SEMESTER 1

GBBT-101 BIOCHEMISTRY& METABOLISM

Course objective:

- Bioenergetics, pH, salts, acid and base, buffers.
- Carbohydrates and polymers
- Lipid classification and uses
- Enzyme classification and its activity

Course Content:

UNIT I

Biochemistry as molecular logic of living beings.A Brief account and function of biomolecules.
Bioenergetics: Principles of bioenergetics. Energy Rich compounds. BiologicalOxidation - reduction reactions.
Structure, function and properties of water, Water as universal solvent, Acids, bases and salts, pH and buffers.

UNIT II

Carbohydrates: Classification of carbohydrates. Chemical structure and properties ofmonosaccharides, disaccharides, oligosaccharides and polysaccharides- Starch, cellulose and glycogen.

UNIT III

Lipids: Classification and general structure, properties of fats and Oils, Definitions and determination of Acid value, Saponification value, Iodine Number, Reichert-Meissl-Wollny number.

UNIT IV

Enzymes: General characteristics of enzymes Classification of enzymes, Co-enzymes andcofactors. Mechanism of enzyme action.Competitive and non -competitive inhibition.
Allosteric regulation of enzymes.Isoenzymes. Factors contributing to catalytic efficiency of enzymes.

Recommended Books:

1. Lehninger A.L., Nelson D.L. and Cox M.M. (2005).Principles of biochemistry (W. H. Freeman, USA).
2. Stryer L, J. M. Berg, J.L. Tymoczko (2001). Biochemistry (W.H. Freeman and Company, New York).
3. Rawn J.D. (1989). Biochemistry (Neil Patterson Publishers).
4. G.L. Zubay, W.W. Parson, D.E. Vance. (1995). Principles of biochemistry:Student study art notebook (Wm.C. Brown).

GBBT-102 CELL BIOLOGY

Course Objective:

At the end of this course the students will be able to describe:
1. What is cell, its structure& function also regarding different cellular organelles.
2. Function of cell wall, Plasma membrane structure, different models, function etc.
3. Regarding cell division, Mitosis, meiosis, Comparison.
4. Regarding Movement across membranes- Passive transport: simple diffusion, facilitated diffusion-transporters (uniporters and co-transporters) and channel proteins. Active transport.
5. What is cell cycle, programmed cell death, Carcinogenesis, types and therapy, Chromosomal Organization, alteration in chromosome number, polyploidyetc.

Course Syllabus:

UNIT I

Cell theory, prokaryotic and eukaryotic cells, Structure and Functions of Organelles: Endoplasmic Reticulum, Chloroplast, Lysosome, Golgi Complex, Peroxisome (Microbody), Nucleus and Mitochondria, A general account of Cytoskeleton, Cilia & Flagella, Function of cell wall.

UNIT II

Plasma membrane, structure and models, Unit membrane model, Singer and Nicolson's fluid mosaic.Membrane structure- 2D Lipid bilayer, composition of membranes, asymmetric nature, fluidity, membrane proteins, Functions of cell membranes, Cell division, Mitosis, meiosis, Comparison.

UNIT III

Movement across membranes- Passive transport: simple diffusion, facilitated diffusion-transporters (uniporters and co-transporters) and channel proteins. Active transport: Pumps, Group Translocation and Electrochemical Gradients.

UNIT IV

Regulation of cell cycle, programmed cell death, Carcinogenesis, types and therapy, Chromosomal Organization, alteration in chromosome number, polyploidy, A general account of Extra-nuclear genome, mitrochondrial and plastid DNA, Plasmids.

Suggested readings:

1. Cell Biology by Sadava
2. Molecular Cell Biology, Lodish*et al.,* Freeman and Company, New York, 1999
3. Essential Cell Biology- An introduction to the molecular Biology of the cell- Alberts, Bray, Johnson, Lewis, Raff, Roberts, Walter, Garland Publishing.
4. Molecular Biology of the cell- Bruce Alberts, Garland Publishing Inc.
5. Cell Biology- A short course, Second edition, Stephen R. Bolsover, Wiely Publication
6. Genes IX - Benjamin Lewin, Prentice Hall Publication
7. An introduction to Practical Biochemistry- David T Plummer, Tata McGraw-Hill Edition
8. Developmental Biology, Ninth edition, S. F. Gilbert, Sinauer Associates Inc.

GBBT-103 BASIC MICROBIAL BIOTECHNOLOGY

Course Objective

At the end of this course the students will be able to:

1. Describe unique characters of animal kingdom.
2. Recognize life functions of different animal kingdom.

Course Content:

UNIT I

History and evolution of microbiology, Spontaneous generation *vs.* biogenesis, work of following scientists: Anton von Leeuwenhoek, Joseph Lister, Paul Ehrlich, Edward Jenner, Louis Pasteur, Robert Koch, Alexander Fleming. Whittaker's five kingdom classification systems.

UNIT II

Microbial Diversity:Distribution and characterization Prokaryotic and Eukaryotic cells, Morphology and cell structure of major groups of microorganisms e.g. – Bacteria and Viruses.

UNIT III

Microbial growth: Growth curve, Generation time, synchronous batch and continuous culture, measurement of growth and factors affecting growth of bacteria. Nutritional requirements.Control of Microorganisms:By physical, chemical and Chemo-therapeutic Agents.

UNIT IV

Bacterial Reproduction:Transformation, Transduction and Conjugation. Endospores and sporulation in bacteria. Microbial Metabolism: Metabolic pathways, amphi-catabolic and biosynthetic pathways.

Recommended Books:

1. Michael J Pelczar, JR. E.C.S. Chan, Noel R. Krieg. Microbiology, 5th Edition, Tata MacGraw Hill Press.
2. Prescott L.M., Harley J.P., and Klein D.A. Microbiology, 6th Edition. MacGraw Hill Companies Inc.
3. Ingraham J. L. and Ingraham C.A. Introduction to Microbiology. 3nd Edition. Thomson Brooks / Cole.
4. Daniel Lim, Microbiology, 2nd Edition; McGraw-Hill Publication

Lab Course (GBBT 101,102,103)

List of Practical:

1. Study of Lab safety, Glasswares and instruments used in lab: Cleaning, working and maintenance.
2. Microscopy
3. Sterilization.
4. Staining
5. Preparation of solutions (Molar, Normal etc.).
6. Preparations of Buffers.
7. Qualitative tests of biomolecules (Carbohydrate, Protein, lipids etc.).
8. Acid-base titration.
9. Determination of λ_{max} of given substance.
10. Demonstration of Mitosis and meiosis
11. Preparation and handling of solutions
12. Preparation of buffer
13. Identification of carbohydrate present in the given sample by qualitative method.
14. Estimate the concentrations of reducing sugar present in the given sample by DNSA method.
15. Estimate the concentrations of sugar present in the given sample by anthrone method.
16. Isolation of milk protein from the given milk sample.
17. Determination of vitamin C content in fresh fruit.
18. Microscope: Type, working knowledge and its use.
19. To identify the number of cells present in the given 1ml sample
20. Determination of osmotic concentration of cell sap by plasmolytic method.
21. Determination of osmotic value of plant tissue.
22. Determination of osmotic pressure of cell contents.
23. Demonstration of permanent slides of different stages of mitosis.
24. Demonstration of permanent slides of different stages ofmeiosis.
25. Preparation of acetocarmine solution for meiotic and mitotic studies.

GBBT-104 BOTANY I
(Introductory Phycology and plant physiology)
Course Objective

After the completion of this course, the students understand in advanced level of the diversity in plant life can be understood from the following topics of diversity: Diversity on The Basis of Habitat, plants classified into following groups students understand the geographical understanding respectfully: Hydrophytes: These plants may be: Hygrophytes: Halophytes: Mesophytes: Xerophytes: Geological time scale, theories of fossil formation, types of fossils, fossil gymnosperms. Life histories of Cycas &Pinus"

Course Content
UNIT I

1. General characteristic of the group (Algae), basic outlines of Fritsch's and Smith's classification, elementary knowledge of thallus organization and alternation of generation.2. Structure of thallus and mode of reproduction in *Volvox*, *Oedogonium,Ectocarpus*; General Characters and applications of Lichens.3. A brief idea of algal ecology; epiphytic, parasitic and symbiotic algae, Cyanobacteria, Economic importance of algae.

UNIT II

1. Cell Physiology, diffusion, permeability, plasmolysis, imbibition, water potential and osmotic potential. Types of soil water, water holding capacity, wilting coefficient. 2. Active and passive absorption, path of water transport and theories related with ascent of sap, mechanism of transpiration, factors affecting transpiration, guttation.3. Mechanism of absorption of mineral salts, mechanism of solute translocation.

UNIT III

1. Concept of macro and micronutrients, mineral deficiency disorders, techniques of water and sand culture. 2. Nitrogen cycle and nitrogen fixation, Importance of nitrate reductase and its regulation, Ammonium assimilation.

UNIT IV

1. A brief history of photosynthesis, role of primary pigments.2. Concepts of two photosystems, Z-scheme, Photophosphorylation. 3. Calvin cycle; C-4 cycle, CAM plants; Factors affecting photosynthesis.

UNIT V

1. Respiration, glycolysis, Kreb's cycle. 2. Electron transport mechanism (Chemi-osmotic theory), oxidative phosphorylation.3. Factors affecting respiration.

Practical

1. Demonstration of the instrumentation in Lab and studies of its principle and functions
2. Demonstration of permanent slides of Algae
3. Preparation of transverse section of root nodules if *Arachis hypogea* roots for the observation of N_2-fixing bacteroids.
4. Making of a potato Osmoscope for the demonstration of the mechanism of Osmosis.
5. Extraction of chlorophyll and carotenoids from given plant samples and estimation of the λmax of pigments.
6. Slide preparation to demonstrate the structure and number of stomata in leaves and study of the mechanisms of stomatal opening and closing.
7. Demonstration of hydroponics and study of its significance.
8. Estimation of the rate of transpiration using Ganong'sPotometer.
9. Demonstration of the mechanism of exosmosis, endosmosis and Imbibition using grapes, raisin and gram seeds.
10. Demonstration of starch formation during photosynthesis.

Books Recommended:

1. Khan M. Fundamentals of Phycology. BSMPS, Dehradun
2. Morris IN Introduction to Algae, Hutchinson Library Series
3. Smith. Cryptogamic Botany Vol I
4. Devlin RM. Plant Physiology .(Indian Print). New Delhi
5. Verma SK. A Text Book of Plant Physiology
6. Kochhhar PL and HB Krishnamurthy. Plant Physiology
7.Taiz and Zeiger, Plant Physiology, Publisher: Sinauer Associates, California, USA.

GBBT-105 ZOOLOGY I
(Human Physiology)

Course Objective

"At the end of this course the students will be able to: 1. Describe unique feature of diverse appearance of animals, this course will enhance the students to get the knowledge about the anatomy of different systems of higher chordates. 2. On completion of this course, the students will gain in-depth knowledge related to excretory system, nervous system and structures of Brain, Eye and Ear."

Course Content

UNIT I

Musculoskeletal system: Bones, ligaments, tendons, cartilages andmuscles. Physiologyofmuscle contraction in skeletal and smoothmuscles.

Nervous system: Central and peripheral nervous systems, structureand functions of neurons and brain, action potential, IPSP, EPSP,synaptic transmission, neurotransmitters, nerve conduction mechanism.

UNIT II

Circulatory system: Structure and functions of heart and bloodvessels, cardiac output, hemoglobin, blood coagulation, Oz and CO2transport, components and functions of blood. **Respiratory system:** Structure and function of lungs, pulmonary circulation, regulation of respiration.

UNIT III

Digestive system: Parts of digestion system, digestions and absorptionof protein, carbohydrates, lipids and nucleic acids.

Reproductive system: Male and female sex organs, Reproductivemechanisms, functional morphology of reproductive organs,gametogenesis, menstrual cycle, hormonal control of reproduction.

UNIT IV

Endocrine system: Endocrine glands: structure and functions,endocrine hormones and their functions.

Practical

1. Test of the following in food samples.
    a. Carbohydrates.
    b. Proteins.
    c. Fats.
2. Demonstration of the action of salivary amylase.
3. Process of Peptic digestion.
4. Identification of the blood groups and Rh factor.
5. Counting of total RBC and WBC.
6. Demonstration of Percent hemoglobin.
7. Demonstration of ammonia and Urea in the Urine sample.
8. Effect of hyper tonic and hypo tonic solution.
9. Study of skeletal system with the help of models.
10. Study of different types of heart with the help of chart/model.
11. Study of urinogenital system with the help of chart.
12. Study of muscular system with the help of chart.
13. Study of digestive system with the help of chart.
14. Study of urinogenital system with the help of chart.
15. Study of blood-vascular system with the help of chart.

Recommended Books

1. Guyton, A.C. and Hall, 3.E., 2000, A Text Book of Medical Physiology, Xth Edition,
2. W.B. Saunders Company.
3. Ganong, H, 2003, Review of Medical Physiology, 21st Edition, McGrawHill.
4. Strand Fluer, 1978, Physiology (a regulatory system approach) McMillan Pub. Co.
5. David Shier, Jakie, Butler & Lewis, 1996, Human Anatomy & Physiology, WCB, USA.

GBBT-106 CHEMISTRY I

Course Objective:

(i) After the completion of this course, the student will understand the modern view of atomic structure, and learn to fill configuration of elements

(ii) The students will learn the physical chemistry concepts in gaseous states and its applications.

(iii) The student will be able to understand the homogenous non-crystalline substance, generate application of colloids and nano-materials and their real-world applications.

(iv) The student will learn the general concepts regulating organic chemistry reaction mechanism and their examples with real world applications.

(v) The students will learn different types of organic reaction mechanisms and their examples.

Course Content

1. ***Atomic Structure:*** Idea of de Broglie matter waves. Heisenberg uncertainty principle. Quantum numbers. Aufbau and Paulis exclusion principles. Hund's multiplicity rule. Variation of orbital energies with atomic number and energy level diagram, electronic configuration of elements, Schrödinger wave equation, significance of wave functions, effective nuclear charge and shielding; radial and angular wave functions.
2. ***Gaseous State*:**Kinetic theory of gases, ideal gas laws and kinetic theory. Collision in a gas- mean free path, collision diameter, collision number. Behaviour of real gases - the van der Waal's equation, brief mention of other equations of state. Critical phenomena - critical constants of a gas and their determination, continuity of state, the van der Waals equation and critical state.
3. ***Colloids and Nano-Chemistry*:**Adsorption- Langmuir and Freundlich isotherms. Multi layer adsorption- BET equation (no derivation) and its application to surface area measurement. Sols (reversible and

irreversible), gel, suspension, colloids, true solution, phases of colloidal solution, methods to prepare colloidal solution (in brief), surfactants, emulsions and emulsifiers, association colloids (micelles), parameters governing the formation of surfactant aggregates. Properties of colloidal solution. Nanomaterials and their applications in medicine, food, environment, energy, next generation computer chips, catalysis, water purification.

4. ***Structure and Reactivity*:**Atomic orbitals, hybridization, orbital representation of methane, ethane, ethene, ethyne and benzene; polarity of bonds – inductive, resonance and steric effects and their influence on acidity and basicity of organic compounds.
5. ***Organic reaction mechanisms* :**Heterolytic and homolytic cleavage, nucleophiles, electrophiles and free-radicals; substitution, addition and elimination reactions; mechanism of chlorination of methane, SN1 and SN2 mechanisms. E1 and E2 mechanisms, Elimination versus substitution reactions, Addition reactions (electrophilic and free radical), Hydration, hydroxylation, hydroboration.

Recommended Books:

1. *"A New Concise Inorganic Chemistry",* **J. D. Lee**, 5th Edition (1996), Chapman & Hall, London.
2. *"Modern Inorganic Chemistry",* **R. C. Aggarwal**, 1st Edition (1987), KitabMahal, Allahabad.
3. *"Basic Inorganic Chemistry",* **F. A. Cotton, G. Wilkinson, and Paul L. Gaus,** 3rd Edition (1995), John Wiley & Sons, New York.
4. *"Organic Chemistry",* **R. T. Morrison and R. N. Boyd**, 6th Edition (1992), Prentice-Hall of India (P) Ltd., New Delhi.
5. *"Organic Chemistry",* **S. M. Mukherjee, S. P. Singh, and R. P. Kapoor**, 1st Edition (1985), New Age International (P) Ltd. Publishers, New Delhi.
6. *"Organic Chemistry – Structure and Reactivity",* **Seyhan N. Ege**, 3rd Edition (1998), AITBS Publishers and Distributtors, Delhi.
7. *"Organic Chemistry",* **Paula Y. Bruice**, 2nd Edition , Prentice-Hall InternattionalInc, New Jersey, International Edition (1998).
8. *"Physical Chemistry",* **P. C. Rakshit,** 5th Edition (1988), 4th Reprint (1997), Sarat Book House, Calcutta.
9. *"Principles of Physical Chemistry",* **B. R. Puri, L. R. Sharma, and M. S. Pathania,** 37th Edition (1998), ShobanLalNagin Chand & Co., Jalandhar.
10.*"Physical Chemistry",* **K. J. Laidler and J. M. Meiser**, 3rd Edition, Houghton Mifflin Comp., New York, International Edition(1999).
11. "Principle of Nanoscience and Nanotechnology", (2010), **M. A. Shah and Tokeer Ahmad,** Narosa Publishing House, New Delhi.