



MAHATMA GANDHI UNIVERSITY

KOTTAYAM

B.Sc BIOTECHNOLOGY

SCHEME AND SYLLABUS

*AND SYLLABI OF OPEN COURSES,
COMPLEMENTARY COURSES OFFERED BY
THE BIOTECHNOLOGY DEPARTMENTS*

AS PER THE NEWLY INTRODUCED CBCSS PROGRAMME

2009 Admission Onwards

Members of Bsc. Biotechnology Expert Committee

1. Dr. Keerthi.T.R(Convenor)
Reader in Biotechnology
School of Biosciences
Mahatma Gandhi University
Email:keerthisureshabu@gmail.com\keerthisureshabu@yahoo.co.in
Mob:9497655293
2. Dr. Jayachandran.K
Reader in Biotechnology
School of Biosciences
Mahatma Gandhi University
jayansbs@gmail.com
Mob:9446356612
3. Manjula.S
Senior Lecturer
Department of Microbiology
Sree Sankara College, Kalady
Mob:04842278868
4. Dr. Indu.C.Nair
Lecturer
S.A.S SNDP Yogam College
Konni, Pathanamthitta
Email: inducnair73@gmail.com
Mob:9447806612
5. Manzur Ali.P
Lecturer
M.E.S. College
Marampilly, Aluva, Mob:9447587335

Scheme for B.Sc Biotechnology programme

Sem	Course code	subject title	Inst Hrs		Credits	Total Inst. Hrs	Total Credits
			T	P			
Semester 1	EN01AA901	English-Communication Skills in English	5		4	25	20
	BT01BAC01	Basic Life Science	5		4		
	BT01BAC02	Elementary Chemistry	5		4		
	BT01BAC03	Basic Biology and Chemistry Practical 1		2	2		
	CH01CAA02	Biochemistry- Elementary Biochemistry	2		3		
	MB01CA901	Microbiology- Fundamentals of Microbiology I	2		3		
Semester 2	EN02AA901	English-Critical Thinking, Academic Writing & Presentation	5		4	25	20
	BT02BAC01	Cell Biology	4		4		
	BT02BAC02	Methodology and Perspective of sciences	4		3		
	BT02BAC03	Evolutionary Biology & Environmental science	2		1		
	BT02BAC04	Practical -Cell Biology		2	2		
	CH02CA906	Biochemistry-Elementary Biochemistry II	2		3		
	MB02CA901	Fundamentals of Microbiology II	2		3		
Semester 3	BT03BAC01	Immunology	5		4	25	20
	BT03BAC02	Biostatistics and Computer Application	5		4		
	BT03BAC03	Genetics	4		3		
	BT03BAC04	Practical -Immunology and Genetics		3	3		
	BC03CAB01	Biochemistry-Enzymology and Metabolism 1	2		3		
	MB03CAC01	Microbiology- Applied Microbiology	2		3		

Semester 4	BT04BAC01	Molecular Biology	5		4	25	20
	BT04BAC02	Enzymology	4		4		
	BT04BAC03	Biophysics & Bioinformatics	4		3		
	BT04BAC04	Practical Molecular Biology and enzymology		4	3		
	CH04CA905	Biochemistry-Metabolism II	2		3		
	MB04CA901	Microbiology- Medical Microbiology	2		3		
Semester 5	BT05BAC01	rDNA Technology	5		4	25	20
	BT05BAC02	Industrial Biotechnology	5		4		
	BT05BAC03	Animal Biotechnology	5		4		
	BT05BAC04	Practical rDNA Technology and Industrial Biotechnology		5	4		
		Open Course	5		4		
Semester 6	BT06BAC01	Plant Biotechnology	5		4	25	20
	BT06BAC02	Environmental Biotechnology	5		4		
	BT06BBC03	Choice Based Course	5		4		
	BT06BAC03	Practical Environmental Biotechnology and Plant Biotechnology	5		4		
	BT06BFC01	Project and Viva		5	4		

Syllabus for common courses , complimentary courses, and open courses shall be taken from the concerned programme syllabus

Choice based Courses Offered by the Department

BT6B22AU-	Bioinformatics
BT6B22BU-	Nanotechnology
BT6B22CU-	Diseases and Diagnostic Biotechnology

Open Courses Offered by the Department

- A. Tissue culture techniques
- B. Biotechnology for sustainable development
- C. IPR and patents

**SYLLABUS FOR B.Sc. BIOTECHNOLOGY AND COMPLEMENTARY
COURSES OFFERED BY THE BIOTECHNOLOGY DEPARTMENT**

BTOIBACOI
Core1. BASIC LIFE SCIENCES

Total hours of instruction: 90

hours/ week: 5

Credit : 4

Module 1

45Hrs

Nutrition-digestive system, mechanism of digestion-enzymes, absorption-carbohydrate, lipid and proteins, storage and mobilization of food reserves , respiration, respiratory system- mechanism, Hb- structure and function, regulation, circulation- blood and lymphatic system, blood cells, coagulation, factors and mechanism, anticoagulants, plasma proteins, functions of blood, clotting disorders, lymphatic system, lymph-functions excretion- structure of kidney and nephron, glomerular filtration, urine-normal and abnormal constituents, nervous and hormonal coordination.

Ref: 1. Physiology - Guyton

2. Animal Physiology - M.S.Sebastian

3. Medical Physiology- Mahapatra

4. Foundation course in Biology- Aggrawal, Ane books.

Module II

15 Hrs

Theories on embryology, spermatogenesis, oogenesis, fertilization, morula blastula, fatemap

1. A manual of Developmental biology Vijayakumar Nair.K and Jeorge .P.V,
Academia Publication, Javahar Nagar, TVM- 41

2. Developmental Biology- Muller, Springer

3. Chordate embryology, P.S. Varma and V.K.Agarval, S Chand and Co.& Ltd

Module III

15 Hrs

Absorption and transport of water, macro and micro nutrients, transpiration, respiration, Photosynthesis, plant movements, photoperiodism, vernalisation

Ref: 1. Text Book of Plant Physiology V Verma

2. Fundamentals of Plant Physiology V.K.Jain

Module IV

15Hrs

Structure of flower, stages of flower development, androecium, gynoecium, micro and megasporogenesis, pollination and fertilization, structure of monocot and dicot embryos, polyembryoni.

Ref: 1.Essentials of Modern Biology-R C Sobti and VL Sharma

2. Plant Anatomy B.P. Pandey. S.Chand & Company Ltd.New Delhi

BTOIBAC02
Core 2. ~~PHYSICAL~~ ELEMENTARY CHEMISTRY

Total hours of instruction: 90

hours/ week: 5

Credit : 4

Module I

24 Hrs

Bohr atom model, Limitations, De broglie Equation, Heisenberg uncertainty principle, Schrodinger equation, Atomic orbitals. Quantum numbers and significance. Lattice energy of ionic compounds, applications, VSEPR theory, Hybridization involving s, p, d orbitals – sp, sp², sp³, dsp², sp³d, sp³d². Molecular orbital theory, Hydrogen bonding in H₂O, structure of water molecule, organic molecule and biomolecules, intermolecular forces, ion-dipole, dipole-dipole, dipole-induced dipole, induced dipole-induced dipole interactions.

Ref:

1. University General Chemistry. By C.N. R. Rao. Mc Millan Publication.
2. Principles of Physical Chemistry By Puri, Sharma & Pathania

Module II

22 Hrs

Mole concept, Determination of mole wt. By gram molecular volume relationship, problems based on mole concept, Solutions, colligative properties, Methods of expressing concentrations, strength, Normality, Molarity & Molality, ppm. Standardization of solutions, Colloids, pH, buffer systems, dissociation constant, pK value, Preparation of standard solution of acids and bases, problems related to acid base titrations, volumetric experiments-acidimetry, alkalimetry, permanganometry, dichrometry, iodometry.

Ref:

1. University General Chemistry. By C.N. R. Rao. Mc Millan Publication.
2. A Text Book of Physical chemistry By A.S. Negi & S.C. Anand
3. Chemistry, Second edition Rob Lewis and Wynne Evans. Palgrave foundations

Module III**24 Hrs**

Rates of reactions - various factors influencing rate of reactions - Order and molecularity - zero, first, second and third order reactions. Derivation of integrated rate equations (single reactant only), fractional life time, its relation to initial conc. of reactants for various orders, units of rate constants. Influence of temperature on reaction rates, Arrhenius equation, calculation of Arrhenius parameters, Collision theory of reaction rate.

Ref:

1. Principles of Physical Chemistry. By Maron and Pruton 4th Ed. Oxford and IBH Publication
2. University General Chemistry. By C.N. R. Rao. Mc Millan Publication.
3. Chemistry, Second edition Rob lewis and Wynne evans. Palgrave foundations

Module IV**20 Hrs**

Structure of organic compounds-Conformation and configuration, Rotation about carbon-carbon single bond, conformations of ethane. Isomerism, types, Geometrical isomerism, Optical isomerism : explanation with examples.

Ref:

1. Principles of Organic chemistry-I. Finar, ELBS
2. Principles of Organic chemistry- Puri and Sharma

BTOIBAC03
Core 3. PRACTICAL-BASIC BIOLOGY AND CHEMISTRY

Total hours of instruction: 36

Hours/ week: 2

Credit: 2

1. Method of expressing concentration of solutions- calculations based on Normality and Molarity
2. Standardization of the concentration of acids/alkali based on volumetric titrations
3. Qualitative analysis of the organic compounds
Tests for –Hydrocarbons, alcohol, aldehydes, ketones, aniline, amide
4. Sectioning of monocot and dicot embryos
5. Cross section of Anther and Ovule
6. Pollen tube formation
7. Demonstration of various developmental stages of chick embryo

Ref:

1. Practical Chemistry- A.O.Thomas
2. A practical guide to developmental Biology, Melissa A. Gibbs, Oxford University Press

SEMESTER 2
BTO2BAC01
Core 4. CELL BIOLOGY

Total hours of instruction: 72

Hours/ week: 4

Credit: 4

Module I

10Hrs.

History and development of cell biology. Universal features of cell. Chemical components of cell. Cell theory. General organization of eukaryotic and prokaryotic cell. Evolution of eukaryotic cell.

Ref: 1. Cell and Molecular Biology, Gerald Karp, John Wiley & sons, Inc.

2. Cell, Cooper

Module II

22Hrs.

Cell cycle-stages, Mitosis, Meiosis, MPF, cyclins. Cell death-Necrosis and apoptosis. Cell Signaling. G protein coupled and tyrosine kinase receptors. Cell junction. Cell-cell adhesion.

Ref: 1. Cell and Molecular Biology, Gerald Karp, John Wiley & sons, Inc.

2. Cell, Cooper

3. Cell Biology, Smith and Wood

Module III

25Hrs.

Cell Membrane- structure and function. Molecular models of cell membrane. Membrane transport- active passive facilitated, symport, antiport. Cytoskeleton- Microtubules, Microtubular organelles, microfilaments, Intermediate filaments. Endomembrane system- Nuclear envelope, ER, Golgi complex. Membrane organelle- Mitochondria, chloroplast, Lysosome, peroxisome.

Ref:

1. Cell and Molecular Biology, Gerald Karp, John Wiley & sons, Inc.
2. Cell, Cooper
3. Cell Biology, Smith and Wood

Module IV

15Hrs

Techniques in cell biology- Light microscopy, Electron microscopy-SEM,TEM. Fluorescent microscopy. Fixation and staining. Cytochemical methods. Cell fractionation. Immunocytochemistry.

Ref:

1. Cell and Molecular Biology 8th Edn. EDP De Robertis and EMF De Robertis, Lippincott Williams and Wilkins publication.
2. Molecular Cell Biology 6th Edn. Lodish, Berk, Kaiser, Krieger, Scott, Bretscher, Pelech, Matsudaira. W.H Freeman and company Publication
3. Microbiology, Prescott, Harley and Klein Wim C, Brown publishers.

BT02BAC02
Core 5. ~~BEEB05U~~ METHODOLOGY AND PERSPECTIVES OF SCIENCES

Total hours of instruction: 72

hours/ week: 4

Credit : 3

Module I - Science and Science Studies

7Hrs

Types of knowledge: practical, theoretical, and scientific knowledge. Information. What is science; what is not science; laws of science. Basis for scientific laws and factual truths. Science as a human activity, scientific temper, empiricism, vocabulary of science, science disciplines. Revolutions in Science and Technology

Ref:

- Gieryn, T.F. Cultural Boundaries of Science., Univ. Chicago Press, 1999.
- Collins H. and T. Pinch. The Golem: What Everyone Should Know About Science. Cambridge Univ. Press, 1993.
- Hewitt, Paul G, Suzanne Lyons, John A. Suchocki & Jennifer Yeh, Conceptual Integrated Science, Addison-Wesley, 2007
- Newton RG. The Truth of Science : New Delhi, 2nd edition
- Bass, Joel, E and et.al. Methods for Teaching Science as Inquiry, Allyn & Bacon, 2009
- Debbie Holmes, Peter Moody, Diana Dine. Research methods for the biosciences, International Student Edition, Oxford university press

Module II - Methods and Tools of Science

15Hrs

Hypotheses; theories and laws in science; Observations, evidences and proofs. Posing a question; formulation of hypothesis; Hypothetic co-deductive model, Inductive model. Significance of verification (proving), corroboration and falsification (disproving), auxiliary hypothesis, ad-hoc hypothesis, Revision of scientific theories and laws.

Importance of models, simulations and virtual testing. Mathematical methods versus Scientific methods. Significance of Peer Review

Ref:

- Gieryn, T.F. Cultural Boundaries of Science., Univ. Chicago Press, 1999.
- Collins H. and T. Pinch. The Golem: What Everyone Should Know About Science. Cambridge Univ. Press, 1993.
- Hewitt, Paul G, Suzanne Lyons, John A. Suchocki & Jennifer Yeh, Conceptual Integrated Science, Addison-Wesley, 2007
- Newton RG. The Truth of Science : New Delhi, 2nd edition
- Bass, Joel, E and et.al. Methods for Teaching Science as Inquiry, Allyn & Bacon, 2009

Module III - Experimentation in Science

30Hrs

Design of an experiment; experimentation; observation; data collection; interpretation and deduction. Necessity of units and dimensions; repeatability and replication; Documentation of experiments, Record keeping. Connection between measurements and underlying theory.

Types of experiments. Experiments to test a hypothesis, to measure a variable or to gather data by preliminary and explorative experiments.

Planning of experiments: Design, selection of controls, observational requirements, instrumental requirements, Scientific Instruments; Sensory extension; choice and selection of instruments; sensitivity of instruments; Accuracy and precision and errors, Types of instrumentation; Historical development and evolution of scientific instruments. Robotics. (Only a general orientation of scientific instruments required) Making observations: direct and indirect observations, controlled and uncontrolled observations, human and machine observations. human error. Examples of great experiments in science. (To illustrate how various tools were applied to answer a question)

Ref:

- Gieryn, T.F. Cultural Boundaries of Science., Univ. Chicago Press, 1999.
- Collins H. and T. Pinch. The Golem: What Everyone Should Know About Science. Cambridge Univ. Press, 1993.

- Hewitt, Paul G, Suzanne Lyons, John A. Suchocki & Jennifer Yeh, Conceptual Integrated Science, Addison-Wesley, 2007
- Newton RG. The Truth of Science : New Delhi, 2nd edition
- Bass, Joel, E and et.al. Methods for Teaching Science as Inquiry, Allyn & Bacon, 2009
- Debbie Holmes, Peter Moody, Diana Dine. Research methods for the biosciences, International Student Edition, Oxford university press

Module IV - Data handling and Ethics in science

20Hrs

Documentation of experiments. Nature and Types of data -typical examples; Data acquisition; Treatment of data; Data interpretation, Significance of statistical tools in data interpretation, errors and inaccuracies. Data presentation: graphs, tables, histograms and pi diagrams.

Statistical testing of hypothesis, null hypothesis, Significance test,- Statistics based acceptance or rejection of a hypothesis. Deduction of scientific correlation, patterns and trends.

Ethics in Science; Scientific information, Depositories of scientific information, primary, secondary and digital sources Sharing of knowledge; transparency and honesty; danger of preconceived ideas.

Reporting of observational and experimental data, human bias, Biased observations, Influence of observer on observations, using and acknowledging observations by others. Publications and Patents.(Details not required) Plagiarism

Ref:

- Gieryn, T.F. Cultural Boundaries of Science., Univ. Chicago Press, 1999.
- Collins H. and T. Pinch. The Golem: What Everyone Should Know About Science. Cambridge Univ. Press, 1993.
- Hewitt, Paul G, Suzanne Lyons, John A. Suchocki & Jennifer Yeh, Conceptual Integrated Science, Addison-Wesley, 2007
- Newton RG. The Truth of Science : New Delhi, 2nd edition

- Bass, Joel, E and et.al. Methods for Teaching Science as Inquiry, Allyn & Bacon, 2009
- Debbie Holmes, Peter Moody, Diana Dine. Research methods for the biosciences, International Student Edition, Oxford university press

BT02BAC03
Core 6. ~~BIBLOS~~ EVOLUTIONARY BIOLOGY AND ENVIRONMENTAL SCIENCE

Total hours of instruction: 36

Hours/ week: 2

Credit : 1

Module I

8Hrs.

History, theories on evolution, prebiotic environment and molecular evolution, origin of life, Relationship among organisms and evidences of evolution

Ref1. Ecology, evolution and zoogeography- Andrews and Joy

2. Evolution- Arumugham, Saras publication

Module II

12 Hrs.

Miller-Urey experiment, Darwinian's theory of evolution, natural selection, speciation, adaptive radiation, role of mutation, modern theories of evolution, micro and macroevolution, human evolution.

Ref1. Ecology, evolution and zoogeography- Andrews and Joy

2. Evolution- Arumugham, Saras publication

Module III

10Hrs

The components of ecosystem- producer, consumer, decomposer, abiotic components. Food chain, foodweb, energy flow. Biogeochemical cycles – nitrogen cycle, carbon cycle.

Ref:

1. Microbial ecology-Atlas and Bartha

Essential Environmental Studies S.P.Misra,S.N.Pande Ane Books Pvt.Ltd.

Ecology and environment-Sharma P.D

Module IV

6Hrs.

Environmental pollution- air, soil and water pollution with suitable case studies, global warming, green house effect, acid rain, smog, hazards of nuclear fall out.

Ref 1. Microbial ecology-Atlas and Bartha

Essential Environmental Studies S.P.Misra,S.N.Pande Ane Books Pvt.Ltd.

Ecology and environment-Sharma P.D

BTO2BAC01
Core7- B12B070 PRACTICAL- CELL BIOLOGY

Total hours of instruction: 36

Hours/ week: 2

Credit: 2

1. Cell counting methods:

- a) Haemocytometer: WBC, RBC
- b) Differential counting using Leishman's stain

2. Micrometry:

- a) Calibration using ocular micrometer
- b) Finding out average cell size

3. Squash Preparation

- a) Study of mitotic stages
- b) Measurement of Chromosome length.

4. Cell fractionation

- a) Homogenization of tissue
- b) Organelle specific marker for mitochondria, chloroplast.

5. Feulgan staining of chromosomes

Ref:

1. Allyn Bregman, 1996. Laboratory investigation in cell and molecular biology. John Wiley & Sons.
2. Microbiology Laboratory Manual – Cappuccino, Sherman, Pearson Education
3. A Text book of Practical Physiology - CL Ghai, Jaypee Brothers Publishers (P) LTD New Delhi.

4. Medical Laboratory Technology. Procedure Manual for Routine Diagnostic Tests
-Volume I, Kanai L Mukherjee; Tata Mc Graw-Hill publishing Company.Ltd
New Delhi

SEMESTER 3

~~BTO3BAC01~~ Core 8 -~~BT03BAC01~~ IMMUNOLOGY

Total hours of instruction: 90

Hours/ week: 5

Credit: 4

Module I

30Hrs

Introduction to immunology. Innate immunity, non specific immunity. Types of immunity. Antigen, antibody. Structure and types of immunoglobulins ,distribution and function. Antigen- antibody interactions and complements. Haptens and Adjuvants.

- Ref: 1. Kannan (2007). " Immunology" M J P Publishers Chennai;
2. Roitt's Essential Immunology by Peter Delves, Seamus Martin, Dennis Burton, Ivan Roitt;
3. Immunology Janis Kuby, Thomas .J.Kindt, Barbara.A.Osbome and Richard .A. Goldsty;
4. Ananthanarayan and Paniker,s Textbook of Microbiology , R. Ananthanarayan, C.K. Jayaram paniker.

ModuleII

30Hrs

Organs of immune system-primary and secondary. Cells of immunsystem. Immune response. Humeral and cell mediated immunity. MHC structure and function. Immunological tolerance. Autoimmunity and hypersensitivity.

Ref:

1. Kannan (2007). " Immunology" M J P Publishers Chennai;
2. Roitt's Essential Immunology by Peter Delves, Seamus Martin, Dennis Burton, Ivan Roitt;
3. Immunology Janis Kuby, Thomas .J.Kindt, Barbara.A.Osborne and Richard .A. Goldsty;
4. Ananthanarayan and Paniker,s Textbook of Microbiology , R. Ananthanarayan, C.K. Jayaram paniker.

Module III

15Hrs

Transplant immunity. Immunology of malignancy. Immunohaematology. Blood groups and blood grouping. A, B, Rh antigens and antibodies, Rh typing. Bombay group

Ref:

1. Kannan (2007). " Immunology" M J P Publishers Chennai;
2. Roitt's Essential Immunology by Peter Delves, Seamus Martin, Dennis Burton, Ivan Roitt;
3. Immunology Janis Kuby, Thomas .J.Kindt, Barbara.A.Osborne and Richard .A. Goldsty;
4. Ananthanarayan and Paniker,s Textbook of Microbiology , R. Ananthanarayan, C.K. Jayaram paniker.

ModuleIV

15Hrs

Immunization. Vaccines,types and applications.Polyclonal antibodies and monoclonal antibodies.

Ref:

1. Kannan (2007). " Immunology" M J P Publishers Chennai;
2. Roitt's Essential Immunology by Peter Delves, Seamus Martin, Dennis Burton, Ivan Roitt;
3. Immunology Janis Kuby, Thomas .J.Kindt, Barbara.A.Osborne and Richard .A. Goldsty;
4. Ananthanarayan and Paniker,s Textbook of Microbiology , R. Ananthanarayan, C.K. Jayaram paniker.

Ref:

1. Kannan (2007). " Immunology" M J P Publishers Chennai
2. Roitt's Essential Immunology by Peter Delves, Seamus Martin, Dennis Burton, Ivan Roitt;
3. Immunology Janis Kuby, Thomas .J.Kindt, Barbara.A.Osborne and Richard .A. Goldsty
4. Ananthanarayan and Paniker,s Textbook of Microbiology , R. Ananthanarayan, C.K. Jayaram paniker.

BT03BAC02
Core 9- ~~BT03BAC01~~ BIostatistics AND COMPUTER APPLICATION

Total hours of instruction: 90

Hours/ week: 5

Credit: 4

Module I

25Hrs

Nature, application and limitation of statistics in life science. Data collection: Primary and secondary. Sampling Classification, tabulation and representation of data. Analysis of data, Measures of central tendency. Measures of dispersion. Measures of asymmetry. Correlation and regression.

Ref:

1. Research Methodology- Methods and techniques. C.R Kothari
2. Fundamentals of Biostatistics. Veer Bala Rastogi
3. Biostatistics-a foundation for analysis in the Health Sciences. Wayne W Daniel

Module II

30Hrs

Probability theory and distribution. Binomial, Poisson and Normal. Testing of hypothesis, t-test, Chi-square test, F test. Non parametric tests. Analysis of variance-ANOVA. Concept of ANOVA, Basic principles, ANOVA technique.

Ref:

1. Research Methodology- Methods and techniques. C.R Kothari
2. Fundamentals of Biostatistics. Veer Bala Rastogi
3. Biostatistics-a foundation for analysis in the Health Sciences. Wayne W Daniel

Module III

15Hrs

Introduction to Computers. Low level and high level languages. Binary number system. Flow chart and programming techniques. Introduction to data structures and database concepts. Introduction to Internet and its applications.

Ref:

1. Computer programming. Rajaraman V. Prentice hall India Publication.
2. The programmer's Book of Rules. Ladin B Rc & Ledin V. Lifetime learning Publishers

Module IV

20Hrs

Introduction to MS office software, Word processing , spread sheet and software. Computer oriented statistical techniques. Frequency table of single discrete variable Bubble sort, computation of mean variance and Standard deviation. Introduction to Bioinformatics. Biological databases: protein and nucleic acid databases.

Ref:

1. Bioinformatics. Daniel W Mount.
2. Computer programming. Rajaraman V. Prentice hall India Publication.
3. The programmer's Book of Rules. Ladin B Rc & Ledin V. Lifetime learning Publishers

Ref:

1. Research Methodology- Methods and techniques. C.R Kothari
2. Fundamentals of Biostatistics. Veer Bala Rastogi
3. Biostatistics-a foundation for analysis in the Health Sciences. Wayne W Daniel
4. Bioinformatics. Daniel W Mount.
5. Computer programming. Rajaraman V. Prentice hall India Publication.
6. The programmer's Book of Rules. Ladin B Rc & Ledin V. Lifetime learning Publishers

BT03BAC03
Core 10- GENETICS

Total hours of instruction: 72

Hours/ week: 4

Credit: 3

Module I

17hrs

The birth of genetics, symbols and terminology , Mendel's experiments, principle of segregation, monohybrid cross, principle of independent assortment, dihybrid ratio, dominance recessiveness, codominance, semidominance, lethal, multiple alleles, ABO blood typing ,gene interactions-epistasis, pleiotropy, polygenic inheritance.Test cross,Back cross.

Ref:

1. Principles of genetics- Snustad and A.G.Gardner,John Wiky pub
2. Genetics-Strick Berger
3. Text book of genetics, Veer Bala Rastogi
4. Genetics, Daniel L.Hartin and Elizabeth W. John

Module II

20hrs

Linkage, crossing over, recombination mapping of genes, sex determinations-XX-XY mechanism sex linked inheritance, sex influenced, sex limited gene expression, dosage compensation

Ref:

1. Principles of genetics- Snustrd and A.G.Gardner John Wiky pub
2. Genetics-Strick Berger
3. Text book of genetics, Veer Bala Rastogi
4. Genetics, Daniel L.Hartin and Elizabeth W. John

Module III

23hrs

Chromosome- size, shape, structure and types of chromosomes, chromosome banding, giant chromosomes, variation in chromosome number, euploidy, aneuploidy, polyploidy, extrachromosomal inheritance- mitochondria and chloroplast, maternal effects- in drosophila and snail shell coiling, inborn errors of metabolism- alkaptonuria

Ref:

1. Principles of genetics- Snustad and A.G.Gardner John Wiley pub
2. Genetics-Strick Berger
3. Genetics –A molecular approach-Prere J.Russel.
4. Genetics, Daniel L.Hartin and Elizabeth W. John

Module IV

12hrs

Population genetics- genetic variation, allele frequencies, random mating, Hardy Weinberg equilibrium, assortive mating, genetic equilibrium

Ref:

1. Principles of genetics- Snustad and A.G.Gardner John Wiley pub
2. Genetics-Strick Berger
3. Text book of genetics, Veer Bala Rastogi
4. Genetics, Daniel L.Hartin and Elizabeth W. John

BTO3BAC04
Core11- ~~AC03B10~~ PRACTICAL - IMMUNOLOGY AND GENETICS

Total hours of instruction: 52

Hours/ week: 3

Credit: 3

1. Slide agglutination test
2. Bacterial agglutination test
3. Haemagglutination test
4. Precipitation in tube-Capillary test
5. Precipitation in gel-Immunodiffusion (Demonstration only)
6. Immunoelectrophoresis (Demonstration only)
7. Blood grouping by slide agglutination method
8. Staining of polytene chromosomes.
9. Staining of barr body.
10. Problems in mendelian law, linkage, population genetics.

Ref:

1. Bailey and Scott,s Diagnostic Microbiology.
2. Practical Medical Microbiology by Mackie and Mc Cartney.
3. Hand book of experimental Immunology by D.M. Weir.
4. Genetics-Strickberger.
5. Principles of Genetics-Snustad and A.G. Gardner.

SEMESTER 4

Core 12- ~~BT04BAC01~~ MOLECULAR BIOLOGY

Total hours of instruction: 90

hours/ week: 5

Credit : 4

Module I

10hrs

Central dogma, Identification of genetic material-Griffith, Avery, Chargaff's, Hershey Chase and X-ray crystallographic experiments. Watson and Crick DNA. Composition and structure of DNA and RNA. Physico- Chemical properties of DNA. RNA as genetic material.

Ref:

1. Molecular biology of the gene. Watson, Baker, Gann, Bell, Levine, Losick. Pearson education.
2. Genes VIII, B.Lewin-Pearson Publications.
3. Fundamentals of Molecular Biology. Veer Bala Rastogi. Ane Books
4. Essentials of modern Biology- R.C. Sobti & V.L. Sarma. Ane books

Module II

20hrs

Organisation of DNA in viral, prokaryotic and eukaryotic chromosome. Packaging of DNA in eukaryotes- Histones, Nucleosomes. Concept of Gene, Gene structure and organization of genome. Microsatellites, SINES and LINES. C-value paradox. Genetic Code- features, codon anticodon pairing, Wobble hypothesis.

Ref:

1. Genetics. A Molecular approach. 2nd Edn. Peter J Russel.
2. Cell-a molecular approach. Geoffrey M. Cooper, Robert E. Hoausman

3. Fundamentals of Molecular Biology. Veer Bala Rastogi. Ane Books
4. Essentials of modern Biology- R.C. Sobti & V.L. Sarma. Ane books

Module III

40hrs

DNA Replication-Meselson and Stall Experiment. Structure and functions of enzymes and protein involved in Replication. Replication in *E.coli*. Mutation-Types. Repair-Direct reversal, Base excision and Nucleotide excision repair. Transcription in prokaryotes-Initiation, Elongation and termination. Translation in prokaryotes-Role of RNAs, Initiation, Elongation and termination.

Ref:

1. Molecular Cell Biology. 6 Edn. Lodish. Pearson publication
2. Genetics a molecular approach. 2nd Edn, Peter J Russel

Module IV

Regulation of Gene expression-Regulatory protein, promoters, activators, repressor. Operon concept, positive and negative regulation. Molecular details of Lac operon. Gene expression in λ BTda phage- lytic and lysogenic pathway.

Ref:

1. Genes VIII.B Lewin. Pearson publication.
2. Molecular Cell Biology. 6th Edn. Lodish. Pearson publication

Ref:

1. Molecular biology of the gene. Watson, Baker, Gann, Bell, Levine, Losick. Pearson education.
2. Genetics. A Molecular approach. 2nd Edn. Peter J Russel.
3. Molecular Cell Biology. 6 Edn. Lodish. Pearson publication.
4. Genes VIII.B Lewin. Pearson publication.

5. Cell and Molecular Biology. Gerald Carp.
6. Cell -a Molecular approach-Geoffrey M. Cooper Robert E. Hoasman Publisher.
7. Fundamentals ofMolecular Biology. Veer Bala Rastogi. Ane Books.
8. Essentials of modern Biology- R.C. Sobti & V.L. Sarma. Ane books.

~~Core13-
BT04-BAC02~~
ENZYMOLOGY

Total hours of instruction: 90

Hours/ week: 4

Credit: 4

Module I

10 Hrs

Enzyme nomenclature and classification. Isolation of enzymes. Extraction of soluble and membrane bound enzymes .Purification of enzymes, precipitation, dialysis, chromatography and electrophoresis

Ref:

1. Enzymes-Biochemistry,Biotechnology and Clinical chemistry by Trever Palmer, Horwood Publishers
2. Biochemistry- Donald Voet and Judith G Voet

Module II

30 Hrs

Structure and properties of enzymes, active site, specificity, Enzyme unit, mechanism of enzyme action. Factors affecting enzyme activity, Kinetics of enzyme substrate reactions, Michaelis- Menton equation

Ref:

1. Biochemistry- Donald Voet and Judith G Voet
2. Enzyme technology –M.F.Cplin and C.Burke. CaBTridge university press

Module III

30 Hrs

Inhibition of enzymes, inhibitors, types of inhibition, Mechanism of inhibition-competitive, uncompetitive and noncompetitive and allosteric inhibition

Ref:

1. Biochemistry- Donald Voet and Judith G Voet
2. Enzyme technology –M.F.Cplin and C.Burke. CaBTridge university press

Module IV

20 Hrs

Clinical and industrial application of enzymes, immobilization of enzymes, Biosensors, synthetic enzymes, abzymes, enzyme engineering

Ref:

1. Immobilization of enzymes and cells-A Rosevear, IOP publishing
2. Industrial enzymes and their application- Helmut

Ref:

1. Enzymes-Biochemistry, Biotechnology and Clinical chemistry by Trevor Palmer, Horwood Publishers
2. Biochemistry- Donald Voet and Judith G Voet
3. Enzyme technology –M.F.Cplin and C.Burke. CaBTridge university press
4. Immobilization of enzymes and cells-A Rosevear, IOP publishing
5. Industrial enzymes and their application- Helmut

BTO4BAC03
Core14 - BIOPHYSICS AND BIOINFORMATICS

Total hours of instruction: 72

Hours/ week: 4

Credit: 3

Module I

30 Hrs

Laws of thermodynamics, Role of water in living organisms, Enthalpy, entropy, free energy Basic principles and biological significance of Osmosis, diffusion, adsorption, surface tension, colloids, radioactivity. GM counter, scintillation counter, spectroscopy- UV, visible, IR.

Ref;

1. Biophysics- Vasantha pattabhi, N. Gautham. Kluwer Aca. Pub: Narosa Pub. House.
2. Text book of Biophysics- R.N.Roy, New central Book Agency Pvt. Ltd.
3. Biophysical Chemistry- Upadhyay.

Module II

15 Hrs

Stabilizing forces in macromolecules

Protein conformation – primary, secondary, tertiary and quaternary structure, folding- chaperones, DNA conformation & Polymorphism.

Ref:

1. Biochemistry- Donald Voet & Judith G Voet: John Wiley Sons, Inc.
2. Principles of Biochemistry- Leninger

Module III

15 Hrs

Introduction to Bioinformatics, Definition, history, important Biological databases, sequence format, NCBI, gene bank, EBTL, Swissport, PDB, Drug bank

Ref:

1. Bioinformatics: Sequence & Genome analysis- David W mount, Cold Spring Harbor Lab
2. Algorithms in Bioinformatics- Benson, Ane Books

Module IV

12 Hrs

Tools for alignment studies, FASTA, BLAST, biology, applications- phylogenetic analysis, homology modeling, structure prediction

Ref: Algorithms in Bioinformatics- Benson, Ane Books

Ref:

1. Bioinformatics-sequence and genome analysis, David W Mount, Cold Spring Harbor Laboratory
2. Biophysics- Vasantha pattabhi, N. Gautham. Kluwer Aca.Pub: Narosa Pub. House
3. Text book of Biophysics- R.N.Roy, New central Book Agency Pvt. Ltd.
4. Biophysical Chemistry- Upadhyay.
5. Biochemistry- Donald Voet & Judith G Voet: John Wiley Sons, Inc.
6. Principles of Biochemistry- Leninger
7. Algorithms in Bioinformatics- Benson, Ane Books

~~BTD4BAC04~~
Core 15 - ~~BTD4BAC04~~ PRACTICAL- MOLECULAR BIOLOGY AND
ENZYMOLGY

Total hours of instruction: 72

Hours/ week: 4

Credit: 3

1. Estimation of enzyme activity-amylase assay
2. Estimation of clinically important enzymes-SGPT, SGOT
3. Factors affecting enzyme activity
 - effect of pH enzyme activity
 - effect of temperature on enzyme activity
 - effect of metal ion on enzyme activity
 - effect of inhibitors on enzyme activity
3. Immobilization of enzymes
4. DNA isolation
5. Separation of DNA by agarose gel electrophoresis
6. RNA isolation
7. Separation of RNA by agarose gel electrophoresis

Ref:

1. Molecular gene cloning –Sambrooke and Maniatis, Cold Spring Harbour Laboratory
2. Practical Biochemistry- David Plummer.
3. Practical skills in Biomolecular Sciences- rob Reed, Dand Holmes, janathan Weyers, Allen Janes, Longman England.

SEMESTER 5

BT05BAC01 Core16- ~~BT05BAC01~~ RECOMBINANT DNA TECHNOLOGY

Total hours of instruction: 90

Hours/ week: 5

Credit: 4

Module I

20Hrs

Introduction to genetic engineering. Steps of genetic engineering. Enzymes in genetic engineering- Restriction endonucleases, alkaline phosphatase, polynucleotide kinase, Terminal transferase, S1 nuclease, RNAase H, DNA polI, Klenow fragment, Taq polymerase, Reverse transcriptase.

Ref:

1. Gene Cloning and DNA analysis. T A Brown. Blackwell Publication.
2. Biotechnology-Fundamentals and applications. S S Purohit and S.K Mathur. Agrobotanica publications.

Module II

25Hrs

Gene cloning vectors. Plasmid vectors-features, pUC and pBR322. Bacteriophage vectors-Lambda, M13. Cosmids. Vectors for animal and plant cell. Shuttle vectors. YAC. BAC.

Ref:

1. Gene Cloning and DNA analysis. T A Brown. Blackwell Publication.
2. Biotechnology-Fundamentals and applications. S S Purohit and S.K Mathur. Agrobotanica publications.

Module III

25Hrs

Gene transfer methods-CaCl₂ mediated, Electroporation, Microinjection, Lipofection. Partial Bombardment Agrobacterium mediated gene transfer. Shotgun and cDNA cloning. Genomic library. Selection of recombinants replication, Colony hybridization, Marker genes, reporter genes, Insertional inactivation, Blue-white assay and Southern blotting.

Ref:

1. Recombinant DNA-Genes and Genomes. James D Watson, Any A candy, Richard M.M, Jan A Witkowski. W H Freeman and Company Publication.
2. Biotechnology-Fundamentals and applications. S S Purohit and S.K Mathur. Agrobotanica publications.
3. Gene Cloning and DNA analysis. T A Brown. Blackwell Publication.

Module IV

20Hrs

DNA sequencing. Chromosome walking. RAPD, RFLP and PCR

Application of genetic engineering- Human genome project. Recombinant insulin. Transgenic plants-Herbicide and pest resistance. BT cotton. Molecular pharming. Gene therapy.

Ref:

1. Gene Cloning and DNA analysis. T A Brown. Blackwell Publication.
2. Recombinant DNA-Genes and Genomes. James D Watson, Any A candy, Richard M.M, Jan A Witkowski. W H Freeman and Company Publication.

Ref:

1. Principles of Gene manipulation and Genomics. S.B Primrose and R M Twyman. Blackwell Publication

2. Biotechnology-Fundamentals and applications. S S Purohit and S.K Mathur. Agrobotanica publications.
3. Gene Cloning and DNA analysis.T A Brown. Blackwell Publication.
4. Recombinant DNA-Genes and Genomes. James D Watson, Any A candy,Richard M.M, Jan A Witkowski. W H Freeman and Company Publication.

BT05BAC02
Core 17 - ~~BT05BAC02~~ INDUSTRIAL BIOTECHNOLOGY

Total hours of instruction: 90

Hours/ week: 5

Credit: 4

Module I

20Hrs

Advantages of bioprocess over chemical process, Fermentation -definition, types-submerged and solid state, applications of fermentation. Industrially important microbial metabolites. Isolation, screening of industrially important microorganisms, primary and secondary screening. Methods of screening. Identification of the s elected organism. Methods of strain improvement –Mutation, Protoplast fusion and Genetic Engineering.

Ref:

1. Principles of Fermentation technology –Stanbury et al. Wiley publishers
2. Industrial Microbiology by Prescott

Module II

20Hrs

Medium designing in fermentation, Defined and undefined medium, carbon and Nitrogen sources .Precursors, inducers, inhibitors and antifoam agents .Effect of pH, temperature and salt concentration in fermentation. Optimization of the process of fermentation.

Ref:

1. Principles of Fermentation technology –Stanbury et al. Wiley publishers
2. Industrial Microbiology by Cassida

Module III

10Hrs

Bioreactor , typical bioreactor, parts of a bioreactor, Criteria for the designing of a bioreactor, types of bioreactors, Instrumentation of the bioreactor, Mode of culturing microorganisms -Batch, continuous, fed batch culture systems. Methods of downstream processing –centrifugation, filtration and chromatographic techniques.

Ref:

1. Biotechnology: The biological Principles. Trevan et al, Tata McGraw Hill Edn.

Module IV

40Hrs

Fermentative production of enzymes- amylase , protease, antibiotics -penicillin, organic acids- citric acid, amino acids, alcohol, Immobilization of microbial cells. Industrial application of enzymes.

Ref:

1. Principles of Fermentation technology –Stanbury et al. Wiley publishers
2. Industrial Microbiology by Cassida

Ref:

1. Principles of Fermentation technology –Stanbury et al. Wiley publishers
2. Industrial Microbiology by Cassida
3. Industrial Microbiology by Prescott
4. General Microbiology volume2 by Powar and Dhaginawala

5. Biotechnology: The biological Principles. Trevan et al, Tata McGraw Hill Edn.
6. Biotechnology- An introduction by Susan R Barnum, Thomsun.
7. Biotechnology: fundamentals and Applications- purohith and Mathur, Agrobotanical Publishers, India.

BT05BAC03
Core 18 - ANIMAL BIOTECHNOLOGY

Total hours of instruction: 90

Hours/ week: 5

Credit: 4

Module I

20Hrs

History of animal cell culture .Basic requirements of animal cell culture. Culture media – natural,synthetic and serum containing media.Role of hormones. Preparation and sterilization of media. Importance of growth factors of the serum.

Ref:

1. Animal cell culture (III edition) A practical approach. John R.W.Masters
2. Animal Biotechnology. R.Sasidhara.
3. Animal biotechnology Raja- Florence Periera. Dominant publishers New Delhi.2006(ISBN 81/7888/424/0)
4. Invitro cultivation of animal cells. Open University- Netherlands. New Delhi, Butter Worth-Heinemann, 1994(ISBN-81-8147-465-1)

Module II

30Hrs

Primary cell cultures - Anchorage dependent and non anchorage dependent cells
secondary cell cultures-. Transformed animal cells, Established/ continuous cell lines.

Characteristics of cells in culture. Maintenance of cell lines commonly used animal cell lines-their origin and characteristics.

Ref:

1. Animal cell culture (III edition) A practical approach. John R.W.Masters
2. Animal Biotechnology. R.Sasidhara.
3. Animal biotechnology Raja- Florence Periera. Dominant publishers New Delhi.2006(ISBN 81/7888/424/0)
4. Invitro cultivation of animal cells. Open University- Netherlands. New Delhi, Butter Worth-Heinemann, 1994(ISBN-81-8147-465-1)

Module III

20Hrs

Cell differentiation. Stem cells. Organ culture or 3D culture.Large scale culture of cell lines-monolayer culture, suspension culture and immobilized culture. Bioreactors for large scale culture of cells

Ref:

1. Animal cell culture (III edition) A practical approach. John R.W.Masters
2. Animal Biotechnology. R.Sasidhara.
3. Animal biotechnology Raja- Florence Periera. Dominant publishers New Delhi.2006(ISBN 81/7888/424/0)
4. Invitro cultivation of animal cells. Open University- Netherlands. New Delhi, Butter Worth-Heinemann, 1994(ISBN-81-8147-465-1)

Module IV

20Hrs

Application of animal cell culture-Production of monoclonal antibody, Production of vaccines .Production of specific metabolites. Transgenic animals-Transgenic mice, fish and cow. Knock –out and Knock in Technology.

Ref:

1. Animal cell culture (III edition) A practical approach. John R.W.Masters
2. Animal Biotechnology. R.Sasidhara.
3. Animal biotechnology Raja- Florence Periera. Dominant publishers New Delhi.2006(ISBN 81/7888/424/0)
4. Invitro cultivation of animal cells. Open University- Netherlands. New Delhi, Butter Worth-Heinemann, 1994(ISBN-81-8147-465-1)

Ref:

1. Animal cell culture (III edition) A practical approach. John R.W.Masters
2. Animal Biotechnology. R.Sasidhara.
3. Animal biotechnology Raja- Florence Periera. Dominant publishers New Delhi.2006(ISBN 81/7888/424/0)
4. Invitro cultivation of animal cells. Open University- Netherlands. New Delhi, Butter Worth-Heinemann, 1994(ISBN-81-8147-465-1)

BT05BAC04
Core 19- PRACTICAL- RECOMBINANT DNA TECHNOLOGY AND INDUSTRIAL BIOTECHNOLOGY

Total hours of instruction: 90

Hours/ week: 5

Credit: 4

1. Competent cell preparation
2. Transformation of the competent cell
3. Isolation of Plasmid

4. Separation of plasmid by agarose gel electrophoresis
5. Isolation of industrially important microorganism
6. Secondary screening of industrially important microorganism
7. Fermentative production of microbial metabolites-Submerged
8. Immobilization of bacteria for metabolite production.

OPEN COURSES (A/B/C)

A. TISSUE CULTURE TECHNIQUES

Total hours of instruction: 90

Hours/ week: 5

Credit: 4

Module I

10Hrs

Construction and basic requirements of both plant cell culture and animal cell culture laboratory

Ref:

1. Animal cell culture (III edition) A Practical approach John R.W. Masters.
2. Animal Biotechnology R. Sasidhara
3. Plant tissue culture S.S Bhojwani and M.K. Razdan.
4. Plant tissue culture S.P. Misra.
5. Plant cell and tissue culture. S. Narayanaswamy

Module II

35Hrs

Plant cell culture medium- Media preparation ,sterilization and standardization. Surface sterilization of explant. Factors effecting plant cell culture. Growth kinetics of plant cell culture. Callus culture, Cell suspension culture and single cell culture. Anther and pollen culture, ovary and ovule culture. Meristem culture, embryo culture and protoplast culture.

Ref:

1. Plant tissue culture S.S Bhojwani andM.K. Razdan.
2. Plant tissue culture S.P. Misra.
3. Plantcellandtissueculture. S. Narayanaswamy

Module III

30 Hrs

Animal cell culture medium-Media preparation and sterilization. Surface sterilization of primary explant. Factors effecting animal cell culture and growth kinetics of animal cell culture. Primary culture, established culture and single cell cloning. 3D culture.

Ref:

1. Animal cell culture (III edition) A Practical approach John R.W. Masters.
2. Animal Biotechnology R. Sasidhara.
3. Animal biotechnology Raja- Florence Periera. Dominant publishers New Delhi.2006 (ISBN 81/7888/424/0)
4. Invitro cultivation of animal cells. Open University- Netherlands. New Delhi, Butter Worth-Heinemann, 1994(ISBN-81-8147-465-1)

Module IV

15 Hrs

Animal cloning. Plant as bioreactors. Application of animal cell and plant cell culture.

Ref:

1. Animal Biotechnology R. Sasidhara.
2. Animal biotechnology Raja- Florence Periera. Dominant publishers New Delhi.2006 (ISBN 81/7888/424/0)
3. Plant biotechnology-Ignacimuthu, Oxford &IBH pub.
4. Plant tissue culture S.S Bhojwani andM.K. Razdan

Ref:

1. Animal cell culture (III edition) A Practical approach John R.W. Masters.
2. Animal Biotechnology R. Sasidhara.
3. Animal biotechnology Raja- Florence Periera. Dominant publishers New Delhi.2006 (ISBN 81/7888/424/0)
4. Invitro cultivation of animal cells. Open University- Netherlands. New Delhi, Butter Worth-Heinemann, 1994(ISBN-81-8147-465-1)
5. Plant tissue culture S.S Bhojwani andM.K. Razdan.
6. Plant tissue culture S.P. Misra.
7. Plant biotechnology-Ignacimuthu, Oxford &IBH pub.

B. BIOTECHNOLOGY FOR SUSTAINABLE DEVELOPMENT

Total hours of instruction: 90

Hours/ week: 5

Credit: 4

Module I

20Hrs

Natural raw materials, classification, physicochemical and biological analysis, exploitation of the natural waste materials through biotechnology, preparation of nutritive and cost effective substrates for industrial application, Socio economic aspects.

Ref:

1. Advanced Environmental biotechnology- S.K. Agarwal
2. Biotechnology: fundamentals and Applications- purohith and Mathur, Agrobotanical Publishers, India.

Module II

20Hrs

Chemical fertilizers- disadvantages. Biofertilizers- advantages , types. Nitrogen fixing organisms, Azospirillum, Azolla, Rhizobium, Lichens, Cyanobacterium. Mycorrhiza

Ref:

1. Biotechnology: fundamentals and Applications- purohith and Mathur, Agrobotanical Publishers, India.
2. Environmental biotechnology- R.A Sharma
3. Text Book of Biotechnology- R.C. Dubey

Module III

25 Hrs

Solid waste management- Composting, types, different stages in composting, types of composting- pile, windrow composting .microorganisms in composting, temperature profile in composting, advantages of composting, vermicomposting.

Ref:

1. Waste water Microbiology- Gabriel Bittan
2. Text Book of Biotechnology- R.C. Dubey
3. Essentials of Biotechnology-R.C.Sobi &Suparna S.Pachauri.Ane Books

Module IV

25 Hrs

Biopesticides, biofilters, biopolymers, biofuels, biosurfactants, mushroom cultivation, biotechnology in aqua culture- development of probiotics, diagnostic probes, extraction of marine natural products through biotechnology

Ref:

1. Biotechnology- An introduction by Susan R Barnum, Thomsun Publishers
2. Applied Zoology- Zoological Society of India

Ref:

1. Advanced Environmental biotechnology- S.K. Agarwal
2. Biotechnology- An introduction by Susan R Barnum, Thomsun Publishers.
3. Biotechnology: fundamentals and Applications- purohith and Mathur, Agrobotanical Publishers, India.
4. Waste water Microbiology- Gabriel Bittan
5. Applied Zoology- Zoological Society of India

6. Environmental biotechnology- R.A Sharma
7. Text Book of Biotechnology- R.C. Dubey
8. Essentials of Biotechnology-R.C.Sobi & Suparna S. Pachauri. Ane Books

C. IPR and Patents

Total hours of instruction: 90

Hours/ week: 5

Credit: 4

Module I

10 Hrs

General guidelines for DNA research, containment facilities and biosafety practices, special guidelines in India.

Ref:

1. Biotechnology- An introduction, Susan R.Barnum, Thomas Books\Code publishers,U.K.
2. Industrial Microbiology, Cassida,Iviely Eastern Publishers.
3. Modern concept of Biotechnology, H.D.Kumar, Vikas Publishing house Pvt.LTD.
4. Microbial Biotechnology-Principles and application, Lee Yuan Kun, World Scientific publishers.

Module II

30 Hrs

Forms of IPR like patent, design and copyright: Patents: different types of intellectual property, patent, Introduction to patent law and conditions for patentability; Procedure for obtaining patents; Rights of a patentee; Patent infringements; Biotechnology patents and patents on computer programs; Patents from an international perspective.

Ref:

1. Biotechnology- An introduction, Susan R.Barnum, Thomas Books\Code publishers,U.K.
2. Industrial Microbiology, Cassida,Iviely Eastern Publishers.
3. Modern concept of Biotechnology, H.D.Kumar, Vikas Publishing house Pvt.LTD.
4. Microbial Biotechnology-Principles and application, Lee Yuan Kun, World Scientific publishers.

Module III

20 Hrs

Copyright: Registration procedure and copyright authorities; Assignment and transfer of copyright Copyright infringement and exceptions to infringement; Software copyright

Ref:

1. Biotechnology- An introduction, Susan R.Barnum, Thomas Books\Code publishers,U.K.
2. Industrial Microbiology, Cassida,Iviely Eastern Publishers.
3. Modern concept of Biotechnology, H.D.Kumar, Vikas Publishing house Pvt.LTD.
4. Microbial Biotechnology-Principles and application, Lee Yuan Kun, World Scientific publishers.

Module IV

30 Hrs

IPR laws: Rights/protection, infringement or violation, remedies against infringement: civil and criminal; Indian Patent Act 1970 and TRIPS; Major changes in Indian Patent system as post TRIPS effects; Contents of patent specification and the procedure for patents; (a) Obtaining patents; (b) Geographical indication; (c) WTO; Detailed information on patenting biological products; Plant breeders' and farmer's rights; Biodiversity; Budapest treaty; Appropriate case studies. 20L

Ref:

1. Biotechnology- An introduction, Susan R.Barnum, Thomas Books\Code publishers,U.K.
2. Industrial Microbiology, Cassida,Iviely Eastern Publishers.
3. Modern concept of Biotechnology, H.D.Kumar, Vikas Publishing house Pvt.LTD.
4. Microbial Biotechnology-Principles and application, Lee Yuan Kun, World Scientific publishers.

Ref:

- 1 .Biotechnology- An introduction, Susan R.Barnum, Thomas Books\Code publishers,U.K.
2. Industrial Microbiology, Cassida,Iviely Eastern Publishers.
3. Modern concept of Biotechnology, H.D.Kumar, Vikas Publishing house Pvt.LTD.
4. Microbial Biotechnology-Principles and application, Lee Yuan Kun, World Scientific publishers.

SEMESTER 6

Core 20- ^{BTO6BAC01} PLANT BIOTECHNOLOGY

Total hours of instruction: 90

Hours/ week: 5

Credit: 4

Module I

20Hrs

Plant tissue culture- a historical approach. Tissue culture media. Media preparation. Role of growth hormones. Totipotency and cyto-differaniation.

Ref:

1. Plant tissue culture S.S Bhojwani and M.K. Razdan.
2. Plant tissue culture S.P. Misra.
3. Plant Breeding B.D. Singh.
4. Plant cell and tissue culture S. Narayanaswamy

Module II

30 Hrs

Types of culture-Callus culture, Suspension culture and single cell culture. Somaclonal variation. Organogenesis and Embryogenesis. Artificial seeds, Meristem culture. Haploid production-ovary, ovule, anther and pollen culture

Ref:.

1. Plant tissue culture S. S. Bhojwani and M.K. Razdan.
2. Plant tissue culture S.P. Misra.
3. Plant Breeding B.D. Singh.
4. Plant cell and tissue culture S. Narayanaswamy

Module III

20 Hrs

Plant protoplast –isolation, culture and somatic hybridization. Cybrids and hybrids. Gene transfer techniques in plants

Ref:

1. Plant tissue culture S.S Bhojwani and M.K. Razdan.
2. Plant tissue culture S.P. Misra.
3. Plant Breeding B.D. Singh.
4. Plant cell and tissue culture S. Narayanaswamy

Module IV

20 Hrs

Uses of plant cell culture. Protoplast and tissue culture for genetic manipulation of plants. Role of *Agrobacterium* in gene transfer. Maintenance and storage of plant cell. Germplasm conservation and gene bank.

Ref:

1. Plant tissue culture S.S Bhojwani and M.K. Razdan.
2. Plant tissue culture S.P. Misra.
3. Plant Breeding B.D. Singh.
4. Plant cell and tissue culture S. Narayanaswamy
5. Plant biotechnology-Ignacimuthu, Oxford & IBH pub.

Ref:

1. Plant tissue culture S.S Bhojwani and M.K. Razdan.
2. Plant tissue culture S.P. Misra.
3. Plant Breeding B.D. Singh.
4. Plant cell and tissue culture S. Narayanaswamy
5. Invitro cultivation of plant cells. Elsvier (BIOTOL)
6. Plant biotechnology-Ignacimuthu, Oxford & IBH pub.

BTO6BAC02
Core 21-~~000000~~ ENVIRONMENTAL BIOTECHNOLOGY

Total hours of instruction: 90

Hours/ week: 5

Credit: 4

Module I

20Hrs

Environmental pollution- air, water and soil pollution. Green house effect, Heavy metal pollution, industrial pollution, ozone layer depletion, depletion of natural resources, Pesticide pollution, Environmental laws, Food adulteration

Ref:

1. Environmental Chemistry. Anil Kumar. De Wiley Eastern Ltd. New Delhi
2. Environmental Science: Earth as living planet- Daniel B Bottein & Edward.A. Keller, John Wiley Sons.

Module II

10Hrs

Characteristics of waste water –COD, BOD, TOC, Suspended solids, Total dissolved solids, chlorides, acidity, alkalinity. Bacteriological analysis of drinking water, presumptive, completed and confirmed tests, Coagulation, Disinfection by chlorination

Ref:

1. Microbial ecology: Fundamentals and Applications- Atlas and Bartha, Pearson Education

Module III

30Hrs

Treatment of waste water, primary, secondary and tertiary treatment. Biological treatment of waste water- aerobic methods, floc and film based processes Activated sludge process,

Trickling filter process. Aerobic pond. Anaerobic process- Methanogenesis, Single and double stage reactors. Solid waste management- anaerobic treatment and land filling.

Ref:

1. Microbial ecology: Fundamentals and Applications- Atlas and Bartha, Pearson Education

Module IV

30Hrs

Biodegradation of organic compounds. Types of reactions in biodegradation, enzymes involved in biodegradation, Biodegradation of hydrocarbons, cellulose and lignin. Molecular biology of biodegradation, catabolic plasmids.

Ref:

1. Biocatalysts and biodegradation- Lawrence P Wackett and Douglas Hershberger. ASM Press, Washington

Ref:

1. Environmental Chemistry. Anil Kumar. De Wiley Eastern Ltd. New Delhi
2. Microbial ecology: Fundamentals and Applications- Atlas and Bartha, Pearson Education
3. Biocatalysts and biodegradation- Lawrence P Wackett and Douglas Hershberger. ASM Press, Washington
4. Environmental Science: Earth as living planet- Daniel B Bottein & Edward.A. Keller, John Wiley Sons.
5. Biotechnology- The Science and Business- V. Mopses and R.E. Capes

BIO6BBC03
Core 22- ~~BIO6BBC03~~ CHOICE BASED COURSES (A/B/C)

A. BIOINFORMATICS

Total hours of instruction: 90

Hours/ week: 5

Credit: 4

Module I

15 Hrs

Introduction to bioinformatics- definition, history, significance and applications, careers in bioinformatics , genomics, transcriptomics, proteomics

Ref:

1. Beginning Perl for Bioinformatics-James D.Tisdall;Paperback.
2. Bioinformatics :Sequence and Genime Analysis;David W Mount.
3. Bioinformatics and Molecular Evaluation;Paul G Higgs and Teresa K.Attwood, Blackwell Publishers

Module II

30 Hrs

Collection and storage of database, Submission of sequences, biological databases , NCBI, EBTL, DDBJ, Genbank, PDB, Swissprot, WIT' sequence format, FASTA/Pearson and EBTL.

Ref:

1. Beginning Perl for Bioinformatics-James D.Tisdall;Paperback.
2. Bioinformatics :Sequence and Genime Analysis;David W Mount.
3. Bioinformatics and Molecular Evaluation;Paul G Higgs and Teresa K.Attwood, BlackwellPublishers

4. Algorithms in Bioinformatics-Benson ;Anne books

Module III

30 Hrs

Alignment of pairs and sequences: definition of sequence alignment- global alignment, local alignment, alignment of sequence pairs- dot matrix analysis, FASTA and BLAST, multiple sequence alignment CLUSTALW

Ref:

1. Beginning Perl for Bioinformatics-James D.Tisdall;Paperback.
2. Bioinformatics :Sequence and Genome Analysis;David W Mount.
3. Bioinformatics and Molecular Evolution;Paul G Higgs and Teresa K.Attwood, BlackwellPublishers
4. Algorithms in Bioinformatics-Benson ;Anne books

Module IV

15 Hrs

Computational biology, Rasmol, phylogenetic analysis, homology modeling, structure prediction.

Ref:

1. Beginning Perl for Bioinformatics-James D.Tisdall;Paperback.
2. Bioinformatics: Sequence and Genome Analysis;David W Mount.
3. Bioinformatics and Molecular Evolution;Paul G Higgs and Teresa K.Attwood, BlackwellPublishers
4. Algorithms in Bioinformatics-Benson ;Anne books

Ref:

1. Beginning Perl for Bioinformatics-James D.Tisdall;Paperback.
2. Bioinformatics :Sequence and Genime Analysis;David W Mount.
3. Bioinformatics and Molecular Evaluation;Paul G Higgs and Teresa K.Attwood, BlackwellPublishers
4. Algorithms in Bioinformatics-Benson ;Anne books
5. Developing Bioinformatics Computer Skills-Cynthia Gibas, Per Jambeck.

B. NANOTECHNOLOGY

Total hours of instruction: 90

hours/ week: 5

Credit :4

Module I

20Hrs

Nanotechnology-definition, advantages, applications, material science, nanomedicine, emerging trends, scope, research potential, Nanotechnology in India.

Ref:

1. B.D.Ratner,A.S.Hoffman, F.J.Schoen and J.E.Lemons.Biomaterial Science.An Introduction to materials. Elsevier 2004.
2. C.Br'echignas,P.Hoody and M.Lemani. Nanomaterials and nanochemistry. Springer,Verlag.2007.
3. David J.Lockwood.Nanotechnology in Catalysis. Volume 3, Springer Science, 2007.

4. A.S. Eddstein and R.C.Cammarate.Nanomaterials-Synthesis,Properties and applications.Institute of Physics U.K.1998

5. Introduction to Nanotechnology.Johnwileg &son 2008.

Module II

30Hrs

Nanomaterials, types ,examples, nanoemulsions, poly amino acid micelles, dendrimers, albumin designing of nanomaterials , selection of nanomaterials, physicochemical and biological properties, interaction of the drug with nanomaterials

Ref:

1. B.D.Ratner,A.S.Hoffman, F.J.Schoen and J.E.Lemons.Biomatrial Science.An Introduction to materials. Elseviar 2004.

2. C.Br'echignas,P.Hoody and M.Lemani. Nanomaterials and nanochemistry. Springer,Verlag.2007.

3. David J.Lockwood.Nanotechnology in Catalysis. Volume 3, Springer Science, 2007.

4. A.S.Eddstein and R.C.Cammarate.Nanomaterials-Synthesis,Properties and applications.Institute of Physics U.K.1998

5. Introduction to Nanotechnology.Johnwileg &son 2008.

Module III

20Hrs

Drug delivery- principle, receptor mediated endocytosis, delivering systems, method of targeting, labeling of the carrier, mechanism and site of drug action, Blood brain barrier

Ref:

1. B.D.Ratner,A.S.Hoffman, F.J.Schoen and J.E.Lemons.Biomatrial Science.An Introduction to materials. Elseviar 2004.

2. C.Br'echignas,P.Hoody and M.Lemani. Nanomaterials and nanochemistry. Springer,Verlag,2007.
3. David J.Lockwood.Nanotechnology in Catalysis. Volume 3, Springer Science, 2007.
4. A.S.Eddstein and R.C.Cammarate.Nanomaterials-Synthesis,Properties and applications.Institute of Physics U.K.1998
5. Introduction to Nanotechnology.Johnwileg &son 2008.

Module IV

20Hrs

Targeted diseases, cancer, respiratory disorders, cardiovascular problems, diabetics, AIDS. Enhanced permeability and retention effect, applications of short interfering RNA

Ref:

1. B.D.Ratner,A.S.Hoffman, F.J.Schoen and J.E.Lemons.Biomaterial Science.An Introduction to materials. Elsevier 2004.
2. C.Br'echignas,P.Hoody and M.Lemani. Nanomaterials and nanochemistry. Springer,Verlag,2007.
3. David J.Lockwood.Nanotechnology in Catalysis. Volume 3, Springer Science, 2007.
4. A.S.Eddstein and R.C.Cammarate.Nanomaterials-Synthesis,Properties and applications.Institute of Physics U.K.1998
5. Introduction to Nanotechnology.Johnwileg &son 2008.

Ref:

1. Jackson MJ (2006). Microfabrication and nanomanufacturing. Taylor and Francis; Boca Raton.

2. Costantino L, Gandolfi F, Tosi G, Rivasi F, Vandelli MA, Forni F (2005). Peptide- derivatized biodegradable nanoparticles able to cross the blood brain barrier. *J Control Release*, 1981; 84-96.
3. Michaelis K, Hoffmann MM, Dries S, Herbert E, Alyautdin RN, Michaelis M, Kreuter J, Langer K (2006). Covalent linkage of apolipoprotein e to albumin nanoparticles strongly enhances drug transport into the brain. *J Pharmacol Exp Ther*, 317,3 1246-1253
4. Zhang D, Tan T, Gao L, Zhao W, Wang .P.(2007). Preparation of azithromycin nanosuspensions by high pressure homogenization and its physicochemical characteristic studies. *Drug Dev Ind Pharm*, 33, 5: 569-575 .
5. NanoScience and nanotechnology- V.S. Muralidharan and A. Subramania. Anne Book Pvt. Ltd, New Delhi.

C. DISEASES AND DIAGNOSTIC BIOTECHNOLOGY

Total hours of instruction: 90

Hours/ week: 5

Credit: 4

Module I

20Hrs

Molecular genetics of Genetic Disorders- Hemoglobinopathies- Sickle cell anemia, Beta Thalassemia. Muscular disorders- Duchenne's Muscular dystrophy. Triplet disorders- Fragile X syndrome, Huntington's disease, Myotonic dystrophy. Genetic disorders- cystic fibrosis, Alzheimer's disease. Chromosomal disorders- autosomal, sex chromosomal.

Ref :

1. Genes in Medicine Molecular biology and human genetic disorders. Rasko, I., Downes. C.S. Springer Publication.

2. Genes and Disease by Bathesda.NCBI.www.ncbi.nlm.nih.gov/books.

3. Essential Medical Genetics, 5th Edition.Michael Connor, M. Ferguson Smith.Wiley Publication.

Module II

20Hrs

DNA diagnostics of genetic and Chromosomal disorders. Identifying disease genes-position independent strategies, positional cloning.PCR based diagnostics. Ligation chain reaction. Southern blot diagnostics. Array based. genetic profiling. single nucleotide polymorphism. Karyotyping analysis,G-banding, FISH and on-FISH. Comparative genomic hybridization (CGH).

Ref:

1. Forensic DNA typing 2nd Edn by John M Butler. Academic Press

2. Human Molecular Genetics 2.Tom Strachen and Andrew P read. Garland Publishers

Module III

20Hrs

DNA typing- Specimen collection, acquisition processing and analysis. Paternity. Ancestry- Mitochondrial. Forensic Science-Standard STR testing, Y-STR testing, Mitochondrial sequencing, SNP testing.

Ref:

1. Genetics. A Molecular approach.2nd Edn. Peter J Russel.

2. Molecular diagnostics for the clinical laboratarian by William B Coleman and Gregory J Tsongalis.Humana Press Publishers.

Module IV

30Hrs

Cancer diagnostics- Special karyotyping, Molecular testing of BRCA1 and BRCA 2.Tumor markers. Viral disease diagnostics-HIV, Avian Flu, Chikungunya, Swine fever- RT-PCR, ELISA, F-Ab testing, Immunoarrays, Electron microscopy.

Ref:

1. Cancer Diagnostics with DNA microarrays. Steen Knudsen. Wiley Publication
2. Current Medical diagnostics and treatment. Stephen J McPhee and Maxine A Papadakis. McGraw Hill Lange Publishers
3. Emerging infectious diseases By Felissa R. Lashley, Jerry D. Durham. Springer Publishing Company.
4. Infectious disease epidemiology by Nelson. Jones and Bartlett Publishers, Inc.

BT06BAC03

**Core 23-~~BT06BAC03~~ PRACTICAL- ENVIRONMENTAL BIOTECHNOLOGY AND
PLANT BIOTECHNOLOGY**

Total hours of instruction: 90

Hours/ week: 5

Credit: 4

1. Enumeration of Total number of heterotrophic bacterial population in water samples
2. Bacteriological analysis of drinking water- Presumptive, completed and confirmed tests
3. Estimation of alkalinity
4. Estimation of acidity
5. Estimation of total solids, suspended and dissolved solids
6. Estimation of Chemical oxygen demand
7. Estimation of Biological oxygen demand
8. Preparation of medium for plant tissue culture
9. Surface sterilization of explants

10. Inoculation and callus initiation of plant tissue culture

11. Hardening of the tissue cultured plant

12. Meristem culture

Ref:

1. Experiments in Microbiology, Plant Pathology, Tissue culture and Mushroom Cultivation. K.R. Aneja; Wishwa Prakashan, New delhi.
2. Biotechnology Fundamentals and application. Purohit and Mathur, Agro botanical Publishers, New Delhi.
3. Practical Skill in Biomolecular Sciences. Rob Reed, David Holmes, Jonathan Weyers, Allan Jones. Logman publishers, U.K.
4. Microbiological Applications –A Laboratory Manual in General Microbiology. Harold. J. Benson, WCB publishers.
5. Plant, Cell, Tissue and Organ Culture Fundamental Methods. Gamborg and Phillips, Narosa Publishers.

BT06BFC01

Core 25 Project and Viva Voce

COMPLEMENTARY COURSES OFFERED BY THE DEPARTMENT

1. BT1CO1U COMPLEMENTARY COURSE 1

(Fundamentals of Biotechnology)

2. BT1CO2U PRACTICAL- BIOTECHNOLOGY 1

3. BT2CO3U COMPLEMENTARY COURSE 2

(Molecular Biology and Recombinant DNA technology)

4. BT2CO4U PRACTICAL - BIOTECHNOLOGY 2

5. BT3CO5U COMPLEMENTARY COURSE 3

(Plant and Animal Biotechnology)

6. BT3CO6U PRACTICAL - BIOTECHNOLOGY 3

7. BT4CO7U COMPLEMENTARY COURSE 4

(Industrial and Environmental Biotechnology)

8. BT4CO8U PRACTICAL - BIOTECHNOLOGY 4

BT1CO1U COMPLEMENTARY COURSE 1

(Fundamentals of Biotechnology)

Total hours of instruction: 36

Hours/ week: 2

Credit: 2

Module I

2hrs

Biotechnology-definition, scope, advantages, multidisciplinary nature, trends, Scope of research, Milestones in the development of Biotechnology

Ref:

1. Biotechnology-The biological Principles –Trevan M D, Boffey.S, GouldingK.H and P.Stanburry, TataMcGraw Hill

Module II

15hrs

Cell membrane, endoplasmic reticulum, cell organelles- nucleus, mitochondria, chloroplast, lysosomes, golgi complex, cytoskeleton

Ref:

1. The world of the Cell- Becker, Reece,Poeni-

2.Cell and Molecular Biology .Gerald Carp

Module III

10hrs

The birth of genetics, symbols and terminology, mendel's experiments, principle of segregation, monohybrid cross, principle of independent assortment, dihybrid ratio, dominance, recessiveness, codominance, semidominance,lethal, multiple alleles, ABO blood typing ,gene interactions-epistasis, pleiotropy, polygenic inheritance.

Ref:

1.Principles of Genetics- A.G.Gardner, John Wiley and Sons pub.

2.Genetics. A Molecular approach.2nd Edn. Peter J Russel

Module IV

9hrs

Linkage, crossing over- mechanism-holliday model , recombination mapping of genes- two factor cross, sex linked inheritance. Chromosome- size, shape, structure and types of chromosomes, chromosome banding, giant chromosomes, variation in chromosome number, euploidy, aneuploidy, polyploidy, extrachromosomal inheritance- mitochondria and chloroplast.

Ref:

- 1.Principles of Genetics- A.G.Gardner, John Wiley and Sons pub.
- 2.Genetics. A Molecular approach.2nd Edn. Peter J Russel

BT1CO2U PRACTICAL- BIOTECHNOLOGY 1

Total hours of instruction: 36

Hours/ week: 2

Credit: 1

1. Cell counting methods
 - a) Haemocytometer : WBC, RBC
 - b) Differential counting using Leishmans
 - c) Blood grouping
2. Cell fractionation
 - a) Homogenization of tissue
 - b) Organelle specific marker for mitochondria, chloroplast.
3. Problems in mendelian law, crossing over and linkage

Ref:

1. Allyn Bregman, 1996. Laboratory investigation in cell and molecular biology.
John Wiley & sons.
2. A Text book of Practical Physiology - CL Ghai, Jaypee Brothers Publishers (P) LTD
New Delhi.

3. Medical Laboratory Technology. Procedure Manual for Routine Diagnostic Tests - Volume I, Kanai L Mukherjee; Tata Mc Graw-Hill publishing Company.Ltd New Delhi

BT2CO3U COMPLEMENTARY COURSE 2

(Molecular Biology and Recombinant DNA technology)

Total hours of instruction: 36

Hours/ week: 2

Credit: 2

Module I

8Hrs

Central dogma, Identification of genetic material-Griffith, Avery, Chargaff's, Harshey Chase expt. Watson and Crick model of DNA. Structure of DNA and RNA. Physico- Chemical properties of DNA. RNA as genetic material. Packaging of DNA in eukaryotes- Histones, Nucleosomes, concept of gene- exon,intron.

Ref:

Molecular biology of the gene.Watson, Baker, Gann, Bell, Levine, Losick. Pearson education.

Module II

10 Hrs

DNA Replication-Meselson and Stall Experiment. Structure and functions of enzymes and protein involved in Replication. Replication in *E.coli*. Mutation-types, addition, deletion, transition, transversion, missence, nonsense. Repair-Direct reversal, Base excision and Nucleotide excision repair.

Ref:

Genetics. A Molecular approach.2nd Edn. Peter J Russel.

Module III

8 Hrs

Transcription in prokaryotes-Initiation, Elongation and termination. Genetic Code-features, codon anticodon pairing, Wobble hypothesis. Translation in prokaryotes-Role of

RNAs, Initiation, Elongation and termination. Regulation of Gene expression-Regulatory protein, Operon concept, positive and negative regulation. Molecular details of Lac operon.

Ref:

Molecular Cell Biology.6 Edn. Lodish. Pearson publication

Module IV

10 Hrs

Basics of recombinant DNA technology, restriction enzymes, steps in rDNA technology, vectors, types, Ligation, C DNA preparation. cDNA cloning, Gene transfer methods- CaCl_2 mediated, Electroporation, Microinjection,. Genomic library. Selection of recombinants-Insertional inactivation, Blue-white assay and Southern blotting.PCR, RFLP, RAPD techniques.

Ref:

1. Molecular biology of the gene. Watson, Baker, Gann, Bell, Levine, Losick. Pearson education.
2. Genetics. A Molecular approach.2nd Edn. Peter J Russel.
3. Molecular Cell Biology.6 Edn.Lodish. Pearson publication.
4. Genes VIII.B Lewin. Pearson publication.
5. Cell and Molecular Biology .Gerald Carp
6. Cell -a Molecular approach-Geoffrey M. Cooper Robert E. Hoausman Publisher.

BT2CO4U PRACTICAL-BIOTECHNOLOGY 2

Total hours of instruction: 36

Hours/ week: 2

Credit : 1

1. DNA isolation
2. Separation of DNA by agarose gel electrophoresis
3. Estimation of DNA
4. Competent cell preparation
5. Transformation of the competent cell

Reference:

1. Molecular Cloning: A Laboratory Manual 3rd ed. Sambrook K.J.; Fritsch E.F.; Maniatis T. CHLS N.Y.

. Practical Biochemistry 4th ed . Keith Wilson and John Walker.

BT3CO5U COMPLEMENTARY COURSE 3

(Plant and Animal Biotechnology)

Total hours of instruction: 36

Hours/ week: 2

Credit: 2

Module I

5Hrs

Plant tissue culture- a historical approach. Tissue culture media. Media preparation. Role of growth hormones. Totipotency and cyto-differentiation.

Ref:

1. Plant tissue culture S.S Bhojwani and M.K. Razdan.
2. Plant tissue culture S.P. Misra.
3. Plant cell and tissue culture S. Narayanaswamy

Module II

13 Hrs

Types of culture-Callus culture, Suspension culture and single cell culture. Somaclonal variation. Organogenesis and Embryogenesis. Meristem culture. Haploid production- ovary, ovule, anther and pollen culture. Application of Plant cell culture.

Ref:

1. Plant tissue culture S.S Bhojwani and M.K. Razdan.
2. Plant tissue culture S.P. Misra.
3. Plant cell and tissue culture S. Narayanaswamy
4. Plant Breeding B.D.Singh.

Module III

5 Hrs

History of animal cell culture .Basic requirements of animal cell culture. Culture media – types and preparation. Importance of growth factors of the serum.

Ref:

1. Animal cell culture (IIIrd edition) A practical approach. John R.W.Masters
2. Animal Biotechnology. R.Sasidhara.
3. Animal biotechnology Raja- Florence Periera. Dominant publishers New Delhi.2006(ISBN 81/7888/424/0)
4. Invitro cultivation of animal cells. Open University- Netherlands. New Delhi, Butter Worth-Heinemann, 1994(ISBN-81-8147-465-1)

Module IV

13 Hrs

Primary cell cultures - Anchorage dependent and non anchorage dependent cells secondary cell cultures-. Transformed animal cells, Established/continuous cell lines. Commonly used animal cell lines-their origin and characteristics. Application of Animal cell culture-vaccine production and secondary metabolites.

Ref:

1. Animal cell culture (111rd edition) A practical approach. John R.W.Masters
2. Animal Biotechnology. R.Sasidhara.
3. Animal biotechnology Raja- Florence Periera. Dominant publishers New Delhi.2006 (ISBN 81/7888/424/0)
4. Invitro cultivation of animal cells. Open University- Netherlands. New Delhi, Butter Worth-Heinemann, 1994(ISBN-81-8147-465-1)

Ref:

1. Plant tissue culture S.S Bhojwani andM.K. Razdan.
2. Plant tissue culture S.P. Misra.
3. Plant cell and tissue culture S. Narayanaswamy
4. Plant Breeding B.D.Singh. 1. Animal cell culture (111rd edition) A practical approach. John R.W.Masters
5. Animal Biotechnology. R.Sasidhara.
6. Animal biotechnology Raja- Florence Periera. Dominant publishers New Delhi. 2006(ISBN 81/7888/424/0)
7. Invitro cultivation of animal cells. Open University- Netherlands. New Delhi, Butter Worth-Heinemann, 1994(ISBN-81-8147-465-1)

BT3CO6U PRACTICAL - BIOTECHNOLOGY 3

Total hours of instruction: 36

Hours/ week: 2

Credit: 1

1. Preparation of medium for plant tissue culture
2. Surface sterilization of various explants
3. Inoculation and callus initiation of plant tissue culture
4. Rooting and Shoot development through tissue culture
4. Hardening of the tissue cultured plant
5. Micrometry-Calibration using ocular micrometer and finding out average cell size.
6. Squash preparation of Onion root tip and study of Mitotic stages.

Ref:

1. Experiments in Microbiology, Plant Pathology, Tissue culture and Mushroom Cultivation. K.R. Aneja; Wishwa Prakashan, New delhi.
2. Plant, Cell, Tissue and Organ Culture Fundamental Methods. Gamborg and Phillips, Narosa Publishers.
3. Plant Biotechnology-S.Ignacimuthu,Oxford&IBH Pub.
4. Basic agricultural Biotechnology-Purohit,Kothari and Mathur, AgrobotanicalPub.
5. Alltyn Bergman, 996. Laboratory investigation in cell and molecularbiology,John Wiley & Sons.

BT4CO7U COMPLEMENTARY COURSE 4

(Industrial and Environmental Biotechnology)

Total hours of instruction: 36

Hours/ week: 2

Credit: 2

Module I

12

hours

Advantages of bioprocess over chemical process, Fermentation -definition, types- submerged and solid state, applications of fermentation .Industrially important microbial metabolites. Isolation, screening of industrially important microorganisms. Primary and secondary screening. Methods of screening. Identification of the s elected organism. Methods of strain improvement –Mutation, Protoplast fusion and Genetic Engineering.

Ref:

- 1.Principles of Fermentation technology –Stanbury et al. Wiley publishers
2. Principles of Fermentation Technology-Peter Stanburn, Allan Whitaker, Stephen J. Hall. Pergaman Publishers.
3. Industrial Microbiology Cassida, Wiley. Eastern Publishers.

Module II**8 hours**

Medium designing in fermentation. Defined and undefined medium, carbon and Nitrogen sources. Precursors, inducers, inhibitors and antifoam agents, Bioreactor, typical bioreactor, parts of a bioreactor, types of bioreactors, Methods of downstream processing –centrifugation, filtration and chromatographic techniques.

Ref:

1. Principles of Fermentation technology –Stanbury et al. Wiley publishers
2. Industrial Microbiology by Cassida

Module III**8 hours**

Characteristics of waste water –COD, BOD, TOC, Suspended solids, Total dissolved solids, chlorides, acidity, alkalinity. Bacteriological analysis of drinking water, presumptive, completed and confirmed tests, Coagulation, Disinfection by chlorination

Ref:

1. Environmental Chemistry- Anilkumar DE. Wiley International Publications.
2. Microbial Ecology- Atlas and Bartha. Perason Publishers

Module IV**8 hours**

Treatment of waste water, primary, secondary and tertiary treatment. Biological treatment of waste water- aerobic methods, floc and film based processes. Anaerobic process- Methanogenesis, Single and double stage reactors. Composting.

Ref:

1. Microbial Ecology- Atlas and Bartha. Perason Publishers
2. Principles of Fermentation Technology, Stanbury.

Ref:

1. Principles of Fermentation technology –Stanbury et al. Wiley publishers
2. Principles of Fermentation Technology-Peter Stanburn, Allan Whitaker, Stephen J. Hall. Pergaman Publishers.
3. Industrial Microbiology by Cassida
4. Environmental Chemistry- Anilkumar DE. Wiley International Publications.
5. Microbial Ecology- Atlas and Bartha. Perason Publishers

BT4CO8U PRACTICAL - BIOTECHNOLOGY 4

Total hours of instruction: 36

Hours/ week: 2

Credit: 1

1. Enumeration of total number of heterotrophic bacterial population in the soil sample.
2. Primary screening of α -amylase producing strain from soil.
3. Secondary screening of α -amylase producing strain.
4. Estimation of α -amylase by starch iodine method and DNS method.
5. Bacteriological analysis of drinking water. Presumptive test by MPN method.
6. Estimation of Chemical Oxygen demand.
7. Estimation of Biological oxygen demand.

Ref:

1. Methods in Biotechnology, Hans Peter Schmander, Taylor and Francis
2. Experiments in Microbiology, Patient Pathology, Tissue culture and Mushroom Cultivation.
3. Aneja K. R. Wishwa Prakashan Publishers, New Delhi.