KONGUNADU ARTS AND SCIENCE COLLEGE

(AUTONOMOUS)

COIMBATORE – 641 029

DEPARTMENT OF BIOTECHNOLOGY (UG)

CURRICULUM AND SCHEME OF EXAMINATIONS (CBCS)

(2019 - 2020 and onwards)

Vision

Developing the total personality of every student in a holistic way by adhering to the principles of Swami Vivekananda and Mahatma Gandhi.

Mission

- Imparting holistic and man-making education with emphasis on character, culture and value - moral and ethical.
- Designing the curriculum and offering courses that transform its students into value added skilled human resources.
- Constantly updating academic and management practices towards total quality management and promotion of quality in all spheres.
- Extending the best student support services by making them comprehensive and by evolving a curriculum relevant to student community and society at large.
- Taking steps to make education affordable and accessible by extending scholarships to the meritorious and economically disadvantaged students.
- Moulding the teachers in such a way that they become the role models in promoting Higher Education

DEPARTMENT OF BIOTECHNOLOGY

Vision

- To nurture world-class bioengineers with a potential to innovate, invent and disseminate knowledge for the benefit of society and environment.
- To develop the candidate with zeal towards Life Sciences with the spirit of moral, ethics, life and character building required for future Good Human being, a Genuine Scientist, a Hardworking Person, as Entrepreneur and as Bread Earner.
- To produce competent Biotechnologist's who can employ premium processes and applications which will profoundly influence the existing paradigm of agriculture, industry, healthcare and restoration of environment providing sustainable competitive edge to present society.

Mission

- The Department of Biotechnology of Kongunadu Arts and Science College, a family of Enthusiastic students, Committed teachers and Independent thinkers working and learning together to shape the future.
- We focus on implementing the valued education in the Life Sciences to bring about a new revolution in the field of Biotechnology.
- We encourage and comfort the candidate with the passion to undergo in the future to take the alleyway of education and research to serve the World with new energy of knowledge and beneficial products as life saver.

B.Sc. BIOTECHNOLOGY

PROGRAMME OUTCOME (PO)

PO1: Realization of cultural, social and ethical acceptance to impart sound minds and make better society

PO2: Acquire knowledge on the basic concepts of structure, morphological features, and physiological functions of biotic and abiotic forms

PO3: Understand the technical need, functioning and application of basic and higher necessity gadgets for a basic and improved knowledge

PO4: Understand the fundamentals of molecular biology theories and techniques for rational development in society

PO5: Gain a proper and complete insight on the new and updated technologies available to solve the present date crisisin the core and allied areas of Biotechnology

PO6: Apply acquired fundamental technical knowledge and skill to find feasible practical solutions to technological challenges and problems

PO7: Graduates will be able to realize the need and impact of biotechnological solutions on environment and societal context keeping in view need for sustainable solution

PO8: Adopt new and innovative technology, by continuously updating their knowledge for achieving personal and organizational development.

PROGRAMME SPECIFIC

OUTCOME (PSO) PSO1

Apply knowledge of applied science and research fundamentals in the area of biotechnology – cell and molecular biology, microbial technology, genomics, proteomics, genetic engineering, advanced plant and animal sciences, computational biology, etc.

PSO2

Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PSO3

Understand the impact of the biological solutions / needs in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. Apply ethical principles and commit to professional ethics and responsibilities and norms of the current practice.

PSO4

Demonstrate knowledge and understanding of concepts, principles and experimental approaches in Biotechnological to one's own work, as a member and leader in a team. Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

PSO5

Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

UBT01

KONGUNADU ARTS AND SCIENCE COLLEGE (Autonomous)

COIMBATORE-641 029.

B.Sc. BIOTECHNOLOGY

Curriculum & Scheme of Examination under CBCS

(Applicable to Students Admitted from the Academic Year 2019-2020 and onwards)

Semester	Part	Subject Code	Title of the Paper	Instruction Hours / cycle	Exam. Marks			Duration of Exam. Hrs.	Credits
					CIA	ESE	Total		
I	I	19TML101@	Language I	6	25	75	100	3	3
	II	19ENG101	English I	6	25	75	100	3	3
	III	19UBT101	C.P.1 – Cellular Biology	4	25	75	100	3	4
		19UBT102	C.P.2. - Bioinstrumentation and Environmental Biotechnology	4	25	75	100	3	4
		19UCH1A1	Allied - Paper 1: Chemistry – I	4	20	55	75	3	4
		19UBT1CL	C.Pr.1 – Lab in Cellular Biology and Bioinstrumentation	2	20	30	50	3	2
		19UCH1AL	Allied Pr.1 - Chemistry Practical	2	-	-	-	-	-
	IV	19EVS101	Environmental Studies*	2	95	50	50	3	2
			Total	**30**			**575**	**-**	**22**
II	I	19TML202@	Language II	6	25	75	100	3	3
	II	19ENG202	English II	6	25	75	100	3	3
	III	19UBT203	C.P.3. – Microbiology	6	25	75	100	3	4
		19UCH2A2	Allied - Paper 2: Chemistry – II	5	20	55	75	3	4
		19UBT2CM	C.Pr.2- Lab in Microbiology	3	20	30	50	3	2
		19UCH2AL	Allied Pr.1 - Chemistry Practical	2	20	30	50	3	2
	IV	19VED201	Value Education - Moral and Ethics*	2	-	50	50	3	2
			Total	**30**			**525**	**-**	**20**
III	I	19TML303@	Language III	6	25	75	100	3	3
	II	19ENG303	English III	6	25	75	100	3	3
	III	19UBT304	C.P.4 – Molecular Biology	4	25	75	100	3	4
		19UBT305	C.P.5 – Genetics	4	25	75	100	3	4
		19UBT3A3	Allied - Paper 3 : Basic Mathematics and Statistics	4	20	55	75	3	4
		19UBT3CN	C.Pr.3- Lab in Molecular Biology and Genetics	2	20	30	50	3	2
	IV	19UGA3S1	Skill Based Subject: 1 General Awareness	2	25	75	100	3	3
		19TBT301/ 19TAT301/ 19UCA3N1	Basic Tamil* / Advanced Tamil** / Non Major Elective-I***	2	-	75	75	3	2
			Total	**30**			**700**	**-**	**25**

IV	I	19TML404[@]	Language	6	25	75	100	3	3
	II	19ENG404	English IV	6	25	75	100	3	3
	III	19UBT406	C.P.6 – Fundamentals of Biochemistry	5	25	75	100	3	4
		19UBT4CO	C.Pr.4- Lab in Biochemistry	3	20	30	50	3	2
		19UBT4A4	Allied - Paper 4 : C - Programming and Numerical Methods	4	20	55	75	3	4
		19UBT4AL	Allied Pr. 1 – Lab in C-Programming	2	20	30	50	3	2
	IV	19UBT4S2	Skill Based Subject: 2 – Clinical LabTechnology – I – Pathology	2	25	75	100	3	3
		19TBT402/ 19TAT402/ 19UCA4N1	Basic Tamil* / Advanced Tamil** / Non Major Elective - II***	2	-	75	75	3	2
			Total	**30**	**-**	**-**	**650**	**-**	**23**
V	III	19UBT507	C.P.7- Immunology	6	25	75	100	3	4
		19UBT508	C.P.8- Recombinant DNA Technology	6	25	75	100	3	4
		19UBT509	C.P.9 - Animal Biotechnology	5	25	75	100	3	4
		19UBT5CP	C.Pr.5 – Lab in Immunology, Recombinant DNA Technology and Animal Biotechnology	6	40	60	100	4	3
		19UBT5E1	Major Elective - I	5	25	75	100	3	5
	IV	19UBO5X1/ 19UBC5X1/ 19UZO5X1	Extra Departmental Course (EDC) – 1	2	25	75	100	3	3
		19UBT5ST	Summer Internship ****	-	-	-	-	-	-
			Total	**30**	**-**	**-**	**600**	**-**	**23**
VI	IV	19UBT610	C.P.10 - Bioprocess technology	5	25	75	100	3	4
		19UBT611	C.P.11 - Plant Biotechnology	5	25	75	100	3	4
		19UBT612	C. P. 12–Genomics, Proteomics and Bioinformatics	5	25	75	100	3	4
		19UBT6CQ	C.Pr.6- Lab in Bioprocess technology, Plant Biotechnology and Bioinformatics	5	40	60	100	4	3
		19UBT6E2	Major Elective – II	5	25	75	100	3	5
		19UBT6Z1	Practicum and Viva - Voce****	3	20	80	100	3	3
	V	19UBT6S3	Skill Based Subject: 3 – Clinical Lab Technology – II – Hematology	2	25	75	100	3	3
		19UBT5SL	Skill Based Subject: 4 – Practical Clinical Lab Technology¥	-	-	-	-	-	-
	VI	19NSS101/ 19NCC101/ 19PYE101/ 19YRC101[#]	Extension Activities**	-	50	-	50	-	1
			Total	**30**	**-**	**-**	**750**	**-**	**27**
			Grand Total	**180**			**3800**	**-**	**140**

@ French/Hindi/Malayalam/Sanskrit

***** No End of Semester Examinations (ESE). Only Continuous Internal Assessment (CIA)

****** No Continuous Internal Assessment (CIA). Only End of Semester Examinations (ESE)

*** Non Major Elective subjects; No CIA examination. Only ES Examinations

UBT03

******** Practicum – 60 marks; Viva-voce – 20 marks; Internal – 20 marks

******** The students shall undergo an Internship training/field work for a minimum period of 2 weeks at the end of the fourth semester during summer vacation and submit the report in the fifth semester. The report will be evaluated for 100 marks along with the internal viva voce by the faculty members and HoD. According to their marks, the grades will be awarded as given below.

Marks %	Grade
85-100	O
70-84	D
60-69	A
50-59	B
40-49	C
<40	U (Reappear)

Major Elective Papers (2 papers are to be chosen from the following 6 papers)

1. Research Methodology and Biostatistics
2. Bioentrepreunership
3. Bionanotechnology, IPR and Biosafety
4. Natural Products and Algal Biotechnology
5. Enzyme Technology
6. Developmental Biology

Non-Major Elective Papers

1. Human Rights 2. Women's Rights 3. Consumer Affairs

Skill Based Subjects

1. General Awareness (On-line Examination)
2. Clinical Lab Technology – I: Pathology
3. Clinical Lab Technology – II: Hematology
4. Practical: Clinical Lab Technology[¥]

[¥]The students shall attend the practical during fourth semester through the MoU signed between College and reputed Clinical laboratory and submit the practical record book and report. The report will be evaluated for 100 marks along with the internal viva voce by the faculty members and HoD. According to their marks, the grades will be awarded in the mark sheet as given below.

Marks %	Grade
85-100	O
70-84	D
60-69	A
50-59	B
40-49	C
<40	U (Reappear)

UBT04

List of Extra Departmental Courses (EDC)

S. No.	Subject code	Subject	Offering Department
1.	19UBC5X1	Diagnostic Biochemistry	Biochemistry
2.	19UBO5X1	Medicinal Botany	Botany
3.	19UZO5X1	Ornamental Fish Culture Technology	Zoology

 # List of Extension Activities:

1. National Cadet Corps (NCC)
2. National Service Scheme (NSS)
3. Youth Red Cross (YRC)
4. Physical Education (PYE)
5. Eco Club (ECC)
6. Red Ribbon Club (RRC)
7. Women Empowerment Cell (WEC)

Job Oriented Courses (JOC)

1. Clinical Research and Medical Coding (19UBT0J1)
2. Agro Industrial biotechnology (19UBT0J2)

Note: JOC which are offered at present will be applicable for the students admitted during the academic year 2019-2020 and will be considered as extra credit courses.

Tally Table:

S. No.	Part	Subject	Marks	Credits
1.	I	Language – Tamil/Hindi/Malayalam/French/Sanskrit	400	12
2.	II	English	400	12
3.	III	Core – Theory/Practical/Project	1700	65
		Allied	400	20
		Electives	200	10
4.	IV	Basic Tamil/Advanced Tamil/Non-major elective	150	4
		Skill Based Subjects	300	9
		Extra Departmental Course (EDC)	**100**	**3**
		Environmental studies	50	2
		Value Education	50	2
5.	V	Extension Activities	50	1
Total			**3800**	**140**

Note: CBCS – Choice Based Credit System; CIA – Continuous Internal Assessment
ESE – End of Semester Examinations

- 25 % CIA is applicable to all subjects except JOC, COP and SWAYAM courses which are considered as extra credit courses.
- The students are advised to complete a **SWAYAM-MOOC** before the completion of the 5th semester and the course completed certificate should be submitted to the HOD. Two credits will be given to the candidates who have successfully completed.
- A **Field Trip** preferably relevant to the course should be undertaken every year.

UBT05

Components of Continuous Internal Assessment

Components		Marks	Total
Theory CIA 1	75	(75+75 = 150/10) 15	25
CIA 2	75		
Assignment/ Demonstration/Seminar		5	
Attendance		5	
Practical CIA Practical		10	20
Observation Notebook		5	
Attendance		5	
Practical CIA Practical		25	40
Observation Notebook		10	
Attendance		5	
Practicum Review		15	20
Regularity		5	

BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN

K1-Remember; **K2**-Understanding; **K3**-Apply; **K4**-Analyze; **K5**-Evaluate

1. **Theory Examination - Part I, II & III**

(i) CIA I & II and ESE: 75 Marks

Knowledge Level	Section	Marks	Description	Total
K1 Q1 to 10	A (Answer all)	10 x 1 = 10	MCQ	75
K2 Q11 to 15	B (Either or pattern)	5 x 5 = 25	Short Answers	
K3 & K4 Q16 to 20	C (Either or pattern)	5 x 8 = 40	Descriptive / Detailed	

(ii) CIA I & II and ESE: 55 Marks

Knowledge Level	Section	Marks	Description	Total
K1 Q1 to 10	A (Answer all)	10 x 1 = 10	MCQ	55
K2 Q11 to 15	B (Either or pattern)	5 x 3 = 15	Short Answers	
K3 & K4 Q16 to 20	C (Either or pattern)	5 x 6 = 30	Descriptive / Detailed	

2. Practical Examination:

Knowledge Level	Section	Marks	Total
K3	Experiments	25	30
K4		05	
K5	Record Work		

Knowledge Level	Section	Marks	Total
K3	Experiments	50	60
K4		10	
K5	Record Work		

3. Practicum and Viva - Voce:

Knowledge Level	Section	Marks	Total
K3	Project Report	60	80
K4		20	
K5	Viva voce		

UBT07

19UBT101

Programme code: 08		Programme name: B. Sc. Biotechnology		
Course code: 19UBT101		C. P. 1 – Cellular Biology		
Batch 2019-2020	Semester I	Hours / Week 4	Total Hours 60	Credits 4

Course Objectives

1. To understand the structural and functional aspects of the prokaryotic and eukaryotic cells
2. To get knowledge on structural and functional aspects of cellular organelles and its functions
3. To make the student to learn molecular mechanisms underlying cellular functions

Course Outcomes (CO)

K1	CO1	Recollecting the details about of prokaryotic and eukaryotic cells and organelles
K2	CO2	Understanding the theories of cell divisions and mechanisms of cell death
K3	CO3	Analyzing the cell to cell interactions
K4	CO4	Examining the cells and their interactions using microscopy

Syllabus

Unit I (12 Hours)

Cell: Discovery of cells - Cell Theory – Protoplasmic and organismal theory, Types of Cells – Prokaryotic, Eukaryotic and Virus with structure and example; Structure and Function of Plant and Animal cells. Animal cell types.

Unit II (12 Hours)

*Cellular Organelles***:** Cell wall, Plasma Membrane; Nuclear compartment, chromatin; Structure and Functions of Mitochondria, Plastids, Endoplasmic reticulum, Golgi apparatus, **Lysosomes*,** Microbodies, Peroxysomes, Microtubules and Plasmodesmata. Ribosomes, Cytoskeleton structures (Microtubules, Microfilaments and Intermediate filaments). Cilia, flagella- structure and function

Unit III (12 Hours)

Specialized cells: Muscle and Nerve cells (Physiology and Function), Reproductive cells, Cell junctions and Cell-Cell interaction. Erythropoiesis- genetic and molecular basis of erythrocyte differentiation, morphological specialization of red blood cells.

Unit IV (12 Hours)

Cell division in prokaryotes and eukaryotes: Cell Cycle and its regulation, Mitosis and Meiosis, Cell death (Apoptosis). Cell Signaling-G protein coupled receptors, RTKs, Cytokine Receptors & NRTKs, Prions. Cancer – Types and pathogenesis.

Unit V (12 Hours)

Tools of Cytology: Microscopy - Resolving power, Light Microscope, Phase Contrast, Bright field Microscope and Fluorescent microscope. Specimen preparation for microscopy. Cell fractionation techniques - Physical, Chemical and Enzymatic methods.

**denotes self-study*

Teaching Methods

Powerpoint presentation/ Google Class rooms/Seminar/Quiz/Discussion/Assignment/ Demonstration

Text Books

1. Verma, P.S. and V. K. Agarwal., (2016), Cell biology (cytology, Biomolecules, Molecular biology, S. Chand and Co, New Delhi.

Reference Books

1 Alberts, B (2002), Molecular Biology of the Cell, 4th Edition, Garland Publishing,Inc.,New York.
2 Ekambranatha Ayyer, M. and T.N. Ananthakrishnan (1982), Outlines of Zoology: Invertebrate, S. Viswanathan Printers and Publishers Pvt. Ltd.
3 Stephen L.Wolfe, (1993), Molecular and cellular Biology, Wadsworth Publishing Company.
4 De Robertis., E.D.P, and E.M.F. De Robertis., (1995), Cell and Molecular Biology, 8th Edition, B.I. Waverly Pvt. Ltd., New Delhi.
5 Cooper G.M., Housman Robert E., (2013), The Cell: A Molecular Approach, 6th edition, Boston University, Sinauer Associates, Inc. • Publishers, Sunderland, Massachusetts U.S.A.
6 Lodish et al. (1995), Molecular Cell Biology, Scientific American Books.
7 Ekambranatha Ayyer, M. and T.N. Ananthakrishnan., (1982), Outlines of Zoology: Invertebrate, S. Viswanathan Printers and Publishers Pvt. Ltd.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	M	H	M	M	M
CO2	M	H	H	H	H
CO3	M	M	S	M	M
CO4	H	S	M	S	M

S – Strong **H** – High **M** – Medium **L** – Low

UBT09

19UBT102

Programme code: 08		Programme name: B. Sc. Biotechnology		
Course code: 19UBT102		C. P. 2 – Bioinstrumentation and Environmental Biotechnology		
Batch 2019-2020	Semester I	Hours / Week 4	Total Hours 60	Credits 4

Course Objectives

1. To impart the basic principles, knowledge about instruments
2. To understand the applications of instruments in biotechnology
3. To handle and maintain the instruments
4. To study the role of technology in solving environment issue and also to get wealth out of waste

Course Outcomes (CO)

K1	CO1	Students are trained to remember each and every topics by comparative studies
K2	CO2	Students are taught with models and audio visuals to understand the concept easily
K3	CO3	Direct applications and benefits of instruments are discussed with hands-on training to students
K4	CO4	Discuss the role of biotechnology to overcome environmental problems

Syllabus

Unit I (12 Hours)

Principle, working mechanism and applications of pH meter, Preparation of Buffer, Microscopy: transmission electron microscopy and scanning electron microscopy, Sonicator**,—and Lyophilization** Centrifugation, types: preparative and analytical.

Unit II (12 Hours)

Photometry: Principle, working mechanism and applications of **Colorimetry***, Beer-Lambert law, UV-visible spectrophotometry, Mass spectrometry, FTIR**,** Flourimetry and Flame photometry and ELISA reader.

Unit III (12 Hours)

Chromatography: Principle, working mechanism and applications of **Paper chromatography***, Thin layer chromatography (TLC), Column chromatography, Ion exchange chromatography, Molecular exclusion chromatography, Affinity chromatography, High perfromanance liquid chromatography (HPLC) and Gas liquid chromatography (GLC).

Unit IV (12 Hours)

Electrophoresis: Principle, working mechanism and applications of Agarose gel electrophoresis (AGE), Polyacrylamide gel electrophoresis (PAGE), Immunoelectrophoresis, 2 D-gel electrophoresis and

Capillary electrophoresis. Geiger Muller and Scintillation counters. PCR: Principle, working mechanism and applications.

Unit-V (12 Hours)

Biotechnology in Environmental Protection: Introduction, Waste water and effluent treatment- Biological treatment- aerobic and anaerobic. **Eutrophication***, Bioindicators and Biosensors for detection of pollutants. Carbon credits. Bioremediation: Heavy metal - Accumulation, Biosorption, and Bioleaching. Composting – process, decomposition stages in compost preparation and methods; Vermicomposting (**Vermitechnology***), Mushroom cultivation.

** denotes Self study*

Teaching Methods

Powerpoint presentation/ Google Class rooms/Seminar/Quiz/Discussion/Assignment/ Demonstration/Demonstration

Text Books

1. Veerakumari, L. 2009. Bioinstrumentation. MJP Publishers, New Delhi, India
2. Sharma, B.K. 2005. Instrumental Methods of Chemical analysis. 24th Revised Edition, Goel Publishing House, Meerut.
3. Jogdand, SN. (2008). Environmental Biotechnology, Himalaya Publishing House, Mumbai.

Reference Books

1. Holme and Peck. 1998. Analytical Biochemistry, 3rd Edition, Pearson Education Ltd, Essex, England
2. Skoog and Leary. 1992. Principles of Instrumental analysis, 4th Edition. Saunder's College Publishing, New York.
3. Wilson, K. and Walker, J. 2000. Principles and Techniques of Practical Biochemistry, 5th edition, Cambridge University Press, Cambridge.
4. Handbook of Biomedical Instrumentation – R.S. Khandpur, Tata McGraw Hill.
5. Gel Electrophoresis of Nucleic acids-A Practical approach. Rickwood D and BD Hames
6. Scragg, A. (2005). Environmental Biotechnology, Oxford University Press, London.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	**CO1**	S	H	H	H
CO2	**CO2**	H	S	H	M
CO3	**CO3**	H	M	S	H
CO4	**CO4**	H	M	S	H

S – Strong **H** – High **M** – Medium **L** – Low

UBT11

19UBT1CL

Programme code: 08		Programme name: B. Sc. Biotechnology		
Course code: 19UBT1CL		C. Pr. 1 – Lab in Cellular Biology and Bioinstrumentation		
Batch 2019-2020	Semester II	Hours / Week 2	Total Hours 30	Credits 2

Course Objectives

1. To understand various basic aspects of cell biology and bioinstrumentation
2. To get hands on experience in identification of cells and examine the stages of cell divisions.
3. To learn about the cell fractionation and have hands on experience in smearing and counting of blood cell.

Course Outcomes (CO)

K3	CO1	Experiment with different cells types and developing skill on bioinstrumentation
K4	CO2	Examining the cell types and different stages of cell divisions
K5	CO3	Distinguishing the blood cells and obtaining the skill of blood cell counting and analyzing the amino acids pattern using chromatography techniques.

Syllabus

CELLULAR BIOLOGY (15 Hours)

1. General Laboratory Instructions and Safety – Video / Power-point
2. Microscopy
3. Cell types – Microbial, Animal and Plant cells
4. Fraction of Cellular components
5. Cell Counting – RBC and WBC
6. Preparation of blood Smear
7. Mitotic Preparation in Onion root tip
8. Differential leukocyte count by Leishmann's staining

BIOINSTRUMENTATION (15 Hours)

1. pH meter-Preparation of Buffers
2. Centrifuge – Ultra and Table top
3. Colorimeter and Spectrophotometer
4. HPLC (Demo)

5. LYOPHILIZER (Demo)
6. SONICATION

Teaching Methods

- Google classrooms; information and communication technology; Powerpoint presentations; Board teaching; Demonstration of experiments; Providing hands on training in all the experiments as well as the preparation of reagents; Discussion and Interpretation of results

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	S	H	L
CO2	S	M	S	H	L
CO3	S	M	S	H	L

S – Strong **H** – High **M** – Medium **L** – Low

UBT13

19UBT203

Programme code: 08		Programme name: B. Sc. Biotechnology		
Course code: 19UBT203		C. P. 3 – Microbiology		
Batch 2019-2020	Semester II	Hours / Week 6	Total Hours 90	Credits 4

Course Objectives

1. To make the students to understand the basic concepts of the biology of microorganisms
2. To learn the general principles for microbial the growth, evolution and classification
3. To make the students to understand the role of microbes in human life

Course Outcomes (CO)

K1	CO1	Recollecting the early development, physiology and evolution of microorganisms
K2	CO2	Understanding the methods of studying microorganisms
K3	CO3	Identification of microbial interaction in soil, food, human and animals
K4	CO4	Studying the diseases caused by various microorganisms

Syllabus

Unit I (18 Hours)

History of Microbiology - Ultra structure and function of Prokaryotes (Bacteria). General classification: Bacteria (Bergey's and molecular taxonomy), fungi and virus (Baltimore Classification of virus). Classification of Algae.

Unit II (18 Hours)

Culture media - Types and preparation. Sterilization methods - Dry heat, moist heat, radiation, filtration and chemicals. Test for sterility- Phenol co-efficient test. Culture methods - Isolation and maintenance of pure culture (spread plate, streak, and pour plate). Preservation methods, bacterial staining (simple, Grams, negative, capsular, flagellar, acid-fast,spore) and fungal staining methods.

Unit III (18 Hours)

Nutritional requirement of bacteria - Nutritional Types of Microorganisms. Microbial growth – growth curve; Measurement of microbial growth - dry weight, colony count, packed cell volume, turbidometry and haemocytometry.

19UBT203

Unit IV (18 Hours)

Microbial interaction: Symbiosis, asymbiosis, ammensalism, synergism, mutalism, neutralism, **commensalisms***. Microbiology of water – water pollution and water borne disease (Cholera). Bacteriological examination of water – Membrane filtration technique and MPN test.

Unit V (18 Hours)

Microbial Diseases: Causative agents, pathogenesis, symptoms, diagnosis and prophylaxis of Typhoid, Staphylococcosis, Aspergillosis, Candidiasis, TMV Chikungunya, **HIV***, Dengue fever, Influenza.

**denotes Self study*

Teaching Methods

Powerpoint presentation/ Google Class rooms/Seminar/Quiz/Discussion/Assignment/ Demonstration

Textbook

1. Pelczar, Jr. 2004. Microbiology, 5th Edition, Tata McGraw-Hill Publishing Co. Ltd, New Delhi.

References

1. Prescott's Microbiology, 10th edition Eds. Joanne M Willey, Joanne Willey, Linda Sherwood, Christopher J Woolverton. McGraw-Hill Education.

2. Stainer, *et al*. 1992. General Microbiology, 5th edition. Macmillan Education Ltd., London.

3. Ronald M. Atlas and R. Bartha, 1998. Microbial Ecology – Fundamentals and Applications. Pearson Education, Asia.

4. Michael T. Madigan, Kelly S. Bender, Daniel H. Buckley, W. Matthew Sattley, David A. 2015. Stahl Brock - Biology of Microorganisms (15th Edn.), Pearson.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	H	H	H
CO2	H	S	H	M	H
CO3	H	M	S	H	H
CO4	H	M	S	H	S

S – Strong **H** – High **M** – Medium **L** – Low

UBT15

19UBT2CM

Programme code: 08		Programme name: B. Sc. Biotechnology		
Course code: 19UBT2CM		C. Pr. 2– Lab in Microbiology		
Batch 2019-2020	Semester II	Hours / Week 3	Total Hours 45	Credits 2

Course Objective

1. To demonstrate the ability to work with standard lab safety protocols and procedures.
2. To acquire hands on experience in microbiological techniques
3. To get experience of analyzing, identifying and characterizing the microorganisms by using the appropriate microbiological techniques

Course Outcomes (CO)

K3	CO1	Understand the practical skill on basic microbial structure and function
K4	CO2	Analyzing master aseptic techniques and be able to perform routine culture handling tasks safely and effectively
K5	CO3	Compiling the methods of various physical and chemical growth requirements of bacteria and get equipped with various methods of bacterial growth measurement.

Syllabus

MICROBIOLOGY **(**45 Hours)

1. Preparation of agar slant and Stab for bacteria and fungi and sterilization methods
2. Pure culture techniques - Pour plate, spread plate and Streak Method
3. Anaerobic culture techniques-Wrights tube method
4. Motility test – Hanging Drop method
5. Staining of Bacteria - Simple, Gram's, Capsule, Endospore
6. Fungal Staining – LCB technique
7. Biochemical tests for identification of Bacteria
8. Enumeration of microorganisms from soil
9. Bacterial growth curve – Spectrophotometry method.
10. Antibiotic sensitivity test – Kirby Bauer method

Teaching Methods

- Google classrooms; information and communication technology; Powerpoint presentations; Board teaching; Demonstration of experiments; Providing hands on training in all the experiments as well as the preparation of reagents; Discussion and Interpretation of results

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	S	M	M
CO2	H	S	S	H	H
CO3	H	S	S	M	H

S – Strong **H** – High **M** – Medium **L** – Low

UBT17

19UBT304

Programme code: 08		Programme title: Biotechnology		
Course Code: 19UBT304		C.P. 4 - Molecular Biology		
Batch 2019-2020	Semester III	Hours / Week 4	Total Hours 60	Credits 4

Course Objectives

1. To seed the basic concepts about molecular biology
2. To make students understand regulations and mechanism of cell
3. To employ and study mutations and its defect.

Course Outcomes (CO)

K1	CO1	Students are trained to remember molecular aspects of genome organization
K2	CO2	Students are made to penetrate deep into the concept with help of visual aids for their better understanding
K3	CO3	Interaction sessions are engaged in order to discuss the application of molecular techniques.
K4	CO4	Students are made to figure out the gene expression and regulation and to analyze the same.

Syllabus

Unit I (12 Hours)

Universal genetic code, Wobble hypothesis**,** degeneracy; Replication: Mechanism in prokaryotes and eukaryotes, Theta and rolling circle model, enzymology of replication. Types and synthesis of RNA. Replication of RNA genome- replicase and reverse transcriptase

Unit II (12 Hours)

Mutation: **Mutagenesis*,** biochemical basis of mutations, spontaneous and conditional mutants, Ames test for mutation, reversion and suppression mutations. DNA damage and molecular mechanisms of repair (mismatch, excision and recombination)

Unit III (12 Hours)

Gene expression in eukaryotes: Transcription, translation; RNA processing and post transcriptional modification ~~and post- transcriptional modification~~, post-translational modifications and folding of newly assembled polypeptides, translational regulations, signal sequences and protein export.

19UBT304

Unit IV (12 Hours)

Gene regulatory elements: *cis*-regulatory elements (promoter, enhancer, silencer, response elements) and trans-regulatory elements (transcription factors)**,** gene regulation in prokaryotes-Operon concept – *trp* and *lac;* Transposons and insertion sequences, Prokaryotic and Eukaryotic Transposons.

Unit V (12 Hours)

Recombination – Homologous and Non homologous – Holliday model, recombinases - RecA, Cre. Lambda phage: genome, **lytic and lysogeny cycle***, transcriptional switch genetics (Cro gene, Cl gene).

** denotes Self study*

Teaching Methods

Powerpoint presentation/ Google Class rooms/Seminar/Quiz/Discussion/Assignment/ Demonstration

Text Books

1. Malacinski, G. M. 2008. Freidfelder's Essentials of Molecular Biology. 4th edition. Narosa Book Distributors Private Ltd (reprint 2008)

Reference Books

1. Lodish *et al*. 2001. Molecular Cell Biology. W.H. Freeman and Co., New York.
2. Watson, J. D. *et al*. 1998. Molecular Biology of the gene, 4th Edition., The Benjamin/Cummings Publ. Co., Inc., California.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	H	H	H
CO2	H	S	H	M	H
CO3	H	M	S	H	H
CO4	H	M	S	H	S

S – Strong **H** – High **M** – Medium **L** – Low

UBT19

19UBT305

Programme code: 08		Programme name: B. Sc. Biotechnology		
Course code: 19UBT305		C. P. 5 – Genetics		
Batch 2019-2020	Semester III	Hours / Week 4	Total Hours 60	Credits 4

Course Objectives

1. To make the students to understand the principles and theories of inheritance
2. To learn the concepts of chromosome morphology
3. To make the students to understand the gene expression and regulation

Course Outcomes (CO)

K1	CO1	Revising the Mendelian Genetics and molecular basis of heredity
K2	CO2	Understanding the modern concept of genes and population genetics
K3	CO3	Applying the gene transformation in recombination
K4	CO4	Analyzing the types gene mutation and causes on genetic disorders

Syllabus

Unit I (12 Hours)

Mendelian Principles: **Segregation, Independent assortment***, Non-Mendelian Inheritance, Dominance relations and Multiple alleles in diploid organisms: Incomplete Dominance, Overdominance, Codominance,.

Unit II (12 Hours)

Gene Interaction, Epistasis. Complementation test, Chromosomal theory of inheritance, Linkage and crossing over, Sex determination and Sex linkage in diploids. Gene: Fine structure of gene, Cistron, Muton, Recon, Structure of eukaryotic and prokaryotic gene**.**

Unit III (12 Hours)

Chromosome morphology, banding pattern, landmarks, FISH, Chromosomal aberrations. Karyotyping. Human Genetic Diseases - Down's syndrome, Turner's syndrome, Klinefelter's syndrome.

Unit IV (12 Hours)

Gene Mutation - Classification of mutations, suppressor and reverse mutations, DNA as a genetic material (Transformation, conjugation and transduction).

Unit V (12 Hours)

Modern concept of genes. Population genetics: Hardy –Weinberg law, gene frequency, gene pool, inbreeding, outbreeding. Genetic drift, shift, pedigree analysis and genetic counselling.

19UBT305

**denotes Self study*

Teaching Methods

Powerpoint presentation/ Google Class rooms/Seminar/Quiz/Discussion/Assignment/ Demonstration

Text Books

1. Verma P.S. and V. K. Agarwal, 2003. Genetics. S. Chand and Co, New Delhi.

Reference Books

1 Tamarin, R.H., 2002. Principles of Genetics, Tata McGraw-Hill Publishing Co. Pvt. Ltd., New Delhi (ISBN 9780070486676).

2 Gupta, P.K., 1996. Genetics. Rastogi Publications, Meerut.

3 Helen V.Firth.,2017.Clinical genetics and genomics, Oxford desk reference

4 Strickberger, 2006. Genetics - Published by Prentice Hall of India Pvt. limited., Edition:3.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	M	H	M	M	M
CO2	M	S	M	M	S
CO3	M	S	S	H	S
CO4	H	S	S	M	M

S – Strong **H** – High **M** – Medium **L** – Low

UBT21

19UBT3CN

Programme code: 08		Programme name: B. Sc. Biotechnology		
Course code: 19UBT3CN		C. Pr. 3: Lab in Molecular biology and Genetics		
Batch 2019-2020	Semester III	Hours / Week 2	Total Hours 30	Credits 2

Course Objectives

1. To exhibit a knowledge base in genetics, cell and molecular biology, and anatomy and physiology
2. To independently execute a laboratory experiment using the standard methods and techniques in molecular biology, with the appropriate analysis and interpretation of results obtained
3. To analyse the need and importance of ongoing development through the available lifelong learning

Course Outcomes (CO)

K3	CO1	Developing their handling knowledge to execute a laboratory experiment using the standard methods and techniques in molecular biology and with the appropriate analysis and interpretation of results obtained
K4	CO2	Demonstrating the relationship between phenotype and genotype in human genetic traits.
K5	CO3	Examining the techniques involved in and molecular biology and genetics.

Syllabus

MOLECULAR BIOLOGY (15 Hours)

1. Extraction of Genomic DNA (Bacteria and Animal).
2. Agarose gel electrophoresis
3. Extraction of Plasmid DNA.
4. Polyacrylamide Gel Electrophoresis (Demo)

5.Bacterial Transformation

GENETICS (15 Hours)

1. Problem Solving in Mendelian Ratios
2. Sex chromatin (Buccal smear)
3. Estimation of DNA by Diphenylamine method
4. Estimation of RNA by Orcinol method

5. Estimation of DNA by UV-Spec method
6. Estimation of RNA by UV-Spec method

Teaching Methods

- Google classrooms; information and communication technology; Powerpoint presentations; Board teaching; Demonstration of experiments; Providing hands on training in all the experiments as well as the preparation of reagents; Discussion and Interpretation of results

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	S	S	M
CO2	H	H	S	H	H
CO3	H	S	S	M	H

S – Strong **H** – High **M** – Medium **L** – Low

UBT 23 **19UBT406**

Programme code: 08		Programme name: B. Sc. Biotechnology		
Course code: 19UBT406		C.P.6 – Fundamentals of Biochemistry		
Batch 2019-2020	Semester IV	Hours / Week 5	Total Hours 75	Credits 4

Course Objectives

1. To get an overall understanding of structure of atoms, molecules and chemical bonds.
2. To understand the enzyme kinetics.
3. To gains the knowledge of biopolymers and metabolic reaction in the living systems.

Course Outcomes (CO)

K1	CO1	Defining the Structure of atoms, molecules, chemical bonds
K2	CO2	Classification and comparison of biopolymers and metabolic reactions
K3	CO3	Understanding the functions and manifestations of vitamins and minerals
K4	CO4	Simplifying the enzyme kinetics

Syllabus

Unit I (15 Hours)

Water: Structure of water, Hydrogen bonding and solubility, Physicochemical properties, Cellular reactions of water, Ionization of water. pH and pKa: Definition, Henderson-Hasselbalch Equation, titration curve. Water conductivity.

Unit II **(**15 Hours)

Carbohydrates: Classification, structure and chemical properties and functions (with two examples for each classification) (glucose, fructose, sucrose, lactose, starch, glycogen) of sugars. Glycolysis, TCA cycle, Electron transport chain and Oxidative phosphorylation. Gluconeogenesis* HMP shunt and its regulation.

Unit III **(**15 Hours)

Amino acids: Classification, structure and reactions and functions of amino acids. Amino acid catabolism (Transamination, deamination and decarboxylation) Proteins: Classification and orders of protein structure and functions Introduction to Protein sequencing.

Unit IV **(**15 Hours)

Lipids: **General properties***, classification and functions. Fatty acid - Biosynthesis and oxidation - beta oxidation. *Nucleic acids:* Nucleosides and Nucleotides. Structure of DNA and RNA. Synthesis of purines and pyrimidines and its regulation. *Vitamins:* Classification, functions and its hypo, hyper manifestations. *Minerals*: sources, functions and manifestations of sodium, potassium, Phosphorus, calcium and selenium

Unit V **(**15 Hours)

Enzymes: Definition, IUB classification, Nomenclature and properties, Physical factors affecting enzyme activity. Enzyme kinetics: Michaelis-Menton Equation, Linewaever-Burkeplot. Mechanism of Enzyme regulation. Enzyme inhibition and its types. Co-enzyme and Co-factors.

** denotes Self study*

Teaching Methods

Powerpoint presentation/ Google Class rooms/Seminar/Quiz/Discussion/Assignment/ Demonstration

Text Books

1. Jain, J.L.,Sunjay Jain, Nithin Jain (2009), Fundamentals of Biochemistry, S.Chand and Company Ltd.

2. Sathyanarayana U.,Chakrapani, U. (2014). Biochemistry. Books and Allied Pvt. Ltd., Kolkatta

Reference Books

1. Aroor, A. K., 2010. Medical Biochemistry, Japee brothers. Medical publications Pvt Ltd.

2. Chawla, R. and Tarekh, H., 2014. 1st Edition. A comprehensive Text book of Medical Biochemistry, Lippincott Williams and Wikins.

3. Voet, D. and Voet. J., 2010. Biochemistry, Donald Voet, Judith G. Voet, Published by J. Wiley & Sons, Eds. 4.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	M	H	M	M	M
CO2	M	H	H	H	H
CO3	H	M	M	M	M
CO4	H	M	M	M	M

S – Strong **H** – High **M** – Medium **L** – Low

UBT25

19UBT4CO

Programme code: 08		Programme name: B. Sc. Biotechnology		
Course code: 19UBT4CO		C. Pr. 4 – Lab in Biochemistry		
Batch 2019-2020	Semester IV	Hours / Week 3	Total Hours 45	Credits 2

Course Objectives

1. To understand various basic aspects of Biochemistry
2. To get hands on experience in preparation of standard solutions – Normality, Molarity and Molality
3. To learn about the Qualitative and Quantitative estimation of Sugars, Proteins, lipids and Separation technique like Chromatography.

Course Outcomes (CO)

K3	CO1	Preparation of Standard solution
K4	CO2	Qualitative and Quantitative analysis of Sugars, Proteins, Lipids
K5	CO3	Separation of Amino acids by Chromatographic techniques

BIOCHEMISTRY **(**45 hours**)**

1.Preparation of standard solutions (Molar, Normal, Molal and Percentage solutions)

2. Qualitative analysis of sugars (Glucose, lactose and starch)

3. Estimation of total sugars by Anthrone method

4. Qualitative tests for Amino acids (Arginine and Tyrosine).

5. Estimation of Protein by Lowry's method

6. Qualitative analysis of Lipids

7. Estimation of Cholesterol by Zak's method

8. Enzyme analysis – Amylase

9. Quantification of Vitamin C

10. Paper chromatography

11. Thin layer Chromatography

Teaching Methods

- Google classrooms; information and communication technology; Powerpoint presentations; Board teaching; Demonstration of experiments; Providing hands on training in all the experiments as well as the preparation of reagents; Discussion and Interpretation of results

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	S	H	L
CO2	S	M	S	H	L
CO3	S	M	S	H	L

S – Strong **H** – High **M** – Medium **L** – Low

UBT27

19UBT507

Programme code: 08		Programme name: B. Sc. Biotechnology		
Course code: 19UBT507		C.P.7– Immunology		
Batch 2019-2020	Semester V	Hours / Week 6	Total Hours 90	Credits 4

Course Objectives

- To make the student to understand the definition and concepts of immunity
- To make the student to be familiar about the structural features and components of the immune system as well as their functions
- To know how the immune system recognizes self from non-self

Course Outcomes (CO)

K1	CO1	Recalling the innate and adaptive immune responses coordinate to fight invading pathogens
K2	CO2	Demonstrating the strategies used to enhance immune responses or to suppress unnecessary immune responses such as might be required in hypersensitivity reactions, transplantations or autoimmune diseases.
K3	CO3	Applying key immunological concepts and methods to diagnose immune disorders
K4	CO4	Analyzing the strategies to improve existing vaccines

Syllabus

Unit I (18 Hours)

Immunity: Definition and History of immunology. Types of Immunity: Innate and Acquired immunity. Primary and Secondary immune responses. Cells and Organs of the Immune system (Primary lymphoid organ-Bone marrow, secondary lymphoid organ-lymph node). Humoral and Cell mediated immunity. Hematopoiesis and Development of B & T lymphocytes- clonal expansion, production of plasma and memory cells.

Unit II (18 Hours)

Antigens: Essential features of antigens, Epitopes, Haptens, Adjuvants, Cross reactivity, Synthetic antigens. MHC- structure and function, MHC restriction. HLA typing. *Antibody:* Structure, Types, properties and their biological functions. CD markers.

Unit III (18 Hours)

Complement biology: Definition, Nomenclature, Activation pathways (classical and alternate). *Cytokines:* Interleukins and interferons and its biological functions. *Hypersensitivity reactions:* Type I to IV. Tolerance and Immunosuppression.

19UBT507

Unit IV (18 Hours)

Transplantation Immunology: Types of grafts, transplantation reactions (graft versus host) Tumour Immunology: tumor antigens and its regulation, tumor immuno Therapy. Autoimmunity. **General Immune response to infectious diseases (Bacteria and Viruses**)*. Immunodeficiency diseases-types-X-Linked A gamma globulinemia, SARS.

Unit V (18 Hours)

Vaccines and Immunotechniques : Definition, Types of vaccines (Attenuated, sub-unit and DNA vaccines and anti-idiotype vaccines). Monoclonal antibodies production and applications, **agglutination***, precipitation, complement fixation, Immunofluorescence, ELISA, RIA and Immunoblotting.

**denotes Self study*

Teaching Methods

Board teaching, Powerpoint presentation/ Google Class rooms/ Seminar/ Quiz/ Discussion/ Assignment/ Demonstration

Text Books

1. Owen, J., Punt, J., Stranford, S., (2013). Kuby's Immunology, 7th Edition. W. H. Freeman and company, New York.
2. Peter J. Delves., Seamus J. Martin., Dennis R. Burton., Ivan M. Roitt. (2016). Roitt's Essential Immunology, 13th edition. Wiley-Blackwell.

References

1. Ashim, K. Chakravarthy. (2006). Immunology and Immunotechnology. Oxford University Press (India).
2. Tizard, I. R. (1995). Immunology: An Introduction, 4th edition. Prentice Hall, International.
3. Abbas, A K., Lichtman, AH., Pillai S. (2016). Basic Immunology –Functions and Disorders of the Immune System Fifth Edition, Elsevier.
4. Khan, Fahim Halim. (2009). The elements of Immunology, Pearson Education (India) Pvt. Ltd.
5. Ballarin, L., Cammarata, M. (2016). Lessons in Immunity. 1st Edition. Academic Press, Elsevier.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	H	S	M	H
CO2	S	M	H	S	M
CO3	M	S	S	H	S
CO4	S	H	M	S	H

S – Strong **H** – High **M** – Medium **L** – Low

UBT29

19UBT508

Programme code: 08		Programme name: B. Sc. Biotechnology		
Course code: 19UBT508		C. P. 8 – Recombinant DNA Technology		
Batch 2019-2020	Semester V	Hours / Week 6	Total Hours 90	Credits 4

Course Objectives

1. To enable the students to learn the various molecular biology techniques and principles of recombinant DNA technology, which includes cloning strategies
2. To enable the students to learn about the manipulating enzymes, various cloning and expression vectors and its screening procedures
3. To know about the applications of recombinant DNA technology in various fields

Course Outcomes (CO)

K1	CO1	Remembering the principles of recombinant DNA technology and the structure and pattern of different type of vectors for cloning and expression
K2	CO2	Understanding the concept of different cloning strategies and their expression,
K3	CO3	Exploiting the applications of genetic engineering for different purposes and also know how to solve the problems encountered
K4	CO4	Analysing and applying the results obtained using recombinant DNA technology strategies

Syllabus

Unit I (18 Hours)

Basics of rDNA technology - Tools for rDNA technology and steps of gene cloning in prokaryotes, and other hosts: characteristic features and problems. Manipulating Enzymes: Restriction Endonucleases and its types, Exonucleases, Polymerases, Ligases DNA modifying enzymes-Alkaline phosphatases, Terminal deoxynucleotidyl transferases, kinases.

Unit II; (18 Hours)

Vectors: Plasmid Types and Nomenclature. Cloning vectors: pBR322, Blue white screening- pUC8, pUC18, vectors. Phage vectors - λ vectors, cosmids (pJB8) and phagemids (pBluescript, pGEM). M13 based Single strand vectors (M13mp8), Shuttle vectors.

Unit - III (18 Hours)

Specialized vectors: Yeast episomal plasmids, Yeast integrative plasmids, Yeast replicative plasmids, Bacterial Artificial Chromosome and Yeast Artificial Chromosome. Expression vectors (pET) for prokaryotes, Choice of promoters used in expression vectors, cassettes and gene fusion, advantages of fusion proteins, Problems encountered in expressing foreign gene in *E.coli*, Problems caused by *E. coli*.

19UBT508

Unit - IV (18 Hours)

Genomic library, cDNA library – Reverse Transcriptase-PCR, Real time PCR. Methods of labeling probes, Detection of cloned gene - Southern and **Northern hybridization***, Selection of clones by hybridization probes - colony and plaque hybridization. Antibody based screening.

Unit - V (18 Hours)

DNA sequencing- Sanger's and Maxam-Gilbert method, Pyrosequencing, Applications of sequencing. Reporter Genes – *gus, GFP, lux* and *luc.* RNAi technology- siRNA, miRNA. DNA analysis in **forensics, medicine and Agriculture***

** denotes Self study*

Teaching Methods

Powerpoint presentation/ Google Class rooms/Seminar/Quiz/Discussion/Assignment/ Demonstration

Text Books

1. Brown, T.A., (2010). Gene cloning and DNA analysis, An Introduction. John Wiley & Sons
2. Primrose, S.B., and Twyman. R., (2006). Principles of gene manipulation and genomics, 7th edition, Wiley.com

Reference Books

1. Winnacker, E.L., (2003). From Genes to Clones. Panima Publishing Corporation, New Delhi.
2. Primrose, S.B., Twyman, R.M., Old, R.W., (2001). Principles of Gene Manipulation, 6th Edition. Blackwell Science, London.
3. Glick, B. R., Pasternak, J.J., Patten, C.L., (2010). Molecular Biotechnology: principles and applications of recombinant DNA, 4th Edition, ASM Press, Washington.
4. Watson et al. (1992). Recombinant DNA, 2nd Edition. W.H. Freeman and Co., New York.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	H	M	M
CO2	H	S	S	M	M
CO3	S	H	H	S	S
CO4	S	M	M	S	S

S – Strong **H** – High **M** – Medium **L** – Low

UBT31

19UBT509

Programme code: 08		Programme name: B. Sc. Biotechnology		
Course code: 19UBT509		C. P. 9 : Animal Biotechnology		
Batch 2019-2020	Semester V	Hours / Week 5	Total Hours 75	Credits 4

Course Objectives

1. To enable the students to remember the basics of animal biotechnology.
2. To equip the students to learn and understand various culturing techniques
3. To provide knowledge on gene transferring methods

Course Outcomes (CO)

K1	CO1	Debates and interactions are carried out to elicit and remember the core of animal biotechnology
K2	CO2	Students understand the molecular events and mechanism with proper interpretations and reasoning.
K3	CO3	Students are assigned to apply the techniques in production of natural drugs and proteins
K4	CO4	Students use to interpret the qualitative and quantitative assays and analyze them.

Syllabus

Unit I (15 Hours)

Molecular events during fertilization (mammals), Types of eggs*, Blastulation, Gastrulation, Embryonic induction (Spemann organizer) and Fate maps in amphibians; Drosophila- Genetics and pattern of development: Morphogens (Bicoid and Nanos), morphogenic gradient, Homeotic genes (Antennapedia and Bithorax).

Unit II (15 Hours)

Culture media: Balanced salt solutions and simple growth media, functions of physical and chemical constituents of culture medium, role of carbon dioxide, serum, growth factors, glutamine and other amino acids of cell culture medium. Serum and serum free media for cell lines. Contamination: source, types, monitoring and eradication.

Unit III (15 Hours)

History of animal tissue culture, primary and established cell culture, culture methods (plasma clot, agar gel raft, and grid) - cell strain - cell lines - cell separation - cell synchronization, cell counting (dye exclusion assay), Cytotoxicity (MTT assay). Culturing

of embryos, cryopreservation, Semen banking, Micro manipulation of cells, artificial insemination, IVF-PZD, SUZI.

Unit IV (15 Hours)

Stem cells: Stem cells and their applications (Cell cloning: Therapeutic cloning, reproductive cloning (Dolly); Transformation of cells in culture –Viral vectors -Adeno and Retro (Sv40, AAV), gene targeting (knock out mouse) Gene therapy and its application

Unit V (15 Hours)

Transgenic animals: Production (Physical, chemical and biological methods), application – Hormone - Insulin to humulin, cytokines, interferons and human growth hormones, blood clotting factors (Plasminogen activators), biopharming (Somatropin).

** denotes Self study*

Teaching Methods

Powerpoint presentation/ Google Class rooms/Seminar/Quiz/Discussion/Assignment/ Demonstration

Text books

1. Satyanarayana, U. 2005. Biotechnology. McGraw Hill Publishing Co., Kolkata.
2. Ranga, M. M., 2004. Animal Biotechnology, 2nd Edition. Agrobios (India), Jodhpur.

References book

1. Freshney, R. I., 2006. Culture of Animal cells: Manual of Basic technique, 5th edition. John Wiley Publications.
2. Masters, J. R. W., 2000. Animal Cell Culture: A practical approach series, 3rd Edition. Oxford University Press, London.
3. Bruce Carlson, 2006. Foundations of Embryology. Tata McGraw Hill Publications.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	S	S	H
CO2	H	H	S	H	S
CO3	H	H	S	H	S
CO4	H	S	H	S	H

S – Strong **H** – High **M** – Medium **L** – Low

UBT33

19UBT5CP

Programme code: 08		Programme name: B. Sc. Biotechnology		
Course Code: 19UBT5CP		C. Pr. 5 –Lab in Immunology, rDNA Technology and Animal Biotechnology		
Batch 2019-2020	Semester V	Hours / Week 6	Total Hours 90	Credits 3

Course Objectives

- To have hands on experience and to learn the principles behind immunological techniques
- To give hands on experience in manipulation and detection of nucleic acids and proteins
- To understand the principles behind animal cell culture techniques

Course Outcomes (CO)

K3	CO1	Developing and applying the recent technology involved in diagnostic techniques of immunology and animal cell culture
K4	CO2	Analyzing the results involved in immuno techniques, rDNA Technology and Animal Biotechnology
K5	CO3	Examining the techniques involved in Immunology, rDNA Technology and Animal Biotechnology

Syllabus

IMMUNOLOGY (30 Hours)

1. ELISA
2. Immunoelectrophoresis
3. ABO blood grouping.
4. Radial immunodiffusion.
5. Ouchterlony Double immunodiffusion.
6. Preparation of serum and plasma from blood.
7. Immunoassay of particulate antigen.
8. WIDAL test

RECOMBINANT DNA TECHNOLOGY (30 Hours)

1. Restriction Digestion and Ligation
2. Amplification of a gene by Polymerase Chain Reaction
3. Southern Blotting and Hybridization (Demo)

UBT34

19UBT5CP

ANIMAL BIOTECHNOLOGY (30 Hours)

1. Animal cell culture medium preparation
2. Primary cell culture and subculturing.
3. PBMC isolation and cell counting (haemocytometer)
4. DNA fragmentation analysis

Teaching Methods

- Google classrooms; information and communication technology; Powerpoint presentations; Board teaching; Demonstration of experiments; Providing hands on training in all the experiments as well as the preparation of reagents; Discussion and Interpretation of results

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	H	M	S
CO2	H	S	S	S	M
CO3	S	M	H	M	S

S – Strong **H** – High **M** – Medium **L** – Low

UBT35

19UBT610

Programme code: 08		Programme name: B. Sc. Biotechnology		
Course Code: 19UBT610		Course title: C. P. 10 – Bioprocess Technology		
Batch 2019-2020	Semester VI	Hours / Week 5	Total Hours 75	Credits 4

Course Objectives

1. To understand the basic principle and applications of Bioreactors
2. To makes the student to learn the concepts of upstream and downstream process of fermentation
3. To learn the role of industrially important microorganisms in yield of products

Course Outcomes (CO)

K1	CO1	Recollecting the principle and application of industrially important microorganisms on large yield of products
K2	CO2	Explaining the basic design and types of bioreactors and its working principles
K3	CO3	Demonstrating various techniques like media formulation, strain improvement and inocula development and product recovery to improve processing
K4	CO4	Obtaining the skill to examine the growth kinetics of fermentation systems to improve product yield

Syllabus

Unit I (15 Hours)

Bioprocess technology**:** Basic principles, **scope and advantages of bioprocess technology***. Fermentation systems of batch, fed batch-and continuous and kinetics (batch and continuous).

Unit II (15 Hours)

Bioreactor: Components, design and functions. Types of bioreactors (CSTR, packed bed, batch, Air lift bioreactor, immobilized bed bioreactors, Photobioreactors). Isolation, screening and maintenance of industrially important microorganisms and strain improvement methods.

Unit III (15 Hours)

Upstream Processing**:** Media formulation. sterilization-Batch, Continous. Inocula development. Scale up and Scale down. Transport phenomena: - Mass, oxygen and heat transfer mechanism.

Unit IV (15 Hours)

Downstream Processing: Introduction, removal of microbial cells and solid matter, foam separation, membrane processes (microfiltration, Ultrafiltration, nanofiltration and reverse osmosis), precipitation

(solvent precipitation and salting out), filtration, centrifugation, cell disruptions (Mechanical, enzymatic and chemical), liquid – liquid extraction chromatography, drying and crystallization.

Unit V (15 Hours)

Industrial Biotechnology**:** Alcoholic beverages (**beer and wine***), organic acids (acetic and citric acid), Organic solvents (ethanol), enzymes (Amylase and Protease), antibiotics (Pencillin and Streptomycin), vitamin B12 and amino acids (glutamic acid).

** denotes Self study*

Teaching Methods

Powerpoint presentation/ Google Class rooms/Seminar/Quiz/Discussion/Assignment/ Demonstration

Text Books

1. Stanbury, P. F. and A. Whitaker., (2003), Principles of Fermentation Technology. Pergamann Press, Oxford.
2. Sathyanarayana, U., (2007), Biotechnology, Books & Allied (P) Ltd.

Reference Books

1. Shuler, M. L. and F. Kargi., (2003), Bioprocess engineering: Basic Concepts. Prentice Hall, Engelwood Cliffs.
2. Cruger, W. and A. Cruger., (2003), A Textbook of Industrial Microbiology, Panima Publishing Corporation, New Delhi.
3. Casida, L.E., (1999,. Industrial Microbiology. New Age International Pvt. Ltd., New Delhi.
4. Patel, A.H., (2016), Industrial microbiology, 2nd edition, Trinity publication.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	M	H	H	M	H
CO2	M	M	H	H	H
CO3	H	H	M	M	M
CO4	M	M	H	H	M

S – Strong **H** – High **M** – Medium **L** – Low

UBT37

19UBT611

Programme code: 08		Programme name: B. Sc. Biotechnology		
Course code: 19UBT611		Course title: C. P. 11-Plant Biotechnology		
Batch 2019-2020	Semester VI	Hours / Week 5	Total Hours 75	Credits 4

Course Objectives

1. To make students understand about the basics of plant science
2. To equip students with culture techniques and scope of plant biotechnology
3. To provide knowledge on genetic engineering in the improvement of plants for human welfare

Course Outcomes (CO)

K1	CO1	Topics are recall with repeated discussions
K2	CO2	With the help of comparative statements students are understand the concepts
K3	CO3	Students are practiced to apply the experiments for their study topics
K4	CO4	Students ability is judged by using class seminars and discussions

Syllabus

Unit I (15 Hours)

Plant breeding: Conventional methods, self pollination, cross pollination, mass selection, Heterosis and Male sterility. Plant tissue culture: History, laboratory organization, **sterilization methods***, types and composition of media and preparation, Plant growth regulators.

Unit III (15 Hours)

Propagation techniques: Micropropagation, Callus culture, Cell culture, Isolation of protoplast, fusion and culture, Somatic embryogenesis and Synthetic seed preparation, Haploid production: Anther and Pollen culture, Somaclonal variation.

Unit III (15 Hours)

Plant genome organization: Nucleus, Chloroplast and Mitochondrial, Protein targeting: Chloroplast and Mitochondria. Model plant: Arabidopsis.

Unit IV (15 Hours)

Plant Gene Transformation and Techniques: Biological N_2 fixation: Mechanism of *nif* and *nod* genes. Transformation: Stable and Transient gene expression, Gene transformation methods: Chemical and Gene gun. Model Plants: Tobacco, *Agrobacterium* characteristics, Ti and Ri plasmids, Mechanism of T-DNA transfer. Plant viral vector - CaMV.

19UBT611

Unit V (15 Hours)

Transgenic plants: Chitinase gene based fungal resistance, Coat protein mediated virus resistance, Insect resistance (Bt genes) and Herbicide resistance, Golden rice and Flavr Savr tomato, Plantibodies, Edible vaccines (interleukins and interferons) and Biodegradable plastics. GM food and **Biosafety issues***.

** denotes Self study*

Teaching Methods

Powerpoint presentation/ Google Class rooms/Seminar/Quiz/Discussion/Assignment/ Demonstration

Text books

1. Chawla, H. S. 2002. Introduction to Plant Biotechnology. 2nd Edition, Science Publishers, Inc., Enfield, NH, USA.
2. Kalyan Kumar De. 2004. An Introduction to Plant Tissue Culture.2008. New Central Book Agency, Kolkata.
3. Dubey, R.C., 2013. A text book of Biotechnology (Revised Edition), S. Chand & Company Ltd. New Delhi.
4. Razdan, M. K., 2003. Introduction to Plant Tissue Culture. 2nd Edition, Science Publishers, Inc., Enfield, NH, USA.

Reference books

1. Slater, Scott and Fowler, 2008. Plant Biotechnology, 2nd Edition, Oxford University Press.
2. Primrose, S.B. and Twyman, R. 2006. Principles of Gene Manipulation and Genomics. 7th Edition, Blackwell Publishing, Malden, MA, USA.
3. Buchanan, Gruissem and Jones.2000. Biochemistry and Molecular Biology of Plants. John Wiley & Sons, UK.
4. Molecular Plant Biology: A practical approach (Vol. I and II), Edited by Gilmartin and Bowler, 2002, Oxford University press, UK

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	S	S	H
CO2	H	H	S	H	S
CO3	H	H	S	H	S
CO4	H	S	H	S	H

S – Strong **H** – High **M** – Medium **L** – Low

UBT39

19UBT612

Programme code: 08		Programme name: B. Sc. Biotechnology		
Course code : 19UBT612		C. P. 12 – Genomics, Proteomics and Bioinformatics		
Batch 2019-2020	Semester VI	Hours / Week 5	Total Hours 75	Credits 4

Course Objectives

1. To study and deduce the molecular characterization of human genome
2. To study the techniques involved in structural and functional proteomics
3. To utilize the bioinformatics tools to design and development of novel drugs

Course Outcomes (CO)

K1	CO1	Commemorating the molecular techniques involved in characterization of genomes and proteomes
K2	CO2	Recognizing and interpreting the techniques involved in genomics, proteomics, bioinformatics
K3	CO3	Administering the principles of genomics, proteomics, bioinformatics to discovery novel drug development
K4	CO4	Analyzing the molecular markers and its applications

Syllabus

Unit I (15 Hours)

Genomics: Genomes of bacteria and eukaryotes-topology, organization. Human Genome Project: Goals, Historical background; Human genome features-protein coding regions repetitive sequences, CpG Islands and pseudogenes. **Ethical, legal, social implications of HGP*.**

Unit II (15 Hours)

Mapping and Sequencing: Molecular markers for genome analysis – RAPD, RFLP and SNP, Genetic and physical mapping- Pedigree analysis, Restriction mapping, STS mapping with radiation hydrid panels; DNA and Maxam and gilbert sequencing, Shotgun sequencing-Hierarchial, Whole genome; Contig assembly.

Unit III (15 Hours)

Proteomics: Structural proteomics- NMR, X-ray crystallography and Mass spectroscopy-MALDI-TOF, ESI, SELDI-TOF. Functional Proteomics - 2D analysis of cellular proteins, Yeast two hybrid system for protein-protein interaction, Protein micro arrays.

Unit IV (15 Hours)

Bioinformatics: Nucleic acid sequence databases: Genbank, Protein sequence databases - Swiss-Prot, PDB; Databank search: File formats - EMBL, **FASTA***, GCG. BLAST: types, steps involved in use, interpretation of results, multiple sequence alignment (ClustalW), Phylogenetic analysis for nucleic acid and proteins, Next Generation sequencing.

19UBT612

Unit V (15 Hours)

Emerging areas of Bioinformatics: Gene expression analysis: DNA microarrays- concept and design, analysis, visualization of data, expression profiling using SAGE. Medical informatics, Disease genes identification and drug targets, Molecular Docking.

** denotes Self study*

Teaching Methods

Powerpoint presentation/ Google Class rooms/Seminar/Quiz/Discussion/Assignment/ Demonstration

Text Books

1. Brown, T.A., (2017). Genomes, CRC Press is a member of Taylor & Francis Group
2. Lesk, A. M., (2002). Introduction to Bioinformatics, Oxford University Press, UK.

Reference Books

1. Sandy B. Primrose, Richard Twyman (2007), Principles of Gene Manipulation and Genomics, 7th edition, Willey-Blackwell.
2. Daniel. C. Liebler, (2002). Introduction to Proteomics, Humana Press.
3. Tsai, C.S., (2002). An Introduction to Computational Biochemistry, Wiley-Liss, Inc., NY.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	H	M	S
CO2	H	S	S	M	M
CO3	S	H	S	S	M
CO4	S	M	M	H	S

S – Strong H – High M – Medium L – Low

UBT41

19UBT6CQ

Programme code: 08		Programme name: B. Sc. Biotechnology		
Course code : 19UBT6CQ		C. Pr.6: Lab in Bioprocess technology, Plant biotechnology and Bioinformatics		
Batch 2019-2020	Semester VI	Hours / Week 5	Total Hours 75	Credits 3

Course Objectives

1. To get hands on experience in large scale production of products by industrially important microorganisms.
2. To make students to learn and have experience on plant tissue culture and techniques behind the transgenic plants synthesis.
3. To get hands on knowledge on basic tools of *in silico* analysis

Course Outcomes (CO)

K1	CO1	Developing the handling techniques in plant tissue culture Utilizing the basic tools in sequencing
K2	CO2	Comparing the different growth parameters to optimize the growth to improve yields and to analyse the products like amylase, ethanol and lactic acid.
K3	CO3	Utilizing the basic tools in sequencing

Syllabus

BIOPROCESS TECHNOLOGY

1. Study of the parts of a bioreactor.
2. Isolation of amylase producing bacteria
3. Optimization of conditions for bacterial growth and amylase production (media, pH & temperature)
4. Purification of bacterial amylase
   - Ammonium sulfate precipitation
   - Dialysis
   - Gel filtration chromatography
5. Wine production and analysis
6. Sauerkraut preparation for lactic acid fermentation and analysis.

PLANT BIOTECHNOLOGY

1. PTC Laboratory organization
2. Preparation of MS medium and sterilization.

3. *In vitro* seed germination
4. Artificial seed preparation and culture
5. Micropropagation - Nodal and shoot tip
6. Callus and suspension culture
7. Isolation of plant genomic DNA
8. Isolation of protoplast and viability check
9. Genetic Transformation (Demo)

BIOINFORMATICS

1. File Formats of Nucleic acid and aminoacid sequences
2. Sequence similarity searching using NCBI (BLAST)
3. Protein Data banks (SWISSPROT and ExPASy)
4. Multiple sequence alignment (ClustalW)
5. Molecular docking

Teaching Methods

- Google classrooms; information and communication technology; Powerpoint presentations; Board teaching; Demonstration of experiments; Providing hands on training in all the experiments as well as the preparation of reagents; Discussion and Interpretation of results

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	S	S	H
CO2	M	M	S	H	M
CO3	M	M	S	M	H

S – Strong **H** – High **M** – Medium **L** – Low

UBT43

Major Elective

Programme code: 08	Programme name: B. Sc. Biotechnology		
Course code:	Major Elective : Research Methodology and Biostatistics		
Batch 2019-2020	Hours / Week 5	Total Hours 75	Credits 5

Course Objectives

1. To make students understand the research concepts, plagiarism and thesis writing etc.
2. To create idea about data collection and data processing
3. To teach various statistical tools for analysis and interpretation of results

Course Outcomes (CO)

K1	CO1	Students are trained to remember the concepts by label the important concepts
K2	CO2	Concepts are made in to easily understandable by interpreting the results
K3	CO3	Students are practiced to apply the statistical concepts by using models
K4	CO4	Students are tested to solve the statistical calculations

Syllabus

UNIT I (15 hours)

Research: Scope and significance, Types of Research, Research Process, Characteristics of good research, Problems in Research, Identifying research problems. Seminar paper preparation and presentation.

UNIT II (15 hours)

Thesis Writing: Literature collection and citation, Research report writing: Content, Table, Figure formatting and typing. Plagiarism, Research article writing and Reference writing.

UNIT III (15 hours)

Biostatistics: **Definitions and scope of biostatistics***. Collection of data and tabulation, Graphical and diagrammatic representations. *Measures of central tendency:* Mean, Median and Mode. *Measures of dispersion:* Absolute and Relative measures. Range, Standard deviation and Variance, Coefficient of variation.

UBT44

Major Elective

UNIT IV (15 hours)

Correlation: Definition, Types and Karl Pearson's coefficient of correlation. *Regression*: Definition, Regression of Y on X and X on Y.

UNIT V (15 hours)

Testing of Hypothesis: Student's t test, Chi-square test and its applications, ANOVA and its significance. Designing of experiments and statistical analysis and Use of software for statistical analysis.

** denotes Self study*

Text Books

1. Gurumani, N. 2006. Research Methodology for Biological Sciences. M JP Publishers, Chennai.
2. Pillai R. S. N. and Bhagavathi V., 2000. Statistics, Sultan Chand & Co., New Delhi.
3. Gupta, S. P., 2001. Statistical Methods, Sultan Chand & Co, New Delhi.

References

1. Kothari, C.R., 2004. Research Methodology – Methods and Techniques, Second edition, New Age International Pvt. Ltd, New Delhi.
2. Sundar Rao, P.S.S., and J. Richard., 2006. Introduction to Biostatistics and Research methods, PHI Publication, New Delhi.
3. Sandhu, T., 1990. Research Techniques in Biological Sciences, Anmol Publishers, New Delhi.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	S	H	H
CO2	S	H	H	H	M
CO3	H	H	M	S	H
CO4	H	S	H	H	S

S – Strong **H** – High **M** – Medium **L** – Low

UBT45

Major Elective

Programme code: 08	Programme name: B. Sc. Biotechnology		
Course code:	Major elective - Bioentrepreunership		
Batch 2019-2020	Hours / Week 5	Total Hours 75	Credits 5

Course Objectives

1. To provide Knowledge about the importance of conserving biodiversity and to acquire a broad base of knowledge of environmental systems
2. It enables the students to understand the fundamental and applied aspects of environmental biotechnology
3. To understand the pros and cons of the usage of bioscience in various aspects of environment and its applications

Course Outcomes (CO)

K1	CO1	Defining the principles and scope of Biodiversity and Environmental Biotechnology
K2	CO2	Illustration of the fundamental problems in environment
K3	CO3	Develop the students to take up roles as environmental analysts and environmental managers with an emphasis on environmental monitoring and pollution control
K4	CO4	Discover the environmental and technological issues in the management and control of air, soil and water pollution

Syllabus

Unit-I (15 Hours)

General Introduction, Types of Biodiversity, Measures of Biodiversity, Loss of Biodiversity – causes, Economic evaluation of Biodiversity: Direct and Indirect values; Hotspots of biodiversity.

Unit-II (15 Hours)

Current levels of biodiversity-Extinction and endangered species- natural and human caused extinction. Essential services provided by natural ecosystems. Steps to preserve biodiversity. *In situ* and *Ex Situ* conservation. Interaction between environment and biota, Concept of habitat and ecological niches.

Unit-III (15 Hours)

Biotechnology in Environmental Protection: Introduction, Waste water and effluent treatment- Biological treatment- aerobic and anaerobic. Use of genetically engineered organisms in waste water treatment. Carbon credits.

UBT46

Major Elective

Unit-IV (15 Hours)

Removal of specific pollutants: Heavy metal - Accumulation, Biosorption, and Bioleaching. Bioremediation: Applications and examples. Pollutant markers: **Eutrophication*** and *Chironomous* sp, Xenobiotic compounds. Bioindicators and Biosensors for detection of pollutants.

Unit-V (15 Hours)

Treatment of wastes - Pulp industry, Tanning industry, Distilling industry, Dye industry. Composting – process, decomposition stages in compost preparation and methods; Vermicomposting. Organic and biodynamic farming (**Vermitechnology***), Mushroom cultivation.

** denotes Self study*

Teaching Methods

Board teaching, Powerpoint presentation/ Google Class rooms/ Seminar/ Quiz/ Discussion/ Assignment/ Demonstration

Textbooks

1. Glick, BR., Pasternak, JJ. (1998). Molecular Biotechnology, 2nd Edition, ASM Press, Washington.
2. Jogdand, SN. (2008). Environmental Biotechnology, Himalaya Publishing House, Mumbai.
3. Hosetti, BB. (2002). Glimpses of Biodiversity. Deya Publishing House, New Delhi.

References

1. Atlas, RM. (1997). Principles of Microbiology. McGraw-Hill, New York.
2. Cruger, W. Cruger, A. (2003). A Textbook of Industrial Microbiology. Panima Publishing Corporation, New Delhi.
3. Jogdand, SN. (2008). Environmental Biotechnology, Himalaya Publishing House, Mumbai.
4. Scragg, A. (2005). Environmental Biotechnology, Oxford University Press, London.
5. Krishnamoorthy, KV. (2003). An advanced text book on Biodiversity- Principles and Practice. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Joshi, P. C., Joshi, N. (2004). Biodiversity and Conservation. A.P.H. Publishing Corporation, New Delhi.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	M	S	H	H	S
CO2	S	M	H	M	H
CO3	H	S	S	H	S
CO4	S	H	M	S	M

S – Strong **H** – High **M** – Medium **L** – Low

UBT47

Major Elective

Programme code: 08	Programme name: B. Sc. Biotechnology		
Course code:	Major Elective – Bionanotechnology, IPR and Bio safety		
Batch 2019-2020	Hours / Week 6	Total Hours 75	Credits 5

Course Objectives

1. To understand the new concept of nanotechnology applied to the area of biotechnology
2. To acquire requisite skills for the design and development of high throughput screening in nanobiotechnology, IPR
3. To give assay methods leading to the novel drug discovery and designing and biosafety methods.

Course Outcomes (CO)

K1	CO1	Understanding the basic concepts of Nanobiotechnology, IPR
K2	CO2	Differentiate various methods of synthesis of nanoparticles and obtain the skills in characterization methods of the nanomaterials
K3	CO3	Learning the scope and applications of nanomaterials, IPR, biosafety
K4	CO4	Know how Intellectual property rights and biosafety are important to Biotechnology

Syllabus

Unit I (15 Hours)

Basic concepts of Nano science and technology. Development of nanobiotechnology - timelines and progress. Superior properties of nano compared with bulk materials. Strategies for synthesis of nanoparticles: top-down & bottom-up approach, Microemulsions. Biological method- bacteria, fungi, virus, plants.

Unit II (15 Hours)

Bionanostructures: Characterization of nanomaterials: **SEM** Scanning Tunneling and Atomic Force Microscopy, **TEM**: Structural and Functional principles of bionanotechnology, microbial systems for assembly of nanostructures.

Unit III (15 Hours)

Applications: **Scope and applications of nanobiotechnology***. Functional nanoparticles for targeted Cancer Theranostics. Nanoparticles for waste water treatment and management. Use of Bio-molecules such as Proteins*, DNA, RNA, Aptamers, Peptides, Antibody, Virus as nanoparticles for drug targeting and therapy.

Unit IV (15 Hours)

UBT48

Major Elective

Intellectual property rights: meaning, evolution, Classification and forms, Patents : Concepts and principle of patenting – patentable subject matter, Procedure for obtaining patent – Rights of patent, Infringement of patent right, Remedies for infringement of patent rights-patentability and emerging issues.

Unit V

Biosafety: Definition of Biosafety. Requirements, Biosafety for human health and environment Use of genetically modified organisms and their release into the environment, biosafety assessment procedures for biotech foods & related products, Cartagena protocol on biosafety, bioterrorism and convention on biological weapons, WIPO, **GATT*.**

**** denotes Self study***

Teaching Methods

Powerpoint presentation/ Google Class rooms/Seminar/Discussion/Assignment/ Demonstration

Text Books

1. Nanobiotechnology: Concepts, Applications and Perspectives (2004), Christof M.Niemeyer (Editor), Chad A. Mirkin (Editor), Wiley VCH.
2. Michael Kohler, Wolfgang Fritzscw. (2007) Nanotechnology an introduction to nanostructuring techniques. Willey –VCH.

Reference Books

1. Goodsell, DS (2004) Bionanotechnlogy: Lessons from Nature, Wiley - Liss, Inc., NY.
2. Strocio, MA and Dutta, M (2004) Biological Nanostructures and Applications of Nanostructures in Biology: Electrical, Mechanical, and Optical properties, Kluwer Academic / Plenum Publishers, USA.
3. David E. Reisner (2009). Bionanotechnology Global prospects. CRC Press. Taylor & Francis Group 6000 Broken Sound Parkway NW, Suite 300.
4. Stephen R. Grobmyer & Brij M. Moudgil (2010) Cancer Nanotechnology - Methods and Protocols Humana Press.
5. Singh, K., 2000. Intellectual Property Rights on Biotechnology, BCll, New Delhi.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	H	M	M	S
CO2	S	M	H	H	H
CO3	M	M	S	M	M
CO4	H	H	M	H	M

S – Strong **H** – High **M** – Medium **L** – Low

UBT49

Major Elective

Programme code: 08	Programme name: B. Sc. Biotechnology		
Course code:	Major Elective – Natural Products and Algal Biotechnology		
Batch **2019-2020**	Hours / Week **6**	Total Hours **75**	Credits **5**

Course Objectives

1. To acquire the knowledge of medical biotechnology
2. To introduce clinical aspects of biotechnology and significance in diagnostics
3 To obtain the knowledge of cancer, stem cell and gene therapy methods.

Course Outcomes (CO)

K1	CO1	Introducing medical biotechnology, regulatory measures, organizations and drug discovery
K2	CO2	Understanding the role of healthcare, molecular tools and biosensors
K3	CO3	Analyzing the vaccine technology principles and its applications
K4	CO4	Updating the knowledge in the recent developments in medical biotechnology and to acquire the knowledge in different forms of cancer therapy.

Syllabus

Unit-I (15 Hours)

Sources of crude drug: Biological, marine, Mineral and plant tissue culture as source of natural products. Various methods of extraction and isolation of phytopharmaceuticals namely infusion, decoction, maceration, percolation, hot continuous extraction, successive solvent extraction, supercritical fluid extraction, steam distillation, Counter-current Extraction, Ultrasound Extraction (Sonication). Parameters for selection of suitable extraction process.

Unit-II (15 Hours)

Phytochemical Screening: Screening of alkaloids, saponins, cardenolides and bufadienolides, flavonoids and leucoanthocyanidins, tannins and polyphenols, anthraquinones, cynogenetic glycosides, amino acids in plant extracts. Important therapeutic classes: antimicrobial, antidiabetics, hepatoprotectives, immmunomodulators, anti-cancer.

Unit III: (15 Hours)

Algae - Overview A general account and classification of Algae – distribution - range of thallus organization – pigmentation- flagellation- reserve food – Reproduction(vegetative-asexual-sexual) ; Lifecycle patterns – -salient features of algal divisions (Harold C Bold) – phylogeny - Fossil algae.

UBT50

Major Elective

Unit IV: (15 Hours)

Cyanobacterial inoculants (BGA): Isolation, preparation of starter culture, mass cultivation, field applications and crop response. Algae - Applications Algal biotechnology: single cell proteins (SCP): Spirulina as single cell protein-production and harvesting of algal biomass – factors affecting biomass production.

Unit V: (15 Hours)

Economic importance of algae: Algae as food and fodder, use of algae in agriculture and space research, commercial products of algae: Agar Agar, Alginates, Carrageenin, diatomite, mucilage, minerals and elements - Algae in medicine and biofuels.

** denotes Self study*

Teaching Methods

Powerpoint presentation/ Google Class rooms/Seminar/Quiz/Discussion/Assignment/ Demonstration

Reference Books

1. Srivastava, H.N. 1999. Algae. Pradeep publications, Meerut. 2. Sharma, O.P. 2004.

2. A Textbook of Algae. Tata McGraw- Hill publishing Company Limited, New Delhi.

3. Sharma, O.P. 2004. A Textbook of Algae. Tata McGraw- Hill publishing Company Limited, New Delhi.

4. Bilgrami, K.S. and Saha, L.C. 2012. A Textbook of Algae. CBS Publishers & Distributors Pvt. Ltd., New Delhi.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	H	H	S	H
CO2	H	H	S	H	M
CO3	M	S	H	H	M
CO4	H	M	M	H	H

S – Strong **H** – High **M** – Medium **L** – Low

UBT51

Major Elective

Programme code: 08	Programme name: B. Sc. Biotechnology		
Course code:	Major Elective – Enzyme Technology		
Batch 2019-2020	Hours / Week 5	Total Hours 75	Credits 5

Course Objectives

1. To gain knowledge about enzyme technology and production of enzymes
2. To provide an overview of enzyme production processes
3 To obtain the knowledge of cancer, stem cell and gene therapy methods.

Course Outcomes (CO)

K1	CO1	Illustrating the knowledge about the enzymes and their chemistry is of prime importance.
K2	CO2	Updating the knowledge in the recent developments in medical biotechnology and to acquire the knowledge in different forms of cancer therapy.
K3	CO3	Categorizing the enzyme technology with their principles and its applications
K4	CO4	Understanding the concepts in enzyme technology and methods for the production of sustainable and high value-added products utilizing enzymes as biocatalysts and microbes as efficient producers, in order to meet various human needs

Syllabus

Unit I (15 Hours)

Enzyme – General Account Classification of enzymes and enzyme kinetics of single substrate and two substrate catalyzed reactions Factors affecting rate of enzymatic reactions: temperature pH modulators etc. and significance of activation energy and free energy in biochemical reactions.

Unit II (15 Hours)

Enzyme Cofactors and Mechanism of Enzyme Catalysis Structure and biological function of a variety of enzyme cofactors. Enzyme substrate complex concept of ES complex binding sites, active site and type of enzyme specificities. Acid Base catalysis, Orientation and Proximity, Covalent Catalysis (Electrophilic and Nucleophilic), Strain and Distortion.

Unit III (15 Hours)

Regulation of Enzyme activity, Covalent Modification & Allosteric Regulation. Isozymes and Abzymes Asymmetric catalysis through enzymes

Unit IV (15 Hours)

Enzyme immobilization and Biotransformation. Methods and principles, Supporting matrix, advantages, and reactor-design for immobilization of enzymes. **Biotransformation through enzymes and Microbes*** Non-aqueous enzyme technology

UBT52

Major Elective

Unit V (15 Hours)

Enzyme technology for industrial application. Applications of enzyme technology in environment Medical, Agricultural, Industrial benefits

** denotes Self study*

Teaching Methods

Board teaching, Powerpoint presentation/ Google Class rooms/Seminar/Quiz/Discussion/Assignment/ Demonstration

Textbooks

Anil Kumar, Sarika Garg. (2015) Enzymes and Enzyme Technology, Viva Books.

References

1. Nicholas C. Price and Lewis Stevens (2000) Fundamentals of Enzymology-The Cell and Molecular Biology of Catalytic Proteins, 3rd Edition. Oxford University Press.
2. Creigntion, (2011) Proteins: Structure & Molecular Properties, Freeman Pub.
3. Stephen Neidle, Nucleic acid Structure and Recognition, Oxford University Press
4. Rob Reed , David Holmes, Practical Skills in Bimolecular Sciences, LONGMAN Pub

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	M	S	H	H	S
CO2	S	M	H	M	H
CO3	H	S	S	H	S
CO4	S	H	M	S	M

S – Strong **H** – High **M** – Medium **L** – Low

UBT53

Major Elective

Programme code: 08	Programme name: B. Sc. Biotechnology		
Course code:	Major Elective – Developmental Biology		
Batch **2019-2020**	Hours / Week **5**	Total Hours **75**	Credits **5**

Course Objectives

- Describe the events in the developmental process,
- Predict the results of genetic or embryological manipulations, based on their knowledge of the developmental process,
- Make hypotheses about the mechanisms involved in the process based on experimental results, and
- Design experiments to test hypotheses about the developmental process.

Course Outcomes (CO)

K1	CO1	Illustrating the basics of medical biotechnology, regulatory measures, organizations and drug discovery
K2	CO2	Developing the role of healthcare, molecular tools and biosensors
K3	CO3	Categorizing the vaccine technology with their principles and its applications
K4	CO4	Updating the knowledge in the recent developments in medical biotechnology and to acquire the knowledge in different forms of cancer therapy.

Syllabus

Unit I (15 Hours)

Gametogenesis and Fertilization: Definition, scope and historical perspective of development Biology, Gametogenesis – Spermatogenesis, Oogenesis Fertilization - Definition, mechanism, types of fertilization. Different types of eggs on the basis of yolk.

Unit II (15 Hours)

Early embryonic development: Cleavage: Definition, types, patterns and mechanism Blastulation: Process, types and mechanism Gastrulation: Morphogenetic movements– epiboly, emboly, extension, invagination, convergence, de-lamination. Formation & differentiation of primary germ layers.

Unit III (15 Hours)

Embryonic Differentiation: Differentiation: Cell commitment and determination- the epigenetic landscape: a model of determination and differentiation, control of differentiation at the level of genome, transcription and post-translation level Concept of embryonic induction: Primary, secondary & tertiary embryonic induction, Neural induction and induction of vertebrate lens.

UBT54

Major Elective

Unit IV (15 Hours)

Organogenesis: Neurulation, notogenesis, development of vertebrate eye. Fate of different primary germlayers Development of behavior: constancy and plasticity, Extra embryonic membranes, placenta in Mammals.

Unit V (15 Hours)

Medical implications of developmental biology - genetic errors/ teratogenesis/ stem cell therapy etc.

** denotes Self study*

Teaching Methods

Board teaching, Powerpoint presentation/ Google Class rooms/Seminar/Quiz/Discussion/Assignment/ Demonstration

Textbooks

Developmental Biology, Werner A Muller, Springer, ISBN 0387947183

References

1. Developmental Biology, Eighth Edition" by Scott F Gilbert.
2. Essential Developmental Biology by Jonathan Slack, Wiley Blackwell, March 2001
3. Principles of Development - Lewis Wolpert, Oxford University Press, 2011.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	M	S	H	H	S
CO2	S	M	H	M	H
CO3	H	S	S	H	S
CO4	S	H	M	S	M

S – Strong **H** – High **M** – Medium **L** – Low

UBT55

19UBT6Z1

Programme code: 08		Programme name: B. Sc. Biotechnology		
Course code: 19UBT6Z1		Practicum and Viva-voce *		
Batch 2019-2020	Semester VI	Hours / Week 2	Total Hours 60	Credits 4

Course Objectives

1. To identify the talent at early stage, by providing them with excellent on scientific projects
2. To explore the ability to plan carryout innovation project in group
3. To develop and execute the knowledge by planning and coordinating a project.

Course Outcomes (CO)

K3	CO1	Applying the practical experience to design project
K4	CO2	Inducing the students to become scientist
K5	CO3	Have gained practical experience in planning of projects and project management in biotechnological industry

DIRECTIONS

- Students are allocated a dissertation topic for a group under the supervision of faculty of the department.
- The dissertation must be similar to the thesis style and encompass:
  - (i) Introduction
  - (ii) Review of Literature
  - (iii) Materials and Methods
  - (iv) Results
  - (v) Discussion and Conclusion
  - (vi) Bibliography
- The dissertation should be submitted in type-written, bound form to the department for record.
- While evaluation of dissertation, 15 marks (internal) should be based on oral presentation before the HoD, faculty members of department and in the presence of concerned supervisor during the period of CIA examinations and 5 marks for his/her regularity.
- External / end semester - 80 marks should include:
  - (i). Evaluation of project work (60 marks) based on:
    - (a) Scientific content and Objectives (20marks)
    - (b) Experiments and final outcome (20 marks)
    - (c) Presentation (20 marks)
  - (ii). Viva-voce by Examiners** (20 marks)

UBT56

19UBT6Z1

** Group project*

*** Project report and viva voce will be evaluated by both the project supervisor (Faculty of the department) and an External Examiner.*

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	H	H	S
CO2	M	H	M	M	M
CO3	S	M	H	M	H

S – Strong **H** – High **M** – Medium **L** – Low

UBT57

19EVS101

Programme code: 08		Programme name: B. Sc. Biotechnology		
Course code: 19EVS101		Part IV – Environmental Studies		
Batch 2019-2020	Semester I	Hours / Week 2	Total Hours 30	Credits 2

Course Objectives

- To inculcate knowledge and create awareness about ecological and environmental concepts, issues and solutions to environmental problems.
- To shape students into good "ecocitizens" thereby catering to global environmental needs.

Syllabus

UNIT I Multidisciplinary nature of environment (6 hours)

Definition : scope and importance – Need for public awareness - Natural resources – Types of resources – Forest Resources – Water Resources – Mineral Resources – Food Resources – Energy Resources – Land Resources.

UNIT II Ecosystems (6 hours)

Concept of an ecosystem – Structure and functions of an ecosystem – Procedures, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food web and ecological pyramids – Structure and function of the following ecosystem – Forest Ecosystem –Grassland Ecosystem – Desert Ecosystem – Aquatic Ecosystem.

UNIT III Biodiversity and its conservation (6hours)

Introduction – Definition – Genetic – Species and ecosystem diversity- Bio geographical classification of India – Value of biodiversity – Biodiversity at global, national and local levels – India as a mega - diversity Nation - Hot spot of biodiversity – Threats to biodiversity - Endangered and endemic species of India – Conservation of Biodiversity – insitu Conservation of Biodiversity – exsitu Conservation of Biodiversity

UNIT IV Environmental pollution (6 hours)

Definition - Causes, effects and control measures of : Air Pollution – Water Pollution – Soil Pollution – Marine Pollution – Noise Pollution – Thermal Pollution – Nuclear Pollution – Solid Waste Management: Causes, effects, control measures of urban and industrial wastes – Role of individual in prevention of pollution – Pollution case studies – domestic waste water, effluent from paper mill and dyeing, cement pollution – Disaster Management – Food, Drought, Earthquake, Tsunami, Cyclone and Landslide.

19EVS101

UNIT V Social issues and the environment (6 hours)

Sustainable Development – Urban problems related to energy – Water Conservation: Rain Water Harvesting and Watershed Management – Resettlement and rehabilitation of people, its problems and concerns, case studies Narmatha Valley Project – Environmental ethics, issues and possible solutions – Climate change, global warming, ozone layer depletion, acid rain, nuclear accidents and holocaust, case studies – Hiroshima and Nagasaki, Chernobyl – Consumerism and waste products – Environmental Protection Act – Air Pollution Act (Prevention and Control) – Water Pollution Act (Prevention and control) – Wild Life Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness – Human Population and the environment – Population Growth and Distribution – Population Explosion – Family Welfare Programme – Environment and Human Health – Human Rights – Value Education – HIV/ AIDS – Women and Child Welfare – Role of Information Technology in Environment and Human Health -.

* Self Study (Questions may be asked from these topics also)

Text Book

Arul, P., 2004. A Text Book of Environmental Studies, Environmental Agency, No 27, Nattar Street, Velacherry Main Road, Velacheery, Chennai – 42, First Edition, Nov. 2004.

References

1. Purohit Shammi Agarwal, A text Book of Environmental Sciences, Publisher Mrs.Saraswati Prohit, Student Education , Behind Naswan Cinema Chopansi Road, Jodhpur.
2. Suresh and K. Dhameja, Environmental Sciences and Engineering , Publisher S.K.Kataria & Sons, 424/6, Guru Nanak Street, Vaisarak, Delhi -110 006.
3. Glynn Henry, J. and Gary W Heinke, Environmental Science and Engineering, Prentice Hall of India Private Ltd., New Delhi – 110 001.

UBT59

19VED201

Programme code: 08		Programme name: B. Sc. Biotechnology		
Course code: 19VED201		Part IV – Value Education – Moral and Ethics		
Batch 2019-2020	Semester II	Hours / Week 2	Total Hours 30	Credits 2

Course Objectives

- To impart the value education in every walk of life and make them understand the relationship between Moral and Ethics.
- To impart the right attitude by practicing self-introspection and make them realize about their hidden power within them.
- To develop a knowledge for the steps of upliftment and to know about their goal of life.
- To make them understand the importance of yoga and meditation and to realize what is the real peace.
- To understand what are the ways to contribute peace to the whole world and to goad youth to reach excellence and reap success.

Syllabus

UNIT I (6 Hours)

Introduction – Meaning of Moral and Ethics – Ethics and Culture – Aim of Education.

UNIT II (6 Hours)

Swami Vivekananda – A Biography.

UNIT III (6 Hours)

The Parliament of Religions – Teachings of Swami Vivekananda.

UNIT IV (6 Hours)

Steps for Human Excellence.

UNIT V (6 Hours)

Yoga & Meditation.

Text Book

Value Base Education – Moral and Ethics – Published by Kongunadu Arts and Science College (Autonomous), First Edition, 2015.

References

Easy steps to Yoga by Swami Vivekananda, A Divine Life Society Publication, 2000.

UBT60

19UHR3N1

Programme code: 08	Programme name: B. Sc. Biotechnology		
Course code: 19UHR3N1	Part IV -Non Major Elective - Human Rights		
Batch 2019-2022	Hours / Week 2	Total Hours 30	Credits 2

Course Objectives

1. To prepare for responsible citizenship with awareness of the relationship between Human Rights, democracy and development.
2. To impart education on national and international regime on Human Rights.
3. To sensitive students to human suffering and promotion of human life with dignity.
4. To develop skills on human rights advocacy
5. To appreciate the relationship between rights and duties
6. To foster respect for tolerance and compassion for all living creature.

UNIT – I (6 Hours)

Definition, Meaning, Concept ,Theories and Kinds of Human Rights- Evaluation and Protection of Human Rights in India- Development of Human Rights under the United Nations.

UNIT – II (6 Hours)

United Nations Charter and Human Rights - U. N. Commission on Human Rights- Universal Declaration of Human Rights - International Covenant on

- Civil & Political Rights
- Economic, Social and Cultural Rights

UNIT – III (6 Hours)

Human Rights and Fundamental Rights (Constitution) - Enactments regarding Human Rights Laws in India - National Human Rights Commission and State Human Rights Commission.

UNIT – IV (6 Hours)

Aged persons and their Human Rights - Human Rights of Persons with Disabilities - Tribal Human Rights in India - Three Generation Human Rights -Social Awareness and Responsibilities of Individuals.

UNIT – V (6 Hours)

Rights of Women, Child, Refugees and Minorities – Social media and Human Rights - NGO's in protection of Human Rights - Right to Election

Text Books

1. Human Rights (2019) Published by Kongunadu Arts and Science College,

Coimbatore –29.

UBT61

19UHR3N1

References

1.Human Rights, (2018) Humanitarian Law and Refugee Law	Jaganathan,MA.,MBA.,MMM.,ML.,ML., J.P.Arjun Proprietor,Usha Jaganathan law series, 1st floor, Narmatha Nanthi Street, Magathma Gandhi Nagar, Madurai – 625014.

UBT62

19UWR4N2

Programme code: 08		Programme name: B. Sc. Biotechnology		
Course code: 19UWR4N2		Part IV -Non Major Elective – II Women's Rights		
Batch 2018-2019	Semester	Hours / Week 2	Total Hours 30	Credits 2

Course Objectives

- To know about the laws enacted to protect women against violence.
- To impart awareness about the hurdles faced by women.
- To develop a knowledge about the status of all forms of women to access to justice.
- To create awareness about women's rights.
- To know about laws and norms pertaining to protection of women.
- To understand the articles which enables the women's rights.
- To understand the Special Women Welfare laws.
- To realize how the violence against women puts an undue burden on health care services.

Syllabus

UNIT 1

Women Studies: (6 Hours)

Basic concepts of Women's studies in Higher education, Women's studies perspectives - Socialisation- Patriarchy- Women's studies as an academic discipline- Growth and development of Women's studies as a discipline internationally and in India.

UNIT II

Socio-economic Development of Women: (6 Hours)

Family welfare measures, role of women in economic development, representation of women in media status of women land rights, women entrepreneurs, National policy for the empowerment of women.

UNIT III

Womens' rights – Access to Justice: (6 Hours)

Crime against women, domestic violence – physical abuse- verbal abuse – emotional abuse - economic abuse – minorities, dowry- harassment and death, code of conduct for work place, abetment of suicide.

UNIT IV (6 Hours)

Women protective acts:

Protective legislation for women in the Indian constitution - Anti dowry, SITA, PNDT, and Prevention Sexual Harassment at Workplace (Visaka case), Domestic violence (Prevention) Act.

UNIT V (6 Hours)

Women and Child welfare:

Safety provisions - various forms of mass media, radio, visual, internet, cyber space, texting, SMS and smart phone usage.

Healing measures for the affected women and child society by private and public sector, NGO and society.

Text Book

1. Women's Rights (2019) Published by Kongunadu Arts & Science College, Coimbatore – 641 029

Reference Books

1. "Rights of Indian women" by Vipul Srivatsava. Publisher: Corporate Law Advisor , 2014.
2. "Women's security and Indian law" by Harsharam Singh. Publisher : Aabha Publishers and Distributors, 2015
3. "Women's Property Rights in India" by Kalpaz publications, 2016.

UBT64

Non Major Elective

Programme code: 08	Programme name: B. Sc. Biotechnology		
Part IV -Non Major Elective – Consumer Affairs			
Batch 2019-2020	Hours / Week 2	Total Hours 30	Credits 2

Objectives

1. This paper seeks to familiarize the students with their rights and responsibilities as a consumer, the social framework of consumer rights and legal framework of protecting consumer rights.
2. It also provides an understanding of the procedure of redress of consumer complaints, and the role of different agencies in establishing product and service standards.
3. The student should be able to comprehend the business firms' interface with consumers and the consumer related regulatory and business environment.

Syllabus

UNIT I (6 Hours)

CONCEPTUAL FRAMEWORK - Consumer and Markets: Concept of Consumer- Nature of markets: Liberalization and Globalization of markets with special reference to Indian Consumer Markets-E-Commerce with reference to Indian Market- Concept of Price in Retail and Wholesale- Maximum Retail Price (MRP), Fair Price, GST, labeling and packaging along with relevant laws- Legal Metrology. **Experiencing and Voicing Dissatisfaction:** Consumer buying process, Consumer Satisfaction/dissatisfaction-Grievances -complaint, Consumer Complaining Behaviour: Alternatives available to Dissatisfied Consumers; Complaint Handling Process: ISO 10000 suite

UNIT II (6 Hours)

THE CONSUMER PROTECTION LAW IN INDIA- Objectives and Basic Concepts: Consumer rights and UN Guidelines on consumer protection, Consumer goods, defect in goods, spurious goods and services, service, deficiency in service unfair trade practice restrictive trade practice. **Organizational set-up under the Consumer Protection Act**: Advisory Bodies: Consumer Protection Councils at the Central, State and District Levels; Adjudicatory Bodies: District Forums, State Commissions, and National Commission: Their Composition, Powers, and Jurisdiction (Pecuniary and Territorial), Role of Supreme Court under the CPA with important case law.

UNIT III (6 Hours)

GRIEVANCE REDRESSAL MECHANISM UNDER THE INDIAN CONSUMER PROTECTION LAW- Who can file a complaint? Grounds of filing a complaint; Limitation period; Procedure for filing and hearing of a complaint; Disposal of cases, Relief/Remedy available; Temporary Injunction, Enforcement of order, Appeal, frivolous and vexatious complaints; Offences and penalties.

Leading Cases decided under Consumer Protection law by Supreme Court/National Commission: Medical Negligence; Banking; Insurance; Housing & Real Estate; Electricity and Telecom Services; Education; Defective Products; Unfair Trade Practices.

UBT65

Non Major Elective

UNIT IV (6 Hours)

ROLE OF INDUSTRY REGULATORS IN CONSUMER PROTECTION- i. Banking: RBI and Banking Ombudsman, ii. Insurance: IRDA and Insurance Ombudsman, iii. Telecommunication: TRAI, iv. Food Products: FSSAI, v. Electricity Supply: Electricity Regulatory Commission and vi. Real Estate Regulatory Authority

UNIT V (6 Hours)

CONTEMPORARY ISSUES IN CONSUMER AFFAIRS- Consumer Movement in India: Evolution of Consumer Movement in India, Formation of consumer organizations and their role in consumer protection, Misleading Advertisements and sustainable consumption, National Consumer Helpline, Comparative Product testing, Sustainable consumption and energy ratings. **Quality and Standardization**: Voluntary and Mandatory standards; Role of BIS, Indian Standards Mark (ISI), Ag-mark, Hallmarking, Licensing and Surveillance; Role of International Standards: ISO an Overview

Note: Unit 2 and 3 refers to the Consumer Protection Act, 1986. Any change in law would be added appropriately after the new law is notified

TEXT BOOKS

1. Savita Hanspal and Sheetal Kapoor Khanna, (2007).Sri Ram and H.K. Awasthi. Consumer Affairs.Universities Press.
2. Choudhary, Ram Naresh Prasad (2005). Consumer Protection Law Provisions and Procedure. Deep and Deep Publications Pvt Ltd.

REFERENCE BOOKS

1. G. Ganesan and M. Sumathy,(2012).Globalisation and Consumerism: Issues and Challenges Regal Publications.
2. Suresh Misra and Sapna Chadah (2012). Consumer Protection in India: Issues and Concerns, IIPA, New Delhi.
3. Rajyalaxmi Rao (2012). Consumer is King,Universal Law Publishing Company.
4. Girimaji, Pushpa (2002). Consumer Right for Everyone Penguin Books.

UBT66

19UGA3S1

Programme code: 08		Programme name: B. Sc. Biotechnology		
Course code: **19UGA3S1**		**Skill Based Subject 1: General Awareness**		
Batch 2019-2020	Semester III	Hours / Week 2	Total Hours 30	Credits 3

Course Objectives

- To get all educational and career resources for student relating to objective type general knowledge quiz including articles, quizzes exams, dates, current affairs and other information.

Syllabus

UNIT I (06 Hours)

1. Tamil and other Literatures

Tamil, English, Christian and Muslim Literatures – Ancient Literature – Bakthi Literature – Epics – Medieval Literature – Modern Literature (Novel, Dramas, Short Stories, Modern Poetry).

2. Economics and Commerce

Basic Economics – Auditing – Management – Capital Market – Foreign Trade – Companies – Banking.

3. Social studies

Indian History – Inventions – Indian Poetry – Constitution - Judiciary – Languages – Literacy – Indian Geography – Lithosphere – Climate – Soil – Agriculture – Population.

UNIT II (06 Hours)

4. Numerical Aptitude

Objective Arithmetic : Number systems – probability – **HCF and LCM of numbers*** - decimal fractions – simplification – square roots and cube roots – average – percentage – profit and loss – ratio and proportion – time and work – simple interest – area, **volume and surface area*.**

5. Verbal Aptitude

Spot the odd one out – correct form of verb – preposition – find out the rightly spelt word – choose the correct meaning of idioms – synonyms and antonyms.

6. Abstract Reasoning

Logic Reasoning: Logic – statement – arguments – statement assumptions – Statement course of action – theme detection – deriving conclusion from passages.

Non – verbal Reasoning: Series – analogy – classification – analytical reasoning – mirror images – water images – paper folding – paper cutting – rule detection – grouping of identical figures.

UNIT III (06 Hours)

7. General Science and Technology

SCIENCE - Basic principles and concepts in Physics, Chemistry, Botany and Zoology.

TECHNOLOGY - Metallurgy, instrumentation, discoveries and inventions of techniques.

8. Computer Science

Historical evolution of computers – Computer applications – Data processing concepts – Computer codes and arithmetic – Hardware components – Data Structures.

9. Education

Development process of the learner – Principles of development (physical, social, emotional and intellectual) – Learning process – Teaching and teacher behaviour – Interaction analysis – Microteaching – Teacher as a leader – Motivation – Personality dimension – concept of mental health – Counseling.

UNIT IV (06 Hours)

10. Library and Information Science

Library and Information Science – Basics, Computer, Library Network and others like Research, Reprography etc.

11. Sports and Games

Athletics – Track Events – Field Events – Games – Indoor Games – Outdoor Games – General knowledge – Sport and Olympics – First Aid.

12. Current Affairs

State, Central and International affairs: Budgets – Politics – Sports – Education – Commerce and Industry – Inventions – Science and Technology – Currency – Agriculture – Movies – Guinness records – Awards – IT Industry – Space Research – Defense etc.

UNIT V (06 Hours)

13. National Cadet Corps (NCC)

Introduction to the Armed Forces (Army, Navy, Air Force) – Drill – Weapon Training – Map Reading – Civil Defense.

19UGA3S1

14. National Service Scheme (NSS)

History of NSS – History of Motto, Symbol, Badge – Aims and Objectives – Duties and Total Hours – Organizational and Administrational setup – History of voluntary organization – Regular activities – Special camp activities – Special programmes – awards – Important days.

15. Youth Red Cross (YRC)

History of International Red Cross – History of Indian Red Cross – History of Youth Red Cross – Main objectives of YRC – Emblem – Fundamental principles of Red Cross – Organizational Setup – Activities of Youth Red Cross – Role of different functionaries – Training programmes for YRC Program Officers – Training programme for YRC Volunteers – YRC Song – Working Hours – General orientation – Special orientation – Program skill learning

Text Book

General Awareness, Question Bank, Kongunadu Arts and Science College, Coimbatore, First Edition 2014.

UBT69

19UBT4S2

Programme code: 08		Programme name: B. Sc. Biotechnology		
Course code : 19UBT4S2		Skill Based Subject 2: Clinical lab technology I – Pathology		
Batch 2019-2020	Semester IV	Hours / Week 2	Total Hours 30	Credits 3

Course Objectives

1. To understand the laboratory organization and histopathology techniques

Course Outcomes (CO)

K1	CO1	To learn the facts on Laboratory Organisation and quality control techniques
K2	CO2	Acquiring knowledge about the Histopathology techniques
K3	CO3	Organizing the acquire knowledge of Frozen Section technique
K4	CO4	Simplifying and assessing the clinical pathology techniques

Syllabus

Unit I (06 Hours)

Laboratory organization Reception of organization, dispatch of reports, "Records keeping" coding the lesions of cases Follow up programme, quality control of techniques etc.

Unit II (06 Hours)

Histopathology: Introduction to histopathology. - Receiving specimens in laboratory - Grossing techniques various fixatives - Mode of action, Indications, Preparation Decalcification of calcified tissue before sectioning - Processing of tissues for routine paraffin sections and other methods of embedding.

Unit III (06 Hours)

Frozen section techniques: CO_2 Freezing, Cryostat and freezing microtome. Techniques and principles of sections cuttings and routine staining, and special stains. Mounting Techniques, various mo lining.

Unit IV (06 Hours)

Clinical pathology. 1. Urine examination physical. Chemical microscopic 2. Stool examination. Examination of body fluids, cell counts Ascitic fluid, pleural fluid, synovial fluid, pericardial fluid, urinary calculi. Semen analysis CSF (Cerebro Spinal Fluid).

Unit V (06 Hours)

Use of microscope, polarizers. Introduction to Electron Microscopy and technique of preparing slides. Maintenance of records and filing slides, Familiarization with computer. Microphotography - technique. Museum technology - preservation, Coding-. ICDS – Classification*.

** denotes Self study*

19UBT4S2

Teaching Methods

Powerpoint presentation/ Google Class rooms/Seminar/Quiz/Discussion/Assignment/ Demonstration

Textbook

1. Ramani Sood,Laboratory technology(Methods and interpreations) 4th Ed. J.P. Bros, New Delhi, 1996.
2. Satish Gupta, -Short tect book of medical laboratory for technicians, J.P. Bros, New Delhi.

References

1. Medical Laboratory Technology I,II,III by Kanai Mukherjee, Mc Graw hill education.

2. Todd and Sanford, Clinical diagnosis by laboratory method.

3. Culling -Histopathology techniques.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	H	M	H
CO2	M	M	H	M	M
CO3	H	M	H	M	H
CO4	H	M	H	M	H

S – Strong **H** – High **M** – Medium **L** – Low

UBT71

19UBT6S3

Programme code: 08		Programme name: B. Sc. Biotechnology		
Course code : 19UBT6S3		Skill Based Subject 3: Clinical lab technology II – Hematology		
Batch 2019-2020	Semester VI	Hours / Week 2	Total Hours 30	Credits 3

Course Objectives

1. To understand the ABO blood group system and Rh factor
2. To diagnose Laboratory methods used in the investigation of anemia.
3. To analyze the investigation of hemorrhagic disorders

Course Outcomes (CO)

K1	CO1	To define the ABO Blood group system
K2	CO2	To explain the concept of Pathogenesis
K3	CO3	To identify the Diagnosis of diseases
K4	CO4	To discover the Assessment of behavioral and neurological functions

Syllabus

Unit I (06 Hours)

ABO Blood group system, Rh typing and weaker variants in Rh system, Subgroup and weaker variants of A and B and Bombay phenotype. Preparation and standardization of anti-human globulin reagent, Coomb's test. Blood grouping and cross- matching in blood bank, investigation of transfusion reaction.

Unit III (06 Hours)

Blood collection Anticoagulants used in Haematology Normal values in Haematology Basic Haematological techniques a. RBC Count b. Haemoglobin estimation c. Packed cell volume d. WBC counts - Total and differential e. Absolute eosinophil oount f. Platelet count g. Erythrocyte sedimentation rate h. Reticulocyte count

Unit III (06 Hours)

Laboratory methods used in the investigation of anemia: a. B 12 and folate assay b. Schilling test c. Serum iron and iron bonding capacity Laboratory methods used in the investigation of haemolytic anaemias: a. Osmotic fragility b. Investigation of G-6 PD deficiency c. Test for sickling d. Estimation on of Hb-F,Hb-A2

Unit IV (06 Hours)

Investigation of haemorrhagic disorders

a. Mechanism of coagulation

b. Collection and anticoagulants used in coagulation studies

c. Bleeding time and clotting time

d. Other coagulation studies PT, KPTT, TGT, etc.,

e. Assay of clotting factors

Test for blood fibrinolytic activity and detection of FDP Platelet function tests

Unit V (06 Hours)

Automation in haematology, organisation and quality control in haematology laboratory Preparation of glassware and disposal of the waste in the laboratory

** denotes Self study*

Teaching Methods

Powerpoint presentation/ Google Class rooms/Seminar/Quiz/Discussion/Assignment/ Demonstration

Textbook

1. Ramani Sood, Laboratory technology(Methods and interpretations) 4th Ed. J.P. Bros, New Delhi, 1996.
2. Satish Gupta, -Short text book of medical laboratory for technicians, J.P. Bros, New Delhi.

Reference

1. Medical Laboratory Technology I,II,III by Kanai Mukherjee, Mc Graw hill education.

2. Dycie and Lewis -Practical haematology.

3. Chatterjee, Human Physiology, 10lh F.ds., Medical Allied agency.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	H	M	H
CO2	M	H	M	H	M
CO3	M	M	H	H	M
CO4	H	M	M	H	M

S – Strong **H** – High **M** – Medium **L** – Low

UBT73 **19UBT5SL**

Programme code: 08		Programme name: B. Sc. Biotechnology		
Course Code: 19UBT5SL		Skill Based Subject 4: Practical Clinical lab technology		
Batch 2019-2020	Semester II	Hours / Week	Total Hours	Credits

Course Objectives

1. To understand various basic aspects of histopathology and haematology.
2. To get hands on experience in Examination of urine, Histopathological techniques and blood analysis.
3. To learn about the stool examination, grossing techniques and differential RBC and WBC count.

Course Outcomes (CO)

K3	CO1	Analyse the physical, chemical and Microscopic examination of urine sample
K4	CO2	Understanding the parts of the tissue processor and calculating the bleeding time and clotting time
K5	CO3	Estimating the Haemoglobin and blood count

Syllabus

I. Examination of urine sample.

a. Physical examination: Volume, colour, odour, appearance, specific gravity and pH.

b. Chemical examination:

(i) Protein - Heat and acetic acid test, sulphosalicylic acid method.

(ii) Reducing sugar - Benedicts test: Ketone Bodies - Rotheras test.

(iii) Bile pigment - Fouchets method.

(iv) Bile salts -Hay's test.

c. Microscopic examination.

(i) Stool examination.

a. Physical examination.

b. Chemical examination

(i) Occult blood -Reducing sugar.

(ii) Semen analysis.

(iii) C.S.F Examination.

(iv) Examination of body fluids - pleural, pericardial and peritoneal fluid,

(v) Synovial fluid analysis.

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19UBT5SL

HISTOPATHOLOGY

Part I: Grossing techniques. Preparation of various fixatives Decalcification of calcified tissue before sectioning. Processing of tissue for routine paraffin sections and other methods of embedding. (DEMO)

Part II : Frozen section- Demonstration- freezing microtome, crystat. l. Museum technique- Demonstration.

HAEMATOLOGY

(a) Haemoglobulin estimation by cyanmethaemoglobin method.

(b) R.B.C total count, W.B.C total count-Micropipette method and bulk dilution.

(c) Platelet count-Direct and indirect method.

(d) Absolute eosinophil count.

(e) Reticulocyte count.

(f) Differential W.B.C Count.

(g) Packed cell volume- Wintrobe's method. Calculation of erythrocyte indices.

(h) Erythrocytes sedimentation rate- westergrens methods.

(i) Bleeding time and clotting time.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	S	H	S
CO2	H	S	H	H	H
CO3	S	M	S	H	M

S – Strong **H** – High **M** – Medium **L** – Low

19UBT5X1

Programme code: 08		Programme name: B. Sc. Biotechnology		
Course code : **19UBT5X1**		**EDC – 1: Life Style Biotechnology**		
Batch 2019-2020	Semester V	Hours / Week 2	Total Hours 30	Credits 3

Course Objectives

1. To describe the principle of health and nutrition.
2. To understand the concepts and diagnostic methods of Life style disease
3. To facilitate, implement good life style to avoid health problems

Course Outcomes (CO)

K1	CO1	Defining the basic principles of health and nutrition
K2	CO2	Stating the deficiency and abnormal values leading to diseases
K3	CO3	Applying the molecular diagnostic methods to detect disease
K4	CO4	Categorizing good life style methods to have healthy life

Syllabus

Unit I (06 Hours)

Introduction to health- Definition and concept of health. BMR (Basal Metabolic Rate), Daily nutritional requirements, Essential amino acids Dietary requirements of food: Protein, Carbohydrate, Lipid, Micronutrients: Vitamins, Minerals and trace minerals.

Unit II (06 Hours)

Major nutritional deficiency diseases- Protein Energy Malnutrition, Vitamin A deficiency, Iron deficiency anemia, Iodine deficiency disorders, their causes, symptoms, treatment and prevention. Normal and abnormal values of life style diseases such as hypertension, diabetes mellitus, and obesity.

Unit III (06 Hours)

Effect of Stress for the onset of Life style diseases. Importance of Diagnostic testing and screening; Molecular Diagnostics: genetic testing to reveal predisposition to disease, early detection of disease at the molecular level.

Unit IV (06 Hours)

Life style related diseases- cardiovascular disease, hypertension, stroke, depression, diabetes mellitus, obesity, asthma and cancer- their causes and prevention through dietary/lifestyle modifications.

19UBT5X1

Unit V (06 Hours)

Social health problems- smoking, alcoholism, drug dependence and Aquired Immuno Deficiency Syndorme (AIDS). Common aliments- cold, cough, fevers, diarrhoea, constipation- their causes and dietary treatment.

** denotes self-study*

Teaching Methods

Powerpoint presentation/ Google Class rooms/Seminar/Quiz/Discussion/Assignment/ Demonstration

Text Book

1. Stafford Valentine Redden (2011). As Biology with Stafford: Unit 1: Lifestyle, Genes and Health.
2. Lakra, P., Singh, M.D., (2008). Textbook of Nutrition and Health; First Ed; Academic Excellence.

Reference Books

1. Geofferey Campbell-Platt (2009). Food Science and Technology, Willey and Blackwell Publication, UK.
2. Bruns, D.E., Ashwood, E.R., Burtis, C. A., (2007). Fundamentals of Molecular Diagnostics, Saunders Group.
3. Buttriss, J.L., Welch, A.A., Kearney, J. M., Lanham, S.A., (2017). Public Health Nutrition, 2nd Edition, Wiley-Blackwell.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	H	M	H
CO2	H	M	M	M	H
CO3	M	H	M	H	M
CO4	M	M	H	M	M

S – Strong **H** – High **M** – Medium **L** – Low

UBT77

19UBT0J1

Programme code: 08	Programme name: B. Sc. Biotechnology		
Course code: 19UBT0J1	JOC1 – Clinical Research & Medical Coding		
Batch	Hours / Week	Total Hours	Credits
2019-2020	2	30	2

Course Objectives

1. To learn the various medical terminology and treatment strategies used for medical coding
2. To Interpret and understand healthcare documentation and billing
3. To assign and understand diagnostic and procedure codes using ICD and HCPCS/CPT coding systems

Course Outcomes (CO)

K1	CO1	Remembering the various medical terminology and treatment strategies used for medical coding
K2	CO2	Conceiving the different procedures involved in medical documentation and billing
K3	CO3	Applying the standard coding resources for accurate insurance billing
K4	CO4	Estimating the accurately and maintain medical records using codes

Syllabus

Unit I

Clinical Research: Anesthesia; Radiology; Pathology and laboratory coding, Medicine, including injections, psychotherapy, and other office procedures, in addition to heart catheterizations.

Unit II

Medical terminology; Evaluation and management service guidelines, Billing Process and filling the forms for claims. Coding guidelines: Types of coding systems. Comprehensive Surgery Coding.

Unit III

Introduction to Current Procedural Terminology (CPT)/Procedure Coding System; CPT-4- numbers and their sequences, terminology and format; CPT Modifiers. Healthcare Common Procedure Coding System (HCPCS) codes.

Unit IV

Diagnostic codes: Introduction to International Classification of diseases (ICD)-9/ICD-10, ICD-10-CM Manual, Code structure, Alphabetic index, benefits of ICD-10-CM.

19UBT0J1

Unit V

ICD-10-Procedural codes (PCS) Coding in the Medical and Surgical Subsection; Pharmaceutical codes for identifying medications; Topographical codes indicating a specific location in the body; The Systematized Nomenclature of Medicine (SNOMED).

** denotes Self study*

Teaching Methods

Powerpoint presentation/ Google Class rooms/Seminar/Quiz/Discussion/Assignment/ Demonstration

Text Books

1. 2015 Medical Coding Training: CPC®- AAPC; AAPC publisher; ISBN-13: 978-1-626880-900
2. 2015 Medical Coding Training: Practical Application CPC®- AAPC; AAPC publisher; ISBN-13: 978-1-626880-924

Reference

http://www.icd10data.com/

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	H	M	H
CO2	H	M	S	M	H
CO3	M	H	M	S	M
CO4	M	S	M	H	S

S – Strong **H** – High **M** – Medium **L** – Low

19UBT0J2

Programme code: 08	Programme name: B. Sc. Biotechnology		
Course code : 19UBT0J2	JOC 2 – Agroindustrial biotechnology		
Batch 2019-2020	Hours / Week 2	Total Hours 30	Credits 2

Course Objectives

- To provide knowledge on Indian agriculture, biomass, biofertilizer and biocontrol agents
- To develop students technical skills on bio fertilizer and Biocontrol agents production
- To encourage natural ways of crop disease management

Course Outcomes (CO)

K1	CO1	Defining and to impart training of ecofriendly agricultural inputs so as to nullify the ill effects of chemical fertilizers.
K2	CO2	Illustrating the production and use of biopesticides, bio-control agents etc as alternative inputs in organic farming
K3	CO3	Demonstrating the effectiveness of biofertilizer cultural practices in the farmers fields for enhanced crop productivity through bioreclamation of waste land
K4	CO4	Analyzing and promoting disease management in the country

Syllabus

Unit I

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

Unit II

Biofertilizers: Isolation, purification and characterization of *Rhizobium*, *Azospirillum, Blue green algae, Azolla* and *Frankia*. Screening for their activity and strain improvement, Spirulina, biogas, biodiesel, SCP, mushroom.

Unit III

Biocontrol agents: Types: parasites, parasitoids, predators and entomopathogenic nematodes. and mass production strategies of Biocontrol agents, Field application methods.

19UBT0J2

Unit IV

Biopesticides: Definition and significance, mass production and formulation of microbial control agents: Bt and NPV. Economics of production of biocontrol agents and biopesticides: cost of production, capital cost and profit.

Unit V

Disease Management: Major crops and major diseases in India. Emerging diseases, Alternate approaches of disease management. Drought, Salinity, Cold tolerant crops in India and its economic importance. Post harvest and storage of grains.

Teaching Methods

Board teaching, Powerpoint presentation/ Google Class rooms/Seminar/Quiz/Discussion/Assignment/ Demonstration

Text book

1. Ahindra Nag, (2009). Textbook of Agricultural Biotechnology, PHI Learning Private Ltd., New Delhi,
2. Dubey, R.C., (1996). A Textbook of Biotechnology, S. Chand and Co. Ltd., New Delhi.

References

1. Subba Rao. N.S., (1982). Biofertilizers, In: Advances in Agricultural Science. Oxford and IBH Pub. Co., New Delhi.
2. Tanuja S. (2008). Biofertilizer Technology. Agrobios (India).
3. Mahendra Rai. (2006). Handbook of Microbial Biofertilizers, CRC Press.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	S	M	M
CO2	H	S	M	H	S
CO3	M	H	S	S	S
CO4	S	H	H	H	H

S – Strong **H** – High **M** – Medium **L** – Low

UBT81

Question Paper Pattern

QUESTION PAPER PATTERN for CIA and ESE

PART-I, PART – II, CORE PAPERS, MAJOR ELECTIVE PAPERS, SKILLED BASED SUBJECT 2 &3 AND EDC

Time 03 Hrs Maximum marks 75

Section - A (10 x 1 = 10 marks)

Q. No. 1 to 10 : Multiple choice type alone with four distracters each.

Section - B (5 x 5 = 25 marks)

Q. No. 11 to 15 : Either or / short notes type questions (one question ‘a’ or ‘b’ from each unit).

Section - C (5 x 8 = 40 marks)

Q. No. 16 to 20 : Either or / essay type questions (one question ‘a’ or ‘b’ from each unit).

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UBT82

Question Paper Pattern

QUESTION PATTERN & BREAK-UP OF MARKS FOR PRACTICALS

END OF SEMESTER PRACTICAL EXAMINATION

Max. Marks: 60
Duration: 3 / 4 hrs

I.	**Major**	(1 x 20 = 20)
II.	**Minor**	(1 x 10 = 10)
III.	**Spotters**	(3 x 5 = 15)

Examine, identify and critically comment on the spotters A, B, C, D and E.

IV.	**Viva**	(05)
V.	**Record / Observation***	(10)

**Record for ESE; Observation for CIA exam.*

INTERNAL - PRACTICAL MARKS

From Model Practical Examination	-	25
Observation	-	10
Attendance	-	5
Total	**-**	**40**

UBT83

Question Paper Pattern

ENVIRONMENTAL STUDIES & VALUE EDUCATION – MORAL AND ETHICS

(End-of semester only)

Duration: 3 hours Total Marks: 50

Answer all Questions (5 x 10 = 50 Marks)

Essay type, either or type questions from each unit.

QUESTION PAPER PATTERN FOR SKILL BASED SUBJECT 1

Max. Marks 100

End of Semester Examination (ESE) - On-Line Examination 75 Marks

1. 150 questions are to be given. Each question carries ½ mark.

2. In each unit, 100 questions are to be given, covering all the 5 units.

Continuous Internal Assessment (CIA) (Through On-Line) 25 Marks

a) Two Exams. 15 Marks

b) Assignment/ Demonstration 5 Marks

c) Attendance 5 Marks

* Each student has to submit an Assignment/ Demonstration in the Current Affairs area.

UBT84

Question paper pattern

(External Only)

NON-MAJOR ELECTIVES

Duration: 3 Hours Max. Marks: 75

Answer ALL Questions

Duration: 3 hrs **Max: 75 Marks**

Section A (5 x 5=25)

Short notes

Either – or / type – question from each unit.

Section B (5 x 10=50)

Essay type

Either – or / type – question from each unit.