



SHRI SHIVAJI SCIENCE COLLEGE, AMRAVATI

Programme Outcomes & Programme Specific Outcomes

Introduction

In view of Vision and Mission the College has clearly stated POs, PSOs and COs. The attainment of POs, PSOs and COs is assured through proper strategic planning developed and deployed by the IQAC and its effective implementation by the respective departments and committees of college.

- The institute communicates pre stated POs, PSOs and COs to the stakeholders through college website.
- In every department COs and PSOs of every programmes, run by the department, are made available for faculty and for students. COs of the courses are displayed on the notice board.

Programme Outcomes (POs)

After completion of his/her study of specific programme, student is expected to acquired

UG		
	B.Sc.	<ul style="list-style-type: none">• Scientific Knowledge required to handling complex scientific problems.
		<ul style="list-style-type: none">• Compatibility in using modern tools of ICT to learn and transfer the knowledge.
		<ul style="list-style-type: none">• Environment consciousness.
		<ul style="list-style-type: none">• Professional ethics and human values.
		<ul style="list-style-type: none">• Working capability as an individual and a team leader.
		<ul style="list-style-type: none">• Communication skills and project management.
	B.C.A.	<ul style="list-style-type: none">• Computer and IT Knowledge required to handling complex technological projects.
		<ul style="list-style-type: none">• Compatibility in using modern tools ICT to learn and transfer the knowledge.
		<ul style="list-style-type: none">• Environment consciousness.
		<ul style="list-style-type: none">• Professional ethics and human values.
		<ul style="list-style-type: none">• Working capability as an individual and a team leader.
		<ul style="list-style-type: none">• Communication skills and project management.
PG	M.Sc.	<ul style="list-style-type: none">• Intellectual, personal and professional development.• Ability of investigation and Research skills• Compatibility in using modern tools of ICT to learn and transfer the knowledge.

Department of Biotechnology

Course Outcome

1. Students will be able to handle each and every instrument and tools in microbiology/Biotechnology Laboratory.
(e.g. Inoculation needle and inoculation loops, Autoclave, Laminar air flow, Bacteriological Incubator, Hot air oven, Colony counter, pH meter, Electric balance, Spectrophotometer, centrifuge, Microscope.)
2. Students will be able to isolate particularly said and research wise interested microorganisms. e.g. *S.aureus* and *E.coli*.
3. Will be able to Diagnose and detect diseases caused by Microorganisms.(e.g. Pneumonia, Hepatitis, Typhoid, WIDAL test, Precipitation reaction based on immunodiffusion test, VDRL serological test for Syphilis, Detection of specific antigen by using ELISA technique, Blood examination for Rh Factor.
4. Work in water treatment plant as well as sewage treatment plant either as technician or as Laboratory Scientific officer.
5. Physical and chemical parameter estimation of soil and water. (E.g. estimation of quantity of nitrogen Phosphorous, carbon, Sulphur, etc.)
6. Production of solid and Liquid Fertilizer.(e.g. Rhizobium, Azotobacter, PSB)
7. Production of Food and Dairy Products. (Quality control and Quality assurance)
8. Production of soft as well as Alcoholic beverages such as Beer, wine, etc.
9. Production of various Probiotic medicine, Probiotic food and Liquid food material for better metabolism.(e.g. Yoghurt, cheese, Paneer)
10. Production o Amino acid, Vitamins and Enzymes.
11. Isolate genetic material like DNA and RNA from Microorganisms.
12. Students will be able to handle equipments like BOD incubator, CO₂ Incubator, Small scale lab Fermenter, inverted Microscope.
13. Students can work as tissue culturist at tissue culture institute in both plant and animal tissue culture.
14. Students can be entrepreneur in the business like production of biofertilizer, production of tissue culture plants.

Class Subject: Botany	Sem	Paper	Course Outcome(s)
			At the end of the course, students are expected to be able to:
B. Sc. I Year	I	Diversity And Application Of Microbes And Cryptogams	<ol style="list-style-type: none"> 1. Introduction of Cryptogams and general account of viruses. 2. Able to Classification and general characters of algae. 3. Explain the Classification and general characters of Fungi. 4. Classification and general characters of Bryophytes. 5. Able to Classification and general characters of Pteridophytes. . 6. Appreciate their Economic importance of microbes and cryptogams.
	II	Gymnosperm , Morphology of Angiosperms and utilization of Plants	<ol style="list-style-type: none"> 1. Explain Geological time scale and fossil gymnosperms. 2. Brief Classification and general accounts of Gymnosperms. 3. Understand concepts of Morphology of Angiospermic plants. 4. Uses of plants Parts. 5. Focus on deep study of Pharmacognosy and phytochemictry of medicinal plants.
B. Sc. II Year	III	Angiosperm Systematics, Anatomy & Embryology	<ol style="list-style-type: none"> 1. Explain Origin and evolution of angiosperms. 2. Focus on deep study Systematic of Classification of Angiosperms. 3. Give an account Systematic study of Dicotyledons and monocotyledons (Families). 4. Brief General characteristics and anatomy of root and stem. 5. Deep knowledge of Development of male and female gametophytes.
	IV	Cell Biology, Genetics And Biochemistry	<ol style="list-style-type: none"> 1. Structure and function of cell organelles. 2. Understand Mendels Law 3. Do Problem of genetics . 4. Explain Enzymes 5. Understand Carbohrate
B. Sc. III Year	V	Plant physiology and ecology	<ol style="list-style-type: none"> 1. Brief Mechanism of Water translocation in plants. 2. Clear ideas of Metabolic activities - photosynthesis and respiration. 3. Deep knowledge of Nitrogen metabolism and growth hormones. 4. Explain Concept of Photoperiodism and plant movements. 5. Structure and function of ecosystem.

	VI	Molecular biology and biotechnology	<ol style="list-style-type: none"> 1. Explain Structure and function of DNA. 2. Understand Transcription and Translation in Eukaryotes. 3. Gene regulation in Prokaryotes. 4. Do Techniques of gene transfer. 5. Clear ideas of Plant tissue culture. 6. Role of Biotechnology in Agriculture, Industry and Health care
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Class Computer Sc.	Semester	Title of the Paper	At the end of the course, students are expected to be able to:
BSC	I	Fundamentals of Information Technology and C Programming	<ul style="list-style-type: none"> • Understands the basic concepts of computers • Students should be able to elaborate topic • Learn basic programming techniques • Should be able to do logical designing such as algorithm • Able to access C programming tools • Able to do implementation by using C programming tools
	II	Web Technology and Advanced programming in C	<ul style="list-style-type: none"> • Understand basic tags • Apply markup tags for processing and presentation of information on web pages. • Should design web pages. • Use scripting languages to add interactive components to web pages. • Students will be able to write a well formed or valid XML document. • Able to do implementation by using advanced C programming techniques.
	III	Data Structure and C++	<ul style="list-style-type: none"> • Should be able to analyze algorithms. • Understand searching and sorting techniques. • Should understand stack, queue and linked list operation.

			<ul style="list-style-type: none"> • Should get knowledge of tree and graphs concepts. • Know the concepts of object-oriented programming • Able to do implementation by using C++ programming tools
	IV	RDBMS and PL/SQL	<ul style="list-style-type: none"> • Understanding of the Elementary & Advanced Features of DBMS & RDBMS • Good Practical Understanding of the SQL • Prepare Various Database Tables using SQL Commands • Able to Develop Structured Query Language (SQL) Queries to Create, Read, Update, And Delete Relational Database Data • Should write PL/SQL program
	V	. Net Technology and Java Programming	<ul style="list-style-type: none"> • Understand the code solution and compile VB project in .NET framework • Design and develop console and windows base .NET applications • Learn about MS.NET framework developed by Microsoft. • To develop, implement, and demonstrate Component Services, and Windows and web services. • Able to get familiar with Java programming and to learn classes and objects • To learn programming using Java. • Able to use Java Applets
	VI	Advanced Java and VB.net	<ul style="list-style-type: none"> • To learn and understand advance concept of Java • Able to write program using Exception Handling • To learn the programming using Servlets and JSP. • To learn Java Bean so as to make the reusable software components

			<ul style="list-style-type: none"> • Be able to understand use of VB.NET basics, Objects and Types • To develop, implement and creating Applications in VB.NET and database
BCA	I	1ST1 Computer fundamental 1ST2 C-Programming 1ST3 Digital Techniques-I 1ST4 Numerical Methods 1ST5 Discrete Mathematics 1ST6 Communication Skill	<ul style="list-style-type: none"> • Understands the basic concepts computers • Learn basic programming techniques • Able to access C programming tools • Able to do implementation by using C programming tools • Ability to understand Sets and their algebra, duality, power sets and partitions. • Principle of Strong Mathematical Induction, Product sets 2. • Ability to analyze various binary relations characteristic function and Recursive functions • Ability to understand logical operators, Implications, Tautologies, validity of arguments, and quantifiers • Ability to model problems using Graphs, connectivity, Rooted trees. Minimum Spanning Trees • Devise a communication strategy
	II	2ST1 Operating System 2ST2 Advance C 2ST3 Digital Techniques-II 2ST4 Numerical methods 2ST5 Discrete Mathematics-II 2ST6 Communication Skill	<ul style="list-style-type: none"> • To understand the fundamental concepts and techniques of Operating Systems. • To study the concepts in process management and memory managements and deadlocks • Able to do implementation by using advance C programming techniques. • acquire the basic knowledge of digital logic levels and digital electronics circuits. • Be able to specify and manipulate basic mathematical objects • able to communicate effectively orally and in

			writing.
	III	3ST1 Data Structure 3ST2 Object Oriented Programming with C++ 3ST3 Data-Base Management System 3ST4 Advanced Operating System 3ST5 Electronics	<ul style="list-style-type: none"> • Should able to analyze algorithms. • Understand searching and sorting techniques. • Should understand stack, queue and linked list operation. • Should get knowledge of tree and graphs concepts. • Know the concepts of object-oriented programming • Ability to design and develop Object Oriented systems • Good Practical Understanding of the SQL • Prepare Various Database Tables using SQL Commands • To learn the fundamentals of Operating Systems and the mechanisms of OS to handle processes
	IV	4ST1 System Analysis Design And MIS 4ST2 Visual basic 4ST3 Web Designing and Office Automation 4ST4 Networking 4ST5 Advance Microprocessors and Microcontroller	<ul style="list-style-type: none"> • Compare the processes of developing and implementing information systems. • Understand the IDE and design and develop applications in VB • Understand the networking concept and Describe the functions of each layer in OSI • Describe the architecture of microprocessor • Design I/O circuits.
	V	5ST1 Core Java 5ST2 Network Security 5ST3 Software Engineering 5ST4 Computer Graphics 5ST5 E-Commerce	<ul style="list-style-type: none"> • To learn and understand advance concept of Java • Able to write program using Exception Handling • To learn the programming using Servlets and JSP. • To learn Java Bean so as to make the reusable software components • identify some of the factors driving the need for network security • knowledge of Software Process Models and become

			<p>aware of the Software Product.</p> <ul style="list-style-type: none"> • To acquire the background of Software Architecture. • Have a basic understanding of the core concepts of computer graphics.
	VI	<p>6ST1 .Net Using ASP 6ST2 Client Server Technology 6ST3 Multimedia and Its Applications 6ST4 Software Testing 6ST5 Advance Data Base Management System</p>	<ul style="list-style-type: none"> • Create a Web form with server controls • Can develop a client –server-based application. • Should create multimedia applications • Apply modern software testing processes in relation to software development and project management. • Understanding of the Elementary & Advanced Features of DBMS & RDBMS • Prepare Various Database Tables using SQL Commands
MSC	I	<ol style="list-style-type: none"> 1. Advanced Programming in JAVA 2. Software Engineering & Software Testing 3. .Net Technology using ASP 4. Computer Networks 	<ul style="list-style-type: none"> • To learn the programming using Servlets and JSP. • To learn Java Bean so as to make the reusable software components • Knowledge of Software Process Models and become aware of the Software Product. • Manage incidents and risks within a project. • Understand the networking concept and Describe the functions of each layer in OSI model
	II	<ol style="list-style-type: none"> 1. Programming in C# 2. Distributed Operating System 3. Advanced Database Management System 4. Fundamentals of Open Source Systems 	<ul style="list-style-type: none"> • Should able to develop projects in C# • To provide hardware and software issues in modern distributed systems. • To get knowledge in distributed architecture • Understanding of the Elementary & Advanced Features of DBMS & RDBMS • Prepare Various Database Tables using SQL Commands • Knowledge of Open Source Systems

	III	<p>1.Data Warehouse and Data Mining, 2.PHP Programming 3.Mobile Computing with Android Elective: 1. Computer Graphics 2. Compiler Construction</p>	<ul style="list-style-type: none"> • Understand the functionality of the various data mining and data warehousing component • Display and insert data using PHP and MySQL. • Test, debug, and deploy web pages containing PHP. • understanding of the fundamentals of Android operating systems . • Acquire skills of using Android software development tools. • understanding of the core concepts of computer graphics. • Make lexical analysis of program and describe the role of compiler in ensuring security and integrity of data
	IV	<p>1.Cyber Security & Digital Forensic 2.Soft Computing 3.Web Content Management System Elective: 1. Cloud Computing 2. Design and Analysis of Algorithms</p>	<ul style="list-style-type: none"> • Understand and Analyze various computer forensics systems • Comprehend the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory • Understand the use of MATLAB and working in MATLAB • Understand content management systems so as to be able to create and host modern websites. • Able to use Cloud Services and implement Virtualization • Ability to analyze the performance of algorithms • Ability to choose appropriate algorithm design techniques for solving problems.
	B.sc. Environmental Science		
CO-1	Principle, scope and ethics of environmental science.		
CO-2	Describe components of environment with respect to structure and composition		

CO-3	Detail classification and conservation of natural resources
CO-4	Write down India as a mega diverse country
CO-5	Explain fundamentals of environmental chemistry
CO-6	Write down renewable energy resources need of 21st century with suitable example.
CO-7	Write down about toxicity types and bioassay study
CO-8	Use of control techniques and management tools for air pollution
CO-9	Write down handling, transport, storage and disposal of hazardous waste.
CO-10	Describe role of national and international organization in environmental protection

	M.sc.
CO-1	Describe interdisciplinary approach
CO-2	Explain impact of urbanization and environmental economics
CO-3	Classify ecology with types and processes
CO-4	Explain biodiversity and its ways of conservation
CO-5	Describe the term Environmental Chemistry and geodynamics using term environmental pollution and different processes
CO-6	Explain natural resources conservation and management
CO-7	Explain use of bioinformatics in environmental analysis
CO-8	Identify relation between Environmental and Microorganisms
CO-9	Describe causes, effect and control technology of different environmental pollution
CO-10	Explain environmental impact assessment and audit
CO-11	Identify computer application of remote sensing and GIS
CO-12	Write down about environmental toxicology and hazardous waste management

CO-13	Describe environmental policies and legislation
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Class Chemistry	Semester	Title of the Paper	At the end of the course, students are expected to be able to:
BSC	I	Chemistry	<ul style="list-style-type: none"> * Get idea about periodic properties of elements. * Know about different types of bonding. * Properties of S-block and P-block elements. * Characteristics of aliphatic hydrocarbons and their applications * Characteristics of aromatic hydrocarbons and their applications. * Thermodynamic processes. * Application phase rule. * Fundamental assumption of kinetic theory of gases.
	II	Chemistry	<ul style="list-style-type: none"> * Concepts of Hybridization and hybridization of different molecules & their geometry. * Concepts of Acid and bases with their applications. * Properties of Non aqueous solvents. * Halogen derivatives of aliphatic and aromatic hydrocarbons. * Chemistry of compounds containing hydroxy group. * Rate of reaction, order of different reaction and effect of temp. on it.
	III	Chemistry	<ul style="list-style-type: none"> * Student came to know about MOT and MO diagram. * Metallic bonding and VBT. * Students got idea about molecular geometry. * Students came to know about volumetric analysis, normality, molality, molarity and requirement of primary standard. * Principles involved in Acid Base and Redox titration. * Different aspects of stereochemistry.

			*Students got idea about Thermodynamics its laws, Electrochemistry, Liquid state.
	IV	Chemistry	*Transition elements gives information regarding the catalytic properties and complex formation behavior. *The principle of extraction of elements are useful in metallurgical process. *Various methods are useful fir the conc. Of ore. *Students are aware about the glucose and the its conversion into fructose. *Students had a clear idea about nitrogen containing compounds. *Students got information about colligative properties. *study of crystalline state, symmetry and different bravais lattices.
	V	Chemistry	*Chemistry of Heterocyclic compounds and their application. *Synthetic application of organo metallic compounds. *Study of different polymers their characteristics . *Characteristics of Dyes & their uses. *Characteristics of Drugs & their uses. *Laws of photochemistry and study of photochemical reaction. *Application of molecular spectroscopy for str. Determination. *Electronics spectroscopy of metal complexes.
	VI	Chemistry	*Know about different techniques of spectroscopy. *Application of spectroscopy in identification of structure of unknown organic compounds. *To know kinetics of exchange of ligands in the metal complexes. *To distinguish between labile and inert complexes . *Separation of components with the help of paper chromatography to check the purity. *How to classify organo metallic & non-organo metallic

			<p>compounds.</p> <ul style="list-style-type: none"> *Application of Inorganic polymers in various fields. *Importance of oxygen transport in the human being. *Application of schrodinger wave equation in Determination of str. Of atom.
MSC Chemistry	I	Chemistry	<p>Students are supposed to know most of the topics included in the syllabus.</p> <p>They will be in a position to perform separation using Gas Chromatography and HPLC Techniques.</p> <p>They are supposed to know Main Group Elements and MOT thoroughly, and Group Theory.</p> <p>They are also supposed to know Reactions, Mechanism and Stereochemistry.</p> <p>They are supposed to be able to solve all the five units in the examination.</p>
	II	Chemistry	<p>At the end of the course, students will have knowledge of electronic spectra and Magnetochemistry along with reaction mechanism of transition metal complexes.</p> <p>Students will learn photochemistry and pericyclic reactions.</p> <p>They will also understand the concept of Green Chemistry and Green synthesis.</p> <p>The knowledge of Quantum Chemistry Macromolecules and Chemical Dynamics would have been imparted.</p> <p>They are also supposed to know different types of pollutions and their causes.</p>
	III	Chemistry	<p>By the end of this semester students will have theoretical and practical knowledge of spectroscopy.</p> <p>The instrumental techniques used in different branches of Chemistry would be taught by the end of semester.</p> <p>Umpolung concept and retrosynthesis alongwith Oxidation-Reduction as well as name reactions are supposed to be completed.</p>

			Natural Products Chemistry including Carbohydrates, Lipids and Proteins along with Alkaloids and Steroids would be known to them.
	IV	Chemistry	<p>The end of this semester prepares these students to face last exam of their Master's Degree.</p> <p>By this time they will know the principles of Raman Spectroscopy, Photoelectron Spectroscopy and other allied Techniques.</p> <p>They will be in a position to know Food and Cosmetic Analysis.</p> <p>Designing Organic Synthesis and Reagents required for it will be known to them along with Heterocyclic Chemistry.</p> <p>Knowledge of Dyes, Agrochemicals and Drug Design would have been imparted by the end of this semester.</p>
Class Geology	Semester	Title of the paper	At the end of the course, students are expected to be able to:
B.Sc	I	General Geology, Physical Geology, Mineralogy, Crystallography & Field Geology	<ul style="list-style-type: none"> • Identification of Minerals samples through use of Physical & microscopic properties of mineral and • These enable students for field identification of minerals which is most essential part for Rock Identification, anomaly study and research purposes. • Toposheet reading and interpretation which is preliminarily requirement for Geological reconnaissance survey, • Field planning, locating study area on map and also used as a base map for digitization in GIS environment.
	II	Igneous, Sedimentary & Metamorphic Petrology	<ul style="list-style-type: none"> • Megascopic Identification of Igneous, Sedimentary and Metamorphic Rocks on the basis of mineralogical composition, their textural arrangement and groundmass. • Identification of rocks in field is the crux for a Geologist. Rocks in thin section are studied under petrological

			<p>microscope for detail Identification of rocks and mineralogical composition and</p> <ul style="list-style-type: none"> • Inter-arrangement of minerals in rocks. Exercise on ACF, AKF and AFM diagrams which are used for plotting unknown rock sample's chemical composition and for interpretations of geochemical data.
	III	Stratigraphy & Paleontology	<ul style="list-style-type: none"> • Major stratigraphic division with description and • Fossil study which is used for study of evolution of earth and its surface, • Sequential arrangement of rock strata according to age of formation and • Important fossil used for stratigraphy establishment.
	IV	Structural Geology, Tectonics & Geomorphology	<ul style="list-style-type: none"> • Structural Geology Problems where cross-section maps are prepared with the use of available exposures orientation which are useful in underground rock orientation predication which is • Used for civil engineering constructions like dam, tunnels and roads. • Structural Geology problems are also used for mining and drilling exploration.
	V	Economic Geology & Mineral Exploration	<ul style="list-style-type: none"> • Economic Geology study where economic important minerals are specially studied with physical properties, maps are prepared for different economic deposits and • Special exploration and ore reserve calculation problems this are very important estimations which is to be done before mining activity which will lead to profit and loss calculation for mining activity.
	VI	Hydrogeology,	<ul style="list-style-type: none"> • Hydrogeology studies various hydro chemical and hydro

		Remote sensing , Engineering Geology & Geological Skill	<p>physical parameters which are studied for predication of movement, availability and dynamics of surface and groundwater and its contents as it is much dependent upon geomorphology of the area, rocks and</p> <ul style="list-style-type: none"> • Geological structures. Various Recharge structures are studied and those are used for rain water harvesting. • Remote Sensing study of Arial photographs and satellite images which are used in predication on the earth's surface various parameters which are used for geological predictions remotely. • Engineering Geology studies various engineering properties of rock and engineering structure like tunnel, dam, etc. • These engineering properties are useful for study of constructing site and such as great importance in safe, stable designs of the engineering projects. • Geological Skill studies useful for geological skill development.
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Class English	Semester	Title of the Paper	At the end of the course, students are expected to be able to:
B.Sc. I	I	ENGLISH COMPULSORY & SUPPLIMENTARY ENGLISH	<ol style="list-style-type: none"> 1. Communicate in English 2. Read, Write, Speak effectively in English 3. Take interest in reading English novels, poems, plays and short stories 4. Discuss in groups various current issues in English 5. Face interviews with confidence 6. Improve Public Speaking skills 7. Enhance English Vocabulary 8. Improve English Grammar for accurate

			<p style="text-align: center;">communication</p> <p style="text-align: center;">9. Use proper punctuation in writing</p>
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Class Marathi	Semester	Title of the Paper	At the end of the course, students are expected to be able to:
B.Sc. I	I	MARATHI	<ol style="list-style-type: none"> 1. Communicate in Marathi 2. Read, Write, Speak effectively in Marathi 3. Take interest in reading Marathi novels, poems, plays and short stories 4. Discuss in groups various current issues in Marathi 5. Face interviews with confidence 6. Improve Public Speaking skills 7. Enhance Marathi Vocabulary 8. Improve Marathi Grammar for accurate communication 9. Use proper punctuation in writing Marathi.

Subject: Microbiology

Course Outcome

1. Students will be able to handle each and every instrument and tools in microbiology Laboratory.
(e.g. Inoculation needle and inoculation loops, Autoclave, Laminar air flow, Bacteriological Incubator, Hot air oven, Colony counter, pH meter, Electric balance, Spectrophotometer, centrifuge, Microscope.)
2. Students will be able to isolate particularly said and research wise interested microorganisms. e.g. *S.aureus* and *E.coli*.
3. Identification of Microorganisms. (e.g. Morphology, Grams staining, acid fast staining, negative staining, IMViC test)
4. Will be able to Diagnose and detect diseases caused by Microorganisms.(e.g. Pneumonia, Hepatitis, Typhoid, WIDAL test, Precipitation reaction based on immunodiffusion test, VDRL serological test for Syphilis, Detection of specific antigen by using ELISA technique, Blood examination for Rh Factor.
5. Work in water treatment plant as well as sewage treatment plant either as technician or as Laboratory Scientific officer.

6. Physical and chemical parameter estimation of soil and water. (E.g. estimation of quantity of nitrogen Phosphorous, carbon, Sulphur, etc.)
7. Production of solid and Liquid Fertilizer.(e.g. Rhizobium, Azotobacter, PSB)
8. Production of Food and Dairy Products. (Quality control and Quality assurance)
9. Production of soft as well as Alcoholic beverages such as Beer, wine, etc.
10. Production of various Probiotic medicine, Probiotic food and Liquid food material for better metabolism.(e.g. Yoghurt, cheese, Paneer)
11. Production o Amino acid, Vitamins and Enzymes.
12. Isolate genetic material like DNA and RNA from Microorganisms.
13. Students will be able to handle equipments like BOD incubator, CO₂ Incubator, Small scale lab Fermenter, inverted Microscope.

Class Mathematics	Semester	Title of the paper	At the end of the course students are expected to be able to
B.Sc. I	Sem I	Paper I Algebra and Trigonometry	1. Apply De Moivre's theorem to solve problems on roots.
			2. Have full knowledge of Trigometric series, Gregory series, Euler's series, Machin's series, Rutherford series.
			3. Find the characteristic equation, eigen values and corresponding eigen vectors of a given matrix.
			4. Find the coefficients of quadratic equations by using relation between roots and coefficients of equations.
			5. Find the inverse of square matrix.

B.Sc. I	Sem. I	Paper II Differential and Integral Calculus	1. Have full knowledge of calculus involving the fundamental tools such as continuity and differentiability.
			2. Solve the problem on integration
			3. Find whether the function is continuous or not.
			4. Classify functions into continuous and discontinuous function.
			5. Find nth derivative of product of two functions using Leibnitz's theorem.
B.Sc. I	Sem. II	Paper III Differential Equations : Ordinary and partial	1. To solve first order differential equation utilizing the standard techniques for separable, exact linear, homogenous, Bernoulli cases
			2. Find the complete solution of a non-homogenous differential equation as a linear combination of the complementary function and a particular solution
			3. Students will be introduced to the complete solution of a non-homogenous differential equation with constant coefficients by the method of undetermined coefficients
			4. Students will be able to find the complete solution of a differential equation with constant coefficients by variation of parameters
			5. Students will have a working knowledge of basic application problems described by second order linear differential equations with constant coefficients
B.Sc. I	Sem. II	Paper IV Vector analysis and Geometry	1. Memorize definition of directional derivative and gradient and illustrate geometrical meaning with the aids of sketches.
			2. Memorize theorem relating directional derivative to gradient and reproduce proof.

			3. Calculate directional derivatives and gradient.
			4. Apply gradient to solve problems involving normal vectors to level surfaces.
B.Sc. II	Sem III	Paper Advanced Calculus	V
			1. Determine if an infinite sequence is bounded.
			2. Determine if an infinite sequence is monotonic.
			3. Determine if an infinite sequence is convergent or divergent.
			4. Find the sequence of partial sums of an infinite series.
			5. Determine if a geometric series is convergent or divergent.
			6. Find the sum of a convergent geometric series.
			7. Determine if an infinite series is convergent or divergent by selecting the appropriate test from the following (a) test for divergence (b) integral test (c) p-series test (d) Comparison test (e) Alternating series test. (f) Absolute convergence test (g) ratio test (h) root test.
B.Sc. II	Sem. III	Paper Elementary Number Theory	VI
			1. Demonstrate knowledge and understanding of topics including but not limited to divisibility, prime numbers, congruence, quadratic reciprocity, Diophantine equations.
			2. Learn methods and techniques used in number theory.
			3. Write programs / functions to compute number theoretic functions.
			4. Use mathematical induction and other types of proof writing techniques.
			5. Students are able to effectively communicate mathematics, reading, writing, listening, speaking. Students make effective use of library, Conduct research and make oral and written presentation of their findings.
B.Sc. II	Sem VII	Paper Modern Algebra :	VII
			1. Have knowledge of algebraic structures groups, rings.

		Groups and rings	<p>2. Know definition of homomorphism, isomorphism, natural homomorphism.</p> <p>3. Algebra of ideals, prime ideal, principal ideal, quotient rings.</p> <p>4. Knowledge of ring, integral domain, field.</p> <p>5. Extend group structure to finite permutation group.</p>
B.Sc. II	Sem. IV	Paper VIII Classical Mechanics	<p>1. Knowledge of D' Alembert's Principle and Lagrange's equation of motion.</p> <p>2. Apply keplers laws to solve the problems.</p> <p>3. An understanding of the calculus of variation.</p> <p>4. A knowledge of Hamilton's Principle.</p>
B.Sc. III	Sem. V	Paper IX Mathematical Analysis	<p>1. To solve examples of improper integrals.</p> <p>2. Students will be introduced to the concept of continuity of complex functions.</p> <p>3. Students will have a working knowledge of differentiability for complex functions and be familiar with the Cauchy - Riemann equations.</p> <p>4. Students will be introduced to metric spaces, cauchy sequences.</p> <p>5. Understand purpose and functions of the gamma and beta functions.</p>
B.Sc. III	Sem. V	Paper X Mathematical Methods	<p>1. Students will have full knowledge of Legendre's equation.</p> <p>2. The students are expected to learn Bessel's equation, generating function for $J_n(x)$, Sturm Liouville boundary value problem.</p> <p>3. Understand Fourier series.</p> <p>4. Apply Laplace transform to solve ordinary and partial differential equations.</p>

			5. to understand Fourier transform.
B.Sc. III	Sem. VI	Paper XI Linear Algebra	1. To have full knowledge of vector space.
			2. Identify and construct linear transformation of a matrix.
			3. To have knowledge of modules, Inner product spaces.
			4. Express linear transform in other forms such as matrix equation and vector equations.
			5. Characterize a set of vectors and linear systems using the concept of linear independence.
B.Sc. III	Sem VI	Paper XII Special theory of Relativity	1. Use tensor notation in relativity theory.
			2. Apply the concept of length contraction and time dilation as well as use Lorentz transformation.
			3. Solve simple kinematical problems.
			4. Analyze Maxwell's equations and use their relativistic invariance.
			5. Compute basic quantities in differential geometry.
			6. Analyze Einstein's Field equations.
			7. Have knowledge about cosmological models.
			8. Report some experimental tests of general relativity.

PG:Botany	Sem	Paper	Course Outcome(s)
			At the end of the course, students are expected to be able to:
M. Sc. I Year	I	Cell biology , cytology and genetics	<ol style="list-style-type: none"> 1. Explain Cell organelles 2. Introduction of Cell cycle, cell to cell interaction and protein sorting 3. Brief account on Chromosome organization and aberrations 4. Understand Mutation and cancer 5. Deep Knowledge Regulation of gene expression in Prokaryotes 6. Clear ideas Genetics of Nitrogen fixation
		Resourse utilization and conservation	<ol style="list-style-type: none"> 1. Concept of Biodiversity 2. Explain diversity of domesticated plants 3. Understand Green revolution 4. Clear ideas of Sanctuaries, National parks, Biosphere reserves Explain Ex- situ conservation, and General accounts and activities of national institutes
		Biology and diversity of algae	<ol style="list-style-type: none"> 1. Brief Classification and reproduction of algae.

		and bryophytes	<ol style="list-style-type: none"> Phylogenetic study . Appreciate the Economic importance of Algae Deep knowledge of Fossil Bryophytes. Progressive and retrogressive evolution in Gametophytes and Sporophytes.
		Plant development and reproduction	<ol style="list-style-type: none"> Focus on deep study of Unique features of plant development Explain Organisations of shoot apical meristem (SAM). Clear ideas of Plant reproduction Understand Double fertilization Polyembryony, apomixis, In-vitro plant regeneration
	II	Cytogenetics and molecular biology	<ol style="list-style-type: none"> Explain Plant Breeding Clear ideas of Physical mapping of genes on chromosomes Explain Gene expression and its regulation in Eukaryotes. Use of Molecular markers. Introduction to Molecular Biology and Bioinformatics
		Biology and diversity of microbes and fungi	<ol style="list-style-type: none"> Explain important bacterial diseases of regional crops. Explain Important viral disease of regional crops Brief Classification of Fungi proposed by Ainsworth (1971) Understand Fungi as Biological Agent
		Plant pathology	<ol style="list-style-type: none"> Brief account of Photosynthesis Deep knowledge Respiration Growth Regulators and Elicitors
		Plant metabolism	<ol style="list-style-type: none"> Explain Carbohydrate Metabolism Understand Amino Acid Metabolism Able to understand Lipid Metabolism Explain Nitrogen Metabolism Brief account Phosphate Metabolism
M.Sc.	II III	Biology and diversity of pteridophytes and gymnosperms	<ol style="list-style-type: none"> Outline Classification of Pteridophyta – G.M. Smith Deep knowledge anatomy and reproduction Pteridophyta

Year			<ol style="list-style-type: none"> 3. Explain Classification of gymnosperms: D.D.Pant and S.V.Meyen 4. Understand Fossil gymnosperm 5. Morphology, anatomy, reproduction and evolutionary tendencie in gymnosperms
		Taxonomy of angiosperms	<ol style="list-style-type: none"> 1. Systems of Angiosperm classification 2. Differtantiate Ecads & Ecotypes 3. Deep knowledge of Taxonomic hierarchy 4. Explain Systematic studies of Dicot families. 5. Understand Systematic studies of Monocot families
		Applied mycology - I	<ol style="list-style-type: none"> 1. Explain Mycorrhizae Ectotrophic 2. Human diseases caused by dermatophyte 3. Describe Industrial production of Penicillin 4. Enzymes 5. Fungi in medicine
		Plant Pathology – II	<ol style="list-style-type: none"> 1. Understand Koch's Postulate - Principles and method 2. Able to understand Integrated Pest management (IPM) 3. Deep knowledge of Diseases of cereals 4. General account of post harvest diseases of vegetables and fruits 5. Clear ideas of Viral diseases
IV	Plant Ecology	<ol style="list-style-type: none"> 1. Understand effects of Ecological factors 2. Explain Community concept 3. Apply Types and mechanism of ecological succession 4. Differentiate between Abiotic and biotic components 5. Deep knowledge of Major Biomes of the world. 	

	Environmental Ecology	<ol style="list-style-type: none"> 1. Understand Environmental impact and assessment 2. Apply Effect of solid waste disposal on soil. 3. Consequences of water pollution 4. Apply Disaster management. 5. Impact of urbanization
	Plant Biotechnology	<ol style="list-style-type: none"> 1. Deep knowledge of Plant Cell and tissue culture 2. Clonal propagation 3. Genetically modified organisms in the Environment 4. Phytoremediation 5. Importance and application of microbes in Biotechnology
	Genetic Engineering	<ol style="list-style-type: none"> 1. Explain Bacterial cultures and maintenance of Cell lines. 2. Define Isolation of gene. 3. Aims and strategies for transgenic development. 4. Brief account of Alien gene transfer 5. Understand Gene Knockout Technologies.

Course Outcome of Zoology UG – B.Sc. I (Sem-I)

Sample COs of the course “Life and Diversity of Non Chordata”

Describe classification of Non-Chordata.

CO1 Classify Protozoa up to phylum using examples life cycle of *Plasmodium vivax* and Protozoan parasites causing Human Diseases.

CO2 Classify Phylum Porifera, Type study *Scypha* with canal system.

CO3 Describe the phylum Coelenterata ,Type study *Metridium*.

CO4 Write down the Classification of Phylum Platyhelminthes,Type study of *Fasciola hepatica*, its Larval forms.

CO5 Describe Phylum Aschelminthes.Type study *Ascaris lumbricoides*,Life cycle.

CO6 Identify the characters of Phylum Annelida,Type study Leech.

CO7 Write down the classification of Phylum Arthropoda, Type study Cockroach.

- CO8 Describe the phylum Mollusca, Type Study of *Pila globosa*.
- CO9 Write down the classification and of Phylum Echinodermata, Type Study Asterias with its water vascular system
- CO10 Phylum Hemichordata type study Balanoglossus, its affinities with Chordata and non-chordata.
- CO11 Write down Coral and Coral reefs with their economic importance.
- CO12 Describe the parasitic adaptation in helminthes (Morphological and Physiological).
- CO13 study of larval form and their significance (Amphiblastula, Planula, Trochophore, Bipinnaria and Brachiolaria).

Course Outcome of Zoology UG – B.Sc. I (Sem-II)

COs of the course Cell and Developmental Biology

- CO1 Describe the general organization of Prokaryote and Eukaryote cell
- CO2 Describe the ultra structure and functions Plasma membrane, Endoplasmic reticulum
- CO3 Describe the ultra structure and functions of Golgi complex
- CO4 Describe the ultra structure and functions of Mitochondria
- CO5 Describe the ultra structure and functions of Lysosomes
- CO6 Describe the ultra structure and functions of Nucleus and Nucleolus
- CO7 Describe general organization of Chromosome and its types
- CO8 Structure of Polytene and Lampbrush chromosome
- CO9 Describe the Mitosis, Meiosis and its significance
- CO10 Describe the Gametogenesis - Spermatogenesis and Oogenesis
- CO11 Describe the types of Fertilization and its Mechanism
- CO12 Describe the embryonic development up to coelom formation in Amphioxus
- CO13 Describe the embryology of Frog up to the formation three germ layers, and its Fate map.
- CO14 Describe the embryology of Chick up to the formation three germ layers, and its Extra embryonic Membranes(Amnion, Chorion, Allantois and Yolk sac.)
- CO16 Write down the Placentation in mammals: types and functions of placenta
- CO17 Describe Parthenogenesis : types and significance
- CO18 Describe regeneration in Invertebrate and Vertebrate
- CO19 Describe Elementary idea of sources, types and use of Stem cells

Course Outcome of Zoology UG - B.Sc. II (Sem-III)

COs of the course “Life and diversity chordate and Concept of Evolution”

CO1 Describe general taxonomic rules on animal classification

Co2 Study of Protochordata

CO3 Study of class Amphibia and Physiological systems of *Rana tigrina*

CO4 Study of class Reptilia and Physiological systems of *Calotis versicolor*

CO5 Describe respiratory and urinogenital system in Birds

CO6 Study of class Mammalia and endocrine glands in Mammalia

CO7 Describe Evolution, Direct and indirect evidences of evolution

CO8 Describe Darwinism, Lamarckism and modern concept of organic evolution

CO9 Study of Adaptive radiations in mammals and Evolution of man

COs of the course - B.Sc. III (Sem-IV)

“Advance Genetics and Animal Ecology”

CO1 Describe Mendelian laws of heredity

CO2 Describe Interaction of genes

CO3 Describe Multiple alleles with examples

CO4 Describe types and theories of crossing over

CO5 Describe sex determination in animals and genetic counselling

CO7 Describe genetic disorders, genetic diseases and syndromes

CO8 Describe ecosystem

CO9 Describe ecological abiotic and biotic factors

Course Outcome of Zoology UG – B.Sc. III (Sem-V)

COs of the course “Animal Physiology & Economic Zoology”

CO1 Describe respiratory physiology

Co2 Describe blood circulation physiology

CO3 Describe muscle physiology and neuromuscular junction

CO4 Describe nerve physiology and neurotransmitters

CO5 Describe endocrine physiology and hormonal disorders

CO6 Describe reproductive physiology and physiology of mammalian placenta

CO7 Describe the physiology of excretion, osmoregulation and thermoregulation

CO8 Describe the economical importance of insects, rodents, snakes, owls and bats

CO9 Describe aquaculture and its economic importance

COs of the course - B.Sc. III (Sem-VI)

Molecular Biology & Biotechnology

CO1 Describe Structure, chemistry and functions of deoxyribonucleic acids (DNA) and ribonucleic acids (RNA)

CO2 Describe mechanism of replication of DNA and concept of gene

CO3 describe genetic code, mechanism of protein synthesis and gene expression

CO4 describe types, mechanism of mutation and DNA repair mechanism

CO5 Describe polymerase chain reaction (PCR), Southern, Northern, western blotting techniques

CO6 Describe recombinant DNA technology and its importance

CO7 Describe immune system and immunological techniques

Course Outcome of Zoology PG

M.sc I sem I

COs of ANIMAL STRUCTURE AND FUNCTION (NON-CHORDATA)

CO1 Concept of biosystematics taxonomy and classification in Nonchordata.

CO 2 Describe feeding & Digestion and Mechanism movements of food in Protozoa and types and mode of feeding in insect, mollusca, bryozoans and echinodermata, Insect flight mechanism.

CO3 Study of Organs of respiration and respiratory pigments in invertebrate, excretory organs and mechanism of excretion in invertebrate.

CO4 Describe of organization of Nervous system in invertebrate and sense organs(Chemical senses, mechanoreceptors, chemoreception, photoreception, in Invertebrates and morphology of compound eye in Insects.

CO5 Study of Reproductive mechanism, functional variation of reproductive structures, hormones of reproduction in Invertebrates. Larval form of invertebrates and metamorphosis Mechanism in insects and its hormonal Control.

COs of ANIMAL STRUCTURE AND FUNCTION (CHORDATA)

CO1 Describe the concept of biosystematics taxonomy and classification in chordata.

CO2 Describe the of structure, derivatives, functions of vertebrates Integuments(Skin). Study of endoskeleton in vertebrates. Study of structure of tooth and dentition in mammals. Study of structure and function of digestive system in protochordata. Study of structure and function of Alimentary canal & digestive glands in vertebrates.

CO3 Describe the concepts of respiratory surface, respiratory organs in fish. Study of mammalians lungs, mechanism of exchange of gases, study of larynx and vocalization in mammals. Detail study of blood

CO4 Describe the concepts of Excretion and Osmoregulation in mammals and fish. study of Nervous system and sense organs in mammals.

CO5 Describe the concepts of echolocation, electoreception, flight ,aquatic adaptation in mammals. adaptive radiation in mammals and migration in birds and fishes.

COs of GAMETE BIOLOGY

CO1 Write about male reproductive organs & semen.

CO2 Write about female reproductive organs & fertilization .

CO3 Describe the concept of cleavage & embryogenesis.

CO4 Describe the assisted reproductive techniques (IVF,ICSI,GIFT,ZIFT).

CO5 Describe the concept of transgenic animals, gene knockout technology and gene therapies.

COs of GENES AND DIFFERENTIATION

CO 1 Describe the concept of Cell specification and Differentiation and migration of germ line cell in different Invertebrates and Vertebrates .

CO 2 Describe the concept of Body axis formation in drosophila, amphibians, birds, mammals and proximate tissue interaction and homeo-box concepts .

CO 3 Describe the concept of environmental cues and effects and study of contraception and different type of contraceptives method and use of that methods.

CO 4 Describe the concept of sex determination in mammals and drosophilla and regeneration.

CO5 Describe the concept stem cells & stem cells disorder.

M.sc I sem II

COs of MOLECULAR CELL BIOLOGY

CO 1 Describe the concept Biomembranes and Extracellular matrix.

CO 2 Describe the concept and mechanism of all cell surface receptors

CO 3 Describe the concept and pathways of cell signaling.

CO 4 Describe the concept cell cycle, mechanism of cell cycle, control of cell cycle & cytoskeleton.

CO 5 Write about Secretory pathways.

COs of TOOLS AND TECHNIQUES IN BIOLOGY

CO 1 Study of principles and uses of colorimeter, spectrophotometer, spectrofluorometer, ARS,ESR,NMR,XRD Radioactivity counters

CO 2 Describe the concept microscopes its principles and application. Study of microbiological techniques.

CO 3 Describe the concept of organelle separation by different type of centrifugation methods.

CO 4 Describe the concept of Cryotechniques and separation techniques in biology.

CO 5 Study of principles and uses of Radioisotope and mass isotope techniques in biology.

COs of ENDOCRINOLOGY

CO 1 Histological study of endocrine gland , function of melatonin .

CO 2 Study of classification of hormones, hormonal action and function at cellular, genetic, digestive ,biological clock, reproduction level.

CO 3 Describe the concept of synthesis , transport metabolism of steroids and non steroids hormones.

CO 4 Describe the concept of endocrine gland hormones and its disorders.

CO 5 Study of Hormone replacement therapy and its risks and benefits. Mechanism and hormones involved in insects ,crustacean and Amphibian metamorphosis.

COs of ENVIRONMENT AND ECOLOGY

CO 1 Study of Environments and Population Ecology.

CO 2 Describe the concept of community ecology.

CO 3 Describe the concept of environmental pollution, managements of pollutions. study of biodiversity statuses.

CO 4 Describe the concept of Conservation biology and toxicology

CO 5 Describe the concept of environmental Monitoring and Environmental Impact Assessment Processes

M.sc II sem- III

COs of MOLECULAR CYTOGENETICS- I

CO 1 Describe the concept of Mutations and Molecular basis of gene mutation, and DNA repair mechanism.

CO 2 Describe the concept of Somatic Cell Genetics study and mechanism of Epigenetics.

CO 3 Write on genome organization and genetics of Cancer

CO 4 Describe the concept of Human Cytogenetics, Numerical abnormalities of human chromosomes and related syndromes, Structural abnormalities of human chromosomes and related syndromes, Human metabolic disorders and other Genetic Diseases.

CO 5 Describe the concept of Mitochondrial DNA and human diseases and Genetic Counseling.

COs of MOLECULAR CYTOGENETICS- II

CO 1 Describe the concept of Microbial genetics, Bacteriophages , Extra chromosomal inheritance.

CO 2 Describe the concept of Drosophilla genetics and Polytene chromosomes and behavioral traits.

CO 3 Describe the concept of and applications of different Molecular Cytogenetic Techniques and study of genome models in of lambda phage, E. coli, C. elegans, Drosophila and human and Functional genomics.

CO 4 Write about Population Genetics and quantitative traits in populations.

CO 5 Describe the concept of molecular phylogenetic and methods of phylogenetic tree construction.

COs of Animal Physiology -I

CO 1 Describe the concept of Structure of Muscle, properties of muscles , Chemical changes during muscular contraction.

CO 2 Write about Ultra Structure of neuromuscular junction and Muscular disorders.

CO 3 Ultra structure of neuron, properties of nerves ,action potential ionic theory and nerve conductions.

CO 4 Describe the concept of synapse ,synaptic potential, role and function of Ach. role of Ca⁺, K⁺,Na⁺ and types of neurotransmitters.

CO 5 Detail study of Neurotrophins and Growth factor, Physiology of imprinting, emotions . Parkinsons' disease , Duchenne's muscular dystrophy.

COs of Animal Physiology -II

CO 1 Describe the concept of Physiology of Receptor & Pathways.

CO 2 Describe the concept of Physiology of High altitude and exercise.

CO3 Describe the concept of Physiology of Excretion and role of hormones involve in excretion.

CO4 Write about Structure and mechanism of action of Hypothermic hormones. male and female hormones .

CO5 Describe the concept of Sociophysiology ,Honey and lac productions in insects, Pheromones in insects and mammals. Physiology underlying fear and anxiety in animals ,parental care in Primates.

M.sc IIsem IV

COs of Biochemistry

CO1 Describe the concept of Biomolecules ,bonds , PH, Pka

CO2 Describe the Structure of Amino acids and Structure and folding in Proteins.

CO3 Describe the structure , functions, of nucleic acids.

CO4 Study of pathways of Carbohydrate metabolism

CO5 Study of pathways of Lipid Metabolism.

COs of ENZYMOLOGY AND BIOSTATISTICS

CO1 Describe Enzymes Structure, Classification & kinetics

CO2 Describe the concept of Enzyme Categories & Functions of enzymes involve in different processes

CO3 Describe the functional diversity and application of enzymes.

CO4 Describe the concept Diagrammatic representation of data Graphic representation of data Confidence Intervals (CI) ,Standard deviation, Standard error,Significance test.

CO5 Describe the concept of chi square test , Analysis of variance , correlation analysis Regression analysis, Estimation of allele frequency Examples and Hardy-Weinberg equilibrium.

COs of Animal Physiology –III

CO1 Describe the Nervous System, physiology of CNS and ANS and Physiology of sleep.

CO2 Describe the physiology of learning, Mimicry, Audio signals, Echo-location Organs and its physiology . Mechanism and significance of Bioluminescence

CO3 Describe concept of Homeostasis physiology .

CO4 Describe concept of Adaptation and Acclimatization, Biological Rhythms and thermoregulatory mechanism in poikilotherms and Endotherms. Osmoregulatory mechanism in stenohaline and euryhaline species. Fresh water Marine water Terrestrial environment.

CO5 Describe concept of Patterns of Nitrogen excretion among different animal Groups. Mechanism of ions and minerals .

COs of Animal Physiology –IV

CO1 Describe the process of Digestion, Absorption, Utilization of Protein, Carbohydrate and Lipid and histophysiology of gastric glands. Gastrointestinal peptides, function and disorders .

CO2 Describe the Physiology of Respiration and neuronal hormonal control

CO3 Describe the Physiology of Circulation blood pressure, Blood pigments, Origin and conduction of cardiac impulse ,Myocardial infarction and cardio myopathy.

CO4 Describe Anatomy and histology of mammalian heart , Cardiac cycle, Cardiac sound.

CO5 Describe the Blood pressure and its regulation, Factors that affects blood pressures,ECG &Lymph- composition, Formation and Functions of lymph , structure of lymph nodes.