

ALAGAPPA UNIVERSITY, KARAIKUDI
NEW SYLLABUS UNDER CBCS PATTERN (w.e.f. 2017-18)

B.Sc., BIOTECHNOLOGY – PROGRAMME STRUCTURE

Sem.	Part	Course code	Title of the Course	Cr.	Hrs./ Week	Marks		Total	
						Int.	Ext.		
I	I	711T	Tamil/Other languages – I	3	6	25	75	100	
	II	712E	English – I	3	6	25	75	100	
	III	7BBT1C1	Core – I – Biochemistry	4	6	25	75	100	
		7BBT1P1	Core – II – Practical – I – Lab in Biochemistry	4	6	40	60	100	
			Allied – I (Theory only) (or) Allied – I (Theory cum Practical)	5 4	5 3	25 15	75 60	100 75	
			Allied Practical-I	-	2**	-	-	-	
	IV	7NME1A/ 7NME1B/ 7NME1C	(1) Non-Major Elective – I – (A) jkpo; nkhopad; mbg; gilfs; / (B) ,f; fhy ,yf; fpak; / (C) Communicative English	2	1	25	75	100	
	Total(Allied -Theory only)				21	30	--	--	600
	Total(Allied -Theory cum Practical)				20		--	--	575
	II	I	721T	Tamil/Other languages – II	3	6	25	75	100
II		722E	English – II	3	6	25	75	100	
III		7BBT2C1	Core – III – Microbiology	4	6	25	75	100	
		7BBT2P1	Core – IV – Practical – II – Lab in Microbiology	4	5	40	60	100	
			Allied – II (Theory only) (or) Allied – II(Theory cum Practical)	5 4	5 3	25 15	75 60	100 75	
			Allied Practical-I	2	2	20	30	50	
IV		7BES2	(3) Environmental Studies	2	2	25	75	100	
Total(Allied -Theory only)				21	30	--	--	600	
Total(Allied -Theory cum Practical)				22		--	--	625	
III	I	731T	Tamil/Other languages – III	3	6	25	75	100	
	II	732E	English – III	3	6	25	75	100	
	III	7BBT3C1	Core – V – Cell & Molecular Biology	4	5	25	75	100	
		7BBT3P1	Core – VI – Practical – III – Lab in Cell & Molecular Biology	4	5	40	60	100	
			Allied – III (Theory only) (or) Allied–III(Theory cum Practical)	5 4	5 3	25 15	75 60	100 75	
			Allied Practical-II	-	2	-	-	-	
	IV	7NME3A/ 7NME3B/ 7NME3C	(1) Non-major Elective – II – (a) ,yf; fpaKk; nkhopg; gad; ghLk; / (b) goe; jkpo; ,yf; fpaq; fSk; ,yf; fpa tuyhWk; / (c) Effective Employability Skills	2	1	25	75	100	
		7SBS3A1/ 7SBS3A2/ 7SBS3A3	(2) Skill Based Subjects – I	2	2	25	75	100	
	V	7BEA3	Extension Activities	1	--	100	--	100	
	Total(Allied -Theory only)				24	30	--	--	800

			Total(Allied -Theory cum Practical)	23				775
IV	I	741T	Tamil/Other languages – IV	3	6	25	75	100
	II	742E	English – IV	3	6	25	75	100
	III	7BBT4C1	Core – VII – Principles of Genetics	4	5	25	75	100
		7BBT4P1	Core – VIII – Practical – IV – Lab in Genetics	4	4	40	60	100
			Allied – IV (Theory only) (or) Allied– IV(Theory cum Practical)	5 4	5 3	25 15	75 60	100 75
			Allied Practical-II	2	2	20	30	50
	IV	7SBS4B1/ 7SBS4B2 7SBS4B3	(2) Skill Based Subjects – II	2	2	25	75	100
		7BVE4/ 7BMY4/ 7BWS4	(4) Value Education / Manavalakalai Yoga / Women’s Studies	2	2	25	75	100
			Total(Allied -Theory only)	23	30	--	--	700
			Total(Allied -Theory cum Practical)	24				725
V	III	7BBT5C1	Core– IX – Principles of Immunology	4	5	25	75	100
		7BBT5P1	Core–X–Practical–V–Lab in Immunotechnology	4	6	40	60	100
		7BBT5C2	Core – XI – Microbial Biotechnology	4	5	25	75	100
		7BBTE1A/ 7BBTE1B	Elective – I - A) Biostatistics (or) B) Biophysics	5	5	25	75	100
		7BBTE2A/ 7BBTE2B	Elective–II- A) Biodiversity (or) B) Ecology and Evolution	5	5	25	75	100
	IV	7SBS5A4/ 7SBS5A5/ 7SBS5A6/ 7SBS5A7	(2) Skill Based Subjects – I	2	2	25	75	100
			(2) Skill Based Subjects – I	2	2	25	75	100
				Total	26	30	--	--
VI	III	7BBT6C1	Core – XII – Recombinant DNA Technology	4	5	25	75	100
		7BBT6P1	Core – XIII – Practical VI– Lab in Genetic Engineering.	4	6	40	60	100
		7BBT6C2	Core – XIV – Plant and Animal biotechnology	4	5	25	75	100
		7BBT6PR	Core-XV- Project in Biotechnology	4	5	100	-	100
	7BBTE3A/ 7BBTE3B	Elective – III -A) Human Physiology (or) B) Agrobiotechnology	5	5	25	75	100	
	IV	7SBS6B4/ 7SBS6B5/ 7SBS6B6/ 7SBS6B7	(2) Skill Based Subjects – II	2	2	25	75	100
			(2) Skill Based Subjects – II	2	2	25	75	100
			Total	25	30	--	--	700
			Grand Total	140	180	--	--	4100

**** University Examinations will be held in the Even Semesters only.**

B.Sc., BIOTECHNOLOGY

I YEAR – I SEMESTER COURSE CODE: 7BBT1C1

CORE COURSE - I – BIOCHEMISTRY

Unit – I

Carbohydrates Classification. Monosaccharides – D and L designation, open chain and cyclic structures, epimers, anomers and mutarotation. Occurrence, structure and biological importance of disaccharides (sucrose, lactose, maltose) and polysaccharides (storage-starch, glycogen; structural – cellulose).

Unit – II

Proteins Structure, Classification, Physical and Chemical properties of amino acids. Essential and non-essential aminoacids. Biological importance of proteins; Classification based on structure and functions, structural organization of proteins (primary, secondary, tertiary and quaternary structures)

Unit – III

Lipids Structure and properties of fatty acids. Structure and functions of phospholipids, sphingolipids, glycolipids and Lipoproteins.

Unit – IV

Nucleic acids Structure and functions of DNA and RNA; Watson and Crick model of DNA and other forms for DNA (A and Z) composition, structure, types and Biological importance.

Unit – V

Enzymes Nomenclature and classification of enzymes, enzyme units. Interaction between enzyme and substrate- lock and key, induced fit models. Enzyme kinetics (derivation of Michaelis - Menten Equation, Line - Weaver and Burk plot, Eadie- Hofstee plot).

Books for Reference:

1. Lehninger Principles of Biochemistry (2012) by D.L. Nelson and M.M. Cox. W.H Freeman Publishers.
2. Harpers Illustrated Biochemistry (2014) by David Bender, Kathleen M. Botham Peter, J.Kannelly, P.Anthony Weil. The McGraw-Hill companies, Inc.
3. Biochemistry (2014) by U. Satyanarayana, Books & Allied Publications
4. Harpers Illustrated Biochemistry 30th Edition - published 2015 by Victor Rodwell



**I YEAR – I SEMESTER
COURSE CODE: 7BBT1P1**

CORE COURSE - II – PRACTICAL – I - LAB IN BIOCHEMISTRY

1. Qualitative estimation of carbohydrates.
2. Estimation of sugar by Anthrone Method.
3. Estimation of reducing sugar – Dinitrosalicylic acid Method.
4. Isolation of casein in Milk
5. Estimation of protein by Bradford Method
6. Determination of pK and pI values of amino acids
7. Separation of amino acids by paper chromatography.
8. Determination of acid value of an edible oil
9. Determination of Saponification value of an edible oil
10. Determination of Iodine number of an edible oil

Books for Reference:

1. Practical Clinical Biochemistry (2014) by Ranjina Chawla. JP Medical Ltd.
2. Textbook of Medical Laboratory Technology (2014) by Praful B. Godkar
3. Practical Biochemistry for Colleges, (2012) by E.J.Wood. Elsevier publications.



**I YEAR – II SEMESTER
COURSE CODE: 7BBT2C1**

CORE COURSE - III – MICROBIOLOGY

Unit – I

Definition and scope of Microbiology. Classification of bacteria – Bergey's Manual of Determinative bacteriology. Importance and scope of Microbiology as a modern Science. Branches of microbiology.

Unit – II

Microscopy – Simple and Compound Microscopy – Dark field – Phase contrast – Fluorescence and Electron Microscopy. Specimen preparation of electron microscopy – Ocular and stage micrometers.

Unit – III

Basic Methods in microbiology: Sterilization and Disinfection techniques, Staining techniques – Simple and differential staining (Gram staining, endospore, capsular & Granular), enumeration, aerobic and anaerobic cultivation and preservation techniques. Nutritional types and requirements.

Unit - IV

Cellular structures of prokaryotes and eukaryotes – Ultra structure and functions of Prokaryotic cell wall, flagella, slime layer, capsule, pili, cytoplasmic membrane and cytoplasmic inclusions – Sporulation and its mechanism. Basic characteristics of viruses and fungi.

Unit – V

Environmental Biotechnology – Microbes in air, water and soil. Microbes in extreme environments.

Books for Reference:

1. Prescott's Microbiology (2013) by Joanne Willey, Linda Sherwood, Chris Woolverton. Tata McGraw – Hill Publication.
2. Basher Science: Microbiology – (2015) - 3rd editions by Simon Basher, Dan Green
3. Microbiology (2013) - 1st edition by Boundless
4. Fundamental Principles of Bacteriology (2014) by A.J. Salle. Tata McGraw – Hill Publishing Company Limited.
5. Textbook of Diagnostic Microbiology, 5th edition (2014) by Connie R. Mahon MS MT (ASCP) CLS. Saunders publication.
6. Text Book of Microbiology (2012) by Surinder Kumar. Jaypee Brothers medical publishers Pvt. Ltd.



**I YEAR – II SEMESTER
COURSE CODE: 7BBT2P1**

CORE COURSE - IV – PRACTICAL – II - LAB IN MICROBIOLOGY

1. Media preparation: Broth, Agar slant, Agar plate, Differential media (MacConkey agar) and Selective medium – EMB.
2. Enumeration of bacteria and fungi from environmental samples such as air, water and soil.
3. Pure culture techniques: Streak, Pour and Spread plate technique.
4. Staining Techniques: Simple staining, Negative staining, Gram's staining and Capsular staining.
5. Lactophenol cotton blue staining for fungal samples
6. Motility test – Hanging drop method
7. Growth curve of bacteria.
8. Effect of pH and Salinity on Microbial growth

Books for Reference:

1. Basic Microbiology: An illustrated Laboratory manual (2012) by B.K.Khuntia. Daya Publishing House.
2. Laboratory Manual of Microbiology (2011) by V.Kumar. Scientific Publishers.
3. Loose Leaf Version of Benson's Microbiological Applications: Lab Manual in General Microbiology Complete Version (2014) 1 edition by Alfred Brown, Heidi Smith
4. Lab manual: Pathology and Microbiology (2016) by Atheena Milagi Pandian S
5. Lab Manual for Microbiology Fundamentals: A Clinical Approach (2012) 1st edition by Steve Obenauf, Susan Finazzo



**II YEAR – III SEMESTER
COURSE CODE: 7BBT3C1**

CORE COURSE - V – CELL & MOLECULAR BIOLOGY

Unit - I

Cell as a basic unit of living systems: Structure of Prokaryotic and Eukaryotic cell. Broad and detailed classification of cell types within an organism. Cell, tissue, organ and organism and different levels of organization

Unit - II

Cell division – Mitosis, Meiosis. Cell cycle -Introduction and mechanism. Cell synchrony and its applications. Anomalies in Cell Division

Unit - III

Structure and function of cell organelles: Ultrastructure of Cell membrane, Golgi bodies, and Endoplasmic reticulum (rough and smooth). Organization and functions of Cytoskeletons. Organization and functions of nucleus, mitochondria and chloroplasts.

Unit - IV

DNA Replication: Central dogma of molecular Biology. Mechanism of DNA replication in Prokaryotes and Eukaryotes. Enzymes & proteins involved in DNA replication. Models of replication. (Semi-conservative, Unidirectional, bidirectional, rolling circle mechanism).

Unit - V

Transcription – Prokaryotic & Eukaryotic Transcription. Translation: Factors involved in translation – Mechanism of translation in Prokaryotes and Eukaryotes – Initiation – elongation – termination.

Books for Reference:

1. Molecular Biology of Cell (2014) by Bruce Alberts, Alexander Johnson. Julian Lewis, David Morgan, Martin Raff, Keith Roberts, Peter Walter. Garland Science publication.
2. Molecular Biology – Genes to Proteins (2012) by Burton E. Tropp. Jones and Bartlett Publishers.
3. Biochemistry and Molecular Biology (2014) – 1st edition by Despo Papachristodoulou, Alison Snape, William H. Elliott
4. Freifeder's Essentials of Molecular Biology (2013) by George M. Malacinski. Norosa Publishing House.



**II YEAR – III SEMESTER
COURSE CODE: 7BBT3P1**

**CORE COURSE - VI – PRACTICAL – III - LAB IN CELL & MOLECULAR
BIOLOGY**

1. Isolation of Chromosomal DNA from animal and plant tissues
2. Estimation of DNA by diphenylamine method
3. Analysis of DNA by agarose gel electrophoresis
4. Estimation of protein by Lowry and Biuret Method.
5. Estimation of RNA by orcinol method
6. Analysis of protein by SDS-PAGE.
7. Isolation of Chloroplast from spinach leaves
8. Observation of human blood cells
9. Measurement of microbial cell size using Ocular and stage Micrometer

Books for References:

1. Molecular Biology and Recombinant DNA Technology: A Practical Book (2011) by Ashok Kumar. Narendra Publishing House.
2. CELL AND MOLECULAR BIOLOGY : A Lab Manual (2013) – 1st edition by K. V. Chaitanya
3. Laboratory Manual of Microbiology, Biochemistry and Molecular Biology (2012) by J. Saxena, M. Baunthiyal, I. Ravi. Scientific Publishers.
4. Lab Molecular Biology Tech: Specialty Review and Self-Assessment – 1st edition- (2016) by Carrie Coover (Editor)



**II YEAR – IV SEMESTER
COURSE CODE: 7BBT4C1**

CORE COURSE - VII – PRINCIPLES OF GENETICS

Unit - I

Mendelian Principles: Domination, segregation, independent assortment, deviation from Mendelian inheritance. Genotype & phenotype

Unit - II

Extensions of Mendelian principles: Codominance, incomplete dominance, gene interactions, pleiotropy, penetrance and expressivity, Linkage, sex linkage, sex limited and sex influenced characters.

Unit - III

Structural and numerical alterations in chromosome – Euploidy – Aneuploidy – Deletion – Duplication – insertion - Translocation

Unit - IV

Population genetics: Pedigree analysis, Mendelian traits and sex – linked traits in human – population genetics – Hardy - Weinberg genetic equilibrium.

Unit - V

DNA transfer mechanism: In Prokaryotes – Transformation, Transduction (Generalized and specialized) & Conjugation. Transposons (Bacteria, Human). Davis U Tube experiments

Books for Reference:

1. Molecular Genetics of Bacteria (2013) Larry Snyder, Joseph E. Peters, Tina M. Henkin. ASM Press publication.
2. Behavioral Genetics - published 2012 – 12th editions by Robert Plomin, John C. DeFries, Gerald E. McClearn
3. Human Biology - Genetics - published 2013 - 2nd editions by CK-12 Foundation



**II YEAR – IV SEMESTER
COURSE CODE: 7BBT4P1**

CORE COURSE - VIII – PRACTICAL – IV - LAB IN GENETICS

1. Problem sets in Mendelian inheritance a) single point crosses & b) two point crosses.
2. Mitosis in onion root
3. Meiosis in flower buds of Hibiscus Rosa sinensis
4. Life cycle of Drosophila melanogaster
5. Culture techniques and handling of flies
6. Polygenic inheritance with reference to Finger Print
7. Determination of Phenomenon of segregation – Artificial – Probability
8. Determination of independent assortment – Artificial – Probability
9. Antibiotic sensitivity test in bacteria
10. Barr body identification in cells of buccal smear

Books for Reference:

1. Concepts of Genetics& Student Hdbk&s/M& Lab (2013)- 1st edition by Pearson (Contributor)
2. Genetics Laboratory Lab Manual (2012) 1st edition by David Peyton
3. Genetics Laboratory Investigations (2014) by Thomas L Mertens, Robert L. Hammersmith. Benjamin Cummings publication.



**III YEAR – V SEMESTER
COURSE CODE: 7BBT5C1**

CORE COURSE - IX – PRINCIPLES OF IMMUNOLOGY

Unit - I

Scope of immunology. Haematopoiesis. Cell and organs of immune responses and their functions. Basic mechanisms of innate, adaptive, humoral and cell mediated immunity.

Unit - II

Antigens: Immunogenicity Vs antigenicity. Properties of immunogen, haptens, epitopes and adjuvants. Antibodies: Structure and function.

Unit - III

Antigen – Antibody interactions: Avidity and affinity. Basic principles and applications of precipitation reactions (radial immuno diffusion, double immuno diffusion and immuno electrophoresis), agglutination reactions, RIA, ELISA and Western blotting

Unit - IV

Antigen presentation: Class I and II MHC molecules, cytosolic and endocytic pathways. Complement pathways – classical and alternative

Unit - V

Vaccines: Active and Passive immunization. Hypersensitivity reactions and its types

Books for Reference:

1. Kuby Immunology (2013) by Judy Owen, Jenni Punt, Sharon Stanford. Macmillan Higher Education International publication.
2. Textbook of Immunology Second Edition (2012) by Seemi Farhat Basir (shelved 2 times as *biochemistry*)
3. Veterinary Immunology (2012)- 3 editions by Ian R. Tizard
4. Textbook of Immunology (2012) by Bazir A. Phi Learning Private Limited publication.
5. Textbook of Immunology (2013) by S.K.Mohanty, K.SaiLeela. Jaypee brothers medical Publishers Pvt. Ltd.



**III YEAR – V SEMESTER
COURSE CODE: 7BBT5P1**

CORE COURSE - X – PRACTICAL – V - LAB IN IMMUNOTECHNOLOGY

1. Determination of human blood groups – A, B, AB, O and Rh factor by slide agglutination method.
2. Enumeration of White Blood Cells.
3. Enumeration of Red Blood Cells.
4. Detection of differential leukocyte count in blood sample.
5. Radial immunodiffusion.
6. Double immunodiffusion.
7. Separation of serum and plasma from blood sample.
8. Rocket immunoelectrophoresis, Counter current immunoelectrophoresis
9. Widal test
10. ELISA (Demo).

Books for Reference:

1. Genetics Laboratory Lab Manual (2012) 1st edition by David Peyton
2. Lab Molecular Biology Tech: Specialty Review and Self-Assessment - 1 edition- (2016) by Carrie Coover (Editor)



**III YEAR – V SEMESTER
COURSE CODE: 7BBT5C2**

CORE COURSE - XI – MICROBIAL BIOTECHNOLOGY

Unit - I

Screening and Isolation of Microorganisms, maintenance of strains improvement (Mutant selection, Recombinant DNA methods). Fermentation Media: Natural and synthetic Media.

Unit - II

Fermenters: Process of Aeration, Agitation, Temperature regulation and Filtration method. Types of Fermentation: Solid State, submerged fermentation and continuous fermentation.

Unit - III

Process Development – Shake flask fermentation, Downstream processing (DSP), Disintegration of cells, Separation, Extraction, Concentration and purification of products.

Unit - IV

Gene cloning of industrial microorganisms: Gene cloning – strategies in gene cloning – Importance, advantage and methods of gene cloning in *Bacillus* and yeast. Pollution and waste control: Industrial wastes – Waste management using *Pseudomonas* – Microbial based environmental applications of biotechnology.

Unit - V

Application of Bioprocess technology: Production of microbial biomass (*Spirulina*, yeast); SCP extracellular enzymes; Production of Microbial products. Brief account of the following products obtained by industrial microbiological fermentation: Alcohol, Alcoholic Beverage – Beer, Organic acid – Citric acid, Antibiotic – Penicillin, Amino acids – Glutamic acid, Vitamin – B12. Brief account of Steroid biotransformation

Books for Reference:

1. Principles of fermentation technology (2015) by Stephen J.Hall, Peter Stanbury and Allan Whittakker. Elsevier publications.
2. Microbial Biotechnology: Methods and Applications (2012) by H.N. Thatoi, B.B. Mishra, Narosa publishing house India Ltd.



**III YEAR – V SEMESTER
COURSE CODE: 7BBTE1A**

ELECTIVE COURSE - I (A) – BIOSTATISTICS

Unit - I

Brief description and tabulation of data and its graphical representation of biological data.

Unit - II

Measures of central tendency of discrete series: Mean, median and mode applications.

Unit - III

Measures of Dispersion of Discrete series: Mean deviation, variance and standard deviation

Unit - IV

Analysis of variance (ANOVA): One-way & Two-way.

Unit - V

Introduction to MS office software covering word processing and spread sheets.

Books for Reference:

1. Statistical methods (2011) by S.P. Gupta. S. Chand publication.
2. Essentials of Statistics (2011) by Mario F.Triola. Pearson Education Publications.
3. Primer of Biostatistics (2012) by Stanton A.Glantz. McGraw-Hill Publications.



**III YEAR – V SEMESTER
COURSE CODE: 7BBTE1B**

ELECTIVE COURSE - I (B) - BIOPHYSICS

Unit - I

Radioisotopes techniques: GM & Scintillation counting, Auto radiography, Radio immune assay, safety aspects & application.

Unit - II

Spectroscopic techniques: UV spectroscopy, Infra Red spectroscopy, NMR, Mass spectroscopy.

Unit - III

Electrophoresis: Concepts of Electrophoresis. Horizontal & Vertical gel electrophoresis, Native gel electrophoresis, SDS – PAGE, Isoelectric Focusing, Immunoelectrophoresis.

Unit - IV

Chromatographic techniques: HPLC, Ion – exchange chromatography, Gel filtration chromatography, Affinity chromatography, Gas – Liquid chromatography.

Unit - V

PCR, DNA Sequencing methods (Sanger, Maxam and Gilbert and Automated gene sequencing), ELISA (Direct, Indirect & Sandwich).

Books for Reference:

1. Fundamentals and Techniques of Biophysics and Molecular Biology – 2016 by Pranav Kumar (Author).
2. Biochemistry and Molecular Biology (2014) - 1 edition by Despo Papachristodoulou, Alison Snape, William H. Elliott.



**III YEAR – V SEMESTER
COURSE CODE: 7BBTE2A**

ELECTIVE COURSE - II (A) – BIODIVERSITY

Unit - I

Biodiversity: Concepts, significance. Levels of biodiversity: Genetic, species, and ecosystem. Biodiversity and its uses: Source of food, medicine.

Unit - II

World's major gene banks of plant genetic resources. India's biodiversity richness: plant, animal and human diversity.

Unit - III

Threats to biodiversity: Climate change and habitat loss. Carbon emissions, carbon credit and carbon trading. RED DATA book.

Unit - IV

Global biodiversity: Conservation of biodiversity, endangered species, conservation strategies for plant diversity: *In situ* strategies – biosphere reserves, reserve forests, national parks and sanctuaries. *Ex situ* strategies – tissue culture and cryopreservation. Role of IUCN in the conservation of Biodiversity.

Unit - V

Conservation of animal diversity: gene banks, captive breeding. Ecotourism and Wild life trade.

Books for Reference:

1. Earth and Life: Global Biodiversity, Extinction Intervals and Biogeographic Perturbations through time (2012) by John A. Talent, Springer.
2. "The emerging synthesis in human biodiversity." *Evo & Proud* (2015) by Frost, Peter.
3. "The nature of race" *Open Behavioral Genetics* (2015) by Fuerst, John
4. Loss of Biodiversity (2011) by David.M. Barker, ABDO Publishers.



**III YEAR – V SEMESTER
COURSE CODE: 7BBTE2B**

ELECTIVE COURSE - II (B) – ECOLOGY AND EVOLUTION

Unit - I

Environmental factors – Biotic and abiotic factors – physical, chemical factors. Energy flow in ecosystem – Food chain – Food web – Ecological pyramids – Pond and Grass land as the ecosystem.

Unit - II

Population interaction:

- i) Intra specific interactions – Aggregation, Social organization, divisions of labour and Social behavior, Territorialism, migration.
- ii) Intra specific interaction – Neutralism, commensalism, synergism, mutualism, symbiosis, commensalism, Antagonism, parasitism, competition and predation.

Unit - III

Biosphere – Lithosphere, Hydrosphere and atmosphere. Habitats – Terrestrial, Aquatic – Marine and Fresh water habitats. Biomes: Fresh water biomes – lakes and rivers. Terrestrial biomes- Soil and forests. Marine Biomes: Estuaries and Mangroves.

Unit - IV

Theories and concepts of evolution – Theories of Lamarck, Darwin and Devries – New Lamarckism and Neo Darwinism.

Unit - V

Species and speciation – Factors – isolation mechanisms – distribution of species – mutations and selection – Polymorphism.

Books for Reference:

1. Clarke, G.L (2012) Elements of ecology, Thomas.M.Smith and Robert Leo Smith. Benjamin Cummings Publishers.
2. An Introduction to behavioural Ecology (2012) by Nicholas B.Davies. Wiley Blackwell Publishers.
3. Ecology and Evolution – December (2016) (Vol 6) by John Wiley & Sons Ltd
4. Ecology and Evolution – February (2017) (Vol 7) by John Wiley & Sons Ltd
5. Ecology and Evolution - 14 August (2012) by John Wiley & Sons Ltd



**III YEAR – VI SEMESTER
COURSE CODE: 7BBT6C1**

CORE COURSE - XII – RECOMBINANT DNA TECHNOLOGY

Unit - I

Molecular tools and applications: Restriction enzymes. DNA Polymerases, DNA dependent RNA polymerases. DNA ligases, alkaline phosphatase.

Unit - II

Cloning vectors and their applications: Bacterial plasmids, pBR322, pUC18, pUC19. Cosmids, Phagemids. Construction, Principle and uses of YAC, BAC.

Unit - III

Regulation of gene expression in Prokaryotes – Lac operon and trp operon & attenuation. Regulation in eukaryotes: gene loss, gene amplification, gene rearrangement.

Unit - IV

Basic principles of construction of genomic and cDNA libraries. PCR based cloning approach (TA cloning).

Unit - V

Analysis of cloned genes. Southern hybridization – Preparation of radiolabelled / non radiolabelled DNA & RNA probes, hybridization and autoradiography.

Books for Reference:

1. Analysis of Genes and Genomes (2011) by Daniel L. Hartl, Maryellen Ruvolo. Laxmi Publications.
2. Recombinant DNA Technology (2012) by Keya Chaudhuri. The Energy and Resources Institute, TERI.
3. Recombinant DNA Technology – (2012) 1st edition by Keya Chaudhuri
4. Recombinant DNA Technology and Genetic Engineering (2012) — 1st edition by K Rajagopal
5. Early Cloning and Recombinant DNA Technology at Herbert W. Boyer's Ucsf Laboratory in the 1970s: Oral History Transcript (2015) 1st edition by Sally Smith Hughes, Mary Carolyn Ive Betlach



**III YEAR – VI SEMESTER
COURSE CODE: 7BBT6P1**

CORE COURSE–XIII–PRACTICAL–VI- LAB IN GENETIC ENGINEERING

1. Isolation of plasmid DNA from *E. coli* & Agarose gel electrophoresis.
2. Isolation of genomic DNA from *E. coli*.
3. Extraction of genomic DNA from Yeast
4. Restriction digestion of DNA.
5. Ligation.
6. Transformation in *E.coli* and selection of recombinants. (Blue-white selection method).
7. Transformation of Yeast cell using Lithium acetate.
8. Southern blotting (Demo)
9. PCR (Demo).
10. Isolation & identification of *Rhizobium* from root nodules.

Books for Reference:

1. Molecular cloning: A Laboratory Manual (2015) by Joseph Sambrook, Michael R Green. Cold Spring Harbor publication.
2. Laboratory manual for Genetic Engineering (2010) by Johnvennison, PHI Learning publication.



**III YEAR – VI SEMESTER
COURSE CODE: 7BBT6C2**

CORE COURSE - XIV – PLANT AND ANIMAL BIOTECHNOLOGY

Unit - I

Plant tissue culture: Types of cultures – Callus, Cell suspension, Micropropagation, and Anther culture. Plant regeneration: Somatic embryogenesis and organogenesis. Different types of culture media (MS & LS). Microsporangium & Megaporangium development in plants

Unit - II

Culture media: serum media & serum free media – biology of cultured cells – cell growth kinetics – primary culture– subculture.

Unit - III

Gene transfer techniques in plants: Methods of transformation – Direct (microinjection and microlaser & Biolistics) and Indirect – selectable markers, reporter genes and promoters used in plant expression vectors. Types of Ti-plasmid vectors

Unit - IV

Spermatogenesis & Oogenesis in mammals. Gene transfer techniques in animals – Transfection – liposuction – electroporation, microinjection.

Unit - V

Organogeny: Development of brain, eye and ear in frog. Placentation in mammals

Books for Reference:

1. Medical Microbiology (2012) by D. Greenwood, Mike Barer, Richard Slack and Will Irving, Churchill Livingstone publication.
2. Practical Plant Biotechnology and Genetics (2015) 1 edition edition by Archana Rani
3. Hybridoma technology in the Biosciences and Medicine (2012) by Timothy. Springer Plenum Press.
4. Designer Animals: Mapping the Issues in Animal Biotechnology (2012) — 3rd editions by Conrad G. Brunk (Editor), Sarah Hartley (Editor)
5. Bulbous Plants: Biotechnology (2014) by K.G. Ramawat, J.M. Merillon
6. Plant & Animal Tissue Culture, (2013) by Seema Sambrani, Vision Publications.



**III YEAR – VI SEMESTER
COURSE CODE: 7BBT6PR**

CORE COURSE - XV – PROJECT IN BIOTECHNOLOGY



**III YEAR – VI SEMESTER
COURSE CODE: 7BBTE3A**

ELECTIVE COURSE - III (A) - HUMAN PHYSIOLOGY

Unit - I

Digestive System: Intra & Extra cellular digestion. Digestive enzymes and their role in digestion.

Unit - II

Respiratory system: External & Internal (tissue) respiration. Transport of oxygen and carbon dioxide.

Unit - III

Circulatory system: Types, composition and functions of blood. Working of Heart.

Unit - IV

Nervous system: Anatomy of human brain & Neurons. Propagation of nerve impulse. Synaptic potential, Release of neurotransmitters.

Unit - V

Excretory and Endocrine System: Overview of urine formation in Kidney and Excretion of nitrogenous waste from intestine. Endocrine glands in human, functions of hormones of pituitary gland, thyroid hormones, growth hormones, Glucagon, Androgen, Estrogen.

Books for Reference:

1. The Washington Manual of Surgical Pathology- (2012) by Humphrey
2. Histology for Pathologists - 4th ed., (2012) by Mills
3. Biopsy Interpretation of the Breast (Biopsy Interpretation Series)- (2012) by Stuart Schnitt
4. Dermatopathology - 2nd edition, (2013) by Elston,



**III YEAR – VI SEMESTER
COURSE CODE: 7BBTE3B**

ELECTIVE COURSE - III (B) – AGROBIOTECHNOLOGY

Unit - I

Floriculture: Growth and Development of Flower Crops, Production Technology of Commercial Flower Crops.

Unit - II

Sericulture: Silk producing organisms- Tasar, muga and eri silkworm. Rearing of silkworm- rearing house, and appliances used for feeding, bed cleaning and supporting the spinning larvae. Rearing methods- paraffin paper and new net method - uses of silk.

Unit - III

Apiculture: Rearing of honey bees. Functions of Queen bees, Worker and drone bees. Economic importance of honey bees. Medicinal uses of Honey bees.

Unit - IV

Mushroom Cultivation: Importance of Mushroom Cultivation – Nutritive Value of Mushroom – Preparation of Media – Preparation of Mother spawn – bed spawn – Methodology of Mushroom Cultivation.

Unit - V

Vermicompost: Preparation and use of Vermicompost. Earthworm species used in vermicompost production- endemic species, exotic species. Role of vermicompost in organic farming. Vermicomposting as a tool for soil waste management – a small scale industry and its economics.

Books for Reference:

1. An introduction to Sericulture (2014) by J.Sulochana Chetty and G.Ganga, Oxford & IBH publishing Co. Pvt. Ltd.
2. Molecular Markers in Plants - December (2012) by Robert J. Henry (Editor).
3. Plant Gene Containment – October (2012) by Melvin J. Oliver (Editor), Yi Li (Editor)
4. Principles of Plant Genetics and Breeding, 2nd Edition(2012) by George Acquaah.
5. Plant Gene Containment - October (2012) by Melvin J. Oliver (Editor), Yi Li (Editor)

