotechnology – Application & Research edited by Paul Chere misinoff and Robert Ouellete
(Technomic Publications)
- 8) An Introduction to Plant Tissue and Cell Culture by Emkay Publication.

Sant Gadge Baba Amravati University Amravati

Scheme of teaching, learning & Examination leading to the Degree Bachelors of Science (Choice Based Credit System)

(Three Years Six Semesters Degree Programme- C.B.C.S)

| Sr. No. | Subjects | Subject Code | Teaching & Learning Scheme | | | | | | | Duration of Exams Hrs. | Examination and Evaluation Scheme | | | | | | |
|-----------|--|-------------------|----------------------------|---|---|-------|---------|-----------|-------|------------------------|---|-----------------------------------|-----------|----------|-----------------|-------|-------|
| | | | Teaching Period Per week | | | | Credits | | | | Maximum Marks | | | | Minimum Passing | | |
| | | | L | T | P | Total | Theory | Practical | Total | | Theory + MCQ External | Skill Enhancement module Internal | Practical | | Total Marks | Marks | Grade |
| 1 | BCM (6S) Immunology and Clinical Biochemistry (Theory) | BCM (6S) DSE-I-T | 6 | | | 6 | 4.5 | | 4.5 | 3 hours | 80 | 20 | Internal | External | 100 | 40 | p |
| 2 | BCM (6S) Practical | BCM(6S) DSC-I-Pr | | | 6 | 6 | | 2.25 | 2.25 | 3 Hours | | | 25 | 25 | 50 | 25 | p |
| 3 | Mini-Project / Hands on Training /workshop/DIY related to Subject-Phase I | | | | 6 | 6 | | 2.25 | 2.25 | 2 hours | Internal Assessment by College/Institute/department | | | | 50 | 25 | p |
| 3 | Total | | 6 | | 6 | 18 | 4.5 | 4.5 | 9.0 | 8 hours | 80 | 20 | 25 | 25 | 200 | 90 | P |
| OR | | | | | | | | | | | | | | | | | |
| 1 | BCM (6S) Herbal Biochemistry and Herbal Technology | BCM (6S) DSE-II-T | 6 | | | 6 | 4.5 | | 4.5 | 3 hours | 80 | 20 | Internal | External | 100 | 40 | p |
| 2 | BCM (6S) Practical | BCM(6S) DSE-II-Pr | | | 6 | 6 | | 2.25 | 2.25 | 3 Hours | | | 25 | 25 | 50 | 25 | p |
| 3 | Mini-Project / Hands on Training / workshop/DIY related to Subject-Phase I | | | | 6 | 6 | | 2.25 | 2.25 | 2 hours | Internal Assessment by College/Institute/department | | | | 50 | 25 | p |
| 3 | Total | | 6 | | 6 | 12 | 4.5 | 2.25 | 6.75 | 6 hours | 80 | 20 | 25 | 25 | 200 | 90 | P |

B.Sc. Part-III) (Semester-VI) BIOCHEMISTRY
Syllabus Prescribed for 2024-2025 UG Programme

Programme: UG in Biochemistry

Semester-VI

| Code of the Course /Subject | Title of the Course/Subject | Total Number of Periods |
|--|---|--------------------------------|
| BCM(6S) DSC-I-T | Immunology and Clinical Biochemistry | 90 |

COs

After the completion of this course, the student will be able to:

1. Out line, compare and contrast the key mechanism of innate and adaptive immunity
2. Gain knowledge on different types of antigens, antibodies and how different types of antibodies are produced.
3. Gain knowledge on undesirable immunological reactions and their complications in health management
4. Apply knowledge in disease diagnosis through serological tests.
5. Understand concept of Clinical Biochemistry
6. To know methods for chemical analysis of body fluids.
7. Apply the knowledge of clinical biochemistry for disease diagnosis.

| COURSE MODULE | UNIT | CONTENT |
|--------------------------|-------------------------------|--|
| DSE | Unit-I Basic Immunology | a. Immunology: Concept of immunity, types of Immunity: Innate immunity-mechanism of immune response (anatomic; physiological; phagocytic and inflammatory barriers) b. Adaptive immunity: Humoral and Cell-mediated immunity; Mechanism of immune response antigen processing and presentation; types and structures of Major Histocompatibility Complex molecules (MHC) and their role in antigen presentation; clonal selection of lymphocytes. |

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| | | <p>c. Antigen: Definition, factors determining antigenicity, complete antigen, types of antigens.</p> <p>Antibodies (Immunoglobulins): Definition, structure, classification, properties and differences</p> <p style="text-align: right;">(15 Periods)</p> |
| | <p>Unit-II Antigen- Antibody reactions</p> | <p>a. Precipitation: Definition, Mechanism; Marrack's Hypothesis, zonal phenomenon, Application; ring test, flocculation test. immunodiffusions, and immunoelectrophoresis</p> <p>b. Agglutination: Definition, mechanism, Types; direct and indirect agglutination, Application: slide agglutination test, tube agglutination test, Coombs' test, Latex agglutination test.</p> <p>c. Complement Fixation Test and toxin – antitoxin neutralization reaction, ELISA,RIA</p> <p style="text-align: right;">(15 Periods)</p> |
| | <p>Unit-III Hypersensitivity and Hybridoma technology</p> | <p>a. Hybridoma technology. : Production of monoclonal antibody, Application of Monoclonal antibodies.</p> <p>b. Complement: Components, Classical Pathway, Alternative Pathway Lectin pathway</p> <p>c. Allergy and hypersensitivity: Cell and coombs classification, definition and description of I- IV types of hypersensitivity.</p> <p style="text-align: right;">(15 Periods)</p> |
| | <p>Unit-IV Basic Clinical Biochemistry</p> | <p>a. Basic concepts of clinical biochemistry. Definition and scope of clinical biochemistry in diagnosis. Brief review of units and abbreviations used expressing concentration and standard solution,.</p> <p>b. Requirements of setting up of clinical laboratory , Safety measures in clinical laboratory, Quality Control in clinical laboratory</p> <p>c. Types of Automation, Analyzer- Semi and auto analyzer, Manual versus automation in clinical laboratory.</p> <p style="text-align: right;">(15 Periods)</p> |

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|------------|--|---|
| | Unit-V Clinical enzymology and metabolic disorders | <p>a. Functional and non-functional plasma enzymes. Isozymes and diagnostic applications of isozymes.</p> <p>b. Enzyme pattern in health and diseases with special reference to plasma lipase, amylase, choline esterase, alkaline and acid phosphatase, SGOT and SGPT, LDH and CPK.</p> <p>c. Glycogen Storage Diseases, Lipid malabsorption and steatorrhea Sphingolipidosis , Inborn Errors of Amino Acid Metabolism - Primary Aminoacidurias , Secondary Aminoacidurias , Alkaptonuria, Albinism.</p> <p style="text-align: right;">(15 Periods)</p> |
| SEM | Analytical clinical biochemistry | <p>a. Collection and preservation of biological fluids (Blood, serum, plasma, urine and CSF).</p> <p>b. Chemical analysis of blood, urine and CSF. Normal values of important constituents (in SI units) in blood (Plasma/serum) CSF and urine</p> <p>c. Clearance test for urea and Creatinine.</p> <p style="text-align: right;">(15 Periods)</p> |
| | <p>COs:</p> <p>By the end of this module, the students will be able to:</p> <ol style="list-style-type: none"> 1. To know the methods for collection of body fluids for chemical analysis. 2. To know methods for preservation of body fluids. 3. To know methods for chemical analysis of blood, urine and CSF. 4. To know normal values of different metabolites in body fluids. | |
| | **Activities | <ol style="list-style-type: none"> 1. Class test(10M) 2. Assignment(5M) 3. Educational Visit /Group discussion /Seminars and projects/Any innovative activity (5M). |

Syllabus Prescribed for 2024-2025 UG Programme

Programme: UG in Biochemistry

Semester-VI

| Code of the Course /Subject | Title of the Course/Subject | Total Number of Periods |
|-----------------------------|-----------------------------|-------------------------------|
| BCM (6S) DSE-I-Pr | BCM (6S) Practical | 6 periods /per week/per batch |

COs:

By the end of this module, the students will be able to perform:

1. Glucose tolerance test, liver function test, cardiac function test and kidney function tests
2. Determination blood groups.
3. Detection of pregnancy
4. Test for diagnosis of Hepatitis

Practical: 6S Biochemistry

List of Practical/Laboratory Experiments.

A) Clinical Biochemistry :

1. Separation of Serum and plasma from whole blood.
2. Glucose tolerance test
3. Liver function tests (SGPT/SGOT/Alkaline Phosphatase/Serum bilirubin)
4. Cardiac function tests (Serum Cholesterol, CPK, Triglycerides, LDL-Cholesterol, HDL-Cholesterol, LDH)
5. Kidney function tests (Blood urea, Serum creatinine, Serum Na⁺ , K⁺)

B) Serological tests :

1. Blood Grouping
2. HBsAg (Hepatitis/B/C)
3. Pregnancy test

The distribution of marks for the practical examination shall be as follows:

| External Examination | | Internal Examination | |
|--|----------|-----------------------------------|----------|
| Performance of any two experiments (Anyone experiment from Section A and another experiment from section B) | 20 marks | Attendance & students performance | 10 Marks |
| Viva-voce | 05 marks | Practical Record book | 10 Marks |
| | | MCQ/ Objective test | 05 Marks |
| Total | 25 Marks | Total | 25 Marks |

Course Material/Learning Resources

List of Books Recommended:

- 1) Immunology by Roitt (Blackwell)
- 2) Cell and Molecular Biology : Darnell Lodish Baltimore.
- 3) Animal Cell Culture : Practical approach : R.J.Freshney.
- 4) Introduction to Practical Biochemistry by Plummer
- 5) Practical Manual in Biochemistry by Jairaman.
- 6) Text Book of Biochemistry and Human Physiology by J.P.Talwar.
- 7) Lehninger's Principles of Biochemistry (2000) by - Nelson, Cox, M.M.Macmillan, New York.
- 8) Text Book of Biochemistry by U.Satyanarayana.
- 9) Text Book of Biochemistry by Sucheeta Dandekar.
- 10) Practical Clinical Biochemistry by Hirowled Varle

Syllabus Prescribed for 2024-2025 UG Programme

Programme: UG in Biochemistry

Semester-VI

| Code of the Course /Subject | Title of the Course/Subject | Total Number of Periods |
|--------------------------------|---|-------------------------|
| BCM(6S) DSE-II-T | HERBAL BIOCHEMISTRY AND HERBALTECHNOLOGY | 90 |

COs

After the completion of this course, the student will be able to:

1. Explain history, classification, Properties, distribution, biosynthesis, biological role and applications of secondary metabolites.
2. Gain knowledge on different aspects of nutraceuticals.
3. Apply knowledge in extraction of secondary metabolites.
4. Explain Sources and Description of raw materials of herbal origin used in herbal cosmetics.
6. To know methods for chemical analysis of herbal extract.
7. Describe nomenclature, characteristics & classification and chemical constitution of herbs used for hair care.

| COURSE MODULE | UNIT | CONTENT |
|------------------|---|---|
| DSE | Unit-I Plant Secondary Metabolites | a. History, Classification, Properties, Distribution in Nature, Biosynthesis, Biological role and applications of Alkaloids, Glycosides, Tannins , Phenol Compounds, Volatile oils and resins. b. Sources and functions of Medicinal polysaccharides : dextrins, inulin, gums and mucilages, Peptides and lectins of medicinal importance. <p style="text-align: right;">(15 Periods)</p> |

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| | <p>Unit-II Nutraceuticals</p> | <p>a. General Aspects, Market Growth, Scope and Type of Products available in market.</p> <p>b. Health benefits and role of nutraceuticals in ailments like diabetes and CVS diseases, Cancer, IBS and various GI disorders</p> <p>c. Study of the following food as health food: Alfa, chicory, Ginger, Fenugreek, Garlic, honey, Amla, ginseng, Aswagandha, Spirulina</p> <p style="text-align: right;">(15 Periods)</p> |
| | <p>Unit-III Herb as a raw material</p> | <p>a. Herbal medicine, herbal medicinal Products and herbal medicinal Preparations</p> <p>b. Selection, identification and authentication of herbal materials</p> <p>c. Processing of herbal raw materials</p> <p>d. Extraction, isolation and analysis of phyto pharmaceuticals from herbs - Infusion , Decoction , Digestion , Maceration , Percolation, Successive solvent extraction – Super critical fluid extraction Steam distillation , Head space techniques , Sepbox Selection of a suitable extraction process .</p> <p style="text-align: right;">(15 Periods)</p> |
| | <p>Unit-IV Herbal technology for Skin care</p> | <p>Sources and Description of raw materials of herbal origin used in Herbal cosmetics for skin care and oral hygiene products.</p> <p>a) Fixed oils and waxes</p> <p>b) Gums</p> <p>c) Colourants and Perfumes</p> <p>d) Protective agents, bleaching agents</p> <p>e) Antioxidants</p> <p style="text-align: right;">(15 Periods)</p> |
| | <p>Unit-V Herbal technology for hair care</p> | <p>Nomenclature, characteristics & classification and chemical constitution of herbs used for hair care.</p> <p>a. Hair grooming: - Apricot, Aloe</p> <p>b. Hair growth promoter: Brahmi, Manjistha, Jatamansi.</p> <p>c. Hair Tonics: Bawachi, Hibiscus, Amla , Almond oil, Coconut oil Olive oil.</p> <p>d. Antidandruff: Tulsi, Neem, Wheat Gram Oil, Beturla Pedula. Hair</p> <p>e. Colorants: Amala, Heena, Bhringaraja (Eclipta alba), Comomite, Safflower (Carthamus Officinatis).</p> <p>f. Hair cleansing: Ritha, Shikakai, Amla.</p> <p style="text-align: right;">(15 Periods)</p> |

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|---|---|
| <p>SEM Methods of Extraction and Analysis of Herbal Extract</p> | <p>a. Extraction & isolation of active principles of herbs & their incorporation in various cosmetics formulations like creams, lotions, powders & other cosmetics, formulations.</p> <p>b. Analysis of herbs: General method of analysis of herbs- Determination of standard values, qualitative & quantitative estimation of resin & sugars.</p> <p>c. Chromatographic techniques used in analysis of herbs & their constituents. (15 Periods)</p> |
| | <p>COs:</p> <p>By the end of this module, the students will be able to:</p> <ol style="list-style-type: none"> 1. To know the methods for extraction & isolation of active principles of herbs & their incorporation in various cosmetics formulations like creams, lotions, powders & other cosmetics, formulations. 2. To know general method of analysis of herbs 3. To know Chromatographic techniques used in analysis of herbs & their constituents. |
| | <p>**Activities</p> <ol style="list-style-type: none"> 1. Class test(10M) 2. Assignment(5M) 3. Educational Visit /Group discussion /Seminars and projects/Any innovative activity (5M). |

Syllabus Prescribed for 2024-2025 UG Programme

Programme: UG in Biochemistry

Semester-VI

| Code of the Course /Subject | Title of the Course/Subject | Total Number of Periods |
|-----------------------------|-----------------------------|-------------------------------|
| BCM (6S) DSC-II-Pr | BCM (6S) Practical | 6 periods /per week/per batch |

COs:

By the end of this module, the students will be able to perform:

1. Preliminary phytochemical screening of crude herbal extract.
2. Quantitative analysis of aldehyde content, Phenol content, total alkaloids, Alcohol Content etc of herbal extract.
3. Solvent fractionation of herbal Extract and Thin layer chromatography of herbal extract
4. Preparation of turmeric Cream and Methi-Shikakai Shampoo

List of Practical's

1. To perform preliminary phytochemical screening of crude herbal extract.
2. Determination of Aldehyde content
3. Determination of Phenol content
4. Determination of total alkaloids
5. Determination of the Alcohol Content of Asava And Arista
6. To perform solvent fractionation of herbal Extract.
7. Thin layer chromatography of herbal extract.
8. Preparation and Evaluation of Turmeric Cream
9. Preparation and Standardization of Methi-Shikakai Shampoo.

Course Material/Learning Resources

List of Books Recommended:

1. Lehninger's Principles of Biochemistry (2000) by - Nelson, Cox, M.M. Macmillan, New York
2. Textbook of Pharmacognosy by Trease & Evans.
3. Textbook of Pharmacognosy by Tyler, Brady & Robber.
4. Pharmacognosy by Kokate, Purohit and Gokhale
5. Essential of Pharmacognosy by Dr.S.H.Ansari
6. Pharmacognosy & Phytochemistry by V.D.Rangari
7. Pharmacopoeal standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopathy)
8. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.
9. Agarwal, S.S. and Paridhavi, M., "Herbal Drug Technology" Universities Press (India) Private Limited, 2007.
10. Wallis, T.E., "Textbook of Pharmacognosy" 5th Edition, CBS Publishers and Distributors, 1985.
11. Daniel, M., "Herbal Technology: Concepts and Advances" Satish Serial Publishing House, 2008.