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॥ अंतरी पेटवू ज्ञानज्योत ॥



**North Maharashtra University,
Jalgaon.**

**Syllabus for
M.Sc. (Part-II)**

BIOCHEMISTRY.

(Sem. III & IV)

W.E. From June, 2003

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**NORTH MAHARASHTRA UNIVERSITY, JALGAON.
CORRECTIONS.**

M.Sc. (Part-II) Biochemistry.

(Sem.-III)

BC-301 : Mol. Biology.

Chapter.*	1	2	3	4	5	6	7	8	9
Number of periods allotted.	05	02	05	07	07	07	06	06	05

BC-302 : Env. Toxicology.

Chapter.*	1	2	3	4	5	6	7	8	9
Number of periods allotted.	06	05	08	08	05	04	05	05	04

Bc-303 : Plant Biotechnology.

Chapter.**	1	2	3	4	5	6	7	8	9	10	11	12	13
Number of periods allotted.	02	03	03	04	04	04	04	03	05	04	03	07	04

(Sem.-IV)

BC-401 : Applied Biochem.

Chapter.*	1	2	3	4	5	6	7
Number of periods allotted.	08	07	10	06	06	06	07

BC-402 : Immunology.

Chapter.	1	2	3	4	5	6	7	8	9
Number of periods allotted.	04	03	04	05	10	05	10	06	03

BC-403 : Genetic Engi.

Chapter.*	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Number of periods allotted.	04	03	02	04	04	03	03	04	05	04	05	03	02	04

* Represents chapter.

** Number represents chapter.

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NORTH MAHARASHTRA UNIVERSITY, JALGAON.
SYLLABUS STRUCTURE FOR M.Sc. Part-II.
BIOCHEMISTRY.

(With Effect From June, 2003)

Semester: III

BC - 301	:	Molecular Biology
BC - 302	:	Environmental toxicology
BC - 303	:	Plant Biotechnology
BC - 304	:	Lab Course I
BC - 305	:	Lab Course II

Semester: IV

BC - 401	:	Applied Biochemistry
BC - 402	:	Immunology
BC - 403	:	Genetic Engineering
BC - 404	:	Lab Course I
BC - 405	:	Lab Course II (Project)

(Each theory course to be completed in 50 lectures of 60 min. duration each)

**SYLLABUS FOR M.Sc. Part-II.
BIOCHEMISTRY.**

(With Effect From June, 2003)

BC 301: Molecular Biology

- DNA structure: Current concept, melting of DNA. DNA replication: general principles, various models of replication, isolation and properties of DNA polymerases, proof reading, continuous and discontinuous synthesis. Asymmetric & dimeric nature of DNA polymerase III, DNA polymerase; exonuclease activity in eukaryotic DNA polymerases.
- Superhelicity in DNA, linking number, topological properties, mechanism of action of topoisomerases.
- Inhibitors of DNA replication DNA damage and repair: types of DNA damage. Repair pathways-methyl-directed mismatch repair, very short patch repair, nucleotide excision repair, base excision repair, recombination, repair, SOS system.
- Transcription: RNA types & functions Initiator and elongator class of tRNA, ribosome binding site on mRNA and corresponding site on rRNA, peptidyl transferase activity of 23S rRNA. Transcription: General principles, basic apparatus, types of RNA polymerase, steps: initiation, elongation and termination, inhibitor of RNA synthesis. Control of transcription by interaction between RNA polymerase and promoter regions, Use of alternate sigma factors, controlled termination: attenuation and antitermination.
- Maturation and processing of RNA: methylation, cutting and trimming of rRNA; capping, polyadenylation and splicing of mRNA; Catalytic RNA, group I and group II intron splicing, RNase P.
- Regulation of gene expression: operon concept, catabolite repression, instability of bacterial RNA, positive and negative regulation with example, inducers and corepressors. regulation by attenuation- *his* and *trp* operons;
- Antitermination-N protein and *nut* sites in I. DNA binding proteins, enhancer sequences and control of transcription heat shock response, stringent response and regulation by small molecules such as ppGpp and cAMP.
- Basic features of the genetic code. Protein synthesis: steps, details of initiation, elongation and termination, role of various factors in the above steps, inhibitors of protein synthesis.
- Protein Targeting: Synthesis of exported proteins on membrane bound ribosomes, signal hypothesis, signal recognition particle and its role, chaperon proteins, targeting of lysosomal proteins, protein destruction.

Reference:

1. Genes VII, Lewin (Oxford University Press) 2000.
2. Molecular cell biology by Lodish, Berk, Zippursky (W.H. Freeman).
3. Fundamentals of Biochemistry: D Voet, J. Voet & C. Prati, John Wiley and Sons, New York 1999.
4. Molecular biology of genes: J Watson, NH Hopkin J.W. Roberts, J.P. stertz and A.M. Weiner, Freeman Co. (Latest edition)
5. Biochemistry (IV edition) L. Stryer, W.H. Freeman & co., New York.

BC-302: Environmental Toxicology

- **Definition and scope of toxicology:** Principles of toxicology Toxic effects: Basis for general classification & nature. Dose – Response relationship: Synergism and Antagonism. Determination of ED₅₀ & LD₅₀. Acute and Chronic exposures. Factors influencing Toxicity. Pharmacodynamics & Chemodynamics.
- **Principles & procedures of testing for acute toxic effects:** Regulatory guidelines, Mammalian systems affected & the clinical signs of Systemic Toxicity. Factors affecting acute Toxicity studies.
- **Xenobiotic metabolism:** Absorption & distribution. Phase I reactions. Oxidation, Reduction, Hydrolysis and Hydration. Phase II reactions/Conjugation: Methylation, Glutathione and amino acid conjugation. Detoxification.
- **Toxicity testing:** Test Protocol, Genetic toxicity testing & Mutagenesis assays: *In vitro* Test systems-Bacterial Mutation Tests: Reversion Test, Ames test, Fluctuation Tests and Eukaryotic Mutation Tests. *In vivo* Mammalian Mutation tests – Host mediated assay & Dominant Lethal Test. Use of *Drosophila* in Toxicity testing. DNA repair assays. Chromosome damage test. Toxicological evaluation of Recombinant DNA-derived proteins.
- **Pesticide toxicity:** Insecticides: Organochlorines, Anti - cholinesterases - Organophosphates and Carbamates. Fungicides. Herbicides. Environmental consequences of pesticide toxicity. Biopesticides.
- **Metal toxicity:** Toxicology of Arsenic, mercury, lead and cadmium, Environmental factors affecting metal toxicity – effect of light, temperature & pH.
- **Air pollution:** Common air Pollutants & their sources. Air pollution & ozone. Air pollution due to chlorofluorocarbons (CFCs) and asbestos. Control of air pollution.
- **Soil and water pollution:** Pollutants Souces, adverse effects and control measures.
- **Solid waste:** Classification, toxic effects and treatment methods.

Reference Books:

1. Casarett and Doull's Toxicology, Ed. J. Doull, C.D. Kleassen and M.D. Aunder. Macinillan. Publisher Co. New York.
 2. Hays's Principles and Methods of Toxicology, Ed. A. Wallance Hages, Raven Press, New York.
- Environmental Biology K.C. Agrawal Agro Botanical Publishers, India.

BC- 303: Plant Biotechnology

1. Conventional Plant Breeding
2. Introduction to cell and Tissue Cultured, tissue culture as a technique to produce novel plants and hybrids.
3. Incubation Systems- advantages, limitations and applications of each system.
4. Tissue culture media (composition and preparation)
5. Initiation and maintenance of callus and suspension culture; single cell clones.
6. Organogenesis; somatic embryogenesis; transfer and establishment of whole plants in soil.
7. Shoot-tip culture; rapid clonal propagation and production of virus-free plants.
8. Embryo culture and embryo rescue.
9. Protoplast isolation, culture for production of haploid plants and homozygous lines.
10. Anther, pollen and ovary culture for production of haploid plants and homozygous lines.
11. Cryopreservation, slow growth and DNA banking for germ plasm conservation.
12. Plant cells as producers of secondary compounds. Introduction to secondary metabolism, significance of degree of cell differentiation, selection, downstream processing influence of culture conditions on accumulation of secondary metabolites.
13. Immobilization of plant cells: Introduction, characterization of immobilization processes, advantages and disadvantages of immobilization.

Reference Books:

1. Applied and fundamental aspects of plant cell, tissue and organ culture, J.Reinert and Y.P.S.Bajaj, III edition. 1992.
 2. Plant cell biotechnology, R.Endress, Springer Verlag, 1994.
 3. Biotechnology in Agriculture, M.S.Swaminathan, 1992.
 4. Secondary Metabolism in Plant Cell Culture, P.Morrist, A.H.Scragg, A Stafford, M.W.Fowles, 1986.
 5. Basic and Agriculture Biotechnology, S.S.purohit, P.R.Kothari and S.K.Mathur, Agro-botanical Publ., India 1993.
 6. Plant Biotechnology. J.Hammond, P.McGravery and V.Yusibov (Eds.) Springer Verlag, 2000
 7. Plant Cell and Tissue Culture for the Production of Food ingredients. T-J. Fu, G.Singh, and W.R.Curtis (Eds.) Kluwer Academic/Plenum Press. 1999
 8. Biotechnology in Crop Improvement, H.S.Chawla International Book Distributing Company. 1998
- Practical Application of plant Molecular Biology. R.J.Henry: Champman and Hall. 1997.

BC-304: Laboratory Course – I

1. Isolation of DNA From *E. coli* / liver
2. Estimation of DNA by diphenylamine reaction
3. Isolation of RNA from yeast / liver
4. Estimation of RNA by orcinol method
5. Determination T_m of DNA
6. Agarose gel electrophoresis of DNA
7. Regulation of *lac* operon
8. Isolation of Plasmid DNA and analysis.
9. Peptide analysis by PAGE/ SDS-PAGE
10. Determination of BOD of given sample.
11. Determination of COD of given sample.
12. Estimation of heavy metals in water / soil by atomic absorption Spectrophotometer (D).
13. Determination of coliforms for determination of purity of potable water.
14. Determination total dissolved solids of water.
(Any 10 experiments from first 13 experiments, D= Demonstration only)

Reference Books:

1. Mackie & McCrtney Practical Medical Microbiology (13th Ed), J.G.Collee, J.P.Duguid, A.G.Fraser, B.P.Marimion, Churchill Livingstone International Student Ed.
2. Methods for Cloning & Analysis of Eukaryotic Genes. Bothwell, Yancopoulos, Alt.Jones & Bartlett Publishers, Boston (1990)
3. Laboratory Manual in Biochemistry, J. Jayraman, Wiley Eastern Limited.
4. Varley's Practical Clinical Biochemistry, (6th edition, 1988), Ed. by A.H.Gowenlock, Heinemann Professional Publishing Co., UK.

BC-305: Laboratory Course – II

1. Comparative efficacy of sterilization of plant material.
2. Callus induction and characteristics of callus (*S.khasianum* and *V.radiata*)
3. Plant regeneration from callus (*S.khasianum*).
4. Somatic embryogenesis
5. Isolation of secondary metabolites from callus tissue (*S.khasianum* and *W.somnifera*)
6. Meristem culture for medicinal plants (*W.somnifera*)
7. Regeneration of high yielding banana plantlet from rhizome.
8. Microbial bio-pesticide preparation and evaluation.
9. Botanical biopesticide preparation & evaluation
10. Isolation of Phosphate solubilising microbes and determination of bioefficacy
11. Isolation of Nitrogen fixing microbes and determination of bioefficacy
12. Isolation of alkaloid / Steroid / flavanoid from suitable source and estimation (quantitative / qualitative) (D)
13. Separation of plant secondary metabolites by HPTLC (D)
(Any 10 experiments from the first 12 experiments, D = Demonstration only)

Reference Books:

1. An Introduction to Plant Tissue Culture, Kalyan Kumar De, II Edition, New Central Book Depot, Calcutta, 1995.
2. Plant tissue culture: Techniques and Experiments, R.H.Smith, 1992.
3. Plant Cell & Tissue Culture: A Laboratory Manual, J. Reinert and M.M.Yeoan1989.
4. Methods in Plant Molecular Biology, M.A.Schuler and R.E.Zielinski, 1989.
5. A Laboratory Manual of Plant Biotechnology, S. S. Purohit, Agro-botanical Publ., India 1995.

BC- 401: Applied Biochemistry

Section I: Microbial Biotechnology

- Introduction to bioprocess engineering. Isolation, preservation and maintenance of industrial microorganisms, media for industrial fermentation, types of fermentation process, specialized bioreactors, analysis of mixed microbial population.
- Measurement and control of bioprocess parameters. Introduction to downstream processing, removal of microbial cells and solid matter, foam separation, precipitation, filtration. membrane process, drying and crystallization, effluent treatment.
- Whole cell immobilization and their industrial applications, industrial production of ethanol, citric, acetic and gluconic acid, glycerol, penicillin, lysine, glutamic acid etc. Single cell protein.

Section II: Clinical Biochemistry

- Disorders of carbohydrate metabolism: Diabetes mellitus, glycohemoglobins, hypoglycemia, ketone bodies, various types of glucose tolerance test, glycogen storage diseases, galactosemia.
- Lipids, lipoproteins and apolipoproteins: physiology of lipids/lipoproteins, lipidosis, clinical inter-relationships of lipids, lipoproteins and apolipoproteins, Diagnostic tests for apolipoproteins, HDL-Cholesterol, LDL cholesterol and triglycerides disorders.
- Disorders of amino acid metabolism, phenylalaninemia, homocystineuria, tyrosinemia and related disorders, amino acidurias.
- Principles of diagnostic enzymology. Clinical significance of SGOT, SGPT, CK & LDH, inborn errors of metabolism. Homeostasis and thrombosis extrinsic and intrinsic pathways of blood clotting, laboratory test to measure coagulation and thrombolysis.

Reference Books:

- Principles of Fermentation Technology: Stambury PF & Whitaker A, Pergamon Press.
- Bioreaction Engineering Principles: Nielson J and Villadsen J., Plenum Press.
- Biochemical Engineering: Lee JM, Prantice Hall Inc.
- Biochemical Engineering Fundamentals: Baily J.E. & Ollies D.F., McGraw Hill.
- Biochemical Reactors: Alkinson B, Pion Ltd.
- Biochemical Engineering: Aiba S., Humphrey A.E. and Millis N.F., Univ. of Tokyo Press.
- Lecture notes on Clinical Biochemistry: L.G, Whitby, A.F. Smith, C.T.Beckett, S.M. Walker, Blackwell Sci. Inc.
- Tietz Fundamentals of Clinical Chemistry: C.A. Burtis & ER Ashwood, Saunder W.B. Co.
- Text book of Medical Physiology (10th edition, 2001) A.G.Gayton, J.E. Hall, Harcourt, Asia
- Selection of microbial strain: Fundamental criteria for selection, isolation, primary, secondary tertiary and quaternary screening, strain improvement through selection, mutation and genetic engineering.

EC - 402: IMMUNOLOGY

Introduction to Immune System

- Memory, specificity, diversity, innate and acquired immunity, self vs non-self discrimination.
- Structure and functions of primary and secondary lymphoid organs.

Cells Involved in Immune Responses

- Phagocytic cells and their killing mechanisms
- T and B lymphocytes
- Differentiation of stem cells and idiotypic variations.

Nature of Antigen and Antibody

- Antigen vs Immunogen, Haptens
- Structure and functions of immunoglobulins
- Isotypic, allotypic and idiotypic variations.

Generation of Diversity in Immune System

- Clonal selection theory --- concept of antigen specific receptor.
- Organization and expression of immunoglobulin genes: generation of antibody diversity
- T cell receptor diversity.

Humoral and Cell Mediated Immune Responses

- Kinetics of primary and secondary immune responses
- Complement activation and its biological consequences
- Antigen processing and presentation
- Cytokines and costimulatory molecules: Role in immune responses.
- T and B cell interactions.

Major Histocompatibility Complex (MHC) Genes and Products

- Polymorphism of MHC genes
- Role of MHC antigens in immune responses
- MHC antigens in transplantation.

Development, Regulation and Evolution of the Immune System

Measurement of Antigen -- Antibody Interaction

- Production of polyclonal and monoclonal antibodies: Principles, techniques and applications.
- Agglutination and precipitation techniques
- Radio immunoassay
- ELISA
- Immunofluorescence assays: Fluorescence activated cell sorter (FACS) technique.

Immune Responses in Diseases

- Immune responses to infectious diseases: viral, bacterial and protozoal
- Cancer and immune system
- Immunodeficiency disorders
- Autoimmunity.

Immunization

- Active immunization (immunoprophylaxis)
- Passive immunization (Immunotherapy)
- Role of vaccines in the prevention of diseases.

References

1. Roitt, I.M. (1998) Essentials of Immunology, ELBS, Blackwell Scientific Publishers, London.
2. Kuby, J. (1994) Immunology 2nd edn., W.H. Freeman and Company, New York.
3. Topley and Wilson's (1995) Textbook on Principles of Bacteriology, Virology and immunology, IX edn., (5 volumes) Edward Arnold, London.
4. Barrett, J.T. (1983) Text book of Immunology, Mosby, Missouri.
5. Stites, D.P., Stobo, J.D., Fudenberg, H.H. and Wells, J.V. (1984) Lange Medical Publications, Los Altos., California.

BC- 403 Genetic Engineering

- Genetic engineering concepts, restriction enzymes, their mode of action, modification enzymes, RNA & DNA markers.
- Cloning vectors: Plasmids, Cosmids, phages, artificial chromosomes & phagemids
- Cloning in yeast
- cDNA synthesis and cloning. Genomic & cDNA library construction.
- Restriction mapping of DNA fragments and map construction. Nucleic acid sequencing methods. Automatic DNA sequencing.
- Selection of recombinant DNA, clone characterization, S1 mapping, hybridization and immunological techniques.

- Site directed mutagenesis and its applications.
- PCR and its applications, RFLP, AFLP & RAPD techniques & their applications.
- Feature of Ti & Ri plasmids, basis of tumor formation, mechanism of DNA transfer, role of virulence genes, use of reporter genes, genetic markers.
- Viral vectors & there applications, particle bombardment electroporation, micro injection transformation of monocots, transgene stability & gene silencing, antisense thechnology.
- Application of plant transformation for productivity & performance, herbicide resistance, Bt genes, protease inhibitors, abiotic stress, long shelf life of fruits & flowers.
- Advances in molecular genetic of β -lactum and aminoglycoside antibiotics biosynthesis.
- Scope and applications in medicine, agriculture and industry.
- Gene therapy, vector engineering, gene delivery, gene replacement, argumentation, gene editing.

Reference Books:

- Recombinant DNA: J.D. Watson, N.H.Hopkins, J.W.Roberts, J.A. Steitz & A. M. Weiner, W.H. Freeman & Co.
- Molecular Biology of Gene: The Benzamin Cummins Publ. Co.
- Biochemistry: L Stryers, W.H. Freeman & Co.
- Molecular Cloning: A laboratory mannul : J. Sambrook E.F. Frithsch & T. Maniatis, Cold Spring Harbor lab. Press.
- Molecular Biotec nology: S.B.Primrose, Black Well Scientific Publishes.
- Methods in Enzymology Vol. 151: Guide to Molecular Cloning Techniques, Academic Press.
- DNA Cloning : A practical approach: D.M. Glover & B.D. Hames, IRL Press.
- Principles of Ge netis: Gardner, Simnons & Snustad, Viley Eastern.

BC-404: Laboratory Course – I

1. Bacterial culture & antibiotic selection media & preparation of competent Cells.
2. Restriction digestion of DNA and separation by agarose gel electrophoresis.
3. Comparative studies of Ethanol production using different substrates.
4. Preparation of Agrobacterium culture and Agrobacterim medicated root / tumour is duction in vitro.
5. Amplific ation of DNA by polymerase chain reaction (PCR) (D)
6. Demonst ration of Southern blotting technique (D)

7. Estimation of SGOT/SGPT and its pathological significance.
 8. Microbial production of Citric acid using *Aspergillus niger*.
 9. Estimation of serum cholesterol and its diagnostic applications.
 10. Use of alginate for cell immobilization
 11. Use of ELISA technique.
 12. Determination of blood group
 13. Widal test and its significance.
 14. Complement fixation test
 15. Radio immuno assay (RIA) of hormones (D)
- (Any 10 experiments out of 15 experiments, D = Demonstration only)

Reference Books:

1. An Introduction to Practical Biochemistry, D.T.Plummer(1992) Tata McGraw Hill Publisher, New-Delhi.
2. Experiments In Microbiology, Plant pathology, Tissue Culture and Mushroom Cultivation, (2nd edition, 1996), K.R.Aneja, Wishwa Prakashan, New Age International (P) Ltd.
3. Molecular Cloning: A laboratory manual: J Sambrook, E.F. Fritsch & T Maniatis, Cold Spring Harbor Lab. Press, New York.
4. A Handbook of Practical & Clinical Immunology, Vol. 1 & 2 (IInd Ed.) Editors- G.P.Talwar & S.K.Gupta, CBS Publishers & Distributors.

**BT-405: Laboratory Course – II
Project (Dissertation)**