List of New Course(s) Introduced

Department : *Biotechnology*

Program Name : *B.Sc.*

Academic Year : 2021-22

List of New Course(s) Introduced

Sr. No.	Course Code	Name of the Course
1.	BTUATT2	Biochemistry
2.	BTUATA1	Biotechnology and Human Welfare
3.	BTUATL1	Plant Tissue Culture
4.	BTUBTG1	Biostatistics
5.	BTUBTA1	Bio-management of environment
6.	BTUBTL1	Animal Tissue Culture
7.	BTUCTG1	Food Biotechnology
8.	BTUCLG1	Laboratory-GE3 (based on GE-3)
9.	BTUCTA1	Intellectual property rights and entrepreneurship
10.	BTUDTG1	Scientific Writing
11.	BTUDLG1	Laboratory-GE4 based on GE-4
12.	BTUDTA1	Molecular techniques in disease diagnosis.
13.	BTUELT1	Laboratory-11 based on core-11
14.	BTUETT2	Plant and Animal Biotechnology
15.	BTUELT2	Laboratory-12 based on core-12
16.	BTUETA1	Biotechnology in Societal Welfare
17.	BTUFTT1	Statistics in Biological Research
18.	BTUFLT1	Laboratory-13 based on core-13
19.	BTUFTD4	Molecular Diagnostics
20.	BTUFLD4	Laboratory (based on DSE-3 BTUETD2)

Signature & Seal of HoD

विभागाध्यक्ष, जैव प्रौद्योगिकी विभाग
Head, Department of Biotechnology
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

Minutes of Meetings (MoM) of Board of Studies (BoS)

Academic Year : 2021-22

School : *School of Studies of Interdisciplinary Education and Research*

Department : *Biotechnology*

Date and Time : *04-03-2022 – 3:00 PM*

Venue : *Room of Head, Department of Biotechnology*

THE MEETING OF BOARD OF STUDIES IN BIOTECHNOLOGY GURU GHASIDAS VISHWAVIDYALYA MINUTESOF, BILASPUR HELD ON 04/03/2022

A online meeting of the board of studies in biotechnology under School of interdisciplinary education and Research was held on 04/03/2022 at 3:00PM under the chairmanship of Dr. Renu Bhatt, Head Department of Biotechnology. The following members were present.

1) Dr. Renu Bhatt, Head — Chairman
2) Prof. B.N. Tiwary,Professor — Member
3) Prof. Pradeep Verma — Expert present online
4) Dr. Naveen Kumar Vishvakarma — Member
5) Dr. Jayabharat Reddy — Expert from Industry

The agenda was placed to discuss:

To implement Learning Outcome Based Curriculum Framework (LOCF) Syllbus in B.Sc. (H) Biotechnology programme

At the very outset the HOD, Chairman of Board of Studies welcomed all the BoS members and discussed the agenda at length. Following resolutions were made in this meeting.

Resolutions: The syllabus of different courses (Core, Gerneral elective, ability enhancement course (AEC) and skill enhancement course (AEC) were reviewed by the BoS members very carefully and disussed the different course content as per university guideline and approved by BoS.

The following new courses were introduced in the Syllabus of B. Sc.

Sr. No.	Course Code	Name of the Course
1.	BTUATT2	Biochemistry
2.	BTUATA1	Biotechnology and Human Welfare
3.	BTUATL1	Plant Tissue Culture
4.	BTUBTG1	Biostatistics
5.	BTUBTA1	Bio-management of environment
6.	BTUBTL1	Animal Tissue Culture

7.	BTUCTG1	Food Biotechnology
8.	BTUCLG1	Laboratory-GE3 (based on GE-3)
9.	BTUCTA1	Intellectual property rights and entrepreneurship
10.	BTUDTG1	Scientific Writing
11.	BTUDLG1	Laboratory-GE4 based on GE-4
12.	BTUDTA1	Molecular techniques in disease diagnosis.
13.	BTUELT1	Laboratory-11 based on core-11
14.	BTUETT2	Plant and Animal Biotechnology
15.	BTUELT2	Laboratory-12 based on core-12
16.	BTUETA1	Biotechnology in Societal Welfare
17.	BTUFTT1	Statistics in Biological Research
18.	BTUFLT1	Laboratory-13 based on core-13
19.	BTUFTD4	Molecular Diagnostics
20.	BTUFLD4	Laboratory (based on DSE-3 BTUETD2)

The meeting ended with a vote of thanks by the Chairman

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Head, Department of Biotechnology
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

Scheme and Syllabus

Scheme for Choice Based Credit System (CBCS) in B.Sc. Honours Biotechnology

Course		Course Code	Name of the course	Credit
Semester-I				
Core (C)	C1Theory	BTUATT1	Cell Biology	3
	C1 Practical	BTUALT1	Laboratory-1 based on core-1	2
	C2 Theory	BTUATT2	Biochemistry	3
	C2 Practical	BTUALT2	Laboratory-2 based on core-2	2
Generic Elective-1 (GE-1)	GE-1 Theory	BTUATG1	Bioethics and Biosafety	3
	GE-1 Practical	BTUALG1	Laboratory-GE1 based on GE-1	2
Ability Enhancement Course (AEC)	AEC1	BTUATA1	Biotechnology and Human Welfare	2
Skill Enhancement Course	SEC1	BTUATL1	Plant Tissue Culture	2
Additional Credit Course As per University Notification				
			TOTAL	19
Semester-II				
Core (C)	C3 Theory	BTUBTT1	General Microbiology	3
	C3 Practical	BTUBLT1	Laboratory-3 (based on core-3)	2
	C4 Theory	BTUBTT2	Genetics	3
	C4 Practical	BTUBLT2	Laboratory-4 (based on core-4)	2
Generic Elective-2 (GE-2)	GE-2 Theory	BTUBTG1	Biostatistics	3
	GE-2 Practical	BTUBLG1	Laboratory (based on GE-2)	2
Ability Enhancement Course (AEC)	AEC2	BTUBTA1	Bio-management of environment	2
Skill Enhancement Course	SEC2	BTUBTL1	Animal Tissue Culture	2
Additional Credit Course As per University Notification				
			Total	19
Semester-III				
Core (C)	Core5 Theory	BTUCTT1	Molecular Biology	3
	Core 5 Practical	BTUCLT1	Laboratory-5 (based on core-5)	2
	Core 6 Theory	BTUCTT2	Recombinant DNA Technology	3
	Core 6 Practical	BTUCLT2	Laboratory-6 (based on core-6)	2
	Core 7 Theory	BTUCTT3	Chemistry-1	3
	Core 7 Practical	BTUCLT3	Laboratory-7 (based on core-7)	2
Generic Elective-3 (GE-3)	GE-3 Theory	BTUCTG1	Food Biotechnology	3
	GE-3 Practical	BTUCLG1	Laboratory-GE3 (based on GE-3)	2
Ability Enhancement Course (AEC)	AEC3	BTUCTA1	Intellectual property rights and entrepreneurship	2
Additional Credit Course As per University Notification				
			Total	22
Semester IV				
Core (C)	Core-8 Theory	BTUDTT1	Bio-analytical Tools	3
	Core -8 Practical	BTUDLT1	Laboratory-8 based on core-8	2
	Core -9 Theory	BTUDTT2	Immunology	3
	Core -9 Practical	BTUDLT2	Laboratory-9 based on core-9	2
	Core 10 Theory	BTUDTT3	Chemistry-2	3
	Core 10Practical	BTUDLT3	Laboratory-10 based on core-10	2
Generic Elective-4 (GE-4)	GE-4 Theory	BTUDTG1	Scientific Writing	3
	GE-4 Practical	BTUDLG1	Laboratory-GE4 based on GE-4	2
Ability Enhancement Course (AEC)	AEC4	BTUDTA1	Molecular techniques in disease diagnosis	2
Additional Credit Course As per University Notification				
			TOTAL	22
SUMMER Internship: at least 15 days				06
Semester V				
Core (C)	Core-11Theory	BTUETT1	Bioprocess Technology	3
	Core11 Practical	BTUELT1	Laboratory-11 based on core-11	2
	Core12Theory	BTUETT2	Plant and Animal Biotechnology	3
	Core12 Practical	BTUELT2	Laboratory-12 based on core-12	2

Discipline Specific Elective (DSE-1)	DSE-1	BTUETD1	MOOC courses* to be selected/opted from SWAYAM portal [from a basket of course approved by BOS from time to time].	2-5*
Discipline Specific Elective (DSE-2)	DSE-2	BTUEED2	Review writing/case studies	5
Ability Enhancement Course (AEC)	AEC5	BTUETA1	Biotechnology in Societal Welfare	2
Additional Credit Course As per University Notification				
			TOTAL	**22***
Semester VI				
Core (C)	Core13 Theory	BTUFTT1	Statistics in Biological Research	3
	Core13 Practical	BTUFLT1	Laboratory-13 based on core-13	2
	Core14 Theory	BTUFTT2	Bioinformatics	3
	Core14 Practical	BTUFLT2	Laboratory-14 based on core-14	2
Discipline Specific Elective (DSE-3)	DSE-3 Theory (Any one)	BTUFTD1	Microbial Technology	3
		BTUFTD2	Biodiversity and Bio-prospecting	
		BTUFTD3	Genomics and Proteomics	
		BTUFTD4	Molecular Diagnostics	
	DSE-3 Practical (Any one)	BTUFLD1	Laboratory (based on DSE-3 BTUFTD1)	2
		BTUFLD2	Laboratory (based on DSE-3 BTUFTD2)	
		BTUFLD3	Laboratory (based on DSE-3 BTUETD3)	
		BTUFLD4	Laboratory (based on DSE-3 BTUETD4)	
Dissertation	Dissertation	BTUFPD1	Dissertation/project	7
Seminar	Seminar	BTUFPS1	Seminar	2
Additional Credit Course As per University Notification				
			Total	**24**

4/3/22

COURSE: Core -2 Theory

Biochemistry (BTUATT2) **CREDITS: 3**

Course objective

The objective of the course is to make students well-versed with the structure and function of various biomolecules, their metabolic synthesis and catabolism. They should have knowledge of qualitative analysis of different types of biomolecules. The course deals with the basic structure and classification of biomolecules and their metabolic reactions. The course elucidates properties of carbohydrates, proteins, lipids, nucleic acids and enzymes.

Course Learning Outcomes

After successful completion of course the students will acquire:

- Students will acquire understanding of various biomolecules which are required for development and functioning of a cell.
- Students will learn structural and functional features of carbohydrates and their role inenergy generation and as storage food molecules for the bacterial cells
- The students will be able to understand structure and function of proteins, to calculate enzyme activity and other quantitative and qualitative parameters of enzyme kinetics; also knowledge about lipids and nucleic acids.
- Student will have the ability to prepare buffers, study enzyme kinetics and calculate Vmax, Km, Kcat values.

Course Contents

Unit I

Introduction to Biochemistry: Amino acids & Proteins: Structure and properties of Amino acids, Synthesis of aromatic and aliphatic amino acids, amino acid oxidation and production of urea. Types of protein and their classification structure and shape. Different levels of structural organization of proteins (primary, secondary, tertiary and quaternary).

Unit II

Structure, classification, functions and properties of carbohydrates Glycolysis, fate of pyruvate under aerobic and anaerobic conditions, Pentose phosphate pathway and its significance, Gluconeogenesis, Glycogenolysis, TCA cycle, Electron Transport Chain, Oxidative phosphorylation.

Unit III

Structure, classification, functions and properties of fatty acid, Biosynthesis of saturated and unsaturated fatty acids. ß-oxidation of fatty acids. Structure, functions, and properties of DNA, double helical model of DNA structure and forces responsible for A, B & Z – DNA. Structure, functions, and properties of RNA

4/3/22

Unit IV

Nomenclature and classification of Enzymes, Holoenzyme, apoenzyme, Cofactors, coenzyme, prosthetic groups, metalloenzymes, monomeric &oligomeric enzymes, activation energy and transition state, enzyme activity, specific activity.

Suggested Reading

1. Berg, J. M., Tymoczko, J. L. and Stryer, L Biochemistry. W.H Freeman and Co.

2. Buchanan, B., Gruissem, W. and Jones, R. Biochemistry and Molecular Biology of Plants. American Society of Plant Biologists.

3. Nelson, D.L., Cox, M.M. Lehninger Principles of Biochemistry, WH Freeman and Company,New York, USA.

4. Hopkins, W.G. and Huner, P.A. Introduction to Plant Physiology. John Wiley and Sons.

5. Salisbury, F.B. and Ross, C.W. Plant Physiology, Wadsworth Publishing Co. Ltd.

4/3/22

COURSE: Ability Enhancement Course - 1 (AEC - 1)

Biotechnology and Human Welfare (BTUATA1) **CREDITS: 2**

Course Objective

The objective of this course is to introduce the scope of biotechnology for human welfare.

Course Learning Outcomes

Learning outcomes on completion of this course the students will be able to;

- Understand industrial biotechnology related techniques.
- Understand agriculture and environmental biotechnology related techniques.
- Understand forensic science related technique
- Understand molecular diagnosis techniques.

Course contents

Unit I

Industry: protein engineering; enzyme and polysaccharide synthesis, activity and secretion, Enzyme immobilization: methods and application.

Unit II

Agriculture and Environments: Plant Tissue culture, N_2 fixation, transgenic plants: insect resistance, bacterial/ fungal stress tolerance, drought/salt tolerance, bioremediation, biofertilizers, biopesticides, biofuels and bioleaching.

Unit III

Forensic science: solving violent crimes such as murder and rape; solving claims of paternity and theft etc. using various methods of DNA finger printing, Polymerase chain reaction, Restriction fragment length polymorphism.

Unit IV

Health: development of non- toxic therapeutic agents, recombinant live and DNA vaccines, gene therapy, Molecular diagnosis: (monoclonal antibodies, DNA probes, Microarrays), transgenic animals.

Suggested Reading

1. Sateesh MK Bioethics and Biosafety, I. K. International Pvt Ltd.
2. Sree Krishna V Bioethics and Biosafety in Biotechnology, New age international publishers
3. Gupta, Elements of Biotechnology
4. Dubey, T. B. of Biotechnology
5. Kumar H. Modern Concept of Biotechnology
6. Jogdand, Advances in Biotechnology
7. Chatwal, T. B. of Biotechnology
8. Primrose, Molecular Biotechnology

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COURSE: Skill Enhancement Course - 1 (SEC-1)

Plant Cell Culture (BTUATL1) **CREDITS: 2**

Course Objective

The course deals with the Plant tissue culture principles and basic techniques. The objective of the course is to make students well-versed with the methods and techniques of plant tissue culture and its application.

Course Learning Outcomes

- Students will acquire skills related to plant tissue culture
- Students will acquire skills on plant tissue culture techniques
- Students will acquire skills on Micropropagation
- Students will acquire skills related to In-vitro Fertilization

Course contents

Unit-I (Introduction to Plant Tissue culture)

Introduction to Plant Tissue culture, Terms and definitions, Historical background, Laboratory organization, Tools and techniques, methods of sterilization. Laboratory contaminants- it's control and measures.

Unit-II (Media and Culture Preparation)

Role of Micro and macro nutrients, Vitamins and carbon source in tissue culture, Media preparation- pH, Temprature, Solidifying agents, Slant Preparations etc. Maintenance of cultures, Environmental Conditions, explants characteristics.

Unit-III (Culture techniques)

Explants selection, sterilization and inoculation; Various media preparations; MS, B5, SH PC L-2; Callus and cell suspension culture.

Unit-IV (Initiation of Cultures)

Induction and growth parameters; Culture initiation, Callus culture., Micropropagation through various explants

Unit-V (In-vitro Fertilization)

Role of Ovary and ovule in In-vitro Fertilization in production of agricultural and horticultural crops. Techniques and significance of Androgensis and Gynogenesis (ovary, ovule, egg, synergids culture)

Suggested Reading

1. Bhojwani S.S. And Rajdan M.K. (1983). Plant Tissue Culture : Theory and practice.
2. Reinert J.and Bajaj Y.P.S. (1977). Applied and Fundamental Aspects of Plant Cell, Tissue and Organ Culture, By Springer - Verlag, Berlin

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3. Amritrao, P.V.D.A. Evans, W.P.Sharp and Bajaj Y.P.S. (1990) Handbook of Plant Cell Culture volumes I-V, McGraw Hill Publishing Co.,New York.
4. Chawla, H.S. 2000. Introduction to Plant Biotechnology. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
5. Dixon, R.A. and Gonzales, R. A. (Eds.) 1994. Plant Cell Culture - A Practical Approach. Oxford University Press, New York.
6. Gamborg, O.L and Phillips, G.C. 1998. Plant Cell, Tissue Organ Culture. Narosa Publishing House, NewDelhi.

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COURSE: Generic Elective-2 (GE- 2)

Biostatistics (BTUBTG1) **CREDITS: 3**

Course Objective

The objective of this course is to provide detailed knowledge of biostatistics. Understanding the concept of statistics is necessary for researchers to test their hypothesis and to analyse their experimental data to make firm conclusions.

Course Learning Outcomes

After successful completion of the course student will be able to understand

- Scope and applications of biostatistics
- Collection, processing and presentation of data
- Measures of central tendency
- Measures of dispersion
- Correlation analysis and regression analysis
- Testing of hypothesis

Course Contents

Unit I: Scope and Applications of Biostatistics

Scope and applications of Biostatistics, samples and population concept, collection, processing and presentation of data, frequency distribution

Unit II: Measures of Central Tendency

Measures of central tendency: Arithmetic, Harmonic and Geometric Mean, Mode and Median, their applications, merits and demerits

Unit III: Measures of dispersion

Measures of dispersion, Variance, Standard Deviation, Coefficient of Variance, their applications, merits and demerits, Correlation analysis and Regression analysis, Concept of Probability

Unit IV: Test of Significance

Comparison of two data sets: testing of hypothesis, Student's t-test, Chi square test, F-test-introduction and application in biology, comparison of three and more data sets: ANOVA test.

Suggested Reading

1. Le CT Introductory biostatistics. John Wiley, USA
2. Glaser AN High Yield TM Biostatistics. Lippincott Williams and Wilkins, USA
3. Edmondson A and Druce D Advanced Biology Statistics, Oxford University Press.

4. Danial W Biostatistics: A foundation for Analysis in Health Sciences, John Wiley and Sons Inc.

5. Mishra BN and Mishra SN, Principles of Biostatistics.

6. Marcello pagano, Principle of Biostatistics.

Ranjit

4/3/22

Naveen

COURSE: Ability Enhancement Course – 2 (AEC - 2)

Bio-management of Environment (BTUBTA1) **CREDITS: 2**

Course Objective

The aim of the course is to study the different techniques such as bioremediation (using microorganisms) and phytoremediation (using plants) techniques which is helpful for the degradation of environmental pollutants such as pesticides, heavy metals, radioactive substances etc. present in the soil, water and aquifers.

Course Learning Outcomes

- On the successful completion of the course, students are aware of the biomanagement of soil.
- Have knowledge about biomanagement of petroleum contaminant.
- Aware of the biomanagement of heavy metal.
- Have the knowledge of bioremediation (using microorganisms) and phytoremediation techniques.

Course contents

Unit I

Biomanagement of soil: An overview of global market and available technologies local gain, global loss: The Environmental cost of action, bioavailability of contaminants in soil,microbial remediation of metals in soils

Unit II

Biomanagement of Petroleum Contaminants: benzene-contaminated underground aquifers. Biomining, Bioleaching, Enrichment of ores by microorganisms (Gold, Copper and Uranium). Environmental significance of genetically modified microbes, plants and animals, Molecular aspects and applications in biotechnology

Unit III

Biosurfactants, strategies based on the use of fungal enzymes, anaerobic Metabolism and bioremediation of BTEX Hydrocarbons (Benzene, Toluene, Ethylbenzene, and Xylene), Treatment of municipal waste and Industrial effluents, Bio-fertilizers, Role of symbiotic and asymbiotic nitrogen fixing bacteria in the enrichment of soil, Algal and fungal biofertilizers (VAM)

Unit IV

Heavy metal phytoremediation: Microbial indicators of soil health for the assessment of remediation efficiency. Environment and the tools in rhizo- and bioremediation of contaminated soil molecular tools for monitoring and validating bioremediation, genetic engineering of bacteria and their potential for bioremediation

Suggested Reading

1. S.C. Santra, Environmental Science
2. Pradipta Kumar Mohapatra, Environmental Biotechnology
3. Hans-Joachim Jordening and Jesef Winter, Environmental Biotechnology – Concepts and Applications
4. Metcalf and Eddy, Tata McGraw hill, Waste Water Engineering
5. S.S. Purohit, Agricultural Biotechnology
6. Alicia L. Ragout De Spencer, John F.T. Spencer, Environmental Microbiology : Methods and Protocols
7. Milton Wainwright, Introduction to Environmental Biotechnology
8. Gilbert Masters, Principles of Environmental Engineering
9. Metcalf & Eddy, Wastewater Engineering
10. Sibley, Law and Strategy of biotechnological patents. Butterworth publication
11. Ganguli-Tat McGrawhill, Intellectual property rights.
12 Wattal, Intellectual Property Right. Oxford Publication

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COURSE: Skill Enhancement Course - 2 (SEC-2)

Animal Cell Culture (BTUBTL1) **CREDITS: 2**

Course Objective

The objective of this course is to provide basic knowledge of animal cell culture. This course is designed to make students aware about techniques of animal cell and tissue culture. This course will also teach how cultured cells can be maintained in animal cell culture laboratory.

Course Learning Outcomes

After successful completion of the course

- Student will acquire experimental skill of Cell culture techniques and competence in laboratory techniques.
- Student will develop proficiency in establishing and maintaining of cell lines.
- To conduct the independent research in the animal cel culture and its further application

Course contents

Unit I

History and scope of animal cell culture technology. Basic requirements of animal cell culture laboratory (Laminar air flow, CO_2 incubator, centrifuge, microscope) biological containment and biosafety levels, good laboratory practices to prevent contamination, common cell culture contaminants

Unit II

Culture media and buffers, natural and defined media, basal media, serum supplemented media, serum free media, growth supplements, balanced salt solution, sterilization and filtration of media.

Unit III

Cell culture techniques, primary and secondary culture, cell lines, monolayer culture, suspension culture, organ culture, cryopreservation of cell lines

Unit IV

Behaviour of cultured cells in terms of growth, differentiation and metabolism, apoptosis, necrosis and senescence, appearance of viable and non-viable cells, application of cell culture, in-vitro fertilization

Suggested Reading

1. Butler, M and Dawson, M. (eds.).: Cell Culture Lab Fax, Eds., Bios Scientific Publications Ltd., Oxford. Clynes, M. (ed).: Animal Cell Culture Techniques. Springer.

2. Sambrook & Russel. Molecular Cloning: A laboratory manual.

3. Freshney, Culture of Animal cell: A mannual of Basic Techniques

4/3/22

COURSE: Generic Elective-3 (GE- 3)

Food Biotechnology (BTUCTG1) **CREDITS: 3**

Course Objective

The objective of the course is to make students knowledgeable about the application of Biotechnology in Food Science. This course will introduce them about role of Biotechnology in production, preservation, and packaging of food. The students will be taught about the biotechnological approaches for enhanced food production and nutritive values. The course will also cover the information about production of food items through alternative biotechnological approach including laboratory groan food items.

Course Learning Outcomes

After successful completion of course the students will able to:

- Describe the role of Biotechnology in Food production
- Define and understand the approaches for production of fermented food
- Explore the possible alternative foods
- Understand the concept of useful molecular methods for enhanced food production
- Design the strategies to increase nutritive value of food

Course Contents

Unit I: Food Science and Biotechnology

Overview of Biotechnology in food science, Food Processing Biotechnology, Food Processing Unit Operation, Quality parameters of Food. Regulations for food industries, Social ethics in food biotechnology.

Unit II: Fermentative production of food

Microbial fermentation; Starter cultures; Curdling products, Curd, Yoghurt, Cheese - principles of cheese making and their types, Fermented milk products, Fermented foods, Fermented vegetables: Sauer kraut, pickles, Olives, Kimchi, Fermented sausages, Alcoholic beverages: wine, brandy and beer etc.; Food additives: organic acid, amino acids, food flavoring agents and pigments.

Unit III: Food Preservation and Packaging

Microbial Biotechnology in Food Products, Role of microbes in food products, Microbial Food Spoilage; Use of microbes for production of food (Yeast; Bacteria and other microorganism-based process), Biotechnology in food preservation and packaging. Prevention of food deterioration.

Unit IV: Alternative food items and Molecular Method for Food production

Raw material for food and its modification, Bio conversion of food raw material, Conversion of food waste in value added products, Methods to increase nutrient values of food items. Alternative food products and their production: Microbes as food product, Mushrooms, Single

Q Bhatt 4/3/22

cell protein, Aqua culture, Nutraceuticals, Laboratory grown food. Molecular methods to enhance food production; Techniques for development of new plant varieties, genetically modified organisms/transgenic organisms as food.

Suggested Books

- Food Microbiology (William C Frazier) New York : McGraw-Hill
- Compendium of the Microbiological Spoilage of Foods and Beverages (William H. Sperber · Michael P. Doyle) Springer
- Introduction to Food Biotechnology (Perry Johnson-Green) CRC Press
- Food Biotechnology (SC Bhatia) CRC Press
- Food Biotechnology: Principles and Practices (VK Joshi) I.K. International Publishing House Pvt. Limited,
- Progress in Food Biotechnology (Ali Osman) Bentham Science Publishers
- Food Biotechnology (Anthony Pometto, Kalidas Shetty, Gopinadhan Paliyath, Robert E. Levin) CRC Press

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COURSE: Ability Enhancement Course – 3 (AEC - 3)

Intellectual Property Right and Entrepreneurship (BTUCTA1) CREDITS: 2

Course Objective

The objective of the course is to introduce the students about the basic knowledge on intellectual property rights and their implications in biological research and product development; students become familiar with India's IPR Policy; about concepts of entrepreneurship including identifying a winning business opportunity, gathering funding and launching a business, growing and nurturing the organization and harvesting there wards.

Course Learning Outcomes

Learning outcomes on completion of this course the students will be able to;

- Understand different types of intellectual property rights.
- Understand the protection of products derived from biotechnology research
- Understand Indian patent Act and issues related to application and obtaining patents.
- Understand entrepreneurial skills
- Understand role of entrepreneurship in developing economy

Course contents

Unit I

Introduction to Indian Patent Law, World Trade Organization and its related intellectual property provisions, Intellectual/Industrial property and its legal protection in research, design, development in Biotechnology

Unit II

Essential requirements for patenting, types of patent, things that are patentable and non-patentable, Drug patents in India, various types of patent application in India, patenting of living organism, traditional knowledge, commercial exploitation and protection.

Unit III

Concept of entrepreneur, nature of entrepreneur, entrepreneurial characteristics, functions of an entrepreneur, role of entrepreneurship in developing economy.

Unit IV

Entrepreneurship: Selection of a product, line, design and development processes, economics on material and energy requirement, stock the product and release the same for making etc. The basic regulations of excise: Demand for a given product, feasibility of its production under given constraints of raw material, energy input, financial situations export potential etc.

Q bhatt
4/3/22

Naveen

COURSE: Generic Elective-3 (GE- 3) Practical

Laboratory (Based on GE-3) (BTUCLG1) CREDITS: 2

Course Objective

The objective of the course is to make students knowledgeable about the various methods in Food Biotechnology. This course will allow them to perform the analysis of food for their qualitative and quantitative parameters. This course intent to provide learning experience in laboratory about nutritive value of food, its contamination content, process of food production, preservation, etc.

Course Learning Outcomes

After successful completion of course the students will able to:

- Evaluate the nutritive value of food.
- Detect the food spoilage
- Preserve the food items
- Produce the food through biotechnological approaches

Course Contents

1. Detection of bacterial load in food items.
2. Determination of spoilage of milk through dye reduction test.
3. Determination of protein contents in food items by Bradford's Method.
4. Curdling of milk.
5. Determination of accuracy of blanching process for vegetable.
6. Production of alcoholic beverages and their distillation
7. Preservation of vegetables through pickling method.

Abhatt 4/3/22

Naveen

COURSE: Generic Elective-4 (GE- 4)

Scientific Writing (BTUDTG1)

CREDITS: 3

Learning Objective:

On completion of this course, the students will be able to understand about:

- The features of communication
- The various writing skills
- The scientific and technical writings

Course Outcome

The Course aims at capacity building in:

- Acquiring knowledge about different aspects of scientific, technical writing and communication
- Hands on usage of related tools and techniques of scientific writing
- Effective manuscript, project and review writing

Course contents

Unit I: Communication and Writing Skills

Language and communication, Speech and writing: differences and distinct features, Selection of topic, developing the hypothesis, introductory, developmental, transitional and concluding paragraphs, linguistic unity, coherence and cohesion, descriptive, narrative, Overview of science writing, how is scientific writing different from general writing, know your audience, writing for general public, science reporting, Science news, explanatory writing, lengthy magazine article, popular articles and popular lectures. Reading material: Popular science magazine articles.

Unit II: Technical Writing

Scientific and technical subjects; formal and informal writings; formal writings/reports, handbooks, manuals, letters, memorandum, notices, agenda, minutes; common errors to be avoided. Authors, acknowledgements, reproducibility, plagiarism, Numbers, units, abbreviations and nomenclature used in scientific writing, Writing references, Power-point presentation. Poster presentation, IMRAD format.

Unit III : Publishing work

Publishing work: selection of journal, impact factors, h index, following author guidelines, on line submission, proof reading of a manuscript, understanding the symbols, reviewing of a manuscript, making corrections and answering reviewers query, galley proof reading, Writing research grant proposal, Book review, write up mini profiles of prominent scientists, letters to editor, opinion writing, interview of a scientist, career in scientific writing

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Unit IV: Ethics and Good Practical's and Art of Scientific Writing

Writing for scientific community, types of paper (short communication, original research article, review), the various components for each type and the content of each components (title, author affiliation, abstract, key words, introduction, material and methods, results and discussion, conclusion, references and bibliography, citation. Scientific writing and ethics, Introduction to copyright-academic misconduct. Ethics in writing, plagiarism, plagiarism checker on line.

References

1. Jane Gregory and Steve Miller, Science in Public: Communication, Culture, and Credibility, Plenum, New York, 1998.
2. James G, Paradis and Muriel L. Zimmerman, The MIT Guide to Science and Engineering Communication. MIT Press, UK, 2002.
3. J.V. Vilanilam, Science Communication and Development in India, Sage, New Delhi, 1993.
4. Michael Alley (1998) The Craft of Scientific Writing Paperback
5. Janice R. Matthews Robert W. Matthews (2014) Successful Scientific Writing 4th edition Cambridge University Press.
6. Stephen B Heard (2016) The Scientist's Guide to Writing: How to Write More Easily and Effectively throughout Your Scientific Career Princeton University Press

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COURSE: Generic Elective-4 (GE- 4) Practical

Laboratory (Based on GE-4) (BTUDLG1) **CREDITS: 2**

Learning Objective:

On completion of this course, the students will be able to understand about:

- The features of communication
- The various writing skills
- The scientific and technical writings

Course Outcome

The Course aims at capacity building in:

- Acquiring knowledge about different aspects of scientific, technical writing and communication
- Hands on usage of related tools and techniques of scientific writing
- Effective manuscript, project and review writing

Course contents

1. Searching relevant scientific documents using appropriate keywords
2. Observing and reading various scientific documents (original research article, review article, graphical review etc.)
3. Detection of text similarity and plagiarism
4. Abstract Writing
5. Poster and graphical abstract preparation
6. Reference/bibliography styling

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COURSE: **COURSE: Ability Enhancement Course – 4 (AEC - 4)**

Molecular techniques in disease diagnosis (BTUDTA1) **CREDITS: 2**

Course Objective

The skill enhancement course prepares the student for a career in academia or industry or become a bioentrpreneur. The objective of the course is to introduce the basic knowledge of molecular techniques used in various disease diagnosis. Student will better understand the basic principle of different molecular techniques required for interpretation of disease.

Course Learning Outcomes

On the successful completion of the course, students will be able to:

- Know the collection, storage, transportation of sample or chemicals as well as follow the biosafety regulation and proper disposal of laboratory waste.
- Gain knowledge about various infectious, non-infectious and lifestyle diseases, tumors and their diagnosis.
- Know the composition of blood and different types of staining used to visualize the blood cells for disease diagnosis includes DLC, TLC, cytochemical staining etc.
- Understand the principle and application of advanced molecular techniques like PCR, RFLP, Immunoassays, Flouresence activated cell sorter, Magnetic cell sorter, FITR used in different types of disease diagnosis.
- Acquire knowledge about common imaging technologies and their utility in the clinic to diagnose a specific disease.

Course contents

Unit I

Transportation of different clinical materials to distant Laboratories, Proper storage of samples, Chemicals, antibodies and enzymes, common anticoagulants used-composition, amount, mechanism of action and methods of preparation of different types of vials, Biosafety measures and disposal of laboratory waste. Basics of quality control methods and Laboratory accreditation

Unit II

Composition of blood and its function, drawing of peripheral blood smear, staining & stain preparation, Methods of estimation of Haemoglobin, Methods of total counts of WBC, RBC, Platelets & fluids used, Blood Group (ABO & Rh), Cytochemical stain for diagnosis/differential diagnosis of leukemia/other diseases

Unit III

Susceptibility tests: Diffusion test procedures, Tests for bactericidal activity, Immunodiagnostic tests,Immuno florescence, Enzyme Immunoassays: Enzyme linked immunosorbent assay,

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Radioimmunoassay, Immunophenotyping, Flouresence activated cell sorter, Magnetic cell sorter, FTR, Spectrophotometry

Unit IV

Molecular techniques to detect genetic disorders: Polymerase chain reaction, Restriction fragment length polymorphism, Nuclear hybridization methods, Single nucleotide polymorphism and DNA finger printing

Suggested Reading

1. Practical Biochemistry, Principles and Techniques, Keith Wilson and John Walker
2. J.F. Van Impe, Kluwer Advanced Instrumentation, Data Interpretation, and Control of Biotechnological Processes,
3. Ananthanarayan R and Paniker CKJ. Textbook of Microbiology. University Press Publication.
4. Brooks GF, Carroll KC, Butel JS and Morse SA Jawetz, Melnick and Adelberg's Medical Microbiology. McGraw Hill Publication.
5. Goering R, Dockrell H, Zuckerman M and Wakelin D. Mims' Medical Microbiology.
6. Joklik WK, Willett HP and Amos DB. Zinsser Microbiology Appleton Centuary-Crofts publication.
7. Willey JM, Sherwood LM, and Woolverton CJ Prescott, Harley and Klein's Microbiology. McGraw Hill Higher Education
8. Michael Hoppert, Microscopic Techniques in Biotechnology

COURSE: Core -12 **Theory**

Plant and Animal Biotechnology (BTUETT2) CREDITS: 3

Course Objective

The objective of this course is to provide basic knowledge of animal and plant tissue culture. This course is designed to make students aware about laboratory organization and techniques of plant and animal tissue culture. This course will also teach application of transgenic animals and transgenic plants

Course Learning Outcomes

After successful completion of the course student will be able to understand

- Concept of totipotency, dedifferentiation and redifferentiation
- Scope and application of animal cell culture technology
- Scope and application of plant tissue culture technology
- Organization of animal and plant tissue culture laboratory
- Culture media and buffers used in animal and plant tissue culture laboratory
- Animal cell culture techniques: primary culture, subculture of cell lines
- Plant tissue culture techniques: Callus culture, organ culture, suspension culture
- Application of transgenic animals and plants

Course Contents

UNIT I: Basic Concepts of Animal Cell Culture

Animal Cell Culture: Laboratory Organization, Buffer and culture media for animal cell culture, primary culture, subculture, established cell lines. Cell viability and cytotoxicity assays. Stem cell culture.

UNIT II: Manipulation of Animal Cells in Laboratory

Cell transformation and cell cloning, tissue engineering, transgenic animals, methods of introducing foreign genes into mice (retroviral vector method, microinjection method, embryonic stem cell method)

UNIT III: Basic Concepts of Plant Tissue Culture

Plant tissue culture: Totipotency, dedifferentiation and redifferentiation of cells. Organization of plant tissue culture laboratory. Constituents of plant tissue culture medium

UNIT IV: Plant Tissue Culture Techniques

Types of plant tissue culture: Callus culture, organ culture (embryo, seed, anther, pollen, ovary, meristem, nucellus, shoot and root culture), suspension culture, culture of isolated single cells, protoplast culture, somatic embryogenesis, micropropagation. Transgenic plants

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COURSE: Core -12 Practical

Laboratory-12 based on core-12 (BTUELT2) **CREDITS: 2**

Course Objective

The objective of this course is to provide practical exposure of basic experiments of animal cell culture and plant tissue culture.

Course Learning Outcomes

After successful completion of the course student will be able to understand/perform

- Preparation of buffers and media for animal cell culture
- Sterilization and filtration of cell culture medium
- Trypsinization of cell lines
- Passaging of cell lines available in department laboratory
- Counting the viable cells using haemocytometer
- Preparation of media for plant tissue culture
- Surface sterilization of explants
- Inoculation of explants in culture medium for in vitro growth

Course Contents

1. To prepare buffer and media for animal cell culture
2. Sterilization and filtration of cell culture medium
3. Trypsinization of cell lines
4. Passaging of cell lines
5. To count the viable cells using haemocytometer
6. To prepare media for plant tissue culture
7. Surface sterilization of explant
8. Inoculation of surface sterilized explant in culture medium

SUGGESTED READING

1. Butler, M and Dawson, M. (eds.).: Cell Culture Lab Fax, Eds., Bios Scientific Publications Ltd., Oxford. Clynes, M. (ed).: Animal Cell Culture Techniques. Springer.
2. Sambrook & Russel. Molecular Cloning: A laboratory manual.
3. Freshney, Culture of Animal cell: A mannual of Basic Techniques
4. Masters, J. R. W. (ed): Animal Cell Culture – Practical Approach, Oxford Univ. Press.
5. Basega, R. (ed): Cell Growth and Division: A Practical Approach. IRL Press.
6. Mather, J.P and Barnes, D. (eds). : Methods in Cell Biology, Vol. 57, Animal Cell Culture Methods. Academic Press.
7. Chawla, H. S. (2000). *Introduction to Plant Biotechnology*. Enfield, NH: Science.
8. Razdan, M. K. (2003). *Introduction to Plant Tissue Culture*. Enfield, NH: Science.
9. Slater, A., Scott, N. W., & Fowler, M. R. (2008). *Plant Biotechnology: an Introduction to Genetic Engineering*. Oxford: Oxford University Press.

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COURSE: Ability Enhancement Course – 5 (AEC - 5)

Biotechnology in Societal Welfare (BTUETA1) CREDITS: 2

Course Objective

The objective of this course is to understand the basic concepts of advanced and emerging issues in biotechnology pertaining to societal welfare. The students will also understand the utility of biotechnology in solving societal issues.

Course Learning Outcomes

- Upon successful completion of the course, the student will be able to understand the basic concepts of advanced and emerging issues in biotechnology
- Analyze, and evaluate social and ethical issues in the conduct of biological research and application of biological knowledge
- Analyze the scientific method by formulating hypotheses, proposing testable predictions and then testing to reach supportable conclusions about biological processes and systems, and articulate the relevance of modern biology to society.
- Apply responsibilities to promote societal health and safety, upholding the trust given to the profession by the society.

Course Contents

Unit I
History of Biotechnology, Basic concepts of genes, Genetic engineering, Tools for manipulation of genes: introduction to recombinant DNA technology, Vectors and expression systems.

Unit II
Intellectual property rights, Recombinant DNA Debates, Biotechnology and Business, Patenting Life, Genetically Modified organisms and Genetically Modified Foods: Risk and Regulation.

Unit III
Assisted reproductive technologies: From the Pill to IVF, Cloning, Stem Cells, Eugenics, The Human Genome Project, Genetic Testing, Bioethics and Medicine.

Unit IV
Personalized medicine, Bioprospecting and Biocolonialism, Vaccines, Gene therapy, Clinical trials, Synthetic Biology and Bioterrorism, Organic farming: Biofertilisers and Biopesticides.

References:
1. Biotechnology and Society: An introduction. Hallam Stevens. University of Chicago Press. 2016.
2. W. Godbey, An Introduction to Biotechnology. The Science, Technology and Medical Applications, 1/e, Woodhead Publishing, 2014.
3. J.M. Walker and R. Rapley, Molecular Biology and Biotechnology, 5/e, Royal society of chemistry, 2009.
4. B.R.Glick, J.J.Pasternak, C.L.Patten. Molecular Biotechnology.ASM Press. 2009.

Semester-VI

COURSE: Core -13 Theory

Statistics in Biological Research (BTUFTT1) **CREDITS: 3**

Course Objective

The objective of this course is to provide detailed knowledge of biostatistics. Understanding the concept of statistics is necessary for researchers to test their hypothesis and to analyse their experimental data to make firm conclusions.

Course Learning Outcomes

After successful completion of the course student will be able to understand

- Scope and applications of biostatistics
- Collection, processing and presentation of data
- Measures of central tendency
- Measures of dispersion
- Correlation analysis and regression analysis
- Testing of hypothesis

Course Contents

Unit I: Scope and Applications of Biostatistics

Scope and applications of Biostatistics, samples and population concept, collection, processing and presentation of data, frequency distribution

Unit II: Measures of Central Tendency

Measures of central tendency: Arithmetic, Harmonic and Geometric Mean, Mode and Median, their applications, merits and demerits

Unit III: Measures of dispersion

Measures of dispersion, Variance, Standard Deviation, Coefficient of Variance, their applications, merits and demerits, Correlation analysis and Regression analysis, Concept of Probability

Unit IV: Test of Significance

Comparison of two data sets: testing of hypothesis, Student's t-test, Chi square test, F-test-introduction and application in biology, comparison of three and more data sets: ANOVA test.

Suggested Reading

1. Le CT Introductory biostatistics. John Wiley, USA

2. Glaser AN High Yield TM Biostatistics. Lippincott Williams and Wilkins, USA

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