DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRPATI SAMBHAJINAGR.

CIRCULAR NO.SU/CBC&GS/B.Sc. Honor's/Model College/39/2024

It is hereby inform to all concerned that, the syllabi prepared by the Ad-hoc Boards and recommended by the Dean, Faculty of Science & Technology, the Hon'ble Vice-Chancellor has accepted the **following syllabi under Choice Based Credit & Grading System as per Guidelines of UGC** run at Model College, Ghansawangi Dist.-Jalna in his emergency powers under section 12(7) of the Maharashtra Public Universities Act, 2016 on behalf of the Academic Council as appended herewith.

Sr.No.	Courses	Semester
1.	**Honours Degree of B.Sc. Biotechnology**	**Vth & VIth**
2.	**Honours Degree of B.Sc. Computer Science**	**Vth & VIth**

This is effective from the Academic Year 2024-25 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Chhatrapati Sambhajinagar
431 004.
REF.No.SU/2024/7308-16
Date:- 10.09.2024

* * * * *

Deputy Registrar,
Academic Section

Copy forwarded with compliments to :-

1] **The Principal, Model College, Ghansawangi Dist. Jalna**
Dr. Babasaheb Ambedkar Marathwada University,

2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

1] **The Director, Board of Examinations & Evaluation,** Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

2] The Section Officer,[B.Sc.Unit] Examination Branch,Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

3] The Programmer [Computer Unit-1] Examinations,Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

4] The Programmer [Computer Unit-2] Examinations,Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

6] The Public Relation Officer, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

7] The Record Keeper, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

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Dr. Babasaheb Ambedkar Marathwada University
Chhatrapati Sambhajinagar - 431004 (MS) India.

Undergraduate Bachelor Degree Program
in

B.Sc. Biotechnology
(Honours)
Faculty of Science and Technology

Course Structure and Curriculum
(Outcome based Curriculum)

Choice Based Credit System

(Effective from Academic Year 2024-25)

Run at Model Degree College,Ghansawangi. Dist: Jalna

Dean,
Faculty of Sci & Tech.

Chairperson,
BOS in Biotech. & Bioinfor.

Semester V									
	Name of Course	Course Code	Course Title	(Teaching periods/week)	Credits	Scheme of Examination			
						Max Marks	CIA	UA	Min Marks
Optional I (DSE-1C) Discipline Specific Core Course	Core A	BTCA-501	Immunology	3Hours /week	3	50	20	30	20
	Core B	BTCB-502	Bio analytical tools	3Hours /week	3	50	20	30	20
	Practical based on Core A	BTCA-501P	Lab Course-XVII	4Hours/week	2	50	0	50	20
	Practical based on Core B	BTCB-502P	Lab Course-XVIII	4Hours/week	2	50	0	50	20
Optional II (DSE-2C) Discipline Specific Core Course	Supportive	BTS-503	Bioinformatics	2Hours /week	2	50	20	30	20
	Practical based on Supportive	BTS-503P	Lab Course-XIX	4Hours/week	2	50	0	50	20
Optional III (DSE-3C) Discipline Specific Core Course	Applied A	BTAA-504	A1:Priciples of Genetic Engineering A2:Bioprocess Technology (Select any one paper from A1/A2)	2Hours/week	2	50	20	30	20
	Practical based on Applied A	BTAA-504P	Lab Course-XXA1: Lab Course-XXA2:	4Hours/week	2	50	0	50	20
	Applied B	BTAB-505	B1:Plant Biotechnology B2:Clinical Biochemistry (Select any one paper from B1/B2	2Hours/week	2	50	20	30	20
	Practical based on Applied B	BTAB-505P	Lab Course-XXIB1: Lab Course-XXIB2:	4Hours/week	2	50	0	50	20
Skill Enhancement Course (SEC-1)	Job Oriented Soft Skills	BT-JOC-506	JOC(Job Oriented Course)	4Hours/week	4	50	20	30	20
	Value Oriented Courses	BT-VOC-507	VOC (Value Oriented course)	4Hours/week	4	50	20	30	20
				40	30	700	200	500	280
Total Credits for Semester III : 30 (Theory : 20 ; Laboratory : 10)									

Semester VI									
	Name of Course	Course Code	Course Title	(Teaching periods/week)	Credits	Scheme of Examination			
						Max Marks	CIA	UA	Min Marks
Optional I (DSE-1C) Discipline Specific Core Course	Core A	BTCA-601	Recombinant DNA Technology	3Hours /week	3	50	20	30	20
	Core B	BTCB-602	Industrial Biotechnology	3Hours /week	3	50	20	30	20
	Practical based on Core A	BTCA-601P	Lab Course-XXII	4Hours/week	2	50	0	50	20
	Practical based on Core B	BTCB-602P	Lab Course-XXIII	4Hours/week	2	50	0	50	20
Optional II (DSE-2C) Discipline Specific Core Course	Supportive	BTS-603	Metabolism	2Hours /week	2	50	20	30	20
	Practical based on Supportive	BTS-603P	Lab Course-XXIV	4Hours/week	2	50	0	50	20
Optional III (DSE-3C) Discipline Specific Core Course	Applied A	BTAA-604	A3:Animal Biotechnology A4:Medical Biotechnology (Select any one paper from A3/A4	2Hours/week	2	50	20	30	20
	Applied B	BTAB-605	B3:Biotechnology and Human Welfare B4:Genomics and Proteomics (Select any one paper from B3/B4	2Hours/week	2	50	20	30	20
	Project	BTP-606	Project	8Hours/week	4	100	0	100	40
Skill Enhancement Course (SEC-1)	Job Oriented Soft Skills	BT-JOC-607	JOC(Job Oriented Course)	4Hours/week	4	50	20	30	20
	Value Oriented Courses	BT-VOC-608	VOC (Value Oriented course)	4Hours/week	4	50	20	30	20
				40	30	700	200	500	280
Total Credits for Semester III : 30 (Theory : 20 ; Laboratory : 10)									

BTCA-501: Immunology

Paper: Core A
Contact Hours: 45 (Clock Hours)

Total Credit: 03
Marks: 30

1. **Types of immunity**: innate, acquired, active and passive. Elements of immune system: Hematopoiesis, T-cells, B-cells, myeloid cells, antigen presenting cells, cell mediated subset of T-Cells, helper and suppressor cells, cell medicated and humor immunity, antibody dependent cell mediated cytotoxicity, natural killer cells. Primary and Secondary organs of immune system

2. Cellular and molecular aspects:

Antigens :- Immunogenicity Vs antigenicity, factors affecting antigenicity, epitopes, haptens, adjuvants. Antigen antibody interactions: - forces of antigen antibody interaction, principle, methods and applications of precipitation and agglutination. Antibody structure, function and diversity antigen-antibody reactions, T-Cells receptors, cell activation complement, lymphokines, regulation of immune response, immunological tolerance. Recognition of antigen: MHC, antigen processing and presentation, T-cell and B - cell activation.

3. Hypersensitivity: An allergy, types of hypersensitivity. Immunology of hypersensitivity. Secondary immune response. Autoantibodies – Autoimmune diseases. Examples such as: Rheumatoid Arthritis, Myasthenia Gravis, Systemic LupesErythematus, Rhesus incompatibility, Protection of fetus from immune response. Immunotechniques: Immuno diffusion, immunoelectrophoresis ELISA, RIA, fluorescence activated cell sorter, PBMC, immunoblotting.

REFERENCE BOOKS

1. Immunology Kuby, R.A. Goldsby, T.J. Kind 1997, 4th Edition B.A. Osborne. 2. Essential of immunology Ivan Riot-Blakswel 1997, 4th Edition B.A. Osborne

3. Fundamentals of Immunology Paul W.E. (Eds.) 1998 Raven press, New York.

4. Text Book of Microbiology by Panikar and Anantnarayan 2009.

5. General Microbiology by Davis

6. Medical Microbiology by Duguid and Cruikshank

BTCB-502: BIO-ANALYTICAL TOOLS

Paper: Core B
Contact Hours: 45 (Clock Hours)

Total Credit: 03
Marks: 30

UNIT I Simple microscopy, phase contrast microscopy, florescence and electron microscopy (TEM and SEM), pH meter, absorption and emission spectroscopy

UNIT II Principle and law of absorption fluorimetry, colorimetry, spectrophotometry (visible, UV, infrared), centrifugation, cell fractionation techniques, isolation of sub-cellular organelles and particles.

UNIT III Introduction to the principle of chromatography. Paper chromatography, thin layer chromatography, column chromatography: silica and gel filtration, affinity and ion exchange chromatography, gas chromatography, HPLC. Introduction to electrophoresis. Starch-gel, polyacrylamide gel (native and SDS-PAGE), agarose-gel electrophoresis, pulse field gel electrophoresis, immuno-; electrophoresis, isoelectric focusing, Western blotting. Introduction to Biosensors and Nanotechnology and their applications.

SUGGESTED READING

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley& Sons. Inc.

2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.

3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.

4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009 The World of the Cell.7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

Practical

Lab Course -XVII

BTCA-501P: Practical Based on Immunology

1. Blood film preparation and identification of immune cells
2. Lumphoid organs and their microscopic organization
3. Immunization and collection of serum
4. Double Diffusion
5. Heamglutination
6. Detection of antigen
7. ELISA
8. WIDAL Test
9. Immunoelectrophoresis

Practical

Lab Course -XVII

BTCB-502P: Practical Based on BIO-ANALYTICAL TOOLS

1. Native gel electrophoresis of proteins

2. SDS-polyacrylamide slab gel electrophoresis of proteins under reducing conditions.

3. Preparation of the sub-cellular fractions of rat liver cells.

4. Preparation of protoplasts from leaves.

5. Separation of amino acids by paper chromatography.

6. To identify lipids in a given sample by TLC.

7. To verify the validity of Beer's law and determine the molar extinction coefficient of NADH.

BTS-503: BIOINFORMATICS

Paper: Supportive
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

UNIT I History of Bioinformatics. The notion of Homology. Sequence Information Sources, EMBL, GENBANK, Entrez, Unigene, Understanding the structure of each source and using it on the web.

UNIT II Protein Information Sources, PDB, SWISSPROT, TREMBL, Understanding the structure of each source and using it on the web. Introduction of Data Generating Techniques and Bioinformatics problem posed by them- Restriction Digestion, Chromatograms, Blots, PCR, Microarrays, Mass Spectrometry.

UNIT III Sequence and Phylogeny analysis, Detecting Open Reading Frames, Outline of sequence Assembly, Mutation/Substitution Matrices, Pairwise Alignments, Introduction to BLAST, using it on the web, Interpreting results, Multiple Sequence Alignment, Phylogenetic Analysis. Searching Databases: SRS, Entrez, Sequence Similarity Searches-BLAST, FASTA, Data Submission. Genome Annotation: Pattern and repeat finding, Gene identification tools

References:

1. Developmental Biology-Gilbert
2. Foundations of Embryology – Patten
3. Cell and Developmental Biotechnology – Raj NarianDesikar
4. Text book of Bryophytes, Pteridophytes , Gymnosperms and Paleobotany - Subramurti
5. Plant Anatomy and Embryology- S.N. Pandey, A. Chadha
6. Teresa K Attwood and David J. Parry-Smith, Introduction to Bioinformatics, Pearson Education Asia, 2001
7. Bexavanis& Francis, Bioinformatics-A practical guide to the analysis of genes and proteins, John Wiley and Sons, 2001
8. Rushidi, Basics of Bioinformatics, CRC Publications, 2001
9. Irfan Khan and AtiyaKhanum, Emerging trends in Bioinformatics, Ukaaz Publishers, 2002

10. David M. Hill, Craig Martiz and Barke Mable, Molecular systematics

11. Khan Imtiyazalam ,Rai University, Hydrabad:- Elementry Bioinformatics

12. N. Gautam Bioinformatics- Databases and algorithm

13. Bioinformatics: A practical guide to the analysis of genes and proteins A.D. Baxevanis and B.F.F. Ouellette (Eds). 2002 John Wiley and Sons.

14. Bioinformatics: Sequence and Genome Analysis by D.W. Mount, 2001, Cold Spring Harbor Laboratory Press.

Practical

Lab Course -XIX

BTS-503P: Practical Based on Bioinformatics

1. Sequence information resource

2. Understanding and use of various web resources: EMBL, Genbank, Entrez, Unigene, Protein information resource (PIR)

3. Understanding and using: PDB, Swissprot, TREMBL

4. Using various BLAST and interpretation of results

BTAA-504 A1: Principles of Genetic Engineering

Paper: Applied
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

Unit 1: DNA modifications and DNA cutting Systems

safeguarding DNA –in detail. Concept of restriction endonuclease action with reference to DNA modification. DNA cutting enzymes: Type I, Type II, and Type III with reference to properties, essential co-factors, mode of action –specificity and limitations of their applications. DNA modifying enzymes with reference to their structure, function, requirements, reaction and applications: Exonucleases, Endonucleases acting on both single strand and double strand, Polymerases, phosphorylating enzymes, Phosphate removing enzymes, Enzyme adding base/s to the end. Nucleic acid Joining Enzymes: RNA ligase, DNA ligases.

Unit 2: Vectors

Concept and types of vectors for genetic engineering, Review of plasmids and modifying natural plasmids to construct a plasmid vector –example of pBR322 –applications, versatility and limitations, cloning of DNA with gene disruption strategy. The pUC18/ pUC19 vectors – with reference to their desing, potential also as an inducible vector system. Viral vectors: M13 life cycle and use of M13 as vector, M13mp1 and M13mp2 design, potential and limitations. Single strand preparations for sequencing reactions. Study of λ-genome to estimate potential as vector system. Concept of insertion and replacement vectors –Two examples with design and application

Unit 3: Cloning and Sequencing

Shotgun cloning; with reference to use of plasmid as vector, mean of cloning foreign piece of DNA (Construction of Chimera), mean to construct genomic library, mean to select recombinant with the use of antibiotic marker –a direct selection example. Generalized strategy of obtaining cDNA from mRNA as a template for PCR (do not teach PCR) or piece of DNA to be cloned in desired vectors. DNA sequencing by chemical method, by Enzymatic method and Chemical synthesis of DNA.

References:

1. An introduction to Genetic Engineering –Desmond S T Nicholl ,Cambridge university press, 2nd Ed.

2. Recombinant DNA: A short Course, Watson J.D, CSHL press

3. Short course in Bacterial Genetics –J. H. Miller

4. Molecular Biotechnology Principles & Applications of Recombinant DNA, Bernard R Glick & Jack J Pasternak, ASM press.

5. Old R.W & Primrose S.B., Principles of Gene manipulations, Blackwell Scientific publications.

6. Ausbel S.M , Brent R, Current Protocols in Molecular Biology., Wiley International New York.

7. Maniatis I, Fritchh E.F ,& Sambrook J, Molecular cloning.

8. D.M Glover , DNA cloning, A practical approach.

9. Methods in Enzymology series, vol 152, 185, Academic press inc, Sandiego.

10. Genes V –Benjamin Lewin

BTAA-504 A2: BIOPROCESS TECHNOLOGY

Paper: Applied
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

UNIT I Introduction to bioprocess technology. Range of bioprocess technology and its chronological development. Basic principle components of fermentation technology. Types of microbial culture and its growth kinetics– Batch, Fedbatch and Continuous culture.

UNIT II Design of bioprocess vessels- Significance of Impeller, Baffles, Sparger; Types of culture/production vessels- Airlift; Cyclone Column; Packed Tower and their application in production processes. Principles of upstream processing – Media preparation, Inocula development and sterilization.

UNIT III Introduction to oxygen requirement in bioprocess; mass transfer coefficient; factors affecting KLa. Bioprocess measurement and control system with special reference to computer aided process control. Introduction to downstream processing, product recovery and purification. Effluent treatment. Microbial production of ethanol, amylase, lactic acid and Single Cell Proteins.

SUGGESTED READING

1. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.

2. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi.

3. Patel AH. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited.

4. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.

Practical

Lab Course –XXA1

BTAA-504PA1: Practical Based on Principles of Genetic Engineering

1. Isolation of plasmid DNA from resistant clinical isolates
2. Transformation of resistance from clinical strain to laboratory strain

(sensitive)

3. Blue-white selection assay
4. Study of restriction fragments of -DNA
5. Study of impact of methylation on restriction activity.
6. Shotgun cloning –demonstration of plasmid resistance transfer
7. Shotgun cloning –to introduce chimeric construct
8. Preparation and demonstration of cDNA
9. Shotgun cloning –cloning of cDNA
10. Cloning of DNA with gene disruption strategy

Practical

Lab Course –XXA2

BTAA-504PA2: Practical Based on BIOPROCESS TECHNOLOGY

1. Bacterial growth curve.
2. Calculation of thermal death point (TDP) of a microbial sample.
3. Production and analysis of ethanol.
4. Production and analysis of amylase.
5. Production and analysis of lactic acid.
6. Isolation of industrially important microorganism from natural resource.

BTAB-505 B1: Plant Biotechnology

Paper: Applied
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

Unit 1.Plant tissue culture:

Media composition: Theory of limiting factor with respective to inorganic salts (Major and minor elements) organic chemicals (carbohydrates, vitamins)

Growth regulators (Auxin, cytokinin, gibberellins, ascorbic acid, ethylene) Amino acids (L-amino acids and its role in Tissue culture) Antibiotics (Ampicillin, Carbenicillin, Cefotaxime, Gentamycin sulphate, methylol urea, Polymixin B Ribavirin, Streptomycin) Uses Chemically undefined constituents and natural complexes (gelling agents, activated charcoal, casein HL, coconut milk, corn milk, corn starch, potato extract, yeast extract, antioxidants

Unit 2.Selection of media for specified application:

Callus induction media, chlorate selection medium, Embryo culture medium, Green algae medium, Propogation medium,Standardization of media and glassware ,Cellular Totipotency Callus culture and dynamics of callus growth:Organogenesis and its applications: Somaclonal variation and its application- Micropropogation and its application: MP through shoot and bud meristem Tip culture, in vitro tuberization, somatic embryogenesis

UNIT-3-Methods in Plant tissue culture

Organ culture: Root culture, shoot tip culture (meristem culture), flower bud culture,ovary culture, ovule culture, embryo culture, anther culture Callus culture and its dynamics Somatic embryogenesis and artificial seeds Protoplast culture, protoplast fusion and somatic hybridization – Application of Plant Tissue Culture

References

1. A text book of genetic engineering by Desmond Nicoll
2. Agrobacterium: From biology to Biotechnology by Tzvi Tzfira
3. Principles of gene manipulation by Primrose
4. Animal cell culture by Jon Masters
5. Plant cell and tissue culture – A tool in Biotechnology- by Ashwani Kumar
6. Laboratory manual of Plant Biotechnology By Purohit-2
7. Methods in Plant tissue culture By U Kumar-1
8. Plant tissue culture Bhojwani:
9. Introduction to Plant Tissue Culture Kalyan Kumar DE
10. Practical application of Plant Molecular Biology R.J.Henry,Chapman and Hall
11. Culture of Animal cells-3rd Edition Freshney Wiley liss
12. Mammalian Cell Biotechnologyy-Apractical Approach, M,Butler Oxford University press ,New York
13. Animal Cell culture techniques, Martin Springer

Practical

Lab Course –XXIB1

BTAB-505PB1: Practical Based on Plant Biotechnology

Practicals

1. Introduction to plant tissue culture.
2. Media preparation for plant , animal,and sterilization
3. -Induction of callus culture, regeneration from callus.
4. Anther culture
5. Preparation of artifical seed
6. Isolation of protoplast
7. Micropropagation
8. Agrobactrium mediated transformation
9. Gene transfer in plant cells,animal cells
10. Introduction toanimal culture.
11. Establishment of primary culture, secondary culure.
12. Preservation of cell lines.
13. Regenration of frozen cellsin vitro
14. Marker gene assay.

BTAB-505 B2: Clinical Biochemistry

Paper: Applied
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

Unit 1: Basic concepts of clinical biochemistry, scope of clinical biochemistry in diagnostics, brief review of units and abbreviations used in expressing the concentrations and standard solutions, quality control. Manual versus automation in clinical biochemistry. Normal value of important constituents in blood, CSF and urine. Collection and preservation of blood, serum, plasma, urine, CSF. Chemical and microbial analysis of blood, urine, sputum and CSF. Basics and application of Colorimeter, Turbidometer, Nephlometer and Spectrophotometer, RIA, ELISA in clinical biochemistry. Defination of functional and non-functional plasma enzyme, isozyme and diagnostics test, enzyme pattern in health, disease and diagnostics related to plasma lipase, choline esterase, alkaline phosphatase, SGPT, SGOT, LDH, CKP, VDRL, immobilized enzymes in diagnostics. Hormonal disorders related to endocrine secretions eg. Thyroid etc.

Unit 2: Antibiotic sensitivity testing. Clearance test for urea, eosinophil sedimentation rate, Packed Cell Volume. Food infection and adulteration. Nutrition and chronic diseases. Physical and biochemical changes in ageing. Different theories in ageing, importance of superoxide dismutase in ageing, plasticity and regeneration.

Unit 3: Inborn errors related metabolic disorders, Galactosemia, Glycogen storage diseases, Phenylketonuria, type I and II Diabetes, Hypoglycemia, Lipid malabsorption, Statorrehea, Albinism. Chromosome aberration related disorders and their symptoms, diagnosis of Down's syndrome, Turner's syndrome. Neurological and psychiatric disorders as Schizophrenia, Depression, Dementia, Alzheimer's disease, Wilson's disease etc. metabolic disorders as gout, Atherosclerosis, Multiple sclerosis

References:

1. Clinical biochemistry by Kaplan L.A. and Pesce A.J.C.V. Mosby 1998.

2. Clinical biochemistry by W.J. Marshall and S.K. Bangery, Chirchill Livinston N.Y. 1995

3. Textbook of Medical Laboratory Techniques P. B. Godkar and D.P. Godkar, second edition Bhalani publication.

4. Practical Clinical Biochemistry by Gowenlock.

5. Biochemical Aspects of Human Diseases by Elkeles and Tavill

6. Fundamentals of Biochemistry, A. C. Deb.

7. Biochemistry, Pamela Champe and R. Harvey 2 nd edition.

8. Text book of Microbiology Ixth edition Anantnarayan

Practical

Lab Course –XXIB2

BTAB-505PB2: Practical Based on Clinical Biochemistry

1. Residual chlorine in water.
2. Qualitative test for food adulteration in food.
3. Analysis of blood group.
4. Haemocytometric analysis.
5. Serum protein fractionation.
6. Blood haemoglobin determination. Erythrocyte sedimentation rate (ESR).
7. Packed cell volume (PCV).
8. Glucose tolerance test (GTT).
9. Liver function test (SGPT, SGOT, alkaline phosphatase, serum bilirubin).
10. Cardiac function test (Serum cholesterol, LDH- cholesterol, CKP, Triglycerides).
11. Kidney function test (blood urea, creatinine, serum Na+ K+

BTCA-601: Recombinant DNA Technology

Paper: Core A
Contact Hours: 45 (Clock Hours)

Total Credit: 03
Marks: 30

UNIT I Molecular tools and applications- restriction enzymes, ligases, polymerases, alkaline phosphatase. Gene Recombination and Gene transfer: Transformation, Episomes, Plasmids and other cloning vectors (Bacteriophage-derived vectors, artificial chromosomes), Microinjection, Electroporation, Ultrasonication, Principle and applications of Polymerase chain reaction (PCR), primer-design, and RT- (Reverse transcription) PCR.

UNIT II Restriction and modification system, restriction mapping. Southern and Northern hybridization. Preparation and comparison of Genomic and cDNA library, screening of recombinants, reverse transcription,. Genome mapping, DNA fingerprinting, Applications of Genetic Engineering Genetic engineering in animals: Production and applications of transgenic mice, role of ES cells in gene targeting in mice, Therapeutic products produced by genetic engineering-blood proteins, human hormones, immune modulators and vaccines (one example each).

UNIT III Random and site-directed mutagenesis: Primer extension and PCR based methods of site directed mutagenesis, Random mutagenesis, Gene shuffling, production of chimeric proteins, Protein engineering concepts and examples (any two).

Genetic engineering in plants: Use of Agrobacterium tumefaciens and A. rhizogenes, Ti plasmids, Strategies for gene transfer to plant cells, Direct DNA transfer to plants, Gene targeting in plants, Use of plant viruses as episomal expression vectors.

References:

1. Brown TA. (2006). Gene Cloning and DNA Analysis. 5th edition. Blackwell Publishing, Oxford, U.K.

2. Clark DP and Pazdernik NJ. (2009). Biotechnology-Applying the Genetic Revolution. Elsevier Academic Press, USA.

3. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington

4. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.

5. Sambrook J, Fritsch EF and Maniatis T. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press

BTCB-601: Industrial Biotechnology

Paper: Core B
Contact Hours: 45 (Clock Hours)

Total Credit: 03
Marks: 30

UNIT I Production of industrial chemicals, biochemicals and chemotherapeutic products. Propionic acid, butyric acid, 2-3 butanediol, gluconic acid, itaconic acid, Biofuels: Biogas, Ethanol, butanol, hydrogen, biodiesel, microbial electricity, starch conversion processes; Microbial polysaccharides; Microbial insecticides; microbial flavours and fragrances, newer antibiotics, anti cancer agents, amino acids.

UNIT II Microbial products of pharmacological interest, steriod fermentations and transformations. Over production of microbial metabolite, Secondary metabolism – its significance and products. Metabolic engineering of secondary metabolism for highest productivity. Enzyme and cell immobilization techniques in industrial processing, enzymes in organic synthesis, proteolytic enzymes, hydrolytic enzymes, glucose isomerase, enzymes in food technology/organic synthesis.

UNIT III Purification & characterization of proteins, Upstream and downstream processing, solids and liquid handling. Distribution of microbial cells, centrifugation, filtration of fermentation broth, ultra centrifugation, liquid extraction, ion-exchange recovery of biological products. Experimental model for design of fermentation systems, Anaerobic fermentations.

Rate equations for enzyme kinetics, simple and complex reactions. Inhibition kinetics; effect of pH and temperature on rate of enzyme reactions. Mathematical derivation of growth kinetics, mathematical derivations of batch and continuous culture operations; single stage CSTR; mass transfer in aerobic fermentation; resistances encountered; overall mass transfer co-efficient (Ka) determination, factors depending on scale up principle and different methods of scaling up. Metabolic engineering of antibiotic biosynthetic pathways.

References:

1. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.

2. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi.

3. Patel AH. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited.

4. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd. 5. Salisbury, Whitaker and Hall. Principles of fermentation Technology,

Practical

Lab Course -XXII

BTCA-601P: Practical Based on Recombinant DNA Technology

PRACTICALS

1. Isolation of chromosomal DNA from plant cells

2. Isolation of chromosomal DNA from E.coli

3. Qualitative and quantitative analysis of DNA using spectrophotometer

4. Plasmid DNA isolation 5. Restriction digestion of DNA

6. Making competent cells

7. Transformation of competent cells.

8. Demonstration of PCR

Practical

Lab Course -XXIII

BTCB-602P: Practical Based on Industrial Biotechnology

1. Random and strategic screening for a metabolite (screening for citric acid producing organisms)
2. Screening, enrichment and isolation for a secondary metabolite producer from the environment crowded plate technique for antibiotic producing organisms
3. Determination of TDP & TDT of *E.coli* for designing of a sterilizer
4. Determination of Growth curve of yeast and compute growth rate & growth yield
5. Strain improvement of the industrially important isolate (*A.niger* / yeast) using EtBr for higher yield of the product
6. Media balancing experiments: carbon and nitrogen as variables (in alcohol fermentation)
7. Alchohol Fermentation: using different substrates and its downstream processing.
8. Production of Organic acid/s by fermentation
9. Antibiotic fermentations Penicillin (upto bioassay)
10. Microbial Enzyme production and its characterization-Amylase
11. Bioinsecticide / Biofertilizers: isolation production purification and assay

BTS-603: Metabolism

Paper: Supportive
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

Unit I: Carbohydrate Metabolism

Importance of glucose in metabolism, glucose transport, Definition, concept, Metabolic map with enzyme and overall Balance sheet of Net gain of ATP; Glycolysis, TCA, HMP, Gluconeogenesis. Electron transport & Oxidative phosphorylation, components involved in Electron transport, Respiratory chain, Oxidative phosphorylation & mechanism. Energies of oxidative phosphorylation.

Unit II: Lipid and Amino Acid Metabolism:

Fatty acid are activated and transported in Mitochondria. Oxidation of fatty acid (Palmitic acid) Fatty acid biosynthesis : Formation of malonyl COA from Acetyl COA, FAS – Multienzyme complex & Reaction of palmitic acid.

Biosynthesis of Amino Acid Metabolic fates of amino groups, Deamination, Decarboxylation & Transamination reactions. Biosynthesis of phenylalanine, Tyrosine & Tryptophan; Biosynthesis of Chorismate, Chorismate to Tryptophan, Phenylalanine & Tyrosine with chemical reaction and enzymes

Unit III: Biosynthesis of nucleotides: - Denovo & Salvage pathway (introductory). Denovo purine nucleotide synthesis from PRPP to IMP, IMP to AMP& GMP; Pyrimidine nucleotide biosynthesis Denovo.

References:

1.Biochemistry by Lubert Stryer,III edn,1988. W.H. Freeman & Co.

2.Principles of Biochemistry by Lehninger, II edn, 1978, Worth Publisher Inc.

3.Biochemistry by Zubay, III edn, 1933, W.C Brown Publisher.

4.Outline of Biochemistry by Cohn and Stump.

5.Practical Biochemistry by D. Plummer.

6.Practical Biochemsitry by J. Jayraman

Practical

Lab Course -XIV

BTS-603P: Practical Based on Metabolism

1.Detection of Phospholipids content in oil.

2. Isolation & Detection of Succinate dehydrogenase.

3. Separation of DNA, RNA, Protein from tissue extract.

4. Estimation of amino acid by ninhydrin Method.

5. Estimation of aromatic amino acid by Folin-Phenol reagent.

BTAA-604 A3: Animal Biotechnology

Paper: Applied
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

Unit 1:Animal Tissue culture:

Media, Natural, artificial, serum, serum free media, chemically defined media and protein free media Primary culture , Tissue disaggregation, secondary culture, cell lines and maintanence, Assesment of growth, measurement of cell death

Unit II: Methods in animal tissue culture

Monolayer culture: Roux bottle, roller bottle, multitray, synthetic hollow fiber, bead bed reactors, continuous flow cultures, Airlift fermentors Immobilized cultures Entrapment cultures, Porous carriers, Fixed bed (Parosphere and fluidized beds)

Unit III Transformation methods

DNA calcium phosphate coprecipitation method, Lipofection, electroporation, DEAE dextran method, Microinjection

References:

1. text book of genetic engineering by Desmond Nicoll
2. Principles of gene manipulation by Primrose
3. Animal cell culture by Jon Masters
4. Culture of Animal cells-3rd Edition Freshney Wiley liss
5. Mammalian Cell Biotechnologyy-Apractical Approach, M,Butler Oxford University press ,New York
6. Animal Cell culture techniques, Martin Springer

BTAA-604 A4: Medical Biotechnology

Paper: Applied
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

Unit-1: RNAi Interference Technology in Therapy

Introduction to RNA interference; its features: DNA – directed RNAi; Mechanism of gene regulation by RNAi; Designing siRNAs; RNAi treatment for genetic diseases; RNAi as defence against viral infections eg. HIV; Use of RNAi for cancer treatment; Knockdown by RNAi as a mechanism to study diseases in model organisms; Limitations and disadvantages of RNAi technology.

Unit-2: Stem Cell Therapy

Introduction to stem cells; Sources of stem cells and their uses; Somatic cell nuclear transfer (Therapeutic cloning); Induced pluripotent stem cells; Development of regenerative treatment models; Stem cells and neurodegenerative diseases; Potential of hematopeotic stem cells in treatment of autoimmune diseases; Ethical issues and disadvantages of stem cell therapy

Unit-3: Biotechnological Interventions in Cancer Therapy

Introduction to different types of cancer therapy; Hormonal therapy; Targeted therapy against surface molecules; Microtubule targeting plant based drugs; p53 protein as a target; Targeting angiogenesis; Introduction to oncogenomics.

References

1. Molecular Biology of the Gene (2008) 6th ed., Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R., Cold Spring Harbor Laboratory Press, Cold Spring. Harbor (New York), ISBN:0-321-50781 / ISBN: 978-0-321-50781-5.

2. Gene Cloning and DNA Analysis (2010) 6th ed., Brown, T.A., Wiley-Blackwell Publishing (Oxford, UK), ISBN: 978-1-4051-8173-0.

3. Principles of Gene Manipulation and Genomics (2006) 7th ed., Primrose, S. B., and Twyman, R. M., Blackwell publishing (Oxford) ISBN: 13: 978-1-4051-3544-3.

4. Molecular Biotechnology: Principles and Applications of Recombinant DNA (2010) 4th ed., Glick B.R., Pasternak, J.J. and Patten, C.L., ASM Press (Washington DC), ISBN: 978-1-55581-498-4 (HC)

BTAB-605 B3: BIOTECHNOLOGY AND HUMAN WELFARE

Paper: Applied
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

UNIT I Industry: protein engineering; enzyme and polysaccharide synthesis, activity and secretion, alcohol and antibiotic formation.

Agriculture: N2 fixation: transfer of pest resistance genes to plants; interaction between plants and microbes; qualitative improvement of livestock.

UNIT II Environments: e.g. chlorinated and non-chlorinated organ pollutant degradation; degradation of hydrocarbons and agricultural wastes, stress management, development of biodegradable polymers such as PHB..

UNIT III Forensic science: e.g. solving violent crimes such as murder and rape; solving claims of paternity and theft etc. using various methods of DNA finger printing. Health: e.g. development of non-toxic therapeutic agents, recombinant live vaccines, gene therapy, diagnostics, monoclonal in E.coli, human genome project.

SUGGESTED READING

1. Sateesh MK (2010) Bioethics and Biosafety, I. K. International Pvt Ltd.

2. Sree Krishna V (2007) Bioethics and Biosafety in Biotechnology, New age international publishers

BTAB-605 B4: Genomics and Proteomics

Paper: Applied
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

UNIT 1

Protein structure, secondary structure and super-secondary structure. Mechanisms of protein folding, tertiary folds. Formation of oligomers. Relationship between protein structure and function. Prions.

UNIT 2

Structure prediction and human proteomics. Mutant proteins. Use of computersimulations and knowledge-based methods in the design process. De-novo design;making use of databases of sequence and structure. Protein structure and drug discovery, Proteins in disease

UNIT 3

The structure, function and evolution of the human genome. Strategies for large-scale sequencing projects. Human disease genes. Expression.Bioinformatics for the analysis of sequence data; approaches for determining gene expression patterns and functions.

Reference

1) Lesk, Arthur M, Introduction to Informatics, 2nd Edition, Oxford University

Press, 2005, ISBN 0 19 9277877. http://www.oup.com/uk/orc/bin/9780199277872/freelecturer/figures/

2) Lesk, Arthur M, Introduction to Protein Science, Oxford University Press, 2004, ISBN 0 19 926511 9. http://www.oup.com/uk/orc/bin/9780199265114/resources/figures/

3)Nature,Genome
gateway:http://www.nature.com/nature/supplements/collections/humangenome/index.h

tml

4) Science, Human Genome special issuehttp://www.sciencemag.org/content/vol291/issue5507/index.dtl

5) This Unit Web site: http://www.lsbu.ac.uk/biology/proteomics/

6) Campbell, A. Malcolm and Heyer, Laurie J., Discovering Genomics, Proteomics & Bioinformatics, Benjamin Cummings, 2002.

7) Fersht, A. Structure and Mechanism in Protein Science, W. H. Freeman (1999).

8) Carey P. R. (Ed.) Protein engineering and design, Academic Press (1996).

9) Strachan T. and Read A. P. Human Molecular Genetics, 2nd edition. Bios (1999)

10) Glick, Bernard R. and Pasternak J. J., Molecular Biotechnology: principles and applications of recombinant DNA, 2nd ed. ASM Press (1998)

11) Brown T. A. Genomes, Bios (1999)

12) Attwood T. K. and Parry-Smith D. J. Introduction to Bioinformatics, Longman (1999)

13) Rees A R., Sternberg M. J. E. and Westsel R., Protein Engineering - a practical approach, IRL Press (1992).

14) Walker J. M. and Rapley R., Molecular Biology and Biotechnology, 4th ed. Royal Society of Chemistry (2000).

BTP-606 : Project

Paper: Project

Total Credit: 04
Marks: 100

Project : Guidelines

1) Project should be NOT less than 10000 word

2) One copy of the project should be hand-written

3) Other 3 copy typed and submit to Collage

4) Project should be written in International standard with at least or not less than 50 references.

5) References quoted should be from peer reviewed international journals, available on Scopus/ Research Gate/ Or Pubmed and should not be merely from www.google.com.

6) The dissertation preparation must be as per research article published in "CELL" http://www.cell.com/cell/authors . Please avoid guidelines provided for Resource article,Theory articles matters arising article or review.

7) Your dissertation may include figures and tables more than in number prescribed by Cell for a Research article. This is because, you are not additionally providing "Supplement information" all data is to be included in the dissertation.

8) Project may pertain to the above mentioned themes or relevant to any course studied during last three years.