

S-20 & 21 June, 2017 AC after Circulars

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DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY



CIRCULAR NO.SU/Sci./Model College/Biotech./32/2017

It is hereby informed to all concerned that, the syllabus prepared by the Committee & recommended by the Dean, Faculty of Science & Technology, the Hon'ble Vice-Chancellor **has accepted the "Revised Syllabus of B.Sc. Honors degree course in Biotechnology third year (V & VI semester)** under the Faculty of Science & Technology in his emergency powers under section 12(7) of the Maharashtra Public Universities Act, 2016 on behalf of the Academic Council **at Model College, Ghansawangi, Dist-Jalna as appended herewith.**

This shall be effective from the Academic Year 2017-2018 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,
Aurangabad-431 004.
REF.NO. SU/SCI/2017/5019
Date:- 29.08.2017.

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**Deputy Registrar,
Syllabus Section.**

Copy forwarded with compliments to :-

- 1] **The Principal, Model College, Ghansawangi, Dist- Jalna.**
- 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.BAMU,A'bad.
- 2] The Section Officer, [B.Sc.Unit] Examination Branch, Dr.BAMU,A'bad.
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**DR. BABASAHEB AMBEDKAR
MARATHWADA UNIVERSITY,
AURANGABAD.**



SYLLABUS OF

B.SC. BIOTECHNOLOGY (HONORS)

IIIRD YEAR

[VTH & VITH SEMESTER]

RUN AT MODEL COLLEGE, GHANSAWANGI,

DIST. JALNA

[Effective from 2017-18 & onwards]

Final Syllabus of B.Sc. Biotechnology V Semester [Honors] Ghansawangi

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B.Sc. Biotechnology (Honors Degree) V Semester

Sr. No	Curriculum	Code	Name of Paper	Theory (UA)	Internal (IA)	Practical (UA)	Total	Credit
1	Major Core A	BTCC-501	Immunology	50	10	40 Exam at the end of Year	100	5
2	Major Core B	BTCC-502	Bio Analytical Tools	50	10	40 Exam at the end of Year	100	5
3	Supportive	BTSU-503	Bioinformatics	50	10	40 Exam at the end of Year	100	4
4	Applied	BTSU-504	Bioprocess Technology	50	10	40 Exam at the end of Year	100	8
5	JOC	BT JOC-505	Job Oriented Life skills II	30	20	-	50	4
6	VOC	BT VOC-506	Value Oriented Courses	30	20	-	50	4

B.Sc. Biotechnology (Honors Degree) VI Semester

Sr. No	Curriculum	Code	Name of Paper	Theory (UA)	Internal (IA)	Practical (UA)	Total	Credit
1	Major Core A	BTCC-601	Recombinant DNA Technology	50	10	40	100	5
2	Major Core B	BTCC-602	Plant and Animal Biotechnology	50	10	40	100	5
3	Supportive	BTSU-603	Industrial Biotechnology	50	10	Project(80Marks)	100	4
4	Applied	BTSU-604	Biotechnology and human welfare	50	10	100	8	
5	JOC	BT JOC-605	Job Oriented Life skills II	30	20	-	4	
6	VOC	Bt VOC-606	Value Oriented Courses	30	20	-	4	

Handwritten signature and date: 21/8/2017

Immunology

- 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 mediated 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 Lupes Erythematus, 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

Practical's:

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

BIO-ANALYTICAL TOOLS

UNIT I Simple microscopy, phase contrast microscopy, fluorescence 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 :

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.

BIOINFORMATICS

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.

PRACTICALS

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

References:

1. Developmental Biology-Gilbert
2. Foundations of Embryology – Patten
3. Cell and Developmental Biotechnology – Raj Narian Desikar
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 atiya Khanum, Emerging trends in Bioinformatics, Ukaaz Publishers, 2002
10. David M. Hill, Craig Martiz and Barke Moble, Molecular Systematics
11. Khan Imtiyaz alam, Rai University, Hyderabad:- Elementary Bioinformatics
12. N. Gautam Bioinformatics- Databases and algorithm
13. Bioinformatics: A practical Guide to the analysis of genes and proteins A.D. Baxeavanis 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.

BIOPROCESS TECHNOLOGY

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.

PRACTICALS

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.

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.

RECOMBINANT DNA TECHNOLOGY

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.

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

SUGGESTED READING

1. Brown TA. (2006). Gene Cloning and DNA Analysis. 5th edition. Blackwell Publishing, Oxford, U.K.
2. Clark DP and Pazdernik NJ. (2009). Biotechnology-Appling 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

Plant and Animal Biotechnology

Unit 1: Terminology- Totipotency, Competency, Determinism, Requirements of tissue culture facilities, surface sterilization of materials, Basic procedure for Aseptic Tissue transfer, Culture media, composition of media, phytohormones, media components (Vitamins, Unidentified supplements, carbohydrate for energy source, Nitrogen source and organic supplements, complex substances, Activated charcoal) An appraisal of different media, Hormones: Auxins, cytokinins, Gibberellins, Absciscic Acid, ethylene.

Unit 2: Establishing callus and cell culture, Dynamics of callus growth, callus subculture and maintenance, Growth Measurements, Organ cultures-Shoot cultures, root cultures. Somaclonal variation, cell suspension culture, Plant Propagation—Meristem Cultures, Somatic Embryogenesis and their practical applications, Plant Cell Cultures and Pharmaceuticals, and pigment Compounds.

Unit 3: Culture Media: Natural media –Plasma Clot, biological fluids tissue extract, Importance of Serum in media. Chemically defined media. Primary Culture – Cell lines, isolation of tissue, enzyme disaggregation, and mechanical disaggregation. Secondary Culture – transformed animal cells and continuous cell lines.

Transfection of animal cell lines. Selectable Markers. Production of Vaccines in animal Cells. Production and Applications of monoclonal antibodies. Growth factors promoting proliferation of animal cells- EGF, FGF, PDGF, IL-1, IL-2, NGF and Erythropoietin. Transgenic Animals- Techniques and Applications (Transgenic mice and sheep).

References:

1. Plant Cell and Tissue Culture- A Tool in Biotechnology Basics and Application, Karl-Hermann Neumann, Ashwani Kumar, Jafargholi Imani, Springer-Verlag Berlin Heidelberg
2. Plant Tissue Culture: Theory and Practice, S.S. Bhojwani, M.K. Razdan - Elsevier Science.
3. Culture of Animal Cells. A Manual of Basic Technique, Freshney, Wiley
4. Cell Culture Lab Fax. Eds. M. Butler & M. Dawson, Bios Scientific Publications Ltd., Oxford.
5. Animal Cell Culture Techniques. Ed. Martin Clynes, Springer.
6. Methods in Cell Biology, Vol. 57, Animal Cell Culture Methods. Ed. Jenni P. Mather and David Barnes. Academic Press.
7. Cell Growth and Division: A Practical Approach. Ed. R. Basega, IRL Press.

Final Syllabus of B.Sc. Biotechnology V Semester [Honors] Ghansawangi
Practicals:

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1. Plant tissue culture media preparation & sterilization.
2. Induction of callus using suitable explants
3. Anther culture.
4. Suspension culture.
5. Micropropagation. 6. Embryo Rescue.
7. Plant regeneration from callus.
8. Animal cell culture Preparation of media and filter sterilization
9. Anchorage Dependent Cell Culture
10. Anchorage Independent Cell Culture
11. Cell Viability analysis –by staining method

Industrial Biotechnology

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, steroid 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 (K_a) determination, factors depending on scale up principle and different methods of scaling up. Metabolic engineering of antibiotic biosynthetic pathways.

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.
5. Salisbury, Whitaker and Hall. Principles of fermentation Technology,

BIOTECHNOLOGY AND HUMAN WELFARE

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

Dissertation in lieu of two practical courses:

1. Dissertation is being submitted in lieu of two laboratory courses (Industrial Biotechnology, biotechnology and human welfare), weighing 80 marks.
2. Dissertation would include abstract, introduction, materials and methods, results, discussion, acknowledgments, references in chronological order. The writing should not be less than 4000 words without space, excluding figures and tables.

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