

DEPARTMENT OF BOTANY

PROGRAMME: B. SC.

Statements of program me Specific Outcomes (PSOs)

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

1. Understand the basic concepts of lower group plants and morphology of higher groups.
2. Understand the evolution, Classification ,anatomical details of higher group plants.
3. Analyze the cell organells and application of genetics, molecular biology in plant breeding.
4. Identify the bacteria, viruses and plant pathogen.
5. Analyze metabolic activities of plants.
6. Understand the application of genetic engineering for the improvements of plants.
7. Understand the basic concepts of ecology.
8. perform the procedure of laboratory technique in biochemistry, biotechnology and utilization of plants.

Statements of course outcomes (Cos)

B.Sc.Course:SEM-I Paper -1

Course Outcomes:By the end of this course, the students will be able to:

1. Understand the basic concept of bacteria, virus and mycoplasma.
2. Student will understand types of bacteria, viruses and mycoplasma.
- 3 Student will able to describe Classification and general characteristic of Algae.
- 4 Analyze economic importance of bacteria, virus and algae.
5. Student will describe life-cycle of micro organism and Algae.
6. Student differentiated between bacteria and Algae.

B.Sc.Course:SEM-I Paper -2

Course Outcomes:By the end of this course, the students will be able to:

1. Compare lower group of plants with higher.
2. Students understand Fungi ,Lichen, Plant diseases and Bryophytes.
3. Identify the different plant diseases.
4. Understand the Economic importance fungi, lichens and bryophytes.
5. Discuss the classification of fungi and Bryophytes.

B.Sc.Course:SEM-I Lab

Course Outcomes: By the end of this course, the students will be able to:

1. Student will understand working and precaution while handling microscope.
2. Understand the basic technique in lab e.g. Slide preparation and Section cutting.
3. Identify bacterial, cynobacterial ,algal, fungal lichens and Bryophytic plant.
4. Comparative study of lower groups and lower higher groups.
5. Understand and identify the algal, bryophyte, fungal, plant pathology and lichens under natural habitat.

B.Sc.Course:SEM-II Paper-1

Course Outcomes: By the end of this course, the students will be able to:

- 1.Explain the classification pteridophyta and gymnosperm.
- 2 Describe the economic importance of pteridophyta and gymnosperm.
- 3.Discuss the alternation of generation pteridophyta and gymnosperm.
- 4.Critize the concept of heterospory and seed habit.
- 5 .Discuss morphology and anatomy of cycadeoidea.

B.sc. course:SEM II Paper -2

Course outcomes: By the end of this course, the students will be able to:

- 1.Understand the paleobotany and geological time scale.
- 2.Identify the different type of fossils.
- 3.Explain the morphology and modification of plants.
- 4.Compare the types inflorescence and fruits.
- 5.Describe the parts of flower.
- 6.Student will understand the process of fossilization.
- 7.Student will understand fossil types in the field.
- 8.Student will describe vegetative and floral parts in scientific language.
- 9.Students will identify types of root,stem,leaves and flowers.

B.Sc.Course:SEM-II Lab

Course Outcomes: By the end of this course, the students will be able to:

- 1.Describe the various parts of flower.
- 2.Identify the anatomy of plants material by making temporary mount.
- 3.Identify the different types of fossils.
- 4.Identify various Plant specimen.
- 5.Understand and Identify the morphological characters of plants in natural environment.
- 6.Students will understand the structure of *Enigmocarpon* fruit.
- 2.Students will identify types of roots, stem, leaves, inflorescence, flower and fruits in the field visit.

B.Sc.Course:SEM-III Paper-1

Course Outcomes: By the end of this course, the students will be able to:

- 1.Describe general taxonomic rule of plant classification.
- 2.Acquire the basic knowledge of taxonomy.
- 3.Made aware with local flora.
- 4.Discuss the principal of botanical nomenclature.
- 5.Criticize the classification of angiosperms.
- 6.Justify the merits and demerits of systems of classification.
- 7.Understand the fossil angiosperm *sahanianthus*

B.Sc.Course:SEM-III Paper-2

Course Outcomes: By the end of this course,the students will be able to:

- 1.Describe the structure of plant cell and its organelles.
- 2.Analyze the morphology of chromosome organization.
- 3.Explain the plant cell-division and its significance.
- 4.Evaluate the biostatic formulas.
- 5.Understand the method of plants breeding.
- 6.structure of typical plant cell and plant membrane.
- 7.Objectives and application of plant breeding statistical methods used in biology.

B.Sc.Course:SEM-III lab

Course Outcomes: By the end of this course,the students will be able to:

- 1.Preparation of herbarium.
- 2.Analyze the floral formula of monocot and dicot families.
- 3.Perform the procedure of cytological techniques.
- 4.Analyze the biostatics data.
- 5.Understand and identify the plants under natural environment.
- 6.Enriched with fundamental aspects of botany.

B.Sc.Course:SEM-IV paper-1

Course Outcomes: By the end of this course,the students will be able to:

- 1.Classify the meristimatic and permanant tissue based on origin and position.
2. Compare the different theories of tissue.
- 3.Understand primary,secondary and anomalous ,anatomical structure of plant parts.
- 4.Understand the various types of pollination mechanism.
- 5.Explain the types of ovules.
- 6.Students will understand double staining technique.

B.Sc.Course:SEM-IV paper-2

Course Outcomes: By the end of this course,the students will be able to:

- 1.Describe the laws of mendelism.
- 2.Summarize the theories of linkage.
- 3.Design and construct the variation in chromosome structure and number.
- 4.Understand the concept of gene.
- 5.Discuss the types of mutations and its application in crop –improvement.

B.Sc.Course:SEM-IV Lab

Course Outcomes: By the end of this course, the students will be able to:

- 1.Perform double-stained permanant slide mounting.
- 2.Calculate the percent germination of pollen-grains.

- 3.Solve the Mendel's law of inheritance through color beads.
- 4.Solve interaction of gens from the given data.

B.Sc.Course:SEM-V Paper-1

Course Outcomes: By the end of this course,the students will be able to:

- 1.Classify and describe about bimolecular.
- 2.Describe about the basic of enzymes.
- 3.Understand plant water relation.Write about mineral nutrients.
- 4.Summerize the cycle of respiration and photosynthesis.

B.Sc.Course:SEM-V Paper-2

Course Outcomes: By the end of this course,the students will be able to:

- 1.Define and explain about ecology branches and its significance.
- 2.Summarize the environmental factors.
- 3.Understand and explain the nitrogen cycle.
- 4.Compare the various Phytogeographic regions of india.
- 5.Describe the types of ecosystem.
- 6.Student will explain the effect of climatic factors on vegetation.
- 7.Students will understand food chain,food web and ecological pyramids.

B.Sc.Course:SEM-V Lab

Course Outcomes: By the end of this course,the students will be able to:

- 1.Perform major and minor physiology experiment.
- 2.Perform micro-chemical and bio-chemical test.
- 3.Understand ecological adaptations of plants.
- 4.Compare different types of soil.
- 5.students able to measure the water holding capacity and moisture content.

B.Sc.Course:SEM-VI Paper-1

Course Outcomes: By the end of this course,the students will be able to:

- 1.Describe the plant growth and its growth regulators.
- 2.Describe the seed –dormancy.
- 3.Describe the plant-defense and role of secondary metabolites.
- 4.Discuss plant tissue culture technique and its application.
- 5.Discuss the advantages and disadvantages of genetic-engineering.

B.Sc.Course:SEM-VI Paper-2

Course Outcomes: By the end of this course,the students will be able to:

- 1.Compare the various ecological successions.
- 2.Explain different types of environmental pollution and its management.
- 3.Understand about the renewable and non-renewable natural sources.

4. Analyze the principal, types and application of instruments.
5. Explain morphology utilization and chemical-constituents of different plants.

B.Sc.Course:SEM-VI lab

Course Outcomes: By the end of this course, the students will be able to:

1. perform principles and working of instruments.
2. Study and identify the types and Characteristic of soil.
3. Study the physical and chemical properties of water.
4. Study the plants of ethnobotanical importance.
5. Understand and identify ethno-botanical plants under natural habitat.

DEPARTMENT OF MATHEMATICS

PROGRAMME: B. SC.

Statements of Programme Specific Outcomes (PSOs)

By the end of the course, the students will be able to:

- Join school as mathematics teacher.
- Prepare for competitive exams like MPSC, UPSC, GATE, CAT, IIT-JAM
- Analyze and grasp abstract ideas to apply them to important practical problems.
- Develop strong analytical skills and a broad-based background in the mathematical sciences to join Indian industry.

Statement of Course Outcomes (COs)

B.Sc. Sem-I Paper-M 1: Elementary Mathematics

By the end of this course, Students will be able to:

- Understand the basic concept of complex analysis.
- Use Matrices to solve system of linear equations.
- Understand the concept of Eigen value & Eigen vectors and method to find it.
- Find roots of polynomial equation in one variable.
- Understand the basic concept of Number Theory.

B.Sc. Sem-I Paper-M 2: Differential and Integral Calculus

By the end of this course, Students will be able to:

- Understand the concept series expansions (Maclaurin & Taylor Series).
- Find limits of Indeterminate forms by using L'Hospital Rule.
- Understand the concept of limit, continuity and differentiability of function of one variable, successive differentiation and Leibnitz's theorem.
- Understand the concept of partial differentiation, Euler's theorem, Jacobians.
- Solve definite integrals.

B.Sc. Sem-II Paper- M 3: Geometry, Differential & Difference Equations

By the end of this course, Students will be able to:

- Understand the concept of Geometry (line, Plane, Circle, Sphere, cone, cylinder).
- Solve first order exact differential equation, first order linear differential equation.
- Study Bernoulli's differential equation.
- Study higher order linear differential equation.
- Study Difference equation.

B.Sc. Sem-II Paper- M 4: Vector Analysis

By the end of this course, Students will be able to:

- Understand the concept of vector calculus (Gradient, Divergence, Curl)
- Use double integration to find area. Understand the concept of triple integration
- Study Beta and Gamma function
- Understand the concept of line Integral, surface integral, volume integral
- Solve problems on vector Integration (Surface Integral, Volume Integral).
- Understand Green's theorem, Gauss Divergence theorem, Stoke's theorem

B.Sc. Sem-III Paper-M 5: Partial Differential Equations & Calculus of Variation

By the end of this course, Students will be able to:

- Solve simultaneous differential equations. Understand Pfaffian differential equations
- Form partial differential equations of first order.
- Use suitable method to find solution of partial differential equations of first order.
- Solve linear partial differential equations of higher order.
- Study calculus of variation.

B.Sc. Sem-III Paper-M 6: Modern Algebra

By the end of this course, Students will be able to:

- Understand the concept of groups and its examples
- Understand the concept of Normal sub-groups, Quotient groups, homomorphisms
- Understand the concept of ring theory, homeomorphism of rings, Ideals and Quotient ring
- Understand the concept of Integral domain, Euclidean ring polynomial ring.

B.Sc. Sem-IV Paper-M 7: Real Analysis

By the end of this course, Students will be able to:

- Understand basic properties of set of real numbers, the concept of Open sets, Close set, limit point of sets, B-W theorem.
- Understand the concept of sequence of real numbers
- Understand the concept of series
- Understand the concept Riemann integral and its properties
- Understand fundamental theorem of Calculus.

B.Sc. Sem-IV Paper-M 8: Mathematical Methods

By the end of this course, Students will be able to:

- Understand the Series solution of first and second order linear equations, ordinary, singular and regular points.
- Understand Bessel's and Legendre's functions with their properties.
- Understand the concept of Laplace transform and Inverse Laplace transform.
- Understand the concept of Fourier Transform.

B.Sc. Sem-V Paper-M 9: Analysis

By the end of this course, Students will be able to:

- Understand the concept of fourier series.
- Understand the concept Riemann-Stieltjes integral.
- Understand fundamental theorem of calculus.
- Understand basic concept of analytic functions.
- Study Mobius transformation.

B.Sc. Sem-V Paper-M 10: Metric Spaces, Complex Integration & Algebra

By the end of this course, Students will be able to:

- Examine countable and uncountable sets.
- Understand the concept Metric spaces.
- Understand the concept of Ring.
- Study complex integration.

M.Sc. Sem-VI Paper-M 11: Abstract Algebra

By the end of this course, Students will be able to:

- Understand the concept of Group Automorphism.
- Give examples of vector spaces.
- Understand the concept of linear transformation.
- Link linear transformations with matrices.
- Study inner product spaces.

B.Sc. Sem-VI Paper-M 12 (Optional)

Special Theory of Relativity

By the end of this course, Students will be able to:

- Study Newtonian Relativity, Galilean Transformation.
- Understand failure of Newtonian Relativity.
- Study Einstein's Theory of Relativity, Lorentz Transformation.
- study Tensors, Riemannian metric, metric tensor.
- Study Maxwell's equations of electromagnetic theory, equivalence of mass and energy $E=mc^2$.

B.Sc. Sem-VI Paper-M 12 (Optional)

Discrete Mathematics and Elementary Number Theory

By the end of this course, Students will be able to:

- Distinguish between equivalence relation and partial order relation.
- Understand Boolean algebra.
- Study basic concept of Number Theory.
- Understand Greatest Integer Function, Quadratic Residues and Reciprocity.
- Study the Diophantine equations $ax+by=c$, the equations $x^2+y^2=z^2$ $Ax^4+y^4=z^4$.

B.Sc. Sem-VI Paper-M 12 (Optional)

Differential Geometry

By the end of this course, Students will be able to:

- Study curve in space, its parametric representation, curvature of curve.
- Understand the concept of Envelopes, developable surfaces.
- Study curves on a surface, normal curvature.
- Study differential equation of Geodesic, Curvature of Geodesic, Gaussian curvature

Department of Microbiology

Programme outcomes and course outcomes

Under Graduate programs – 03 years

Course Name: B.Sc. in Microbiology

Number of Semester: 06

Programme Outcomes:

- Students will be able to know the basics of microbiology, from the fundamentals of microbiology to basic techniques in microbiology and microorganisms' roles in food and milk.
- Students will be able to know the major biomolecules and their roles in life's metabolism.
- Students will come to know the newest and most interesting areas like the fermentation process, biotechnology-based techniques and their applications, genetic engineering, biomolecule-based modern devices, and cloning technology.
- Students will be able to know the disease-spreading mechanisms, epidemiology, the defensive mechanisms of the body, the major pathogenic microbes and viruses, their diagnosis, and their prevention.
- Overall, the students will be able to distinguish between beneficial and harmful microorganisms, educate society about bacterial infections in rural areas, deepen their understanding of the fermentation industry, and learn diagnostic techniques.

Course outcomes of Department of Microbiology

Semester: Semester I

Title of the paper: Fundamentals of Microbiology – I

Class: F.Y.B.Sc.

Objectives: To understand the basics of microbiology and microbes.

Course content (Syllabus in brief):

1. History of Development and Scope of Microbiology
2. Bacterial Physiology
3. Microbial nutrition types and media
4. Growth of microbes and synchronous culture

Course level learning outcomes:

1. Students will gain knowledge about the origination of the subject, contribution of the scientist in the subject while solving major social and biological development issues, the application of subject in different area in detail.
2. Students will also study the physiology of microbes different organelles and biomolecules.
3. Students will learn basic of nutritional requirements of bacteria and its types.
4. Students will learn the growth pattern of bacteria, mathematical expression and related terminologies.

Suggested reading (Bibliography):

1. Microbiology: An Introduction. Tortora GJ, Funke BR and Case CL. Pearson Education
2. Prescott's Microbiology. Wiley JM, Sherwood LM and Woolverton CJ. McGraw Hill International
3. Microbiology. Pelczar MJ, Chan ECS and Krieg NR. McGraw Hill Book Company.
4. General Microbiology. Stanier RY, Ingraham JL, WheelisML, and Painter PR. McMillan
5. Microbiology: A Laboratory Manual; Cappucino J and Sherman N.. Pearson Education Limited

Semester: Semester I

Title of the paper: Basic techniques in Microbiology - II

Class: F.Y.B.Sc.

Objectives: To study the basics of isolation and identification techniques of bacteria

Course content (Syllabus in brief):

1. Basics of Microscopy with its type.
2. Basic of Staining techniques
3. Basic bacterial isolation techniques and determination of nutritional requirement techniques.
4. Basic of Microbial control techniques.

Course level learning outcomes:

1. Students will come across about the microscopy and its type.
2. Students will gain knowledge about the different techniques of isolation of bacteria as well as growth measurement.
3. Students will study the physical, chemical and antibiotics are used to microbial control.
4. Students will learn basics of stains and dye, staining types and techniques for different levels.

Suggested reading (Bibliography):

1. Pelczar MJ, Chan ECS and Krieg NR. Microbiology. McGraw Hill Book Company.
2. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. General Microbiology. McMillan.
3. Tortora GJ, Funke BR and Case CL. Microbiology: An Introduction. Pearson Education
4. Cappucino J and Sherman N. Microbiology: A Laboratory Manual. Pearson Education Limited.
5. Wiley JM, Sherwood LM and Woolverton CJ. Prescott's Microbiology. McGraw Hill International.

Semester: Semester II

Title of the paper: Microbial Diversity – I

Class: F.Y.B.Sc.

Objectives: To study Prokaryotic and eukaryotic, acellular (viruses) microbes and microbial interactions

Course content (Syllabus in brief):

1. Prokaryotic microbes
2. Eukaryotic Microbes
3. Acellular Microbes(viruses)
4. Microbial interactions.

Course level learning outcomes:

1. Students will study about different prokaryotic microbes and its importance.
2. Students will gain knowledge about the eukaryotic microbes and its importance.
3. Students will also learn about discovery of viruses, bacterial virus(Bacteriophage) and life cycle, cultivation and detection.
4. Students will come to know the bacterial interactions with other inter as well as intra-species.

Suggested reading (Bibliography):

1. Dimmock NJ, Easton AL and Leppard KN. Introduction to Modern Virology. Blackwell Publishing Ltd.
2. Pelczar MJ, Chan ECS and Krieg NR. Microbiology. McGraw Hill Book Company.
3. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. General Microbiology. McMillan.
4. Tortora GJ, Funke BR and Case CL. Microbiology: An Introduction. Pearson Education
5. Cappucino J and Sherman N. Microbiology: A Laboratory Manual. Pearson Education Limited.

Semester: Semester II

Title of the paper: Food Microbiology and Milk Microbiology- II

Class: F.Y.B.Sc.

Objectives: To study the basics food spoilage, preservation techniques, Milk and milk products and food intoxication and food infections.

Course content (Syllabus in brief):

1. Spoilage of Food
2. Preservation of food
3. Milk Microbiology
4. Food borne diseases and food standards

Course level learning outcomes:

1. Students will learn about the basics of food deterioration , vegetable, meat& meat products and canned food spoilage factors and their types.
2. Students will gain knowledge about food preservation, types and techniques.
3. Students will learn about milk composition, microbial contamination in milk, its spoilage, preservation methods, different techniques used to check the quality of milk, milk products production.
4. Students will know the food borne diseases like food poisoning, responsible microbes in food poisoning, toxins types, basics of FDA, BIS and FSSAI objectives and responsibilities and Introduction of HACCP.

Suggested reading (Bibliography):

1. Food Microbiology by Frazier 5th ed
2. Modern Food Microbiology by James Jay 6th ed
3. Applied Dairy Microbiology by Martha & Steele.
4. Prescott, Hurley. Klein-Microbiology, 7th edition, International edition, McGraw Hill.
5. Kathleen Park Talaro & Arthur Talaro- Foundations in Microbiology International edition 2002,|McGraw Hill.
6. William C. Frazier, Dennis C. Westhoff, N. M. Vanitha (2013). Food Microbiology, 5thEdn.McGraw-Hill Education (India).
7. Banwart G. J. (1989). Basic Food microbiology, 2nd Edn. Chapman and Hall. International Thompson Publishing.
8. BIS standards, FSSAI
9. Clarence Henry Eckles, Willes Barnes Combs, Harold Macy (1943). Milk and milkproducts, 4th Ed. McGraw-Hill book Company, Incorporated.

Semester: Semester III

Title of the paper: Chemistry of organic constituents and enzymology - I

Class: S.Y.B.Sc.

Objectives:

1. To study major biomolecules, its basic structure.

Course content (Syllabus in brief):

2. Carbohydrates and lipids.
3. Amino acids and proteins.
4. Enzymes, kinetics, and inhibitions.
5. Nucleic acids, DNA, RNA and Forms of DNA.
6. Vitamins and its functions.

Course level learning outcomes:

1. Students will learn basics of major biomolecules, structure, types and functions.

Suggested reading (Bibliography):

2. Lehninger. Principles of Biochemistry. 4th Edition. D. Nelson and M. Cox. W.H. Freeman and Company. New York 2005.
3. Biochemistry, Satynarayan and Chakrapani, 5th Edition, Elsevier, Relx India Pvt. Ltd.
4. Biochemistry, by J. L. Jain et. al., S. Chand and Company Limited.
5. Microbiology an Introduction. 6th Edition. Tortora, Funke and Case. Adisson Wesley Longman Inc. 1998.
6. Prescott, Hurley. Klein-Microbiology, 5th & 6th edition, International edition 2002 & 2006, McGraw Hill.

Semester: Semester III

Title of the paper: Industrial Microbiology - II

Class: S.Y.B.Sc.

Objectives:

1. To study the fundamentals of industrial microbiology, fermentation process, fermenter design, quality control and production of products through overall process.

Course content (Syllabus in brief):

2. Fundamentals of industrial microbiology and fermenter design.
3. Fermentation and its types, inoculum development, raw materials at industrial scale
4. Upstream and downstream process and quality control
5. Scale up of fermentation and factor affecting fermentation at industrial level.
6. Production of products, recovery and applications.

Course level learning outcomes:

1. Students will gain knowledge of importance of fermentation, fermenters and industrial microbiology.
2. Students will also know fermentation, the role of industrial important microbes, and raw materials.
3. Students will study about the upstream and downstream process and quality control
4. Students will study the overall process of production of products, its biochemistry and recovery process.
5. Students will learn the scale-up process of fermentation.

Suggested reading (Bibliography):

1. Stanbury, P. F. and Whittaker, A. (1984) Principles of Fermentation technology, Pergamon press.
2. Casida, L. E., (1984), Industrial Microbiology, Wiley Easterbs, New Delhi
3. Peter F. Stanbury. Principles Of Fermentation Technology, 2E, Elsevier (A Division of Reed Elsevier India Pvt. Limited), 2009
4. Prescott, S.C. and Dunn, C. G., (1983) Industrial Microbiology, Reed G. AVI tech books.
5. Reed G. Ed. Prescott and Dunn's Industrial Microbiology. 4th Ed., CBS Pub. New Delhi.
6. Van Damme E. J. (1984) Biotechnology of Industrial Antibiotics, Marcel Dekker Inc. New York.
7. Indian Pharmacopia and British Pharmacopia (Latest Edn).

Semester: Semester IV

Title of the paper: Metabolism – I

Class: S.Y.B.Sc.

Objectives: To study in detail the metabolism of major biomolecules, photosynthesis and electron transport chain and energy generation.

Course content (Syllabus in brief):

1. Carbohydrates catabolism and anabolism
2. Lipid and amino acids catabolism.
3. Oxidative phosphorylation and photophosphorylation.
4. DNA replication, genetic code, transcription and translation.

Course level learning outcomes:

1. Students will study the detailed of carbohydrates, lipids and amino acids metabolism.
2. Students will gain the knowledge about the energy generation in ETC, and photosynthesis.
3. Students will learn in detail the molecular processes such as replication, transcription and translation.

Suggested reading (Bibliography):

1. Pelczar, M.J., Chan, E.C.S. and Krieg, N.R. Microbiology. McGraw Hill Book Co
2. Gardner, E.J., Simmons, M.J. and Snustad, D.P. Principles of Genetics. Wiley- India.
3. Stanier, R.Y. General Microbiology. Macmillan Publishers.
4. Wiley, J.M., Sherwood, L.M. and Woolverton, C.J. Prescott's Microbiology. McGraw Hill International.
5. Stryer, L. Biochemistry. W H Freeman and Company.
6. Primrose, S.B., Twyman, R.M. and Old, R.W. Principles of Gene Manipulation. Wiley Blackwell.
7. Nelson, D.L. and Cox, M.M. Lehninger Principles of Biochemistry. W H Freeman.
8. Sambrook, J. and Russell, D. Molecular Cloning: A Laboratory Manual. Cold Spring Harbor Laboratory Press.

Semester: Semester IV

Title of the paper:

Environmental Microbiology-II

Class: S.Y.B.Sc.

Objectives: To study microorganisms in water, soil, and air. The role of microbes in the natural resources, bioremediation and bio magnifications.

Course content (Syllabus in brief):

1. Fresh water microbiology
2. Waste water microbiology
3. Air and agriculture microbiology
4. Bioremediation and Bio magnification

Course level learning outcomes:

1. Students will understand the fresh water and its resources, potable water & its treatment process, Waste water and its treatment process and microbiological quality testing techniques in potable as well as waste water, water quality standards (BIS and WHO).
2. Students will also learn Air microbiology and agriculture microbiology useful in farming.
3. Students will be able to get the idea of useful environmental recycling process of materials with the involvement of microbes. (Bioremediation, Bio augmentation, Microbial leaching).
4. Students will learn about xenobiotic and recalcitrant compounds, Bioaccumulation and bio magnification.

Suggested reading (Bibliography):

1. Ajay Singh, Owen P. Ward, 2004 edition, Applied Bioremediation and Phytoremediation (Soil Biology). Springer;
6. David S. Ingram, N.F. Robertson (1999). Plant Disease. 1st Edn.: Collins
7. George Nicholas Agrios (2005). Plant Pathology. 5th Edn. Academic Press Inc.
8. James M. Jay, Martin J. Loessner, David A. Golden (2005). Modern food microbiology, 7th Edn. Springer Science & Business.
9. John Postgate, (1998). Nitrogen Fixation. Cambridge University Press
10. K. S. Bilgrami, H. C. Dube (1984). A textbook of modern plant pathology. 7th Edn.
11. Martin Alexander (1999). Biodegradation and Bioremediation. Academic Press
12. Matthew Dickinson, (2003). Molecular Plant Pathology. Garland Publishing Inc.
13. N. S. SubbaRao. (1995). Soil Microorganisms and Plant growth. 3rd Edn. Science Pub Inc

Semester: Semester V

Title of the paper: Medical Microbiology - I

Class: T.Y.B.Sc.

Objectives: Understand relationship between human host and pathogens, the ability of pathogens to cause disease, pathogenic microorganisms and disease control.

Course content (Syllabus in brief):

1. Epidemiology and host-parasite relationships.
2. Infectious microbiology and normal flora.
3. Study of pathogenic microorganisms.
4. Disease control.

Course level learning outcomes:

1. Students will be able to understand the terminologies related to disease spreading in host and region related, mode and source of transmission and control of communicable diseases.
2. Students will learn pathogenicity, normal flora of human host and microbial disease in human.
3. Students come to know different pathogenic microorganisms and method of identification in medical laboratory.
4. Students will gain knowledge of mechanism of action of drugs, drug resistance and drug susceptibility testing methods.

Suggested reading (Bibliography):

1. Ananthnarayana, R. and C.E, Jayaram Panikar, 1996 Text book of microbiology, 5th edition, Orient Longman.
2. Park and Park, Preventive and Social medicine. 2013, Publisher: Banarsidas Bhanot, Jabalpur.
3. Dey, N.C and Dey, TK. 1988, Medical Bacteriology, Allied Agency, Calcutta, 17 Edition.
4. Davis B.D., Delbacco, 1990 Microbiology 4th edition, J.B. Lippincott Co. NY
5. Medical Microbiology edited by Samuel Baron. Fourth edition. (University of Texas Medical Branch of Galvesion)
6. Sherris, John C, Ed, Medical Microbiology: an Introduction to infectious diseases.

Semester: Semester V

Title of the paper: Molecular Biology and Bioinstrumentation – II

Class: T.Y.B.Sc.

Objectives:

1. To understand different concept of gene, mechanisms of gene transfer.
2. To study the different bio instruments used in detection or separation of biological molecules.

Course content (Syllabus in brief):

1. Concept of gene, gene regulation, gene mutation and genetic suppressions.
2. Genetic recombination (Transformation, Transduction, Conjugation, Transposable genetic elements)
3. Bioinstrumentations (Spectroscopy, Centrifugation, Electrophoresis, Chromatography, Isotopic tracer techniques)

Course level learning outcomes:

1. Students will gain knowledge of prokaryotic gene transfer mechanisms, mutations and recombination.
2. Students will know the mechanism of different bioinstrumentation for the separation of desired biomolecules.

Suggested reading (Bibliography):

1. Pelczar, M.J., Chan, E.C.S. and Krieg, N.R. Microbiology. McGraw Hill Book Company.
2. Gardner, E.J., Simmons, M.J. and Snustad, D.P. Principles of Genetics. Wiley-India.
3. Stanier, R.Y. General Microbiology. Macmillan Publishers.
4. Wiley, J.M., Sherwood, L.M. and Woolverton, C. J. Prescott's Microbiology. McGraw Hill International.
5. Stryer, L. Biochemistry. W H Freeman and Company.
6. Primrose, S.B., Twyman, R.M. And Old, R.W. Principles of Gene Manipulation. Wiley-Blackwell.
7. Nelson, D.L. and Cox, M.M. Lehninger Principles of Biochemistry. W H Freeman.
8. Sambrook, J. and Russell, D. Molecular Cloning: A Laboratory Manual. Cold Spring Harbor Laboratory Press.

Semester: Semester VI

Title of the paper: Immunology – I

Class: T.Y.B.Sc.

Objectives:

1. To study the components of human immune system.
2. To understand human defense mechanisms.

Course content (Syllabus in brief):

1. Introduction of Immunology
2. Immune Cells and Organs
3. Antigens and Antibodies
4. Major Histocompatibility Complex
5. Complement System
6. Generation of Immune Response
7. Hypersensitivity
8. Immunological Techniques

Course level learning outcomes:

1. Students will gain the knowledge about defensive lines in host, the terminologies, antigen and antibody, organ involved in defensive mechanism.
2. Students will learn natural and induced immunity, Cell mediated immunity cytokines, hypersensitivity, antigen-antibody reaction and diagnostic immunology.

Suggested reading (Bibliography):

1. Delves P, Martin S, Burton D, Roitt IM. Roitt's Essential Immunology. Wiley-Blackwell Scientific Publication, Oxford.
2. Goldsby RA, Kindt TJ, Osborne BA. Kuby's Immunology. W.H. Freeman and Company, New York.
3. Murphy K, Travers P, Walport M. Janeway's Immunobiology. Garland Science Publishers, New York.
4. Peakman M, and Vergani D. Basic and Clinical Immunology. Churchill Livingstone Publishers, Edinberg.
5. Richard C and Geiffrey S. Immunology. Wiley Blackwell Publication.

Semester: Semester VI

Title of the paper: Microbial Biotechnology & Recombinant DNA technology – II

Class: T.Y.B.Sc.

Objectives:

1. To familiarize the students with tools and techniques in genetic engineering and health care biotechnology.
2. After the completion of the topic the students understands agriculture biotechnology and Industrial biotechnology.

Course content (Syllabus in brief):

1. Introduction to genetic engineering
2. Tools and strategies:
3. DNA modifying enzymes and their applications:
4. Cloning and Expression vectors:
5. Methods in molecular cloning
6. Applications of recombinant DNA technology
7. Products of rDNA technology
8. Protoplast fusion, bio pesticide, bio fertilizers, oriental fermented food and genetically modified foods, transgenic plants.
9. Biosensors, Biochips

Course level learning outcomes:

1. Students will be able to understand the basic process of DNA modification via using various tools.
2. The students will understand the recombinant DNA technology used in the production of insulin. Health care related products production processes.
3. The students will gain the role of biotechnology in agricultural field, transgenic plant, etc.
4. The students will know biosensors, biochip enzyme technology.

Suggested reading (Bibliography):

1. Sambrook J and Russell D. Molecular Cloning: A Laboratory Manual. Cold Spring Harbor Laboratory Press.
2. Freifelder D. Microbial Genetics. Jones and Bartlett Publishers.
3. Gardner EJ, Simmons MJ, Snustad DP. Principles of Genetics. Wiley India.
4. Krebs JE, Goldstein ES, Kilpatrick ST. Lewin's Genes. Jones and Bartlett Publishers.
5. Glick BR, Pasternak JJ, and Patten CL. Molecular Biotechnology ASM Press.
6. Dubey RC, A Textbook of Biotechnology. S. Chand & Co. Ltd.
7. Mathur SK, Purohit SS, Biotechnology. Fundamentals and Applications. Agro Botanica.
8. Brown TA. Gene Cloning and DNA Analysis: An Introduction. Wiley Publication.

Department of Physics

Programme Outcomes

- PO1: Students acquire adequate knowledge about the subject
- PO2: Build a foundation towards the higher learning
- PO3: Inculcate the ability of self learning
- PO4: Imbibe the ethical and moral values
- PO5: Able to analyse the results and apply them in various problems.
- PO6: Develop critical thinking
- PO7: Attain skills for career development
- PO8: Become empowered to face the challenges
- PO9: Become conscious about environment and societal responsibilities

Physics

- CO1:- Understand the basic concepts of Properties of Matter , mechanics, Electrostatics, Time varying fields & Electric Currents.
- CO2 :- Understand the theoretical and practical basis of Oscillations, Kinetic theory of gases, Thermodynamics, Gravitation, Astrophysics, Magnetism and Magneto statics.
- CO3:- Understand the basic concept of Sound waves, Applied acoustic, Ultrasonic, Power supply, Physical optics and Electromagnetic waves.
- CO4:- Understand basics of Solid state physics, X-ray, Laser, Solid state electronics and Molecular physics.
- CO5:- Understand the theoretical basis of Atomic physics, free electron theory, Statistical physics Quantum mechanics, Nanomaterials and Nanotechnology.
- CO6:- Understand and apply the concepts of Electronics, Digital electronics and basics of Fiber optics, Communication, Relativity, Nuclear physics and Bio Physics
- CO7:- Apply and verify theoretical concepts through laboratory experiments

Program Specific Outcomes (PSOs) and Course Outcomes (COs) of Zoology (Part of B.Sc. Program, offered in combination with other subjects)

Program Outcomes (POs)

After completion of B.Sc. programme, the students will be able to –

1. Understand the core fundamentals of basic sciences.
2. Understand the diverse day to day applications of various fields.
3. Demonstrate, solve and an understanding of major concepts in all disciplines of science.
4. Analyse any data in a scientific manner, interpret the data and come to a logical conclusion.
5. Apply the acquired knowledge and the applications of basic sciences to community.
6. Apply ethical principles and commit to professional ethics and responsibilities and norms of the scientific practice.
7. Have sustainable development.
8. Develop skills in handling scientific instruments, planning and performing in laboratory experiments.
9. Go for higher studies i.e. M. Sc and then do some research for the welfare of mankind.
10. Look for professional job-oriented courses, Indian Army, Indian Navy, Indian Air Force as officers, Indian Civil Services.

After completion of this programme, the students would be able to:

PSO1: Learn scientific way of classification and identification of animals. Also, understand anatomical, morphological and physiological similarities and differences among non-chordates and chordates.

PSO2: Understand the importance and role of every animal in maintaining harmony with the environment for coexistence.

PSO3: Understand not only the basic concepts of cell biology, molecular biology, genetics, animal physiology, developmental biology and immunology, but also learn how to apply this knowledge in real life.

PSO4: Understand how to apply basic knowledge of zoology in its applied branches like aquaculture, entomology.

PSO5: Understand the principles behind every technique used in various biotechniques like filtration, sterilization, separation along with others like microtechnique and biotechnology so as to evolve into skilled and employable workforce.

PSO6: Understand and implement basic concepts of biology and blend the knowledge with concepts from other branches of science to have proficiency in interdisciplinary branches like bioinformatics and biostatistics for better analysis of the experimental data.

Course Outcomes (COs) of Zoology

After completion of these courses, the students would be able to:

Life and Diversity of Animals-Non chordates (Protozoa to Annelida)

CO1: Understand the general characters of Phylum Protozoa and various taxa under Protozoa up to classes and able to identify animals based on these characters

CO2: Describe anatomical and morphological features of Paramecium and Plasmodium with the knowledge of their life cycles

CO3: Understand the modes of infection of parasitic protozoans of humans like Entamoeba, Trypanosoma, Giardia and Leishmania and learn the methods to control these protozoans

CO4: Describe general characteristics of Phylum Porifera and understand classification up to classes

CO5: Understand structure, reproduction and development of Sycon as an example of poriferans and understand various types of canal systems in observed in sponges

CO6: Learn general characteristics of Phylum Coelenterata with classification of animals under various taxa up to classes

CO7: Describe structure, life cycle of Obelia as representative coelenterate and study dynamics of coelenterate corals communities

CO8: Understand the general characters of Phylum Platyhelminthes and characteristics of different taxa up to classes under the phylum

CO9: Understand life cycle, morphology and reproductive systems of Ascaris

CO10: Learn anatomy, morphology and life cycle of Taenia solium and parasitic adaptations observed in helminths

CO11: Describe characteristics of Phylum Annelida and various taxa up to classes

CO12: Describe morphology and various systems including digestive and urinogenital systems of Leech

CO13: Understand various life forms during indirect development and study Trochophore larva in details

CO14: Understand importance of worms and practice vermiculture and understand its importance

CO15: Able to handle laboratory equipments, prepare temporary and permanent mountings and understand basic principles of staining

Environmental Biology

CO1: Understand different zones of atmosphere, their importance and components of air

CO2: Learn the global distribution and physico-chemical properties of water

CO3: Describe various types of rocks and understand the process of formation of soil

CO4: Understand the renewable and non- renewable energy sources, the differences between them and their importance

CO5: Understand ecosystem, its types and their importance with example of pond ecosystem

CO6: Understand the meaning and importance of food chains and webs for maintaining balance in the ecosystems and the concept of ecological pyramids

CO7: Describe various models of energy flow in an ecosystem, namely, Single Channel, Y – Shape and Universal model

CO8: Understand the concept and importance of biodiversity, its conservation and causes of depletion of biodiversity

CO9: Study the Wildlife Conservation Acts (1972 and 1984)

CO10: Understand the concept of National parks and sanctuaries with examples of Tadoba, Kanha, Bharatpur and Nagzira

CO11: Describe the concept of hot spots of biodiversity and enlist such hot spots in India

CO12: Describe the causes, effects of water-, noise-, and air-pollution and study various control measures

CO13: Understand the concepts and causes of acid rain, greenhouse effect, ozone depletion leading to global warming; also to study measures to control global warming

CO14: Understand the concepts of bioaccumulation and biomagnifications; describe the effects of heavy metals (lead, cadmium and mercury) on organisms

CO15: Able to understand how to measure pH using pH paper and pH meter; estimate dissolved oxygen and carbon dioxide in water samples by understanding basic principles of titration; study various physical and chemical properties of water

CO16: Prepare temporary and permanent mountings and master principles of staining

Life and Diversity of Animals-Nonchordates (Arthropoda to Hemichordata)

CO1: Understand the general characters of Phylum Arthropoda and categorization of animals into various taxa up to classes

CO2: Learn mouth parts, digestive system and reproductive system of cockroach as representative of arthropods

CO3: Identify various insect vectors, namely, mosquitoes, houseflies, sandflies, Tse-Tse flies and study their importance in completion of life cycles of various pathogens wherever applicable

CO4: Understand indirect development in arthropods and study crustacean larvae, namely, Nauplius, Zoea, and Megalopa

CO5: Understand the concept of social behavior in insects with the example of honeybees; learn the intricacies of behavior of honeybees contributing to their colony

CO6: Learn general characters of Phylum Mollusca and its taxa up to classes

CO7: Understand morphology and digestive, respiratory and reproductive systems of Pila that represents Phylum Mollusca

CO8: Understand economic importance of molluscs with reference to pearl formation

CO9: Understand indirect development in molluscs with study of molluscan larvae, namely, Glochidium and Veliger

CO10: Describe general characteristics of Phylum Echinodermata and classify animals into various taxa up to classes

CO11: Describe external features of starfish and study digestive and water vascular systems with a reference to locomotion

CO12: Understand indirect development in echinoderms through Bipinnaria and Auricularia larvae

CO13: Learn about general characters of Phylum Hemichordata and its phylogeny

CO14: Understand reproduction, development through Tornaria larva in Balanoglossus and study affinities of Balanoglossus with other minor and major phyla

CO15: Achieve fluency in handling laboratory instruments; prepare temporary and permanent mountings

Cell Biology

CO1: Understand the concept of a cell and study ultrastructure of prokaryotic and eukaryotic cell

CO2: Describe various models of structure of plasma membrane with emphasis on Fluid Mosaic Model and understand various functions of plasma membrane

CO3: Understand the ultrastructure and functions of smooth and rough endoplasmic reticulum.

CO4: Understand the ultrastructure and functions of Golgi complex.

CO5: Describe structural details of mitochondria and understand the process of oxidative phosphorylation through Glycolysis, Krebs's Cycle, Electron Transport Chain and Terminal Oxidation.

CO6: Learn the structural details, concept of polymorphism in lysosomes and their functions.

CO7: Describe the ultrastructure of nuclear membrane and understand the importance of it.

CO8: Understand the structure, types of chromosomes including Lamp-brush and polytene chromosomes and the concept of nucleosome.

CO9: Learn the structure and functions of nucleolus.

CO10: Explain structure, types of ribosome with emphasis on Lake's model.

CO11: Understand the cell cycle and its phases; also study the importance of synaptonemal complex, crossover and recombination.

CO12: Describe the process and types of cell division, namely, mitosis and meiosis; understand the special uncontrolled cell division leading to cancer and factors responsible for it.

CO13: Describe the process of cellular aging and events leading to the apoptosis.

CO14: Perform cell biology experiments with available material from plant source to have better understanding of cell biology; able to use information technology resources to have understanding of animal systems.

Life and Diversity of Animals-Chordates (Protochordata to Amphibia)

CO1: Describe animals belonging to protochordata up to order scientifically.

CO2: Understand the structure and digestive system in Herdmania; study the process of development through ascidian tadpole and also to understand retrogressive metamorphosis.

CO3: understand morphology and anatomy through various systems, namely, digestive, circulatory, excretory systems and sense organs in Amphioxus.

CO4: Learn general characters of Cyclostomata with reference to Petromyzon and Myxine.

CO5: Describe characteristics of Chondrichthyes and Osteichthyes.

CO6: Understand the evolution of fishes in terms of occurrence of paired fins; learn about occurrence and importance of accessory respiratory organs in fishes.

CO7: Study the phenomenon of migration in fishes.

CO8: Describe Amphibia and classify the amphibians up to order by studying the identifying characters.

CO9: Understand occurrence and importance of parental care and its various types; describe neoteny in Amphibia.

CO10: Describe the process of gametogenesis in vertebrates and describe type of eggs and the process of fertilization of eggs based on their types.

CO11: With emphasis on fish development, understand post fertilization changes.

CO12: Describe types of scales in fishes and study development of placoid scales.

CO13: Understand the development of frogs through cleavages, blastulation and gastrulation; learn about various morphogenetic movements with reference to frog gastrula.

CO14: Understand the concept and importance of fate map.

CO15: Understand the development of respiratory organs and aortic arches in frog.

CO16: Prepare permanent preparations of fish scales and other biological samples; understand the histology of various organs of lower vertebrates and fish and frogs.

Genetics

CO1: Understand the principles of inheritance with the help of Mendel's experiments and also understand allelic interactions that do not follow Mendelian laws.

CO2: Understand the phenomenon of gene interactions with emphasis on epistasis and altered Mendelian ratios.

CO3: Understand Quantitative genetics with the help of polygenic traits; understand impact of inbreeding, outbreeding and hybrid vigor on gene pool, gene and allelic frequencies and overall recombination process.

CO4: Describe the concept and importance of extracellular genome with reference to mitochondrial DNA and plasmids.

CO5: Learn about the phenomenon of inheritance through cytoplasm with reference to Kappa particles in Paramecium, CO₂ sensitivity in Drosophila and milk factor in mice.

CO6: Understand theories of linkage, its types and effects of linkage on crossing over.

CO7: Understand different concepts of genes, namely, cistron, muton and recon.

CO8: Understand the altered physiology and inheritance of genetic disorders in humans with reference to hemoglobin disorders, namely, thalassemia and sickle cell anemia and the metabolic disorder phenylketonuria.

CO9: Understand various patterns of sex determination, namely, ZZ, XY, XO and ZW patterns; also describe genic balance mechanism of sex determination in Drosophila and role of environment in sex determination of Bonellia.

CO10: Describe various structural chromosomal aberrations, namely, addition, deletion, duplication and inversion and understand their effects.

CO11: Describe numerical chromosomal aberrations with reference to Turner, Klinefelter and Down syndromes.

CO12: Understand the concept of mutations and describe spontaneous and induced mutations; also describe various types of mutagenic agents and their effects on DNA sequences and expressions.

CO13: Understand the concept of lethal genes and the consequences.

CO14: Learn the basic concepts of population genetics with emphasis on Hardy Weinberg equilibrium.

CO15: Understand the importance of genetic counseling to deal with various hereditary diseases and disorders.

CO16: Describe the use and importance of DNA fingerprinting, amniocentesis and karyotyping techniques and the usefulness of sperm banks to understand the applicability of genetics.

CO17: Demonstrate the genetic crosses using coloured beads to understand Mendelian principles; perform population surveys for various traits and testing the hypothesis with appropriate statistical tools.

CO18: Understand the Hardy-Weinberg principle with suitable example and perform calculations to find out gene and allele frequencies in a population.

Life and Diversity of Animals-Chordates (Reptilia, Aves and Mammals)

CO1: Understand the classification of reptiles considering the temporal vacuities.

CO2: Study snakes with reference to the poison apparatus, biting mechanism and also understand the importance of snake venom.

CO3: Compare Ratitae with Caranitae; understand flight adaptations.

CO4: Understand Migration in birds.

CO5: Describe the general characters of subclasses Prototheria, Metatheria and Eutheria of class Mammalia.

CO6: Understand and discuss Darwinism and Neo-Darwinism.

CO7: Understand the cursorial, aquatic, terrestrial, fossorial and volant adaptations with suitable examples.

CO8: Describe the genetic basis of evolution with reference to species and demes and the variations responsible for the process.

CO8: Understand the Caucasoid, Negroid, Mongoloid and Australoid races in man to know more about racial differences among the members of the same species.

CO10: Compare aortic arches and hearts in reptiles, birds and mammals.

CO11: Understand the structure of egg of a hen and study the development of chick embryo up to primitive streak stage.

CO12: Understand the development and functions of extra embryonic membranes in chick

CO13: Describe structure and the importance of blastocyst in mammals.

CO14: Describe implantation of embryo in mammals; study types of placenta on the basis of morphological and histological structures and the functions.

CO15: Understand the concept of stem cells; study the sources, types and importance of stem cells in human welfare.

CO16: Understand the behavior in birds with respect to the diurnal and rhythmic behavior and pheromones and reproductive behavior in mammals.

CO17: Discuss the skeletal systems in birds and mammals with examples of fowl and rabbit respectively.

CO18: Prepare permanent mountings of chick embryos representing various developmental milestones.

Molecular Biology and Immunology

CO1: Understand the landmark experiments that proved DNA and RNA as genetic materials.

CO2: Understand the intricacies of the proposed and accepted models for structures of DNA.

CO3: Learn about various forms of DNA, their properties and understand the physico-chemical parameters in which those forms exist.

CO4: Understand various forms of RNA and describe their structures, their properties and roles in cellular physiology.

CO5: Understand structural details of the prokaryotic and eukaryotic genes and describe various other structural elements regulating these genes.

CO6: Describe Griffith's experiment to understand bacterial transformation; also learn about other modes of recombination, namely, conjugation and transduction in bacteria.

CO7: Understand various experiments including Meselson-Stahl experiment which helped understand the replication process.

CO8: Describe the semiconservative model of replication with the help of concepts like origin of replication and directionality of replication.

CO9: Learn about the concept and characteristics of genetic code including Wobble hypothesis.

CO10: Understand the mechanism of processes transcription and translation with various regulating factors to describe the process of protein synthesis.

CO11: Understand regulation of gene expression with emphasis on Lac operon and Trp operon.

CO12: Describe the concept of immunity and understand the importance of having an immune system; study innate and acquired immunity in addition to different organs of the immune system.

CO13: Understand the basics of structure, diversity, functions and types of antigens and antibodies.

CO14: Understand the mechanism of antigen-antibody interactions based on structural details to explain humoral immunity.

CO15: Understand the intricacies of the B cell response and the T cell response to understand the humoral as well as cell mediated immunity.

CO16: Understand the concept and pathways of the complement system and its importance.

CO17: Describe one of the most important the molecular players of the immune response which are cytokines and learn about cytokines related disorders.

CO18: Describe impaired immune system causing autoimmune diseases and learn about the ways in which those can be treated.

CO19: Understand the immunodeficiencies including AIDS and others and understand the ways to manage those diseases.

CO19: Understand the principles and working of laboratory instruments used in molecular biology experiments; learn to stain nucleic acids and also to isolate DNA from a suitable source.

CO20: Demonstrate the antigen-antibody interaction and learn about organs of the immune system.

General Mammalian Physiology-I: Enzymology; digestive, respiratory and circulatory systems.

CO1: Understand the concept, chemical nature and distribution of enzymes.

CO2: Describe the general properties and classification of enzymes.

CO3; Understand various physico-chemical factors and conditions affecting the enzyme action.

CO4: Describe the histology and physiology of digestive glands, namely, salivary, gastric, intestinal glands, liver and pancreas.

CO5: Understand the endocrinology of gastrointestinal hormones.

CO6: Understand the physiology of digestion and absorption of proteins, carbohydrates and lipids.

CO7: Describe various fat soluble and water soluble vitamins with reference to their sources, the deficiencies and related diseases.

CO8: Learn about the types, distribution and the physico-chemical properties including binding dynamics with the respiratory gases of various respiratory pigments.

CO9: Understand the detailed mechanism of respiration including transport of O₂ and CO₂ along with various respiratory pigments and working of respiratory organs.

CO10: Understand the disorders of respiratory systems with special reference to effect of smoking.

CO11: Learn about normal and abnormal constituents and functions of blood.

CO12: Describe the importance of intrinsic and extrinsic blood clotting factors and understand the principles behind ABO blood grouping system and Rh factor.

CO13: Learn about different phases of cardiac cycle; understand the principle behind ECG and describe various factors regulating blood pressure.

CO14: Demonstrate enzyme action on substrate by using salivary amylase.

CO15: Perform detection tests for carbohydrates, proteins and fats.

CO16: Detect presence of vitamins A and C.

CO17: Measure total WBC and RBC counts; demonstrate presence of haemin crystals.

CO18: Measure lung capacity by using suitable method.

CO19: Understand the histology of various mammalian organs with the help of available permanent slides.

Applied Zoology-I (Aquaculture and Economic Entomology)

CO1: Understand and discuss the parameters used for construction of various ponds used for rearing various stages of fish.

CO2: Explain breeding of fishes by bund and Chinese hatcheries and understand the practice and importance of induced breeding using hypophysation and the new generation drugs.

CO3: Explain different culture methods, namely, polyculture, cage culture, sewage fed fish culture and integrated fish farming.

CO4: Learn about commercial aspects of aquaculture by studying fish products and byproducts and study different methods of fish preservation.

CO5: Explore commercial aspects aquaculture with respect to prawn culture and pearl culture.

CO6: Understand commercial setup required for culturing aquarium fish species and study the process of fabrication and setting up of aquaria, their maintenance and breeding of aquarium fishes.

CO7: Learn about different diseases caused by different causative agents, namely, fungi, bacteria, protozoa and helminthes.

CO8: Describe the use, mode of action, merits and demerits of using different classes of chemicals as insecticides.

CO9: Explain use, merits and demerits of using predators and parasites as biological control agents for insect pests.

CO10: Describe the life cycle of, damage caused by and control measures for plant pests, *Earias vitella*, *Sitophilus oryzae* and animal pests *Musca nebulo* and *Stomoxys calcitrans*.

CO11: Explain life cycles, rearing methods of different species of silkworms, namely, *Bombyx mori* and *Antheraea mylitta*.

CO12: Understand cocoon processing steps for synthesis of silk fabric, namely, cocoon boiling, reeling, rereeling, winding, doubling, twisting and weaving.

CO13: Explain types, life cycles of honey bees and explain methods of apiculture along with commercial importance of bee products.

CO14: Understand the life cycle of the lac insect, *Laccifer lacca* and the processing of raw lac to prepare various products and understand their economic importance.

CO15: Describe the economically important food and aquarium fishes; study various systems through virtual dissection or through other available media; prepare permanent mountings of scales and zooplanktons following ethical guidelines.

CO16: Describe various economically important insect species; study various mountings related to insects.

CO17: Understand different breeding/ rearing setups by visiting different facilities/ educational centres..

General Mammalian Physiology-II: Nervous, muscular, excretory, endocrine and reproductive systems

CO1: Describe neuronal cell types and understand the structure of neurons including electron micrographs of different regions of neurons.

CO2: Understand the conduction of impulse across the nerve.

CO3: Understand the ultrastructure of a striated muscle and the physiology of muscle contraction with the help of sliding filament theory.

CO4: Describe various properties of muscles, namely, twitch, tetanus, tonus, summation, All or None Principle and muscle fatigue with better understanding of muscle physiology.

CO5: Learn about the structural details of a uriniferous tubule.

CO6: Understand the mechanism of urine formation with emphasis on counter – current mechanism and describe the idea of dialysis.

CO7; Describe normal and abnormal constituents of urine.

CO8: Understand the position, morphology, histology and physiology of the pituitary, thyroid, parathyroid, adrenal and pineal glands.

CO9: Understand the oestrous and menstrual cycles to describe reproductive physiology of females.

CO10: Describe the chemical nature and functions of male and female sex hormones.

CO11: Describe the causes of infertility in males and females.

CO12: Understand the concept and importance of contraception and describe different mechanical and hormonal contraceptives.

CO13: Understand the concept and importance of in vitro fertilization.

CO14: Perform experiments for detection of various normal and abnormal constituents of urine.

CO15: Perform qualitative analysis of the semen sample.

CO16: Study different endocrine gland of fish with suitable diagrams/ digital tools.

CO17: Observe various histological slides to understand the ultra structure of various organs of muscular, nervous, endocrine, reproductive and excretory systems.

Applied Zoology-II: Biotechniques, Microtechnique, Biotechnology, Bioinformatics and Biostatistics

CO1: Explain various techniques of sterilization from crude to the most sophisticated techniques, namely, filtration, autoclaving, dry heat sterilization, wet sterilization and radiation.

CO2: Understand various separation techniques, namely, centrifugation, chromatography, agarose gel electrophoresis, SDS-PAGE.

CO3: Describe the working principles of colorimeter and spectrophotometers.

CO4: Understand basics of microtomy and the steps involved from tissue fixation to section cutting and also understand the ways of troubleshooting the process of microtomy/ section cutting and the spreading of tissue sections.

CO5: Understanding the basic concepts of staining with various kinds of stains and describe double staining using haematoxylin and eosin.

CO6: Describe basics and practical applications of histochemical staining techniques for carbohydrates, proteins and lipids.

CO7: Understand basic concepts of recombinant DNA technology and describe the types and uses of DNA manipulation enzymes.

CO8: Learn the theoretical aspects of shotgun cloning.

CO9: Understand the concept of cloning vectors, their types and the merits and limitations.

CO10: Understand the principles behind insertion of DNA fragment and ligation using blunt and cohesive ends.

CO11: Describe the application of biotechnology for recombinant insulin and vaccine production.

CO12: Understand the basic concepts, importance and role of bioinformatics in life sciences and describe the concept and types of databases used in bioinformatics including nucleotide and protein databases.

CO13: Understand the concept and importance of biostatistics and learn about tabulation and presentation of data.

CO14: Understand the meaning and importance concepts used in biostatistics, namely, sampling errors, mean, mode, median, probability, standard error and standard deviation.

CO15: Perform experiments related to use of various biotechniques studied in theory including sterilization and separation techniques.

CO16: Get acquainted with microtechnique and staining procedures.

CO17: Use computer software to analyze biological data using statistical tools CO18: Practice using various basic computer programmes.

CO19: Perform specific searches related to biological information using bioinformatic tools and databases.

CO20: Understand working principles of various sophisticated instruments by visiting biotechnology institutions and research centre

Department of Chemistry
Session 2021-2022

Undergraduate Programm-03 years

Course Name- B.Sc. in Chemistry

Number of semester-06

The Programme Outcomes (POs) of Chemistry

1. Identify and become familiar with the scope, methodology and application of modern chemistry and learn to appreciate its ability to explain various aspects.
2. Understand theoretical and practical concepts of instruments that are commonly used in most chemistry fields.
3. Understand safety of chemicals, transfer and measurement of chemical, preparation of solutions, and using physical properties to identify compounds and chemical reactions.
4. Explain how chemistry is useful for social, economic and environmental problems and issues facing our society in energy, medicine and health.
5. Design and carry out scientific experiments and record the results of such experiments

Course Outcome of Chemistry

1. Learn the basic concepts of periodic properties of elements; understand formation of different types of bonding & factors affecting ionic bond formation. Understand properties viz, electronic configuration, ionization energy, and oxidation state of s and p block elements.
2. To learn about the various effects operating through the covalent bonds, to understand the physical and chemical properties of aliphatic hydrocarbon.
3. Have a knowledge of the aromaticity, structural and chemical behavior of aromatic hydrocarbons and their applications on the basis of electrophilic substitution.
4. Learn fundamentals of Thermodynamics, Thermodynamic properties, laws of Thermodynamics and know the concept of entropy.
5. Basic understanding about the classification, preparation and chemical reactions of Phenol, Ethers and Epoxides.
6. Describe synthesis and chemical reactions of alkyl halides, aryl halides and alcohol.
7. Accruing the information about the study of magnetic properties of substances. Identify polar and non-polar molecules and know paramagnetic and diamagnetic substances.
8. Students learnt about rate of reaction, order of reaction, molecularity of reaction along with energy changes. Describe rate of reaction in terms of change in concentration and how the rate of chemical reaction changes as a function of time.
9. Aims to enable the students, to identify the given organic compound containing different functional groups through its detail qualitative analysis and to prepare its

solid derivatives.

10. To understand the chemistry of Aldehyde and Ketones and also study of different Organic Acids and their acidic strengths.
11. Impart basic ideas to categorize the coordination compounds on the basis of various theories and on the basis of electronic structure and magnetic properties.
12. To study the basic information about molecular spectroscopy, useful tool for the structure determination of newly synthesized compound in research
13. Conductometric and potentiometric titrations are very useful for the analysis of various compounds including pharmaceutical, inorganic, organic, etc compounds. The colligative properties are used to study molar mass, depression in freezing point and elevation in boiling point.
14. Quantum mechanics is very important branch of physical chemistry. Students utilized their knowledge to study the shapes of orbital and to find out probability and probability density.