

BACHELOR OF SCIENCE

IN

BIOTECHNOLOGY

Curriculum and Syllabus

(For Students admitted from academic year 2015-2016 onwards)

UNDER CHOICE BASED CREDIT SYSTEM

DEPARTMENT OF BIOTECHNOLOGY

FACULTY OF SCIENCE AND HUMANITIES

SRM UNIVERSITY

SRM NAGAR, KATTANKULATHUR – 603 203

B.Sc BIOTECHNOLOGY
(For students admitted from academic year 2015-2016 onwards)
CURRICULUM

SEMESTER I							
Career Stream Title	Subject Code	Subject Title	L	T	P	Total of LTP	C
Language	ULT15101	Tamil – I	4	1	0	5	4
	ULH15101	Hindi – I					
	ULF15101	French – I	4	1	0	5	4
	ULE15101	English – I					
Compulsory Core	UBT15101	Cell Biology	4	0	0	4	4
Compulsory Core Lab	UBT15102	Cell Biology Lab	0	0	4	4	3
Compulsory Core	UBT15103	Microbiology	4	0	0	4	4
Compulsory Core Lab	UBT15104	Microbiology Lab	0	0	3	3	3
Allied	UBT15105	Chemistry	3	0	0	3	4
Supportive Course (Internal Evaluation)	CDC 15101	Verbal Ability	2	0	0	2	2
TOTAL			21	2	8	30	28
SEMESTER II							
Career Stream Title	Subject Code	Subject Title	L	T	P	Total of LTP	C
Language	ULT15201	Tamil – II	4	1	0	5	4
	ULH15201	Hindi – II					
	ULF15201	French - II	4	1	0	5	4
	ULE15201	English - II					
Compulsory Core	UBT15201	Biochemistry	4	0	0	5	4
Compulsory Core Lab	UBT15202	Biochemistry Lab	0	0	3	3	3
Compulsory Core	UBT15203	Basics of Genetics	4	0	0	4	4
Compulsory Core Lab	UBT15204	Basics of Genetics Lab	0	0	3	3	3
Allied	UBT15205	Basics Of Computers	4	0	0	4	4
Extension Activities	UNS15201	NSS	0	0	0	0	1
	UNO15201	NSO					
	UNC15201	NCC					
	UYG15201	Yoga					

Supportive Course (Internal Evaluation)	CDC 15201	Quantitative Aptitude & Reasoning -I	2	0	0	2	2
TOTAL			22	2	6	30	29
SEMESTER III							
Career Stream Title	Subject Code	Subject Title	L	T	P	Total of LTP	C
Compulsory Core	UBT15301	Molecular Biology	3	2	0	5	4
Compulsory Core	UBT15302	Bioinstrumentation	3	2	0	5	4
Compulsory Core Lab	UBT15303	Molecular Biology Lab	0	0	4	4	3
Compulsory Core Lab	UBT15304	Bioinstrumentation Lab	0	0	3	4	3
Allied	UBT15305	Biostatistics	3	2	0	5	4
Skill Based Electives - I	UBT15E51	Disease Management	3	0	0	3	3
	UBT15E52	Diagnostic Tools					
Non Major Electives		Open Elective -I	2	0	0	2	2
Supportive Course (Internal Evaluation)	CDC 15301	Quantitative Aptitude & Reasoning -II	2	0	0	2	2
TOTAL			17	6	7	30	25
SEMESTER IV							
Career Stream Title	Subject Code	Subject Title	L	T	P	Total of LTP	C
Compulsory Core	UBT15401	Bioprocess Technology	3	2	0	5	4
Compulsory Core	UBT15402	Enzymology	3	2	0	5	4
Compulsory Core Lab	UBT15403	Bioprocess Technology Lab	0	0	4	4	2
Compulsory Core Lab	UBT15404	Enzymology Lab	0	0	4	4	2
Allied	UBT15405	Biophysics	3	2	0	5	4
Skill Based Electives- II	UBT15E53	Biofertilizer Technology	3	0	0	3	2
	UBT15E54	Agricultural Biotechnology					
Non Major Electives		Open Elective -II	2	0	0	2	2
Supportive Course (Internal Evaluation)	CDC15401	Communication Skills	2	0	0	2	2
TOTAL			16	6	8	30	22

SEMESTER V							
Career Stream Title	Subject Code	Subject Title	L	T	P	Total of LTP	C
Compulsory Core	UBT15501	Plant and Animal Biotechnology	4	1	0	5	4
Compulsory Core	UBT15502	Genomics And Proteomics	4	1	0	5	4
Compulsory Core Lab	UBT15503	Plant and Animal Biotechnology Lab	0	0	5	4	2
Compulsory Core Lab	UBT15504	Genomics and Proteomics lab	0	0	4	4	2
Core Elective - II	UBT15E01	Human physiology	3	1	0	4	3
	UBT15E02	Medical Biotechnology					
Core Elective -II	UBT15E03	Bioinformatics	3	1	0	4	3
	UBT15E04	Bioethics, IPR and Biosafety					
Supportive Course	UES15501	Environmental Science	3	0	0	3	3
TOTAL			17	4	9	30	21
SEMESTER VI							
Career Stream Title	Subject Code	Subject Title	L	T	P	Total of LTP	C
Compulsory Core	UBT15601	Biology of Immune Systems and Immunotechnology	4	1	0	5	4
Compulsory Core	UBT15602	rDNA technology	4	1	0	5	4
Compulsory Core Lab	UBT15603	Immunology Lab	0	0	3	3	2
Compulsory Core Lab	UBT15604	rDNA Technology Lab	0	0	3	3	2
Core Elective - III	UBT15E05	Environmental Biotechnology	4	1	0	5	4
	UBT15E06	Nanobiotechnology					
Core Elective - IV	UBT15E07	Cancer Biology	4	0	0	4	4
	UBT15E08	Pharmacogenomics					
Mini Project	UBT15605	Mini Project (Review/Research)	0	0	5	3	3
TOTAL			16	3	11	30	23

Total credits to be earned for the degree - 148

SEMESTER I
முதல் பருவம்

குறியீட்டு எண்	பாடம்	L	T	P	Total LTP	C
ULT15101	தமிழ் - I	4	1	0	5	4

பகுதி 1. தமிழ் இலக்கிய வரலாறு

(நூல் – தமிழ் இலக்கிய வரலாறு- முனைவர் சு.ஆனந்தன், கண்மணி பதிப்பகம், திருச்சி, 2010.)

1. சிற்றிலக்கியம் - தோற்றமும் வளர்ச்சியும்
2. புதுக்கவிதை - தோற்றமும் வளர்ச்சியும்
3. சிறுகதை - தோற்றமும் வளர்ச்சியும்
4. புதினம் - தோற்றமும் வளர்ச்சியும்
5. உரைநடை - தோற்றமும் வளர்ச்சியும்

பகுதி 2. இலக்கியம்

அ. இக்காலக்கவிதைகள்

1. பாரதியார்
நெஞ்சு பொறுக்கு திலையே ...என்று தொடங்கும் கவிதை
2. பாரதிதாசன்
உலக ஒற்றுமை - தன்பெண்டு தன்பிள்ளை ...என்று தொடங்கும் கவிதை
3. ந.பிச்சமூர்த்தி - கிளிக்கூண்டு
4. இன்குலாப் - மரங்களின் சுற்றம்
சந்திக்கச் செல்வதில்லை...என்று தொடங்கும் கவிதை
5. நா. காமராசன் - கருப்பு மலர்கள்

- காகிதப் பூக்கள் - கால மழைத்துறலிலே... என்று தொடங்கும் கவிதை
6. சு.வில்வரெத்தினம் --வேற்றாகி நின்ற வெளி
நிலவின் எதிரொலி - பறம்பு மலை ...என்று தொடங்கும் கவிதை
 7. பாரதி புத்திரன் - மாரிக்கால இரவுகள்
சிவகாசிச் சிசுக்கள் - மகனே அன்றொரு நாள் ...என்று தொடங்கும் கவிதை
 8. து.நரசிம்மன் - வானம் பிறந்தது
ஒரு பிஞ்சின் வேண்டுகோள்...என்று தொடங்கும் கவிதை
 9. ப.கல்பனா- வானம் பிறந்தது
கீறல் விழுந்த மாலைக்காலங்கள்- இன்று வர... என்று தொடங்கும் கவிதை

ஆ. சிற்றிலக்கியம்

கலிங்கத்துப்பரணி- போர் பாடியது: 404 -- 408 பாடல்கள்

குற்றாலக்குறவஞ்சி - மலைவளம்

1. வானரங்கள் கனிகொடுத்து என்று தொடங்கும் பாடல்
2. முழங்கு திரைப் புனலருவி கழங்கென முத்தாடும் என்று தொடங்கும் பாடல்

இ. காப்பியங்கள்

**சிலப்பதிகாரம் - வழக்குரை காதை - 'தேரா மன்னா! செப்புவது உடையேன்;-- இணை அடி தொழுது வீழ்ந்தனளே, மடமொழி.
(30 - வரிகள்)**

பகுதி 3 உரைநடைப் பகுதி

“எண்ணங்கள்” டாக்டர் எம்.எஸ்.உதயமூர்த்தி, கங்கை புத்தக நிலையம், 2005.

பாட நூல்கள் :

1. முனைவர் சு.ஆனந்தன் (2010), தமிழ் இலக்கிய வரலாறு, கண்மணி பதிப்பகம், திருச்சி, 2010.
2. எம்.எஸ்.உதயமூர்த்தி, “எண்ணங்கள்”, கங்கை புத்தக நிலையம், 2005.
3. செய்யுள் புத்தகம், தமிழ்த்துறை, அறிவியல் மற்றும் மானுடவியல் புலம் , எஸ். ஆர். எம். வெளியீடு, 2014.

Subject Code	Title of the Subject	L	T	P	Total LTP	c
ULH 15101	Hindi	4	1	0	5	4

INSTRUCTIONAL OBJECTIVES

- To express and communicate literature which is part of life
- To incorporate day to day personal & professional life's need to communicate in the language.
- To help the students to imagine & express their mind through Literature .

UNIT I - Prose

(35 Hours)

1. USNE KAHA THA (STORY) -
CHANDRADHAR SHARMA GULERI
2. CHIEF KI DAWAAT (STORY) -
BHISHAM SAHNI
3. PREMCHAND (NIBANDH) -
DR. RAMVILAS SHARMA
4. BHOLARAM KA JEEV (SATIRE STORY) -
HARISHANKAR PARSAI
5. BHAGWAN NE KAHA THA (SATIRE STORY) -
SURYA BALA
6. CHAMAR KI BETI (STORY) -
DR.N. CHANDRSHEKHARAN NAIR

UNIT II - OneActPlay

(15 Hours)

1. LAXMI KA SAWAGAT **UPENDRANATH ASHK**

2. JAB MAA RO PADI **SETH GOVIND DAS**

UNIT III - CORRESPONDENCE (10 Hours)

1. OFFICIAL LETTER
2. DEMI- OFFICIAL LETTER

UNIT IV - COMPUTER (10Hours)

UNIT V - TECHNICAL TERMINOLOGY (5 Hours)

TEXT BOOKS

1. Hindi I Edited by Dr.S.Preethi, Dr.MD.Islam, Dr. S. Razia Begum Published by Department of Hindi, FS&H,SRM University

REFERENCE

1. Prayajon Mulak Hindi (Author - *Madhav Sontakke*)

Subject Code	Title of the Subject	L	T	P	Total of LTP	C
ULF15201	French-II	4	1	0	5	4

Instructional Objectives

- Consolidate the knowledge of theoretical aspects of French grammar with examples provided from different angles: from present day literature, day to day conversation.
- Improve their oral and written skills through a combination of theory and practice.

Unité - I (15 Heures)

Quelle journée !- La conjugaison pronominale- L'impératif- L'expression de la quantité : peu, un peu de, quelque, etc...- Les activités quotidiennes- Les achats, L'argent - **Qu'on est bien ici !** Prépositions et adverbess de lieu- Verbes exprimant un déplacement : emploi des prépositions- Le logement, La localisation, L'orientation, L'état physique, Le temps qu'il fait.

Unité - II (15 Heures)

Souvenez-vous- L'imparfait- Emploi du passé composé et de l'imparfait- Expression de la durée- L'enchaînement des idées : alors, donc, mais- Les sens réciproque- Les moments de la vie- La famille- Les relations amicales, amoureuses, familiales.

Unité - III (15 Heures)

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B.Sc Biotechnology (2015-2016) SRM (FS&H)

On s'appelle ? – Les pronoms compléments directs- les pronoms compléments indirects de personne- L'expression de la fréquence et de la répétition – Les moyens de communication : courrier, téléphone, internet.

Unite - iv (15 Heures)

Un bon conseil ! – Expression du déroulement de l'action – Passé récent- Présent progressif – Futur proche – Action achevée/ inachevée – Les phrases rapportés – Les Corps – La santé et la maladie.

Unité - V (15 Heures)

Parlez-moi de vous – La place de l'adjectif – La proposition relative finale avec « qui » - C'est/il est – Impératif des verbes avec pronoms – La formation des mots – La description physique et psychologique des personnes – Les vêtements – Les Couleurs.

REFERENCE BOOK

1. “ECHO-A1”, Méthode de français, J.GIRARDET, J.PECHEUR, CLE International, Janvier-2011.

Subject Code	Title of the Subject	L	T	P	Total of LTP	C
ULE15101	English	4	1	0	5	4

Instructional Objectives

- To enhance students' proficiency in English language.
- To enable the students to think in English.
- To be abreast with the world literature.
- To equip students with the awareness and strategies needed to enable the study of English as a lifelong process.
- To engage in ongoing professional development with respect to both teaching and research.

UNIT I - Poetry (15 Hours)

1. If by Rudyard Kipling
2. Where the Mind is Without Fear by Rabindranath Tagore
3. The Road Not Taken by Robert Frost
4. Snake by D. H. Lawrence

UNIT II - Prose (15 Hours)

1. Of Truth by Francis Bacon
2. Spirit of India by A. P. J. Abdul Kalam

UNIT III - Short Stories (15 Hours)

1. The Bet by Anton Chekhov
2. The Postmaster by Rabindranath Tagore

UNIT IV - Movie Review (15 Hours)

1. Whose Life is it Anyway?
2. The Accused- Feature Film
3. Water

UNIT V - Language Component (15 Hours)

1. Tenses
2. Focus on Articles, Prepositions, Subject Verb Agreement
3. Comprehension Passage

TEXT BOOKS

1. Cambridge University Press,. Raymond Murphy, "*Essential Grammar in Use*", 3rd Edition 2010
2. Edited by Dr. Shanthichitra, "*Glean to ACME English Tex Book*", Published by Department of English, FSH, SRM University

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15101	CELL BIOLOGY	4	0	0	4	4

OBJECTIVES

- To understand the basics of cell biology and to know the cellular role in depth.
- To provide sound knowledge about cell functions.

UNIT I - AN OVERVIEW OF CELLS (12 Hours)

An Overview of cells, Classification of cells –Prokaryotic cells and Eukaryotic cells. Meiotic and Mitotic division.

UNIT II - CELL STRUCTURE AND FUNCTION (12 Hours)

Cell Membrane and their models. Membrane proteins, carbohydrates and their role. Transport across membranes –Diffusion - active and passive diffusion.

UNIT III - CELL STRUCTURE AND FUNCTION (12 Hours)

Endoplasmic reticulum, Golgi apparatus ,Lysosome , Peroxisomes and glyoxisomes. Types of Ribosomes

UNIT IV - CHROMOSOMAL ORGANISATION (12 Hours)

Nucleus, Chromosomes, chromatin structure. Mitochondria ,Cytoskeleton: Types of filaments and their functions.

UNIT V - CANCER (12 Hours)

Oncogenesis: Oncogenes, Development and causes of cancer, Types of cancer, Benign and malignant tumour, Treatment of cancer, tumor suppressor gene.

TEXT BOOKS

- Pal J. K. and Ghaskadbi. “*Fundamentals of Molecular Biology*”, OUP 2009.
- Veer Bala Rastogi, “*Fundamentals of Molecular Biology*” Ane Books Pvt.Ltd 2008.

REFERENCES

- Robert Weaver. “*Molecular Biology*” 5th edition, 2011.
- Frank Lee. “*Molecular Biology Web Book*”, Web Books Publishing, 2009.

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15102	CELL BIOLOGY LAB	0	0	4	4	3

1. Mitosis in onion root tip
2. Enumeration of RBC
3. Enumeration of WBC
4. Identification of giant chromosome in chironomous larvae
5. Estimation of hemoglobin by sahlis method
6. Observation of Barr bodies
7. Grams Staining
8. Cell Counting and viability
9. Blood Smear Preparation

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15103	MICROBIOLOGY	4	0	0	4	4

OBJECTIVES

1. To offer a sense of the history of microbial science, its methodology and its many contributions to humanity
2. To ensure the students understand about the microbiology and diseases.

UNIT I - BASICS OF MICROBIOLOGY (12 Hours)

Microbiology - history and scope – General structure & functions -viruses, bacteria, algae, fungi, protozoa –Microscopy - Principles & classification of microbes – Whittaker five kingdom classification.

UNIT II - STERILIZATION (12 Hours)

Sterilization and disinfection - stain and staining methods –. Microbial media –methods of obtaining pure cultures - Phases of growth curve, Factors influencing the growth of microbes –classification of microorganisms.

UNIT III - FOOD AND INDUSTRIAL MICROBIOLOGY (14 Hours)

Role of microbes in food production - Microbiology of fermented food and dairy products - Alcoholic beverages- Food spoilage and Preservation processes. Production of antibiotics, amino acids and organic Acids.

UNIT IV - MEDICAL MICROBIOLOGY (12 Hours)

Pathogenesis, lab diagnosis, prevention and control of important microbial diseases. Pathogenic bacterial diseases, Fungal diseases, Viral Diseases and Protozoan diseases.

UNIT V - ENVIRONMENTAL MICROBIOLOGY

(10 Hours)

Role of microbes in the ecosystems – Microorganisms in soil, air and water. Sewage treatment methods - biological nitrogen fixation - biofertilizers.

TEXT BOOKS

1. A. H. Patel, "*Industrial microbiology*", Macmillan Publishers India, 2002.
2. Pelezar, chan, "*Microbiology*" – Krieg Tata McGraw Hill Publications, 2007.
3. Prescott, Harley and Klein, "*Microbiology*", McGraw Hill publications, Fifth edition, 2003.

REFERENCES

1. Wulf Crueger and Anneliese Crueger, "*Biotechnology – A textbook of Industrial Microbiology*", Panima publishing corporation, New Delhi , 2000, reprint 2005.
2. Jacquelyn G.Black, "*Microbiology -Principles and Explorations*" Wiley publications 2008.

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15104	MICROBIOLOGY LAB	0	0	3	3	3

1. Preparation of media for growth of various organisms.
2. Identification and culturing of various organisms
3. Staining of microorganisms. – Grams staining, spore staining, capsular staining.
4. Measure of bacterial population by turbidometry and studying the effect of temperature, pH, carbon and nitrogen.
5. Assay of antibiotics production and demonstration of antibiotic resistance.
6. Biochemical tests to identify various organisms.

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15105	CHEMISTRY	3	0	0	3	4

OBJECTIVES

- To understand the basics of organic and inorganic compounds
- To study the kinetics of chemical reactions

UNIT I - Nomenclature and Isomerism (14 Hours)

Nomenclature of straight chain and closed ring compounds-mono and poly-functional organic compounds. Hybridisation - sp, sp² and sp³. Bond length, bond angle, dipole moment, inductive effect, mesomeric effect and hyperconjugation. Solubility- protonic and aprotic solvents. Isomerism-geometrical and optical isomerism, optical activity, asymmetry, dissymmetry, elements of symmetry, R, S notations. Reactive intermediates- carbocation, carbanion and free radicals (generation, structure and stability).

UNIT II - Carbohydrates, Benzene and Heterocyclic Compounds (12 Hours)

Classification of carbohydrates –Properties and uses of glucose and fructose-mutarotation, interconversion of glucose and fructose. Amino acids- preparation and properties of glycine and alanine. Proteins - peptide linkage - primary,secondary and ternary structure of proteins. Chemistry of benzene - preparation, mechanism of electrophilic substitution reactions. Heterocyclic compounds– Preparation and properties of pyrrole and pyridine

UNIT III - Chemistry of Hydrogen, Halogen, Silicon and Metals (12 Hours)

Occurrence, extraction and chemical properties of iron, cobalt, nickel and copper. Electrochemical theory of rusting. Position of hydrogen in periodic table, atomic hydrogen and isotopes of hydrogen. Preparation and structure of borazole, SiO₂, SiC and SiCl₄. General characteristics of halogens-interhalogens.

UNIT IV - Chemical Kinetics (12Hours)

Rate of reaction, order, molecularity, first order rate law and simple problems, half life period of first order reaction, pseudo first order reaction, zero and second order reactions. Arrhenius and collision theories - assumption, derivation, demerits-experimental determination of order of reactions.

UNIT V - Industrial Chemistry (10 Hours)

Fuels-Classification –gaseous fuels – water gas, producer gas, liquefied petroleum gas, gobar gas, and compressed natural gas. Hardness of water – temporary and

permanent hardness, disadvantages of hard water - boiler scales and sludges - softening of hard water – Zeolite process, demineralization process and reverse osmosis – Purification of water for domestic use: use of chlorine, Ozone and UV light – Definition and determinations of BOD and COD.

TEXT BOOK

1. Puri B.R., Sharma L.R., Kalia K.K., “*Principles of Inorganic Chemistry*”, Shobulal Nagin Chand & Co. 2001
2. Bahl B.S. and Arun Bahl, “*A text book of Organic Chemistry*”, 21st Edition, Sultan Chand & Co., 2012

REFERENCES

1. Puri B.R., Sharma L.R., Pathania M.S., “*Principles of Physical Chemistry*”, Vishal Publishing Company, 2008.
2. Kamaraj P. and Arthanareeswari M., Chemistry – “*A Technological approach*”, Sudhandira Publications, 3rd edition. 2006.

Subject Code	Title of the Subject	L	T	P	Total LTP	c
CDC15101	VERBAL ABILITY	2	0	0	2	2

OBJECTIVES: At the end of this course, the students will be able to answer objective questions for any verbal ability exam.

COURSE REQUIREMENT: At the end of every unit, the students will be expected to answer a model verbal ability exam.

UNIT –I

Vocabulary- Synonyms, Antonyms, Idioms and phrases, ordering of words/sentences.

UNIT –II

Grammar- Sentence improvement, Change of speech, sentence correction.

UNIT-III

Vocabulary-One word Substitute, Verbal Analogies, Closet test.

UNIT-IV

Grammar- Spotting errors, selecting words, sentence completion

UNIT-V

Vocabulary- Word Quest, Puzzles, Crossword

TEXT BOOK:

1. Raymond Murphy, Essential English Grammar, Cambridge University Press, 2007
2. Raymond Murphy, Intermediate English Grammar, Cambridge University Press, 2007
3. Raymond Murphy, Advanced English Grammar Cambridge University Press, 2007

REFERENCE

1. Prabhu.C, Vivekanandan.P “*The Essentials of Quantitative Aptitude and Verbal Aptitude*”, Enrich & Excell, BEACON, Chennai, 2012.

SEMESTER II

இரண்டாம் பருவம்

குறியீட்டு எண்	பாடம்	L	T	P	Total LTP	C
ULT15201	தமிழ் - II	4	1	0	5	4

பகுதி -1 தமிழ் இலக்கிய வரலாறு

(நூல் – தமிழ் இலக்கிய வரலாறு - முனைவர் சு.ஆனந்தன், கண்மணி பதிப்பகம், திருச்சி, 2010.)

1. சங்க இலக்கியங்கள்
2. நீதி இலக்கியங்கள்
3. பக்தி இலக்கியங்கள்
4. காப்பியங்கள்

பகுதி - 2 அ. சங்க இலக்கியம்

1. முளி தயிர் பிசைந்த... என்று தொடங்கும் குறுந்தொகை (167) பாடல் முல்லை, செவிலித்தாய் கூற்று).
2. மனை நடு வயலை வேழம் சுற்றும்... என்று தொடங்கும் ஐங்குறுநூறு (11) பாடல் (மருதம், ஐங்குறுநூறு- வேழப்பத்து.)
3. எம் வெங் காமம் இயைவது ஆயின்என்று தொடங்கும் அகநானூறு (15) பாடல் (பாலை , மகட் போக்கிய தாய் சொல்லியது)
4. கூடர் தொடஇ கேளாய்..... என்று தொடங்கும் கலித்தொகை (51) பாடல் (குறிஞ்சி, தலைவி கூற்று)
5. மண்டு அமர் அட்ட ... என்று தொடங்கும் புறநானூறு (213) பாடல், பாடியவர் : புல்லாற்றூர் எயிற்றியனார், பாடப்பட்டோன் : கோப்பெருஞ்சோழன்; திணை : வஞ்சி; துறை - துணைவஞ்சி.
6. நறவுவாய் உறைக்கும் நாகுமுதிர் ... என்று தொடங்கும் பத்துப்பாட்டு - சிறுபாணற்றுப்படை (51-67) பாடல்
7. கலந்தோர் உவப்ப எயில் பல கடையி... என்று தொடங்கும் பத்துப்பாட்டு -- மதுரைக் காஞ்சி (220-237) பாடல்.

ஆ. நீதி இலக்கியம்

1. திருக்குறள் - நட்பாராய்தல்
புலவி நுணுக்கம் (2 அதிகாரம்)
2. நாலடியார்- பொருட்பால்- மேன்மக்கள் - 5 பாடல்

இ. பக்தி இலக்கியம்

சைவம் - பன்னிரு திருமுறைகள்

1. திருஞானசம்பந்தர் தேவாரம் - முதலாம் திருமுறை
காதல் ஆகி, கசிந்து ... என்று தொடங்கும் பாடல்
2. திருநாவுக்கரசர் தேவாரம் - ஐந்தாம் திருமுறை
மாசில் வீணையும் மாலை ... என்று தொடங்கும் பாடல்
3. சுந்தரர் தேவாரம் - ஏழாம் திருமுறை
பொன்னார் மேனியனே ... என்று தொடங்கும் பாடல்
4. மாணிக்கவாசகர் - திருவாசகம் - பிடித்த பத்து
பால் நினைந்து ஊட்டும் தாயினும் சால ... என்று தொடங்கும்
பாடல்
5. திருமூலர் - திருமந்திரம்
மரத்தை மறைத்தது மாமத யானை ... என்று தொடங்கும் பாடல்

வைணவம் - நாலாயிரத் திவ்யப் பிரபந்தம்

1. பூதத்தாழ்வார்
பெருகு மத வேழம் மாப்பிடிக்கு...என்று தொடங்கும் பாடல்
2. குலசேகராழ்வார்
ஆனாத செல்வத்து அரம்பையர்கள் தற்கூழ ...என்று தொடங்கும்
பாடல்
3. பெரியாழ்வார்
எந்நாள் எம்பெருமான் ...என்று தொடங்கும் பாடல்
4. ஆண்டாள்
ஓங்கி உலகளந்த உத்தமன் ... என்று தொடங்கும் பாடல்
5. திருப்பாணாழ்வார்
சதுர மாமதில் சூழ் இலங்கைக்கு ... என்று தொடங்கும் பாடல்

இஸ்லாம்

குணங்குடி மஸ்தான் சாகிபு பாடல்கள் - தவமே பெற
வேண்டுமெனல் - 3 பாடல்கள்

கிறித்துவம்

ஆதிநந்தாவனப் பிரளயம் - ஏதேன் தோட்டம் - 3 பாடல்கள்

பகுதி 3: சிறுகதை

“ஒற்றைச் சிறகு”, இலக்கியச் சிந்தனை 2012 ஆம் ஆண்டின் சிறந்த சிறுகதைகள் தொகுப்பு.

பாட நூல்கள் :

1. முனைவர் சு.ஆனந்தன் (2010), தமிழ் இலக்கிய வரலாறு, கண்மணி பதிப்பகம், திருச்சி, 2010.
2. ஒற்றைச் சிறகு, இலக்கியச் சிந்தனை 2012 ஆம் ஆண்டின் சிறந்த சிறுகதைகள் தொகுப்பு, 2012.
3. செய்யுள் புத்தகம், தமிழ்த்துறை, அறிவியல் மற்றும் மானுடவியல் புலம், எஸ். ஆர். எம். வெளியீடு, 2014.

Subject Code	Title of the Subject	L	T	P	Total LTP	c
ULH 15201	Hindi	4	1	0	5	4

INSTRUCTIONAL OBJECTIVES

- To express and communicate literature which is part of life
- To incorporate day to day personal & professional life's need to communicate in the language.
- To help the students to imagine & express their mind through Literature .

Unit I - Poetry

(30 Hours)

1. Suprashid Dohey **Kabir, Rahim, Bihari, Surdas** -
2. Nar Ho Na Nirash Karo Mann Ko **Maithlisharan gupt** -
3. Jo Tum Aaa Jaate **Mahadevi Varma**
4. Hum Panchi Unmukt Gagan Ke **Shiv mangal singh suman** -
5. Chalawa **Santosh shreeyansh** -
6. Yahan Thi Vaha Nadi **Manglesh Dabral** -

Unit II - Story

(25Hours)

1. Eidgaha **Premchand**
2. Vapsi **Priyamvada Usha**
3. Ek Muthi Aakash **Santosh Srivastav**
4. Ek Plate Sailab **Mannu Bhandari**

Unit - III (10 Hours)

1. Anuvad : Anuvad Ki Paribhasha Evam Bhed

Unit - IV (5 Hours)

1. Anuvad : English to Hindi

Unit - V (5 Hours)

1. Administrative words

RECOMMENDED TEXTS

1. Hindi I Edited by Dr.S.Preethi, Dr. MD.Islam, Dr.S.Razia Begum.Published by Department of Hindi, FS&H,SRM.University

REFERENCES

1. Prayajon Mulak Hindi (Author - Madhav Sontakke)
2. Practcal Guide to is Translation & Composition (Author- K. P. Thakur)

Subject Code	Title of the Subject	L	T	P	Total of LTP	C
ULF15201	French-II	4	1	0	5	4

Instructional Objectives:

- Consolidate the knowledge of theoretical aspects of French grammar with examples provided from different angles: from present day literature, day to day conversation.
- Improve their oral and written skills through a combination of theory and practice.

Unité-I (15 Heures)

Quelle journée !- La conjugaison pronominale- L'impératif- L'expression de la quantité : peu, un peu de, quelque, etc.,- Les activités quotidiennes- Les achats, L'argent - **Qu'on est bien ici !** Prépositions et adverbes de lieu- Verbes exprimant un déplacement : emploi des prépositions- Le logement, La localisation, L'orientation, L'état physique, Le temps qu'il fait.

Unité-II (15 Heures)

Souvenez-vous- L'imparfait- Emploi du passé composé et de l'imparfait- Expression de la durée- L'enchaînement des idées : alors, donc, mais- Les sens réciproque- Les moments de la vie- La famille- Les relations amicales, amoureuses, familiales.

Unité-III (15 Heures)

On s'appelle ? – Les pronoms compléments directs- les pronoms compléments indirects de personne- L'expression de la fréquence et de la répétition – Les moyens de communication : courrier, téléphone, internet.

Unité-IV (15 Heures)

Un bon conseil ! – Expression du déroulement de l'action – Passé récent- Présent progressif – Futur proche – Action achevée/ inachevée – Les phrases rapportées – Les Corps – La santé et la maladie.

Unité-V (15 Heures)

Parlez-moi de vous – La place de l'adjectif – La proposition relative finale avec « qui » - C'est/il est – Impératif des verbes avec pronoms – La formation des mots – La description physique et psychologique des personnes – Les vêtements – Les Couleurs.

REFERENCE BOOK

1. “**Echo-A1**”, Méthode de français, J.GIRARDET, J.PECHEUR, CLE International, Janvier-2011.

Subject Code	Title of the Subject	L	T	P	Total of LTP	C
ULE15201	English	4	1	0	5	4

Instructional Objectives

- To enhance students' proficiency in English language.
- To enable the students to think in English.
- To become aware of the world literature and the writers.
- To equip students with the awareness and strategies needed to enable the study of English as a lifelong process.
- To engage in ongoing professional development with respect to both teaching and research.

UNIT I - Poetry (15 Hours)

1. The Hawk in the Rain by Ted Hughes
2. Crutches by Bertolt Brecht
3. Obituary- A. K. Ramanujan
4. Dream Deferred- Langston Hughes

UNIT II - Prose (15 Hours)

1. The Story of my Experiments with Truth by M.K. Gandhi (Excerpts)
2. I have a Dream by Martin Luther King
3. Farewell Speech by Mark Antony

UNIT III - Play and Short Story (15 Hours)

1. Monkey's Paw by W.W.Jacobs
2. Bear by Anton Chekhov

UNIT IV Book Review (15 Hours)

1. To kill a Mocking Bird (Excerpts)
2. Merchant of Venice (Excerpts)

UNIT V Language Component (15 Hours)

1. Transformation of Sentences
2. Jumbled Sentences
3. Précis Writing

TEXT BOOKS

1. Cambridge University Press,. Raymond Murphy, *Essential Grammar in Use* 3rd Edition 2010
2. Edited by Dr.Shanthichitra, *Glean to ACME English Tex Book* Published by Department of English, FSH, SRM University

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15201	BIOCHEMISTRY	4	0	0	5	4

OBJECTIVES

1. To make the students understand the basics of biomolecules.
2. To study structural and functional properties of carbohydrates, proteins, lipids and nucleic acids.

UNIT I - CARBOHYDRATES (10 Hours)

Definition, classification & properties of carbohydrates, epimers, anomers, glycolysis, TCA cycle.

UNIT II - LIPIDS

(12 Hours)

Definition, classification of lipids. Simple lipids- Physical and chemical properties of fats. Characterization of fat – Saponification number, acid number, iodine number , Compound lipids-Structure and function of phospholipids, glycolipids and lipoproteins. Derived lipids, Biosynthesis of fattyacid.

UNIT III - PROTEINS

(12 Hours)

Amino acids and peptides. Definition, amino acids as ampholytes. Structure and classification of amino acids based on chemical nature, Essential amino acids , Protein- classification, Structure and properties.

UNIT IV - NUCLEIC ACIDS

(12 Hours)

Structure of Purines and Pyrimidines; Nucleotides and Nucleosides. DNA: double helix: A, B and Z forms, Nucleic acid sequencing.

UNIT V - VITAMINS & MINERALS

(14 Hours)

Vitamins: Definition, Classification. Fat soluble vitamins- sources, structure and physiological functions; Water soluble vitamins-sources, structure and physiological functions. Minerals: Mineral requirement, essential macro minerals and essential micro minerals, sources and functions.

TEXT BOOKS

1. Robert K. Murray, David Bender, Kathleen M. Botham and Peter J. Kennelly, Harpers "*Illustrated Biochemistry*" 29th Edition, Mc Graw Hill 2012.
2. Lehninger, Nelson and Cox, "*Principles of Biochemistry*", 6th edition, W.H. Freeman & Company, 2013.

REFERENCES

1. Voet & Voet, "*Fundamentals of Biochemistry*", John Wiley & Sons, 2010.
Jeremy M. Berg, John L. Tymoczko and Lubert Stryer, Biochemistry, 4th Edition , Freeman and Company, 2011

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15202	BIOCHEMISTRY LAB	0	0	3	3	3

Qualitative Analysis

1. Analysis of sugars
 - a) Monosaccharide-Glucose, Fructose, Galactose, Mannose, Pentose.
 - b) Disaccharides-Sucrose, Maltose and Lactose.
 - c) Polysaccharides-Starch and Dextrin.
2. Analysis of amino acids
 - a) Histidine b) Tyrosine c) Tryptophan d) Methionine e) Cysteine f) Arginine
3. Separation of amino acids by TLC
4. Column chromatography.

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15203	Basics of Genetics	4	0	0	4	4

OBJECTIVE

1. To make the students understand the basics of genetics
2. To study structural and functional properties of cell organelles.

UNIT I

DNA as a genetic material ,Mendel's experiments, monohybrid cross, dihybrid cross, principles of segregation - independent assortment; epistasis; multiple alleles- ABO blood groups, genetic code.

UNIT II

Chromosome structure and organization in eukaryotes; Mutation - molecular nature - physical and chemical mutagens and its applications.DNA damage - mechanism of repair excision repair, recombination repair, SOS repair.

UNIT III

Chromosomal abnormalities- deletions, duplications, inversions, translocations; mutagens and mutations- types and classification; chromosomal aberration- euploidy, aneuploidy, significance.

UNIT IV

Linkage, crossing over and recombination - cytological basis of crossing over; Sex-Linked Inheritance, Chromosome mapping, Bacterial genetic system - transformation, conjugation and transduction.

UNIT V

Hardy Weinberg equilibrium, Application of Hardy Weinberg equilibrium, Random genetic drift, types of inbreeding, polygenic inheritance- characteristics of quantitative traits, types.

TEXT BOOK

1. Gardner, Simmons, Sunstad, "Principles of Genetics," 8 th edition – John Wiley and Sons, Inc., 2003.

REFERENCE

1. Monroe W. Strickberger, "Genetics," 3 rd edition – Phi Learning, 2008
2. Verma .P.S & Agarwal .K, "Cell Biology Genetics Molecular Biology Evolution & Ecology", S Chand Publication, 2004.
3. Gupta .P.K, "Cytogenetics", Rastogi Publications, 1995.
4. Gerald Karp, "Cell and Molecular Biology Concepts and Experiments", Wiley 6 th Edition, 2010.

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15204	Basics of Genetics-Lab	0	0	3	3	3

1. Microscopy and micrometry
2. Sub cellular fractionation
3. Observation of Mitosis in onion root tip
4. Observation of polytene chromosome
5. Barr body identification from buccal smear
6. Cytoplasm and nuclear staining
7. Heterochromatin –lampbrush chromosome
- 8.

COURSE CODE	COURSE NAME	L	T	P	Total of LTP	C
UBT14205	BASICS OF COMPUTERS	4	0	0	4	4

OBJECTIVE

1. To know about computer and to operate the computer.
2. To familiarize the office suite.

UNIT I - INTRODUCTION TO COMPUTER (9 Hours)

What is Computer – Evolution – Basic Components – Memory – Software Components - Input / Output Devices - External Storage Devices – Personal Computer – Work Station - Mainframes.

UNIT II - MS - WORD (9 Hours)

Introduction – User Interface – Themes and Quick Styles - Server Components

Word Basics: Parts of Word Window – Formatting Features – Menus, Commands, Toolbars and their Icons – MS Word menus in focus - Word Exercise I – Word Exercise II.

UNIT III - MS-EXCEL (9 Hours)

Introduction – Entering and Editing Text - Menus, Commands and Toolbars – MS Excel Menus in Focus - Excel Exercise-I – Alternate method - Entering formulas – Formatting Cells, Date Range – Inserting Headers & Footers – Saving a file and opening a file.

UNIT IV - MS-POWER POINT (9 Hours)

Creating a new presentation and new slide– Opening a presentation – Deleting a slide, Copying a slide – Numbering the Slides – Saving a presentation – Changing the default directory – Printing a presentation – Working with Power Point – MS Power Point Menus in focus – Formatting in Power Point.

UNIT V - MS-ACCESS (9 Hours)

Parts of an Access Window – MS Access Menus in Focus – Starting Microsoft Access – Creating a New Database – Creating Table using Table Wizard – Saving the Database - Creating Tables in design view – Query – Forms – Reports.

TEXT BOOK

1. Sanjay Saxena, "*MS Office for Everyone*", Vikas Publishing House Pvt. Ltd., New Delhi, 2010, Reprinted 2010,.

REFERENCE

1. Sinha P.K., "*Computer Fundamentals*", BPB Publications, 6th Edition, New Delhi, 2004.

Subject Code	Title of the Subject	L	T	P	Total LTP	c
CDC 15201	Quantitative Aptitude and Reasoning - I	2	0	0	2	2

Course Title: Quantitative Aptitude and Reasoning - I

COURSE OBJECTIVES : At the end of this course, the students will be able to,

- Critically evaluate various real life situations by resorting to Analysis of key issues and factors
- Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.

COURSE REQUIREMENT: At the end of every unit, the students will be expected to answer a model quantitative aptitude test for internal assessment.

UNIT - I

- Simple equations
- Ratio & Proportion
- Variation

UNIT - II

- Percentages
- Profit and loss
- Partnership
- Simple interest and Compound interest

UNIT - III

- Deductions
- Connectives

UNIT - IV

- Analytical Reasoning puzzles

- Problems on Linear arrangement
- Problems on Circular arrangement

UNIT - V

- Clocks
- Calendars
- Blood relations

TEXT BOOKS

1. R S Agarwal, "*Quantitative Aptitude*", S.Chand Publishers,2013
2. R S Agarwal, "*A modern approach to Logical reasoning*", S.Chand Publishers

REFERENCES

1. Abhijit Guha, "*Quantitative Aptitude*" - Mc Graw Hills Publishers
2. R S Agarwal, , "*A modern approach to Logical reasoning*", S.Chand Publishers

SEMESTER III

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15301	MOLECULAR BIOLOGY	3	2	0	5	4

OBJECTIVES

1. To study about the genome and its organization in prokaryotic and eukaryotic organism
2. To imparts the knowledge about the regulation of genes and chromosomal abnormalities.

UNIT I - GENOME ORGANIZATION (12 Hours)

Genome organization – Prokaryotic and Eukaryotic; Chromosome structure and function, chromatin; Chloroplast DNA; Mitochondrial DNA; Gene families; Gene Clusters

UNIT II - CENTRAL DOGMA (12 Hours)

Prokaryotic and Eukaryotic DNA replication, Transcription, Translation and regulation mechanisms – Post transcriptional modification– Post translational modifications - Ribosomes, protein biosynthesis and transportation- Different mechanisms of Signal transduction.

UNIT III - GENE REGULATION MECHANISMS (12 Hours)

General aspects of Regulation, The lactose operon model, The Galactose operon, The Arabinose operon, The Tryptophan operon, Relative positions of Promoters and Operators, Feedback Inhibition

UNIT IV - DNA REPAIR MECHANISMS (12 Hours)

DNA repair mechanisms; Mutagenesis, Mutations - Types and Mutants, Biochemical Basis of Mutants, Mutagenesis, Mutational Hot Spots, Reversion. Transposable elements - Insertion sequence and transposons, Integrons and Antibiotic-Resistance cassettes; Bacterial Genetics (Conjugation, Transformation, Generalized transduction, Specialized Transduction)

UNIT V - CHROMOSOMAL VARIATIONS AND MAPPING (12 Hours)

Chromosomal variation in Number & Structure – Chromosomal aberrations & evolution. Chromosome Mapping - Haploid mapping, Diploid mapping - Oncogenesis: Development and causes of cancer, Types of cancer, Oncogenes: Retro viral, proto, tumour suppressor gene.

TEXT BOOKS

1. Harvey Lodish, Baltimore. Arnold Berk et al. "*Molecular cell biology*" 7th edition. *Publisher*: W. H. Freeman, 2011.
2. DeRobertis, EDP, E.M.F Robertis,. Cell and molecular biology, Saunders Company, 2006.

REFERENCES

1. David Freifelder, "*Molecular Biology*", 3rd edition Jones & Bartlett publications, 2009.
2. Cooper M,. "*The cell molecular approach*", ASM Press, 2004.

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15302	BIOINSTRUMENTATION	3	2	0	5	4

OBJECTIVES

1. To provide knowledge about the various techniques in Biotechnology.
2. To understand the applications of these techniques in life science research.

UNIT I - CENTRIFUGATION

(12 Hours)

Centrifugation Principle, Types of centrifuge, Preparative and Analytical Centrifugation, Density Gradient Centrifugation, Differential centrifugation. Cell Disintegration: Physical, chemical and enzymatic methods of microbial, plant and animal cell disintegration.

UNIT II - CHROMATOGRAPHY TECHNIQUES

(12 Hours)

Theory principle and applications of Paper, TLC, Gel Filtration Chromatography, Ion Exchange Chromatography, Affinity Chromatography, GLC and HPLC.

UNIT III - ELECTROPHORESIS

(10 Hours)

Theory principle and applications of SDS -PAGE, Agarose Gel Electrophoresis 2DE, Immuno Electrophoresis.

UNIT IV - SPECTROSCOPY

(14 Hours)

Theory principle and applications of UV and Visible Spectroscopy, Fluorescence Spectroscopy, Mass spectroscopy, NMR, Atomic Absorption Spectroscopy, Flame spectrophotometry, Luminometry.

UNIT V - RADIOISOTOPES

(12 Hours)

Radioactivity - radioactive Decay. Principles and Applications of GM Counter, Scintillation Counter, Autoradiography Use of radio isotopes in Life Sciences. Safety aspects.

TEXT BOOKS

1. Keith Wilson and John walker "*Principles and Techniques of Biochemistry and Molecular biology*" 7th edition. Cambridge University Press, 2010.
2. Upadhyay, Upadhyay and Nath "*Biophysical chemistry Principles and Techniques*" Himalaya Publishing house 2009.

REFERENCES

1. Palanivelu P "*Analytical Biochemistry and Separation techniques*" 4th edition. Twenty First Century Publication, 2013.
2. Sawhney SK, Randhir Singh "*Introductory Practical Biochemistry*" 2nd edition. Alpha science International Ltd, 2005

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15303	MOLECULAR BIOLOGY LAB	0	0	4	4	3

1. Isolation of bacterial genomic DNA
2. Isolation of plant genomic DNA
3. Isolation of bacterial plasmid DNA
4. Gel electrophoresis
5. Purification of cellular DNA
6. Extraction and purification of cellular RNA
7. Southern blotting
8. Label probe / hybridization
9. Mitosis stages
10. Meiosis stages

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15304	BIOINSTRUMENTATION LAB	0	0	3	4	3

1. Paper chromatography – Carbohydrates, Amino acids.
3. Thin-layer Chromatography – Plant pigments.
4. Column Chromatography.
5. Agarose Electrophoresis.
6. SDS- PAGE.
7. Differential Centrifugation.
8. Study of UV – Visible Spectroscopy.

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT14305	BIostatISTICS	3	2	0	5	4

OBJECTIVES

1. To apply statistical methods for analyzing biological data
2. To analyze biological data and to draw inferences

UNIT I - INTRODUCTION

(12 Hours)

Statistics – Definition, functions and its limitations – Collection, Classification, Tabulation of data – Diagrammatic and Graphical representation of data.

UNIT II - MEASURES OF CENTRAL TENDENCY AND MEASURES DISPERSION

(12 Hours)

Measures of Central Tendency – Mean, Median, Mode, Geometric mean, Harmonic mean – Merits and demerits of these measures - Measures of Dispersion – Range, Quartile deviation, Mean deviation, Standard deviation, Variance, Coefficient of Variation, Skewness – Kurtosis.

UNIT III - CORRELATION AND REGRESSION ANALYSIS

(10 Hours)

Correlation – Types, scatter diagram – Karl Pearson's coefficient of correlation, Spearman's Rank Correlation – Regression – Formation of Regression lines – Uses of Regression lines.

UNIT IV - BASICS OF PROBABILITY

(12 Hours)

Basics of Probability Theory – Addition & Multiplication Rule – Binomial, Poisson and Normal Distribution and their uses in biological sciences.

UNIT V - LARGE SAMPLE TEST

(14 Hours)

Test for Mean – Test for the difference between two means – Test for proportion – Test for the difference between two proportions – Small sample Tests: Student's t-test, F-test – Analysis of variance (one-way and two-way – Basic Ideas only).

TEXT BOOKS

1. S.P.Gupta (2011), Statistical methods, Sultan Chand & Sons, 4th Edition.

REFERENCES

1. Jerold H.Zar (2009): Bio-statistical Analysis, 4th Edition, Pearson Education Inc.,
2. Dorling Kindersley (India) Pvt. Ltd., New Delhi.
3. Antonisamy.B, Solomon Christopher and Prasanna Samuel.P, (2010):
4. Bio-Statistics Principles and Practice, 1st Reprint 2011, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
5. Pvt. Ltd., New Delhi.

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15E51	DISEASE MANAGEMENT	3	0	0	3	3

OBJECTIVE

1. To create awareness on disease
2. To understand the principles of disease management.
3. To provide knowledge about stem cells.

UNIT - I

Health – Basic concepts and Definition; Need for good health; factors affecting health, Basic sanitation and personal hygiene – Food (Balanced diet) food habits and cleanliness, food adulterants, avoiding smoking, drugs and alcohol.

UNIT - II

Public Health: Communicable diseases, Mode of disease transmission (Epidemic and endemic diseases), Vaccination, Management of Hygiene in public places (Railway stations, Bus stands and other public places) hospitals – Nosocomial / Hospital acquired infections and hygiene in Educational institutions.

UNIT - III

Occupational Health and Safety: Occupational health and hazards – physical, chemical and biological hazards. Occupational diseases – Prevention and control. Health protection measures for workers – health education – first aid. Management of medical emergencies.

UNIT - IV

Disease: Introduction - principles of disease control - Infection- portal of entry; Disease- types of diseases (Deficiency, infection, pollution diseases). Microbial flora of human. Host - Parasite relationship. Management of communicable and non-communicable diseases.

UNIT - V

Health and Disease: Basic concepts and Definition, Disease control and Levels of prevention, Determinants and indicators of health, Health situation and trends in India. International bodies in health protection and promotion. Role of quarantine rules, laws and enforcement in the preventive measures of pandemic diseases.

TEXT BOOKS

1. Robbin, Cotran and Kumar .,“Robbin’s Textbook of Pathology” 6th edition, Elsevier publisher, 2013.

REFERENCE BOOKS

1. Ananantanarayan, R. and Paniker, C.J.K “Textbook of Microbiology” 8th edition. Universities Press, Orient Blackswan, 2005.
2. Park K, “Textbook of Preventive & Social Medicine” 22nd edition, Banarsidas Bhanot publishers, 2013.
3. Roger Detels, Robert Beaglehole, Mary Ann Lansang, Martin Gulliford., “Oxford Textbook of Public Health”, 5th edition. Oxford press, 2011

Subject code	Subject Title	L	P	T	Total of LTP	C
UBT15E52	Diagnostic tools	3	0	0	3	3

OBJECTIVE

1. To understand the principles of diagnostic techniques.
2. To provide knowledge about stem cells.

UNIT: I BIOTECHNOLOGY MEDICAL APPLICATIONS

Diagnostics- Introduction, medical and diagnostic products: Diagnostic kits, DNA probe, Molecular Markers - SNPs, RAPD, RFLP .

UNIT: II VACCINE & HORMONES

Preventive- Vaccination, principles of vaccine preparation, history, killed vaccine (TAB), attenuated vaccine (BCG, Sabin, Salk), polysaccharide (Hib), toxoid, limitation to current mode of vaccine production, route of administration and side effect of vaccines. Hormones – Insulin, human growth hormone, somatostatin, erythropoietin.

UNIT: III

RIA – ELISA-direct, indirect, sandwich. Flow cytometry. Monoclonal antibodies as diagnostic tools and application.

UNIT: IV

Stem cell Potential use of stem cells – Cell based therapy.

UNIT : V BIOSENSORS

Introduction to Biosensors: Concepts and applications. Application of Biosensors to environmental samples. Introduction to Biochips and their application in modern sciences. Biosensors for personal diabetes management.

TEXTBOOKS:

1. Nanotechnology, Principles and practices, S. K. Kulkarni, Capital Publishing Co.

REFERENCE BOOK:

1. Textbook of Biotechnology (2005),R.C.Dubey,S.Chand and Co.
2. Immunology, 6th Edition, Kuby, RA Goldsby, Thomas J. Kindt, Barbara, A. Osborne, Freeman, 2002.
3. Commercial Biosensor: Grahm Ramsay, John Wiley & Son, INC. (1998).

Subject Code	Title of the Subject	L	T	P	Total LTP	c
CDC 15301	Quantitative Aptitude and Reasoning - II	2	0	0	2	2

COURSE OBJECTIVES : At the end of this course, the students will be able to,

1. Critically evaluate various real life situations by resorting to Analysis of key issues and factors
2. Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.

COURSE REQUIREMENT: At the end of every unit, the students will be expected to answer a model quantitative aptitude test for internal assessment.

UNIT - I

- Numbers
- Time and Distance
- Time and Work
- Averages, Mixtures and Allegations

UNIT - II

- Data Interpretation
- Data Sufficiency
- Mensuration
- Permutation and Combinations
- Probability

UNIT - III:

- Cubes
- Venn diagrams
- Binary Logic

UNIT - IV:

- Number and letter series
- Number and Letter Analogies
- Odd man out

UNIT - V:

1. Coding and decoding
2. Direction sense test
3. Critical Reasoning
4. Lateral reasoning puzzle

TEXT BOOKS:

1. R S Agarwal, 'Quantitative Aptitude' S.Chand Publishers,2013
2. R S Agarwal,'A modern approach to Logical reasoning' S.Chand Publishers

REFERENCES:

1. Abhijit Guha, Quantitative Aptitude - Mc Graw Hills Publishers
2. R S Agarwal, , 'A modern approach to Logical reasoning' S.Chand Publishers

SEMESTER IV

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15401	BIOPROCESS TECHNOLOGY	3	2	0	5	4

OBJECTIVES

1. To study the design of the bioreactors and the kinetics and dynamics behind the bioprocess technology.
2. To ensure the students understand about the industrial processes and production of commercial products.

UNIT I - BIOREACTOR AND TYPES (12 Hours)

Introduction to Bioprocess Technology: History and Scope- Bioreactor: Design, parts and accessories, functions- Modes of Operation of fermenter – Batch & continuous - Types of reactors - Applications of Bioprocess Technology.

UNIT II - MICROBIAL KINETICS AND BIOREACTOR INSTRUMENTATION

(10 Hours)

Microbial growth kinetics: Batch and continuous reactors- Immobilized cell systems- Bioreactor instrumentation, control and monitoring variables. Computers in bioprocess control systems.

UNIT III - STRAIN IMPROVEMENT AND MEDIA FORMULATION (12 Hours)

Isolation and screening of microbes: Preservation of microbes- Strain improvement: General, mutation and recombination- Media and sterilization - Inocula preparation – Immobilization.

UNIT IV - DOWNSTREAM PROCESSING (12 Hours)

Downstream processing- Cell disruption - Recovery and purification of products, Separation of soluble products – Purification - crystallization and drying.

UNIT V - INDUSTRIAL BIOTECHNOLOGY (14 Hours)

Industrial Bioprocesses: ethanol, lactic acid production - Citric acid, acetic acid - penicillin- Streptomycin - beer, Amylase and protease, vitamin B12, PHA, biofertilizers - vermicompost, biopesticides – *Bacillus thuringiensis*, recombinant insulin and hepatitis B – Waste water management.

TEXT BOOKS

1. Stanbury PF and Whitaker A. Pergamon, (2005), "Principles of Fermentation technology", second edition reprinted 2012, Pergamon Press, Oxford.

- P.T. Kalaichelvan and I. Arul Pandi, (2007), "Bioprocess Technology".MJP Publishers, Chennai.

REFERENCES

- Wulf Crueger and Anneliese Crueger, (2000), "Biotechnology – A textbook of Industrial Microbiology", reprint 2005. Panima publishing corporation, New Delhi.
- A.H.Patel, (2000), "Industrial microbiology", Macmillan Publishers India.

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15402	ENZYMOLGY	3	2	0	5	4

OBJECTIVES

- To introduce students the different properties of enzymes and to explain how enzymes act and mediate biochemical reactions.
- To understand the basics and mechanisms of enzyme catalysis.

UNIT I - INTRODUCTION TO ENZYMES (12 Hours)

Classification - IUB system. Characteristics of enzymes, enzyme substrate complex. Concept of active centre, binding sites. Effect of temperature, pH and substrate concentration on reaction rate. Activation energy. Transition state theory. Enzyme activity, international units, specific activity, turnover number.

UNIT II - ENZYME ACTION (10 Hours)

Enzyme specificity : Group specificity, absolute specificity, Stereo-Specificity. Hypotheses of enzyme action- lock and key Hypothesis, induced fit Hypothesis. Mechanism action of chymotrypsin, lysozyme.

UNIT III - ENZYME KINETICS (12 Hours)

Kinetics of single substrate enzyme catalyzed reactions- Michaelis Menten Equation and its significance. Lineweaver Burk plot and Eadie Hofstee plots. Enzyme inhibitors, Introduction to irreversible and reversible competitive, uncompetitive and non competitive inhibitions with suitable examples.

UNIT IV - CO-ENZYMES (12 Hours)

NAD, NADP, FAD, FMN, Thiamine Pyrophosphate, Pyridoxal Phosphate, Lipoic Acid, Tetrahydro folate & Vitamin B12.

UNIT V - EXTRACTION & PURIFICATION OF ENZYMES (14 Hours)

Extraction of soluble enzymes & membrane bound enzymes - Physical and chemical methods. Preliminary purification of enzymes by various fractionation methods – advanced purification methods: different electrophoresis and chromatographic methods. Enzyme Immobilization – methods & Importance of enzyme immobilization. Properties and application of immobilized enzymes.

TEXT BOOKS

1. Nicholas C. Price and Lewis Stevens, “*Fundamentals of Enzymology*”, Oxford University Press, 2003.
2. Trevor Palmer and Philip Bonner, “*Enzymes - Biochemistry, Biotechnology, Clinical chemistry*”, 2nd edition, East-West Press Pvt. Ltd, 2004.

REFERENCES

1. Lehninger, Nelson and Cox, “*Principles of biochemistry*”, 6th edition, W.H. Freeman & Company, 2013.
2. Prakash M., Digmarti Bhaskara Rao, Jena T, *Enzyme Biotechnology*, 1st edition, Discovery Publication, 2010.

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15403	BIOPROCESS TECHNOLOGY LAB	0	0	4	4	2

1. Growth kinetics
2. Optimization of culture conditions for amylase production
3. Downstream process – purification of any one protein / enzyme from fermented broth using chromatography
4. Cell/Enzyme immobilization in alginate/polyacrylamide
5. Bread making
6. Production of wine
7. Production of citric acid
8. Mushroom cultivation
9. Qualitative analysis of any one industrial effluent
10. Vermicomposting – demonstration
11. Isolation of starch /cellulose degrading microorganism

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15404	ENZYMOLGY LAB	0	0	4	4	2

- Subcellular fractionation of organelles from liver cells and identification by marker enzymes.
- Assay of protease.
 - Determination of substrate concentration of protease activity.
 - Determination of optimum temperature of protease activity.
 - Determination of optimum pH of protease activity.
 - Determination of inhibitor of protease activity.
- Assay of Urease.
- Affinity chromatography

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15405	BIOPHYSICS	3	2	0	5	4

OBJECTIVES

- To understand the structural organization of biological macromolecules.
- To improve the knowledge of physics in biological systems.

UNIT I - MACROMOLECULAR STRUCTURE – PROTEIN (12 Hours)

Peptide bond - Torsion angles - Structural organization of protein - primary, secondary, tertiary and quaternary levels, Ramachandran plot.

UNIT II - MACROMOLECULAR STRUCTURE - NUCLEIC ACIDS (10 Hours)

Structural components of nucleic acid - Nucleosides and nucleotides - Watson and Crick model of DNA - Polymorphism of DNA - Unusual structures of DNA- Structure of tRNA.

UNIT III - APPLICATIONS OF PHYSICAL METHODS IN BIOLOGY (12 Hours)

Diffusion - Sedimentation - Separation techniques: SDS -PAGE, Agarose, HPLC, Southern blotting, Northern blotting, Western blotting, Dot blotting and hybridization.

UNIT IV - BIOMOLECULAR STRUCTURE DETERMINATION (14 Hours)

Crystal - unit cell - seven crystal systems - Bravais Lattice - X-ray diffraction - Bragg's law - Principle, instrumentation and applications of NMR - ESR - Mass spectrometry – Light microscopy - Electron microscopy.

UNIT V - CONFORMATIONAL ANALYSIS

(12 Hours)

Van der waals radii of atoms - contact distance criteria - Noncovalent forces determining biopolymer structure – dispersion forces - electrostatic interactions - van der waals interactions - hydrogen bonds - hydrophobic interactions.

TEXT BOOKS

1. Vasantha Pattabhi and N. Gautham(2009), Biophysics , Narosa Publishmg House, New Delhi,.
2. Narayanan .P (2010), Essentials of Biophysics, New Age International (P) Ltd. Publishers, New Delhi.

REFERENCES

1. D.Voet & J.G.Voet (2010), Biochemistry, John Wiley & Sons , Newyork.
2. P.S. Kalsi and N. Mahanta (2013), Biophysical Chemistry, New Academic science.

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15E53	BIOFERTILIZER TECHNOLOGY	3	0	0	3	2

OBJECTIVE

1. To provide knowledge on biofertilizer
2. To develop students technical skills on bio fertilizer production

UNIT - I: BIOFERTILIZER

Biofertilizers: Definition and types. Importance of biofertilizers in agriculture - Strain selection - Inoculum preparation - Mass production. Plant-microbe interaction - Soil ecosystem.

UNIT - II: ALGAL BIOFERTILIZER

Algal Biofertilizers - Cyanobacteria (BGA) as biofertilizers - *Anabaena*, *Nostoc* and *Tolypothrix*. Algalization, *Azolla* - *Anabaena* as biofertilizers. Mass cultivation of *Azolla* - Cyanobacterial biofertilizers - Symbiotic association - Field application of Cyanobacterial inoculants.

UNIT - III: BACTERIAL BIOFERTILIZER

Bacterial biofertilizers - *Azospirillum*, *Azotobacter*, *Frankia*, Phosphobacteria and *Rhizobium*. Isolation - Mass production of *Azospirillum*, *Azotobacter* and Phosphobacteria. N₂ fixation - Phosphate solubilization and mobilization.

UNIT - IV: FUNGAL BIOFERTILIZER

Mycorrhizal fungi as biofertilizers – Importance of Ecto, Endo and Arbuscular mycorrhizae (AM). Methods of collection and inoculum production – Application - Techniques of Ectomycorrhizal inoculums , Endo mycorrhizae of orchids.

UNIT - V: LIQUID BIOFERTILIZER

Liquid biofertilizers - Formulation – Advantages - Application methodology. Role of liquid biofertilizer in tissue culture. National and Regional biofertilizer production and development Centers.

TEXT BOOK

1. Dubey, R. C., “A Textbook of Biotechnology”, S. Chand & Co., New Delhi.

REFERENCE BOOK

- Newton, W. E. et al. “Recent Developments in Nitrogen Fixation”, Academic Press, New York.
1. Schwintzer, C. R. and Tjepkema, J. D., “The Biology of Frankia and Actinorhizal Plants”, Academic Press Inc., San Diego, USA.
 2. Subba Rao, N. S., “Soil Microbiology”, 4th ed. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
 3. Yadav, A.K., Motsara M.R and Raychaudhuri S., “Recent Advances in Biofertilizer Technology” SPURT publication, New Delhi, 2001.

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15E54	AGRICULTURAL BIOTECHNOLOGY	3	0	0	3	2

OBJECTIVES

TO MAKE THE students familiar about agriculture and the modern techniques in it.
To understand the challenges in the production and improvement of crops

UNIT - I

History of Indian Agriculture, Green Revolution in India, Cropping patterns in India, Soil, Rainfall Patterns in India.

UNIT - II

Microbes in Agriculture and Food: microbial enzymes and their applications in food processing and agro-chemical industries, agro-waste utilization, biodegradable polymers and their applications.

UNIT - III

Production and utilization of essential amino-acids, chemicals from micro-algae, Micorrhiza: Applications in agriculture and forestry.

UNIT - IV

Genetic Engineering for Crop Improvement: Plant cell and tissue culture, gene transfer techniques into plant cells, application in agricultural and food industries.

UNIT - V

Plant Pathology – Major crops and major diseases in India. Developing diseases, Drought, Salinity, Cold tolerant crops in India and its economic importance. Post harvest and storage of grains.

TEXT BOOK

1. Textbook of Agricultural Biotechnology by Dr. Ahindra Nag, PHI Learning Private Ltd., New Delhi, 2009.

REFERENCE BOOKS

1. Agricultural Biotechnology Edited by Arie Altman, Pub. Marcel Dekker, Inc., 1998
2. Biotechnology – Expanding Horizons. B. D. Singh. Kalyani Publishers, 2004.
3. Plant Genetic Engineering by J. H. Dodds, Cambridge University Press, 1983.
4. Biotechnology and Utilization of Algae – The Indian Experience. Venkataraman, V. and E.W. Becker 1985.
5. Agricultural Microbiology by Rangaswami G., Bagyaraj D.J. PHI; 2 edition, 1992.

Subject Code	Title of the Subject	L	T	P	Total LTP	c
CDC15401	COMMUNICATION SKILLS	2	0	0	2	2

OBJECTIVES: At the end of this course, the students will be able to communicate fluently and develop all the four skills in communication namely listening, speaking, reading and writing

COURSE REQUIREMENT: At the end of every unit, the students will be expected to submit an assignment or make a presentation as a part of internal assessment.

UNIT I - LISTENING SKILL

Listening comprehension and response through various modes- face-to-face conversations, telephone conversations, reading out written material, audio-video recorded material, mimes.

UNIT II - SPEAKING SKILL:

Group communication- Features of an effective, fluent speech through regular practice- role-play, extempore-situational conversations-Greetings, requests, demands, instructions and enquiries.

Informal speech- Facing audience-Body language- Conversion of mother tongue to English language, Formal speech-Paper presentation and essential aspects of Business communication.

UNIT III - READING SKILL:

Reading Comprehension-Poems, passages- conversations, short messages, e-mails, formal/informal letters, Phonics, Speed Reading, Reading comprehension strategies.

UNIT IV - WRITING SKILL:

Letter Writing- Formats and language- Types-Personal, Business, Applications, Thanks, Invitation, Condolence, Requests, Complaints-E-mail etiquette. Reports, Essay Writing.

UNIT - V

Interpersonal and intrapersonal communication- Ways to communicate in different scenarios- job interview, business meeting, project submission/proposal, informal gathering, speech for a large audience, a debate etc.- dress code, Eye contacts, body language and handshakes.

TEXT BOOK

1. Soft Skills- Know You and Know the World, Author-Dr.K.Alex.

REFERENCE BOOK

1. Communication Skills-Language in Use-Cambridge Edition.

SEMESTER V

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15501	PLANT AND ANIMAL BIOTECHNOLOGY	4	1	0	5	4

OBJECTIVES

1. To study the culture techniques of the plant tissue and animal cell culture.
2. To ensure the students understand about the production of transgenic plants and animals and transgenic products and their therapeutic application.

PLANT BIOTECHNOLOGY

UNIT I - GENOME ORGANIZATION

(10 Hours)

Plant genomic organization – nuclear, organelle genomes – mitochondria and chloroplast – inheritance pattern. *Arabidopsis thaliana* – a model plant for genome analysis.

UNIT II - PLANT TISSUE CULTURE

(12 Hours)

Plant tissue culture – basis, plant hormones in PTC – micropropagation - callus induction, organogenesis, embryogenesis, somatic embryogenesis, somaclonal variation, artificial seeds and embryo rescue, plant cell suspension culture. Protoplast culture.

UNIT III - PLANT GENETIC ENGINEERING

(12 Hours)

Plant genetic engineering – gene transfer methods – plant cloning vectors, *Agrobacterium* technology, Nitrogen fixation – Molecular biology, transgenic plants - pharmaceuticals – Bt cotton, Bt corn, Golden rice, GURT.

ANIMAL BIOTECHNOLOGY

UNIT IV - CELL CULTURE TECHNIQUES

(14 Hours)

Animal cell culture – basis, materials and methods - animal cell lines, biology of cultured cells – types of culture - Organ culture – Stem cells - basics – applications – transplantation. Pharmaceuticals from animal systems – humanized pharmaceuticals. Animal cell & systems as bioreactors.

UNIT V - ANIMAL GENETIC ENGINEERING

(12 Hours)

Animal transgenesis- methods and applications. Assisted reproduction techniques – methods of cryopreservation. Animal cloning – case study Dolly, Applications of animal biotechnology in medicine - gene therapy.

TEXT BOOKS

1. Ignacimuthu S, , "Plant Biotechnology", Tata mcgraw-Hill Pub., New Delhi, 2006.
2. Dubey R.C., , "Textbook of Biotechnology" reprint 2005.S. Chand publishers, 2001.

REFERENCES

1. Satyanarayana U., "Biotechnology" Krishna Pakashan, 2009.
2. Das H.K., , "Textbook of Biotechnology", third edition, S .Chand Publication, 2007

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15502	GENOMICS AND PROTEOMICS	4	1	0	5	4

OBJECTIVES

- 1.To understand the molecular biology in a genomic and proteomic knowledge.
2. To study the gene expression systems through computational approaches.

UNIT I - DATA ANALYSIS (12 Hours)

Biological databases – Pairwise sequence alignment and multiple sequence alignment analysis of nucleic acid/protein sequence data using web-based tools.

UNIT II - GENE PREDICTION (12 Hours)

Gene prediction approaches – prokaryotes and eukaryotes - Open Reading Frame (ORF) prediction – Hidden Markov Model – NN model – discriminant analysis - Prediction of promoter sequences

UNIT III – PROTEIN SECONDARY STRUCTURE PREDICTION (12 Hours)

Protein Secondary structure prediction – Chou-Fasman, Garnier-Osguthorpe- Robson (GOR) methods – Neural network concepts. Globular and Transmembrane structure prediction..

UNIT IV - PROTEIN TERTIARY STRUCTURE PREDICTION (12 Hours)

Homology modeling, Threading, Ab initio prediction. Methods to construct phylogenetic tree

UNIT V – DRUG DISCOVERY (12 Hours)

Drug designing – characteristics of a drug compound – drug discovery pipeline – target identification, lead compound identification, serendipity, QSAR, ADME predictions

TEXT BOOKS

1. Arthur Lesk "Introduction to Genomics" 2nd edition. Oxford University Press 2007.
2. Andreas D Baxevanis, B F Francis Oullette "*Bioinformatics: A practical guide to the analysis of genes and proteins*". 2nd edition. Wiley publishers, 2005.

REFERENCES

1. Jin Xiong "*Essential Bioinformatics*", 1st edition Cambridge University Press, 2006.
2. David Mount "*Bioinformatics: sequence and genome analysis*" 3rd edition. Cold Spring Harbor Laboratory Press, 2004.

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15503	PLANT AND ANIMAL BIOTECHNOLOGY LAB	0	0	5	4	2

1. Sterilization techniques – glasswares, media and laminar air flow chamber
2. Preparation of plant tissue culture media – MS, B5
3. Callus induction
4. Organogenesis – caulogenesis and rhizogenesis
5. Hardening and green house transfer
6. Isolation of plant genomic DNA .
7. Isolation of RNA from plant leaf tissue.
8. Isolation of plant protoplasts enzymatic method
9. Protoplast fusion by fusogen - polyethylene glycol
10. Agrobacterium mediated tumor induction
11. Preparation of animal cell culture medium.
12. Preparation of single cell suspensions from animal tissue
13. Preparation of Animal cell monolayer
14. Subculturing of cell lines
15. Cell counting – Quantitation of cells in culture
16. Cell viability assay
17. Chick embryo fibroblast culture.

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15504	GENOMICS AND PROTEOMICS LAB	0	0	4	4	2

1. Study of Internet resources in Bioinformatics.
2. Searches on MEDLINE, PubMed and CDRom bibliographic databases.
3. Introduction to sequence databases
Protein sequence databank – UNIPROT
Nucleic acid sequence databank – Gene bank, EMBL, DDBJ
4. Sequence alignment
BLAST, FASTA
Pair wise alignment- Needleman-Wunsch and Smith-Waterman algorithms
Multiple alignment- CLUSTALW, CLUSTAL X, T-COFFEE
5. Evaluation of protein structure by Swiss PDB viewer and visualization tools
RASMOL
6. Homology modeling of a given protein sequence

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15E01	HUMAN PHYSIOLOGY	3	1	0	4	3

Objectives:

1. To study an introduction to Human Body ,Cell, Blood.
2. To study about the functioning of the Cardiovascular, respiratory systems, Nervous System, Digestive and Excretory system.

UNIT I- INTRODUCTION HUMAN BODY: CELL AND BLOOD (10 Hours)

Overview of organ systems, Cell: Different types of cells, Cell Structure and its organelles, Functions of each component in the cell , Blood-Composition RBC,WBC ,Platelets.

UNIT II- DIGESTIVE AND EXCRETORY SYSTEM (10 Hours)

Digestive system- Organization, function. Excretory System- organization, Functions.

UNIT III- ENDOCRINE GLANDS (10 Hours)

Endocrine glands, different glands and their hormones, Thyroid Parathyroid glands, secretions, Maintenance of Calcium homeostasis, Maintenance of glucose homeostasis.

UNIT IV- CARDIOVASCULAR AND RESPIRATORY SYSTEMS (10 Hours)

Physiology of heart - Cardiac cycle, Parts of respiratory system , Mechanics of respiration .

UNIT V- NERVOUS SYSTEM (12 Hours)

Nerve cell anatomy, Functions of nervous system - Brain anatomy, Spinal cord, neurotransmission.

TEXT BOOKS

1. G. K. Pal, 'Text Book Of Medical Physiology', Second Edition, 2014.

REFERENCES

1. T . S. Ranganathan, *Text Book of Human Anatomy* , S.Chand &Co. Ltd.,Fifth Edition ,1996
2. Arthur.C.Guyton, John E Hall, '*Textbook of Medical Physiology*', W.B. Saunders Company, Twelfth edition, 2006
3. Kim E. Barrett , Susan M. Barman , Scott Boitano ,'*Ganong's Review of Medical Physiology*', 24th Edition, 1 May 2012

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15E02	MEDICAL BIOTECHNOLOGY	3	1	0	4	3

OBJECTIVES

1. To study about the medicinal approach of Biotechnology and recent advancements in diagnosis.
2. To understand the various techniques and advancements of biotechnology in the field of medicine.

UNIT I - ART AND ACC

(12 Hours)

Assisted reproductive technology- Pregnancy diagnosis - Animal cell culture-media, maintenance and culture of primary, secondary and continuous cell lines- organ culture- applications- cancer cell lines- apoptosis.

UNIT II - CHROMOSOMAL DISORDERS

(14 Hours)

Chromosomal disorders – Gene controlled diseases –Identification of disease genes- Haemophilia, DMD, Alzheimer's – Molecular basis of human diseases: Pathogenic mutations – Oncogenes - Loss of function - Tumour Suppressor Genes- Immunopathology: Hepatitis, Autoimmune Disorders.

UNIT III - DIAGNOSTICS METHODS

(10 Hours)

Prenatal diagnosis - Invasive techniques and Non-invasive techniques – Diagnosis of pathogenic microbes: Classical and modern methods- Diagnosis using protein and enzyme markers, DNA/RNA based diagnosis - Molecular markers - Microarray technology - genomic and cDNA arrays.

UNIT IV - PREVENTION AND TREATMENT

(12 Hours)

Vaccines-conventional, recombinant, synthetic peptide, anti-idiotypic, DNA vaccines- Deletion mutant and vaccinia vector vaccine- Antibiotics-mode of action- antibacterial, antifungal, antiviral, antitumor antibiotics- synthetic chemotherapeutic agents- development of microbial resistance to antibiotics.

UNIT V - MODERN MEDICINE

(12 Hours)

Hybridoma technique for MAb production and applications- Gene therapy: Ex vivo, In vivo, In situ- Cell and tissue engineering- Stem cell therapy- Nanomedicines- Gene products in medicine – Humulin, Erythropoietin, Growth Hormone/Somatostatin, tPA, Interferon.

TEXT BOOKS

1. Jogdand, S. N.. Medical Biotechnology, Himalaya Publishing house, Mumbai, 2005.
2. Click, B. R. and Pasternak.. Molecular Biotechnology: Principle and applications of recombinant DNA. ASM Press, 2010.

REFERENCES

1. Ramasamy, P.. “Trends in Biotechnology”, University of Madras, Pearl press, 2002.
2. Trevan.. “Biotechnology”. Tata McGraw-Hill, 2005.

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15E03	BIOINFORMATICS	3	1	0	4	3

OBJECTIVES

1. To study the analysis of macromolecules and genetic material using bioinformatics tools
2. To gain brief knowledge about analysis of sequences.

UNIT I - INTRODUCTION TO BIOINFORMATICS (12 Hours)

Biological data formats. Application of bioinformatics in various fields.

UNIT II - BIOLOGICAL DATABASES (12 Hours)

Nucleotide databases - Protein Sequence Databases – PDB - Various Data retrieval formats in biological databases – ENTREZ, SRS

UNIT III - SEQUENCE ANALYSIS (14 Hours)

Sequence similarity, identity and homology - Definitions of homologues, orthologues and paralogues. Scoring matrices .Pairwise Sequence Alignment: Dot matrix, Dynamic programming alignment, BLAST and FASTA.

UNIT IV - PHYLOGENETIC ANALYSIS (12 hours)

Multiple Sequence Alignment – Progressive and Heuristic approach – Evolutionary analysis: distances - clustering methods - Bootstrapping strategies – phylogenetic trees – rooted and unrooted tree.

UNIT V - DRUG DISCOVERY (10 Hours)

Discovering a drug - target identification and validation - identifying the lead compound - optimization of lead compound - chemical libraries.

TEXT BOOKS

1. Andreas D. Baxevanis, B. F. Francis Ouellette (Editor) (2005), Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, 3rd Edition. Wiley publishers.
2. Jin Xiong (2006) Essential Bioinformatics 1st edition. Cambridge University Press.

REFERENCES

1. David W. Mount (2004) Bioinformatics: Sequence and Genome Analysis 3rd edition. Cold Spring Harbor Laboratory Press.
2. Arthur M. Lesk (2007) Introduction to Genomics 2nd edition. Oxford University Press.

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15E04	BIOETHICS, IPR AND BIOSAFETY	3	1	0	4	3

OBJECTIVES

1. To help the students to understand the ethical, social, legal aspects in biology.
2. To learn the importance of biosafety in research.

UNIT I - BIOETHICS

(12 Hours)

Bioethics - legal and socioeconomic impacts of biotechnology- ethical concerns of biotechnology research and innovation, Bioethics committees.

UNIT II - INTELLECTUAL PROPERTY RIGHTS

(12 Hours)

Intellectual property rights - patent, copyright, trade mark, TRIPS- GATT and PBR, WTO.

UNIT III - PATENTS AND PATENT LAWS

(12 Hours)

Patent system – patenting laws - Legal development- Patentable subjects and protection in biotechnology - patenting living organisms.

UNIT IV - BIOSAFETY

(2 Hours)

GLP - Containment facilities – Biosafety levels - Genetically modified organisms - Genetically modified foods, Biosafety guidelines – National and International.

UNIT V - BIODIVERSITY

(12 Hours)

Basic concepts of Biodiversity - Elements of Biodiversity - Ecosystem Diversity, Genetic Diversity, Species Abundance & Diversity.

TEXT BOOKS

1. Singh B.D., Biotechnology, kalyani publishers, 2009.
2. Chawla H.S., Introduction to plant Biotechnology, Science publishers, 2004.

REFERENCES

1. Shaleesha A, Stanley, Bioethics, Wisdom educational service, 2008.
2. Das H.K., Text book of Biotechnology, Wiley Publishers, 2010.

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UES15501	ENVIRONMENTAL STUDIES	3	0	0	3	3

INSTRUCTIONAL OBJECTIVES

- To gain knowledge on the importance of environmental education and ecosystem.
- To acquire knowledge about environmental pollution- sources, effects and control measures of environmental pollution.
- To understand the various energy sources, exploitation and need of alternate energy resources. Disaster management .
- To acquire knowledge with respect to biodiversity, its threats and its conservation and appreciate the concept of interdependence.
- To be aware of the national and international concern for environment for protecting the environment

UNIT I - ENVIRONMENTAL EDUCATION AND ECOSYSTEMS (6 hours)

Environmental education: Definition and objective. Structure and function of an ecosystem – ecological succession –primary and secondary succession - ecological pyramids – pyramid of number, pyramid of energy and pyramid of biomass.

UNIT II - ENVIRONMENTAL POLLUTION (6 hours)

Pollution – Air, water, soil –causes and effects and control measures . Specifically: acid rain, ozone layer depletion, green house gas effect and global warming. Waste management : prevention and control measures of solid waste.(General).

National concern for environment: Important environmental protection Acts in India – water, air (prevention and control of pollution) act, wild life conservation and forest act . Functions of central and state pollution control boards. Issues involved in enforcement of environmental legislation.

UNIT III - BIODIVERSITY AND ITS CONSERVATION (6 hours)

Introduction: definition - genetic, species and ecosystem diversity – bio diversity hot spots - values of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - threats to biodiversity: habitat loss, poaching of wildlife – endangered and endemic species of India, Conservation of biodiversity: in-situ and ex-situ conservations.

UNIT IV - : ENERGY RESOURCES AND CONSERVATION (6 hours)

Energy resources and their exploitation. . Conventional energy sources: -coal, oil, biomass and nature gas (overview)- over- utilization.. Non-conventional energy sources: hydroelectric power, tidal, wind, geothermal energy, solar collectors, photovoltaic, nuclear-fission and fusion. Energy use pattern and future need projection in different parts of the world, energy conservation policies.

UNIT IV - : NATURAL HAZARDS AND DISASTER MANAGEMENT (6 hours)

Natural and Man made disasters -types, causes, onset, impacts. (viz. earthquake,flood, drought, cyclone, tsunamic, volcanics, landslide, industrial accidents.). Forecasting and managements

TEXT BOOKS

1. Jeyalakshmi.R, “*Principles of Environmental Science*”, 1st Edition, Devi Publications, Chennai, 2006.
2. De.A.K., “*Environmental Chemistry*”, New Age International, New Delhi, 1996.
3. Sharma.B.K. and Kaur, “*Environmental Chemistry*”, Goel Publishing House, Meerut, 1994.

REFERENCES

1. Dara S.S., “*A Text Book of Environmental Chemistry and pollution control*”, S.Chand & Company Ltd., New Delhi, 2004.
2. Dr.Rahavan Nambiar, “*Textbook of Environmetal studies.Scitech Publication (India)Pvt.Ltd.Second edition.*

SEMESTER VI

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15601	BIOLOGY OF IMMUNE SYSTEMS AND IMMUNOTECHNOLOGY	4	1	0	5	4

OBJECTIVES

1. To access knowledge in Immunology and to understand their practical applications.
2. To understand the mechanism of immune system.

UNIT I - OVERVIEW OF THE IMMUNE SYSTEM (12 Hours)

Introduction to immunology, Types of immunity, Overview of immune system, Lymphoid organs.

UNIT II - IMMUNOGLOBULIN STRUCTURE AND FUNCTIONS (12 Hours)

Antigen and antigenicity, Immunoglobulins – structure and function, components of complement system, Major histocompatibility complex.

UNIT III - ANTIGEN – ANTIBODY INTERACTIONS (12 Hours)

Antigen - antibody interaction, Phagocytosis, monoclonal antibody production and applications; immunodiagnosis.

UNIT IV - CELL MATURATION, ACTIVATION AND DIFFERENTIATION (12 Hours)

Cell mediated immunity; T cell activation -Humoral response; B cell activation and proliferation- Cytokines, hypersensitive reactions.

UNIT V - IMMUNE SYSTEM IN HEALTH & DISEASES (12 Hours)

Autoimmunity, vaccines and immune response to infectious diseases, Immunodeficiency diseases (AIDS) -immune suppression & transplantation.

TEXT BOOKS

1. Richard A. Goldsby "*Immunology*"
2. Barbara, A. Osborne, Janis Kuby *Immunology*, 5th Edition., W. H. Freeman & Company, 2006.

REFERENCES

1. Janeway, Travers, Walport, Shlomchik, Garland, "*Immunobiology*" 6th Edition, 2007 .

2. Ivan Riott, "Essential immunology", Blackwell Science, 9th Edition, 2007.

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15602	rDNA TECHNOLOGY	4	1	0	5	4

OBJECTIVES

- To help the students to understand about the cloning strategies, expression pattern, in genetic Engineering.
- To understand techniques involved in the rDNA technology and applications in the advancement of Biotechnology.

UNIT I - RESTRICTION ENZYMES (10 Hours)

History, origin, recognition site, types, artificial enzymes, nomenclature, application, factors influence restriction enzyme activity, DNA modifying enzymes..

UNIT II - RECOMBINANT VECTORS (12 Hours)

Plasmid cloning vector PBR322, Vectors based on the lambda Bacteriophage, Cosmids, M13 vectors, Expression vectors, Vectors for cloning and expression in Eukaryotic cells, Super vectors: YACs and BACs.

UNIT III - CLONING STRATEGIES (14 Hours)

History of molecular cloning, Steps in molecular cloning Choice of host organism and cloning vector, Preparation of vector DNA ,Preparation of DNA to be cloned ,Creation of recombinant DNA with DNA ligase, Introduction of recombinant DNA into host organism ,Selection of organisms containing vector sequences, Applications of molecular cloning.

UNIT IV - GENE TRANSFER (12 Hours)

Bacterial Conjugation, Transformation, Transduction, Episomes, Microinjection, Electroporation, Microprojectile, Shot Gun method, Ultrasonication, Liposome fusion, Microlaser.

UNIT V - POLYMERASE CHAIN REACTION

(12 Hours)

History, variants of PCR- RT - PCR, multiplex PCR, nested PCR- Identification of PCR product- Factors influencing PCR- Cloning of PCR products- Application of PCR technology - Molecular markers: RFLP, RAPD, AFLP, SSCP and SNP,

TEXT BOOKS

1. Sandy B. Primrose and Richard Twyman, , *"Principles of Gene Manipulation and Genomics"*, 2009.
2. Desmond S. T. Nicholl., *"An Introduction to Genetic Engineering"* 2008.

REFERENCES

1. Russ Hodge and Nadia Rosenthal, *"Genetic Engineering: Manipulating the Mechanisms of Life"* (Genetics & Evolution) 2009.
2. Howe C. J., *"Gene Cloning and Manipulation"* 2007.

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15603	IMMUNOLOGY LAB	0	0	3	3	2

1. Single Radial immuno diffusion
2. Countercurrent immunoelectrophoresis
3. ODD
4. Immunoelectrophoresis
5. RIE
6. DOT ELISA
7. Separation of mononuclear cells from peripheral blood.
8. Blood grouping

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15604	rDNA TECHNOLOGY LAB	0	0	3	3	2

1. Isolation of Genomic DNA
2. Plasmid preparation
3. Restriction enzyme digestion
4. Ligation
5. DNA molecular size determination
6. Transformation
7. Identification of Recombinants

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15E05	ENVIRONMENTAL BIOTECHNOLOGY	4	1	0	5	4

OBJECTIVES

1. To provide sound knowledge about ecosystem.
2. To make students understand the environmental crisis and about its control measures.

UNIT I - ECOSYSTEM

(12 Hours)

Ecosystem structure and functions, abiotic and biotic component, Energy flow, food chain, food web, Ecological Pyramids-types, biogeochemical cycles.

UNIT II - POLLUTION

(12 Hours)

Environmental problems - ozone depletion, green house effect, water, air and soil pollution - Control measures.

UNIT III - BIOREMEDIATION

(12 Hours)

Introduction, constraints and priorities of Bioremediation, Biostimulation of Naturally occurring microbial activities, Bioaugmentation, in situ, ex situ, intrinsic & engineered bioremediation.

UNIT IV - METAL BIOTECHNOLOGY

(12 Hours)

Mining—heavy metals, Microbial transformation, accumulation and concentration of metals, metal leaching, extraction and future prospects.

UNIT V - BIOFUELS

(12 Hours)

Microorganisms and energy requirements of mankind; Production of non conventional fuels - Methane (Biogas), Hydrogen, Alcohols and algal hydrocarbons, Use of microorganisms in augmentation of petroleum recovery.

TEXT BOOKS

1. Agarwal S. K., "Advanced Environmental Biotechnology", APH Publishing, 2005.
2. Thakur S, "Environmental Biotechnology: Basic Concepts and Applications", I K International Publishing House, 2006.

REFERENCES

1. Chandrawati Jee, Shagufta, , “*Environmental Biotechnology*”, APH Publishing, 2007.
2. Hans-Joachim Jördening, Josef Winter, “*Environmental Biotechnology: Concepts and Applications*”, Wiley, 2006.

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15E06	NANOBIOTECHNOLOGY	4	1	0	5	4

OBJECTIVES

1. To learn the application of nanotechnology in biological system
2. To help the students to understand about nanomaterial and nanomedicine

UNIT I - NANOMATERIALS

(12 Hours)

Introduction to nanotechnology and nanobiotechnology - Nanomaterial: Carbon nanomaterial, Fullerenes, Nanotube, Nanowire.

UNIT II - TECHNIQUES IN NANOBIOTECHNOLOGY

(14 Hours)

Nanofabrication: Photolithography -Electron-Beam Lithography - Nanoimprint lithography- Softlithography Patterning. Techniques used in nanotechnology : Electron Microscopy, X Ray Diffraction, Atomic Force Microscopy.

UNIT III - BIOSENSORS

(12 Hours)

Nanobiotechnological devices: Nanoparticles, Dendrimers, Nanorobots, Nubot, Nanoshell. Biosensors -Antibodies as biosensors - Biosensors detects glucose levels for management of diabetes .

UNIT IV - BIOPOLYMERS

(12 Hours)

Biopolymer - polymer nanofibers - electrospinning method and their biomedical applications, polymer nanocomposite- bone and dental restorations, polymer controlled drug delivery for the treatment of cancer.

UNIT V - NANOMEDICINE

(10 Hours)

Nanomedicine today - Drugs may be delivered with liposomes –Artificial blood saves life – Gene therapy corrects genetic . Implications of nanotechnology in the society. Positive and negative aspects of nanotechnology.

TEXT BOOKS

1. David S. Goodsell, “*Bionanotechnology*”, John wiley & sons inc., publications, 2004.

2. Shanmugam.S, "Nanotechnology", MJP publishers, 2010.

REFERENCES

1. Niemeyer, C.M. Mirking C.A., "Nanobiotechnology concepts, Applications and Perspectives", 2004.
2. Manasi Karkare, "Nanotechnology", I.K. International publishing House Pvt.Ltd, 2008.

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15E07	CANCER BIOLOGY	4	0	0	4	4

Total Hours: 30

OBJECTIVES

1. To provide knowledge about biological aspects of cancer
2. To impart basic concepts of cancer biology, various stages in carcinogenesis, molecular cell biology of cancer, cancer metastasis, and cancer therapy.

UNIT 1 FUNDAMENTALS OF CANCER BIOLOGY (6 Hours)

Regulation of Cell cycle, Mutations that cause changes in signal molecules, effects on receptor, signal switches, tumour suppressor genes, Modulation of cell cycle-in cancer, Different forms of cancers, Diet and cancer.

UNIT 2 PRINCIPLES OF CARCINOGENESIS (6 Hours)

Chemical Carcinogenesis, Metabolism of Carcinogenesis, Natural History of Carcinogenesis, Targets of Chemical Carcinogenesis, Principles of Physical Carcinogenesis, X-Ray radiation – Mechanism of radiation Carcinogenesis.

UNIT 3 PRINCIPLES OF MOLECULAR CELL BIOLOGY OF CANCER (6 Hours)

Oncogenes, Identification of Oncogenes, Retroviruses and Oncogenes, detection of Oncogenes, Growth factor and Growth factor receptors that are Oncogenes. Oncogenes / Proto Oncogenes activity. Growth factors related to transformations.

UNIT 4 PRINCIPLES OF CANCER METASTASIS (6 Hours)

Clinical significances of invasion, heterogeneity of metastatic phenotype, Metastatic cascade, Basement membrane disruption, Three step theory of invasion, Proteinases and tumour cell invasion.

UNIT 5 NEW MOLECULUS FOR CANCER THERAPY (6 Hours)

Different forms of therapy, Chemotherapy, Radiation Therapy, Detection of Cancers, Prediction of aggressiveness of Cancer, Advances in Cancer detection.

TEXT BOOKS :

1. King R.J.B., *Cancer Biology*, Addison Wesley Longmann Ltd, U.K., 1996.

REFERENCES :

1. Maly B.W.J., *Virology a practical approach*, IRL press, Oxford, 1987.
2. Dunmock.N.J and Primrose S.B., *Introduction to modern Virology*, Blackwell Scientific Publications.
3. Ruddon.R.W., *Cancer Biology*, Oxford University Press, Oxford, 1995.

COURSE CODE	COURSE TITLE	L	T	P	Total of LTP	C
UBT15E08	PHARMACOGENOMICS	4	0	0	4	4

OBJECTIVES

1. To describe how pharmacogenomics can be utilized to improve the efficacy of certain drugs or reduce potential adverse effects.
2. To explain the current recommendations for pharmacogenomic implementation and the information necessary to advance emerging scenarios into clinical practice.
3. To summarize some of the key ethical, legal, and economic issues involved with pharmacogenomic testing and data collection.

UNIT - I (12 Hours)

Basic Human Genetics and Genomics: DNA as the genetic material, genetic code, flow of genetic information, mutation - Principles of inheritance and probability rules - Non-Mendelian inheritance

UNIT - II (12 Hours)

Human Cytogenetics: Organization of cell and cell cycle - Cell division (Mitosis, Meiosis) -Chromatin structure and chromosome organization - Techniques of chromosome analysis Karyotyping, C-,G-banding and fluorescence banding, nomenclatures of bandings In-situ hybridization techniques

UNIT - III (12 Hours)

Clinical Genetics & Genetic Counselling: Genetic Disorders - Classification of genetic disorders - Single gene Disorders (Cystic Fibrosis, Marfan's syndrome) - Multifactorial disorders (Diabetes, Atherosclerosis, Schizophrenia) - Molecular Techniques PCR-RFLP, ARMS-PCR , Multiplex-PCR , DNA Sequencing

UNIT - IV (12 Hours)

Recombinant DNA Technology & Immunology: Bacterial culture, Restriction enzymes, Vectors, Transformation and transfection, Immunology, Overview of immune system, Antigens and antibodies, Antigen-antibody interactions, Major Histocompatibility Complex (MHC), HLA typing, Immunotherapy

UNIT - V (12 Hours)

Developmental & Reproductive Genetics: Overview of human development and developmental disorders (DiGeorge syndrome, neural tube defect, cleft lip and palate, microcephaly) - Sex Determination Hormonal basis of sexual differentiation Reproductive organs and gonads - Assisted Reproductive technologies (ART) - Ethical and legal issues

TEXTBOOK

1. Concepts in Pharmacogenomics: Edited By: Dr. M. Zdanowicz, ASHP Publications , 2010

REFERENCES

1. Pharmacogenomics Werner Kalow, Urs B. Meyer, Rachel F. Tyndale CRC Press, 08-May-2001
2. Handbook of Pharmacogenomics and Stratified Medicine, Sandosh Padmanabhan, Imprint: Academic Press May 2014
3. Pharmacogenomics An Introduction and Clinical Perspective by Joseph S. Bertino , Angela Kashuba , Joseph D. Ma, Uwe Fuhr , 2012.