

Khandesh College Education Society's

Moolji Jaitha College, Jalgaon

**An "Autonomous College" Affiliated to
KBC North Maharashtra University, Jalgaon**



ESTD. 1945

SYLLABUS

Biochemistry

S.Y.B. Sc.

(Semester III & IV)

Under Choice Based Credit System (CBCS)

[w. e. f. Academic Year: 2020-21]

Course Structure: S.Y. B.Sc. (Biochemistry)

Duration: The duration of B.Sc. (Biochemistry) degree program shall be three years.

Semester	Course Module	Subject code	Title of Paper	Credit	Hours per week
III	DSC	BC-231	Food biochemistry	2	2
	DSC	BC-232	Human physiology-I	2	2
	DSC	BC-233	Practical course based on BC-231 and BC-232	2	4
	SEC	BC-230	Microbial isolation and identification techniques-I	2	2
IV	DSC	BC-241	Environmental biochemistry	2	2
	DSC	BC-242	Human physiology-II	2	2
	DSC	BC-243	Practical course based on BC-241 and BC-242	2	4
	SEC	BC-240	Microbial isolation and identification techniques-II	2	2

DSC : Discipline Specific Elective Core Course

SEC : Skill Enhancement Course

BC-YSC : Biochemistry (Y-year; S-Semester; C-Course number)

Examination Pattern:

Examination	Marks
External Marks	40
Internal Marks	10
Total Marks	50

S.Y. B.Sc. (Biochemistry): Semester III
BC-231: Food biochemistry

Total Hours: 30

Credits: 2

Course objectives

- To accustom students with basic concepts of Food Biochemistry
- To study different types of food adulteration
- To study various types of food spoilage and food preservation methods

Course outcomes

Student will be able to-

- Calculate energy value of food and its measurement
- Explain food adulteration and its types
- Understand food spoilage, food allergy and food additives
- Discuss various methods of food preservation

Unit I : Energy Value of Food and Its Measurement

8h

- Nutritive value of different foods: cereals and millets, pulses, nuts and oils, vegetables, fruits, milk and milk products, eggs, meat, fish and other animal foods, fats and oils, sugar and other carbohydrate food, condiments and spices
- Classification of food based on function: energy yielding, body building and protective food
- Five food group plan as per ICMR
- Energy value of food: carbohydrate, protein, lipid
- Energy unit: calorie, kilo calorie, Joule, mega Joule
- Physiological energy value of food: loss in digestion and metabolism
- Determination of energy value using Bomb calorimeter
- Respiratory quotient: definition, RQ for carbohydrate, fat and protein
- Relation between RQ and energy output
- Specific dynamic action of food (SDA)
- Basal Metabolic Rate: definition, determination, factors affecting BMR
- Recommended dietary allowance: definition, factors affecting RDA, RDA for adult man

Unit II : Food Adulterations and Food Spoilage

8h

- Adulteration: Definition, types- Intentional and incidental
- Common adulterants in different foods: Milk and Milk product, vegetable oils, and fats, wheat products, pulses, honey, beverages, spices and condiments, miscellaneous.
- Food spoilage, factors determining food spoilage- intrinsic, extrinsic modes of processing and preservation, implicit parameters
- Micro-organisms involved in food spoilage and food intoxication: bacteria, yeast, molds, and fungi
- Food spoilage by enzymes, and insect.

- Chemical spoilage: lipid oxidation, enzymatic oxidation, lipolysis, discoloration
- Contamination of food with metals
Parasitic infection, toxicants naturally occurring in some food, insect and rodent contamination of stored food.

Unit III : Food preservation and food laws

7h

- Food preservation: Concept and principle
- Methods of food preservation:
 - Preservation by low temperature: freezing, chilling/cold storage/refrigeration
 - Preservation by high temperature: heating below 100°C (pasteurization), heating at 100°C, heating above 100°C
 - Preservation by drying: conventional air drying, microwave drying, osmotic dehydration, freeze drying, mechanical drying, spray drying, foam-mat drying, drying by smoking.
 - Irradiation: Types- radiation sterilization, radurization, radicidation, thermoradiation; ionizing radiation used for food irradiation- electron beam, x-rays, gamma rays and UV; uses of food irradiation, effect of ionizing radiation on nutrients of food
 - Chemicals: acids and their salts, nitrites, NaCl, sulphites, dimethyl dicarbonate, phenolic antioxidants, phosphate
- Food laws and standards: Prevention of food adulteration act 1954; Bureau of Indian Standards, Agmark, Consumer protection act 1986, Hazard analysis critical control point (HACCP)

Unit IV : Food additives, food allergy and diet modification

7h

- Food additives: Concept, importance of food additives,
- Examples of food additives: antimicrobial agents, antioxidants, colour and adjuncts, emulsifiers, flavor enhancers, enzymes, sweeteners, non-nutritive and nutritive additives, propellants, aerating agents and gases.
- Food allergy: Concept, classification immediate and delayed allergy. Clinical signs and symptoms.
- Food as allergen: Animal origin - cow milk, goat milk, egg, fish, meat. Plant origin: cereals, soybean, peanut, other legumes, edible fungi, fats, oils, vegetables, fruits and beverages.
- Detection of food allergy: history taking, diet diaries, elimination diet, provocative diet, pulse acceleration test, leukopenic index, x-ray, skin testing.
- Therapeutic diet / diet modification in diseases: Definition and types of therapeutic diet.
- Concept and significance of balanced diet.
- Representative diets in: diabetes mellitus, cardio vascular diseases, anemia with brief rationale for each type of diet.

References

1. Simpson B. K. (2012). Food Biochemistry and Processing, 2nd edition, John Wiley & Sons, Inc.
2. Michael Eskin N.A., Shahidi F. (2012). Biochemistry of Food, 3rd edition, Academic Press
3. Yildiz F. (2017). Advances in Food Biochemistry, 1st edition, CRC press.
4. Brody T. (1998). Nutritional Biochemistry, 2nd edition, Academic Press.
5. Alais C. (2012). Food Biochemistry, Springer Science & Business Media
6. Swaminathan M. (1998). Essentials of food and Nutrition. Vol I, II, 2nd edition, The Bangalore Printing and Publishing Co. Ltd.
7. Srilakshmi B. (2006). Food Science 3rd edition, New Age International Pvt. Ltd Publishers.
8. Vijaya Ramesh K. (2009). Food Microbiology MJP Publishers.
9. Mirajkar M. and Menon S. (2010). Food Science and Processing Technology, Vol.2 Commercial Processing and Packaging, Kanishka Publishers.
10. Swaminathan M. (2018). Handbook of food & Nutrition, The Bangalore Printing and Publishing Co. Ltd.
11. Satyanarayana U. (2006). Biochemistry, 3rd edition, Chakrapani. U. (ed.) Books and Allied (P) Ltd

Teaching methods:

- Classroom teaching, Lecture method, ICT enabled teaching

S.Y. B.Sc. (Biochemistry): Semester III BC-232: Human physiology-I

Total Hours: 30

Credits: 2

Course objectives

- To study human digestive system
- To study human respiratory system
- To study human circulatory and excretory system

Course outcomes

Student will be able to-

- Understand histology and anatomy of various organs of digestive system
- Explain structure and functions of various parts of respiratory system
- Learn various types of hematopoiesis, mechanism of blood coagulation
- Understand mechanism of urine formation

Unit I: Digestive System

8h

- Digestive system: Structure and functions. Histology of alimentary tract.
- Structure and functions of different parts of digestive system: Esophagus, stomach, small intestine, large intestine.

- Structure and functions of accessory digestive organs: Salivary glands, liver, Gallbladder, pancreas.
- Composition and functions of digestive juices: Saliva, gastric juice, pancreatic juice, intestinal juice (succus entericus), bile.
- Gastrointestinal hormones: Gastrin, Cholecystikin pancreaticozym, secretin and gastricinhibitory peptide, motilin.
- Digestion and absorption of carbohydrate, protein and lipid.
- Absorption of water and electrolytes.

Unit II: Respiratory system

7h

- General structure of respiratory system. Structure and functions of trachea and lungs.
- Physical properties of lungs: surface tension, elasticity, lung volume and lung capacity.
- Respiration: Definition and functions. Mechanism of respiration/breathing: inspiration and expiration concerning diaphragm, intercostal muscle, sternum, ribs, accessory muscles.
- Respiratory process: Oxygen transport: oxygen exchange in lungs and transport in tissue, dissociation curve for hemoglobin and factors affecting it - CO₂ concentration (Bohr's effect and significance), pH, temperature, 2,3-diphosphoglycerate. Carbon dioxide transport: chemical forms in which CO₂ transports, CO₂ transport in tissue (Chloride shift), in RBCs and as carbamino compounds.
- Control of respiration: Nervous and chemical factors controlling respiration

Unit III : Circulatory system

8h

- Composition and functions of blood and plasma. Plasma proteins: specific plasmaproteins (albumins, globulins, carrier proteins, acute phase proteins) and their functions.
- Structure, functions and life span of RBCs, WBCs and platelets.
- Hematopoiesis: Erythropoiesis, granulocytopoiesis, lymphocytopoiesis and Thrombocytopoiesis.
- Hemoglobin: Structure, types (HbA, HbF, HbS) and functions.
- Blood coagulation: Definition, blood clotting factors, extrinsic and intrinsic pathways. Blood coagulation tests: Bleeding time, clotting time, prothrombin time. Blood groups: A, B, O and Rh factor, cross matching, compatibility. Blood transfusion.
- Lymphatics and lymph: Description, properties, formation and functions of lymph.

Unit IV: Excretory System

7h

- Organization of urinary tract.
- Anatomy and functions of kidney.
- Structure and functions of nephron.
- Urine formation: glomerular filtration, tubular reabsorption and tubular secretion. Counter current multiplication theory of urine concentration.
- Characteristics of urine: volume, colour, reaction, specific gravity, turbidity, odour, osmotic pressure. Normal and abnormal constituents of urine.
- Role of kidney in fluid and acid-base balance.

References

1. Sherwood L. (2010). Human Physiology: From Cells to Systems, 7th edition, Brooks/Cole, Cengage Learning
2. Silverthorn D. U. (2015). Human Physiology: An Integrated Approach, 7th edition, Pearson
3. Chatterjee C.C. (2004). Human Physiology, Vol. I, II, 11th edition, Medical Allied Agency.
4. Guyton A. C. and Hall J. E. (2001). Textbook of Medical physiology, 10th edition, Harcourt Publisher International Company.
5. Talwar G.P. and Srivastava L. M. (2006). Text Book of Human Biochemistry, 3rd edition, Prentice Hall of India Pvt. Ltd.
6. Marieb Elaine N. (1996). Essentials of Human Anatomy and Physiology, 9th edition, Pearson International Edition.
7. Stuart I. F. (1996). Human Physiology, 5th ed, Brown Publisher.
8. Murray R. K., Granner D. K. and Rodwell V. W. (2006). Harper's Illustrated Biochemistry, 27th Edition, McGraw Hill Publisher.
9. Suresh R. (2013). Essentials of Human Physiology, Books and Allied (P) Ltd, Kolkata.
10. Chaudhari. S. K. (2014). Concise Medical Physiology, 6th editon, New Central Book Agency Pvt. Ltd. London.
11. Das A. (2006). Medical Physiology, 4th edition, Books and Allied (P) Ltd, Kolkata.

Teaching methods:

- Classroom teaching, Lecture method, ICT enabled teaching

S.Y. B.Sc. (Biochemistry): Semester III **BC-233: Practical course based on BC-231 and BC-232**

Total Hours: 60

Credits: 2

Course objectives

- To acquaint students with various hematological techniques
- To perform food biochemistry related practical
- To execute microbial isolation and staining techniques

Course outcomes

Students will be able to:

- Enumerate RBCs and WBCs and determine blood groups and understand its clinical significance
- Identify adulterants present in food stuffs
- Determine various food parameters: rancidity, moisture content etc.
- Perform isolation, staining and size determination techniques of micro-organisms

Sr. No.	Title of the Practical	Hours
1.	Enumeration of RBCs and WBCs for determining health status.	4
2.	Determination of blood groups (A, B, AB, O and Rh) and its significance	4
3.	Determination of gastric juice acidity	4
4.	Qualitative analysis of some common food adulterants: Pulses, oil, fats, milk and milk products, beverages, spices and condiments.	4
5.	Determination of rancidity in edible oil and its applications.	4
6.	Microbial examination of food.	4
7.	Determination of moisture content in food sample.	4
8.	Isolation and colony morphology study of microorganism	4
9.	Capsule staining of micro-organisms	4
10.	Determination of microorganism size by micrometry	4

Note: Mandatory to perform any 08 of the above

References

1. Aneja K. R. (2007). Experiments in microbiology, plant pathology and biotechnology, New age international publishers.
2. Kale V. and Bhusari K. (2010). Practical Microbiology: Principles and Techniques, Himalaya Publishing House.
3. Godkar P. B. and Godkar D. P. (2003). Textbook of Medical Laboratory Technology, 2nd Edition, Bhalani Publishing House.
4. Rajgopal G. and Toora B. D. (2005). Practical Biochemistry, 2nd edition, Ahuja Publishing House.
5. Maheshwari D. K. (2002). Practical Microbiology, S. Chand Publishing, New Delhi
6. Rajan S. and Christy Selvi R. (2015). Experimental Procedures in Life Sciences, CBS Publishers and Distributors Pvt. Ltd.

Teaching methods:

- Laboratory method, Lecture cum demonstration methods

S.Y. B.Sc. (Biochemistry): Semester III

BC-230: Microbial isolation and identification techniques - I

Total Hours: 30

Credits: 2

Course objectives

- To familiarize students with various media used for microbial isolation
- To study various microbial morphological techniques
- To explore various microscopic techniques

Course outcomes

Students will be able to:

- Understand various types of media used for microbial isolation
- Measure microbial growth by various methods
- Study microbial morphology by various staining techniques
- Understand micrometry techniques used for microbial size measurement

Unit I: Microscopic techniques

8h

- Principle, instrumentation and applications of light microscope:
 - Lenses and the bending of light
 - Microscopic resolution
 - Bright-field microscope
 - Dark-field microscope
 - Phase contrast microscope
 - Fluorescence microscope
 - Inverted microscope
- Electron microscopy- Principle, instrumentation and applications:
 - Transmission Electron Microscope (TEM)
 - Scanning Electron Microscope (SEM)

Unit II: Isolation of microorganisms

7h

- Types of media: Culture Media- solid and broth, selective, differential and enrichment media.
- Media used for isolation of microorganisms like bacteria, fungi, actinomycetes, yeasts and cyanobacteria.
- Characteristic of bacteria, fungi, actinomycetes, yeasts and cyanobacteria.
- Isolation techniques: Concept of isolation techniques: streak plate method, pour plate method, spread plate methods and anaerobic bacterial isolation by candle jar method and fungi isolation by slide culture technique.

Unit III: Microbial growth measurement

7h

- Methods of measurement of Microbial Growth:

- a) Direct Counts :
 - Counting chambers
 - Electronic counters – flow cytometry on membrane filters.
- b) Viable Counting Methods:
 - Spread plate techniques
 - Pourplate techniques
 - Membrane filter technique
 - Turbidity
 - Most Probable Number (MPN).
- c) Measurement of cell mass:
 - Dry weight analysis,
- d) Measurement of cell components

Unit IV: Morphological characteristics and Staining of microorganisms

8h

- Bergey's Manual: Introduction
- Morphological characteristic of microorganisms: Form, Size, Elevation, Margin/border, Surface, Opacity, Colour
- Staining techniques: principles and procedures (Gram staining, acid fast staining, spore staining, capsule staining, Flagella staining, cell wall staining, metachromatic granules staining). Fungi: Lacto phenol cotton blue, arbuscular mycorrhizal staining.
- Measure the size of microorganisms by micrometry by using Ocular micrometer and stage micrometer.

References

1. Madigan M. T., Bender K. S., Buckely D. H., Sattley W. M., Stahl D. A. (2018). Brock Biology of Microorganisms, NY Pearson publisher.
2. Talaro K. P. and Chess B. (2000). Foundations In Microbiology 3rd edition, Mc Graw Hill.
3. Tortora G. J., Funke B. R., Case C. L. (2004). Microbiology An Introduction, 8th edition, pearson Benjamin-Cummings Pub Co.
4. Pelczar M. Jr. (2001). Microbiology, Indian edition, Mc Graw Hill.
5. Willey J., Sherwood L., Woolverton C. J. (2017). Prescott's Microbiology, 10th edition, Mc Graw Hill.
6. Modi, H. A. (1995). Elementary Microbiology, VolI, Ekta Prakashan, Nadiad
7. Aneja K. R. (2007). Experiments in microbiology, plant pathology and biotechnology, New age international publishers.
8. Kale V. and Bhusari K. (2010). Practical Microbiology: Principles and Techniques, Himalaya Publishing House.
9. Rajgopal G. and Toora B. D. (2005). Practical Biochemistry, 2nd edition, Ahuja Publishing House.
10. Maheshwari D. K. (2002). Practical Microbiology, S. Chand Publishing.
11. Rajan S. and Christy S. R. (2015). Experimental procedures in Life Sciences, CBS Publishers and Distributors Pvt Ltd.

Teaching methods:

- Classroom teaching, Lecture method, ICT enabled teaching

S.Y. B.Sc. (Biochemistry): Semester IV

BC-241: Environmental biochemistry

Total Hours: 30

Credits: 2

Course objectives

- To study types of pollutions and pollutants
- To explore the concept of bioenergy
- To study biodegradation and bioremediation

Course outcomes

Students will be able to:

- Understand the concept of pollution and pollutants
- Understand the concept of bioenergy
- Explain biodegradation and bioremediation
- Understand mode of action of pesticides and its impact on environment

Unit I: Pollution and environmental problems

8h

- Pollution: Concept and introduction of pollution and pollutants.
- Introduction, effect and control of; water pollution, land pollution, noise pollution and air pollution.
- Greenhouse effect and global warming. Greenhouse gases. Measures to control greenhouse effect.
- Ozone layer: Importance of ozone layer. Depletion of ozone, ozone hole, effects of ozone depletion. Measures to control ozone depletion.
- Acid rain: Introduction, effects and measures to control acid rain.

Unit II: Bioenergy

7h

- Bioenergy: Introduction. Biomass for energy production: Concept, chemical nature, sources, utilization.
- Biogas: Introduction, substrates, process, microbial production of biogas, factors affecting biogas production, advantages. Limitations for large scale production.
- Introduction to hydrogen as a biofuel. Production of bio-hydrogen by photosynthetic bacteria and fermentation.
- Energy rich crops: Sugar and starch crops, wood rich plants and petroleum plants.

Unit III: Biodegradation and bioremediation

7h

- Xenobiotics: Concept
- Biodegradation: Concept, microorganisms for biodegradation and bioremediation. Enzyme system for biodegradation. Factors affecting biodegradation.
- Bioremediation: Concept, types, advantages and disadvantages. Types of reaction in bioremediation.
- Bioremediation of contaminated soil, waste land and ground water

Unit IV: Environmental toxicology

8h

- Toxins: Concept and types. Introduction, sources and remedies of metal toxins (arsenic, mercury).
- Pesticides: Introduction, classification on the basis of mode of entry, mode of action and chemical nature. Application of pesticides. Environmental effects of pesticides.
- Impact of pesticide on organisms.
- Bio and chemical warfare agents: Anthrax, plague, small pox, sarin, chlorine, hydrogen cyanide, Sulphur mustard, lewisite and ricin

References

1. Hamilton E. (2017). Environmental Biochemistry, Larsen and Keller Education.
2. Krauss G-J., Nies D. H. (2015). Ecological Biochemistry: Environmental and Interspecies Interactions, Wiley-Blackwell
3. Sterner O. (2010). Chemistry, Health and Environment, 2nd edition, Wiley-Blackwell
4. Harborne J. (2014). Introduction to Ecological Biochemistry, 4th edition, Academic Press
5. Ibanez J. G., Hernandez-Esparza, M., Doria-Serrano, C., Fregoso-Infante, A., Singh, M. M. (2007). Environmental Chemistry: Fundamentals, Springer.
6. Satyanarayana U. (2009). Biotechnology, Books and Allied (P) Ltd., Kolkata.
7. Santra S.C. (2010). Environmental Science, New Central Book Agency (P) Ltd, Kolkata.
8. De A. K. (2010). Environmental Chemistry, 7th edition, New Age International Publishers, New Delhi.
9. Jogdand S.N. (2005). Environmental Biotechnology, 2nd edition, Himalaya Publishing House, Mumbai.
10. Rana A. K. and Rana M. K. (2011). Environment and Ecology, Global Vision Publishing House, New Delhi.
11. Saha T. K. (2014). Ecology and Environmental Biology, Books and Allied (P) Ltd, Kolkata.
12. Satake M., Mido Y., Yasuhisa H., Taguchi S., Sethi M. S. and Iqbal S. A. (1997). Environmental Toxicology, Discovery Publishing House, New Delhi.

Teaching methods:

- Classroom teaching, Lecture method, ICT enabled teaching

S.Y. B.Sc. (Biochemistry): Semester IV BC-242: Human physiology-II

Total Hours: 30

Credits: 2

Course objectives

- To study human nervous and reproductive system
- To study human endocrine system
- To study biochemistry various specialized tissues

Course outcomes

Students will be able to:

- Discuss mechanism of synaptic transmission
- Learn molecular events during fertilization
- Explain mechanism of hormone action
- Understand mechanism of taste perception and olfaction

Unit I : Nervous system

8h

- Nervous system: Introduction to central and peripheral nervous system.
- Peripheral nervous system: Cranial and spinal nerves. General structure of nerve.
- Nervous tissue: Structure, functions and types of neurons (uni-, di- and multi-polar, myelinated and non-myelinated).
- Synapse: Definition, classification, properties, types (structural basis: axo-dendritic, axoaxonic, axo-somatic; functional basis- chemical and electrical synapse). Mechanism of synaptic transmission.
- Neurotransmitters: Definition. Structure and functions of excitatory and inhibitory neurotransmitters.
- Reflex action: Definition, types (conditioned and unconditioned).
- Reflex arc: Definition, components and types.

Unit II: Reproductive system

8h

- Male reproductive system: Anatomy. Histology and functions of testis. Structure of sperm, spermatogenesis, hormonal control of spermatogenesis. Semen. Accessory glands: seminal vesicles, prostate, bulbourethral gland.
- Female reproductive system: Anatomy and histology. Ovary: anatomy, histology and functions. Maturation of Graafian follicle and ovum. Menstrual cycle. Oogenesis and its hormonal regulation.
- Hormones secreted by gonads: Chemistry and functions of androgen, testosterone, estrogen and progesterone.
- Fertilization: Definition and molecular events during fertilization

Unit III : Endocrine system

7h

- Endocrine system: Introduction to endocrine and exocrine glands.
- Hormones: Concept and definition,
- General characteristics of hormones: action in low concentration, storage, destruction and excretion, rate limiting action, dual control, multiple secretion, chemical nature, inter-relation of endocrines, inter-relation with vitamin, dysfunction of endocrine glands, therapeutic administration of hormones.
- General properties of hormones: solubility, molecular weight, diffusion, cumulative action.
- Mode of action of hormones: Endocrine, paracrine and autocrine.
- Molecular mechanism of hormone action: protein, peptide, lipid/steroid hormones.
- Pituitary gland: Anatomy: adenohypophysis and neurohypophysis. Functions of growth hormone, prolactin, FSH, LH, TSH, ACTH, MSH, vasopressin and oxytocin.

- Thyroid gland: Anatomy and histology. Thyroid hormones and their functions (T₃, T₄ and thyroxine). Parathyroid gland: anatomy and histology. Functions of parathormone.
- Endocrine pancreas: Anatomy and histology. Functions of insulin and glucagon.
- Adrenal gland: Anatomy and histology. Functions of epinephrine, nor-epinephrine, gluco-corticoid, mineral-corticoid, sex hormones/sex steroid.
- Pineal gland: Anatomy and histology. Functions of melatonin.

Unit IV: Biochemistry of specialized tissue and receptors

7h

- Taste (gustation): Histology of tongue, papillae, taste buds. Taste sensations and constitution related to taste: sweet, bitter, sour, salt. Mechanism of taste perception. Factors affecting taste sensation.
- Smell (olfaction): Olfactory receptors, physiology of olfaction, pathways of olfactory impulses.
- Skin: Structure and functions. Glands in skin: sweat, eccrine and sebaceous gland. Mechanism of secretion of sweat, types of sweating, pigmentation of skin.
- Muscles: Structure and functions of striated and unstriated muscles. Mechanism of muscle contraction and relaxation. Role of actin, myosin, troponin, tropo-myosin, titin, nebulin, Ca²⁺ in muscle contraction and relaxation.

References

1. Sherwood L. (2010). Human Physiology: From Cells to Systems, 7th edition, Brooks/Cole, Cengage Learning
2. Silverthorn D. U. (2015). Human Physiology: An Integrated Approach, 7th edition, Pearson
3. Chatterjee C.C. (2004). Human Physiology, Vol. I, II, 11th edition, Medical Allied Agency.
4. Guyton A. C. and Hall J. E. (2001). Textbook of Medical physiology, 10th edition, Harcourt Publisher International Company.
5. Talwar G.P. and Srivastava L. M. (2006). Text Book of Human Biochemistry, 3rd edition, Prentice Hall of India Pvt. Ltd.
6. Marieb Elaine N. (1996). Essentials of Human Anatomy and Physiology, 9th edition, Pearson International Edition.
7. Stuart I. F. (1996). Human Physiology, 5th ed, Brown Publisher.
8. Murray R. K., Granner D. K. and Rodwell V. W. (2006). Harper's Illustrated Biochemistry, 27th Edition, McGraw Hill Publisher.
9. Suresh R. (2013). Essentials of Human Physiology, Books and Allied (P) Ltd, Kolkata.
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11. Das A. (2006). Medical Physiology, 4th edition, Books and Allied (P) Ltd, Kolkata.

Teaching methods:

- Classroom teaching, Lecture method, ICT enabled teaching

S.Y. B.Sc. (Biochemistry): Semester IV
BC-243: Practical course based on BC-241 and BC-242

Total Hours: 60

Credits: 2

Course objectives

- To acquaint students with various hematological techniques
- To perform various environmental pollution detection methods
- To execute microbial isolation and screening methods

Course outcomes

Students will be able to:

- Determine blood pressure, bleeding time and clotting time and explain its significance
- Analyze wastewater for BOD/COD
- Analyze soil and water for various parameters
- Screen micro-organisms for various products and biochemical parameters

Sr. No.	Title of the Practical	Hours
1.	Recording of blood pressure by sphygmomanometer and its significance.	4
2.	Determination of bleeding time and clotting time and its significance.	4
3.	Determination of sodium and potassium content in blood serum samples by flame photometer.	4
4.	Analysis of wastewater for BOD and COD.	4
5.	Estimation of chlorides in water and hardness of water.	4
6.	Soil analysis: pH, salt concentration by conductometry.	4
7.	Estimation of phosphate by Fisk-Subbarao method.	4
8.	IMViC test	4
9.	Screening of organic acid/antibiotic/ enzyme producing microorganisms	4
10.	Isolation of yeast from sugarcane juice/sweet sample	4

Note: Mandatory to perform any 8 of the above.

References

1. Plummer D. T. (2005). An Introduction to Practical Biochemistry, TATA McGraw-Hill.
2. Sadasivam S. and Manickam A. (2008). Biochemical Methods, 3rd edition, New Age International Publishers.
3. Rao B. S. and Deshpande V. (2005). Experimental Biochemistry: A Student Companion, I.K. International Pvt. Ltd., New Delhi.
4. Sawhney S. K. and Singh R. (2011). Introductory practical Biochemistry, Narosa Publication House Pvt. Ltd.
5. Jayaraman J. (1981). Laboratory Manual in Biochemistry, New Age International Publishers
6. Aneja K. R. (2007). Experiments in Microbiology, Plant Pathology and Biotechnology, New Age International Publishers.
7. Kale V. and Bhusari K. (2010). Practical Microbiology: Principles and Techniques, Himalaya Publishing House.

8. Godkar P. B. and Godkar D. P. (2003). Textbook of Medical Laboratory Technology, Second Edition, Bhalani Publishing House.
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10. Maheshwari D. K. (2002). Practical Microbiology, S. Chand Publishing.
11. Rajan S. and Christy S. R. (2015). Experimental Procedures in Life Sciences, CBS Publishers and Distributors Pvt. Ltd.

Teaching methods: Laboratory method, Lecture cum demonstration methods

S.Y. B.Sc. (Biochemistry): Semester IV

BC-240 : Microbial isolation and identification techniques-II

Total Hours: 30

Credits: 2

Course objectives

- To acquaint students with various biochemical techniques used for microbial identification
- To study microbial isolation on various media
- To study microbial screening and preservation methods

Course outcomes

Students will be able to:

- Understand principle and procedure of various biochemical tests used for identification of microorganism
- Use selective agar and differential media for isolation of microorganisms
- Screen industrially economically important microorganisms
- Understand microbial preservation techniques

Unit I: Biochemical tests for Identification of microorganisms

8h

- Concepts, principles and procedures:
 - Catalase Test
 - Starch hydrolysis test
 - Coagulase Test
 - Oxidase Test
 - Methyl Red / Voges-Proskauer (MR/VP)
 - Kliger's Iron Agar (KIA)
 - Nitrate Broth
 - Urease test
 - Casein hydrolysis
 - Tyrosine hydrolysis
 - Indole production
 - TSI test
 - Sugar fermentation acid and gas production test.

Unit II: Microbial isolation on different media

8h

- Selective agar test:
 - Mannitol Salt Agar (MSA)
 - Blood Agar Plates (BAP)
 - Bile Esculin Agar
 - Nitrate Broth
 - Spirit Blue agar
 - MacConkey agar
 - Simon's Citrate Agar
 - Sulfur Indole Motility Media (SIM)
 - Motility Agar
- Selective and differential media:
 - Eosin Methylene blue (*E. coli*)
 - Xylose lysine deoxycholate agar (*Salmonella* and *Shigella*)
 - Mannitol salt agar (*Staphylococcus* and *Micrococcus*)
 - Cetrimide agar (*Pseudomonas*)
 - Azide Dextrose Broth (*Streptococcus*)
 - *Ashby's* Mannitol Agar (*Azotobacter*)
- Yeast extract mannitol agar (*Rhizobium*)

Unit III: Primary screening techniques

7h

- Enzyme producing microorganisms: amylase, gelatinase, lipase
- Organic acid producing microorganisms by using pH indicator dyes, Calcium carbonate test.
- Antibiotic producing microorganisms by crowded plate technique
- Probiotic producing microorganisms by MRS medium
- Phosphate solubilizing microorganism by Pikovskaya's Agar

Unit IV : Preservation of microorganisms

7h

- Preservation in continuous metabolic active state:
 - Short-term preservation (Agar slants, Agar stabs),
 - Periodic transfer in fresh media
 - Long-term preservation (Glycerol stocks, Gelatin discs, Mineral oil, Storage in soil),
- Suspended metabolic state:
 - Freeze drying (Lyophilization)
 - Drying in vacuum
 - Cryopreservation
 - Storage in silica gel
- Quality control of preserved stock cultures

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Teaching methods: Classroom teaching, Lecture method, ICT enabled teaching