

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER PATTERN



SYLLABUS  
B.Sc BIOCHEMISTRY THIRD YEAR  
w. e. f. Academic year 2018-19

Board of Studies in Chemistry  
Swami Ramanand Teerth Marathwada University, Nanded

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED-431606,  
MS, INDIA**

Distribution of credits for B.Sc Biochemistry  
Under Faculty of Science

**B.Sc Syllabus Structure**

CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-V)**

<b>Course No</b>	<b>Theory Paper</b>	<b>Period / Week</b>	<b>Total Periods</b>	<b>Internal Evaluation</b>	<b>External Evaluation</b>	<b>Marks</b>	<b>Credits</b>
	<b>Environmental Studies</b>	03	45	10	40	50	02
<b>CBCS-V-501</b>	Developmental Biology <b>OR</b> <b>Elective paper</b> Cancer biology	03	45	10	40	50	02
<b>CBCS-V-502</b>	Applied Biotechnology <b>OR</b> <b>Elective paper</b> Environmental Toxicology	03	45	10	40	50	02
<b>CBCS-V-503</b>	Immunology <b>OR</b> <b>Elective paper</b> Agricultural Biotechnology	03	45	10	40	50	02
<b>CBCS-V-504</b>	Molecular Biology-II <b>OR</b> <b>Elective paper</b> Animal Biotechnology	03	45	10	40	50	02
<b>CBCS-V-505</b>	Biochemical Toxicology	03	45	10	40	50	02
<b>CBCS-V-506</b>	NeuroBiochemistry	03	45	10	40	50	02
<b>CBCS-V-507</b>	Pharmaceutical Biochemistry	03	45	10	40	50	02
<b>CBCS-V-508</b>	Enterprenrship Development	03	45	10	40	50	02
<b>SEC-III</b>	Skill enhancement in Biochemical Tec.(Section A) <b>OR Elective</b> Skill enhancement in Biochemical	03	45	10	40	50	02*

	Tec.(Section B)						
	<b>Total</b>						<b>16(2) *</b>

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Course No	Theory Paper	Period/ Week	Total Periods	Internal Evaluatio n	External Evaluatio n	Marks	Credits
<b>CBCS-VI-601</b>	Bioinformatics & Biostatistics	03	45	10	40	50	02
<b>CBCS-VI-602</b>	Virology	03	45	10	40	50	02
<b>CBCS-VI-603</b>	Clinical Biochemistry	03	45	10	40	50	02
<b>CBCS-VI-604</b>	Plant Biochemistry	03	45	10	40	50	02
<b>CBCS-VI-605</b>	Proteomics <b>OR</b> <b>Elective paper</b> Food Biotechnology	03	45	10	40	50	02
<b>CBCS-VI-606</b>	Clinical Microbiology <b>OR</b> <b>Elective paper</b> Research Methodology	03	45	10	40	50	02
<b>CBCS-VI-607</b>	Cell Signal transduction <b>OR</b> <b>Elective paper</b> Molecular basis of infectious diseases	03	45	10	40	50	02
<b>CBCS-VI-608</b>	Basics of Forensic Science <b>OR</b> <b>Elective paper</b> Molecular basis of non-infectious human diseases	03	45	10	40	50	02
<b>SEC-IV</b>	Skill enhancement in Biochemical Tec.(Section A) <b>OR Elective</b> Skill enhancement in Biochemical Tec.(Section B)	03	45	10	40	50	02*
	<b>Total</b>						16 (2*)
	<b>Practical Papers</b>						

	<b>forV&amp; VI</b>						
<b>LCBC-III-1</b>	LC- Biotechnology& Clinical Microbiology ( <b>Section- A</b> ) <b>OR Elective</b> LC- Technique in Molecular Biology ( <b>Section- B</b> )	04	60	20	80	100	04
<b>LCBC-III-2</b>	LC- Pharmaceutical biochemistry & Competitive Skill & Mock Interview ( <b>Section-A</b> ) <b>OR Elective</b> LC- Diagnostic Biochemistry ( <b>Section-B</b> )	04	60	20	80	100	04
<b>LCBC-III-3</b>	LC- Immunology& Clinical Biochemistry ( <b>Section-A</b> ) <b>OR Elective</b> LC- Analytical Biochemistry ( <b>Section- B</b> )	04	60	20	80	100	04
<b>LCBC-III-4</b>	LC-Molecular Biology& Plant Biochemistry ( <b>Section-A</b> ) <b>OR Elective</b> LC- Environmental Biochemistry ( <b>Section-B</b> )	04	60	20	80	100	04
<b>LCBC-III-5</b>	Research & Seminar based Project	04	60	20	80	100	04
							<b>20</b>
<b>V<sup>th</sup> and VI<sup>th</sup> Semester Total Credits= ( 16(2*)+ 16(2*)+20)</b>							<b>52(4*)</b>

**NOTE:**

1. Laboratory Courses includes Skill enhanced practical as mentioned therein.
2. The practical examination will be conducted at the end of year.
3. Practical in the laboratory course papers will be conducted throughout year i.e during fifth and six semesters.

4. Internal evaluation includes conduction of one internal test ( Theory/ objective or both in one paper)
5. Internal evaluation for laboratory course should be for skill enhancement based practical,

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CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-V)**

**Title of the Paper: Developmental Biology (CBCS-V-501)**

**Period: 45**

**(Section- A)**

**Marks: 50**

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**Objective(s):**

**To acquire basic knowledge about stages of development, fertilization, gametogenesis, embryogenesis, morphogenesis, metamorphosis and apoptosis.**

**Unit 1**

**10**

Basic , Concept of development, potency, commitment, specification, induction, competence, determination and differentiation, morphogenetic gradients, cell fate, cell lineages, stem Cell, genomic equivelence, imprinting, mutants and transgenic in analysis of development.

**Unit-II**

**15**

Gametogenesis, fertilization, and early development , Production of gametes, embryo sac development and double fertilization in plants, Zygote formation, cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals, embryogenesis, establishment of symmetry in plants , seed formation and germination.

**Unit-III**

**10**

Morphogenesis and organogenesis in animals, axes and pattern formation in Drosophila, amphibian and chick, larval formation, metamorphosis

**Unit-IV**

**10**

Programmed cell death (apoptosis and autophagy), aging and senescence,

**References:**

Development Biology by freshney

Development Biology by Gilbert

Development Biology by Lewis wolport

The Shape Of life by Rudolfaleraff

Essential development Biology by J.M.W.slack

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**Course Outcome(s):** The student will be able to

1. Gathering basic knowledge of development, specification of cell, competence of cell and genomic equivalence.
2. Understand the different event of fertilization
3. Know the stages of embryogenesis
4. Explaining event of morphogenesis
5. Learn the mechanism of apoptosis involved in pattern formation and PCD



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CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-V)**

**Title of the Paper: Cancer Biology (CBCS-V-501)**

**Period: 45**

**(Section- B)**

**Marks: 50**

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**Objective(s):**

**To acquire basic knowledge about stages of cancer development, chemical carcinogenesis, different type of tumor markers.**

**Unit I**

**11**

Cancer cell

1. Characteristics of cancer cell
2. Types of cancer a. Benign b. Malignant
3. Metastasis
4. Tumor markers (CEA, AFP)

**Unit II**

**11**

Chemical carcinogenesis I

1. Mutation - definition, significance, rates and frequency,
2. Mutagenic agents (Nicotine),
3. Molecular basis of mutagenesis, a. Induced b. Spontaneous mutations,

**Unit III**

**11**

Chemical carcinogenesis II

1. Genetic and epigenetic carcinogens,
2. Procarcinogens and cocarcinogens,
3. Promoters and initiators,
4. Testing for carcinogenicity- Ames test.

**Unit IV**

**12**

Oncogenes and Radiation

1. RNA and DNA tumor viruses,
2. Retroviruses and viral oncogenes
3. Src and Ras gene,
4. Radiation - effect of ionising radiations on DNA

**Suggested readings:**

1. Klaassen C D, Amdur M O & Doull J (1986) Casarett and Doull's Toxicology, III rd edition, Macmillan publishing company, New York. 26
2. Williams P L& Burson J L (1985) Industrial Toxicology, Van- Nostrand Reinhold, New York.
3. Hayes A W (1988) Principles and methods of toxicology, II nd edition, Raven press New York.
4. Stewart C P& Stolman A (1960) Toxicology, vol I, Academic press, New York.

**Course Outcome(s):** The student will be able to

1. Gathering basic knowledge of cancer cell.
2. Understand the concept carcinogenesis.
3. Know the tumor marker
4. Know the mutation
5. Learn the mechanism of oncogene

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CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-V)**

**Title of the Paper: Applied Biotechnology (CBCS-V-502)**

**Period: 45**

**(Section- A)**

**Marks- 50**

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**Objective(s):**

**To enable the students to acquire basic knowledge in plant tissue culture, transformation, and animal cell culture.**

**Unit - I**

**Plant Biotechnology**

**15**

Introduction, plant tissue culture media – major type of media, constituents of media, Preparation of media, sterilization of media. Types of culture, basic technique of plant tissue culture. Callus culture, cell culture, Protoplast culture, somatic hybridization, Production of haploid plants, micropropagation organogenesis, Embryo culture Embryo Rescue. Gemplasm conservation & cryopreservation. Application of plant tissue culture.

**Unit - II**

**Transformation Technology**

**15**

Gene transfer method. Vector mediated gene transfer-*Agro bacterium* mediated gene transfer, Plant viral vectors. Direct or vectors, DNA transfer – physical method & chemical method. Marker genes for plant transformation – selectable marker gene & reporter gene. Transgenic stability & gene silencing.

**Unit - III**

**Animal Biotechnology**

**15**

Structure & organization of animal cell, Equipments & materials for animal culture technology. Culture media for animal cells – Components of media, physiochemical properties of culture media. Types – Natural media, Artificial media, serum free media primary cell culture, cell line. Stem cell culture, Application of animal cell culture.

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### **Reference Books**

1. Genes III - Lewin B, Oxford University Press, New York (2000)
2. Satyanarayana (2006), Textbook of Biotechnology, U.Satynarayana.
3. Biotechnology – Expanding Horizons, B.D. Sign.
4. Basic Biotechnology – P.K.Gupta, Rastogi Publication, Meerut (2001).

**Course Outcome(s):** The student will be able to

1. Gathering basic knowledge of media preparation.
2. Understand the concept plant tissue culture and animal cell culture
3. Know the micro propagation, organogenesis and embryo culture
4. Know the application of plant tissue culture and animal cell culture
5. Learn the mechanism of transformation.

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**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-V)**

**Title of the Paper: Environmental Toxicology (CBCS-V-502)**

**Period: 45**

**(Section-B)**

**Marks- 50**

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**Objective(s):**

**To enable the students to acquire basic knowledge in environmental toxicology, toxicant and toxicity.**

**Unit I:**

**10**

Principles of toxicology: Definition, Purpose and history of toxicology, Types of toxicity: acute, chronic, genotoxicity. Introduction to toxicity at the level of organ system: Dermato toxicity, gastrointestinal toxicity, Respiratory tract toxicity, hepatotoxicity, Nephrotoxicity, Cardiotoxicity, Hematotoxicity, Immuno toxicity, Neurotoxicity and Reproductive toxicity. Toxicants in soil and air.

**Unit II:**

**10**

Factors influencing toxicity: Route of exposures of toxicant, absorption, distribution and excretion of toxicant, Biotransformation Phase I reactions - oxidation, reduction, hydrolysis, hydration. Phase II reactions - conjugation, methylation, glutathione and amino acid conjugation.

**Unit III:**

**10**

Evaluation of toxicity: Introduction to synergism, antagonism and potentiation. Animal's model used in toxicology studies, Determination of dose response curve and LD 50 or LC50 and chronic exposures. Ames test.

**Unit IV:**

**10**

Toxicology of Alcohol, caffeine and nicotine: Biological properties, health effects, regulatory standards and conclusion. Introduction of metal toxins: history, effects exposure, solutions to reducing exposure Mercury, Lead and Arsenic. Introduction to health effect of solvent: history, biological properties, products, health effect of solvent, reducing exposure and regulatory standards, Introduction to radiotoxicity, asbestos and insecticides toxicity.

**Unit V :****05**

Biological toxin: Properties and effects of animal toxins – snake and scorpion, plants toxins – Ricin ,weeds, toxins produced by animals scorpion , snake, mycotoxins and its types and toxic effect. Solid waste management: Toxic effects of solid waste, traditional methods of solid waste treatment i.e composting, incineration, land filling and modern technologies, treatment methods, plasma torch detoxification, advanced wet oxidation and Pyrolysis.

**Recommended Books:**

- Principles and Methods of Toxicology: A. Wallace Hayes (Edt.) (CRC Press)
- Hamilton and Hardy's Industrial Toxicology: R. D. Harbison (Mosby).
- Basic toxicology – Fundamental Target Organs and Risk Assessment: F. C. Lu (CRC Press)
- Environmental biology: K. C. Agrawal (Agro Botanica).
- Casarett and Doull's Toxicology: C. D. Klaassen, M. O. Amdur, J. Doull (Macmillan Publishing Co.).
- Environmental toxicology – Human Exposure and Their Health Effects: M. Lipmann (Ed.) (Wiley Interscience)
  - Fundamental Toxicology for Chemists: J. H. Duffus and H. G. J. Worth (Eds.) (Royal Society of Chemistry).
  - A Small Dose of Toxicology: The Health Effects of Common Chemicals: Steven G. Gilbert. (CRC Press.

**Course Outcome(s):** The student will be able to

1. Understand the basic concept of environmental toxicology.
2. Know the different type of toxicant
3. Understand the biological toxin.
4. Know the evaluation of toxicity.
5. Know the principle of toxicology.

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CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-V)**

**Title of the Paper: Immunology (CBCS-V-503)**

**Period: 45**

**(Section-A)**

**Marks-50**

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**Objective(s):**

**To familiarize the students with the concept of antigen antibodies, immune response and immunological cell.**

**Unit- I**

History of Immunology, Definition – antigenicity immunogenicity, Immunity – Innate and Acquired immunity, Antibody mediated and cell mediated immune response, Primary and secondary lymphoid organs.

**Unit-II**

**12**

Antigens – Antigen properties, specificity, Haptens and determinants, epitopes & paratopes. Adjuvant. Antibodies – Classes and subclasses of immunoglobulins, structure of Antibody, Isotypic, allotypic & idiotypic variation. Antigen – Antibody reaction – Precipitation, agglutination, complement fixation, ELISA, RIA.

**Unit-III**

**10**

Immunological cell & organs structure of T.B. and NK cells, structure and function of Neutrophils, macrophages, eosinophil and Basophil, Antigen processing and presentation, structure and function of MHC molecule, super antigen.

**Unit-IV**

**8**

Nonspecific defenses in Man – Barriers to infection – skin mucous membrane, inflammation, Allergy and hypersensitivity Reaction (Type I, II, III, IV), clinical manifestation immune diseases, Rheumatoid arthritis, AIDS, Myasthenia gravis.

**Unit-V**

**5**

Transplantation – Autograft, isograft, allograft and xenograft. Graft rejection.

## **REFERENCES:-**

- Immunology 3<sup>rd</sup> ed by Janis kuby.
- Essentials of immunology (5<sup>th</sup> ed) Roit, Blackwell Scientific Pubishing, London.
- Immunology by Nagoba.
- Cellular and Molecular immunology, 3<sup>rd</sup> ed, Abbas.

**Course Outcome(s):** The student will be able to

1. Differentiate between innate and adaptive immunity.
2. Understand the cell types and organ involved in the process of immunoresponse
3. Employ the antigen-antibodies interaction to conduct different immunological test.
4. Interpret the important immunological disorder and principle of autoimmunity
5. Know the adverse effect of immuno system including allergy and hypersensitivity



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**B.Sc Biochemistry Third Year (Semester-V)**

**Title of the Paper: Agricultural Biotechnology CBCS-V-503)**

**Period: 45**

**(Section-B)**

**Marks-50**

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**Objective(s):**

**The aim of this paper is to expose the students with knowledge nitrogen fixation and bio fertilizer, plant pathology and disease control.**

**UNIT I:**

**15**

Nitrogen fixation and Biofertilizer

- Symbiotic nitrogen fixation - Legume-Rhizobium symbiosis, host specificity, nodule development, mechanism of nitrogen fixation, Nitrogenase complex
  - Non-symbiotic nitrogen fixation - Diazotrophy, sites of nitrogen fixation in Cyanobacteria, Azotobacter, Azospirillum.
  - Assimilation of sulphur and phosphorus by plants
  - Biofertilizer- Concept, inoculum development for (Rhizobium and phosphate solubilizers)
- Comparative account of biofertilizer and chemical fertilizer

**UNIT II :**

**15**

Plant pathology and disease control

- Concept of plant pathology
- Classification of plant diseases based on symptoms.
- Plant diseases - Causative agent, symptoms, pathogenesis and control of i) Bacterial blight (Telya) of Pomegranate; ii) Bacterial blight of cotton; iii) Whip smut of sugar cane
- Control methods- Chemical and biological

**UNIT III :**

**15**

Agro-Biotechnology and IPM

- Single cell protein and its nutritive value e.g. Spirulina
- Mushroom cultivation- Spawn preparation and cultivation methods.
- Bio-pesticides- Definition and types (microbial and botanical)

- Integrated pest management (IPM)- insect resistant crop, refugia, ecological approach as a part of IPM.

### **References**

1. Bilgrami K.S and Dube H.G.(1994), Textbook of Modern Plant Pathology,Vikas Publications, New Delhi.
2. Gupta P.K. (1998), Genetics and Biotechnology in Crop Improvement,Rastogi Publications, Meerut.
3. Pathak V.N,Khatri N.K.,Pathak M.(1996), Fundamentals of Plant Pathology,Agrobotanical Publications,Bikaner.
4. Powar C.B., Dagainawala H.F., (1990), General Microbiology,Vol. II,Himalaya Publishing House,Mumbai. 5. Purohit S.S.(2002),Agricultural Biotechnology,Agrobios India, Jodhpur.
6. Satyanarayana U. (2007), Biotechnology, Books and Allied Pvt. Ltd. Kolkata.Vyas S. C., Vyas S., Vyas S., and Modi H. A. (1998), Biofertilizer and Organic Farming, Akta Prakashan, Nadiad, G.S, Meerut.
7. Sayyed et al (2014), Text book of Biotechnology BT 311-313, Prashant publication, Jalgaon

**Course Outcome(s):** The student will be able to

1. Understand the basic concept of gene bio fertilizer.
2. Know the different type of plant disease
3. Understand the bio pesticide.
4. Know the single cell protein.
5. Know the nitrogen fixation.

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CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-V)**

**Title of the Paper: Molecular Biology-II (CBCS-V-504)**

**Period: 45**

**( Section-A)**

**Marks-50**

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**Objective(s):**

**The aim of this paper is to expose the students with knowledge genetic engineering, DNA sequencing and transformation.**

**Unit-1**

**Recombinant DNA Technology/Genetic Engineering 15**

Introduction Definitions, Tools of genetic engineering, step in gene cloning. Restriction end nuclease – types Nomenclatures, Recognition sequence, cleavage, pattern, Vectors – characteristics of food vector, plasmid, vector, Bacteriophage vector, cosmid vector, phagemid vector, phasmid vector, Artificial chromosome vector.

**Unit-2**

**DNA Sequencing 10**

Maxam – Gilbert technique, Sanger – Coulson method, primer walking, chromosome walking, Chromosome jumping, Pyro sequencing, Microarray, Genomic Library & c-DNA Library.

**Unit-3**

**10**

Genetic fingerprinting, oligonucleotide directed mutagenesis, protein engineering PCR – Technique, types & application, DNA Bar-coding

**Unit-4**

**Genetic counseling Fish 15**

Transformation of E-coli – section of transformed cells, Identification of recombinant. Southern, Northern & Western blotting technique; probes, FACS, Application of gene cloning Biotechnology, medicine Agriculture & forensic science.

**Reference Books**

1. Biochemistry – Zubey.
2. Biochemistry – Stryer.
3. Principal of microbiology- prescott
4. Fundamental of biochemistry- Voet and Voet
5. Molecular Biology of the cell- Bruce Albert

**Course Outcome(s):** The student will be able to

1. Understand the basic concept of gene cloning.
2. Know the different type of restrictions endonucleases
3. Employ the tool of genetic engineering to conduct gene cloning experiment.
4. Interpret the DNA sequencing.
5. Know the blotting technique.

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**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-V)**

**Title of the Paper: Animal Biotechnology (CBCS-V-504)**

**Period: 45**

**(Section-B)**

**Marks-50**

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**Objective(s):**

**The aim of this paper is to expose the students with knowledge animal cell and tissue culture, transgenic animal and cloning.**

**UNIT I :**

**15**

**Introduction to Animal Cell and Tissue Culture.**

- History and scope of animal cell and tissue culture.
- Principle, merits and demerits of animal cell/tissue culture
- Laboratory facilities for Animal tissue culture. Culture media: a) Natural media b) Defined media.
- Primary and established cell lines and their characterization
- Primary culture, cultured cells and evolution of cell lines and their maintenance.
- Large scale cultivation of mammalian cell.
- Applications of animal cell culture to human health, medical and therapeutic purposes
- Pharmaceutical products of animal cell culture
- Biohazards/Biosafety

**UNIT II :**

**15**

**Transgenic Animals and Cloning**

- Introduction to transgenic laboratory animals.
- Principles and methods of development of transgenic animals
- Cell/embryo cryopreservation,
- Measurement of cell death - Apoptosis,
- Animal cloning: Principle and methods with suitable example.
- Risks and safety in the animal cell culture.
- In-vitro culture of oocytes and embryo

## Cell transformation

- Cell transformation - In vitro culture of oocytes/ embryos
- DNA microinjection.
- Embryogenic stem cell transfer.
- Economics aspects of transgenic animals.
- Ethical issues: Animal welfare and animal rights

**References**

1. Arora M.P. (2003), Biotechnology, Himalaya Publishing House, Mumbai.
2. Freshney R. Ian (2006), Culture of Animal Cells : A Manual of Basic Techniques, John Wiley and Sons, Inc., New York.
3. Gangal Sudha (2007), Principles and Practice of Animal Tissue Culture, Universities Press India Pvt. Ltd.
4. Gupta P.K (2004), Biotechnology and Genomics, Rastogi Publication Meerut.
5. Ignacimuthu S (1995), Basic Biotechnology, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
6. Purohit S.S. (2002), Agricultural Biotechnology, Agrobios India, Jodhpur.
7. Satyanarayana U. (2007), Biotechnology, Books and Allied Pvt. Ltd. Kolkata.
8. Sayyed et al (2014), Text book of Biotechnology BT 311-313, Prashant publication, Jalgaon.

**Course Outcome(s):** The student will be able to

1. Understand the basic concept of gene cloning.
2. Know the different type cell transformation.
3. Employ the tool of genetic engineering to conduct gene cloning experiment.
4. Understand transgenic animal.
5. Know the animal tissue culture.

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CBCS (Choice Based Credit System)

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**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-V)**

**Title of the Paper: Biochemical Toxicology (CBCS-V-505)**

**Period: 45**

**Marks-50**

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**Objective(s):**

**The aim of this paper is to expose the students with knowledge toxicant and toxicity, absorption, biochemical effect and food additives.**

**Unit-1**

**Principal Toxicology**

**08**

Introduction mechanism of toxicants absorption, factor affecting intestinal absorption. Chemical factors affecting absorption, Biochemical effects resulting in toxic injury.

**Unit-2**

**Organ toxicity**

**08**

Neurotoxicity, Structural and functional toxicity, Lung toxicity, hepatotoxicity, Skeletal toxicity.

**Unit-3**

**08**

Measurement of toxicants and toxicity, Bioassay, physical and chemical method, animal toxicity tests, Acute toxicity subacute toxicity, sub chronic, chronic toxicity

**Unit-4**

**08**

**Food additives and Mutagenesis**

Types of food additives, food colors, sweeteners, saccharin, sugar alcohol, flavoring agents, mechanism of mutagenicity, mutagenic agents.

**Unit-5**

**13**

Application of toxicology, forensic, clinical, industrial toxicity and application. Social aspect in relation to toxicants

**Reference Books**

Toxicology – Casarett and Doulls

Toxicology- Mechanism and analytical method

Hand books of food toxicology- S.S Desphande

**Course Outcome(s):** The student will be able to

1. Understand the basic concept of toxicology.
2. Know the different type of organ toxicity
3. Employ the tool of bioassay to measure the toxicant and toxicity.
4. Know the food additives.
5. Know the application of toxicology.



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**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-V)**

**Title of the Paper: Neuro biochemistry (CBCS-V-506)**

**Period: 45**

**Marks-50**

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**Objective(s):**

**To familiarize the students with the concept of Synaptic transmission, cellular signalling, synthesis and distribution, metabolism and mechanism of action of drugs.**

**Unit-I**

**10**

Synaptic transmission and cellular signaling: An overview Acetylcholine: Chemistry, synthesis, storage and release; Nicotinic and muscarinic receptors; Catecholamine: Biosynthesis, storage and release; Dopamine, adrenergic receptors

**Unit-II**

**10**

Serotonin: Synthesis, action and distribution; Role of serotonin receptors in behavior; Excitatory amino acid transmitters: Synthesis, metabolism, distribution and receptor subtypes; Histamine: Dynamics, molecular sites and action in the CNS; GABA, glycine: Synthesis, uptake and release; Receptors of GABA and glycine.

**Unit- III**

**10**

Neuropeptides neurotransmitters: Biosynthesis, function regulation and receptors; Opioid peptide and opioid receptors: Synthesis, metabolism, distribution and receptor subtypes; CSF; Micro circulation and blood brain and CSF barriers Intracellular signaling; G Proteins and second messengers

**Unit-IV**

**10**

Metabolism: Energy metabolism of the brain; Hypoxic-Ischemic brain injury and oxidative stress; Metabolic encephalopathies; Eicosanoids, docosanoids, platelet-activating factor and inflammation

**Unit-V**

**05**

Mechanism of action of drugs; Drug addiction, drug abuse and adverse drug reaction; Neuroendocrinology of behaviour; Apoptosis and necrosis

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**Text Books**

1. Siegel, Basic Neurochemistry (8th Edition) Academic Press, 2012
2. Friefelder: Practical Biochemistry
3. Kendel, Principles of Neural Science (5th edition), McGraw Hill, 2013
4. Squire, Fundamental Neuroscience (4th Edition), Elsevier, 2013

**Course Outcome(s):** The student will be able to

1. Understand the basic concept of neurology.
2. Know the different type of receptor
3. Understand the different neurochemical process.
4. Know the energy metabolism of brain.
5. Know the mechanism action of drugs.

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Distribution of credits for B.Sc Biochemistry  
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**B.Sc Syllabus Structure**

CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-V)**

**Title of the Paper: Pharmaceutical Biochemistry (CBCS-V-507)**

**Period: 45**

**Marks-50**

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**Objective(s):**

**To acquire basic knowledge about pharmacology, biological assay, development of new drugs and effect of drug on various system.**

**Unit-1**

**15**

General pharmacology, Source, Nature and nomenclature of drug, Dosage form route of administration, factor affecting dosage and drug action absorption, distribution metabolism and excretion of drug adverse drug reaction

**Unit-II**

**15**

Biological assay and development of new drug, selection and application of bioassay principle and method of bioassay, evaluation of drug, preclinical evaluation, therapeutic index, physico-chemical properties of drug ionization, hydrogen bonding, chelation.

**Unit-III**

**15**

Study of effect of drug on various system like action of drug on CNS, General overview alcohol and alcoholism, depression amine hypothesis drug dependence, Drug acting on CVS. Pharmacotherapy of hypertension, vaccine and antiserum antibiotic. Drug acting on respiratory system

**References**

1. Biochemistry – Zubey.
2. Biochemistry – Stryer.
3. Principles of microbiology- Prescott
4. Fundamentals of biochemistry- Voet and Voet
5. Pharmaceutical Biochemistry By Lehinger

**Course Outcome(s):** The student will be able to

1. Understand the basic concept of Pharmacology.
2. Know the different route of drug administer
3. Understand the different biological assay.
4. Know the drugs action of CNS.
5. Know the mechanism action of drugs.

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**B.Sc Syllabus Structure**

CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-V)**

**Title of the Paper: Enterprenrship Development (CBCS-V-508)**

**Period: 45**

**Marks-50**

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**Objective(s):**

**To acquire basic knowledge about entrepreneurship development, requirement of entrepreneurship and assessing the market.**

**UNIT I**

**Foundation Of entrepreneurship Development 10**

Introduction to Entrepreneurship Development, Concept of Entrepreneurship, Types of Entrepreneurship, Entrepreneurship as a career, The changing role of the Entrepreneur.

**UNIT II**

**Requirement of entrepreneurship 10**

Attributes Required for Entrepreneurship, Growth of Entrepreneurship in India  
Concept and function of woman Entrepreneurship

**UNIT III**

**Entrepreneurship motivation and process of Entrepreneurship 05**

What is motivation, Motivation theories, Motivation factors, 4 C's of Entrepreneurship

**UNIT IV**

**Assessing the Market 10**

Information gathering techniques, Principle of Market Survey, Analysis of Survey data  
Resource Mobilization

**UNIT V 10**

**Entrepreneurship Programme, SWOT analysis and budget**

SWOT analysis, Types of budget, Contents of project report, Objectives of Entrepreneurship programme, Industrial project – Meaning types of projects , project cycle , Identification, formation, Appraisal, Implementation, Monitoring and evaluation

## REFERENCE BOOKS

- |                                           |                                      |
|-------------------------------------------|--------------------------------------|
| 1 Hand Book for New Entrepreneurs         | Bhatt, EDI faculty,                  |
| 2 Entrepreneurship and Venture Management | Chifford M and Back M B Mc           |
| 3 Entrepreneurship                        | G.Babu Rao, TTTI (SR) Hyderabad – 29 |

**Course Outcome(s):** The student will be able to

1. Understand the basic concept of Entrepreneurship.
2. Know the different type of Entrepreneurship
3. Understand the Information gathering techniques.
4. Know the Analysis of Survey data.
5. Know the SWOT analysis.

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**B.Sc Syllabus Structure**

CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-V)**

**Title of the Paper: Skill enhancement in Biochemical Technique (SEC-III)**

**Period: 45**

**( Section-A)**

**Marks-50**

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**Objective(s):**

**This course aims to give clear understanding of the basic concept of chromatography technique, blotting, extraction and isolation.**

1. Plasmid isolation
2. Blotting
3. MIC and MFC by CLSI M-27 method of unknown molecule.
4. Study of biofilm formation on synthetic medium
5. Protein extraction and purification
6. Extraction of various fractions from plant materials
7. Demonstration of HPTLC
8. Demonstration of GC-MS
9. Demonstration of X-ray crystallography
10. Demonstration of MRI

**Reference Book:**

Physical biochemistry – Frifielder. D, W.H.Freeman and Co. New York, 1983

Analytical biochemistry – Holmes and H.Peck, academic press, New York.

Biophysical technique – Wilson and Goulding, ELBS edition, latest edition.

Biophysical chemistry (principle and technique) – Upadhyaya and Upadhyaya and Nath Himalaya Pub. Nagpur, latest edition

Biochemistry – Zubey.

Biochemistry – Stryer.

Fundamental of biochemistry- Voet and Voet

Molecular Biology of the cell- Bruce Albert

**Course Outcome(s):** The student will be able to

1. Understand the basic concept chromatography.
2. To train the students for extraction and isolation.
3. Understand the blotting techniques.
4. Be able to student for protein purification.

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**B.Sc Syllabus Structure**

CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-V)**

**Title of the Paper: Skill enhancement in Biochemical Technique (SEC-III)**

**Period: 45**

**(Section-B)**

**Marks-50**

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**Objective(s):**

**This course aims to give clear understanding of the biochemical changes in disease, quality control, precautions and limitation..**

Unit 1 Introduction

Organization of clinical laboratory, Introduction to instrumentation and automation in clinical biochemistry laboratories safety regulations and first aid. General comments on specimen collection, types of specimen for biochemical analysis. Precision, accuracy, quality control, precautions and limitations.

Exercises

- Collection of blood and storage.
- Separation and storage of serum.

Unit 2 Evaluation of biochemical changes in diseases

Basic hepatic, renal and cardiovascular physiology. Biochemical symptoms associated with disease and their evaluation. Diagnostic biochemical profile.

Unit 3 Assessment of glucose metabolism in blood

Clinical significance of variations in blood glucose. Diabetes mellitus.

Exercises

- Estimation of blood glucose by glucose oxidase peroxidase method.

Unit 4 Lipid profile

Composition and functions of lipoproteins. Clinical significance of elevated lipoprotein.

Exercises

- Estimation of triglycerides.

Unit 5 Liver function tests

Exercises

- Estimation of bilirubin (direct and indirect).

Unit 6 Renal function tests and urine analysis



Use of urine strip / dipstick method for urine analysis.

Exercises • Quantitative determination of serum creatinine and urea.

Unit 7 Tests for cardiovascular diseases

Involvement of enzymes in diagnostics of heart disease including aspartate transaminase, isoenzymes of creatine kinase and lactate dehydrogenase and troponin.

Exercises • Estimation of creatine kinase MB.

#### SUGGESTED READINGS

1. Medical Laboratory Technology - a Procedure Manual for Routine Diagnostic Tests Vol. I (2010), Mukherjee, K.L., Tata Mc Graw–Hill Publishing Company Limited (New Delhi). ISBN:9780070076594 / ISBN:9780070076631
2. Medical Laboratory Technology - a Procedure Manual for Routine Diagnostic Tests Vol. II (2010), Mukherjee, K.L., Tata Mc Graw – Hill Publishing Company Ltd. (New Delhi), ISBN: 9780070076648.
3. Medical Biochemistry (2005) 2nd ed., Baynes, J.W. and Dominiczak, M.H., Elsevier Mosby Ltd. (Philadelphia), ISBN:0-7234-3341-0.
4. Experimental Biochemistry: A Student Companion (2005) Rao, B.S. and Deshpande, V., IK International Pvt. Ltd. (New Delhi), ISBN:81-88237-41-8.

**Course Outcome(s):** The student will be able to

1. Understand biochemical in disease.
2. To train the students for collection and storage blood.
3. Understand the cardiovascular disease.
4. Be able to student for blood separation.

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**B.Sc Syllabus Structure**

CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-VI)**

**Title of the Paper: Bioinformatics & Biostatistics (CBCS-VI-601)**

**Period: 45**

**Marks-50**

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**Objective(s):**

**The aim of this paper is to expose the students with the knowledge in standard deviation, T test, mean, median, mode and analysis using bioinformatics tool.**

**Unit-1**

**08 hrs.**

Introduction to biostatistics, Methods of sampling (Probability & non – probability sampling), collection of data, classification of data, Tabulation of data, Representation of data (Graphical, Tabular), Pictogram.

**Unit – II**

**12 hrs.**

Measure of Central Tendency: Mean, Median, Mode Measure of Dispersion:

Standard deviation, Range, Variance.

**Unit – III**

**08 hrs.**

Test of significance, T-test, chi-square Test, Correlation Kinds & types of correlation, Karl person's coefficient & spear-man's correlation coefficient, Regression. Types, methods of regression & regression equation.

**Unit – IV Bioinformatics**

**08 hrs.**

Introduction, history of bioinformatics, DNA sequence, and Amino acid square of proteins, nucleotide sequences, /database and search tools, Analysis using bioinformatics tools, Application of bioinformatics.

**Unit – V**

**09 hrs.**

Introduction to database, types of database, Biological database (NCBI, EMBL, DDVJ, PDB, SWISS PROT, TREAMBEL), FASTA, BLAST search tools, Information retrieval database (Entrez, Genebank, pubMed, SRS).

REFERENCE BOOK :

- Daniel Wayne W, Biostatics: A foundation for analysis in the health science, John Wiley & Sons.
- Mahajan BK, Methods in Biostatics, Jaypee publication, New Delhi.
- Bioinformatics – Sequence & genome analysis by Mount.

**Course Outcome(s):** The student will be able to

1. Understand the basic concept biostatics and bioinformatics.
2. To train the students for handling bioinformatics tool.
3. Understand the biological data base.
4. Ability to apply biostatical tool.
5. Know the application of biostatics and bioinformatics.

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**B.Sc Syllabus Structure**

CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-VI)**

**Title of the Paper: Virology (CBCS-VI-602)**

**Period: 45**

**Marks- 50**

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**Objective(s):**

**This course aims to give clear understanding of the basic concept of virology, structure and classification viruses, detection, pathogenicity and lab diagnosis.**

**Unit-1**

**10**

Virus: Structure and classification Definition, Occurrence, nature ,size and structure of viruses, symmetry of viruses, Differences from bacteria, classification.

**Unit-2**

**10**

Plant viruses: Classification of viruses, pathogenesis of plant viruses, Tobamovirus group, Tobacco mosaic virus, patexvirus group, potato virusx ( pvx) rhabdo viruses, gromphena virus, Reo virus, ds DNA virus

**Unit-3**

**13**

Animal viruses: Classification of animal viruses according to their genetic system, cultivation, growth detection, multiplication, pathogenicity, method of lab diagnosis of pox virus, adenovirus, retrovirus, multiplication in RNA viruses, interferon

**Unit- 4**

**12**

Bacteriophage, types of phages  $\Phi$ x174 icosahedral ss DNA phage, FF phage, phage T4 virulent ds DNA phage, lambda temperate ds DNA phage, life cycle of bacteriophage- lytic cycle, lysogenic cycle. Viroids and prions

## Reference Books

- 1) Introduction to Microbiology Anderson D.A.
- 2) Textbook of Microbiology Anantnarayan R. & C.K.J. Panikar
- 3) Industrial Microbiology Casida
- 4) Microbiology 5<sup>th</sup> edition Pelzar M.J., E.C.S. Chan, Krieg N.R.
- 5) General Microbiology by powar and Daginawala

**Course Outcome(s):** The student will be able to

1. Understand the basic concept virology.
2. To train the students for handling unknown virus by known specific antibody.
3. Understand the lytic and lysogenic cycle.
4. Ability to detection of unknown antibodies with help of known viral antigen.
5. Know the RNA Viruses.

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**B.Sc Syllabus Structure**

CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-VI)**

**Title of the Paper: Clinical Biochemistry (CBCS-VI-603)**

**Period: 45**

**Marks-50**

**Objective(s):**

**To acquire basic knowledge about inborn error of metabolism, marker enzyme, and management of disease.**

**Unit-1 Inborn Errors of Metabolism**

**10 hrs.**

Carbohydrate : Lactose intolerance, glycogen storage disease and galactosuria. Protein : Phenylketonuria, Alkaptonuria, Albinism and Maple syrup urine disease. Lipids : Gaucher's disease, Nieman Pick's disease and Tay Sachs's disease. Nucleic acid : Leach – Nyhan syndrome, Gout.

**Unit – II Diagnostic Biochemistry – I**

**10 hrs.**

Marker enzymes: Significance SGOT, SGPT, LDH, Alkaline Phosphates.

Etiology, symptoms and control of:

1. AIDS
2. Hepatitis
3. Arthrosclerosis

**Unit – III Diagnostic Biochemistry – II**

**10 hrs.**

Diabetes: Classification, structure and biosynthesis of insulin mechanism of action of insulin. Glycosuria and Hypoglycemia: introduction and types. Management of Diabetes. Glucose tolerance test.

**Unit – IV Clinical Pathology**

**15 hrs.**

Antigen, structure and function of different immunoglobulins. Primary and secondary immune response. Humoral and cell mediated immunity. Principle and application of: RIA, ELISA. Biopsy techniques: introduction, purposes, principle. Concepts of stem cells, its application.

## REFERENCE BOOK

- Satanarayana (2006), textbook of Biochemistry, U.Staynarayana and U.Chakrapani edition third.
- Clinical Pathology – Manual for Undergraduates, Sabitri Sanyal, B.I. Churchill Living stone, Pvt.eddition first.
- Textbook of Human Biochemistry by G.P.Talwar
- Harper’s book of Biochemistry edited by Murray and Granner, Appleton and Lange, latest edition.
- Clinical pathology – Sood.R, Jaypee Pub. New Delhi.

**Course Outcome(s):** The student will be able to

1. Know disease is at molecular level.
2. Know chemical components of the body.
3. Understand, detection of biomolecule in clinical specimen like blood, urine, CSF..
4. Detect abnormal constituent for the diagnosis of disease.
5. Know the Biopsy

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**B.Sc Syllabus Structure**

CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-VI)**

**Title of the Paper: Plant Biochemistry (CBCS-VI-604)**

**Period: 45**

**Marks- 50**

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**Objective(s):**

**To acquire basic knowledge about plant cell, photosynthesis, plant hormone and biochemical changes of seed germination.**

**Unit-1**

**Plant cell and Photosynthesis**

**12**

Structure of plant cell (i) structure of plant cell membrane and cell wall. Photosynthesis – Structure & function of chloroplast of system, photosynthetic pigment and their functions, photosystem I & II. Photosynthetic electron transport and phosphorylation. Calvin cycle (C3 plant) Hatch slack pathway (C4 plants)

**Unit-II Plant tissue culture and Hormones**

**11**

Plant tissue culture, plant cell organs & embryo culture, another culture somaclonal variation properties isolation fusion and culture of protoplasts, application of plant tissue culture transgenic plant.

**Unit-III Plant Hormones**

**10**

Plant hormones, Biosynthesis, structure and biochemical mode of action of auxins, gibberellins, ctokinins, abscisic acid and ethylene, other plant growth regulator.

**Unit-IV Biochemistry of plant growth**

**12**

Biochemistry of seed development, dormancy, Biochemical changes during germination of seeds, Biochemistry of fruit development and rip ending. Structure and function of phytochrome, hormonal regulation of flowering, photoperiodism and vernalization.



**Reference:**

1. Biochemistry – Zubey.
2. Biochemistry – Stryer.
3. Principal of microbiology- prescott
4. Fundamental of biochemistry- Voet and Voet
5. Molecular Biology of the cell- Bruce Albe

**Course Outcome(s):** The student will be able to

1. Understand the basic concept of photosynthesis.
2. Know chemical components of the plant cell.
3. Understand classification of plant hormone.
4. Able to understand plant metabolic pathway.
5. Know the phytochrome

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**B.Sc Syllabus Structure**

CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-VI)**

**Title of the Paper: Proteomics (CBCS-VI-605)**

**Period: 45**

**(Section-A)**

**Marks-50**

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**Objective(s):**

**The aim of this paper is to expose the student with knowledge in protein extraction, purification, quantification.**

**Unit-I**

**12**

Proteome, proteomics and protein fractionation, separation and purification I, Protein extraction and sample preparation, General Biochemical Properties of Protein

**Unit-II**

**13**

Protein quantification and Isoelectric focusing , Protein 2D gel electrophoresis, Protein digestion and peptide extraction

**Unit-III**

**15**

Mass Spectrometry-Fundamental parameters: Mass accuracy, Resolution, Sensitivity, Ion sources: Electrospray ionization, Matrix assisted laser desorption and ionization, Mass analyzers: Quadrupole, Ion-trap, Time-of-flight, Orbitrap, Fourier-transform ion cyclotron resonance, Hybrid analyzers, Detectors: Electron multipliers, Microchannel plate.

**Unit-IV**

**15**

Gel based proteomics, LC-based proteomics, Peptide mass finger printing, Tandem mass spectrometry, Collision induced dissociation, Electron transfer dissociation, Data-dependent MS/MS, Protein Identification and data evaluation, Identification of post-translational modifications: Phosphorylation, Glycosylation, Acetylation.

**Reference Book:**

Textbook Introducing Proteomics, from concepts to sample preparation, mass spectrometry and data analysis by J. Lovric (2011), Wiley-Blackwell Publisher

.Physical biochemistry – Frifielder. D, W.H.Freeman and Co. New York, 1983

Analytical biochemistry – Holmes and H.Peck, academic press, New York.

Biophysical technique – Wilson and Goulding, ELBS edition, latest edition.

.Biophysical chemistry (principle and technique) – Upadhyaya and Upadhyaya and Nath  
Himalaya Pub. Nagpur, latest edition.

**Course Outcome(s):** The student will be able to

1. Understand the basic concept of extraction, purification.
2. Able to understand the theory of MS.
3. Understand principle of isoelectrofocusing.
4. Able to understand LC based proteomic.
5. Know Interpret

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**B.Sc Syllabus Structure**

CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-VI)**

**Title of the Paper: Food Biotechnology (CBCS-VI-605)**

**Period: 45**

**(Section-B)**

**Marks-50**

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**Objective(s):**

**This course aims to give clear understanding of the basic concept of food biotechnology, aspect of food production, Food Spoilage and Preservation.**

**UNIT I :**

**15**

**Food and Dairy Biotechnology**

- Primary sources of microorganisms in food.
- Food borne Bacteria/ Microbes in food – Bacteria, Molds and Yeasts.
- Intrinsic and extrinsic factors affecting food microflora.
- Bacterial toxin: Botulism and Staphylococcal toxin.
- Fungal Toxin: Aflatoxin.
- Milk - Definition, composition and types.
- Fermented milk products - Yoghurt and cheese.
- Preservation of milk by heat treatment (Pasteurization and ultra high temperature)
- Physicochemical characterization of milk
- Microbiological tests : MBRT and Resazurin test

**UNIT II:**

**15**

**Aspects of Food Production.**

- Food safety - HACCP system to food protection, responsibility for food safety.
- Food additives - Definition, types and functional characteristics.
- Natural colors : Types, applications, advantages of natural colours over artificial colors.
- Sweeteners - Types and applications.
- Fermented food - Idli and Bread (process, microbiology involved, changes during fermentation and nutritive value)

**Food Spoilage and Preservation.**

- Causes of food spoilage.
- Spoilage of fruits, vegetables, meat, poultry products (eggs), dairy products (milk).
- Food preservation – a) Chemical methods - Acids, salts, sugars, antibiotics, ethylene oxide, antioxidants. b) Physical methods - Radiations, low and high temperature and drying.

**References:**

1. Adam M.R and Moss M.O (2003), Food Microbiology, New Age International Pub.New Delhi.
2. Frazier W.C and Westhoff D.C (2005),Food Microbiology,4th Edi.,Tata Mc Graw Hill Pub Company Ltd.New Delhi.
3. Harrigan W. F (1998), Laboratory methods in Food Microbiology, 3rd Edi. Academic Press.New York.
4. Jay J.M. (1992), Modern Food Microbiology, 4th Ed. Chapman and Hall, New York ,NY, USA.
5. K.Vijaya Ramesh(2007), Food Microbiology,MJP Publishers, Chennai.
6. Powar C.B and Dagainawala H.F (2003), General Microbiology, Vol. II, Himalaya Pub.House,Mumbai.
7. Sivsankar B (2002), Food Processing and Preservation, Prentice Hall of India Pvt.Ltd. New Delhi.
8. Sayyed et al (2014), Text book of Biotechnology BT 314-316, Prashant publication, Jalgaon.

**Course Outcome(s):** The student will be able to

1. Understand the basic concept food biotechnology.
2. Able to understand the food microflora.
3. Understand principle of food processing and preservation.
4. Able to understand aspect food production.
5. Know food diseases

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**B.Sc Syllabus Structure**

CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-VI)**

**Title of the Paper: Clinical Microbiology (CBCS-VI-606)**

**Period: 45**

**(Section-A)**

**Marks- 50**

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**Objective(s):**

**This course aims to give clear understanding of the basic concept of clinical microbiology, structure and classification bacteria, viruses, detection, pathogenicity and lab diagnosis.**

**Unit I**

**15**

Human Diseases Classification, habitat, morphology, staining reactions, cultural characters, biochemical characters, antigenic structure, pathogenesis. Laboratory diagnosis, epidemiology, prophylaxis, chemotherapy . Diseases caused by:

Bacteria i) *Staphylococcus aureus* ii) *Pneumococcus* iii) *Mycobacterium tuberculosis* iv) *Salmonella typhi* v) *Vibrio cholerae* vi) *Treponema pallidum* vii) *Leptospirillum*.

**Unit II**

**15**

Classification, habitat, morphology, staining reactions, cultural characters, biochemical characters, antigenic structure, pathogenesis. Laboratory diagnosis, epidemiology, prophylaxis, chemotherapy. diseases caused by:

Viruses i) HIV ii) Hepatitis virus iii) H1N1 iv) SARS v) Chikun guniya vi) Oncogenic viruses.

**Unit III**

**15**

Classification, habitat, morphology, staining reactions, cultural characters, biochemical characters, antigenic structure, pathogenesis. Laboratory diagnosis, epidemiology, prophylaxis, chemotherapy diseases caused by:

(a) Protozoa i) *Entamoeba histolytica* ii) *Plasmodium* spp

(b) Fungi i) *Candida albicans* , ring worm, Yeast

(c) Typhus fever.

**Reference book**

- 1) Introduction to Microbiology by Anderson D.A.
- 2) Textbook of Microbiology by Anantnarayan R. & C.K.J. Panikar
- 3) Industrial Microbiology by Casida
- 4) Microbiology 5th edition Pelzar M.J., E.C.S. Chan, Krieg N.R.
- 5) General Microbiology by Powar and Dagainawala

**Course Outcome(s):** The student will be able to

1. Understand the basic concept habitat, classification bacteria, and virus.
2. Able to understand the pathogenicity.
3. Understand principle of Staining.
4. Able to understand morphological character.
5. Know human disease

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**B.Sc Syllabus Structure**

CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-VI)**

**Title of the Paper: Research Methodology (CBCS-VI-606)**

**Period: 45**

**(Section-B)**

**Marks- 50**

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**Objective(s):**

**This course aims to give clear understanding of the basic concept of research methodology.**

**Unit 1**

**05**

Introduction to Research Methodology

Objectives and motivation in research.

**Unit 2**

**10**

Defining the Research Problem

Selecting and defining a research problem, Reviewing and conducting literature search, Developing a research plan.

**Unit 3**

**15**

Designing of Experiment

Different experimental designs – single and multifactorial design, Making measurements and sources of error in measurements, Methods of data collection and record keeping.

**Unit 4**

**15**

Data Processing and Statistical Analysis

Processing operations, tabulation, and graphical representation, Statistics in research: Concepts of sample and population, Measure of central tendency, dispersion, asymmetry (skewness, kurtosis), Normal distribution (p-value), Statistical tests and hypothesis (Standard error, t-test, chi-square test), and regression analysis, Report writing, Writing a research paper - abstract, introduction, methodology, results and discussion.

**SUGGESTED READINGS**

1. Research in Education (1992) 6th ed., Best, J.W. and Kahn, J.V., Prentice Hall of India Pvt. Ltd.
2. At the Bench: A Laboratory Navigator (2005) Barker, K., Cold Spring Harbor Laboratory



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Press (New York), ISBN: 978-087969708-2. 51

3. Research Methodology - Methods and Techniques (2004) 2nd ed., Kothari C.R., New Age International Publishers.

4. Research Methodology: A Step by Step Guide for Beginners (2005) 2nd ed., Kumar R., Pearson Education.

5. Biostatistics: A Foundation for Analysis in the Health Sciences (2009) 9th ed., Daniel W.W., John Wiley and Sons Inc.

6. Statistics at the Bench: A Step-by-Step Handbook for Biologists (2010) Bremer, M. and Doerge, R.W., Cold Spring Harbor Laboratory Press (New York), ISBN: 978-0-879698- 57-7

**Course Outcome(s):** The student will be able to

1. Understand the basic research methodology.
2. Developing a research plan
3. Understand the data Processing and Statistical Analysis
4. Designing of Experiment.

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Distribution of credits for B.Sc Biochemistry  
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**B.Sc Syllabus Structure**

CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-VI)**

**Title of the Paper: Cell Signal transduction (CBCS-VI-607)**

**Period: 45**

**(Section-A)**

**Marks-50**

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**Objective(s):**

**To familiarize the students with the concept of cell signalling, synthesis, GPCR, Intracellular signal transduction.**

**Unit-1**

**06**

Host parasite interaction, Transport of bacterial protein to the host, regulation of bacterial virulence factor, exotoxin ( AB Exotoxin and Membrane disrupting exotoxin. )

**Unit-2**

**06**

Cell signaling, principal of cell signaling, Endocrine, autocrine and paracrine signaling, Signaling molecules ( steroid hormone, NO and Co , Peptide hormone , growth factor and neurotransmitter) role of protein kinase and protein phosphatase in cell signaling.

**Unit-3**

**12**

Cell surface receptor, GPCR, Tyrosine kinase receptor, Savenger receptor. Signaling mediated through GPCR Signaling mediated by Cyclic AMP and  $Ca^{2+}$  ,  $IP_3$  , Calmodulin mediated signaling Cytokine receptor and non receptor protein tyrosine kinase

**Unit-4**

**09**

Pathway of intracellular signal transduction. ( Ras, Raf, and the MAP kinase pathway) JAT/ STAT pathway. Bacteria and plant two component system

**Unit-5**

**12**

Nerve Conduction, basic structure of neuron, creation and propagation of nerve impulse, action potential ,cholinergic receptor, acetylcholine receptor, acetyl choline esterase, Nerve poison.Biochemistry of vision, taste , smell and hearing, Bacterial chemotaxis and Quarm sensing.

**Reference Books:**

Biochemistry – Zubey.

Biochemistry – Stryer.

Fundamental of biochemistry- Voet and Voet

Molecular Biology of the cell- Bruce Albert

**Course Outcome(s):** The student will be able to

1. Understand the basic concept of cell signaling.
2. Know the different type of receptor
3. Understand the tyrosine kinase receptor.
4. Know the basic structure of neuron.
5. Know GPCR.

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**B.Sc Syllabus Structure**

CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-VI)**

**Title of the Paper: Molecular basis of infectious diseases (CBCS-VI-607)**

**Period: 45**

**(Section-B)**

**Marks-50**

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**Objective(s):**

**To familiarize the students with the concept of infectious disease, infectious agent and disease caused by bacteria, virus and parasite.**

**Unit 1**

**10**

**Classification of infectious agents**

Bacteria, Viruses, protozoa and fungi. Past and present emerging and re-emerging infectious diseases and pathogens. Source, reservoir and transmission of pathogens, Antigenic shift and antigenic drift. Host parasite relationship, types of infections associated with parasitic organisms. Overview of viral and bacterial pathogenesis. Infection and evasion.

**Unit 2**

**10**

**Overview of diseases caused by bacteria.**

Detailed study of tuberculosis: History, causative agent, molecular basis of host specificity, infection and pathogenicity, Diagnostics, Therapeutics, inhibitors and vaccines. Drug resistance and implications on public health. Other bacterial diseases including Typhoid, Diphtheria, Pertussis, Tetanus, Typhoid and Pneumonia.

**Unit 3**

**10**

**Overview of diseases caused by Viruses**

Detailed study of AIDS, history, causative agent, pathogenesis, Diagnostics, Drugs and inhibitors. Other viral diseases including hepatitis, influenza, rabies, chikungunya and polio.

**Unit 4**

**10**

**Overview of diseases caused by Parasites**

Detailed study of Malaria, history, causative agents, Vectors, life cycle, Host parasite interactions, Diagnostics, Drugs and Inhibitors, Resistance, Vaccine development. Other diseases including leishmaniasis, amoebiasis.

**Overview of diseases caused by other organisms**

Fungal diseases, General characteristics. Medical importance of major groups, pathogenesis, treatment.

**SUGGESTED READINGS**

1. Prescott, Harley, Klein's Microbiology (2008) 7th Ed., Willey, J.M., Sherwood, L.M., Woolverton, C.J. Mc Graw Hill International Edition (New York) ISBN: 978-007- 126727. 44
2. Mandell, Douglas and Bennett.S, Principles and practices of Infectious diseases, 7th edition, Volume, 2. Churchill Livingstone Elsevier.
3. Sherris Medical Microbiology: An Introduction to Infectious Diseases by Kenneth J. Ryan, C. George Ray, Publisher: McGraw-Hill
4. Medical Microbiology by Patrick R. Murray, Ken S. Rosenthal, Michael A. Pfaller, Elsevier Health Sciences

**Course Outcome(s):** The student will be able to

1. Understand the basic concept infectious disease.
2. Know the students diseases due to virus.
3. Understand the disease cause by bacteria.
4. Know infectious agent.

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**B.Sc Syllabus Structure**

CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-VI)**

**Title of the Paper: Basics of Forensic Science (CBCS-VI-608)**

**Period: 45**

**( Section-A)**

**Marks- 50**

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**Objective(s):**

**The aim of this paper is to expose the student with the knowledge in criminal investigation, recovery and preservation of samples from a crime scene – biological, toxicological, petroleum, explosives, trace items, projectiles and bullets**

**UNIT-I**

**15**

Growth of Forensic Science Laboratories in India – Central and State level laboratories , Educational setup in Forensic Science in India , Services and functionalities provided by various FSLs , Various divisions in the FSL – Ballistics, Biology, Chemistry Documents, Physics, Psychology, Serology, Toxicology

**UNIT-II**

**15**

Types of crime scenes – primary, secondary, crime scenes based on size of evidence , Crime scene Management – initial response, role of first responding officer, duty management , Forensic Scientists, Investigating officers and their assigned role and duties , Role of the Police and Judiciaries, Fire Brigade, Medico-legal officers and other experts

**UNIT-III**

**15**

Physical evidence, types and importance in a criminal investigation , Protecting a scene of crime – various steps involved, contamination issues. Recovery and preservation of samples from a crime scene – biological, toxicological, petroleum, explosives, trace items, projectiles and bullets

**Reference Books**

1. Introduction to Forensic Science in Crime Investigation By Dr.(Mrs.) Rukmani Krishnamurthy
2. Henry Lee's Crime Scene Handbook by Henry C Lee
3. Forensic Biology by Shrikant H. Lade
4. Crime Scene Processing and Laboratory Work Book by Patric Jones

5. Forensic Science: An Introduction to Scientific and Investigative Techniques 3rd ed. by Stuart H. James
6. Criminalistics: An Introduction to Forensic Science, 9th ed. By Richard Saferstein
7. Compute Crime and Computer Forensic by Dr. R.K. Tiwari
8. Criminal Profiling: An Introduction to a Behavioral Evidence Analysis, 3rd ed. By Brent E. Turvey
9. Forensic Science in Criminal Investigation and Trial, 4th ed. By B.R. Sharma
10. Handbook of Forensic Psychology by Dr. Veerraghavan

**Course Outcome(s):** The student will be able to

1. Understand the basic concept of crime scene.
2. Know the recovery and preservation of samples
3. Understand the crime scene management.
4. Know the various division in FSL.
5. Know role of investigation officer

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CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-VI)**

**Title of the Paper: Molecular basis of non-infectious human diseases (CBCS-VI-608)**

**Period: 45**

**(Section-B)**

**Marks- 50**

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**Objective(s):**

**This course aims to give clear understanding the disease related nutritional disorder, metabolic and lifestyle.**

**Unit1**

**10**

**Nutritional disorders**

Overview of major and minor nutrient components in the diet. Balanced diet and the concept of RDA. Nutrient deficiencies; Kwashiorkor and Marasmus, Scurvy, beri beri, pellagra and B12 deficiency, Xerophthalmia and Night blindness, Vitamin D deficiency, Vitamin K deficiency. Discuss with relation to biochemical basis for symptoms.

**Unit2**

**10**

**Metabolic and Lifestyle disorders**

Obesity and eating disorders like Anorexia nervosa and Bullemia. Diabetes mellitus A metabolic syndrome and the relationship with hypertension, obesity, hypothyroidism and stress. Cardio vascular disorders and Atherosclerosis-defining the broad spectrum of ailments that fall in this category, understanding the factors that contribute to the syndrome, stages of disorder and the management of the condition. Irritable bowel syndrome- biochemistry behind the disorder and the influence of diet, stress and environment on the condition.

**Unit3**

**10**

**Multifactorial complex disorders and Cancer**

Understanding the definition of multifactorial diseases. Polygenic diseases and the relationship of environmental factors and genetic makeup in the onset of diseases. Cancer: characteristics of a transformed cell, causes and stages of Cancer, molecular basis for neoplastic growth and metastasis, Proto-oncogenes and tumor suppressor genes; Cancer causing mutations; Tumor viruses; Biochemical analysis of cancer; Molecular approaches to cancer treatment. Disorders of mood : Schizophrenia, dementia and anxiety disorders. Polycystic ovarian syndrome, Parkinson's disease, ALS.



**Unit4****10****Diseases due to misfolded proteins**

Introduction to protein folding and proteasome removal of misfolded proteins; etiology and molecular basis for Alzheimer's, Prion diseases, Huntington's Chorea, sickle cell anemia, Thalassemia.

**Unit5****05****Monogenic diseases**

In born errors in metabolism: PKU, Alkaptonuria, Maple syrup urine disease; Receptor and transport defects: Cystic fibrosis, Long QT syndrome, familial hypercholesterolemia, Achondroplasia. Hemoglobinopathies and clotting disorders

**SUGGESTED READINGS**

1. Textbook of Biochemistry with Clinical Correlations (2011) Devlin, T.M. John Wiley & Sons, Inc. (New York), ISBN: 978-0-4710-28173-4.
2. Introduction to Human Physiology (2013) 8th edition; Lauralee Sherwood. Brooks/Cole, Cengage Learning.
3. The World of the cell, 7th edition (2009)
4. Genetics (2012) Snustad and Simmons,
5. Cooper, G.M. and Hausman, R.E. 2009 The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.

**Course Outcome(s):** The student will be able to

1. Understand the basic concept noninfectious disease.
2. Know the students diseases due to misfolded proteins.
3. Understand the Obesity and eating disorders.
4. Know inborn error of metabolism.

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CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-VI)**

**Title of the Paper: Skill Enhancement in Biochemical Tech. (SEC-IV)**

**Period: 45**

**(Section-A)**

**Marks-50**

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**Objective(s):**

**This course aims to give clear understanding the growth of microorganism, CFU, Enzyme kinetic and SOP.**

1. Study the growth of various microorganisms like bacteria, yeast and fungi
2. Determination of CFU
3. Enzyme kinetics
4. Synthesis and preparation of paracetamol
5. MTT and XTT assay
6. Vinegar production
7. Study of various animal models used for research purpose
8. Preparation of SOP
9. Demonstration of CT-SCAN
10. Demonstration of Sonography

**Reference Book:**

Physical biochemistry – Frifielder. D, W.H.Freeman and Co. New York, 1983

Analytical biochemistry – Holmes and H.Peck, academic press, New York.

Biophysical technique – Wilson and Goulding, ELBS edition, latest edition.

Biophysical chemistry (principle and technique) – Upadhyaya and Upadhyaya and Nath Himalaya Pub. Nagpur, latest edition

Biochemistry – Zubey.

Biochemistry – Stryer.

Fundamental of biochemistry- Voet and Voet

Molecular Biology of the cell- Bruce Albert

**Course Outcome(s):** The student will be able to

1. Understand the basic concept SOP.
2. To train the students for enzyme kinetic.
3. Understand the Sonography techniques.
4. Be able to student for biological product production.

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CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-VI)**

**Title of the Paper: Skill Enhancement in Biochemical Tech. (SEC-IV)**

**Period: 45**

**(Section-B)**

**Marks- 50**

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**Objective(s):**

**This course aims to give clear understanding purification and characterization of protein.**

Unit 1

Purification and characterization of a protein from a complex mixture (native or heterologously expressed) involving the following methods/techniques

Exercises

- Preparation of the sample.
- Ion-exchange chromatography.
- Gel filtration chromatography.
- Affinity chromatography. • Electrophoresis.

Unit 2

Demonstration of High Performance Liquid Chromatography (HPLC)

SUGGESTED READINGS

1. Physical Biochemistry: Principles and Applications (2010) 2nd ed., Sheehan, D., Wiley Blackwell (West Sussex), ISBN:978-0-470-85602-4 / ISBN:978-0-470-85603-1.
2. Physical Biochemistry: Applications to Biochemistry and Molecular Biology (1982) 2nd ed., Freifelder, D., W.H. Freeman and Company (New York), ISBN:0-7167-1315-2 / ISBN:0-7167-1444-2.
3. An Introduction to Practical Biochemistry (1998) 3rd ed., Plummer D. T., Tata McGraw Hill Education Pvt. Ltd. (New Delhi), ISBN:13: 978-0-07-099487-4 / ISBN:10: 0-07- 099487-0.

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CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-VI)**

**Title of the Paper: LC-Biotechnology & Clinical Microbiology (LCBC-III-1)**

**Period: 60**

**(Section -A)**

**Marks- 50**

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1. To immobilize yeast cells by gel Entrapment method
2. Production of alcohol from starch by immobilized cells of Bakers yeast and estimate by the Nicoloux method.
3. To detect alcohol production by idoform test
4. Production of citric acid by Aspergillus Niger and estimation of citric acid by titration method.
5. Separation of protein by SDS-PAGE
6. Isolation of plasmid DNA.
7. Restriction – Digestion of DNA.
8. Demonstration of PCR technique.
9. Demonstration of RFLP.
10. Demonstration of plant tissue culture technique.
11. Isolation and Identification: i) Staphylococcus aureus ii) Salmonella typhi iii) Vibrio cholera
12. Isolation & Identification of Candida albicans
13. Demonstration of haemolysin & coagulase tests.
14. Determination of antibiotic resistance of bacteria.
15. Detection of specific antigen by ELISA (demonstration – Viral Disease)
16. Visits to related labs, hospitals & institutes.

**Reference Book**

Practical Microbiology : Dr.R.C.Dubey, Dr.D.K.Maheshwari

Manul of Biochemistry- Ranjna Chawal

Practical of Biochemistry- Palmer

Practical in clinical biochemistry – Maheshwari Nanda

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**B.Sc Syllabus Structure**

CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-VI)**

**Title of the Paper: LC- Technique in Molecular Biology (LCBC-III-1)**

**Period: 60**

**(Section – B)**

**Marks- 50**

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1. Isolation of DNA from E. Coli
2. Estimation of DNA by DPA method
3. Estimation of RNA by orcinol method
4. Estimation of chlorophyll pigments by spectrophotometric method
5. Estimation of any one secondary metabolite
6. Industrial production of alcohol/ citric acid
7. Industrial production of amylase
8. Preparation of ATC media
9. Isolation of cells from suitable animal tissue
10. Quantification of cell viability and cell counting
11. Preparation of manure by vermicomposting process
12. Determination of activity of Phosphate solubilizing bacteria.
13. Restriction endonucleases digestion and separation of fragments by agarose gel electrophoresis.
14. Amplification of DNA fragment using PCR and separation of fragments by agarose gel electrophoresis.
15. Preparation of MS media for PTC.
16. Development of somatic embryo from suitable tissue.
17. Development of seedling by aseptic germination of available seed.
18. Development of shoots by shoot tip culture method.
19. Development of callus from suitable tissue.
20. Isolation of protoplast

## **Reference**

1. Biochemical Methods: S.Sadasivam and A.Manikam
2. Experiments in Microbiology, Plant Pathology and Biotechnology K.R.Aneja, VishwaPrakshan Animal Tissue Culture, Freshney
3. Introductory Practical Biochemistry, S.K. Sawhney, R. Singh, Narosa Publishing House, New Delhi
4. Experimental Biochemistry A student companion, B.S. Rao, V. Deshpande, I.K.International Pvt. Ltd., Mumbai.

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**B.Sc Syllabus Structure**

CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-VI)**

**Title of the Paper: LC- Pharmaceutical biochemistry & Competitive Skill & Mock  
Interview (LCBC-III-2)**

**Period: 60**

**(Section -A)**

**Marks- 50**

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1. Qualitative detection of various toxicants in biological samples:  
Phen othiazine derivation, Organochlorine compounds (Fujiwara test), Phenol, Methanol, Arsenic (As), Antimony (Sb), Selenium (Se), Mercury (Hg), Bismuth (Bi), Fluoride (F), Boron(Bo), Gutzeit test for Antimony (Sb), and Arsenic (As), Spot test metal toxicants.
  2. Quantitative determination of Salicylate, Paracetamol (acetaminophen), Sulph on amide in biological samples.
  3. Enzyme assay in toxic conditions: GOT (AST), GPT (ALT), Acid phosphatase, Alkaline phosphatase, Acetyl cholinesterase etc.
  4. Construction of dose – response curves.
  5. Determination of LD50 value of a toxicant.
  6. Induction of hepatotoxicity / diabetes / skin lesions / teratogenesis.
  7. Organ / tissue morphology / histopathology.
  8. Assay of toxicant biotransformation enzymes – cytochrome P450.
  9. Test for teratogenicity / carcinogenicity / Ames test.
  10. Assay of biomarkers of environmental pollution / toxicity.
  11. Gate Exam Preparation: Orientation of GATE Curriculum for students, Providing information regarding literature of GATE Examination. Solving some sample question papers of GATE Examination.
  12. Information regarding Technical MPSC Examination and Recruitment procedure of Graduate students with detail curriculum, Literature and Guidance
  13. Technical Post, Curriculum and authentic literature of RRB, BSRB ,CSIR, NET, SET examination
  14. Information Regarding Higher Education in Foreign Universities, Preparation of Pre requirements like SAT,PTE, LSAT,ACT, CAE,CPE GMAT, GRE, IELTS and the TOEFL.
  15. Preparation for PG entrance examination – Curriculum and information of entrance examination to IIM and national institutes.
  16. Information regarding different Scholarship offered For Higher Studies abroad to the Indian students.

**Reference Book**

Manul of Biochemistry- Ranjna Chawal

Practical of Biochemistry- Palmer

Practical in clinical biochemistry – Maheshwari Nand

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CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-VI)**

**Title of the Paper: LC- Diagnostic Biochemistry (LCBC-III-2)**

**Period: 60**

**(Section -B)**

**Marks- 50**

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1. Hb estimation by using haematometer its significance
2. Estimation of serum urea by DAM reagent.
3. Estimation of serum uric acid.
4. Serum Creatinine estimation by colorimetric method
5. Estimation of cholesterol by colorimetric method.
6. Estimation of serum triglycerides.
7. Estimation of blood glucose in serum by GOD/POD method.
8. Detection of abnormal constituents of urine: - Sugar, protein, ketone bodies and bile pigments
9. Estimation of reducing sugar in urine
10. Estimation of proteins by Biuret method and albumins by Dumas method
11. SGOT estimation by 2, 4 DNPH method.
12. SGPT estimation by 2, 4 DNPH method.
13. Serum alkaline phosphatase estimation by colorimetric method.
14. Serum acid phosphatase estimation by colorimetric method.
15. Serum bilirubin estimation by Jendrassik Groff method.
16. Estimation of serum calcium
17. Widal agglutination test (slide test method).
18. Demonstration of ELIZA and its significance.
19. Ag-Ab reaction by Ouchterlony double diffusion method
20. Immunoelectrophoresis



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## References

1. Practical manual of Biochemistry, Sadhana Sharma and Reema Sharma, Scientific International Publisher and Distributor, New Delhi.
2. Laboratory manual in Biochemistry (1996), J. Jayaraman, Wiley Eastern Ltd.
3. Clinical Biochemistry-Nanda Maheshwari (2008) Jaypee Brothers, Medical Publishers .
4. Introductory Practical Biochemistry, S.K. Sawhney, R. Singh, Narosa Publishing House, New Delhi
5. Experimental Biochemistry, B.S. Rao, V. Deshpande, I.K. Int Pvt. Ltd., Mumbai.
6. Textbook of medical laboratory technology, P.B. Godkar, D.P. Godkar, Bhalani Publishing House, Mumbai.

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**B.Sc Syllabus Structure**

CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-VI)**

**Title of the Paper: LC-Immunology & Clinical Biochemistry (LCBC-III-3)**

**Period: 60**

**(Section -A)**

**Marks- 50**

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1. Identification of Blood group.
2. Enumeration of RBC
3. Enumeration of WBC
4. Determination of Hb by Sahli's hemoglobin meter
5. Bleeding time and clotting time
6. Measurement of body temp, RR (Respiratory Rate)
7. Routine urine examination – Physical & chemical
8. CSF examination physical & chemical.
9. Dialysis of antibody by Ultra membrane Filtration.
10. Isolation of Ig-G from immune globulins by Ion-exchange chromatography.
11. Isolation of polymorphonuclear neutrophil cells.
12. Determination of cell viability by Trypan blue dye.
13. Pregnancy test ELISA.
14. Moutoux test for demonstration of hypersensitivity.
15. Estimation of lipoprotein
16. Glucose tolerance test
17. Estimation of bilirubin
18. Estimation of blood urea
19. Blood sugar determination by Folin – Wu method.
20. Estimation of creatine phosphokinase.
21. Normal and abnormal constituents of urine.
22. Determination of blood cholesterol.
23. Determination of glucose by glucose oxidase method.
24. Estimation of glycosylated hemoglobin.
25. Estimation of LDH and its isozymes.
26. Estimation of alkaline phosphatase from serum.
27. Estimation of total protein and albumin from serum.
28. Determination of SGPT and SGOT
29. Estimation of serum amylase.

**Reference Book**

Manul of Biochemistry- Ranjna Chawal

Practical of Biochemistry- Palmer

Practical in clinical biochemistry – Maheshwari Nanda

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Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-VI)**

**Title of the Paper: LC-Analytical Biochemistry (LCBC-III-3)**

**Period: 60**

**(Section -B)**

**Marks- 50**

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1. Preparation of phosphate buffer of suitable pH and molarity .
2. Determination of viscosity of suitable liquid by viscometer .
3. Estimation of lambda max and extinction coefficient of given chromophore.
4. Purification of protein by salt precipitation and solvent fractionation procedure.
5. Quantitative estimation of protein by Lowry's method.
6. Separation of amino acids using Paper layer chromatography.
7. Separation of amino acids using Thin layer chromatography.
8. Separation of amino acids using paper electrophoresis.
9. Separation of protein by SDS-PAGE.
10. Demonstration of HPLC , GC, Atomic Absorption Spectroscopy (AAS) and infra-red spectroscopy.
11. Estimation of maltose by DNSA method.
12. To determine the effect of enzyme-amylase concentration on the rate of reaction.
13. To determine the effect of substrate concentration on the activity of amylase and determine  $K_m$  and  $V_{max}$  of the reaction .
14. To determine the effect of pH on activity of amylase .
15. To determine the effect of temperature on activity of amylase .
16. Immobilisation of suitable enzyme/yeast cells .
17. Alignment of protein/DNA sequence using BLAST.
18. Preparation of phylogenetic tree.
19. Representation of the given data in line/bar/pie diagram .
20. Calculate mean/mode/median/probability of the given data.

## Reference

1. Biochemical Methods: S.Sadasivam and A.Manikam .
2. Experiments in Microbiology, Plant Pathology and Biotechnology (second Ed.1996) K.R.Aneja, Vishwa Prakshan (New –Age International Pvt.Ltd).
3. Animal Tissue Culture, Freshney.
4. Introductory Practical Biochemistry, S.K. Sawhney, R. Singh, Narosa Publishing House, New Delhi
5. Experimental Biochemistry A student companion, B.S. Rao, V. Deshpande, I.K. International Pvt. Ltd., Mumbai.

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CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-VI)**

**Title of the Paper: LC-Molecular Biology & Plant Biochemistry (LCBC-III-4)**

**Period: 60**

**(Section – A)**

**Marks- 50**

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01. Absorption of water by live & dead seeds.
02. Changes in carbohydrate, protein content during germination.
03. Induction of proteinases, amylases, and lipase during germination.
04. Induction of vit. C synthesis during germination.
05. Isolation and characterization of trypsin inhibitor.
06. Assay of peroxidase, catalase, phenol oxidase, ascorbic acid oxidase.
07. Isolation of plant DNA & RNA.
08. Estimation of carotene, ascorbic acid phenols and tannins in fruits and vegetables.
09. Development of callus culture from meristems and leaves.
10. Isolation of chloroplast from Spinach Leaves.
11. Estimation of chlorophyll – a and - b from isolated chloroplast.
12. Separation of green plant pigment by column chromatography.
13. Demonstration of presence of pectin in guava by jell formation.
14. Determination of Lignin (Klason's method).
15. Isolation of DNA from E-coli / liver / plasmid.
16. Determination of base composition (spectrophotometer)
17. Agarose gel electrophoresis of DNA
18. Restriction digests of DNA
19. Isolation of plasmid
20. Transduction
21. Transformation
22. Expression analysis
23. Ligation
24. PCR
25. Plasmid mapping
26. Mutation
27. Induction of lac operon.

**Reference Book**

Manual of Biochemistry- Ranjna Chawal

Practical of Biochemistry- Palmer

Practical in clinical biochemistry – Maheshwari Nan

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED-431606,  
MS, INDIA**

Distribution of credits for B.Sc Biochemistry

Under Faculty of Science

**B.Sc Syllabus Structure**

CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-VI)**

**Title of the Paper: Environmental Biochemistry (LCBC-III-4)**

**Period: 60**

**(Section – B)**

**Marks- 50**

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- 1) Determination of the pH of water/effluent/soil using a pH meter.
- 2) Determination of the conductance of water / effluent.
- 3) Estimation of organic content of soil –Diphenylamine method.
- 4) Estimation of lead by the EDTA method.
- 5) Estimation of copper by the Isoamyl alcohol method.
- 6) Determination of salinity of / chlorides in water - Silver nitrate method.
- 7) Determination of the Chemical Oxygen Demand of water/effluent by the potassium dichromate method
- 8) Estimation of fluoride in water by the Alizarin red method
- 9) Determination of the Dissolved Oxygen content of water/effluent by the Winkler's Iodometric method - Azide modification.
- 10) Determination of the Biological Oxygen Demand of water/effluent
- 11) Determination of the acidity and alkalinity of water/ effluent.
- 12) Estimation of CaCO<sub>3</sub> of soil - Bromothymol Blue method

**Reference**

- 1) Lehninger's- Principles of Biochemistry by David L. Nelson
- 2) Harper's Illustrated Biochemistry by Robert K. Murray
- 3) Biochemistry by Donald Voet 4) Biochemistry by Jeremy M. Berg
- 5) Biochemistry (2 Volume Set): The Chemical Reactions of Living Cells by David E. Metzler
- 6) Modern Experimental Biochemistry by Rodney F. Boyer
- 7) Basic Concepts in Biochemistry: A Student's Survival Guide by Hiram F. Gilbert
- 8) Analytical Biochemistry by David Holme
- 9) International Biochem by Stryer Tymoczko Berg

- 10) Biophysical Chemistry Upadhyay
- 11) Biochemistry by Dr. A.C. Deb
- 12) Essentials of Pharmacotherapeutics by FSK Brara
- 13) Textbook of Medical Biochemistry by M.N. Chatterjea & Ranashinde
- 14) Immunology by Goldsby and Kuby
- 15) Genetics by Russel
- 16) Gene Biotechnology by Jogdand
- 17) Biostatistics by Arora
- 18) Methods in Biostatistics by Mahajan
- 19) General Principles of Biochemical Investigation by William & Wilson
- 20) Environmental Chemistry by A.K.De
- 21) Biotechnology by U.Satyanarayana
- 22) Advance in Biotechnology by Jogdand
- 23) Biochemical Calculation by Segel
- 24) Biochemical Methods by Sadashivam
- 25) Introductory Practical Biochemistry by Sawhney
- 26) Practical Biochemistry by David Plummer
- 27) Methods of biostatistics for medical students and research workers by Mahajan, B.K.; Jaypee brothers publishers.
- 28) Bioinformatics- Concepts, Skill and applications by Rastogi, S.C.; Mendiratta, Namita and Rastogi, Parag; C.B.S. Publishers & Distributors
- 29) Genes VIII by Lewin, Benjamin; Pearson Prentice and Hall publishers
- 30) Human nutrition and dietetics by Davidson, S. etal.; Churchill Livingstone Publishers.
- 31) Nutrition and dietetics by Joshi, Shubhangini A.; Tata Mc Graw and Hill publishers
- 32) Nutrition Science by Srilakshmi, B.; New Age International publishers
- 33) Introductory practical biochemistry by Sawhney, S.K. and Singh, Randhir; Narosa Publishing House
- 34) Biochemical calculation by Segel, Irwin H.; John Wiley & Sons publishers
- 35) Text book of Medical physiology by Guyton, Arthur C. and Hall, John E.; Harcourt Brace & Company Asia Pvt Ltd



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**B.Sc Syllabus Structure**

CBCS (Choice Based Credit System)

Semester Pattern effective from June 2018

**Subject: Biochemistry (Honors)**

**B.Sc Biochemistry Third Year (Semester-VI)**

**Title of the Paper: LC- Research & Seminar based Project (LCBC-III-5)**

**Period: 60**

**Marks- 50**

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1. Problem related industry, plant, animal and Clinical based