

Biochemistry (जैव रसायन) (PGBCH)

Year	Paper No.	Course Code	Title of the Course	Credits	Compulsory Elective
Compulsory Core Course विषय केन्द्रित अनिवार्य पाठ्यक्रम					
प्रथम वर्ष (Ist Year)	6001	PGBCH-01	Cell Biology & Bimolecules	4	अनिवार्य
	6002	PGBCH-02	Analytical Biochemistry	4	
	6003	PGBCH-03	Nutrition and Physiology	4	अनिवार्य
	6004	PGBCH-04	Bioenergetics and Metabolism	4	
	6005	PGBCH-05 (P)	Practical based on PGBCH-01, 02,03 and 04	8	अनिवार्य
Discipline-Centric Elective Course विषय केन्द्रित वैकल्पिक पाठ्यक्रम Select any two with 04-04=8 Credits					
	6006 or 6007	PGBCH-06 or PGBCH-07	Advance Immunology or Research Methodology	8 or 8	वैकल्पिक
Open Elective Course (Other Disciplines) अन्य विषय केन्द्रित वैकल्पिक पाठ्यक्रम					
	6008 or 6009	PGBCH-08 or PGBCH-09	Bio-Statistics or Bio-Informatics	8 or 8	वैकल्पिक
प्रथम वर्ष का कुल क्रेडिट				40	
Compulsory Core Course/ विषय केन्द्रित अनिवार्य पाठ्यक्रम					
द्वितीय वर्ष	6010	PGBCH-10	Microbiology and Immunology	4	अनिवार्य
	6011	PGBCH-11	Enzymology and Enzyme Technology	4	
	6012	PGBCH-12	Basic Biotechnology	4	अनिवार्य
	6013	PGBCH-13	Industrial Biochemistry	4	
	6014	PGBCH-14(P)	Practical Based on PGBCH-10, 11, 12 and 13	8	अनिवार्य
Discipline Centric Course/ विषय केन्द्रित पाठ्यक्रम					
	6015	PGBCH-15 (PW)	Project Work	8	अनिवार्य
Open Elective Course (Other Discipline)/ अन्य विषय केन्द्रित वैकल्पिक पाठ्यक्रम					
	6016 or 6017 or 6018	PGBCH-16 or PGBCH-17 or PGBCH-18	Cognitive Science and Human Behavior or Clinical Biochemistry or Neuro-Science	8 or 8 or 8	वैकल्पिक
Compulsory Foundation Course / अनिवार्य आधार पाठ्यक्रम					
	2702 or 2703	PGFGS or PGFHR	Gadhian Thoughts and Peace Studies गाँधो विचार एवं शान्ति अध्ययन or Human Rights and Duties मानवाधिकार एवं कर्तव्य	नॉन क्रेडिट	अनिवार्य

द्वितीय वर्ष का	कुल क्रेडिट	40
सम्पूर्ण कार्यक्रम का	कुल क्रेडिट	80

MASTER IN BIOCHEMISTRY (M.Sc.-PGBCH)

PGBCH-01 (Cell Biology and Bio-molecules)

- 1 **Cell Biology:** Biochemical organization, general structure of prokaryotic and eukaryotic cell, structure of cell wall and cell membrane, nucleus, endoplasmic reticulum, mitochondria, chloroplast, golgi apparatus, ribosomes, lysosomes, cytoskeleton.
- 2 **Biomolecules:** Carbohydrates- Classification, structure and properties of monosaccharides, disaccharides and polysaccharides. Proteins- Primary, secondary tertiary and Quaternary structures, structure of hemoglobin. lipids- Types, structure and function of lipids. Enzymes- General properties, classification, enzyme catalysed reactions and kinetics. Nucleic acids structure and function of nucleotides, structures of RNA and DNA, denaturation of DNA.

PGBCH-02 (Analytical Biochemistry)

- 1 **Spectroscopy-** Visible and UV Spectroscopy and its applications.
- 2 **Chromatography-** Principle, thin layer, ion exchange and gel filtration chromatography. HPLC, FPLC
- 3 **Centrifugation-** Principles of centrifugation, types of centrifuge, differential centrifugation, density gradient, ultracentrifugation.
- 4 **Electrophoretic techniques-** general principles, electrophoresis of proteins, PAGE and SDS-PAGE, Agarose gel electrophoresis for DNA, Isoelectric-focusing
- 5 **Microscopy-** basic principles, light and electron microscopy

PGBCH-03(N)/ PGBCH-04(O)

(Nutrition and Physiology)

1. **Basic Concepts** - Function of nutrients. Measurement of caloric value of food. Basal metabolic rate (BMR); factors affecting BMR. Recommended dietary allowances.
2. **Elements of Nutrition** - Dietary requirement of carbohydrates, lipids and proteins. Concepts of protein quality. Essential amino acids, essential fatty acids and their physiological function.
3. **Vitamins and Minerals** - Dietary sources, biochemical functions, requirements and deficiency diseases associated with vitamin B complex.
4. **Introduction to Physiology.** Blood - Composition and functions of plasma, erythrocytes, Leucocytes and thrombocytes. Blood coagulation.
5. **Digestive system** - Compositions, functions and regulation of saliva, gastric, pancreatic, intestinal and bile secretions.
6. **Respiration** – Air passages and lung structure, work of breathing and its regulation.

PGBCH-04(N)/ PGBCH-05(O)

(Bioenergetics and Metabolism)

1. **Bioenergetics** - General concepts. Biological oxidation-reduction reactions, redox potentials. High energy phosphate compounds-ATP, Phosphate group transfer.
2. **Coenzymes and Cofactors** - Types and function of NAD⁺, FAD, Pyridoxal phosphate and B₁₂ coenzymes.
3. **Carbohydrate Metabolism** – Glycolysis, fermentation, TCA cycle, electron transport chain, oxidative phosphorylation, gluconeogenesis. Energetics and regulation of metabolic cycles.
4. **Amino acids** - Types and classification. General reactions of amino acids metabolism, transamination, decarboxylation, deamination. Special metabolism of methionine, tryptophan and leucine.
5. **Urea cycle** – Metabolism and regulation.

PGBCH-05(P) (N) / PGBCH-03(P) (O)

(Practical)

Based on PGBCH-01,02,03,04

- 1 Estimation of carbohydrates using colorimetric methods.
- 2 Determination of protein using biuret reagent
- 3 Estimation of RNA using orcinol reagent
- 4 Assay of urease activity in seeds of *Cajanus cajan*.
- 5 Tests for amino acids.
- 6 Separation and identification for amino acids by paper chromatography.
- 7 Ascorbic acid (Vitamin C) measurement by titrimetric method using dye DCPIP.
- 8 Microscopic study of blood cells.
- 9 Urea estimation of biological samples by colorimetric method.

PGBCH-06 (N)(Advance Immunology)

Part I

- Introduction
- Innate Immunity
- Acquired Immunity

Part II

- Cells and Organs of immune System
- Antigens or Immunogens
- Major and Minor histocompatibility complex
- Antibodies (Immuno-globulins)
- Antigens- Antibody interactions
- Organization and expression of immunoglobulin genes.

Part III

- B-cells maturation, activation and differentiation
- T-cell maturation, activation and differentiation
- T-cells and B-cells reports

Part IV

- Antigens processing and presentation
- Effector responses of cell- mediated and humoral immunity
- Cytokines
- Complement system
- Vaccines

Part V

- Immune response to infection diseases
- Hypersensitivity
- Transplantation Immunology
- Immunologic Tolerance
- Immunology of Tumors
- Immunodeficiency Diseases

PGBCH-07(N) (Research Methodology)

- 1) **Introduction to Research Methodology** : Meaning of Research, Objectives of Research, Motivations in Research, Types of Research, Research Approaches, Significance of Research, Research Methods v/s Methodology, Research and Scientific Methods, Research Process, Criteria of Good Research
- 2) **Defining the Research Problem** : What is Research Problem?, Selecting the Problem, Necessity of and Techniques in defining the problem
- 3) **Sample Design**: Implication, Steps. Criteria for selecting a sample procedure, Characteristics of Good sampling Procedure, Types of Sample Design, Selecting Random Samples, Complex random sampling Design
- 4) **Methods of Data Collection**: Collection of Primary Data, Observation Method, Interview method, Collection of Data through questionnaire and Schedules, Other methods. Collection of Secondary Data, Selection of appropriate method for data collection, Case Study Method, Guidelines for developing questionnaire, successful interviewing. Survey v/s experiment
- 5) **Processing and Analysis of Data**: Measures of Central Tendency, Dispersion,. correlation and Regression, Chi- square test : Applications, Steps, characteristics, limitations, Analysis of Variance and Co-variance
- 6) **Testing of Hypothesis**: Meaning, Basic concepts, Flow diagram, Power of a hypothesis test, Important parametric tests, Hypothesis Testing of Means, hypothesis testing of Correlation coefficients, Limitations of Tests of hypothesis.
- 7) **Computer Fundamentals**- Computer Basics, Data Representation, Input / Output Units, Computer memory, Computer Generation and Classification, Computer Languages, OS, Types of OS, Services and Components of OS, Computer Networks, LAN, MAN, WAN, Internet and WWW, E-mail
- 8) **Introduction to Word processing package**- Creating and Editing a word document, creating a research paper, creating a cover letter and a resume, Creating a document with a title page, table, chart and watermark, Creating a webpage using word, Mail Merge, creating a professional newsletter
- 9) **Introduction to Spreadsheet package**-Features and functions of spreadsheet, creating spreadsheet and enter data, format worksheets, adding graphics, printing, Calculate, manipulate and analyse data, custom calculations, consolidating worksheets, pivot tables, charts, performing what - if analysis
- 10) **Introduction to Presentation Tools**- Features and functions, Creating presentation, master page, adding animation, Customizing presentation, showing presentation, printing handouts.

PGBCH-08 (N)(Bio-Statistics)

1. Role of Biostatistics in Health Sciences

Introduction, What Are Statistics?, Why Study Statistics?, Practical Applications, Statistics in Medical Research, Statistics in Epidemiological Research, Statistics in Public Health and Policy, Statistics in Social Sciences, Misuses, Role of Statisticians.

2. Summarisation and Presentation of Data

Introduction, Types of Data, Summarising Data, Summarising Grouped Data, Presentation of Data, Graphical Presentation, Key Points

3. Probability

Introduction, Basic Concepts, Probability, Classical and Frequentist Approaches to Probability, The Additive Law of Probability, The Multiplicative Law of Probability, Bayes' Theorem

4. Probability Distributions

Introduction, Frequency Distribution, Histograms and Bar Plots: Tools for Describing the Frequency Distribution, Relative Frequency, Probability Distribution, Discrete Probability Distributions, Probability Density Function, Cumulative Distribution Function, Continuous Probability Distributions, Properties of Distributions, Assessing the Fit of Distributions, Standardised Scoring, Transformations*

5. Sampling Methods

Introduction, Defining the Population, Requirement of a Good Sample, Sampling and Non-sampling Errors, Advantages of Sampling, Random and Non-random Sampling, Simple Random Sampling, Systematic Random Sampling, Complex Sampling Schemes, Non-probability Sampling Methods

6. Estimation

Introduction, Estimation Theory*, Terminology in Statistical Inference, Sampling Distribution, Standard Error, Central Limit Theorem, Exact Sampling Distribution, Confidence Intervals, Confidence Intervals for Small Samples, Explanation of 'a' and 'd' and their Relationship**

7. Testing of Statistical Hypotheses

Introduction, Hypotheses, Need for Testing Hypotheses within a 'Statistical' Framework, Statistical Test, Parametric Tests, One-Sample *T*-test, Steps Involved in Testing of Hypothesis, Test for the Difference of Means between A Paired Sample, Test for Difference in Two Independent Means, Test for Difference in Two Independent Proportions, Interpreting Statistical Significance from Confidence Intervals, Issues in Statistical Significance, Student's 'T' Distribution: An Exact Sampling Distribution*, Two Schools of Thought—'Significance' and 'Hypothesis' Testing**, Issues Concerning *P*-values*, Some Common Misuses of Tests, A Note on Transformations

8. Analysis of Variance and Multi-sample Comparison

Introduction, Why it is Not Appropriate to use Multiple *T*-tests?, One-way Analysis of Variance, Multiple Comparison Procedures, Assumptions, Relationship between One-Way Anova and Two Sample *T*-test, Relationship between One-Way Anova and Multiple Regression, Two-Way Anova, Analysis of Covariance, Repeated-Measures Anova, Fixed and Random Effects

9. Hypothesis Testing – Categorical Data

Introduction, Chi-Square Test for Association, Types of Chi-Square Tests, Test for Independence, Test for Homogeneity, Comparison of Chi-Square Test with Normal Test, Fisher's Exact Test for 2x2 Tables, Comparison of Two Correlated Proportions—Matched Pair, Chi-Square Test for Trend

10. Non-parametric Methods

Parametric and Non-parametric Methods, Rational for Using Non-parametric Methods, Advantages and Disadvantages, Wilcoxon Signed Rank Test, Wilcoxon Rank-Sum Test, Kruskal–Wallis Test, Spearman's Rank Correlation

11. Correlation and Regression

Introduction, Scatter Plot, The Correlation Coefficient, Hypothesis Testing and Interval Estimation for Correlation Coefficient, Partial Correlation Coefficient, Precautions in Use and Interpretation, Linear Regression, Analysis of Variance for Regression, Coefficient of Determination, Non-linearity, Uses of Regression, Prediction, Checking the Assumptions in a Regression Analysis, Regression to the Mean*

12. Epidemiologic Study Designs and Analysis

Introduction, Historical Overview, Epidemiology, Measures of Disease Frequency, Epidemiological Study Designs, Bias, Confounding and Interaction, Causality

13. Clinical Trials

Introduction, Definition of a Clinical Trial, Historical Review, Types of Trial, Phases of the Trial, Study Design, Control Group, Randomisation, Methods of Randomisation, Allocation Concealment, Blinding, Types of Randomised Controlled Trials (RCT), Designs for Clinical Trials, Analyses of Clinical Trials, Reporting of Randomised Controlled Trials (RCT), Ethics

14. Diagnostic Tests

Introduction, Diagnostic Test Studies, Diagnostic Test Accuracy, Measures of Discrimination, Measures of Prediction, Likelihood Ratios, The Receiver Operating Characteristic Curve (ROC), Illustration

15. Survival Analysis

Introduction, Censoring, Why Survival Analyses?, Definition of Survival Times, Summarising and Presentation of Survival Times, More on Survival Function and Curves

16. Clinical Measurements

Introduction, Properties of Measurement, Accuracy and Precision, Measurement Error, Coefficient of Variation (CV), The Intra Class Correlation Coefficient (ICC), Correlation Coefficient and Its Misuse, Observer Variation, Reference Intervals, Cronbach's Alpha, Method Comparison Studies, Non-numerical Measurements, Digit Preference

17. Demographic Methods and Vital Statistics

Introduction, Sources of Vital Statistics and Demographic Data, Vital Statistics: Rates, Ratios and Proportions, Measures of Mortality, Measures of Fertility, Measures of Morbidity, The Adjustment of Rates

18. Applied Regression Analysis and Multivariable Methods

Introduction, Multiple Regression Analysis, Logistic Regression Analysis, Cox (Proportional-hazards) Regression Analysis, Log-Linear Analysis, Principal Component Analysis and Factor Analysis, Classification Techniques: Cluster and Discriminant Analysis

19. Research Methods

Introduction, Characteristics of Scientific Research, Purpose of the Scientific Research, Steps in Conducting a Scientific Research, Reporting the Research Findings, Designing Data Collection Forms, Preparing the Data for the Analysis, Statistical Consultations, Limitation of the Scientific Research

20. Sample Size

Introduction, The Importance of Sample Size Calculations, Basic Approach to Sample Size Calculations, Sample Size for Descriptive Studies, Sample Size to Estimate Mean with a Given Precision, Sample Size for Comparative Studies, Calculating Sample Size to Compare Two Means with a Given Power, Calculating Sample Size to Compare Two Proportions with a Given Power, Case-Control Studies, Cross-Over Study Design, Practical Issues with Sample Size Calculations

21. Meta Analysis in Systematic Reviews

Introduction, Systematic Review, Meta Analysis, Fixed Effects, Random Effects, Heterogeneity in Meta Analysis, Bias, Software for Meta Analysis

PGBCH-09(N) (Bio-Informatics)

Part I: Introduction to Bioinformatics

A world on Bioinformatics: Introduction, Branches of Bioinformatics, Aim of Bioinformatics, Scope/ Research Areas of Bioinformatics

Part II: Biological Databases

Sequence and Molecular File Formats: Introduction, Sequence File Formats, Sequence Conversion Tools, Molecular File Formats, Molecular File Format Conversion

Database in Bioinformatics- An Introduction: Introduction, Biological Databases, Classification Schema of Biological Databases, Biological Database Retrieval Systems

Biological Sequence Databases: National Center for Biotechnology Information (NCBI), Tools and Databases of NCBI, Database Retrieval Tool, Sequence Submission to NCBI, BLAST, PSO- BLAST, Specialized Tools, Databases of NCBI, Nucleotide Database, Protein Database, Gene Expression Database, GEO, Structural Database, Chemical Database, Other Database,

EMBL Nucleotide Sequence Database: Introduction, Sequence Retrieval, Sequence Submission at EMBL, Resources of EMBL, Biological Annotation and Data Curation, Sequence Analysis Tools, Features of Database

DNA Data Bank of Japan (DDBJ): Introduction, Resources at DDBJ, Data Submission to DDBJ

Protein Information Resource (PIR): Introduction, Resource of PIR, Data Retrieval in PIR, Database of PIR

Swiss Prot: Introduction, Features of Swiss Prot.

Protein 3D Structure and Classification Database: Protein Database Bank, Harnessing Data From PDB, Data Deposition Tools, PDB Data, RCSB PDB Structural Genomics Information Portal,

Molecular Modeling Database (MMDB): Introduction, Retrieval of structural Database From MMDB, Converted Domain Database (CDD)

E-MSD: Introduction, Resources of EMSD, Data Submission at E-MSD, Search Systems of E-MSD, 3D-Genomics, Accessing 3D- genomics, E- gene 3D, Retrieving Data from Gene3D, Protein Structural Classification Database: CATH: Class, Architecture, Topology, Homologous, SCOP (Structural Classification of Protein)

Part III: Bio-Algorithms and Tools

Sequence Alignments: Introduction, Concept of Alignment, Scoring Matrices, PAM,, BLOSUM, Alignment of Pairs of Sequences, Alignment Algorithms, Heuristic Methods, Multiple Sequence Alignment (MSA)

Gene Prediction Methods Principles and Challenges: Introduction, Biological Overview, What is Gene Prediction, Computational Methods of Gene, Prediction, Methods of Gene Prediction, Combination of Two Methods, Why is Gene Prediction Difficult?

Molecular Phylogeny: Introduction, Phenotypic Phylogeny and Molecular Phylogeny, Representation of Phylogeny, Molecular Clocks, Methods of Phylogeny, Statistical Evaluation of the Obtained, Phylogenetic Trees or Validation Methods, Software for Phylogenetic Analyses, Reliability of Molecular Phylogenetic Prediction

Molecular Viewers: Introduction, A Few Molecular Viewers RasMol, Deep View- The Swiss PDB Viewer (SPDBV), Cn3D.

Part IV: Protein Modeling and Drug Design

Protein Structure and Modelling: Protein and Secondary Structure Prediction, Conformational Parameters of Secondary Structure of a Protein, Secondary Structure Types, Secondary Structure Prediction Software for Secondary Structure Prediction.

Protein Modelling: Introduction, Methods of Protein Modelling, Homology or Comparative Modelling, Model Refinement, Evaluation on the Model Hands on in Comparative Modelling using Swiss-model, Treading or Fold Recognition Ab initio/ De novo Method

Bioinformatics in Computer- aided Drug Design: Introduction, The Drug Discovery Process, Structural Bioinformatics in Drug Discovery, SAR and QSAR Techniques in Drug Design, Graph Theory, Molecular Docking, Recent Upcoming- A Briefing on Drug Bank, Auto Dock- The Docking Software and Auto Dock Tools (ADT)

Part V: Modelling of Biomolecular Systems

Simulation and Statistical Protocols: Introduction, Monte Carlo Methods, Molecule Dynamics, Energy Minimization, Leading MD Simulation Packages

Markov Chain and Hidden Markov Models: Introduction, Markov Chains and HMM, Application of Viterbi Algorithm, Application of HMMs to Specific Problems, Advantages of HMMs

Biochemical Networks: Introduction, Concept, Methods of Simulation, System, Reaction Networks, Model of a Biochemical Network, Sources of Biochemical Pathway Data, Tools for Biochemical Networks

Part VI: Bioinformatics Essentials

Commercial Bio-software: Introduction, GCG Wisconsin Package, Insight II, Discovery Studio2.0

PCBCH- 10(N)/ PGBCH-07(O)
(Microbiology and Immunology)

1. Prokaryotic and Eukaryotic cells
2. Modern approaches to bacterial taxonomy
3. Methods in microbiology, Microbial growth
4. Metabolic diversity among micro organisms
5. Host-parasite relationship, Microbial diseases with reference to tuberculosis, cholera, AIDS, Rabies, Food born diseases, Bacterial transduction, conjugation and recombination
6. Antibiotics- mode of action, mechanism of drug resistance.

PCBCH-11(N)/ PGBCH-08(O)
(Enzymology and Enzyme Technology)

1. Nomenclature and classification of enzyme
2. General Properties of enzymes- active sites, cofactors and specificity, Enzyme Kinetics, Mechanism of Enzyme, action and regulation
3. Isozymes, Multi-enzymes with principles and applications of the involved techniques,
4. Enzyme immobilization- methods, Applications, advantages and disadvantages.

PCBCH- 12 (N)/ PGBCH-10(O)(Basic Biotechnology)

1. Role of Biotechnology in medicine, Industry,
2. Agriculture and Environment, Production of bread, Beer, Cheese and antibiotics, Enzyme Biotechnology.
3. Cell Culture- Methods and applications,
4. Bio-transformations,
5. Immunochemical Applications, Microbial Polysaccharides and single cell oils, Upstream and downstream processing.
6. Microbial Biotechnology, Principles and Applications of Bio techniques, Food Biotechnology

PCBCH-13(N)/ PGBCH-10(O)
(Industrial Biochemistry)

1. Classification, Structure and properties of amino acids,
2. Structure and function of proteins, DNA- Protein and Protein- Protein interaction, protein folding and related diseases, protein, Sequencing, proteomics. Nucleic Acids,
3. Watson-Crick model of DNA, Structural Polymorphism of DNA and RNA, Biosynthesis of purines and pyrimidines, DNA- drug interaction. Carbohydrates- Classification and structure, their synthesis and breakdown.
4. Classification, structure and functions of lipids, oxidation of lipids, biosynthesis of fatty acids. Metabolomics.

PGBCH-14 (Practical)

Based on papers PGBCH-10,11,12 and 13

PGBCH-15(PW) (Project)

PGBCH-16 (N)(Cognitive Science and Human Behaviour)

Part I

- Applied cognitive psychology
- Memory improvement
- Everyday Memory

Part II

- Working Memory and performance limitations
- Skill, Attention and cognitive failure
- Biological cycles and cognitive performance

Part III

- Drugs and Cognitive performance
- Intuitive statistical, judgment and decision
- Auditory perception
- Reading and Dyslexia

PGBCH-17(N) (Clinical Biochemistry)

What is Clinical Biochemistry

Input:-

- ❖ Nutrition and drugs
- ❖ Digestion

Control

- ❖ Genetic Control
- ❖ Endocrinology Chemistry Control
- ❖ Thyroid Harmon
- ❖ Control of water and Electrolyte Metabolism
- ❖ Control of Calcium Metabolism
- ❖ Control of Carbohydrates Metabolism

Processing:-

- ❖ Enzymes
- ❖ Labour errors of metabolism

Transport and Storage

- ❖ Plasma Proteins
- ❖ Lipids and Lipoproteins
- ❖ Acid base balance and blood gases

Defence:-

- ❖ Immunoglobins
- ❖ Protein of the innate immune system

Output:-

- ❖ Kidney function
- ❖ Liver function

Section A- Organization of the Nervous System

- Neuron Structure
- Neuron diversity
- Glial cells and myelination
- Organization of the peripheral nervous system
- Organization of the central nervous system
- Brain imaging
- Meninges and cerebrospinal fluid
- Blood-brain barrier

Section B- Neuron excitation

- Resting potentials
- Action potentials
- Voltage dependent ion channels
- Channel molecular biology
- Action potential conduction

Section C- Synapses

- Morphology of chemical synapses
- Overview of synaptic function
- Postsynaptic events
- Neural integration
- Neurotransmitter release
- Calcium channels
- Neurotransmitter inactivation

Section D- Neurotransmitters

- Ionotropic receptors
- Metabotropic receptors
- Amino acid transmitters
- Dopamine
- Noradrenaline (norepinephrine)
- Serotonin
- Acetylcholine
- Purines and peptides

Section E- Neural Coding

- Information representation by neurons
- Frequency coding
- Location coding
- Modality
- Elementary neural circuits

Section F- Somatosensory System

- Sensory receptors
- Touch
- Pain
- Pain modulation
- Balance

Section G- Vision

- Attributes of vision
- Eye and visual pathways
- Retina
- Phototransduction
- Retinal processing
- Early visual processing
- Parallel processing in the visual system
- Oculomotor control

Section H- Hearing

- Acoustics and audition
- Anatomy and physiology of the ear
- Peripheral auditory processing
- Central auditory processing

Section I- Smell and taste

- Olfactory receptor neurons
- Olfactory pathways
- Taste
- Taste pathways

Section J – Motor function: spinal cord and brainstem

- Nerve muscle synapse
- Motor units and motor pools
- Elementary motor reflexes
- Spinal motor function
- Brainstem postural reflexes

Section K – Movement: Cortex, Cerebellum and Basal Ganglia

- Cortical control of voluntary movement
- Motor lesions
- Anatomy of the cerebellum
- Subdivisions of the cerebellum
- Cerebellar cortical circuitry
- Cerebellar function
- Anatomy of the basal ganglia
- Basal ganglia function

Section L- Neuroendocrinology and Autonomic Functions

- Anatomy and Connections of the hypothalamus
- Posterior Pituitary function
- Neuroendocrine control of metabolism and growth
- Neuroendocrine control of reproduction
- Autonomic nervous system function
- Control of autonomic function

Section M- Developmental Neurobiology

- Emotion
- Motivation and Addiction
- Control of feeding
- Brain Biological clocks
- Sleep

Section N – Developmental Neurobiology

- Early patterning of the nervous system
- Cell determination
- Cortical development
- Axon pathfinding
- Synaptogenesis and developmental plasticity
- Neurotrophic factors
- Brain sexual differentiation

Section O- Memory and Cognition

- Types of learning
- Physiological psychology of memory
- Cell physiology of learning
- Arousal and attention
- Language

Section P – Brain Disorders

- Schizophrenia
- Depression
- Strokes and excitotoxicity
- Epilepsy
- Parkinson's disease
- Alzheimer's disease

Books Recommended:

1. **PGBCH-01, 02, 03, 04, 11, 13**
Principles of Biochemistry: Lehninger, Nelson and Cox. Student Edition, CBS 1439 Publishers and Distributors, Delhi.
Fundamentals of Biochemistry: Dr J L Jain, S. Chand & Company
Textbook of Biochemistry and Human Biology: Talwar and Srivastava. Eastern Economy Edition, Prentice Hall, India.
2. **PGBCH-05(P) and 14(P),**
An Introduction to Practical Biochemistry: DT Plummer, Tata McGraw-Hill Publishing Co.Ltd. New Delhi.
3. **PGBCH-06**
Immunology, C Vaman Rao, Narosa Pub.
4. **PGBCH-07**
Research Methodology, Ranjit Kumar, Pearson Pub.
Research Method, G Rugg and M. Petre
5. **PGBCH-08**
Elements of Biostatistics, S Prasad, Rastogi Pub.
Biostatistics Principles and Practice, B. Antonisamy, Tata McGraw-Hill Publishing Co.Ltd.
6. **PGBCH-09**
Bioinformatics Principles and Application, Z Ghosh and Mallik, OUP
7. **PGBCH-10**
A Text book of Microbiology: R C Dubey and D K Maheswari, S Chand & Company
8. **PGBCH-12**
Biotech Expanding Horizons: B D Singh, Kalyani Pub.
9. **PGBCH-16 (Cognitive Science and Human Behavior)**
An Introduction to Applied Cognitive Psychology: A Esgate and David Groom, TMH
10. **PGBCH-17**
Clinical Biochemistry: R. Luxton, 1999, Butterworth-Heinemann, Oxford
11. **PGBCH-18**
BIOS Instant Notes NeuroScience, Alan Longstaff, Taylor and Francis