P.E. Society's
Modern College of Arts, Science & Commerce
Ganeshkhind, Pune-16

Department of Chemistry

Course : 71320
Course: Organic and inorganic Chemistry

Name of the Subject Teacher: Dr. S.R. Katade (Div A), Mrs. G.S. Shrotriya(Div. B and C)
Class: F. Y. General
Pattern: 2014(Semester I)

Sr	Objectives/ Outcomes
1	Students Should know about types of bonds, reactivity, different effects and hybridization concept
2	To understand basic structure of organic compound their IUPAC name
3	To know about reactions and preparation methods of different functional organic molecule
4	To help students to recognize
5.	To learn properties of s block element

P.E. Society's
Modern College of Arts, Science & Commerce
Ganeshkhind, Pune-16

Department of Chemistry

Course : 81321
Course: Organic and Inorganic Chemistry

Name of the Subject Teacher: Dr. Sushma Katade
Class: S. Y. B. Sc. Chemistry
Pattern: 2015 (Semester I)

Sr	Outcomes
1	Students would know about Chirality, optical activity, enantiomers, erythro, threo, meso-diastereomers with R/S configuration, cycloalkanes, Conformation of cyclohexane, Cyclohexane Stereochemistry, Energy of confirmers etc.
2	Addition, Elimination, substitution (aliphatic electrophilic and nucleophilic, aromatic electrophilic) and rearrangement, Hofmann rearrangement
3	Students know about General Principles of Metallurgy, gravity separation, magnetic separation. Froth flotation, Calcinations, Roasting etc. Reduction, various methods of reduction such as smelting. Metallurgy of Aluminium Occurrence, Physiochemical principles, Extraction of Al, Purification, Electrolysis of alumina, application of aluminum and its alloys. Corrosion and Passivity, Occurrence, concentration, calcination, manufacture of steel by Bessemer and L.D. process, its composition and applications.

P.E. Society's
Modern College of Arts, Science & Commerce
Ganeshkhind, Pune-16

Department of Chemistry

Course : 81311
Course: Physical and Analytical Chemistry

Name of the Subject Teacher: Anuradha Bhamidi
Class: S. Y. B. Sc. Chemistry
Pattern: 2015 (Semester I)

Sr	Outcomes
1	Students know about Kinetics
2	Students know about Photochemistry
3	Students know about the Chemical analysis
4	Students know about the technique Inorganic Qualitative analysis
5.	Students know about the technique Organic Qualitative analysis

P.E. Society's
Modern College of Arts, Science & Commerce
Ganeshkhind, Pune-16

Department of Chemistry

Course No. 913D3

Course: Environmental and Green Chemistry

Name of the Subject Teacher: Dr. Dipratn G. Khandare
Class: T. Y. B. Sc.
Pattern: 2013(Semester I)

Course Outcomes (COs):

1) The students will be able to understand various methods of pollution.
2) They will make them aware of environmental problems occurring due to pollution and other man made activities.
3) Students will be able to understand the problems and their solution to reduce the environmental current issues.
4) Students will develop interest in making new methodologies for reducing pollution or harm caused by man made activities to the environment.
5) Students will be able to apply Green chemistry rules for various synthetic routes of chemicals and to reduce the use of non-renewable sources of energy.

P.E. Society's
Modern College of Arts, Science & Commerce
Ganeshkhind, Pune-16

Department of Chemistry

Course : 91343
Course: Analytical Chemistry

Name of the Subject Teacher: Anuradha Bhamidi
Class: T. Y. B. Sc. Chemistry
Pattern: 2014 (Semester I)

Sr	Outcomes
1	Students know about the technique of Gravimetric analysis
2	Students know about the technique of Electrogravimetric analysis
3	Students know about the technique of Polarography
4	Students know about the technique of Spectrophotometric analysis
5.	Students know about the applications of above techniques

P.E. Society's
Modern College of Arts, Science & Commerce
Ganeshkhind, Pune-16

Department of Chemistry

Course : 91353
Course: Industrial Chemistry

Name of the Subject Teacher: Dr. Sushma Katade and Dr. Sunita Jadhav
Class: T. Y. Chemistry
Pattern: 2014(Semester I)

Sr	Objectives/ Outcomes
1	Students Should know importance of petrochemicals and their classification and properties.
2	To understand techniques of food preservation and methods of starch preparation
3	
4	To help students to recognized
5.	To learn properties of s block element

P.E. Society's
Modern College of Arts, Science & Commerce

Ganeshkhind, Pune-16

Department of Chemistry

CHO: 150

Course: Organic Chemistry

Name of the Subject Teacher: Dr. Dipratn G. Khandare

Class: T. Y. B. Sc.

Pattern: 2013(Semester I)

Course Outcomes (COs):

1) The students will be able to understand various methods of pollution.
2) They will make them aware of environmental problems occurring due to pollution and other man made activities.
3) Students will be able to understand the problems and their solution to reduce the environmental current issues.
4) Students will develop interest in making new methodologies for reducing pollution or harm caused by man made activities to the environment.
5) Students will be able to apply Green chemistry rules for various synthetic routes of chemicals and to reduce the use of non-renewable sources of energy.

P.E. Society's
Modern College of Arts, Science & Commerce
Ganeshkhind, Pune-16

Department of Chemistry

Course : 91333
Course: Organic Chemistry

Name of the Subject Teacher: Dr. Madhuri S. Kulkarni
Class: T. Y. Chemistry
Pattern: 2014(Semester I)

Course Outcomes (COs):

- The students are able to understand importance of IUPAC nomenclature of organic compounds and will be able to draw their structures and name them.
- Students are able to compare acidity and basicity of organic compounds and can predict factors like inductive, resonance, hyperconjugation and tautomerism effects affecting pk_a with examples.
- Students have a good knowledge about nucleophilic substitutions, addition and elimination reactions and will be able to predict products in such reactions.
- Stereochemistry of disubstituted cyclohexane and the relative stabilities can be stated by students.
- Through seminars and interactive sessions, the soft skills are enhanced.

P.E. Society's
Modern College of Arts, Science & Commerce
Ganeshkhind, Pune-16

Department of Chemistry

1. **A. Name of the Head of the Department**: Dr. Madhuri S. Kulkarni

B. Program Specific Outcome. (PSO)-UG

Sr	Objectives/ Outcomes
UG	• It is expected to inspire and boost interest of the students towards chemistry as the main subject. Students are expected to understand the fundamentals, principles, mathematical concepts and analytical techniques in Chemistry. • Students are expected to know the importance of chemistry in everyday life. They will be able to relate physical and chemical phenomena around us with chemical point of view. • As the course gradually deepens the subject knowledge from first year to third year, it makes students well versed with physical chemistry, quantum mechanics, co-ordination chemistry and its applications in various fields. • It would help students to learn various aspects of organic chemistry and its usefulness in natural products isolations, pharmaceuticals, dyes, textiles, polymers, petroleum products, forensic etc. • The environmental chemistry course would create awareness and sense of responsibilities. • The practical courses are in relevance to the theory courses to improve the understanding of the concepts. It would help in development of practical skills of the students. Students would be able to design, analyse and interpret data theoretically as well as practically. • The practical courses would help them to develop good laboratory practices, understand standard operating procedures, preparation of various solutions, identification and removal of impurities, use of analytical instruments, syntheses of complexes and small organic molecules etc. • The students will be thus introduced to concepts, applications, recent developments to inculcate research aptitude. It would enable to develop interdisciplinary approach of the subject for students. • It will help students to build up a progressive successful career and become responsible citizens. **C. Program Specific Outcome. (PSO)**

PG	• To enrich specific knowledge in areas like thermodynamics, kinetics, quantum chemistry, nuclear chemistry, spectroscopy, organometallics, bio-inorganics, reaction mechanisms, photochemistry, biochemistry, medicinal chemistry etc. which will give a bird's eye view to the scope of chemistry. • It would help students to learn applications of various facets of chemistry and their importance. • Problem solving will inculcate logical thinking to address a problem and become result oriented with a positive attitude. • Practical courses will refine the basic techniques and their use for analyses, syntheses, basic computer skills and research. It would develop analytical independent thinking required for academics, research and industrial work. • Literature reading and project work will help for strategic planning and execution, to know recent developments in chemistry, its interdisciplinary relevance and create interest for research. • The credit system would help them to improvise their presentation skills, strive for excellence and create awareness of their social and environmental responsibilities. • To help students build up a progressive successful career.

P.E. Society's Modern College of Arts, Science & Commerce Ganeshkhind, Pune-16

Department: Chemistry

Class: T.Y.B.Sc. Regular

Pattern: 2015 (Semester)

Name of the Subject teacher: Dr. Mohini S. Gupte

Program Specific Outcome: Physical Chemistry

Sr. No.	Objectives/ Outcomes
1	Students can identify the molecularity of chemical reactions and experimentally determine the order of the reaction.
2	Students can calculate the rate of reaction and factors which can alter the rate.
3	Can predict the strong and weak electrolytes based on dissociation constant by conductance measurements.
4	How the phases of substances change with change in pressure and temperature.
5	How molecular spectroscopy used to identify structure of molecules.

P.E.Society's

Modern College of Arts, Science and Commerce,Pune-16

DEPARTMENT OF STATISTICS

11421 - (Paper I)

Course: Statistical Methods-I

Name of the Teacher: Ms. Aditi Mulay

Class: F.Y.B.Sc. (Comp.Science) Pattern: 2013 (Annual)

Course Outcomes: COs: Statistical Methods-I

CO1) Students will understand the concept of Statistical data. They will understand how to collect and condense data using various statistical methods and how to classify and represent that data graphically.

CO 2) Students will learn through various statistical measures such as measures of central tendency, dispersion, moments, skewness and kurtosis.

CO 3) Students will understand the concept of discrete random variables and will be able to apply the standard discrete probability distributions like Binomial ,Poisson,Geometric to different real life situations

CO 4) Students will able to describe the correlation between interrelated variables and also able to find appropriate regression equation among the variables.

CO 5) Students will be able to understand the concept of time series.

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P.E.Society's

Modern College of Arts, Science and Commerce,Pune-16

DEPARTMENT OF STATISTICS

Bb-104

Course: Mathematics and Statistical Methods for Biologists

Name of the Teacher: Ms. Aditi Mulay

Class: F.Y.B.Sc. (Biotechnology) Pattern: 2013 (Annual)

Course Outcomes: COs :Mathematics and Statistical Methods for Biologists

CO1) Students will understand the concept of population and sample . They will understand how to collect data using various statistical sampling methods and how to classify and represent that data graphically.

CO 2) Students will learn through various statistical measures such as measures of central tendency, dispersion, skewness and kurtosis.

CO 3) They will be able to find probabilities related to standard probability distributions

will be able to apply the standard discrete probability distributions to different real life situations

CO 4) Students will able to describe the correlation between interrelated variables

CO 5) Students will be able to understand the concept of testing of hypothesis and analysis of variance

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P.E.Society's

Modern College of Arts,Science and Commerce,Pune-16

DEPARTMENT OF STATISTICS

ST-211- (Paper I)

Course: Discrete Probability Distributions, Time Series & R software

Name of the Teacher: Mrs. Pournima Ajagekar

Class: S.Y.B.Sc. (Statistics) Pattern: 2013 (Semester -I)

Course Outcomes: COs: Discrete Probability Distributions, Time Series & R software

CO 1) Students will be able to identify the real life situations of discrete probability distributions.

CO 2) They will be able to find probabilities related to standard probability distributions.

CO 3) Students will be able to understand the concept of time series.

CO 4) They will learn different methods of measurements of trend and seasonal variations.

CO 5) Students will be to use R-software for statistical computing.

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P.E.Society's

Modern College of Arts,Science and Commerce,Pune-16

DEPARTMENT OF STATISTICS

ST-221- (Paper I)

Course: Statistical Methods and Use of R software

Name of the Teacher: Mrs. Pournima Ajagekar

Class: S.Y.B.Sc. (Statistics) Pattern: 2013 (Semester -II)

Course Outcomes: COs: Statistical Methods and Use of R software

CO 1) Students will be able to fit the best equation of plane of multiple regression.

CO 2) They will be able to understand the concept of testing of hypothesis and they will carry out test for means and proportions.

CO 3) Students will be able to carry out different tests of hypothesis using R software.

CO 4) They will understand the concept of vital statistics and they can compute rates of different vital events.

CO 5) Students will understand the concept of queuing models.

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Modern College of Arts, Science and Commerce,Pune-16

DEPARTMENT OF STATISTICS

71720 - (Paper II)

Course: Discrete Probability and Probability Distributions

Name of the Teacher: Mrs. Pournima Ajagekar

Class: F.Y.B.Sc. (Gen) Pattern: 2013 (Annual)

Course Outcomes: COs: Discrete Probability and Probability Distributions

CO1) Students will get familiar with basic concepts of probability, random variable and probability distributions.

CO 2) Students will be able to understand the difference between random and non-random experiments.

CO 3) Students will be able to solve the numerical problems on probability.

CO 4) Students will be able to obtain the probability distributions of random variables.

CO 5) Students will be able to apply the standard discrete probability distributions to different real life situations.

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P.E.Society's

Modern College of Arts, Science and Commerce,Pune-16

DEPARTMENT OF STATISTICS

11422 - (Paper II)

Course: Statistical Methods-II

Name of the Teacher: Ms. Priyanka S. Deshmukh

Class: F.Y.B.Sc. (Comp.Science) Pattern: 2013 (Annual)

Course Outcomes: COs: Statistical Methods-II

CO1) Students will get familiar with basic concepts of probability, random variable and probability distributions.

CO 2) Students will be able to solve the numerical problems on probability.

CO 3) Students will be able to obtain the probability distributions of random variables.

CO 4) Students will be able to apply the standard continuous probability distributions to different real life situations.

CO 5) They will be able to understand the concept of testing of hypothesis and they will carry out test for means and proportions.

P.E.Society's

Modern College of Arts,Science and Commerce,Pune-16

DEPARTMENT OF STATISTICS

ST-212- (Paper II)

Course: Continuous Probability Distributions-I

Name of the Teacher: Mrs.Sonia Joshi

Class: S.Y.B.Sc. (Statistics) Pattern: 2013 (Semester -I)

Course Outcomes: COs: Continuous Probability Distributions-I

CO1) Students will understand the concept of continuous random variable and its probability distribution.

CO 2) Students will go through various derivations done for mathematical expectation and variance, moment generating function and cumulant generating functions.

CO 3) Students will able to describe and study the different kinds of continuous probability distributions such as Uniform distribution, Normal distribution , Gamma and Exponential distribution.

CO 4) They can find relations among aforesaid continuous random variables.

CO 5) Students can implement these probability distributions in handling the real life data.

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P.E.Society's

Modern College of Arts, Science and Commerce,Pune-16

DEPARTMENT OF STATISTICS

71710 - (Paper I)

Course: Descriptive Statistics

Name of the Teacher: Mrs.Sonia Joshi

Class: F.Y.B.Sc. (Gen) Pattern: 2013 (Annual)

Course Outcomes: COs: Descriptive Statistics

CO1) Students will understand the concept of population and sample . They will understand how to collect data using various statistical sampling methods and how to classify and represent that data graphically.

CO 2) Students will go through various statistical measures such as measures of central tendency, dispersion, skewness and kurtosis.

CO 3) Students will able to describe the correlation between interrelated variables and also able to find appropriate regression equation among the variables.

CO 4) They will understand mathematical operations done with attributes.

CO 5) Students will understand the applications of index numbers in the real life.

Department of Electronics
B.Sc. (Electronic Science)
Course Specific Outcome. (CSO)-UG

A. Name of the Course: Principles of Analog Electronics

B. Name of the Teacher [at F.Y.B.Sc (Science) Level]: Dr. Saroj Hole

Sr	Objectives/ Outcomes
1	This course provides the opportunity to acquire basic theoretical background in electronics and to apply this knowledge in understanding ,troubleshooting and analysis of electronic circuits
2	Provides basic understanding of the principles and applications of analog electronics
3	To study familiar with various components used in electronic circuits
4	To develop an understanding about the different methods of circuit analysis ,diodes ,power supply as electronic gadget
5	To understand transistors ,op-amp and its applications

A. Name of the Course: Principles of Digital Electronics

B. Name of the Teacher [at F.Y.B.Sc (Science) Level]: Dr. Saroj Hole

Sr	Objectives/ Outcomes
1	To understand the decimal ,binary ,octal, hexadecimal no system,
2	Boolean algebra is mathematics of digital system. It provides mathematical basis for expressing logic circuit functions as well as analyzing and designing of the digital system
3	Using logic gates we can realize logical expressions which can be simplified using laws and study combinational and sequential circuits
4	In digital system we require the circuits outputs once set should remain unchanged even if the input is changed Such a device is used to store information in the form of binary number
5	Flip-flops are basic building blocks of counters, shift registers and memory devices. IC is basically a miniaturized electronic circuit . The integration of large numbers of transistors into a small chip was an enormous improvement over the manual assembly of circuits using discrete electronic components.

Department of Electronics
B.Sc. (Electronic Science)
Course Specific Outcome. (CSO)-UG

A. Name of the Course [at F.Y.B.Sc(Science) Level]: Electronics Practical

B. Name of the Teacher: Saroj Hole

Sr	Objectives/ Outcomes
1	To do practicles based on theory in analog as well as digital electronics
2	Smart application development for society, Hands on and skill based knowledge
3	Through Electronic project development activity student become skilled
4	Through seminar ,presentation skills and stage daring quality is enhanced
5	Through guest lectures student get the various new and research oriented knowledge as well as what is the new technology in market coming

Department of Electronics
B.Sc. (Electronic Science)
Course Specific Outcome. (CSO)-UG

A. Name of the Course [at F.Y.B.Sc(Computer Science) Level] : ELC-11311,Principles of Analog Electronics

B. Name of the Teacher: Dr. Varsha M. Bapat

Sr	Objectives/ Outcomes
1	Students will be able to identify various components in Electronic Circuits (Hardware Systems). Function of every component will be known and students will learn where to use these components in various applications.
2	Students will be able to understand the concept of Circuit analysis. By learning different Network theorems and laws they will be able to determine current and voltages across any branch in the circuit. With this knowledge of circuit analysis students can identify faults in the circuit and repair them.
3	Electronics Industry is developing in leaps and bounds , so in order to make the students aware about the current trends and basics of Semiconductor devices, different devices are discussed along with construction, working principle and applications.
4	Operational Amplifiers are part of almost all Process control systems and Instrumentation systems. Students learn various applications of Op-Amp through theory and then they verify it with supportive practical sessions.

A. Name of the Course : ELC-11312,Principles of Digital Electronics

B. Name of the Teacher[at F.Y.B.Sc.(Computer Science) Level]: Mrs. Mrunal Bhadane

Sr	Objectives/ Outcomes
1	Being a Computer science students, they will learn basics of Digital Electronics.
2	Students will be knowing about the devices used to design Central Processing Unit, an important part of a computer system.
3	Students will learn about the integrated circuits fabrication standards
4	Students will learn the basic memory devices used in the computers.

A. Name of the Course [at F.Y.B.Sc(Computer Science) Level]: ELC-11313,Electronics Practical

B. Name of the Teacher: All the staff members from the department.

Department of Electronics
B.Sc. (Electronic Science)
Course Specific Outcome. (CSO)-UG

Sr	Objectives/ Outcomes
1	Students learn to identify and use the various components, instruments and devices.
2	Students will be able to verify different laws and theorems practically which are useful in analysis of the circuits .
3	They will learn functioning of basic semiconductor devices along with their applications .
4	They realize the functioning of different digital circuits applicable in computer system .
5	Technical skills will be developed among the students by designing and implementing small projects.

A. Name of the Course [at S.Y.B.Sc(Computer Science) Level-Sem-I] : ELC- 21321 Digital System Hardware

B. Name of the Teacher: Mrs. Vaishali Salunke

Sr.	Objectives/ Outcomes
1	Course is designed to impart skills of digital circuit design and ability to visualize the computer system operation
2	Knowledge of various aspects of computer system design for speed, cost and memory optimization is given.
3	Concept of general CPU (microprocessor) organization and different microprocessor architecture is developed. Various advancement features of INTEL family microprocessors are introduced.
4	Introduction to multi core processor and hardware-software design.

A. Name of the Course [at S.Y.B.Sc (Computer Science) Level –Sem-I]: : ELC- 21322 Analog Systems

B. Name of the Teacher: Mrs. Pradnya Pathakji

Sr	Objectives/ Outcomes
1	To understand the basics of Analog Electronics.

2	To study different types of sensors and signal conditioning circuits.
3	To learn data conversion technique.
4	To apply knowledge of analog systems in different applications.
5	Students understand implementation of automation in different smart applications/gadgets with the help of sensors and transducers.

A. Name of the Course [at S.Y.B.Sc (Computer Science) Level –Sem-II]: ELC-22321, The 8051 microcontroller Architecture, Interfacing and Programming

B. Name of the Teacher: Mrs. Vaishali Salunke

Sr	Objectives/ Outcomes
1	Study of 8051 microcontroller architecture develops systematic approach for learning architecture of any premier and advanced microcontroller
2	Students learn various parameters of optimally used devices for system integration and their interfacing techniques.
3	Programming skills in assembly language and Embedded 'C'
4	Students acquire skills and techniques of system integration around 8051 microcontroller.

A. Name of the Course [at S.Y.B.Sc(Computer Science) Level –Sem-II]:E-22322, Communication Principles

B. Name of the Teacher: Mrs. Pradnya Pathakji

Sr	Objectives/ Outcomes
1	To understand basics of Electronic Communication system.
2	To learn different types of communication techniques such as wired and wireless communication.
3	To study digital communication techniques.
4	To introduce concepts in latest/advanced wireless communication.
5	Students understand communication principles and implement the use of technology in the form of development of allied projects

Department of Electronics
B.Sc. (Electronic Science)
Course Specific Outcome. (CSO)-UG

A. Name of the Course [at S.Y.B.Sc (Computer Science) Level]: ELC-22323, Electronics Practical

B. Name of the Teacher: All the staff members from the department**.**

Sr	Objectives/ Outcomes
1	Students gain skills of combinational and sequential circuit design, build and verify their operation.
2	Exposure to sensor studies allows the students to learn about working principles and specifications of various sensing elements and to realize their application.
3	Students will be able to develop the applications based on microcontroller.
4	Students will acquire the skills and learn the techniques used in communication electronics.

Department of Electronics
B.Sc. (Electronic Science)
Course Specific Outcome. (CSO)-UG

1. Department: Electronics

A. Name of the Head of the Department: Mrs. Vaishali Salunke

Sr	Objectives/ Outcomes
1	Broadly the curriculum for first and second year is a fine blend of science and technology systematically planned to build foundation of electronics among the students to enable them for their higher studies both in electronics and computer Science. Partially it is designed to motivate and encourage self employment of the students.
2	Specifically first year curriculum covers fundamentals of electronics in both analog and digital electronics. While the second year curriculum emphasizes on designing aids and methods for development of various applications in automation and also covers concepts related to advanced technologies. Practical are designed to realize the theory concepts and are intended to achieve the basic skills required for circuit building and testing.
3	**Objectives :** ➢ To provide in depth knowledge of scientific and technological aspects of electronics. ➢ To familiarize with current and recent technological developments. ➢ To enrich knowledge through programme such as industrial visits, hobby projects, market survey etc. ➢ To train students in skills related to electronics industry and market. ➢ To create foundation for research and development in Electronics ➢ To develop analytical abilities towards real world problems ➢ To help students build-up a progressive and successful career in Electronics.

Head
Department of Electronics

Department of Electronics
B.Sc. (Electronic Science)
Course Specific Outcome. (CSO)-UG

A. Name of the Head of the Department: Mrs.Vaishali Salunke

B. Teacher In-Charge :Dr. Saroj Hole

Sr	Objectives/ Outcomes
1	To provide in depth knowledge of scientific and technological aspects of electronics • To familiarize with current and recent technological developments • To enrich knowledge through programmes such as industrial visits, hobby projects, market survey, projects etc. • To train students in skills related to electronics industry and market. • To creat foundation for research and development in Electronics • To develop analytical abilities towards real world problems • To help students build-up a progressive and successful career in Electronics
2	At First year of under-graduation:The basic topics related to the fundamentals of electronics are covered. Since electronics is very close to technological advancements, the practical course is intended to achieve the basic skills required for circuit building and testing.
3	At second year under-graduation: The level of the theory and practical courses shall be one step ahead of the first year B.Sc. Courses based on content of first year shall be introduced. Analog and digital circuit design concepts will be introduced at this stage.
4	At third Year :Theory papers in each semester deal with the further detailed studies of the branches of Electronics. The first two practical courses based on the theory courses. Third practical course is project course in which student can independently think and carry out the project work
5	To get familiar with basic circuit elements and passive components 2. To understand DC circuit theorems and their use in circuit analysis 3. To study characteristic features of semiconductor devices 4. To study elementary electronic circuits and applications 5. To understand basics of operational amplifiers.
6	To get familiar with concepts of digital electronics 2. To learn number systems and their representation 3. To understand basic logic gates, boolean algebra and k-maps 4. To study arithmetic circuits, combinational circuits and sequential circuits 5. To study comparative aspects of logic families. Term I Unit 1: Number Systems and Logic Gates (

Course outcomes:

Department of Microbiology

Class: FYBSc Microbiology; Pattern: 2013

Paper II

Teachers: Mrs.Prajakta Taple.

Class: F.Y. B.Sc

Pattern: 2013 Semester I

Course Outcome: Cos Basic Techniques in Microbiology

Sem I

1. Understand Microscopy-Bright field microscopy, structure and working of compound light microscope.
2. Know concept of Magnification, Resolving power and Numerical Aperture.
3. Describe aberrations in lenses
4. Know concept of Stain and types of Stain.
5. Describe properties and role of Fixatives, Mordant, Decolorisers and Accentuators.
6. Understand Principles of Monochrome staining, Negative Staining.
7. Understand Differential Staining techniques-Gram Staining and acid fast staining.
8. Describe Sterilization and disinfection by Physical Agents and by Chemical Agents and its mode of action.
9. Describe checking of efficiency of sterilization by using Biological and Chemical Indicators.
10. Describe Phenol Coefficient.

Sem II

1. Know Nutritional requirements and media preparation for cultivation of Microorganisms
2. Understand methods for cultivating Photosynthetic,extremophilic and chemolithotropic bacteria.
3. Understand concept of pure culture,isolation and preservation techniques.
4. Know culture collection centres and their role.
5. Understand Bacterial growth kinetics and growth curve,generation time and growth rate.
6. Describe methods of enumeration.
7. Understand factors affecting bacterial growth (pH,Temperature,salt and sugar concentration and heavy metals.)
8. Know Diauxic growth.

Class: SYBSc Microbiology; Pattern: 2013

Semester I

Course code: **MB 211 (Paper I)**

Course title: **Bacterial systematic and physiology**

Teacher: Dr. Neelima Kulkarni

Student will be able to:

1. Describe concept of bacterial species
2. Describe with suitable examples application of chemotaxonomy and nucleic acids in bacterial classification
3. Describe steps involved in numerical taxonomy
4. Decribe with example use of radioisotopes in studying metabolic pathways using techniques such as Autoradiography, Phospher imaging and pulse chase.
5. Write down following pathways with details such as structures and names of metabolites, names of enzymes and cofactors: EMP, HMP, ED, Phosphoketolase, Glyoxylate, TCA, Homofermentative and heterofermentative lactic acid pathways.
6. Describe various electron carriers of electron transport chain and high energy compounds with specific examples.
7. Write with examples mechanism of Oxidative phosphorylation , Substrate level phosphorylation
8. Describe chemiosmotic hypothesis, Concept of Standard redox potential and Nernst equation.
9. Describe with examples coenzymes, prosthetic group and cofactors.
10. Describe nature of enzyme active site with names of common amino acids at active site.
11. Describe Models for catalysis – i. Lock and key ii. Induced fit iii. Transition state.
12. Describe with suitable examples of catalytic groups the mechanism of Acid-base catalysis, metal ion catalysis, covalent catalysis.
13. Describe the effect of pH & temperature, substrate concentration & enzyme concentration, activators and inhibitors of enzyme

MB:212 (Paper II)

Course title: **INDUSTRIAL AND SOIL MICROBIOLOGY**

Teacher: Mrs Gauri Bhagat

Course Outcome: COs INDUSTRIAL AND SOIL MICROBIOLOGY

A)INTRODUCTION TO INDUSTRIAL MICROBIOLOGY

Student will be able to:

1) Describe industrially important microorganisms
2) Desirable characteristics of industrial strain and Principles of primary and secondary screening
3) Define Master, working and seed culture;
4) Development of inoculum
5) Describe parts of a Fermenter and their operation.
6) Process Control and Monitoring of different fermentation parameters (temperature, pH, aeration, agitation, foam)
7) Types of fermentations: Batch, continuous, dual
8) Constituents of industrial fermentations media
9) Contamination: Sources, precautions, and consequences

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B) SOIL MICROBIOLOGY

Student will be able to:

1) Know the composition and types of soils along with soil microorganisms.
2) Describe the Rhizosphere effect between plants and soil microflora.
3) Understand Role of microorganisms in composting and humus Formation.
4) Understand protocols for large scale production of Biofertilizers: Bacterial, Cyanobacterial, fungal.
5) Describe various Biocontrol agents: Bacterial, Viral, Fungal and their large scale production
6) Understand the Role of microorganisms in elemental cycles in nature (Carbon, Nitrogen, Sulphur, Phosphorous.)
7) How Degradation of cellulose, hemicelluloses, lignin and pectin occurs in nature.
8) Understands microbial interactions like Symbiosis, Neutralism, Commensalism, Competition, Synergism, Parasitism, and Predation.

Course specific outcomes

SY BSc semester II,

MB:221 (Paper I)

Teacher: Mrs Gauri Bhagat

Class: SYBSc Microbiology

Pattern: 2013 Semester II

Course Outcome: BACTERIAL GENETICS

A) UNDERSTANDING MOLECULES OF HEREDITY
Student will be able to:

1) Describe the experiments underlying the Discovery of transforming material (Griffith's experiment),evidence for nucleic acid as genetic material (Avery and MacLeod experiment) Gierer and Schramm / Fraenkel-Conrat& Singer experiment. Hershay& Chase experiment
2) Understand Prokaryotic genome organization and concept of Gene, basic structure ofDNA and its forms.
3)Know the process of DNA replication (Messelson and Stahl's experiment),Theta model (semi-discontinuous), J Cairn's experiment, rolling circle model (plasmid DNA,λphage DNA)
4) Describe Gene organization and expression with respect to genetic code, mechanism of transcription and translation

B)MUTATIONS AND REVERSIONS
Student will be able to:

1)Describe Occurrence and Mechanisms of Spontaneous mutations
2). Mechanisms of induced mutations and Frame shift mutations using Physical Chemical and Biological Agents.
3)Describe Types of mutations: Nonsense, Missense, Silent, Null, Conditional lethal-temperature sensitive, amber, leaky& non leaky
4)Understand and experimentally carry out Isolation of Mutants by Replica plate technique
5) Describe Reversion and Suppression mutation

C) PLASMID GENETICS
1)Describe Structure and Properties of plasmids and Types of plasmids
2)Describe Plasmid replication, incompatibility , curing ,and plasmid amplification .

Paper II:

Course code: MB – 222:

Course title: AIR AND WATER MICROBIOLOGY

Teacher: Dr. Neelima Kulkarni

Student will be able to:

1. To know meaning of Droplet, droplet nuclei, and aerosols, and transient nature of air flora.

2. Describe Chemical pollutants, their sources in air and effects on human health.

3. Describe with the help of diagram construction and working of various air samplers.

4. Describe air bone infections caused by bacteria, fungi and viruses.

5. Describe Physical and chemical methods of air sanitation.

6. To define types of water: surface, ground, stored, distilled, mineral and de-mineralized water.

7. Describe steps in Water purification, Bacteriological standards of potable water. Functions of regulatory bodies such as CPCB, MPCB, BIS, WHO.

8. To describe Escherichia coli, Bifidobacterium, Streptococcus faecalis, Clostridium perfringens, Campylobacter and Pseudomonas as indicators of faecal contamination.

9. To describe Water borne Infections caused by bacteria and viruses.

10. Describe tests for Bacteriological analysis of water for potability.

11. Describe physical and chemical parameters used for waste water analysis.

12. Describe Biomagnification and eutrophication.

13. Describe Methods of effluent treatment – Primary, secondary, tertiary treatment methods.

14 Describe Recycling of waste water and sludge.

15. Solid waste management: Types of anaerobic digesters, raw material and organisms used for biogas production.

Class: TYBSc Microbiology; Pattern: 2013

Semester I

MB 332 (Paper II)

Course: Genetics and Molecular Biology I

Teacher: Mrs. Sneha Ogale

Course outcomes: COs: Genetics and Molecular Biology I

CO1: Students will understand Mendel's laws of inheritance, genetic recombination and linkage, gene mapping by tetrad analysis in the case of *N. crassa* and parasexual cycle with specific reference to *A. nidulans*.

CO2: Students will understand molecular mechanisms of prokaryotic DNA replication.

CO3: Students will understand molecular mechanisms of prokaryotic and eukaryotic transcription and its regulation.

CO4: Students will understand molecular mechanisms of prokaryotic and eukaryotic translation and its regulation.

CO5: Students will have learnt history of Recombinant DNA Technology (RDT), potential uses and biohazards of RDT and safety guidelines for set up of a laboratory involved in RDT.

CO6: Students will have learnt details of techniques used in RDT such as isolation and purification of genomic DNA, Agarose gel electrophoresis, Southern, Northern and Western blotting and hybridization.

Semester II

MB 342 (Paper II)

Course: Genetics and Molecular Biology II

Teacher: Mrs. Sneha Ogale

Class: TYBSc Microbiology; Pattern: 2013 Semester II

Course outcomes: COs: Genetics and Molecular Biology II

CO1: Students will have learnt the details of the process of transformation in Gram positive and Gram negative bacteria and how gene mapping is done by co-transformation.

CO2: Students will have learnt the details of the process of generalized and specialized transduction and how gene mapping is done by co- transduction.

CO3: Students will have learnt the details of the process of conjugation and how gene mapping is done by interrupted mating technique.

CO4: Students will understand how DNA is damaged by hydrolysis, deamination, alkylation oxidation and radiation. They will have learnt details about various DNA repair mechanisms such as Base excision repair, nucleotide excision repair, Recombinational repair, Photoreactivation and Translesion DNA synthesis.

CO5: Students will have learnt about various types of bacteriophage mutants, cis-trans test/ genetic complementation test and fine structure mapping of phage genes by deletion mapping.

CO6: Students will have learnt details about the Generation of a recombinant DNA molecule such as vectors used in RDT, molecular tools used for cutting and joining the DNA molecules, methods used to transfer recombinant DNA into host cells, methods of screening the cells containing the recombinant DNA and identification of clones using probes.

MB:334 (Paper IV)

Teacher: Mrs Gauri Bhagat

Class: TYBSc Microbiology

Pattern: 2013 Semester I

Course Outcome: IMMUNOLOGY 1

1.Understand immunity and formation of blood cells
2. Knows different functions and structure of immune organs
3. Describe three lines of defence mechanisms with non specific and specific immune responses
4. Can describe antigen and antibody structure and properties
5. understand humoral and cell mediated immune responses.
6. Know the activation maturation and differenciation of T and B cells at genetic and molecular level.
7.understand what is transplantation immunity with types of grafts and prevention and rejection of grafts.

MB:344 (Paper IV)

Teacher: Mrs Gauri Bhagat

Class: TYBSc Microbiology

Pattern: 2013 Semester II

Course Outcome: IMMUNOLOGY II

1. Understand structure and function of MHC in man and mouse
2. Know polymorphism of MHC molecules and MHC typing
3. Describe cytokines and its role in immune system activation.
4. Principles of Antigen Antibody reactions and vizualiztion (ELISA,RIA etc)
5. Describe ABO blood group system Rh system and blood banking practices.
6. Know Medico legal applications of blood groups.
7. Describe types of vaccines and immunization schedules.
8. Describe various Hypersensitivity reactionsand autoimmunity.
9. Know monoclonal antibody technique and its application.

MB 335 (Paper V)

Teacher: Mrs.Prajakta Taple.

Class: T.Y. B.Sc

Pattern: 2013 Semester I

Course Outcome: Cos Fermentation Technology – I

1. Describe objectives and methods for strain improvement

2. Describe various methods of media optimization and sterilization.
3. Understand Concept of Plackett-Burman Design and Del factor
4. Know objectives and methods for scale-up and scale-down in fermentation technology
5. Describe principles and methods of Downstream processing.
6. Describe various methods for Quality Assurance (QA) of fermentation product
7. Describe fermentation economics-Recurring and Non-recurring expenses
8. Know IPR and its types.

Course Outcome:

Department of Microbiology

MB 345 (Paper V)

Teacher: Mrs.Prajakta Taple.

Class: T.Y. B.Sc

Pattern: 2013 Semester I

Course Outcome: Cos Fermentation Technology – II

1. Explain solid state fermentation and submerged fermentation
2. Explain large scale production of primary metabolites, secondary metabolites, enzymes, biomass based products, milk products, vaccines, immune sera.

Course Outcome:

Department of Microbiology

MB 336 (Paper VI)

Teacher: Ms. Shobha Devkar

Class: TYBSc Microbiology; Pattern: 2013 Semester I

Course Outcome: Cos: Food and Dairy Microbiology

Course Outcome: Cos: Dairy Microbiology

CO1: Student will have learnt about dairy development in India

CO2: Student will understand milk chemistry and constituents

CO3: Student will understand microbiology of milk

CO4: Student will have leant preservation of milk by pasteurization and its storage

CO5: Student will have learnt microbial analysis of milk

CO6: Student will classify foods based on stability

Teacher: Ms.Shobha Devkar

Class: TYBSc Microbiology; Pattern: 2013 Semester I

Course Outcome: Cos: Food Microbiology

CO1: Student will aware about spoilage of meat and poultry products, bread, fruits and vegetables, eggs, sea foods and canned foods.

CO2: Student will understand principle and methods of food preservation.

CO3: Student will understand microbial food poisoning and food infection.

CO4: Student will explain significance and describe fermented foods.

CO5: Student will have learnt applications of genetically modified microorganisms.

CO6: Student will have learnt food sanitation and regulation.

Progressive Education Society's
Modern College of Arts, Science & Commerce Ganeshkhind, Pune – 16
DEPARTMENT OF BIOTECHNOLOGY

Bb- 103 (Paper III)
Course: Basics Of Plant and animal sciences

Name of the Teacher: Dr. Nivedita Das, Mrs. Swapnali Pawar
Class: F.Y. B.Sc. (Biotechnology)

Course Outcomes:

The main objective of this course is to provide the students with possibilities of acquiring knowledge of plant sciences, its Anatomy, Major pathways in plant metabolism.

At the completion of this course students will be able to develop a basic knowledge about plant sciences and its applications.

The students were assessed by method of assignments and clss tests on differents topics of plant sciences, its anatomy, morphology, pathways in plant metabolisms.

All the students participate in active, interactive session of question and answers on all topics from differents units.

Course : Bb 103 (Paper III) F.Y.B.Sc. Biotechnology	Course Specific outcome CSO	Methodology	No of Lectures
BOTANY **Plant as a Life Form**			
General and Unique features of plants as a category of living organisms Introduction to plant groups and their characters with respect to increasing complexity in organization of plant body (Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms, Angiosperms with one example each) (Excluding plant taxonomy)	An understanding, deep knowledge about plants and the category of the living organisms as life form its features. Importance, Introduction to plants group	Conventional method and active learning Study of permanent glass slides	7
Major aspects of plant sciences			
a) Structural i) Morphology of vegetative and reproductive plant organs	Students getting familiar with morphology & plant cell.	Conventional method and active learning	2
ii) Plant cell biology – Unique features of a plant cell, Cell wall	Gaining knowledge about unique, silent features and chemical compositions of cell	Conventional method and active learning	2

	wall.		
iii) Anatomy – Internal organization of vegetative and reproductive plant organs (leaf, shoot, root and flower)	It extends the knowledge about the concept of internal structure of monocot, dicot root, stem & leaf.	Conventional method and power point presentation	5
b) Functional			
i)Permeability Diffusion – Definition, significance, mechanism, laws and factors affecting diffusion Osmosis – Definition, mechanism, significance, osmotic pressure (OP), types of osmosis – endosmosis, exosmosis, turgor pressure (TP) and wall pressure (WP), relation between OP, DPD (Suction pressure) and TP	Students getting the concept of osmosis and diffusion. Getting difference between osmosis and diffusion	Conventional method and power point presentation.	2 2 4
ii) Absorption and adsorption of water Ascent of sap – Introduction and mechanism (Capillarity, Imbibition, Atmospheric pressure and Cohesion-tension)	Students getting concept of ascent of sap, its mechanism and different theories	Conventional method and active learning	2 2
iii)Major pathways in plant metabolism-photosynthesis and respiration	Gaining knowledge of photosynthesis, respiration & various different cycles	Conventional method, active learning & Power point presentation	4
iv)Nutrition: Essential nutrients for growth and development of plants and their roles	An understanding of micro, macro minerals their role and deficiency	Conventional method and active learning	4
v)Photo-biology: Metabolism, movement and photo-morphogenesis (vegetative)	Understanding concept of photomorphogenesis,plant movement and its different types.	Conventional method and active learning	3
vi)Introduction to physiology of flowering: a) photoperiodism and b) vernalisation	Gaining knowledge on photoperiodism, its mechanism, concept of vernalization its mechanism and applications	Conventional method and active learning	2
	Students will learn different types of	Conventional	4

	growth promoters its role and importance, phytohormones, growth inhibitors	method and active learning	
ZOOLOGY Introduction to Kingdom Animalia	Understanding the concept of classification and construction of animal organization of non chordates and chordates	Conventional method	4
Animal tissue	Basic understanding of animal tissues with examples	Conventional method	6
Animal physiology	Understanding the different functional aspects of various system of animals vertebrates (frog) & invertebrates (honeybee)	Conventional method	25
Parasitology	Understanding the importance of parasites in human health	Conventional method and powerpoint (ICT)	5
Economic Zoology	Imparting practical knowledge on the importance of Vermiculture, Aquaculture & Sericulture	Conventional method, active learning (Seminar)	5

References:-

1. Dutta A. C. A Classbook of Botany (Oxford University Press, UK)
   sss
2. Devlin R.M. Fundamental of Plant Physiology
   (Mac. Millan, New York)
3. Esau K. Anatomy of seed plants
   (Wiley, USA)
4. Ganguli, Das Dutta – College Botany
   (New Central Book Agency, Kolkata)
5. Jordan, E.L. and Verma P.S.- Chordate zoology (S. Chand and company New Delhi)
6. Jordan and Verma- Invertebrates Zoology (S. Chand and company New Delhi)
7. Modern parasitology – A textbook of Parasitology (Cox, Wiley, & Sons, USA)

Progressive Education Society's
Modern College of Arts, Science & Commerce Ganeshkhind, Pune – 16
Department of Biotechnology

Course: Bb 105
Subject: Fundamentals of Biological Chemistry
Class: FY BSc Biotechnology
Name of the Teacher: Dr Pooja Rana

Course outcome:

1. As Biochemistry is the branch of science concerned with the chemical and physico-chemical processes and substances that occur within living organisms, therefore students will be able to understand how biomolecules relate to a particular process (metabolism) within a living cell.
2. Students will be acquainted with the knowledge of structures, functions, and interactions of proteins, nucleic acids, carbohydrates and lipids.
3. The course will help the students to understand the abnormalities in the metabolism their relationship to various diseases. In addition to, it will help to understand the mechanism underlying correct disorders with dietary modifications or genetic modifications.
4. Students will learn about enzyme kinetics and types of inhibition as enzymes are important in catalyzing various reactions in the body

Course: Bb -105 Subject: Fundamentals of Biological Chemistry	Course specific outcome (CSO)	Methodology	No. of lectures
Buffers	Skill-Preparation of buffers is	Active learning as	7

Concept of pH,ionic product of water, dissociation constant, Concept of Buffer and biological buffers	basic need of any practical ,so students will learn about their composition and use in various practicals along with calculations	students will learn about preparation in practicals.	
Water and concept of pH Water and properties and interactions with biological molecules	As water is universal solvent and therefore understanding its properties and various type of solutions is of utmost importance.	Conventional	8
Thermodynamics Concept of thermodynamics, various quantities- Free energy, enthalpy, entropy and their relation to biological systems and significance	As all biochemical reactions are accompanied by free energy changes (spontaneous and non spontaneous), therefore understanding of thermodynamic parameters and their role in deciding the feasibility of reaction is important.	Conventional	8
Carbohydrates: Basic classification, cyclic structures, Haworth projection, Disaccharides(reducing and non reducing), Polysachharides (homo and hetero), storage and structural polysachharides	As carbohydrates are basic macromolecules therefore understanding their classification and structural aspects will help students to be prepared for further metabolic reactions.	Conventional and practical based as students will be practically able to differentiate various reactions of different classes.	12
Lipids: Classification, properties, fat indices and uses of different types with significance	Serving as an important dietary source, component of membranes; knowledge of different types of lipids, their classification and biological significance will definitely help the students in understanding of lipids.	Conventional and practical based as students will have practical learning of reactions of lipids.	10
Enzymes- Mechanism of reaction(Transition state hypothesis), coenzyme, cofactor, Allosteric enzymes and their role in regulation, Types of inhibition (Competetive and noncompetitive)	Enzymes are integral part of any reaction; therefore their role in catalyzing reactions, their role as inhibitors and role in regulation will help the students to understand basic concepts underlying mechanism of reaction.	Conventional	12
Protein Classification of amino acids based on R groups Different levels of structure with examples Protein sequencing and different types of proteins in living systems	Protein is an important component of every cell in the body. Our body uses protein to build and repair tissues. Proteins are also used to make enzymes, hormones, and other body chemicals. Various biological molecules (hemoglobin, myoglobin) have different levels of structure, therefore knowledge of proteins is important.	Conventional and practical based as students will be practically able to differentiate various classes of amino acids.	15
Vitamins	As enzymes require coenzymes,	Conventional	08

Coenzymes derivatives and role in reactions	therefore role of vitamins as coenzymes is vital.		
Nucleic acids Structure A,B and Z DNA, RNA and forces stabilizing structure	Students will be acquainted with the knowledge of structure of genetic material and various forces playing role in maintaining structure.	Conventional	10

Types of evaluation

Formative evaluation- The aim of this evaluation is to improve student's learning and teacher's teaching. Tests and assignments were taken to improve results.

References: 1. Outlines of Biochemistry: 5th Edition, (2009), Erice Conn & Paul Stumpf ; John Wiley and Sons, USA
2. Fundamentals of Biochemistry. 3rd Edition, (2008), Donald Voet & Judith Voet , John Wiley and Sons, Inc. USA
3. Principles of Biochemistry, 4th edition (1997), Jeffory Zubey, McGraw-Hill College, USA
4. Biochemistry: 7th Edition, (2012), Jeremy Berg, Lubert Stryer, W.H.Freeman and company, NY
5. Lehninger , Principles of Biochemistry. 5th Edition (2008), David Nelson &

Michael Cox, W.H. Freeman and company, NY.

Progressive Education Society's
Modern College of Arts, Science & Commerce Ganeshkhind, Pune – 16
Department of Biotechnology

Course: Bb 106
Subject: Biophysics and Instrumentation
Class: FY BSc Biotechnology
Name of the Teacher: Dr Pooja Rana

Course Outcomes

CO1) Students will develop a conceptual understanding of connections between physics and biology.
CO2) Students will be able to explain the behavior and interactions between, matter and energy at both the atomic and molecular levels by different atomic models.
CO3) Students will gain an understanding of interpreting spectra and will be able to explain how spectroscopic methods are used for quantitative analysis of biomolecules.
CO4) Students will understand and interpret the nuclear processes such as radioactivity, fission, and fusion and their use in medicine.
CO5) Students will comprehend the molecular components which constitutes the cell membrane and give its different electrical and physicochemical properties. They will understand the importance of transport in the cells.
CO6) Students will be able to understand the working principle and working of different instruments like pH meter, centrifuge, microscopes, thermometers and their application in analyzing different biological samples.

Course : Bb-106	**Course Specific outcome (CSO)**	**Methodology**	**No of lectures**
Atomic structure: Bohr's atomic model (radius and energy) Sommerfeld model, Vector atom model, Quantum numbers. Emission spectra with respect to Na atoms to understand selection rules.	Students will understand the atomic structure by different atomic models	Conventional teaching	12
Spectroscopy: Electromagnetic spectrum and its applications of spectrum Molecular spectra, Energy levels of rigid diatomic molecules.	Students will implement the principle and working of spectroscopic techniques in handling the instruments and how radiations interact with the	Conventional teaching and Active learning	17

Principle, construction and working of Colorimeter, spectrophotometer, Fluorometer	biomolecules.		
Cell membrane: Structure and function of plasma membrane. Diffusion, Active and passive transport, Neuronal Depolarization hyperpolarization of membrane , types of biopotential measurement instrument	Student will be able to describe the structure , function and properties of cell membrane Skill: Students learn the skill of drawing diagram.	Use of power point presentation	10
Thermoregulation: Thermometric properties and types of thermometers (Clinical, thermocouple, bimetallic, platinum resistance, thermometers. Body temperature and its regulation.	Student will understand the application of different thermometers in day to day life.	Conventional teaching	7
Bioinstruments Analytical techniques, analyte method, procedure and protocol. Principle construction working applications of instruments: pH meter, Centrifuge, different types of centrifuges. Mass spectroscopy	Students will understand the principle and working of the instruments by handling them.	Conventional teaching and Demonstration	15
Microscopes: Resolving power,Chromatic and achromatic aberrations, Compound, bright and Dark field microscopes, Electron microscopes: TEM and SEM.	Students will understand the concepts and implement the use of microscopes in observing the biological specimens.	Demonstration	13
Radioactivity: Nucleus and Nuclear forces. Nuclear models (liquid drop and shell model). Radioactive nucleus and Nuclear radiations and their properties - alpha, beta and gamma. Radioimmunoassay,Production of radionuclides. Measurement of radiation - Dosimetry and detectors. Principle, construction and working of – GM counter. Scintillation Counter (Solid andLiquid).	Students will implement the concepts in sterilization of equipments in medical field and in study of plants and animals.	Conventional teaching	16

Types of Evaluation: Diagnostic Evaluation Test to Identify slow learner and advanced learner

Formative and summative Evaluation

1) Formative Evaluation: Knowledge, Understanding, Application, Skill
2) Summative Evaluation: Term End Examination and University Examination

References:

1. Principles & techniques of Biochemistry & Molecular biology,Wilson and walker
2. Molecular cell biology, 5th edition, Harvey Lodish
3. Instrumentation measurements and analysis – 2nd edition (2003). Nakra and Choudhari, Tata Mc Graw Hill, India.
4. Biophysics. 1st edition (2002), Pattabhi V and Gautham N. Kluwer Academic Publisher, USA.

Population Interactions Population growth forms, age class distribution and carrying capacity Population density, abundance and richness Population Structure and interaction Mathematical modeling- of Logistic growth, competition and prey predator dynamics	Students will understand the concept of population growth and interactions in between them	Active learning		10
Conservation of Biodiversity : Status of biodiversity and need for conservation, Strategies for Conservation, methods for conservation- Ex situ and In situ Conservation policies, laws and	Understand the need to conserve environment by implementing policies with the help of different organizations.	Use of ICT		9

organization Rio Conference, Earth Summit, Conservation efforts in India- Governmental and NGOs				

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Sr. no	Name of the Topic	Course specific outcome (CSO)	Teaching Method	No.of lectures

Department of Biotechnology

Course: Bb 107
Subject: Microbiology
Class: FY BSc Biotechnology
Name of the Teacher: Mrs. Vaishali Randive

Course Outcome:

Student well understood the various topics under different units and this is reflected from.

1) Student understands microorganism as a model system in life science studies and its importance in biotechnology.
2) Students gets knowledge of Eubacteria and Archaebacteria and differences in structure and composition of respective cell
3) Student learn to design artificial nutritional media for microorganisms and methods to grow them in laboratory.
4) Student learn different types of microorganisms, their applications in different sector.
5) Student gets knowledge about interaction between microorganisms and plant and animal that helps them to think about its use in Agriculture , Medical and health, Environment field.

1	Introduction to Microbial World • Biocomplexity of Microorganisms. • Important developments leading to major discoveries • Pre Golden Era- Biogenesis Vs Abiogenesis • Contribution of Leewenhoek • Golden Era • Contribution of Louis Pasteur • Contribution of Robert Koch • Post Golden Era • Discovery of Antibiotics • New Fields of Microbiology	1) Student get knowledge about discovery of microorganisms and contribution of different scientist in development of microbiology. 2) Student understands importance of microorganisms in biotechnology 3) They learn new terms and terminologies.	Assignment Class test Microbiology Quiz Conventional Method	7
2	Handling of microorganisms • Aseptic handling of M.ors • Biosafety measures	1)Student understands meaning of Asepsis and importance of aseptic transfer techniques to be followed in laboratory 2) They get idea about harms caused by microorganisms and how to protect our self from them.	Conventional Practical demonstration.	3
3	Prokaryotic Cell • Eubacteria & Archaebacteria • Function and ultra-structure of - cell wall (Gram positive and negative) • plasma membrane, flagella, pili, • endospore ,capsule, nucleic acid.	1)Student get deep knowledge about ultrastructure of prokaryotic cell and its function 2)They can differentiate between Eubacteria and Archaebacteria.	Conventional chalk board ICT Power point Presentation Verbal Question Answer session	15
4	Basic Considerations • Nutritional, Hydrogen ion concentration,Temperature and Oxygen • Nutritional classification of bacteria • Design of media: Types of media and Composition • Cultivation – In vitro (Streak plate method) - Concept of Pure culture, • co-culture and Mixed culture,	1)Student understand bacterial cell composition. 2)That helps them to get an idea of designing media for growing bacteria 3)They understand how bacteria are classified on the basis of environmental factor and nutrition. 1)They get knowledge about different media and its uses. 2) How to isolate organisms, its need , how to do systematic study of isolate which is helpful in identification and	Conventional chalk board Assignment Microbiology Quiz.	12

	Colony characteristics	classification.		
5	Sterilization • Physical Agents – Heat- Autoclave, Hot Air Oven • Radiation- Ionizing and non ionizing radiations	1)Student get knowledge about sterilization process, its importance in microbiology 2) Different methods of sterilization and its principle. 3) They understand choice of sterilization method depends upon type of material.	Practical demonstration Of instrumentation	8
	• Filtration • Chemicalagents and their mode of action - Aldehydes, Halogens, Quaternary ammonium compounds,		Conventional chalk board	
6	Microbial Growth: • Growth curve, introduction to kinetics of growth, generation time, growth rate. • Reproduction in microorganisms : Binary Fission, Asexual, Sexual, Lytic, Lysogenic Cycle.	1)Student learn different phases of bacterial growth. 2)how to express growth in mathematical equation its importance in industry and research. 3) They also get knowledge of how do microorganisms reproduce.	Conventional chalk Board Class Test	12
	• Cell Enumeration and quantification of Growth • Total Count- Breeds count, Direct microscopic count, haemocytometer, turbidity. • Viable Count- Spread plate, pour plate method.	1) Students learn different methods measurement of bacterial growth and its practical importance.	Conventional chalk board	
7	Outline Classification: of all 5 major groups of m.orgs • Prokaryotic and Eukaryotic. • Bacteria, Fungi, Cyanobacteria and viruses. • Life cycle, nutrition and growth.	1)Student understand basis of classification 2) Student learns classification of microorganism in detail.	Conventional chalk board Wall magazine- Microorganism of the Day	15
8	Microbial interaction: Microbe-Plant, Microbe-Animal, Microbe-Microbe	1)Student learns interaction of microbes with other living beings and their role in ecosystem	Conventional chalk board	8

Types of evaluation

Formative evaluation- The aim of this evaluation is to improve student's learning and teacher's teaching. Tests and assignments were taken to improve results.

References:

1. Microbiology–6thEdition (2006), Pelczar M.J., Chan E.C.S., Krieg N.R., The McGraw Hill Companies Inc. NY 2.General Microbiology - Stanier R.Y., 5th edition,(1987)Macmillan Publication, UK.

3. Presscott’s Microbiology, 8thedition (2010), Joanne M Willey, Joanne Willey, Linda Sherwood, Linda M Sherwood, Christopher J Woolverton, Chris Woolverton, McGrawHil Science Enginering, USA

Progressive Education Society's
Modern College of Arts, Science & Commerce Ganeshkhind, Pune – 16
Department of Biotechnology

Course: Bb 211a
Subject : Genetics Immunology Class: SY BSc Biotechnology
Name of the Teacher: Snehal Gagare

Course Outcomes:

- Genetics is a branch of biology which require understanding of basic concept of inheritance of gene and their role in expression of Phenotype. This course will help the Students to develop analytical and logical reasoning as they understand the concepts of transmission and inheritance genetics.
- This course will introduce the students to new domains of genetics like: Mendelian, Post Mendelian Genetics, Bacterial genetics, Molecular Genetics and Population genetics.
- The concept of Pedigree analysis, will open new avenues of genetic counselling which is a new domain of inheritance biology.
- Along with the theoretical knowledge of inheritance statistical application in biology will make the subject more lucrative and Statistical methods and Probability will help in deeper understanding of interallelic gene interaction.
- The knowledge of chromosomal aberrations will help in getting acquainted with genetic disorders like Kleinfielters, Downs, Edward and Turner syndromes.

Course SYBSc Biotech Bb211	Course Specific outcome	Methodology	Reference books	No of Lects
Mendelian Genetics:	Students will	Active learning,	Genetics by	3

Concept of allele, Mendel's Laws of Heredity with examples.	understand the concept of gamete formation and solving problems using Punnete's Square.	Problem solving.	Strickberger. Genetics – Verma Aggarwal.	
Post Mendelian Genetics: Gene interactions: dominant and Recessive Epistasis, Complementary genes, Duplicate Dominant, Multiple genes Lethal Genes with examples.	Concept of post Mendelian Genetics Understanding difference in the Phenotypic ratios of variations gene interaction.	Active learning, Problem solving.	Genetics by Strickberger. Genetics – Verma Aggarwal.	5
Linkage: Concept of linkage, complete and incomplete linkage, crossing over , three point cross, genetic mapping, Chromosome interference , unordered and ordered tetrad analysis.	Relationship between crossing over and linkage. Students will get a clear idea of solving genetic maps.	Active learning	Genetics by Benjamin Pierce	7
Transmission Genetics : Pedigree analysis: Standard symbols , problems, penetrance , probability , sex linked inheritance. Chromosomal Aberrations: Variation in chromosome no anueuploidy, barr body , dosage compensation Variation in Chromosome Structure.	Students will be able to construct family tree. They will understand modes of inheritance of different traits and link it to genetic manifestation. Different human genetic disorders, their causes are understood.	Problem Solving	I Genetics by Peter Russel	7
Mutation :types mutagens their Action , hot spot of mutation. Bacterial Plasmid: Types, Structure , properties	Mode of action of different mutagens is understood	Conventional AV session on Parmaanu Movie.	Genetics – Verma Aggarwal.	5
Operon: Inducible repressible operons , positive negative regulation . Lactose, Arabinose , tryptophan operon : Structure and regulatory mechanism	Molecular regulation gene expression in Bacterias is cleared.	Conventional	Genetics by Snustads and Simmons.	5
DNA transfer mechanism : Conjugation : F factor , mechanism , HFr transfer , Sexduction .	Different gene transfer mechanism are understood	ICT Quiz	Microbiology by Staineer. Genetics – Verma	3

Transformation : concept , mechanism			Aggarwal	
Transformation : Streptococcus Haemophilus. Transduction : Virulent temperate phages, lytic and Lysogenic Cycle . Mechanism of generalized and specialized transduction , abortive transduction , cotransduction.	Life cycle of virus is understood. Role of virues in changing bacterial gene expression	Conventional ICT	Microbiology by Prescott	4
Transposable elements: P, Alu , Drosophila Maize Elements Mechanism concept.	Concept of Jumping genes and mobile elements is understood	Biography of Macclintok was told to make the concept of mobile elements interesting.	Genetics by Gardner	4
Population Genetics : Hardy Weinberg Law Explaination with problem.	Allelic frequency and Genotypic frequency with respect to population was taught.		Genetics by Benjamin Pierce	2

Types of Evaluation: 1. Diagnostic Evaluation Test to identify slow learner and advanced learner
2. Formative Evaluation: Knowledge, Understanding, Application, Skill
3. Summative Evaluation: Term End Examination and University Examination

Progressive Education Society's
Modern College of Arts, Science & Commerce Ganeshkhind, Pune – 16
Department of Biotechnology

Course: Bb 211b
Subject : Genetics Immunology Class: SY BSc Biotechnology
Name of the Teacher: Dr Pooja Rana

Course outcome:

5. **As Immunology** is the study of the immune system and is a very **important** branch of the medical and biological sciences therefore students will learn about various lines of defense.
6. Students will be able to understand how body fights infections from bacteria and viruses and the development of medical interventions to treat and prevent diseases
7. Students will be acquainted with knowledge of the role of immune responses in the development of many common disorders not traditionally viewed as immunological, including metabolic, cardiovascular, and neurodegenerative conditions.
8. Immunology is also fundamental to the life sciences industry; the discipline is core to the development of modern antibody therapies, cellular therapies, small molecule drugs, vaccines and 'biologics' (therapuetic biomolecules).

Course: Bb -211 B Subject : Immunology	**Course specific outcome (CSO)**	**Methodology**	**No. of lectures**
History and Overview History of immunology Overview of immune system-T & B cells, Organs(primary and	Students will acquire knowledge of various cells of immune system playing role in immunity and organs involved in formation of B	Conventional and ICT	5

secondary)	and T cells and their role.		
Types of Immunity Innate and adaptive immunity	Different types of innate immunity and its difference from adaptive immunity.	Conventional and ICT	2
Vaccines Active and passive immunity and types	Concept of vaccine, its various types and mode of action will be made clear.	Conventional and ICT	3
Antigen and Antibody Antigen properties ,Antibody structures and functions		Conventional and ICT	3
Antigen – Antibody interactions epitope-paratope and techniques viz; ELISA, Western Blotting, Radioimmunoassay, Agglutination, ,Precipitation reactions	Various immunological assays to visualize antigen antibody interactions will be discussed in detail	ICT	3
Hypersensitivity: types and significance	Concept and various types will be discussed.	Conventional and ICT	2

Types of evaluation1. Formative: To monitor how well the instructional goals and objectives are being met. The main purpose is to catch deficiencies so that the proper learning interventions can take place that allows the students to master the required skills and knowledge. There is use of learning materials, to make a record of student learning and achievements, and hence teacher's effectiveness.

2. Development of e-content

References: Kuby immunology, Judy Owen , Jenni Punt , Sharon Stranford., 7th edition (2012), Freeman and Co., NY

Textbook of basic and clinical immunology, 1st edition (2013), Sudha Gangal and Shubhangi Sontakke, University Press, India

Department of Biotechnology

Course: Bb -212 Subject Cell Biology

Class: S.Y. B.Sc. (Biotechnology)

Name of the Teacher: Dr. Rekha Gupta & Dr. Nivedita Das

Course outcome:

Students well understood the various topics under different units & this is reflected from:

1. Students are able to describe the structures and basic components of types of cell i.e. prokaryotic and eukaryotic cell, animal and plant cell.
2. Practical on identification and isolation of cell organelles were performed successfully.
3. Students identified and characterized electron micrographs of cell organelles and also cell events.
4. Prepared slides for mitosis & meiosis, identified and located the stages of division satisfactorily.
5. Completed assignments and class tests on different topics of cell type, organelles, cell division.
6. Participated in interactive session of question and answers on all topics from different units.
7. The knowledge of cell biology is used as basic for other subject like molecular biology, genetics.

Course: Bb -212 **Subject Cell Biology**	**Course specific outcome (CSO)**	**Methodology**	**No. of lectures**
Introduction of Cell Biology, Cell shapes, morphology, Cellular diversity – Prokaryotic, Eukaryotic – Plant and animal cell	Students understood the basic concept of cell and its diversity	Conventional method	2
Cell membrane – Models, Structure, biochemistry and receptors, functions of cell membrane – Transport, Types of diffusion, Active transport, exocytosis & endocytosis. Membrane potential	Describe various models of plasma membrane. and understand various functions of Membrane Skill: Students draw various P.M models	Conventional method and Active learning	6
Cell Wall – Primary & secondary wall - Structure, function and organization	Concept of wall formation and its structure function well understood	Conventional method	4
Cells structure-function of cell organelles Mitochondria, ER, golgi bodies, chloroplast, lysosomes, vacuoles, nucleus,ECM and Cell junctions	Students well understood the structures and functions of different cell organelles. Student learnt Skill of drawing diagram and relating with other organelles.	Conventional method Conventional method	20 5
Cell division – Mitosis, Meiosis in plants and in animals	. Prepared slides for mitosis & meiosis, identified and located	Conventional and By using Models and	13

Cell cycle – phases of cell cycle, check points and regulation	the stages of division satisfactorily.	Active learing	
Protein targeting	Understood the concept of protein sorted to different cell organelles	Conventional method and use of ITC(Power point)	5
Apoptosis and Cancer biology	Understood Process of cellular ageing and cell death	ITC and Active learning	5

- Types of evaluation

  Formative and summative evaluation-
  Development of e-content

References:

1. Cell and molecular biology, 2010, 8th Edn., De Robertis EDP and De Robertis EMF Jr.,
2. Molecular Cell biology, 2013, 1st Edn. C. B. Powar, Himalaya Publication House.
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4. Cell Biology, Genetics, molecular biology evolution and ecology – Verma & Aggarwal C. Chand & company Ltd.
5. Molecular cell biology. Lodish H., Berk A., Kaiser C., Reiger M.,7th edition

Progressive Education Society's
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Department of Biotechnology

Course: **Bb-213** Subject: **Environmental Biology and Biotechnology**

Class: S.Y. B.Sc. (Biotechnology); Pattern: 2013 (Semester 1)

Name of the Teacher: Dr. Geetanjali Litke & Dr. Priyanka Sharma

Course outcome:

Upon successful completion of this subject student should be able to acquire a deep knowledge in techniques and biotechnological methods in environment approach as:

1. They would understand and analyze environmental relationships with a better assessment of the mechanisms of environmental components like atmosphere, hydrosphere and lithosphere.
2. Students will become skilled at basic theoretical concepts highlighting in the field of ecology, and how these are applied to different ecological approaches.
3. The studies of ecology, biogeography and ecosystem structure will provide the awareness on ecological and historical foundations for understanding the distribution and abundance of species and the changes in their distribution and abundance over time and climatic impact.
4. Student understood the concept of environmental pollution, types of pollutants and related hazards.
5. Acquire knowledge of bioremediation and its applications in environmental clean-up and various waste management methods.
6. Build awareness about environment conservation and environment protection acts.
7. Studied importance of Environmental Impact Assessment (EIA), remote sensing and Geographical Information System (GIS) in the management of environment.

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Department of Biotechnology

Course: **Bb-213** Subject: **Environmental Biology and Biotechnology**

Class: S.Y. B.Sc. (Biotechnology); Pattern: 2013 (Semester 1)

Name of the Teacher: Dr. Geetanjali Litke & Dr. Priyanka Sharma

Course specific outcome (CSO)

Course: Bb -213	Course specific outcome (CSO)	Methodology	No. of lectures
Introduction to Environmental science and Ecology	Mainly addressing complex environmental issues with concern to ecology	Conventional method and Active learning	2
Environmental Components- Introduction, Atmosphere, Ozone layer, Hydrosphere, Lithosphere, Biosphere.	Highlighting main understanding on chemistry that is taking place in each components	Conventional method, Power point presentation	4
Ecology and its concepts Biogeography, Ecosystem and Community with examples, Ecosystem Evolution	Students will get deep knowledge on ecology, ecosystems and their organisms, the communities they comprise, and the non-living aspects of their environment.	Conventional method and Active learning	5
Energy flow: Second law of thermodynamics, Food chain, Trophic Levels, Energy Budget, Nutrient cycles (Nitrogen, Phosphorus, and Carbon)	This topic will expose students to understand bioenergetics system in the ecosystem function. They would gain an understanding on various nutrients' cycle and role in ecosystems.	Conventional method and Active learning	5
Factors affecting Ecosystem Natural Factors, Inter & Intra-community Factors, Anthropogenic Factors	This unit will mainly focus on the understanding of various consequences i.e natural and anthropogenic factors influencing the prospect of occurrence of the species. Students will also analyze the value of the ecosystem and how human being depends upon the resources and benefits provided by natural ecosystems	Conventional method and Active learning	4
Pollutants in ecosystems Terrestrial, Aquatic ecosystems Pesticides/Insecticides, Heavy Metals, Toxins, Radiation.	The content and activities included in this unit would help students to develop the understandings and skills necessary to save our environment and what are the causes and measure they should follow for sustainable development	Conventional method and Active learning,	4

Environmental Priorities in India Environmental Impact Assessment (EIA case study), Red data book, TRAFIC.	Students will learn about the vital importance of EIA system in projects development to environmental safety and to ensure sustainable development, red data book makes aware to understand about the endangered or extinct organisms.	Conventional method, Power point presentation	7
Threats to Ecosystem/Environment Pollution- Air, Water, Soil.	This unit will focus on understanding of various pollutants and their effects on various components of environment	Conventional method and Active learning	4
Microbial Biodegradation of Plastic, Hydrocarbons, pesticides/ insecticides and herbicides, Hazardous Waste.	Students will learn about the role and various mechanisms of microorganisms in reduction of complex environmental pollutants	Conventional method	6
Biotechnology in Protection and Restoration of Ecosystem Protection- Social Awareness, Major Protection acts in India (Forest (conservation) Acts 1980, Wild life Protection Act 1972) and protection efforts in the world (Earth Summit, Agenda 21)	This unit will build an awareness about importance of Biotechnology in restoration of ecosystem and international and national efforts for protection of environment	Conventional method and Active learning	3
Bioremediation- Importance of bioremediation, Use of microorganisms, Phytoremediation. Bioindicators and detectors	Students will learn about the importance of microorganisms and plants in environment clean up and monitoring environmental pollution	Conventional method	6
Modern conservation practices- Biotechnology in conservation, *Ex situ* and *In situ* conservation practices, In vitro propagation of rare and threatened species, Conservation of genetic resources	This unit is focused on understanding of various conservation methods for rare and endangered species	Conventional method and Active learning	6
Waste and Disaster Management- Waste water treatment-Biological, Biomedical waste management, Integrated waste management, Hazards in environment, Remote Sensing and GIS	Students will understand different waste management techniques for various types of wastes and highlights the importance of remote sensing and GIS in environment management and conservation	Conventional method and Active learning	5

Types of Evaluation:

A. Diagnostic Evaluation Test to identify slow learner and advanced learner

1) Formative Evaluation: -Knowledge, Understanding, Application, Skill

-Tests and assignments were taken to improve results.

2) Summative Evaluation: Term End Examination and University Examination

B. Field Trip: To enhance the skill techniques among the students for the study of ecosystem structure and environmental impact.

1. Study of different types of ecosystems.
2. Community sampling by list quadrate method to study the species richness and abundance.

References:

1. Environmental Biology (2000) Varma & Agarwal S. Chand Limited, New Delhi Ecology and environment. Sharma PD Rastogi Publication, New Delhi.
2. Ecology: Principles and Applications (1998) J.L. Chapman, M.J. Reiss Cambridge University Press, Cambridge.
3. Environmental pollution and health hazard in India (1987) Ram Kumar Ashish Pub. House, New Delhi.
4. Ecology: Principles and Applications (1998) J. L. Chapman, M. J. Reiss Cambridge University Press, Cambridge
5. Biotechnology (2005) by U. Satyanarayan, Uppala author-publisher interlinks
6. Ecology and Environmental Biology (2005) by P.D.Sharma Rastogi publication, New Delhi
7. Textbook of Environmental Biotechnology (2005) by Mohapatra, I.K.International
8. Biodegradation of hazzardous wastes. Environmental health purspective supplement, 1994, 102(1): 245-252.
9. Biodegradation of hazzardous wastes – A review. In A Practice periodical of hazardous toxic and radioactive waste management. (2006)
10. https://schoolworkhelper.net/biotic-and-abiotic-factors-influence-on-ecosystems/
11. https://www.learner.org/courses/envsci/unit/pdfs/unit4.pdf
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Progressive Education Society's
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Department of Biotechnology

Course: Bb-331 **Pattern: 2013 SemI**
Subject Microbial Biotechnology **Class: TY BSc Biotechnology**
Name of the Teacher: Snehal Gagare and Vaishali Randive

- Microbial Biotechnology introduces the students to the fascinating world of Microbes with astonishing abilities to produce diverse metabolites. By studying the history the students realize the importance of Scientist their hardwork and perseverance towards research. It helps to inculcate values like adapting research metholodogy, logical reasoning and aptitude amongst the students.
- This course will introduce the students to new domains of Microbiology like Food and Diary, Pharamaceutical, Waste Water treatment , Geomicrobiology and GMM . These domains will help in opening new avenues and carrier opportunities for biotechnology students in various industrial sector.
- The clear understanding of production and applications of Biofertilizer Breweries Wineries will help developing entrupreneurship ideas in the students.
- The molecular level adaptations of Microbes in various environmental conditions will help in vivid understanding of their survival in some extreme environment like hot springs, Antartica region or Space. This opens up innovative study areas like Astrobiology. basis of why a microbe can survive in different diverse condition was understood by the student
- In order to go for large scale production of any microbe or microbial product , what are the steps to be followed ,How is a Bacteria establishing itself in a artificial media was conceptualized by the students.

Name of the Topic	Course specific outcome	Teaching method	No. of Lectures
Water and Waste Water	Student understand 1)characteristics of indicator of fecal pollution.	Conventional chalk board Practical demonstration	
Indicator of faecal Pollution- E.Coli			
Presumptive test			

Confirmed test Completed test Membrane filter technique & Eijkman test Bacteriological standard of water	2)poability test of water 3)bacteriological standard of water	and discussion.	
Drinking water purification Sedimentation Coagulation Flocculation Filtration- Slow sand filter Construction , working Rapid sand filter Construction , working	1)How to purify water?	Conventional chalk board Assignment	20
Sewage and Industrial Waste water Types of waste COD, BOD determination & its relevance in treatment process. Sewage treatment process Primary – Screening,Sedimentation, Coagulation, Flocculation Secondary- Activated sludge process Trickling filter, sequencing batch reactor, Anaerobic digestion. Tertiary treatment-Disinfection, Removal of phosphrous, removal of iron by precipitation.	Relevance of BOD with waste water treatment. Student understand depending upon characteristics of waste water what methods can be used to treat it.	Conventional chalk board Visit to Sewage treatment Plant.	
Distillery effluent treatment process Biogas plant Textile and dyeing waste process- Screening, Sedimentation, Coagulation, Flocculation	Composition of distillery waste & textile dye waste. Depending on that what methods to be used to treat waste		
Biological treatment process Microbial consortium for effluent treatment	Concept of microbial consortium. Criteria to choose microorganism to make microbial consortia. And its use.		
		Conventional chalk	

Dairy Microbiology	1.Nutritional value of milk. 2.Reasons and process of milk spoilage. 3. Microbiological quality testing of Milk	board Practical demonstration and discussion.	15
Definition of Milk, composition of milk and factors affecting composition, Sources of contamination			
Microbiological quality test- SPC, DMC.			
MBRT, Resazurin,			
Mastitis test, Brucella ring test			
Pasteurization- Definition, Time-temperature relation	How to preserve milk How time – temperature relation is set for pasteurization		
Methods- LTLT, HTST, UHT			
Efficiency of pasteurization- Phosphatase test			
Sweet curdling, stormy fermentation, Ropiness		Conventional chalk board	
Fermented dairy food- Curd- Production and spoilage	Fermented Milk product procedure and role of microbes in it		
Yoghurt- Production and spoilage			
Kefir- Production and spoilage			
Butter- Production and spoilage			
Cheese- Production and spoilage			
Food Microbiology	Different characteristics of food and environmental parameter affects growth of microbes in food.		
Intrinsic and Extrinsic factors of food.		Conventional chalk board Power point presentation.	
Microbial spoilage and sources of m.orgs. Spoilage of meat and poultry products, Bread, Fruits and vegetable, Spoilage of eggs, canned foods	Student understands 1.M.orgs involved in spoilage of different food are according to characters of food(nutrient composition, PH O-R potential etc.) 2.During production and handling of food how exactly m.orgs enter in food which is very important for HACCP.		
Principle and method of food preservation- Added and developed preservative	Student understands Concept of preservation and basis of choosing particular method of preservation for specific food (Intrinsic	Conventional chalk board Power point presentation	
Canning, Radiation, Low and high temperature			

Concept of TDP, TDT, D, F,Z value	parameter)		
HAACP Hazard analysis critical control points	Student understands concept of HACCP and its importance in food industry.		
Fermented food produced by m.orgs- Idli, Dhokla, Soysauce, Sauerkraut.			
Food Sanitation and Food borne diseases	Student understand difference between infection and intoxication , their causes, symptoms, and prevention.		
Intoxication- *Staphylococcus aurues, Clostridium botulinm, E.coli, Aspergillus flavus*			
Infection- *Salmonella*			

Course Bb-331 (Microbial Biotechnology)	**Course Specific outcome**	**Methodology**	**Reference books**	**No of Lects**
Microbial Biotechnology : History and Scope.	Students will come to know Future Prospects of Microorganism in Industry	Active learning,	Microbial Biotechnology by Modi.	2
Normal Flora concept: **Immunne sytem**	The concept of Immune system and Normal flora was understood by the student.	Active learning by Role Play	Microbiology by Prescott.	4
Pathogenesis Etiology, diagnosis, treatment TB, SARS, ANTHRAX , Leprosy, Polio,Syphilis, Tetanus, Typhoid:.	Students got acquainted with Disease pathogenesis Etiology symptoms and treatment for each disease.	Active learning	Microbiology by Anantnarayan	8
Microbial Growth kinetics: Batch Fed batch and Continuous culture	How is a Bacteria establishing itself in a artificial media was understood. Microbes can be grown in various modes to understand their rate of growth in order to apply it for	Conventional	Principles of Fermentation Technology by Whittaker	4

	large scale production.			
Classification of microorganisms :based on their environmental requirements such as pH, Temperature oxygen salt sugar moisture content , molecular adaptations.	The molecular basis of why a microbe can survive in different diverse condition was understood by the student.	ICT Experimentally grown the bacteria at various pH, Temperature salt and sugar concentration	Microbiology by Tortora	4
Immobilization of enzymes: Methods, Properties Application , Advantages Disadvantages. **Biosensor , Biochips** types and applications.	Industrial utility of various enzymes of Microbial origin was understood.	Practical immobilization of yeast cells was performed to have a clear concept of the topic	Biotechnology by B D Singh.	5
Application of microorganism: Geomicrobiology , MEOR. Alcoholic beverages: Wine beer. **Biofertilizer, Biopesticides** Microbial PGP .Microbial Sweetners Flavour enhancer Microbial toxin production and application .	Microbes have capacity to produce wide variety of metabolites and hence Microbes have variety of application in Food Pharma and Medicine, Breweries, Agriculture.	Conventional	Research Articles	12
Biotechnology and Biosafety norms	Acts and ethics to be followed while going for GMO production was understood.	Conventional	Biotechnology by Veer Bala Rastogi .	2

Types of Evaluation:

1. Diagnostic Evaluation Test to Identify slow learner and advanced learner
2. Formative Evaluation: Knowledge, Understanding, Application, Skill
3. Summative Evaluation: Term End Examination and University Examination

Department of Biotechnology

Course: Bb -332 Subject- Plant and Animal Tissue Culture

Class: T.Y. B.Sc. (Biotechnology)

Name of the Teacher: Dr. Rekha Gupta & Dr. Nivedita Das

Course outcome:

Students well understood the various topics under different units & this is reflected from:

1. Students well understood the concepts and established different types of in vitro cultures by themselves. They also repeated the practical using techniques of tissue culture.
2. Students understood the concept of sterilization and performed practicals under sterile conditions using various techniques.
3. Concept and calcualtions for media preparation very well learnt as the media used for different types of culture were prepared by the students.
4. Completed assignments and class tests on different topics i.e. types of culture, factors affecting terminology & concepts.
5. Students were given task of preparation of question bank from the syllabus taught, this was done very satisfactorily.
6. Participated in interactive session of question and answers on all topics from different Units of the syllabus.
7. The knowledge of tissue culture techniques is used for designing projects, practical Performance, preparation of glassware for practical.

Course: Bb -332 **Subject** Plant and Animal Tissue Culture	**Course specific outcome (CSO)**	**Methodology**	**No. of lectures**
Introduction, to Plant Tissue Culture, Concept of Cell theory Importance and application of Plant tissue culture	Understood the basic concept	Conventional method with examples	3
Infrastructure and organization of Plant Tissue culture lab. Equipment & instruments required, Aseptic techniques, washing & preparation	Knowledge of Practical skill displayed	Conventional method and Active learning by independently handling	4

Culture media – composition, requirement and preparation PGR and role *in vitro*	Prepared media by using techniques	Conventional method practical skill oriented	3
Types of culture technique – principle, methodology, factors affecting - Callus culture, Suspension culture technique –Parameters to assess growth and development *in vitro*	Skill developed for in vitro culture of different organs practically used the techniques for in vitro culture	Conventional method practical skill oriented	5
Shoot tip & meristem culture technique – Root tip & leaf culture technique – Ovary, ovule, endosperm culture technique principle, methodology, factors affecting, embryo culture technique	Skill developed for in vitro culture of different organs	Conventional and By using learning by doing Practical oriented	10
Anther and pollen culture technique – principle, methodology, factors affecting	Skill developed for in vitro culture of different organs practically used the knowledge.	Conventional and By using learning by doing Practical oriented	3
Protoplast isolation, culture and fusion Somaclonal variation – Terminology and origin	Completed assignments and class tests	Conventional	3
Introduction to Animal tissue culture and Historical background and Application of Animal tissue culture	Understood the basic concepts and terminology used in ATC	Conventional method	7
Lab Design:Equipments and Infrastructure	Theoritical and practical knowledge imparted	Practical oriented	4
Nutrition and Physiology: Media formulation,BSS,Serum and Serum free media	Understood the rationale and the concept used for practicals	Practical oriented	4
Primary culture, Subculture and Routine maintanence of cell line and Chacterization	Skill developed for invitro culturing	Practical oriented	13
Cell repository	Learnt the rationale behind cryopreservation and storage	Conventional and practical oriented	2

- Types of evaluation

  Formative and summative evaluation-
  Development of e-content

References: Razdan M.K. Introduction to plant tissue culture
Kalyan Kumar Dey- Plant tissue culture
Bhojwani S.S and Razdan M.K.-Plant tissue culture: Theory and Practice
R.Ian Freshney: Culture of animal cells
Sudha Gangal: Principles and Practices of Animal Tissue Culture

Progressive Education Society's
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Department of Biotechnology

Course: **Bb-333** Subject: **Biodiversity and Systematics**

Class: T.Y. B.Sc. (Biotechnology); Pattern: 2013 (Semester 1)

Name of the Teacher: Dr. Priyanka Sharma & Mrs. Archana Khatode

Course outcome:

1. On successful completion of this course the students will be able to illustrate the importance of biodiversity for upcoming science and economy.
2. The main objective of this course is to provide the students with possibilities of acquiring information on biodiversity, its main principles to know the criteria and various methods used for measurement of biodiversity richness and abundance.
3. The most important outcome is that they would gain knowledge on the tools for policies, acts and laws used in nature conservation and management. Conceptual insight on protected areas management – Management Institutions, legislation and their problems, perspective biodiversity strategy.
4. Students will develop an understanding of biodiversity with respect to biome (terrestrial) and aquatic ecosystem.
5. Studies on taxonomy and systematics will provide foundation to study the diversity of living world and its evolutionary perspective to biodiversity.
6. This will explore and highlight deep understanding as new computational and molecular technologies for a 21st century science of taxonomy.

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Department of Biotechnology

Course: **Bb-333** Subject: **Biodiversity and Systematics**

Class: T.Y. B.Sc. (Biotechnology); Pattern: 2013 (Semester 1)

Name of the Teacher: Dr. Priyanka Sharma & Mrs. Archana Khatode

Course specific outcome (CSO)

Course: Bb-333 Subject: Biodiversity and Systematics	**Course specific outcome (CSO)**	**Methodology**	**No. of lectures (60)**
Concept of Biodiversity, Definitions, Taxonomic, ecological and genetic perspectives of biodiversity, Levels of Biodiversity	It extends deep knowledge about the concept of biodiversity into all spheres of human life	Conventional method and Active learning	7
Change in Biodiversity over time and space, Magnitude, Ecosystem diversity, Mass Extinction, Genetic Diversity	Students getting familiar with hypothesis of ecological and evolutional time in biodiversity	Conventional method, Power point presentation	3
Species diversity, Indices of biodiversity analysis. (Plant, Animal and Microbial)	Gaining knowledge to assess the conditions and trends of biodiversity either globally or sub-globally and to understand it's necessity to measure the abundance of all organisms over space and time	Conventional method and Active learning	3
Biomes of the world: Terrestrial and Aquatic	Understanding of climate impacts on specific ecosystem types and ecological variation	Conventional method and Active learning	2
Biodiversity in India: Habitats, Niche Behaviour patterns of animals- Habits	Students will understand the structures and functions of habitat. Student learnt Skill of behavior patterns of animals by open discussion	Conventional method, Power point presentation	4
Concept of species and variation, Need for taxonomy and nomenclature	Widen deep need to understand the role of taxonomy in identification of different species	Conventional method and Active learning,	6
Introduction to classification systems	Importance of classification in biology and for conservation	Conventional method, Power point presentation	1
Techniques in morphological, histological, embryology and anatomical analysis, Molecular tools in taxonomy	An understanding of the methods and principles of techniques in classification and nomenclature Students will understand the	Conventional method, Power point presentation	8

	function of molecular techniques in taxonomy		
Management, documentation and databases of biodiversity (Biodiversity Informatics)	Gaining knowledge on application of information technologies to the management and interpretation of primary data regarding the life,	Conventional method, Power point presentation	2
Domesticated animal and agricultural diversity	Students will learn about extensive spread of domesticated animal species for global food production is a feature of agricultural diversity	Conventional method and Active learning,	3
Socio-economic important of biodiversity	Understanding of ecosystem services of biodiversity to human being as well as the socioeconomic influences on them	Conventional method and Active learning	2
Population : structure, growth form and interactions	Students will understand the structure, growth and the interactions of populations in the environment	Conventional method and Active learning	10
Conservation of Biodiversity : need for conservation, Strategies for Conservation, Ex situ and In situ Conservation policies, laws and organization Conservation efforts in India- Governmental and NGOs	Understand the need to conserve environment by implementing policies with the help of different organizations.	Use of power point presentation	9

Types of evaluation:

A. Formative Evaluation:

1. Knowledge, Understanding, Application, Skill of the students were assessed by method of assignments and class tests on different topics of biodiversity measurements, population interactions, policies and law, biomes of the world and modern techniques used in systematic.
2. Participated in interactive session of question and answers on all topics from different units.

B. Summative Evaluation: Term End Examination and University Examination

References:

13. An Advanced Text Book On- Biodiversity-Principle and Practices by Krishnamurthy K. V. Oxford and IBH Publishing, Delhi
14. Biological Systematics: Principles and Applications (2002), Randall T. Schuh, Cornell University Press, USA
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16. Ecology: Principles and Applications (1998) J.L. Chapman, M.J. Reiss Cambridge University Press, Cambridge
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DEPARTMENT OF BIOTECHNOLOGY

Course: B.Sc. (Biotechnology)

Course specific outcome:

1. Students develop global competencies in the area of basic and applied biological sciences.
2. Enhancing the subject knowledge of students by using traditional and modern ICT based teaching methods and learning by doing.
3. To enrich students' knowledge and train them in various branches of Biotechnology such as genetics, molecular biology, biochemistry, immunology, fermentation technology, environmental biotechnology and tissue culture techniques.
4. To instil the sense of achieving excellence in the students.
5. To groom the students to meet futuristic challenges and national interests.
6. To bestow the students with all the research skills required to work independently.
7. To develop scientific temperament and social responsibilities in the students.
8. To inculcate nature care by imparting knowledge of advance modern techniques