Acharya Bangalore B-School
AUTONOMOUS Affiliated to Bangalore University

PROGRAM NAME	**: B.Sc.**
TITLE OF THE COURSE	**: CHEMICAL FOUNDATION OF BIOCHEMISTRY 1**
SEMESTER	**: I SEMESTER**
COURSE CODE	**: BSC23C1C2**
CREDITS	**: 4**
TOTAL NO. OF TEACHING HOURS	**: 56 HOURS – 4HOURS/WEEK**

Course Objectives:

To provide students with a solid understanding of the fundamental chemical principles and concepts that underlie the field of biochemistry. This foundational knowledge is essential for comprehending the complex biochemical processes and reactions that occur within living organisms.

Course Outcomes:

By the end of this course student would be able to:

CO1: Explain the structural organization of the cell.

CO2: Apply the knowledge of units of measurement.

CO3: Summarize atomic structure and chemical bonds.

CO4: Apply the knowledge of buffers and colligative properties.

CO5: Relate Thermodynamic laws and Redox reactions in biological system

BSC23C1C2: CHEMICAL FOUNDATION OF BIOCHEMISTRY 1
COURSE CONTENT

MODULE 1: Scope of Biochemistry and units of measurement **14 HOURS**

Scope of Biochemistry, chemical origin of life chemical composition of living organisms;
An overview on the metric system- SI units- mass, volume, temperature, amount, length and time; Significant figures, graphical representation, Atomic weight, molecular weight, equivalent weight; Avogadro`s number, molarity, normality, molality; Dalton concept, mole concept, concentration, mole to molar conversion; oxidation number and its significance; Density and specific gravity and their significances.

UNIT -2: Atomic structure and chemical bonds **14 HOURS**

Structure of an atom (overview); Quantum numbers; orbitals, Illustration of Pauli`s exclusion principle, Aufbau principle, and Hund`s rule; Shapes of orbitals, s, p, d, and f subshells; K, L, M, N, O, and P shells (electronic capacity), Electron configuration; Octet rule; Formation and properties of non- covalent and covalent bonds; Non-covalent bonds: Hydrogen bonds, Ionic bonds, Van der Waals interactions, London forces, dipole- dipole interactions, electrostatic interactions and hydrophobic interactions; Sigma, pi and co-ordinate bonds, back bonding- Corresponding energy associated; Outline of theories of bonding-VSEPR theory, valence bond theory, molecular orbital theory.

UNIT-3: Buffers and colligative properties **14 HOURS**

Acids, bases- Arrhenius concept, Lewis concept, Lowry and Bronsted concepts. basicity of acids, acidity of bases; Buffers-composition, buffers in animal system; pH, pH scale; Henderson-Hasselbalch Equation-Derivation; pK value; Titration curve of H_3PO_4; Isoelectric pH.
Colligative properties and anomalous colligative properties of solutions; vapor pressure and its application in distillation; Van't Hoff law – Boyle's and Charles' law; boiling point, freezing point, Structure of water, phase diagram of pure water, ionic product of water, special properties of water; De-icing; Solutions and types; Ionizable solutes, non- ionizable solutes, ionization of HCl, HNO_3, H_2SO_4; osmosis and osmotic pressure determination, reverse osmosis, surface tension and surfactants.

UNIT-4: Electrochemistry and redox reactions **14 HOURS**

Scope of electrochemistry, electrochemical cells- galvanic cell (Daniel cell); Electrode potential and its measurement; Types of electrolytes; Electrodes- Primary and secondary electrodes, half-

cell reaction; standard electrode-SHE.

Laws of thermodynamics; entropy and enthalpy, their relation; Gibb`s energy, free energy change, Redox reactions; Redox potential, application of redox potential, energy linked to redox reactions, reduction of oxygen, oxidation and reduction of iron in hemoglobin, biological active forms of zinc, calcium, nickel, molybdenum, selenium and cobalt, NAD^+/NADH, $NADP^+$/NADPH, $FAD/FADH_2$, $FMN/FMNH_2$.

Pedagogy: Lectures, Presentations, videos, Assignments and test.

Formative Assessment – 40 Marks; **Summative Assessment** – 60 Marks	
Formative Assessment	
Pedagogy: Lectures, Presentations, videos, Assignments and Internal tests	
Continuous Internal Assessment type	**Weightage in marks**
Internal test	20
Seminar/Presentation	10
assignment	05
Attendance	05
Total	**40 Marks**

REFERENCES:

1. Cotton A and Geoffrey Wilkinson, (1999) Advanced Inorganic Chemistry: A comprehensive Text, 6th edition, Wiley publication
2. Miessler GL, Paul Fischer PJ, and Tarr DA, (2014), Inorganic Chemistry, 5th edition, Pearson Publication
3. Catherine E and Sharpe AG, (2004), Inorganic Chemistry, ACS publication
4. Overton, Rourke, Weller, Armstrong and Hagerman, (2015), Inorganic Chemistry, Oxford Press
5. Donald A, McQuarrie and Simon JD, (2019) Physical Chemistry: A molecular approach, Viva Books Publication
6. Atkins P, Paula JD, Keeler J, (2019) Physical chemistry 11th edition, Oxford press

Acharya Bangalore B-School
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PROGRAM NAME : **B.Sc.**
TITLE OF THE PAPER : **CHEMICAL FOUNDATION OF BIOCHEMISTRY 1 PRACTICAL**
SEMESTER : **I SEMESTER**
COURSE CODE : **BSC23C1P1**
CREDITS : **2**
TOTAL NO. OF TEACHING HOURS : **28 HOURS – 4 HOURS/WEEK**

Course Outcome:

This course aims to familiarize students with the principles of analytical chemistry and basic analytical techniques such as volumetric analysis. Course objective is to provide experimental practice of quantitative volumetric analysis. Upon successful completion students should be able to make solutions of various molar, normal concentrations and determine the amount of a substance in a given sample.

Experiments:

1. Concept of molarity, molality and normality. Calculation and preparation of molar solutions. (Problems to be given in exams). Calculation and preparation of normal solutions and percent solutions and dilute solutions.
2. Calibration of volumetric glassware's (Burette, pipette).
3. Preparation of standard sodium carbonate solution, standardization of HCl (Methyl orange) and estimation of NaOH in the given solution. (methyl orange or phenolphthalein).
4. Preparation of standard Oxalic acid. Standardization of NaOH and estimation of H_2SO_4 in the given solution (phenolphthalein).
5. Preparation of standard Oxalic acid. Standardization of $KMnO_4$ and estimation of H_2O_2in the given solution.
6. Preparation of standard $K_2Cr_2O_7$. Standardization of $Na_2S_2O_3$ and estimation of $CuSO_4$ inthe given solution.
7. Preparation of $ZnSO_4$. Standardization of EDTA and estimation of total hardness of waterusing Eriochrome black-T indicator.
8. Preparation of standard potassium bipthalate. Standardization of NaOH and estimation

ofHCl in the given solution. (Phenolphthalein).

9. Estimation of sulphuric acid and oxalic acid in a mixture using standard sodium hydroxide solution and standard potassium permanganate solution.
10. Preparation of standard Potassium dichromate and estimation of ferrous/ferric mixtureusing diphenylamine indicator (Demonstration).
11. Preparation of standard oxalic acid solution. Standardization of NaOH solution andestimation of acidity in vinegar.
12. Preparation of standard potassium biphthalate solution, standardization of sodiumhydroxide solution and estimation of alkalinity of antacids.
13. Preparation of standard Oxalic acid solution. Standardization of $KMnO_4$ solution andestimation of calcium in milk.

Pedagogy: Lectures, Practical hands-on, videos, Assignments and test.

Formative Assessment – 25 Marks; **Summative Assessment** – 25 Marks	
Formative Assessment	
Assessment Occasion	**Weightage in marks**
Internal test (one)	10
Assignment (Monographs)	05
Class participation	05
Attendance	05
Total	**25**

REFERENCES:

1. Svehla, G., 2012 Vogel's Qualitative Inorganic Analysis, Pearson Education
2. Mendham, J. 2009 Vogel's Quantitative Chemical Analysis, Pearson,
3. Dr. O. P. Pandey, D. N. Bajpai, dr. S. Giri, Practical Chemistry S. Chand and Co. Ltd.,
4. M. Viswanathan, Principles of Practical Chemistry.
5. B.K Sharma.- Instrumental Methods of chemical Analysis
6. R.C. Das and B. Behra - Experiments in Physical Chemistry, Tata Mc Graw Hill
7. J.B. Yadav, Advanced Practical Physical Chemistry, Goel Publishing House
8. J.N.Gurtu and R Kapoor - Advanced Experimental Chemistry. Vol-I, S.Chand and Co.
9. K.K. Sharma, D. S. Sharma - Practical Chemistry (Vikas Publication).
10. General Chemistry experiment – Anil J Elias (University press).
11. G.H. Jeffery, J. Basset.- Vogel textbook of quantitative chemical analysis
12. S. Sahay - Quantitative chemical analysis (S. Chand & Co.).

13. Dr O P Pandey, D N Bajpai, Dr S Giri - Practical Chemistry. S. Chand Publication
14. V K Ahluwalia, Sunitha Dingra, Adarsh Gulati College Practical Chemistry.
15. B. Viswanathan, P S Raghavan - Practical Physical Chemistry- MV Learning Publication

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PROGRAM NAME : OPEN ELECTIVE

TITLE OF THE COURSE : BIOCHEMISTRY IN HEALTH AND DISESE

SEMESTER : I SEMESTER

COURSE CODE : OET1BC1

CREDITS : 3

TOTAL NO. OF TEACHING HOUR : 42 HOURS – 3 HOURS/WEEK

Course Outcome: This open elective course offering to students of various streams gives knowledge about health and various terminologies used in health and disease conditions; Difference between communicable & non-communicable diseases; Health promotion & treatments for various diseases & disorders.

MODULE 1: 14 HOURS

Introduction: WHO definition of health, Health and hygiene, General health care, Factors affecting health, Indices and evaluation of health, Disease patterns in developed and developing world; Classification of diseases - Endemic, Epidemic, Pandemic; Professional health hazards. Disease conditions: Acute disease, Chronic disease, Incurable disease, Terminal disease, Illness, disorders, Syndrome, Pre-disease. Treatment: Psychotherapy, Medications, Surgery, Medical devices, and Self-care. Dimensions of Health: Physical, Mental, Spiritual, Emotional, Environmental, Philosophical.

MODULE 2: 14 HOURS

Communicable diseases: Tuberculosis, Cholera, Typhoid, Conjunctivitis. Sexually transmitted diseases (*STD*): Information, statistics, and treatment guidelines for STD, Prevention: Syphilis, Gonorrhea, AIDS, etc., Non-communicable diseases: Malnutrition- Under nutrition, Over nutrition, Nutritional deficiencies; Anemia, Stroke, Rheumatic heart disease, Coronary heart disease, Cancer, blindness, accidents, mental illness, Iodine deficiency, Fluorosis, Epilepsy, Asthma. Genetic disorders: Down's syndrome, Klinefelter's syndrome, Turner's syndrome, Thalassemia, Sickle cell anemia. Lifestyle disorders: Obesity, Liver cirrhosis, Diabetes mellitus, Hypertension (Causative agents, symptoms, diagnosis, treatment, prognosis, prevention).

MODULE 3: 14 HOURS

Health promotion: Preventing drug abuse, Oral health promotion by tobacco control.

Mental hygiene and mental health: Concepts of mental hygiene and mental health, Characteristics of mentally healthy person, Warning signs of poor mental health, Promotive

mental health, strategies and services, Ego defense mechanisms and implications, Personal and social adjustments, Guidance and Counseling. Infection control: Nature of infection, Chain of infection transmission, Defenses against infection transmission.

Pedagogy: Lectures, Presentations, videos, Assignments and test.

Formative Assessment – 40 Marks; **Summative Assessment** – 60 Marks	
Formative Assessment	
Pedagogy: Lectures, Presentations, videos, Assignments and Internal tests	
Continuous Internal Assessment type	**Weightage in marks**
Internal test	20
Seminar/Presentation	10
assignment	05
Attendance	05
Total	**40 Marks**

REFERENCES

1. Maurice E. Shils, Moshe Shike, A Catharine Ross (2006). - Modern Nutrition in Health and Disease, 10th Edition. Philadelphia : Lippincott Williams & Wilkins,
2. Martin Andrew Crook (2012) - Clinical Biochemistry and Metabolic Medicine, Eighth Edition by, CRC Press,
3. R. Semba and M.W. Bloem (2000) - Nutrition & Health in Developing Countries, Humana Press.

PROGRAM NAME	**: B.Sc.**
TITLE OF THE COURSE	**: CHEMICAL FOUNDATION OF BIOCHEMISTRY 2**
SEMESTER	**: II SEMESTER**
COURSE CODE	**: BSC23C2C2**
CREDITS	**: 4**
TOTAL NO. OF TEACHING HOURS	**: 56 HOURS – 4HOURS/WEEK**

MODULE 2: Chemical Kinetics and Colloids **14 HOURS**

Introduction, Rate of reactions, rate law or Rate equation, Molecularity and order of a reaction with examples, velocity constant or rate constant and half-life period expressions for zero, first and second order reactions with derivations (a=b and a≠b), Numerical problems. Effect of temperature, Pressure and catalyst on rate of reaction, Arrhenius equation and Arrhenius interpretation of energy of activation, Transition state theory with brief explanation. Colloids: True solutions, classification, Brownian movements, electric properties, coagulation, mutual lyophillic sols, peptisation, purification, ultrafiltration, dialysis, electro and persistent dialysis, addition of electrolytes, colloids in daily life and applications. Emulsion, types, micelles with biomolecules and its Biological applications.

MODULE 2: Nomenclature of Organic Compounds **14 HOURS**

Classification, naming, IUPAC nomenclature, compounds containing one, two functional groups with chains, homologous series. Stereochemistry, geometrical and structural Isomerism, conformation and free rotation. Optical isomerism, symmetry of elements, plane polarized light and optical purity. Nomenclature of enantiomers, epimers, recemic mixture, resolution. Fischer and Newmann projection formulae, molecule with one and two chairal and achairal centers. Priority rules; E and Z (CIP rules), R and S, D and L notations, absolute (r and s) and relative (d and l) configuration. Role of stereochemistry in biological systems.

MODULE 3: Organometallic Compounds **14 HOURS**

Metal atom linked organic compounds. Preparation of Grignard reagents and structure, limitations, protonolysis and reactions. Organolithium compounds, preparation and reactions. Organozinc compounds. Organoboranes its mechanisms. Ferrocenes. Organomercury compounds: Methods of preparation and applications, reactions– mercuration of aromatic compounds, solvomercuration, oxymercuration- demercuration. Organosilicon compounds: Methods of preparations and applications, general reactions of trialkyl silyl halides with ethers,

esters, carbamides, epoxides and acetals.

Porphyrins and Metalions: Role of metal ions in biological systems, Fe, Cu, Zn, structure and functions of porphyrins, metalloporphyrins and iron-sulphur clusters with suitable examples and their role in biological systems.

MODULE 4: Inorganic Chemistry **14 HOURS**

Nomenclature of inorganic molecules and coordination compounds, formula. IUPAC nomenclature. Central metal ion, ligand, coordination number, sphere, complex ion, oxidation number of central atom, homoleptic and heteroleptic complexes. Isomerism in complexes, structural, ionisation, solvate, linkage and coordination Stereoisomerism, geometrical, optical isomerism with simple inorganic complexes. Applications of qualitative, quantitative analysis, photographic, metallurgy, medicine, catalysis and biosystems. Heavy Metal Poisons: Introduction, poisons, lead, mercury, aluminium, arsenic, corrosives, cyanide, irritants, phosphorus, CO_2, SO_2, SO_3, NO_2, halides and acid fumes, poisoning, sources, signs and symptoms. Free radicals: introduction, definition, generation and scavenger systems.

Pedagogy: Lectures, Presentations, videos, Assignments and test.

Formative Assessment – 40 Marks; **Summative Assessment** – 60 Marks	
Formative Assessment	
Pedagogy: Lectures, Presentations, videos, Assignments and Internal tests	
Continuous Internal Assessment type	**Weightage in marks**
Internal test	20
Seminar/Presentation	10
assignment	05
Attendance	05
Total	**40 Marks**

REFERENCES

1.Peter Atkins (2006), Physical Chemistry. 8th edition, W.H. Freeman and Company

2.Huheey JE, Keiter EA, Keiter RL (2006), Inorganic Chemistry: Principles of structure and Reactivity, Pearson Education India

3.Kalsi PS, (2009) Stereochemistry: Conformation and Mechanism, New Age International Publications

4.Kurt Mislow (2012), Introduction to Stereochemistry, Dover Publications

5.Raj K Bansal (2016) A text book of Organic Chemistry, 6th edition, New Age International Publications

6.Cotton et al (1999), Advanced Inorganic Chemistry, 6th edition, A Wiley - International

TEXT BOOKS

1. Puri, Sharma and Pathania - Principles of physical Chemistry
2. R. L. Madan, G. D. Tuli. - Physical Chemistry by S. Chand and Co.
3. K. L. Kapoor - A Text Book of Physical Chemistry by. Vol. 2. Mc. Millan Publisher, India Ltd.
4. Bahl and Bahl - Advanced Organic Chemistry.

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PROGRAM NAME : B.Sc.

TITLE OF THE COURSE : CHEMICAL FOUNDATION OF BIOCHEMISTRY 2 PRACTICAL

SEMESTER : II SEMESTER

COURSE CODE : BSC23C2P2

CREDITS : 2

TOTAL NO. OF TEACHING HOURS : 28 HOURS – 4HOURS/WEEK

Course Outcome: The Course Objective is to provide experimental practice of quantitative and qualitative analysis. Also it provides training in physical chemistry laboratory techniques. Upon successful completion, students should develop skills in handling instruments and understand its application in research work.

Experiments:

1. Semi micro Qualitative Analysis of Inorganic salt Mixtures
   Systematic semi micro qualitative analysis of two acid and two basic radicals in the given inorganicsalt mixture. The constituent ions in the mixture to be restricted to the following. (Any four binary mixtures shall be given)

   Anions: HCO^-, CO^{2-}, Cl^-, Br^-, NO^-, BO^{3-}, SO^{2-} and PO^{3-}.

   3 3 3 3 4 4

   Cations: Pb^{2+}, Al^{3+}, Fe^{2+}, Fe^{3+}, Mn^{2+}, Zn^{2+}, Ca^{2+}, Sr^{2+}, Ba^{2+}, Mg^{2+}, K^+, Na^+ a4nd NH^+.
2. Determination of density and viscosity of the given liquid using specific gravity bottle and Ostwald's viscometer.
3. Determination of density and surface tension of the given liquid using specific gravity bottle and stalagnometer.
4. Determination of molecular weight of non-volatile solute by Walker-Lumsdenmethod.
5. Determination of rate constant of decomposition of H_2O_2 using $KMnO_4$ by volumetric analysis method using ferric chloride as catalyst.
6. Determination of distribution coefficient of benzoic acid between water and benzene or iodinebetween water and carbon tetrachloride.
7. Separation of Two Components from given Binary Mixture of Organic Compounds Qualitatively. (Types of binary mixtures- Solid – Solid, Solid – Liquid, Liquid –Liquid)
8. Verification of Beer's Law. Estimation of unknown concentration of a biomolecule by

using colorimeter

9. Calibration of pH meter and determination of pH of aerated soft drinks.

Pedagogy: Lectures, Practical hands-on, videos, Assignments and test.

Formative Assessment – 25 Marks; **Summative Assessment** – 25 Marks	
Formative Assessment	
Assessment Occasion	**Weightage in marks**
Internal test (one)	10
Assignment (Monographs)	05
Class participation	05
Attendance	05
Total	**25**

REFERENCES:

1. Svehla, G. (2012) Vogel's Qualitative Inorganic Analysis, Pearson Education,
2. Mendham, J. 92009) Vogel's Quantitative Chemical Analysis, Pearson.
3. Dr. O. P. Pandey, D. N. Bajpai, dr. S. Giri, Practical Chemistry S. Chand and Co. Ltd.,
4. M. Viswanathan - Principles of Practical Chemistry.
5. B.K Sharma - Instrumental Methods of chemical Analysis.
6. R.C. Das and B. Behra - Experiments in Physical Chemistry, Tata Mc Graw Hill
7. J.B. Yadav, Advanced Practical Physical Chemistry, Goel Publishing House.
8. J.N. Gurtu and R Kapoor, Advanced Experimental Chemistry. Vol-I, S. Chand and Co.
9. K.K. Sharma, D. S. Sharma - Practical Chemistry (Vikas Publication).
10. Anil J Elias, General Chemistry experiment – (University press)
11. G.H. Jeffery, J. Basset - Vogel textbook of quantitative chemical analysis
12. S. Sahay, Quantitative chemical analysis (S. Chand & Co.).

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PROGRAM NAME	**: OPEN ELECTIVE**
TITLE OF THE COURSE	**: NUTRITION AND DIETETICS**
SEMESTER	**: II SEMESTER**
COURSE CODE	**: OET2BC2**
CREDITS	**: 3**
TOTAL NO. OF TEACHING HOURS	**: 42 HOURS – 3 HOURS/WEEK**

Course outcomes:

1. The student will gain knowledge about energy requirements and the Recommended Dietary Allowances.
2. The student will understand the functions and role of macronutrients, their requirements and the effect of deficiency and excess
3. The student learns the impact of various functional foods on our health
4. The student will be able to apply basic nutrition knowledge in making foods choices and obtaining an adequate diet.
5. The student gains competence in connecting the role of various nutrients in maintaining health and learn to enhance traditional recipes.

MODULE 1: Basic concepts of Nutrition **14 HOURS**

Introduction, Basic principles of a balanced diet to provide energy and nutrients. Composition of foods and proximate analysis of foods. Calorific value of foods, and Basal metabolism. Basal Metabolic Rate (BMR), Factors affecting BMR, Energy requirements for different physical activities, Specific dynamic action of food, Nutritive value of proteins. Energy requirements and recommended dietary allowance (RDA) for infants, children and pregnant women. Protein calorie malnutrition.

MODULE 1: Macronutrients and Micronutrients **14 HOURS**

Carbohydrates- Digestible and non- digestible, Dietary fibres, Essential fatty acids, lipoproteins and Cholesterol. Essential amino acids, Fortification of foods, Protein requirement for different categories. **Vitamins**-Sources, requirements, functions and deficiency symptoms of Vitamin-C, Thiamine, Riboflavin, Pyridoxine, Folic acid, Vitamin B12. Absorption of fat soluble vitamins- A, D, E and K. **Micronutrients**: Source, Daily requirement, functions and deficiency disease symptoms of Macro minerals (Ca,

P and Cl) and micro minerals/trace elements (I, Fe, Zn and Se).

MODULE 3: Dietetics and Diet Therapy **14 HOURS**

Introduction to nutrition. Food pyramid. Diet planning and introduction to diet therapy. Nutritional requirements for different age groups, anemic child,expectant women, and lactating women. Diet planning for prevention and cure of nutritional deficiency disorders. **Diet therapy:** Functional foods, Anthropometric measurements, dietary considerations during fever, malaria, and tuberculosis. Prevention and correction of obesity, underweight, and metabolic diseases by diet therapy. Dietary interventions to correct and or manage the gastrointestinal diseases (indigestion, peptic ulcer, constipation, diarrhoea, steatorrhoea, irritable bowel syndrome. Functional foods based diet therapy for diabetes, cardiovascular disease and cancer.

Pedagogy: Lectures, Presentations, videos, Assignments and test.

Formative Assessment – 40 Marks; **Summative Assessment** – 60 Marks	
Formative Assessment	
Pedagogy: Lectures, Presentations, videos, Assignments and Internal tests	
Continuous Internal Assessment type	**Weightage in marks**
Internal test	20
Seminar/Presentation	10
assignment	05
Attendance	05
Total	**40 Marks**

REFERENCES:

1. Antia FP and Abraham P, (2002) Clinical Dietetics and Nutrition, Oxford University Press; 4thEdition. ISBN-10: 9780195664157.
2. Webster-Gandy J, Madden A and Holds worth (2011)- Oxford Handbook of Nutrition and Dietetics.
3. M. Oxford University Press, Print ISBN-13: 9780199585823.
4. Mahan KL and Escott-Stump S (2003) Krause's Food, Nutrition and Diet therapy. Elsevier, ISBN: 9780721697840.
5. Passmore R. and Davidson S (1986) Human Nutrition and Dietetics. Churchill Livingstone Publications, ISBN-10: 0443024863.
6. Rosemary Stanton's Complete Book of Food & Nutrition, 2007, Simon &

Schuster Publishers, Australia, ISBN 10: 0731812999

7. Roday S. (2018) Food Science and Nutrition, Oxford University Press Publishers, ISBN: 9780199489084/0199489084.
8. Srilakshmi S (2007) Food Science, New Age International (P) Limited Publishers, ISBN: 9788122420227/ 8122420222.

Acharya Bangalore B-School

AUTONOMOUS Affiliated to Bangalore University

PROGRAM NAME	**: B.Sc. GENETICS**
SEMESTER	**: I SEMESTER**
TITLE OF THE COURSE	**: PRINCIPLES OF GENETICS**
COURSE CODE	**: BSC23G1C2**
CREDITS	**: 04**
TOTAL NO. OF TEACHING HOURS	**: 56 Hours**

Course Objectives:

The Programme offers both classical as well as modern concepts of Genetics in higher education.

- It enables the students to study genetic diversity in both local and global environments.
- To update the concepts concerning genetic diversity among different traits of population, pattern of inheritance.
- To correlate contemporary and modern techniques like genomics, metagenomics, genome editing and molecular diagnostic tools.
- Bioinformatics and computational tools used in modern sciences will provide ample opportunities to explore different career avenues and provide opportunity to be an entrepreneur.

Course Outcomes:

By the end of this course student would be able to:

CO1: Understand the structure and function of all the cell organelles.

CO2: Know about the chromatin structure and its location.

CO3: Understand the Mendel‟s laws and its deviations.

CO4: Know about the karyotyping of normal human beings.

CO5: Understand the various genetic disorders in humans

THEORY PAPER: BSC23G1C2: PRINCIPLES OF GENETICS

COURSE CONTENT

MODULE 1: HISTORY, SCOPE AND APPLICATIONS OF GENETICS: 14 HOURS

a) Pre-Mendelian Concepts of Heredity: Pre-formation theory, epigenesis, pangenesis, germplasm theory and mutation theory.

b) Scope and applications of Genetics: Genetics in relation to society- plant breeding, animal breeding, medicine.

c) Use of model organisms in studying genetic variations: Structure, life cycle, and genetic significance of Prokaryotes: *Escherichia coli.* Eukaryotes: *Saccahromyces cerevisiae, Caenorhabditis elegance, Drosophila melanogaster, Danio rerio, Mus musculus. Pisum sativum, Arabidopsis thaliana.* Virus: Bacteriophage

MODULE 2: CHROMOSOMES AND CELL DIVISION 14 HOURS

a) Genetic material: DNA, genes, alleles, genome. Inheritance of acquired characters, Genotype, phenotype, clones, pure lines and inbred lines. Chromosomes, Special types of chromosomes: Polytene and Lamp-brush chromosomes.

b) Cell Cycle and Cell Division: Phases of Cell cycle, check points, stages of mitosis, mitotic apparatus, inhibitors of mitosis, significance of mitosis. Meiosis, Stages of meiosis, synaptonemal complex, chiasma formation, significance of meiosis.

c) Cancer Biology: Introduction to cancer, properties of cancer cells, Benign and malignant, sarcoma, carcinoma, lymphoma and leukemia.

MODULE 3: MENDELIAN GENETICS. 14 HOURS

a) Mendelian Inheritance: Law of Segregation: Mono hybrid cross, back cross and test cross, genetic problems related. **Law of Independent Assortment:** Di-hybrid cross, back cross and test cross, genetic problems related.

b) Non-Mendelian inheritance: Incomplete-dominance, co-dominance, Complementary gene interaction (9:7), Supplementary gene interaction, recessive and dominant Epistasis with an example for each trait, genetic problems related.

c) Multiple alleles: Definition, ABO blood groups and Rh factor in Human.

MODULE 4: LINKAGE AND CROSSING OVER 14 HOURS

a) Linkage and crossing over: Types of linkage: complete and incomplete, factors affecting linkage and significance of linkage, crossing over, types, mechanism and significance of crossing over. Linkage groups in man and *Drosophila*, Linkage Maps, construction of linkage maps.

b) Human Cytogenetics: Normal Human Karyotype (Male and Female).

c) Clinical features and Karyotype of Genetic syndromes: Cri-du-chats, Down's, Edward's, Patau's, Turner's, and Klinefelter's.

Pedagogy:

Formative Assessment	
Assessment	Weightage in Marks
Internal Test	20
Seminars/ Minor project	10
Assignment	05
Participation in class/ Attendance	05
Total	**40**

ESSENTIAL READINGS:

1. Karp, G. (2009). *Cell and molecular biology: concepts and experiments*. John Wiley & Sons.

2. Russell, P. J., Hertz, P. E., McMillan, B., & Benington, J. (2020). *Biology: the dynamic science*. Cengage Learning.

3. Singh, S. P., & Tomar, B. S. (2008). *Cell biology*. Rastogi Publications, Meerut, India.

4. Cooper, G. M., Hausman, R. E., & Hausman, R. E. (2007). *The cell: a molecular approach* (Vol. 4). Washington, DC: ASM press.

5. Gupta, P.K. (2010). Cytogenetics. Rastogi Publications, Meerut, India.

6. Lewin, B., Krebs, J., Kilpatrick, S. T., & Goldstein, E. S. (2011). *Lewin's genes X*. Jones & Bartlett Learning.

REFERENCES:

1. Pierce, B. A. (2012). *Genetics: a conceptual approach*. Macmillan publication.

2. Roberts, K., Alberts, B., Johnson, A., Walter, P., & Hunt, T. (2002). Molecular biology of the cell. *New York: Garland Science*.

3. Lodish, Harvey, et al. *Molecular cell biology*. Macmillan, 2008.

4. Snustad, D. P., & Simmons, M. J. (2015). *Principles of genetics*. John Wiley & Sons.

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PROGRAM NAME	**: B.Sc. GENETICS**
TITLE OF THE COURSE	**: PRINCIPLES OF GENETICS**
COURSE CODE	**: BSC23G1P1**
CREDITS	**: 02**
TOTAL NO. OF TEACHING HOURS	**: 28 HOURS - 4 HOURS/WEEK**

Course Objectives:

The students will be able to learn techniques in cytogenetics, able to solve genetic problems on Mendelian genetics, Non Mendelian genetics and Linkage etc. Also able to analyze the karyotype of normal and syndromic individuals.

PRACTICAL PAPER: BSC23G1P1: PRINCIPLES OF GENETICS

COURSE CONTENT

1. Preparation of pre-treating / fixing agents/ stains for cytological studies.
2. Model organisms: External features and life cycle of model organisms (Charts/slides/models)

- ✓ *E. coli* (slide),
- ✓ *Saccahromyces* (slide),
- ✓ *Caenorhabditis eleganse*,
- ✓ *Arabidopsis*,
- ✓ *Drosophila melanogaster*,
- ✓ *Danio rerio*,

3. Observation of mitotic stages in permanent slides.
4. Temporary squash preparation of onion root tips for mitosis.
5. Observation of meiotic stages in permanent slides.
6. Study of Meiosis using onion flower buds/grasshopper testes
7. Preparation of salivary gland chromosomes in *Drosophila* larvae
8. Blood typing in humans for multiple alleles and Rh factor
9. Histological study of Cancer types using permanent slides
10. Simple genetics problems based on theory

Note: 15 Practicals.

Pedagogy:

Formative Assessment	
Assessment Occasion	Weightage in Marks
House Examination Test	10
Models/Charts	10
Record	05
Total	**25**

Acharya Bangalore B-School

AUTONOMOUS Affiliated to Bangalore University

PROGRAM NAME	**: B.Sc. GENETICS**
SEMESTER	**: I**
TITLE OF THE COURSE	**: FUNDAMENTALS OF GENETICS**
COURSE CODE	**: OET1GN1**
CREDITS	**: 03**
TOTAL NO. OF TEACHING HOURS	**: 42 HOURS - 3 HOURS/WEEK**

Course Outcomes (COs):

Upon successful completion, each student will have the basic knowledge:

1. Historical overview and laws Inheritance.
2. Understand Mendel‟s principles and deviations.
3. Gene interactions and their outcome through gene mapping.

OPEN ELECTIVE PAPER

OET1GN1: FUNDAMENTALS OF GENETICS

Course Content

MODULE 1: 14 HOURS

Chapter.1: **Cell and Cell Organelles: Cell organelles:** Ultrastructure, Chemical composition and Functions of Cytoplasmic organelles: Plasma membrane, Endoplasmic reticulum, Ribosomes, Lysosomes, Golgi bodies and Nucleus. **Cell cycle and cell division:** G1, S, G2 and M phase, Mitosis, Meiosis, Significance.

Chapter.2: History of Genetics: Pre- Mendelian genetic concepts; Concepts of Phenotype and Genotype; Heredity, variation, Pure lines and Inbred Lines Biography of Mendel; Mendelian experiments on pea plants - Law of Segregation; Monohybrid cross, Back cross and Test cross, genetic problems related. Law of Independent Assortment: Dihybrid cross in pea plant, Back cross and Test cross, genetic problems related.

Chapter 3: Deviations from Mendelian Inheritance - Incomplete inheritance and Codominance; Dominant Ex.: Fruit color in Cucurbita pepo, Recessive Inheritance-Ex.: Coat color in Mice. Non-Epistasis - Ex.: Comb pattern in Poultry

MODULE 2: 14 HOURS

Chapter.4 Sex Determination: Chromosome theory of Sex determination: XX- XY, XX-XO, ZZ-ZW; Intersexes and Super sexes in *Drosophila*, Y chromosome in sex determination of *Melandrium*.

Chapter.5: Genetic and Hormonal control of Sex determination: Genic balance theory of Bridges, Gynandromorphs, Environment and sex determination.

Chapter. 6: Sex chromosomes and Dosage compensation:

MODULE 3: 14 HOURS

Chapter.7. Extra Chromosomal Inheritance: Characteristic features of Cytoplasmic Inheritance; Inheritance of- Mitochondrial DNA, Chloroplast DNA, Kappa particles in Paramecium, Sigma factor in Drosophila, Shell coiling in snail.

Chapter. 8: Behavioral Genetics: Introduction to Genetics and Behaviour, Mating behavior in Drosophila, Hygienic behavior in Honeybee, Nesting behavior in Ants, Territoriality and conflict behavior in Primates.

Chapter. 9: Microbial Genetics: Transformation, Conjugation, Lytic cycle, Lysogeny, Transduction.

Pedagogy:

Formative Assessment	
Assessment	Weightage in Marks
Internal Test	20
Seminars/ Minor project	10
Assignment	05
Active learning/Problem based/Review Writing/ Paper presentation/ Case studies/Attendance	05
Total	**40**

Text Books:

1. Concepts of Genetics. Klug, WS., Cummins, MR., Spencer, C., Palladino, MA. 2020. 10th Edition. Pearsons Publication.

2. Genetics: A Conceptual approach.Benjamin A.Pierce. 2000. 7th edition. McMillan Publication.

3. Genetics From Genes to Genomes. Hartwell. L., Michael. L Gold berg., Anne E. Reynolds and Lee. M. Silver. 2009. 4th Edition. Mc Graw Hill Publication.

4. Genetics: Analysis & Principles. Robert J. Brooker 7th Edition. Mc Graw Hill Publication.

5. Genetics: Analysis of Genes and Genomes.Daniel L. Hartl 2014. 5th Edition Jones and Bartlett Publishers. Inc.

6. Principles of Genetics. Snustad Simmons. 2008. 6th Edition. John Wiley Publication.

7. Trun, N., & Trempy, J. (2009). Fundamental bacterial genetics. John Wiley & Sons.

8. Streips, U. N., & Yasbin, R. E. (Eds.). (2004). Modern microbial genetics. John Wiley & Sons.

References:

1. Advanced Genetics. G. S. Miglani. Alpha Science International, Ltd. 2012.

2. Fundamentals of Biostatistics. 2nd Edition. Khan & Khanum. 2004. Ukaaz publications.

3. Principles of Genetics, 7th Edition, Robert H. Tamarin. 2002. Tata- Mc Graw Hill ublications.

4. Theory and Problems of Genetics. W. D. Stansfield. 2002. Mc Graw Hill Publications.

5. Chromosomal Aberrations: Basic and Applied aspects by Obe.G. and A.T. Natarajan (1990) Springer Verlag, Berlin.

6. Cytogenetics, Plant Breeding and evolution by U.Sinha and Sunita Sinha , Vikas Publishing House Private, Limited, 1998.

7. Cytology, Genetics and Molecular Biology by P.K.Gupta (2002), Rastogi publications.

8. Elements of Genetics by Phundan Singh, Kalyani Publishers. 2009.

9. Genetic Maps, 6th edition by O"Brien, S (1993)

10.Instant notes in Genetics by P.C.Winter, G.I. Hickey and H.L.Fletcher (2003) Viva Books Pvt.Ltd.

11.Principles of Genetics by E.J.Gardener, M.J.Simmons and D.P.Snustad.J.Wiley and Sons pubs (1998).

Acharya Bangalore B-School

AUTONOMOUS Affiliated to Bangalore University

PROGRAM NAME	**: B.Sc. GENETICS**
SEMESTER	**: II**
TITLE OF THE COURSE	**: BIOINSTRUMENTATION AND ANIMAL CELL CULTURE**
COURSE CODE	**: BSC23G2C2**
CREDITS	**: 04**
TOTAL NO. OF TEACHING HOURS	**: 56 HOURS - 4 HOURS/WEEK**

COURSE OBJECTIVES:

The Programme offers both classical as well as modern concepts of Genetics in higher education.

- ✧ It enables the students to study genetic diversity in both local and global environments.
- ✧ To update the concepts concerning genetic diversity among different traits of population, pattern of inheritance.
- ✧ To correlate contemporary and modern techniques like genomics, metagenomics, genome editing and molecular diagnostic tools.
- ✧ Bioinformatics and computational tools used in modern sciences will provide ample opportunities to explore different career avenues and provide opportunity to be an entrepreneur.

COURSE OUTCOMES (CO's):

By the end of this course student would be able to:

CO1: Understand the basic principles of different laboratory equipment's

CO2: Know the uses of the analytical equipment's in various biological applications.

CO3: Understand the cell lines and culture media and cell culture methods

CO4: Handle and culture different cell lines.

CO5: To understand the applications of tissue cultures in different fields.

THEORY PAPER: BIOINSTRUMENTATION AND ANIMAL CELL CULTURE: BSC23G2C2

COURSE CONTENT

MODULE 1: **14- HOURS**

Introduction, and history of Microscopy, **Principle and Optical Components of microscope:** Eye piece, Eye piece tube, Objective lenses, Coarse and Fine Focus knobs, Stage and stage clips, Aperture, Illuminator, Condenser, Condenser Focus Knob, Iris Diaphragm. **Types of microscopes:** Simple and Compound microscopes, Light microscopes, Fluorescence, electron microscopy (transmission and scanning), Phase contrast, Confocal, Stereo microscopy, Optical pathway in different microscopes. **Uses of microscopy and biological applications:** High resolution imaging, immune histochemistry, high-content screening and high throughput imaging, Medical science, Forensic laboratories.

MODULE 2: **14-HOURS**

Analytical Instruments: pH meter-principle and components of pH meter. **Thermometer:** principle, types of thermometers-digital, mercury, strip type, Infrared, Axillary. **Colorimeter:** principles of measurement and applications. **Spectrophotometer:** Beer-Lambert's Law in spectrometry, UV spectrophotometers, Atomic absorption spectroscopy (AAS), Electron Spin Resonance (ESR), Nuclear Magnetic Resonance (NMR) Spectrophotometers, Flame photometer.

MODULE 3: **14- HOURS**

Instruments used in separation techniques: Centrifugation: Principle and applications of centrifuge, types of centrifuge-high speed centrifuge, ultra-centrifuge, Refrigerated centrifuge. Rotors: Types of rotors- vertical, Swing-out, Fixed angle. Chromatography: Principle, types and application of Chromatography: Thin layer chromatography(TLC), paper chromatography, ion exchange, gel filtration, affinity chromatography HPLC and GCMS. Electrophoresis: Principle and applications of electrophoresis. Types of electrophoresis: vertical and horizontal. Components: Electrodes, Power supply, electrophoresis chamber.

MODULE 4: **14-HOURS**

Animal cell culture: Principles of cell culture, cell types, cell lines, Primary culture, secondary culture, cryopreservation, contaminations, organotypic culture. **Requirements in Animal Cell Culture:** Equipments used in Cell culture, Culture vessels, Aseptic techniques using different types of sterilization methods: Autoclave, steam sterilizers, dry heat sterilizers and ovens and UV chambers. **Cell culture media:** Natural and defined, role and components of serum in culture. *In-vitro* transformation of animal cells, Types of cell culture. **Applications of cell culture:** Cell culture in biomedical research, karyological studies, amniocentesis, mutagenesis, Cytotoxicity assays.

PEDAGOGY:

Formative Assessment	
Assessment	Weightage in Marks
Internal Test	20
Seminars/ Presentation	10
Assignment	05
Participation in class/ Attendance	05
Total	**40**

ESSENTIAL READINGS:

1. Alberts B, Johnson A, Lewis J, et al. "Molecular Biology of the Cell", 2002, 4th edition, New York: Garland Science.

2. Lodish H, Berk A, Zipursky SL, et al. "Molecular Cell Biology". 2000, 4th edition. New York: W. H. Freeman.

3. R. Freshney, "Culture of Animal Cells-A Manual of Basic Technique and Specialized Applications", 2015, Seventh edition, Wiley Blackwell.

4. John M. Davis, "Animal Cell Culture: Essential Methods" 2011, John Wiley & Sons Ltd.

5. A. J. Ninfa and D. P. Ballou, *Fundamental Laboratory Approaches for Biochemistry and Biotechnology,* 1998 2nd Edition Wiley.

6. J. Sambrook and D. W. Russell, *Molecular Cloning: A Laboratory Manual,* 2001, 3rd Edition Cold Spring Harbor Laboratory Press.

REFERENCES:

1. Bronzino, J. D. (1986). Biomedical engineering and instrumentation. PWS Publishing Co...

2. Willard Van Nostrand, ".Instrumental Methods of Analysis"-

3. Sharms, "Instrumental Methods", S Chand & Co.

4. Harry Bronzino E, "Handbook of Biomedical Engineering and Measurements",Reston, Virginia.

5. Jacobson & Websler, " Medicine& Clinical Engg"

6. Leslie Cromwell, " Biomedical Instrumentation and Measurements"

7. Geddes & Baker, "Principles of Applied Biomedical Instrumentation" Wiley.

Acharya Bangalore B-School

AUTONOMOUS Affiliated to Bangalore University

PROGRAM NAME	**: B.Sc. GENETICS**
SEMESTER	**: II**
TITLE OF THE COURSE	**: BIOINSTRUMENTATION AND ANIMAL CELL CULTURE**
COURSE CODE	**: BSC23G2P2**
CREDITS	**: 02**
TOTAL NO. OF TEACHING HOURS	**: 28 HOURS - 4 HOURS/WEEK**

COURSE OBJECTIVES:

The students will be able to learn instrumentation techniques and analytical equipment used in biological sciences, and able to understand tissue culture techniques viz, handling, cultivation and applications.

PRACTICAL PAPER: BSC23GN1P2: BIOINSTRUMENTATION AND ANIMAL CELL CULTURE

PRACTICAL CONTENT

Sl.No.	LIST OF EXPERIMENTS
1	Demonstration of optical Components of microscope: Eye piece, Eyepiece tube, Nose piece, Objective lenses, Coarse and Fine Focus knobs, Stage and stage clips, Aperture, Illuminator, Condenser, Condenser Focus Knob, Iris Diaphragm.
2	Demonstration of compound, Simple, Binocular, Stereo microscopes.
3	Preparation of buffers using pH meter.
4	Temperature recording using Thermometer
5	Colorimetric estimation of proteins by Lowry's method.
6	Colorimetric estimation of proteins by Biuret's method.
7	Demonstration of Beer-Lambert's Law in spectroscopy
8	DNA Estimation by DPA method.
9	Separation of amino acids by TLC
10	Separation of Eye pigments of *Drosophila* by Paper Chromatography
11	Agarose electrophoresis of DNA
12	SDS-PAGE electrophoresis of proteins
13	Demonstration of components of different centrifuges. Rotors: Types of rotors-vertical, Swing-out, Fixed angle.
14	Demonstration of cell culture and cell lines.
15	Demonstration of sterilization methods: Autoclave, steam sterilizers, dry heat sterilizers and ovens and UV chambers.

PEDAGOGY:

Formative Assessment	
Assessment Occasion	Weightage in Marks
House Examination Test	10
Charts/Models	10
Record	05
Total	**25**

ESSENTIAL READINGS:

1. Alberts B, Johnson A, Lewis J, et al. "Molecular Biology of the Cell", 2002, 4th edition, New York: Garland Science.

2. Lodish H, Berk A, Zipursky SL, et al. "Molecular Cell Biology". 4th edition. New York: W. H. Freeman; 2000.

3. R. Freshney, "Culture of Animal Cells-A Manual of Basic Technique and Specialized Applications", 2015, Seventh edition, Wiley Blackwell.

4. John M. Davis, "Animal Cell Culture: Essential Methods" 2011, John Wiley & Sons Ltd.

5. A. J. Ninfa and D. P. Ballou, *Fundamental Laboratory Approaches for Biochemistry and Biotechnology,* 1998 2nd Edition Wiley.

6. J. Sambrook and D. W. Russell, *Molecular Cloning: A Laboratory Manual,* 2001, 3rd Edition Cold Spring Harbor Laboratory Press.

REFERENCES:

1. Joseph Bronzino, “Biomedical Engineering and Instrumentation”, PWS Engg . , Boston.

2. Willard Van Nostrand, “Instrumental Methods of Analysis”- 3. Sharms, “Instrumental Methods”, S Chand & Co.

4. Harry Bronzino E, “Handbook of Biomedical Engineering and measurements”, Reston, Virginia.

Acharya Bangalore B-School

AUTONOMOUS Affiliated to Bangalore University

PROGRAM NAME	**: B.Sc. GENETICS**
SEMESTER	**: II**
TITLE OF THE COURSE	**: GENETIC COUNSELLING**
COURSE CODE	**: OET2GN2**
CREDITS	**: 03**
TOTAL NO. OF TEACHING HOURS	**: 42 HOURS - 3 HOURS/WEEK**

COURSE OUTCOMES (CO's):

Upon successful completion, each student will have the basic knowledge of

CO1: Genetic counselling methods

CO2: Reproductive risk calculation

CO3: Ethical and legal issues of genetic counselling

OPEN ELECTIVE PAPER:

OET2GN2: GENETIC COUNSELLING

COURSE CONTENT

MODULE 1: **14 HOURS**

Genetic Counselling: Introduction; Historical over view, types and scope. Counsellor: Definition, Role, Qualities and responsibilities; Consultant- Definition, needs, Rights. Individual counselling: Definition, objectives, important issues in genetic counselling, Counselor's background, cultural knowledge, health benefits, family issues, building rapport, empathy in family. Group counselling: Definition, objectives, types of groups, theoretically oriented group counselling; Behavioral counselling; Transactional counselling; Group crisis intervention. Family counselling – Definition, objectives, selecting family therapy as the method of choice, family counselling theories and psychoanalytical therapies.

MODULE 2: **14 HOURS**

Process of Genetic Counselling: Information gathering, medical evaluation, Physical examination and investigations. Medico legal case - Diagnosis based on medical history (Past medical, social and family history); Risk Psychological aspects of counselling: assessments – Communication, discussion of options Psychological aspects of counselling: Role of social workers; Nutritional; occupational; Physical; Speech therapist; Psychologists and school professional in genetic counselling. Educating the consultant; Presenting the Risks, Options and Guiding; Diagnostics problems in Genetic counselling; Indications for genetic counselling and genetic counselling case management Reproductive risk assessments: Reproductive failures; consanguinity; endogamous marriages and its impact on genetic disorders.

MODULE 3: **14 HOURS**

Registries for Genetic Counselling: Registries and support groups for rare medical disorders; Principles of predictive counselling and testing in late onset disorders imparting results of predictive testing; Counselling and management in follow up sessions. Ethical concerns in genetic counselling: Ethical issues in testing of minors; Prenatal diagnosis in late onset disorders; Ethical, legal and social issues (ELSI). Acts and amendments: The medical termination of pregnancy act

1971; The Pre- natal diagnostic techniques act 1994; Regulatory bodies of Genetic counselling – BGCI (India); ABGC (USA); CAGC (Canada).

PEDAGOGY:

Formative Assessment	
Assessment	Weightage in Marks
Internal Test	20
Seminars/ Presentation	10
Assignment	05
Participation in class/ Attendance	05
Total	**40**

Text books:

1. Doing a literature review in health and social care: a practical guide, Helen Aveyard (2014).

2. Doing your research project: a guide for first-time researcher, Judith Bell with Stephen Waters (2014).

3. Facilitating the genetic counseling process: practice-based skills. Patricia McCarthy Veach, Bonnie S. LeRoy and Nancy P. Callanan (2018).26

4. Foundations of perinatal genetic counseling: a guide for counselors, Amber Mathiesen and Kali Roy (2018).

5. Gardner and Sutherland's chromosome abnormalities and genetic counselling, R.J. McKinlay Gardner and David J. Amor (2018).

6. Genetic counseling: ethical challenges and consequences, Dianne M. Bartels, Bonnie S. LeRoy, and Arthur L. Caplan (2011).

7. Genetic counseling for adult neurogenetic disease: a casebook for clinicians, Jill S. Goldman (2015).

8. Genetic counseling research: a practical guide, Ian M. MacFarlane, Patricia McCarthy Veach, Bonnie S. LeRoy (2014).

9. A guide to genetic counselling, edited by Wendy R. Uhlmann, Jane L. Schuette, Beverly M. Yashar (2009).

References:

1. Helping the client: a creative practical guide, John Heron (2001).

2. How to read a paper: the basics of evidence-based medicine, Trisha Greenhalgh (2014).

3. Make it stick: the science of successful learning, Peter C. Brown, Henry L. Roediger and Mark A. McDaniel (2014).

4. Normative and pragmatic dimensions of genetic counseling: negotiating genetics and ethics, Joseph B. Fanning (2016).

5. Practical genetic counselling, Peter S. Harper (2010).

6. Thompson & Thompson genetics in medicine, Robert L. Nussbaum, Roderick

R. McInnes, Huntington F. Willard, Ada Hamosh (2016).

Acharya Bangalore B-School

AUTONOMOUS Affiliated to Bangalore University

PROGRAM NAME	**: B.Sc.**
TITLE OF THE COURSE	**: GENERAL MICROBIOLOGY**
SEMESTER	**: I SEMESTER**
COURSE CODE	**: BSC23M1C2**
CREDITS	**: 4**
TOTAL NO. OF TEACHING HOURS	**: 56 HOURS – 4HOURS/WEEK**

Course Objectives:

The Students will gain knowledge about the different cell organelles of microorganisms and their detailed functions. Students will also study the growth and control of microbes as well as different bacteriological techniques involved in microbiology. They will learn about the biomolecules by studying their structures and types.

Course Outcomes:

By the end of this course student would be able to:

CO1: Summarize the contributions of scientists and origin of microorganisms.

CO2: Apply the knowledge and skills in handling microbes.

CO3: Explain the structure of prokaryotic cell and their detailed functions.

CO4: Explain the structure of eukaryotic cell with its organelles.

CO5: Adapt good laboratory and good manufacturing practices in microbial quality control.

BSC23M1C2: GENERAL MICROBIOLOGY

COURSE CONTENT

MODULE 1: Historical development and origin of microorganisms 14 HOURS

Historical development of Microbiology – Theory of spontaneous generation, Biogenesis and Abiogenesis. Contributions of Antony van Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Edward Jenner, Alexander Fleming, Martinus Beijerinck, Sergei Winogradsky and Elie Metchnikoff. Contribution of Indian scientists in the field of Microbiology. Fossil evidences of microorganisms. Origin of life, primitive cells and evolution of microorganisms.

Microscopy- working principle, construction and operation of simple and compound microscopes. Different types of microscopes - Phase contrast, Bright Field, Dark Field, Fluorescent, Confocal, Scanning and Transmission Electron Microscopes.

MODULE 2: Staining, sterilization, media and preservation techniques 14 HOURS

Staining: Nature of stains, principles, mechanism, methods and types of staining-simple, Differential-Gram staining, acid fast staining, capsule staining, endospore, inclusion bodies.

Sterilization: Principles, types and techniques - physical and chemical.

Physical methods: Moist heat (Pasteurization), Moist heat under pressure (Autoclave), Dry heat (incineration, hot air oven), Filtration- membrane filter, HEPA filter, Radiation (UV- rays, X-rays, ultrasonic rays), Chemicals methods: alcohols, formaldehyde, phenol, halogens and heavy metals, gaseous sterilizing agents)

Microbiological culture media: Types, Composition, Preparation, Application and storage; Ingredients of media, natural and synthetic media, chemically defined media, complex media, selective, differential, indicator, transport, enriched and enrichment media.

Preservation of microorganisms: Methods of preservation, slant culture, stab culture, soil culture, mineral oil overlaying, glycerol preservation, Lyophilization.

MODULE 3: Prokaryotic microorganisms 14 HOURS

Overview of prokaryotic cell structure: Size, shape, arrangement. Ultra structure of prokaryotic cell: bacterial and archaeal - cell wall and cell membrane. Components external to cell wall - capsule, slime, s-layer, pili, fimbriae, flagella & its structure, motility, chemotaxis. Cytoplasmic matrix - Cytoskeleton, ribosome, inclusion granules: Composition and function. Nuclear Material – bacterial structure (its differences with the Eukaryotic chromosome); Extra Chromosomal material. Bacterial Endospore - Examples of spore forming organisms, habitats, function, formation and germination. Reproduction in bacteria.

MODULE 4: Eukaryotic microorganisms **14 HOURS**

Overview of eukaryotic cell: Types of cells; Structure and function of organelles- cell wall, cell membrane, cytoplasmic matrix, cytoskeleton, endoplasmic reticulum, Golgi complex, peroxisomes, lysosomes, vesicles, ribosomes, mitochondria, chloroplast and nucleus.

Structure and functions of flagella.

Reproduction in fungi-Vegetative, asexual and sexual.

Pedagogy: Lectures, Presentations, videos, Assignments and test.

Formative Assessment – 40 Marks; **Summative Assessment** – 60 Marks	
Formative Assessment	
Pedagogy: Lectures, Presentations, videos, Assignments and Internal tests	
Continuous Internal Assessment type	**Weightage in marks**
Internal test	20
Seminar/Presentation	10
assignment	05
Attendance	05
Total	**40 Marks**

ESSENTIAL READINGS:

1. Alexopoulos, C.J., Mims, C.W. & Blackwell, M. (2002). Introductory Mycology. 8th edition. John Wiley and Sons (Asia) Pvt. Ltd. Singapore.

2. Atlas, R.M. (1989). Basic and Practical Microbiology. 6th edition. Mac Millan Publishers, USA.987pp.

3. Black, J.G. (2008). Microbiology principles and explorations. 7th edition. John Wiley and Sons Inc., New Jersey. 846pp.

4. Dubey, R.C. & Maheshwari, D.K. (2022). A Textbook of Microbiology, 5th edition, S. Chand & Company Ltd.

5. Madigan, M.T., Martinko, J.M., Dunlap, P.V. & Clark, D.P. (2009). Brock Biology of Microorganisms, - 12th edition, Pearson International edition, Pearson Benjamin Cummings.

6. Michael Pelczar, Jr., Chan E.C.S. & Noel Krieg. (2023). Microbiology - Concepts and Applications, 5th edition. International ed, McGraw Hill.

7. Pommerville, J.C. (2013). Alcamo's Fundamentals of Microbiology. 10th edition. Jones and Bartlett.

REFERENCES:

1. Talaro, K. P. (2009). Foundations in Microbiology, 7th International edition, McGraw Hill.
2. Toratora, G.J., Funke, B.R. & Case, C.L. (2007). Microbiology. 9th ed. Pearson Education Pvt. Ltd., San Francisco. 958 pp.
3. Tortora, G.J., Funke, B.R., & Case C.L. (2008). Microbiology an Introduction, 10th ed. Pearson Education.
4. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2008). Prescott, Harley, and Klein's microbiology. 7th edition. New York: McGraw-Hill Higher Education.

Acharya Bangalore B-School

AUTONOMOUS Affiliated to Bangalore University

PROGRAM NAME : B.Sc.

TITLE OF THE COURSE : GENERAL MICROBIOLOGY PRACTICAL

SEMESTER : I SEMESTER

COURSE CODE : BSC23M1P1

CREDITS : 2

TOTAL NO. OF TEACHING HOURS : 28 HOURS – 4 HOURS/WEEK

1. Microbiological laboratory standards and safety protocols.
2. Operation and working principles of light and compound microscope.
3. Working principle and operations of basic equipments of microbiological laboratory (Autoclave, oven, incubator, LAF, colony counter, membrane filter, BOD incubator, pH meter, spectrophotometer, colorimeter, vortex, magnetic stirrer etc.).
4. Preparation of Physiological saline and Serial dilution.
5. Method of obtaining pure cultures of Microorganisms.
6. Isolation and identification of microorganisms from natural sources (air, water and soil).
7. Bacterial motility by hanging drop method.
8. Simple staining – Negative staining.
9. Differential staining – Gram's staining, Acid fast staining.
10. Structural staining – Flagella and capsule.
11. Bacterial endospore staining.
12. Staining of reserved food materials (granular).
13. Staining of fungi by lactophenol cotton blue.

Pedagogy: Lectures, Practical hands-on, videos, Assignments and test.

Formative Assessment – 25 Marks; **Summative Assessment** – 25 Marks	
Formative Assessment	
Assessment Occasion	**Weightage in marks**
Internal test (one)	10
Assignment (Monographs)	05
Class participation	05
Attendance	05
Total	**25**

REFERENCES:

1. Alexopoulos, C.J., Mims, C.W. & Blackwell, M. (2002). Introductory Mycology. 8th edition. John Wiley and Sons (Asia) Pvt. Ltd. Singapore.
2. Atlas, R.M. (1989). Basic and Practical Microbiology. 6th edition. Mac Millan Publishers, USA.987pp.
3. Black, J.G. (2008). Microbiology principles and explorations. 7th edition. John Wiley and Sons Inc., New Jersey. 846pp.
4. Dubey, R.C. & Maheshwari, D.K. (2022). A Textbook of Microbiology, 5th edition, S. Chand & Company Ltd.

Acharya Bangalore B-School

AUTONOMOUS Affiliated to Bangalore University

PROGRAM NAME : OPEN ELECTIVE

TITLE OF THE COURSE : MICROORGANISMS FOR HUMAN WELFARE

SEMESTER : I SEMESTER

COURSE CODE : OET1MB1

CREDITS : 3

TOTAL NO. OF TEACHING HOURS : 42 HOURS – 3 HOURS/WEEK

MODULE 1: Food and Fermentation 14 HOURS

Fermented Foods – Types, nutritional values and health benefits. Probiotics, prebiotics, synbiotics and nutraceuticals. Fermented Products – Alcoholic and non-alcoholic beverages, dairy products.

MODULE 2: Agriculture 14 HOURS

Bio-fertilizers and bio-pesticides - types and applications, beneficial microorganisms in agriculture, AM fungi, Mushroom cultivation, Biogas production.

MODULE 3: Pharmaceutical Industry 14 HOURS

Drugs – types, development and applications. Antibiotics – types, functions and antibiotic therapy. Vaccines – types, properties, functions and schedules.

Pedagogy: Lectures, Presentations, videos, Assignments and test.

Formative Assessment – 40 Marks; **Summative Assessment** – 60 Marks	
Formative Assessment	
Pedagogy: Lectures, Presentations, videos, Assignments and Internal tests	
Continuous Internal Assessment type	**Weightage in marks**
Internal test	20
Seminar/Presentation	10
assignment	05
Attendance	05
Total	**40 Marks**

ESSENTIAL READINGS:

1. Ananthnarayanan, R & Jeyaram Panicker, C. K. (2022). Textbooks of Microbiology, . 3rd edition. Orient Longman.
2. Dubey, R.C. & Maheshwari, D.K. (2013). A Textbook of Microbiology –2nd edition S Chand & Co. N. Delhi.
3. Pelczar, M.J., Chan E.C.S. & Kreig, N.R. (1998). 6th Edition. Krieg Microbiology Tata McGraw- Hill Publisher.

REFERENCES:

1. Prescott, L.M., Harley, J.P. & Klein, D.A., (2007). Microbiology –7th edition. Wm. C. Brown Publishers, USA.
2. Prescott, M.J., Harly, J.P. & Klein (2002). Microbiology. 5th edition, WCB McGraw Hill, New York.
3. Sateesh, M.K. (2010). Bioethics and Biosafety. IK International Pvt Ltd.
4. Singh, B.D. (2013). Expanding Horizons in Biotechnology.4th edition. Kalyani Publication.
5. Sree Krishna, V. (2007). Bioethics and Biosafety in Biotechnology, 1st edition. New age International publishers
6. Willey, J.M., Sherwood L.M., Woolverton C.J., Prescott, Harley and Klein's. (2013). Microbiology. 9th Edition.McGraw Hill Higher education.

Acharya Bangalore B-School

AUTONOMOUS Affiliated to Bangalore University

PROGRAM NAME	**: B.Sc.**
TITLE OF THE COURSE	**: MICROBIAL BIOCHEMISTRY AND PHYSIOLOGY**
SEMESTER	**: II SEMESTER**
COURSE CODE	**: BSC23M2C2**
CREDITS	**: 4**
TOTAL NO. OF TEACHING HOURS	**: 56 HOURS – 4HOURS/WEEK**

Course Objectives:

The Students will gain knowledge about the different cell organelles of microorganisms and their detailed functions. Students will also study the growth and control of microbes as well as different bacteriological techniques involved in microbiology. They will learn about the biomolecules by studying their structures and types.

Course Outcomes:

By the end of this course student would be able to:

CO1: Summarize the contributions of scientists and origin of microorganisms.

CO2: Apply the knowledge and skills in handling microbes.

CO3: Explain the structure of prokaryotic cell and their detailed functions.

CO4: Explain the structure of eukaryotic cell with its organelles.

CO5: Adapt good laboratory and good manufacturing practices in microbial quality control.

BSC23M2C2: MICROBIAL BIOCHEMISTRY AND PHYSIOLOGY
COURSE CONTENT

MODULE 1: Biochemical concepts 14 HOURS

Basic Biochemical Concepts: Major elements of life and their primary characteristics, atomic and chemical bonds – covalent, non-covalent, ionic, hydrogen and Vander Waal's Forces. Biological Solvents: Structure and properties of water molecule, water as an universal solvent, polarity, hydrophilic and hydrophobic interactions, acids, bases, electrolytes, pH and buffers, Henderson–Hasselbalch equation.

MODULE 2: Macromolecules 14 HOURS

Carbohydrates: Definition, classification, structure and properties.

Amino acids and proteins: Definition, structure, classification and properties of amino acids, structure and classification of proteins.

Lipids and Fats: Definition, classification, structure, properties and importance of lipids; fatty acids: types and classification.

Porphyrins and Vitamins: Definition, structure, properties and importance of chlorophyll, cytochromes and hemoglobin.

MODULE 3: Microbial growth and nutrition 14 HOURS

Microbial Growth: Definition, growth curve, phases of growth, growth kinetics, generation time. Synchronous culture, continuous culture (chemostat and turbidostat), coulter cultures, diauxic growth. Measurement of growth: Direct microscopic count - Haemocytometer; viable count, membrane filtration; electronic Counting; Measurement of cell mass; Turbidity measurements - Nephelometer and spectrophotometer based techniques; Measurement of cell constituents. Growth yield. Influence of environmental factors on growth. Microbial Nutrition: Microbial nutrients, macro and micronutrients, classification of organisms based on nutritional requirements. Membrane Transport: Structure and organization of biological membranes, Types of cellular transport - passive, facilitated, active, group translocation, membrane bound protein transport system, carrier models, liposomes, ion channels, Na+K+-ATPase.

MODULE 4: Bioenergetics, Respiration and Photosynthesis 14 HOURS

Bioenergetics: Free energy, enthalpy, entropy, laws of thermodynamics. High energy compounds: classification, structure and significance, oxidation reduction reactions, equilibrium constant, redox potential.

Microbial Respiration: EMP pathway - substrate level phosphorylation, Electron transport chain - oxidative phosphorylation, protein translocation, inhibitors of ETC and mechanism, structure and function of ATP synthase and ATP synthesis. Fermentation reactions (homo and hetero lactic fermentation)

Microbial Photosynthesis: Light reaction: Light harvesting pigments, Photophosphorylation, CO2 fixation pathways: Calvin cycle, CODH pathway, Reductive TCA pathway.

Pedagogy: Lectures, Presentations, videos, Assignments and test.

Formative Assessment	
Assesement Occasion	**Weightage in Marks**
Test	20
Seminar/Presentation	10
Assignment	05
Participation in class/Attendance	05
Total	**40 Marks**

ESSENTIAL READINGS:

1. Alexopoulos, C.J., Mims, C.W. & Blackwell, M. (2002). Introductory Mycology. 8th edition. John Wiley and Sons (Asia) Pvt. Ltd. Singapore.

2. Atlas, R.M. (1989). Basic and Practical Microbiology. 6th edition. Mac Millan Publishers, USA.987pp.

3. Black, J.G. (2008). Microbiology principles and explorations. 7th edition. John Wiley and Sons Inc., New Jersey. 846pp.

4. Boyer, R. (2002). Concepts in Biochemistry. 2nd Edition. Brook/Cole, Australia.

5. Caldwell, D. R. (2000). Microbial Physiology and Metabolism, 2nd edition. Belm, CA: Star Publishing Co

6. Dubey, R.C. & Maheshwari, D.K. (2022). A Textbook of Microbiology, 5th edition, S. Chand & Company Ltd.

8. Moat, A. G., Foster, J.W. & Spector, M. P. (2002). Microbial Physiology, 4th edition. New York: Wiley.

9. Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J. (2000) Photosynthetic Stages and Light-Absorbing Pigments. Molecular Cell Biology. 4th Edition, W. H. Freeman, New York.

10. White, D. (2000). The Physiology and Biochemistry of Prokaryotes, 2nd edition. Oxford University Press.

REFERENCES:

1. Madigan, M.T., Martinko J.M., Dunlap P.V., & Clark D.P. (2009). Brock Biology of Microorganisms, 12th edition, Pearson International edition Pearson Benjamin Cummings.
2. Michael Pelczar, Jr., Chan E.C.S. & Noel Krieg. (2023). Microbiology - Concepts and Applications, 5th edition. International ed, McGraw Hill.
3. Moat, A. G., Foster, J.W. & Spector, M. P. (2002). Microbial Physiology, 4th edition. New York: Wiley.
4. Palmer, T. (2007). Enzymes: Biochemistry, Biotechnology, Clinical Chemistry 2nd edition. Harwood Publication, Chichester.
5. Pommerville, J.C. 2013. Alcamo's Fundamentals of Microbiology. Jones and Bartlett.
6. Stanier, Ingraham. (2008). General Microbiology, 5th edition. Macmillan education limited. International, edition 2008, McGraw Hill.
7. Talaro, K.P. (2009). Foundations in Microbiology, 7th edition. McGraw Hill.
8. Toratora, G.J., Funke, B.R. and Case, C.L. (2007). Microbiology. 9th edition. Pearson Education Pvt. Ltd., San Francisco. 958pp.
9. Tortora, G.J., Funke, B.R., Case, C.L. (2008). Microbiology - An Introduction, 10th edition. Pearson Education.
10. Voet and Voet, (2016). Biochemistry, 5th edition. John Wiley and Sons, New York.
11. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2008). Prescott, Harley, and Klein's microbiology. 7th edition. New York: McGraw-Hill Higher Education.

Acharya Bangalore B-School

AUTONOMOUS Affiliated to Bangalore University

PROGRAM NAME : B.Sc.

TITLE OF THE COURSE : MICROBIAL BIOCHEMISTRY AND PHYSIOLOGY PRACTICAL

SEMESTER : II SEMESTER

COURSE CODE : BSC23M2P1

CREDITS : 2

TOTAL NO. OF TEACHING HOURS: 28 HOURS – 4 HOURS/WEEK

1. Preparation of normal and molar solutions.
2. Calibration of pH meter and determination of pH of natural samples.
3. Preparation of buffer solutions (any 4).
4. Qualitative analysis of carbohydrates.
5. Qualitative analysis of amino acids and proteins.
6. Qualitative analysis of lipids.
7. Estimation of reducing sugar by DNS method.
8. Estimation of protein by Lowry's method.
9. Determination of saponification values and iodine number of lipids/fatty acids.
10. Determination of bacterial growth by turbidometric method & calculation of generation time.
11. Effect of pH, temperature and salt concentration on bacterial growth.
12. Demonstration of aerobic and anaerobic respiration in microbes.

Pedagogy: Lectures, Practical hands-on, videos, Assignments and test.

Formative Assessment	
Assesement Occasion	**Weightage in Marks**
Test	10
Participation in class & Attendance	10
Record	05
Total	**25 Marks**

Acharya Bangalore B-School

AUTONOMOUS Affiliated to Bangalore University

PROGRAM NAME : OPEN ELECTIVE

TITLE OF THE COURSE : APPLICATIONS OF MICROBIOLOGY

SEMESTER : II SEMESTER

COURSE CODE : OET2MB1

CREDITS : 3

TOTAL NO. OF TEACHING HOURS : 42 HOURS – 3 HOURS/WEEK

MODULE 1: Soil and Air Microbiology 14 HOURS

Soil and air as a major component of environment. Types, properties and uses of soil and air. Distribution of microorganisms in soil and air. Major types of beneficial microorganisms in soil. Major types of harmful microorganisms in soil.

MODULE 2: Water Microbiology 14 HOURS

Water as a major component of environment. Types, properties and uses of water. Microorganisms of different water bodies. Standard qualities of drinking water

MODULE 3: Microbial Diseases and Control 14 HOURS

Public health hygiene and communicable diseases. Survey and surveillance of microbial infections. Air borne microbial diseases, water borne microbial diseases, Food borne microbial infections. Epidemiology of microbial infections, their detection and control.

Pedagogy: Lectures, Presentations, videos, Assignments and test.

Formative Assessment	
Assesement Occasion	**Weightage in Marks**
Test	20
Seminar/Presentation	10
Assignment	05
Participation in class/Attendance	05
Total	**40 Marks**

ESSENTIAL READINGS:

1. Black, J.G. (2008). Microbiology principles and explorations. 7th edition. John Wiley and Sons Inc., New Jersey. 846pp.

2. Dubey, R.C. & Maheshwari, D.K. (2022). A Textbook of Microbiology, 5th edition, S. Chand & Company Ltd.

3. Madigan, M.T., Martinko J.M., Dunlap P.V., & Clark D.P. (2009). Brock Biology of Microorganisms, 12th edition, Pearson International edition Pearson Benjamin Cummings.

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1. Michael Pelczar, Jr., Chan E.C.S. & Noel Krieg. (2023). Microbiology - Concepts and Applications, 5th edition. International ed, McGraw Hill.
2. Pommerville, J.C. 2013. Alcamo's Fundamentals of Microbiology. Jones and Bartlett.
3. Stanier, Ingraham. (2008). General Microbiology, 5th edition. Macmillan education limited. International, edition 2008, McGraw Hill.
4. Talaro, K.P. (2009). Foundations in Microbiology, 7th edition. McGraw Hill.
5. Toratora, G.J., Funke, B.R. and Case, C.L. (2007). Microbiology. 9th edition. Pearson Education Pvt. Ltd., San Francisco. 958pp.
6. Tortora, G.J., Funke, B.R., Case, C.L. (2008). Microbiology - An Introduction, 10th edition. Pearson Education.

Acharya Bangalore B-School
AUTONOMOUS Affiliated to Bangalore University

PROGRAM NAME	**: Bachelor of Science**
TITLE OF THE COURSE	**: Microbiological Methods**
COURSE CODE	**: BSC23T2C1**
SEMESTER	**: II Semester**
CREDITS	**: 4**
TOTAL NO. OF TEACHING HOURS	**: 56 hours - 4 hours/week**

Course Objectives: Comprehensive understanding microbiological instrumentation, sterilization techniques, culture techniques and assessment of antimicrobial agents and their modes of action.

Course Outcomes:

By the end of this course student would be able to:

CO1: Explain the principles of various microscopes and analytical techniques.

CO2: Demonstrates different forms of sterilization techniques.

CO3: Explain the culturing of various microbial strains, preservation and staining techniques.

CO4: Examine the antimicrobial activity of agents by various methods**.**

CO5: Outlines the microbial techniques to evaluate the antimicrobial properties.

BSC23T2C1: MICROBIOLOGICAL METHODS

COURSE CONTENT

MODULE 1: Historical development of Microbiology & Instrumentation 14 HOURS

General Introduction to Microbiology: Scope and relevance of microbiology, Contributions of Antony van Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Edward Jenner, Alexander Fleming, Martinus Beijerinck, Sergei Winogradsky and Elie Metchnikoff, General characteristics of microbes.

Microscopy: Principles of Microscopy-resolving power, numerical aperture, working principle and applications of light, compound microscope, Dark field microscope, Phase contrast microscope, Fluorescence microscope, confocal microscope. Electron microscopes - TEM and SEM.

Analytical techniques: Working principle and applications: centrifuge, ultracentrifuge, colorimeter, spectrophotometer, chromatography: paper, TLC and Column (adsorption, gel-filtration, ion exchange, affinity), HPLC, GC.

MODULE 2: Sterilization techniques 14 HOURS

Definition of terms - sterilization, disinfectant, antiseptic, sanitizer, germicide, microbicidal agents, micro biostatic agents and antimicrobial agents.

Physical methods of control: Principle, construction and applications of moist heat sterilization, Boiling, Pasteurization, Fractional sterilization - Tyndallization and autoclave. Dry heat sterilization – Incineration and hot air oven.

Filtration: Diatomaceous earth filter, Seitz filter, membrane filter and HEPA;

Radiation: Ionizing radiation – γ-rays and non-ionizing radiation – UV rays.

Chemical methods: Alcohols, aldehydes, phenols, halogen, metallic salts, Quaternary ammonium compounds and sterilizing gases as antimicrobial agents.

MODULE 3: Microbiological techniques 14 HOURS

Culture Media: Components of media, natural and synthetic media, simple, complex, selective, differential, indicator, transport, enriched and enrichment media.

Pure culture methods: Serial dilution and plating methods (pour, spread, streak); cultivation – aerobic & anaerobic bacteria.

Microbial growth and its measurements: Growth curve, enumeration methods (turbidity, cell counting, colony counting.

Preservation of microorganisms: Methods of preservation - slant culture, stab culture, soil culture, mineral oil overlaying, glycerol preservation, Lyophilization, stocking of pure cultures; Culture collection centers.

Stains and staining techniques: Principles of staining, Types of stains-simple, structural (cell wall, flagella, capsule and endospore) and differential staining (Gram's and Acid fast).

MODULE 4: Antimicrobial agents and assessment of antimicrobial activity 14 HOURS

Modes of action of antimicrobial agents:

Antifungal agents; Amphotericin B, Griseofulvin. **Antiviral agents;** Amantadine, Acyclovir, Azido thymine, **Antibacterial agents;** Plazomicin, Ervacycline, Omad cyclin and imipenum Challenges in antimicrobial therapy; Emergence of resistance (MDR, XDR)

Assessment of antimicrobial activity: Antibacterial- Disc and agar well diffusion techniques, Microdilution method, Zones of inhibition, MBC, Determination of IC 50. Antifungal- Determination of MFC, Time kills kinetics assay, sorbitol assay, Antiviral- CPE, virus yield reduction assay, TCID, Neutralization assay, Hemagglutination inhibition.

Formative Assessment – 40 Marks; **Summative Assessment** – 60 Marks	
Formative Assessment	
Pedagogy: Lectures, Presentations, videos, Assignments and Internal tests	
Continuous Internal Assessment type	**Weightage in marks**
Internal test	20
Seminar/Presentation	10
assignment	05
Attendance	05
Total	**40 Marks**

Essential Reading:

1. Fundamentals of Light Microscopy and Electronic Imaging by Douglas B.
2. Murphy Principles and Practice of Analytical Chemistry by F. W. Fifield and David Kealey
3. Instrumental Methods of Analysis by Willard, Merritt, Dean, and Settle
4. Microbiology: Principles and Explorations by Jacquelyn G. Black
5. Disinfection, Sterilization, and Preservation by Seymour S. Block
6. Manual of Clinical Microbiology by James H. Jorgensen and Michael A. Pfaller
7. Laboratory Techniques in Microbiology and Immunology" by W. John Hunter
8. Laboratory Techniques in Microbiology and Immunology" by W. John Hunter
9. Methods for Dilution Antimicrobial Susceptibility Tests for Bacteria That Grow Aerobically" (CLSI standard M07)

References:

1. Atlas, R.M. 1997. Principles of Microbiology. 2nd edition. WM.T. Brown Publishers.
2. Black, J.G. 2008. Microbiology: Principles and Explorations. 7th edition. Prentice Hall Bull, A.T. 1987. Biotechnology, International Trends of perspectives.
3. Cappucino, J. and Sherman, N. 2010. Microbiology: A Laboratory Manual. 9thedition. Pearson Education Limited.
4. Frobisher, Saunders and Toppan 1974. Fundamentals of Microbiology Publications Madigan, M.T, and Martinko, J.M. 2014. Brock Biology of Micro-organisms. 14th edition. Parker J. Prentice Hall International, Inc.
5. Paul A. Ketchum, 1988. Microbiology, Concepts and applications, Wiley Publications.
6. Pelczar Jr M.J., Chan, E.C.S. and Krieg, N.R. 2004. Microbiology. 5th edition Tata McGraw Hill.
7. Salley, 1984. Fundamentals of Bacteriology, Tata McGraw Hill Education.
8. Singh, R.B. 1990. Introductory Biotechnology, C.B.D. India
9. Srivastava, S and Srivastava, P.S. 2003. Understanding Bacteria. Kluwer Academic Publishers, Dordrecht.
10. Stanier, R.Y., Ingraham, J.L., Wheelis, M.L. and Painter, P.R. 2005. General Microbiology. 5th edition McMillan.
11. Tortora, G.J., Funke, B.R. and Case, C.L. 2008. Microbiology: An Introduction. 9th edition Pearson Education.
12. Willey, J.M., Sherwood, L.M. and Woolverton, C.J. 2013. Prescott's Microbiology. 9th edition. McGraw Hill Higher Education.

Acharya Bangalore B-School

AUTONOMOUS Affiliated to Bangalore University

PROGRAM NAME **: Bachelor of Science**

TITLE OF THE COURSE **: Microbiological Methods Practical**

COURSE CODE **: BSC23T2P1**

SEMESTER **: II Semester**

CREDITS **: 2**

TOTAL NO. OF TEACHING HOURS **: 28 hours**

1. To study the principle and applications of important instruments (biological safety cabinets, autoclave, incubator, BOD incubator, hot air oven, colony counter, membrane filter, light microscope, pH meter) used in the microbiology and biotechnology laboratory.
2. Sterilization of media using autoclave and assessment for sterility.
3. Sterilization of glass wares using hot air oven and assessment for sterility.
4. Sterilization of heat sensitive material by membrane filtration and assessment for sterility.
5. Preparation of culture media for bacteria, fungi and their cultivation.
6. Plating techniques: Spread plate, pour plate and streak plate.
7. Isolation of bacteria and fungi from soil, water and air.
8. Study of *Rhizopus*, *Penicillium*, *Aspergillus* using temporary mounts.
9. Colony characteristics study of bacteria from air exposure plate.
10. Staining techniques: Bacteria – negative, gram's, capsule, endospore staining and Fungi – Lactophenol cotton blue staining.
11. Water analysis – MPN test.
12. Biochemical Tests – IMViC, starch hydrolysis, catalase test, gelatin hydrolysis.
13. Bacterial cell motility – hanging drop technique

Formative Assessment – 25 Marks; **Summative Assessment** – 25 Marks	
Formative Assessment	
Pedagogy: Lectures, Presentations, Videos, Assignments and Internal test	
Assessment Occasion	**Weightage in marks**
Internal test (one)	10
Assignment (Monographs)	05
Class participation	05
Attendance	05
Total	**25**

Annexure - 4

Acharya Bangalore B-School

AUTONOMOUS Affiliated to Bangalore University

PROGRAM NAME:	**Open Elective**
TITLE OF THE COURSE:	**Applications of Biotechnology**
COURSE CODE:	**OET2BT1**
SEMESTER :	**II Semester**
CREDITS:	**3**
TOTAL NO. OF TEACHING HOURS:	**42 hours – 3 hours/week**

MODULE 1: Agricultural Biotechnology **14 HOURS**

Soil and air as a major component of environment. Types, properties and uses of soil and air. Distribution of microorganisms in soil and air. Major types of beneficial microorganisms in soil. Major types of harmful microorganisms in soil.

MODULE 2: Transgenic plants **14 HOURS**

The GM crop debate – safety, ethics, perception and acceptance of GM crops,GM crops case study: Bt-cotton, Bt-brinjal Plants as bio-factories for molecular pharming: edible vaccines, plantibodies,nutraceuticals.

MODULE 3: Biopesticides **14 HOURS**

Baculovirus pesticides, Myco pesticides, post-harvest protection: Antisense RNA technology for extending shelf life offruits and shelf life of flowers. Genetic Engineering for quality improvement: Seed storage proteins, Flavours -capsaicin, vanillin

Formative Assessment – 40 Marks; **Summative Assessment** – 60 Marks	
Formative Assessment	
Pedagogy: Lectures, Presentations, videos, Assignments and Internal tests	
Continuous Internal Assessment type	**Weightage in marks**
Internal test	20
Seminar/Presentation	10
Assignment	05
Attendance	05
Total	**40 Marks**

References

1. Chrispeels, M.J. et al. 1994. Plants, Genes and Agriculture-Jones and BartlettPublishers, Boston.
2. Gamborg, O.L. and Philips, G.C. 1998. Plant cell, tissue and organ culture (2nd ed.)Narosa Publishing House. New Delhi.
3. Gistou, Pand Klu, H. 2004. Hand book of Plant Biotechnology (Vol.I &

II). JohnPublication.
4. Hammound, J.P McGravey and Yusibov. V. 2000. Plant Biotechnology, Springerverlag.
5. Heldt. 1997. Plant Biochemistry and Molecular Biology. Oxford and IBH PublishingCo. Pvt. Ltd. Delhi.
6. Lydiane Kyte and John Kleyn. 1996. Plants from test tubes. An introduction to Micropropagation (3rd ed.). Timber Press, Portland.
7. Murray, D.R. 1996. Advanced methods in plant breeding and biotechnology. PanimaPublishing Corporation.
8. Nickoloff, J.A. 1995. Methods in molecular biology, Plant cell electroporation andelectro fusion protocols – Humana pressin corp, USA.
9. Sawahel, W.A. 1997. Plant genetic transformation technology. Daya PublishingHouse, Delhi.