"Education through self-help is our motto."

Rayat Shikshan Sanstha's

Lead college of Karmaveer Bhaurao Patil University , Satara.

Yashavantrao Chavan Institute of Science, Satara.

(An Autonomous College)

Reaccredited by NAAC with 'A+' Grade

Syllabus for Bachelor of Science

Part I

Biotechnology

To be Implemented from June, 2023 onward
(As per NEP-2020 Guidelines)

Rayat Shikshan Sanstha's
Yashavantrao Chavan Institute of Science, Satara
Syllabus for Bachelor of Science Biotechnology

1. **Title:** B. Sc. Biotechnology
2. **Year of Implementation:** 2023-24
3. **Preamble:** As per the NEP 2020 guidelines this updated syllabus is prepared for first year undergraduate students of Biotechnology. At this level, to develop their interest towards Biotechnology as applied science and also to prepare them for the academic and industrial exposure simultaneously. Introduction of life science subjects will help to form a basic foundation of concepts for students. The interdisciplinary approach with vigor and depth is compatible to the syllabi of other universities, at the same time is not rigid for the students at first year of their graduation. The units in the syllabus are well defined with scope and the number of lectures. The Reference books are mentioned with relevance.

4. **General Objectives:**
    1) Construction and redesigning of the courses to suite local needs
    2) More emphasis on applied aspects of biotechnology
    3) To develop aptitude of students in the field of research
    4) Enrichment of basic knowledge in areas of Biotechnology

5. **Program Outcomes:** The students will be
    1) Graduate with proficiency in the biotechnology
    2) Eligible to continue higher studies in the subject
    3) Eligible to peruse post graduate study in abroad
    4) Eligible to appear for the examination for job in government sector.

6. **Program Specific Objectives:**
    1) The students are expected to understand the fundamentals, principles, concept and recent developments in Biotechnology.
    2) The practical course is framed in relevance with theory courses to improve understanding of various concepts in biotechnology.
    3) It is expected to inspire and boost interest of students in Biotechnology.
    4) To enrich students' knowledge and train them in various branches of Biotechnology.

7. **Program Specific Outcomes:**
    1) Understand basics of Biotechnology
    2) Learn, design and perform experiments in the labs to demonstrate the concepts, principles and theories learnt in the classroom
    3) Develop the ability to apply the knowledge acquired in classroom and laboratories to specific problems in theoretical and experimental biotechnology.
    4) Identify the area of interest in the academic research and development.
    5) Perform job in various fields like food, pharmaceutical, agriculture, healthcare, public

services and business etc.

6) Be an entrepreneur with precision, analytical mind, innovative thinking, and clarity of thought, expression and systematic approach.

8. **Duration:** One Year

9. **Pattern:** Semester wise

10. **Medium of Instruction:** English

11. **Structure of Course:**

a. Semester I:

Theory: 2 major + 2 minor + 2 open elective papers

Practical's: 2+2+2=06 Papers

b. Semester II:

Theory: 2 major + 2 minor + 2 open elective papers

Practical's: 2+2+2=06 Papers

Rayat Shikshan Sanstha's

Yashavantrao Chavan Institute of Science, Satara (Autonomous)

Department of Biotechnology "NEP Implementation 2020"

…….BIOTECHNOLOGY COURSE TITLEs……

	Major Subject: 1				**Minor Subjects**			**Subject: 3 (GE/OE)**					
Sem	**Course**	**Course Title**	**Credit**	**Course**	**Course Title**	**Credit**	**Paper**	**Course Title**	**Credit**	**SEC**	**IKS**	**VEC**	**CC**
I	BBTT 111	Fundamental of biotechnology	2	BBTT 114	Basics in Microbiology	2	BBTTOE 117	Agriculture economics	2		101		102
	BBTT 112	Biomolecules	2	BBTT 115	Plant Science	2	BBTTOE 118	Agriculture and economic development	2				
	BBTP 113	Lab exercise based on Fundamental of biotechnology and Biomolecules	2	BBTP 116	Lab exercise based on Microbiology and Plant Science	2	BBTTOE 119	Democracy election and good governance	2				
II	BBTT 121	Bio-techniques and Instrumentation	2	BBTT 124	Animal science	2	BBTTOE 127	Farm Manegement	2	103		104	
	BBTT 122	Proteins and Enzymes	2	BBTT 125	Biostatistics	2	BBTTOE 128	Agricultural risk Management	2				
	BBTP 123	Lab exercise based on Bio-techniques and Instrumentation and Proteins and Enzymes	2	BBTP 126	Lab exercise based on animal science and biostatistics	2	BBTP 129		2				
	Total		**12**			**12**			**12**	**2**	**2**	**2**	**2**

BBTTIKS 1: Indian health Sciences ; SEC: Basics in Hydroponics ; VEC 104: Digital technology; BBTTCC 1: Anchoring

Semester I

Major Course

BBTT 111: Fundamentals of Biotechnology

Credit: 02 **Lectures: 30**

Course Objectives: The students should be able to…

1. Know about biotechnology
2. Understand different areas in biotechnology
3. Interpret the applications of biotechnology in health care
4. Know different research institutes from all over india.

Credits 02	**SEMESTER-I** **BBTT 111: Fundamentals of Biotechnology**	**No. of hrs.**
Unit I	**About Biotechnology**	**O8**
	Introduction, Milestones in the History of Biotechnology, Traditional & modern Biotechnology, Branches of Biotechnology, commercial potential of biotechnology, Biotechnology in India, Renounced Biotechnology institutes in India (IIT, IISER, NCL, NCCS, ARI, NIV, CCMB, CDFD etc.)	
Unit II	**Biotechnology and Healthcare**	**07**
	Disease diagnosis, detection of genetic diseases, disease treatment (Any two examples), stem cell technology	
Unit III	**Agricultural Biotechnology**	**08**
	Introduction, Plant Tissue culture, genetically modified crops,(Any two examples), GMOs in Agriculture, Plant based vaccines	
Unit IV	**Food Biotechnology**	**07**
	Biotechnological applications in enhancement of Food Quality, Food Products, Microbial role in food products Yeast, Bacterial and other Microorganisms based process and products. Modern Biotechnological Regulatory Aspects in Food Industries.	

Course Outcomes: The students will be able to…

1. Discuss milestones of biotechnology .
2. Discuss the application of biotechnology in health care, disease diagnosis, tissue culturing method
3. Implement biotechnological applications in enhancement of Food and Different areas in biotechnology
4. Interpret the use of advance technology in food and agriculture sector.

Reference Books:

1. Singh B.D., (2020) Biotechnology , 4th Edition Kalyani Publishers.
2. Razdan M.K., [2019], Introduction to plant tissue culture ,3rd edition oxford and IBH publisher
3. Arora M. P., [2017], Biotechnology , HimalayaPublisher.

4. Lanza R., Atala A., [2013], Essentials of stem cell biology, 3rd Edition, Academic press
5. Clark D., Pazdernik N., [2012], Biotechnology ,Elsevier inc Publisher
6. Hermann K., Kumar A., jafargholi-imani [2009],Plant cell and tissue culture – A tool in biotechnology, Springer-verlag-berlin Heidelberg publisher
7. Kalyankumar de ,[2008] ,Plant tissue culture, new central book agency, New Delhi
8. Dubey R. C., [2006], A text book in Biotechnology, S. Chand publications
9. Hartl D, Jones E., [2001], Genetics- Analysis of genes and genomes, Jones and bartlett publishers
10. JemsM. J., [2000], Modern food biotechnology, 6th Edition, Aspen publishers Inc.

BBTT 112: Biomolecules

Credit: 02 **Lectures: 30**

Course Objectives: The students should be able to…

1. Define basics of chemical science in relevance to biological systems
2. Know concept of evolution
3. Understand fundamental Biomolecules
4. Memorize biomolecules

Credits 02	SEMESTER-I BBTT 112: Biomolecules	No. of hrs
Unit I	**Origin of life**	**08**
	Basic concept, A.I. Oparin concept, Urey Miller's experiment, Concept of Biomolecules- in general about Carbohydrate, amino acids, protein, lipid just definition with at least one example. pH, pk value definition, Biological buffer systems- e.g. Phosphate, Bicarbonate, Hemoglobin buffer system.	
Unit II	**Nucleic Acids**	**07**
	Structure and functions of Nucleic acids, purines& pyrimidines, Nucleosides & Nucleotides, Biologically important nucleotides, Double helical model of DNA structure and forces responsible for A, B & Z – DNA, denaturation and denaturation of DNA, RNA and its Types (rRNA, tRNA, mRNA).	
Unit III	**Carbohydrates**	**08**
	Structure, Function, Classification, Characteristic Reactions, Physical and Chemical Properties, D&L Glyceraldehydes, structure of Monosaccharide, Disaccharides, and Polysaccharides. Chemical/Physical Properties of Carbohydrate, Chemical Reactions for Detection of Monosaccharides, Biological functions of carbohydrates.	
Unit IV	**Lipids**	**07**
	Classification of Lipids, Properties of Saturated, Unsaturated Fatty Acids, Rancidity, and Hydrogenation of Oils Phospholipids: Lecithin, Cephalin structure and function Cholesterol: Structure and Function, Lipoproteins: Structure and Function, Storage Lipids, Structural Lipids	

Course Outcomes: The students will be able to…

1. Illustrate basics of chemical science in relevance to biological systems
2. Describe the concept of evolution
3. Discuss the biomolecules
4. Classify the biomolecules

Reference Books:

1. Voet J. G., Voet D., Pratt C.W., (2016) Fundamentals of Biochemistry, 5th Ed. John Wiley and Sons Inc, New York, USA
2. Satyanarayanan U. (2013) Biochemistry Elsevier; 4th edition

3. Com E.E & Stumpf P.K.(2010).Outlines of Biochemistry.5th Ed. John Wiley Publications
4. Purohit S.S. (2009), Biochemistry - Fundamentals and Applications, Agrobios, Jodhpur
5. Palmer T., Philip B. (2007) Enzymes: Biochemistry, Biotechnology, and clinical Chemistry, 2nd Edition, Woodhead Publishing,
6. Nelson D.L., Cox M.M. Lehninger (2004) Principles of Biochemistry, 5th Edition, WHF reeman and Company, New York, USA
7. Jain J. L. (2004) Fundamentals of Biochemistry, S. Chand Pub
8. Rastogi S. C..(2003) - Biochemistry Tata McGraw-Hill Education, New Delhi
9. Rama Rao A. V. S. S., (2002) A Textbook of Biochemistry. Edition, 9, illustrated. Publisher, Sangam Books Limited, New Delhi.
10. Berg J. M., Tymoczko J. L., Lubert Stryer and Gregory J. Gatto, 2002.Biochemisry, 7th Ed. W.H. Freeman and Company, NY, USA
11. Manickam S. S. (1996) Biochemical methods. 2nd edition, New Age International (p) Ltd. Publisher, New Delhi

Minor Course

BBTT 114:Basics in Microbiology

Credits:02 **Lectures:30**

Course Objectives: The students should be able to...

1. Understand General bacteriology and microbial techniques
2. Know the importance of the field of microbiology to other areas of biology and to general human welfare
3. Know the Principles of physical and chemical methods used in the control of microorganisms and applications for the preventionand control ofinfectious diseases.
4. Understand the Laboratory and techniques for isolation, staining, identification and control of microorganisms.

Credits 2	**SEMESTER-I** **BBTT 114: Basics in Microbiology**	**No. of hrs.**
Unit I	**Introduction of Microbiology**	**O8**
	Definition, Discovery of microscope (Anton von Leeuwenhoek and Robert Hooke), Contributions of various Scientists (Aristotle, Francesco Redi, Louis Pasteur,Tyndall),Introduction to types of Microorganisms – Bacteria, Algae, Fungi, Protozoa and Viruses Morphology of Bacteria– i) Size, ii) Shape, iii) Arrangements Cytology of Bacteria, Structure and functions of :i) Cell wall ii) Cell membrane iii) Capsule and slimelayer iv)Flagella v) Pilli vi) Nuclear material vii) Mesosome viii) Ribosome,Cell inclusions (PHB granules,metachromatic granules and glycogen bodies) Viruses-General characteristics and lytic cycle of T4 bacteriophage	
Unit II	**Bacterial taxonomy**	**08**
	General principles of bacterial nomenclature: Taxonomic ranks,CommonorVernacular name,Scientific or International name,Criteria fo rbacterial classification - Morphological, cultural, biochemical & serological characters. Microbial nutrition: Nutritional requirements of microorganisms: Water; Micronutriets;Macronutrients; Carbon, Oxygen, Hydrogen, Nitrogen, Sulphur and Phosphorous and growth factors. auxotroph, prototroph and fastidious organisms,Nutritional types of microorganism based on carbon and energy sources(Autotrophs, Heterotrophs, Phototrophs, Chemotrophs, Photoautotrophs, Chemoautotrophs,Photoheterotrophs, Chemoheterotrophs.	
UnitIII	**Concept of Sterilization**	**07**
	Definitions: Sterilization, Disinfection,Antiseptic, Germicide, Microbiostasis, Asepsis,Sanitization. **Methods of sterilization by Physicalagents :**(i)Temperature-dryheat, moist heat ii)Radiation-U.V,Gammaradiation iii)Bacteriaprooffilter-membranefilter) **Chemical agents** Phenol & Phenolic compounds, Alcohol,Heavy metalse.g.mercury), **Gaseousagents**-Ethyleneoxide, formaldehyde. Checking of Efficiency of Sterilization–Biological andChemical Indicators	
UnitIV	**StainingTechniques**	**07**

	Definitions: dye and stain (Basic and Acidic),Fixative ,Mordant, Decoloriser, Accentuator Classification of stains–Acidic,Basic and Neutral, Principles, Procedure, Mechanism and application of staining procedures-Monochrome staining and Negative staining ,Differential staining-Gram staining and Acidfast staining, Special staining techniques –Spore,Capsule, Cellwall staining	

Course Outcomes: The students will be able to…

1. Classify microorganisms according to Microbial nutrition.
2. Explain nutritional requirement of microorganism
3. Interpret Basic components of Nutrient medium and their role
4. Explain Basic terms in sterilization, Principles of sterilization and Various agents of sterilization

Reference Books:

1. StanierR.Y.,AdelbergE.A.andIngrahamJ.L.(1987).GeneralMicrobiology,5thEdition.Macmillan PressLtd.
2. IngrahamJ.L.and IngrahamC.A. 2004,IntroductiontoMicrobiology.3rdEdition, Australia Pacific Grove, CA : Brooks/Cole Pub. Co
3. Frobisher martin,(1974),Fundamentalsofmicrobiology.9thed. Philadelpia:Saunders
4. Pelczar micheal.J,JR.Chan E.C.S, NoelR .Krie,(1993),Microbiology,5th Edition,McGraw Hill Education.
5. Paniker.CK. Jayaram, Ananthanarayan.R.,Medicalmicrobiology.(2005),7th edition, Universities Press
6. PrescottL.M, Harley J.P,and Klein.D.A.Microbiology, (2005)6thEdition.MacGrawHill
7. Kenneth alexzander bisset, The cytology and life history of bacteria [2021] Hassell Street Press
8. Arora.D.R,Arora Birjibala ,Textbook of microbiology[2020] 6th edition,CBS publisher.
9. SharmaP.D.,Microbiology[2010],Rastogi publication
10. Swarna.G.,A textbook of microbiology[2022],Florence publisher

BBTT115: Plant Science

Credits:02 **Lectures:30**

Course Objectives: The students should be able to...

1. Understand general classification of plant kingdom.
2. Know morphology and anatomy ofplants.
3. Learn basicknowledge of angiosperm and its reproduction.
4. Study the basic knowledge of plant cloning.

Credits 02	**SEMESTER-I** **BBTT115:Plant Science**	**No. of hrs.**
UnitI	**Plant Diversity**	**08**
	Outline of General Classification of Plant Kingdom. General characters and economic importance of Algae, Fungi, Lichens, Bryophytes, Pteridophytes, Gymnospersms, Anigosperms	
UnitII	**TaxonomyofAngiosperms**	**07**
	Taxonomy:-Definition, Aims, objectives and functions ,Binomial nomenclature and its significance, Principles of ICBN, Study of outline of Bentham and Hooker's system of Classification of plants. Electrophoresis, Agarose gel Electrophoresis, SDS PAGE, Pulse field electrophoresis,2D PAGE.	
UnitIII	**SexualReproductioninAngiosperms**	**08**
	Structure of Typical Flower– Floral whorls and functions:-Calyx, corolla,Androecium ,Gynoecium, Pollination- Definition, Types–Self and Cross,Advantages of Self and Cross Pollination, Development of male and female gametophyte, Fertilization:-Definition, Doublefertilization and its significance,Parthenocarpy- Definition and significance. Cloning of plants:-Bulbs,corns,tubers,Bulblets and Rhizomes, Runners ,Cuttings, Layering, Grafting and mericloning.	
UnitIV	**SeedandPlantAnatomy**	**07**
	Seed–Definition, Formation,s tructure of Monocot and Dicot seed,Dormancy of seed,Causes and Breaking of seed dormancy. Seed germination- Concept, Types-Epigeal and Hypogeal, factors affecting seed germination. Plant Anatomy Tissues-Simple and complex (Xylem and Phloem)	

Course Outcomes: The students will be able to...

1. Analyze the terminology used in Morphology and Anatomy
2. Explain the plant kingdom and need of classification
3. Apply basic and advanced knowledge of plant cloning
4. Describe basic knowledge of angiosperm and its reproduction

Reference books

1. Dube H. C. (2009) AText Book of Fungi Bacteria and Viruses, Jodhpur: Agrobios
2. Naik V.N. (1984) Taxonomy of angiosperms. NewDelhi:TataMcGraw-Hill
3. Chopra G.L., .,(1984) Angiosperms:Systematic and lifecycle.Jalandhar: PradeepPub
4. Chopra G.L.and VermaV(1983),Text Book of Fungi PradeepPublications,Jalandar
5. Devlin R. M., (1983) Fundamentals of plant physiology NewYork:MacMillan
6. Chopra G.L., (1978) ATextbook of Algae Jalandhar: Pradeep Pub.,
7. Chang Shu-ting, Hayes W. A. (1978) The Biology and Cultivation of Edible Mushrooms Academic Press, - Technology & Engineering - 819 pages
8. Bold H.C., (1977) The Plant kingdom, New Delhi: Prentice-Hall India
9. Dutta A.C., (1959) A Classbook ofbotany, NewDelhi: Oxford University Press
10. Eames A. J. and Laurence H. MacDaniels (1947) An introduction of plantan atomy, NewYork:McGraw-Hill.

GE/OE Courses

BBTT 117: Agricultural Economics

Credits:02 **Lectures: 30**

Course Objectives: Students should be able to…

1. Introduce the students about the branch of Agricultural Economics.
2. Study the role of Agricultural sector in economic Development of India.
3. Study the types of farming in Indian Agricultural sector.
4. Know the uncertainty in agriculture

Credits 02	SEMESTER – I BBTT 117: Agricultural Economics	No. of hrs.
Unit I	**Introduction of Agricultural Economics**	**15**
	Introduction of Agricultural Economics: Definition, Nature and Scope for the separate study of agricultural economics ,Utility of agricultural economics Nature of uncertainty in agriculture,Characteristics of agriculture	
Unit II	**Indian Agriculture**	15
	Role of Agriculture in Indian Economy, Place of agriculture in rural Economy , Difference between agriculture and industry ,Systems of Cultivation – Peasant, Co-operative, State Farming, Corporate, Contract, Precision and Organic Farming, Farmers Club	

Course Outcomes: student will able to …

1. Discuss various branches of Agricultural Economics.
2. Describe the role of agricultural sector in economic Development of India.
3. Explain the system of Farm Management.
4. Describe uncertainties in agriculture

Reference Books:

1. Bhende, M.J., (2005), Agricultural Insurance in India: Problems and Prospects, NABARD, Occasional Paper-44
2. Bilgram, S. A. R. (1996), Agricultural Economics, Himalaya Publishing House, Delhi.
3. Christopher Ritson (1977), Agricultural Economics – Principles and Policy, CzosbyLuckwood Staples, London
4. Desai R G (2001): Agricultural Economics - Models Problems and Policy Issues, Himalaya Publishing House, Mumbai.
5. Donald J. Epp & John W. Malone (1981), Introduction to Agricultural Economics, Mc- Million Publishing Company, Inc. New York.
6. Helen Atthowe, Paul Muller (2023), The Ecological Farm, Chelsea Green Publishing Co (17 August 2023)
7. Muniraj Singh Rathore (2010), General Agriculture, Jain Brothers; 27th Edition 2018 (1 January 2010)
8. Jaya S. Anand (1999), Co-operative Agricultural and Rural Development Banks, Atlantic (1 January 1999)
9. V. T. Raju (2017), Economics of Farm Production and Management, Oxford & IBH Publishing Co Pvt.Ltd (1 January 2017)
10. Avery Elizabeth Hurt (2017), Corporate Farming, Greenhaven Publications (15 August 2017)

BBTT 118: Agriculture and Economic Development

Credits:02 **Lectures:30**

Course Objectives: Students should be able to…

1. Understand Agricultural Policy
2. Know the changes in cropping pattern
3. Study the food security
4. Know about national commissions on farmers and agriculture

Credits 02	SEMESTER – I BBTT 118: Agriculture and Economic Development	No. of hrs.
Unit I	**Agriculture and Economic Development**	**15**
	Role of agriculture in economic development , Agricultural Policy During Plan Period and Recent National Agricultural Policy ,Land Reforms in India Land Utilization in India – Change in Cropping Pattern	
Unit II	**Agriculture Reforms**	**15**
	Food security - Buffer Stock and Public Distribution System (PDS), Green Revolution, White Revolution, Blue Revolution, Yellow Revolution , Waste Land Development Programmes ,National Commission on farmers and Agriculture	

Course Outcomes: Students will be able to…

1. Describe agricultural policies
2. Discuss land reforms in India
3. Explain different revolutions
4. Describe Waste Land Development Programmes

Reference Books :

1. Ghatak, S. and K. Ingerscent (1984), Agriculture and Economic Development, Select books, New Delhi.
2. GOI (2007), Report of The Working Group on Risk Management in Agriculture for the Eleventh Five Year Plan (2007-2012) , GOI, New Delhi
3. Kumar K N R (2015): Agricultural Production Economics, Volume-I, Daya Publishing House, A Division of Astral International Pvt. Ltd, New Delhi.
4. Lekhi R K & Singh Jogindar (2013): Agricultural Economics, Kalyani Publisher, New Delhi. Publishing House, Bombay.
5. Reddy, Ram, Sastry & Devi (2010): Agricultural Economics Oxford & IBH publishing Co. Pvt. Ltd, New Delhi.
6. Sadhu A. N. & Singh Amarjit, Fundamentals of Agricultural Economics, (1996), Himalaya
7. Soni, R. N. (1995), Leading Issues in Agricultural Economics, Arihant Press, Jalandhar.
8. Kym Anderson (2016), Agricultural trade, policy reforms, and global food security, 1st edition 2016, Palgrave Macmillan
9. Dhyan kaur (1993), Changing patterns of Agricultural Land Use, South Asia Books Publications.
10. Nirmalendu Sarkar (2012), Pattern Change in Agricultural Land Productivity, LAP Lambert Academic Publishing (31 August 2012)

BBTT 119: Democracy, Election and Good Governance (DEGG)

Credit: 02 **Lectures: 30**

Course objectives: Students should be able to…..

1. Introduce the meaning of democracy and it's important.
2. Study the various approaches of democracy and governance.
3. Understand the election procedure in India.
4. Learn the role of the good Governance and its initiatives in India.

Unit	**Semester I** **Title: Democracy, Election and Good Governance (DEGG)**	**No. of hrs**
Unit I	**Democracy in India**	8
	Introduction: Meaning, Definition of democracy Classification: Direct democracy and representative democracy,features of direct and representative democracy	
Unit II	**Democracy and Decentralization**	8
	– Dimensions of Democracy: Social, Economic and Political – Decentralization: Grassroots Level Democracy – Challenges before Democracy: women and marginalized sectionsof the society	
Unit III	**Election**	8
	– 73rd and 74th Constitutional Amendment Acts: Institutions at thelocal level and Role of State Election commission – Local Body Elections: Urban & Rural – Duties of an Individual towards electoral process	
Unit IV	**Good Governance**	6
	– Meaning and concept – Government and Governance – Good Governance initiatives in India	

Course outcomes: students will be able to……

1. Explain the meaning of democracy and it's important.
2. Describe the various approaches of democracy and governance.
3. Examine critically election process in the country.
4. Define the role of the good Governance and its initiatives in India

References:

1. Banerjee-Dube, ,(2014). I, A history of modern India, Cambridge University Press.
2. Basu, D. D. ,(1982). ,Introduction to the Constitution of India, Delhi: Prentice Hall of India.
3. Bhargava, R, (2008),Political theory: An introduction. Chennai: Pearson EducationIndia.
4. Bhargava, R., &Vanaik, A, (2010),Understanding Contemporary India: CriticalPerspective. New Delhi: Orient Blackswan.
5. Chandhoke, N., &Proyadardhi,P. (Ed.), (2009),Contemporary India: Economy, Society,Politics,Chennai: Pearson Education India.
6. Chandra, B, (1999),Essays on contemporary India, New Delhi: Har-AnandPublications Pvt Ltd.
7. Chaterjee, P, (1997).State and Politics in India. New Delhi: Oxford university Press.
8. Dasgupta. S. (2011), (Ed.). Political Sociology. Chennai: Pearson Education India.

SEMESTER-I

BBTP113: Lab. Exercise Based on Fundamentals of Biotechnology & Biomolecules

Credit: 02 **Lectures: 60**

Learning Objectives: The students should be able to…

1. Understand concepts of solutions and buffers
2. Know about various biomolecules
3. Understand biomolecules detection techniques
4. Know different Research organizations in India

Sr. No.	SEMESTER-I BBTP113: Lab. Excercise in Fundamentals of Biotechnology & Biomolecules	No. of practicals hours
1.	To detect blood group of given sample	4
2.	Preparations of molar / normal solutions	4
3.	To study the plant / Animal tissue culture lab layout	4
4.	To study the methods of sterilization	4
5.	To study different research organizations in India	4
6.	Preparation of buffers (Phosphate buffer, acetate buffer) and determination of pH with pH meter	4
7.	To determine sugars by Molisch test, Benedict's test & Barfoed's test	4
8.	To determine sugars Resorcinol (Seliwanoff's test)	4
9.	To determine sugars by Fehling's test	4
10.	To perform Qualitative tests for Non - Reducing Sugars	4
11.	To Detect of unknown Carbohydrate from mixture (Glucose, fructose, maltose, sucrose, xylose and starch)	4
12.	To estimate Glucose by DNSA method	4
13.	To Determine iodine number of oil sample	4
14.	To Determine soponification value of oil	4
15.	To Estimation of vitamin C (Ascorbic acid)	4

Learning Outcomes: The students will be able to…

1. Apply knowledge in working of various instruments related to biotechnology
2. Analyse Various biomolecules & their qualitative analysis
3. Prepare Buffer , Standardized and calibrate pH meter.
4. Discuss various institutes in India

Reference Books:

1. Upadhyay A. , Upadhyay K., Nath N., (2020) Biophysical Chemistry Fourth Edition Himalaya Publishing House Pvt. Ltd.;
2. Wilson K. and Walker J., (2018) Principles and Techniques of Biochemistry and Molecular Biology 8th edition Cambridge University Press;
3. Plummer D., (2017) An Introduction to Practical Biochemistry 3rd Edition McGraw Hill Education;
4. Nagamani B., (2016) Bioinstrumentation Margham Publications
5. Veerakumari L., (2011) Bioinstrumentation Mjp Publishers
6. Champe P. C., Harvey R. A., Ferrier D. R. 2004 Biochemistry 3rd edition Lippincott Williams and Wilkins;
7. *Sadasivam* S, *Manickam* A (1996) *Biochemical methods*. 2nd edition, New Age International (p) Ltd. Publisher, New Delhi..
8. Fasman G. D.; (1989) Practical Handbook of Biochemistry and Molecular Biology CRC Press
9. Plummer D. 1988. An Introduction to Practical Biochemistry. 3rd ed. Tata McGraw Hill, New Delhi
10. Jayaram. T. 1981. Laboratory manual in biochemistry, Wiley Estern Ltd. New Delhi

SEMESTER-I

BBTP116: Lab. Excercise based on Microbiology & Plant science

Credit: 02 **Lectures: 60**

Learning Objectives: The students should be able to...

1. Understand concepts of microbiology.
2. Know about various bacterial media preparation techniques.
3. Study algae and bryophytes.
4. Learn various techniques plant anatonomy.

Sr. No.	SEMESTER-I BBTP116: Lab. Excercise in Microbiology & Plant science	No. of practical
1.	Introduction to laboratory-rules and procedures, laboratory equipment and apparatus.	4
2.	Preparation of bacteriological culture media-1) Nutrient agar media 2) Nutrient agar broth	4
3.	Preparation of bacteriological culture media- 1)Peptone water 2)Mac-conkeys agar media	4
4.	Preparation of culture media for fungi (Sabouraud's agar, PDA)	4
5.	Isolation of bacteria by pour plate technique.	4
6.	Isolation of bacteria by spread plate technique.	4
7.	Isolation of bacteria by streak plate technique.	4
8.	Microscopic examination of bacteria by, Monochrome staining, Gram staining, negative staining, cell walls staining	
9.	Observation of motility by hanging drop technique	4
10.	Mounting and identification of Aspergillus, Mucor	4
11.	Aseptic transfer techniques–types– slant to slant, broth to broth, broth to Agar	4
12.	Study of algae (*Nostoc, Sargassum*) and bryophyte (*Riccia/ Anthoceros*)	4
13.	Study of Pteridophyte (*Selaginella*) and gymnosperms (*Pinus*)	4
14.	Study of Angiosperms (Sunflower, Maize)	4
15.	Plant root, stem, leaf anatomy–Dicot and monocot	4

Learning Outcomes: The students will be able to...

1. Handeling of equipments and instruments.

2. Differentiate between plant cells & microbial cells
3. Apply Staining techniques, Gram staining, motility.
4. Analyse Structure and morphological aspects of algae, bryophytes.

Reference Books:

1. Aneja K.R. Laboratory Manual of Microbiology and Biotechnology(2018),Medtech publisher.
2. Leboffe.J.Michael , Pierce.E.Burton Microbiology Laboratory Theory & Application(2012) Brief LooseLeaf
3. Johnson Ted, Case, Christine,Laboratory Experiments in Microbiology (What's New in Microbiology),(2018)Spiral-bound illustrated.
4. Zothansanga,Senthilkumar.B. Practical Microbiology (2013)A Laboratory Manual Publisher: Panima Publishing Corporation, New Delhi, India.
5. Mathur R.C, *Systematic Botany Angiosperms.* (1963) Agra Book Store
6. Kaufman, Peter B.,*Practical Botany (*1983)New York
7. Sarvanan.R.,Dhachinamoorthi.D,CH..Prasadarao.M.M A hand book of microbiology (2019) ,lambert academic publisher
8. Goldman emanuel,Green H lorrence,Practical handbook of microbiology(2015)
9. edition 3rd, CRC publication.
10. Colbert.J.Bruce,Gonzalez luis.S. Microbiology-practical application and infection prevention,(2015),2NDedition, Cengage Learning
11. Dr. Dubey .R.C.,Dr. Maheshwari.D.K. Practicalmicrobiology(2010),S.chand publisher

Indian knowledge System

Indian Health Sciences

Credit: 02 **Lectures: 30**

Learning Objectives: The students should be able to…

1. Explore the most fundamental ideas that have shaped Indian Knowledge Traditions over the centuries
2. Understand various aspects of IKS which are related to their study fields and to promote interest in knowing and exploring more
3. Know basic concepts of Ayurveda
4. Study pharmacopeia of Ayurveda.

Credit 02	SEMESTER-I Indian Health Sciences	No. of hrs
Unit I	**Introduction of Bharatavarsha Vaidya**	**O8**
	Charaka and Sushruta on the qualities of a Vaidya. The whole world is a teacher of the good Vaidya. Charaka's description of a hospital. Hospitals in ancient and medieval India. How Ayurveda continued to flourish till 18/19th centuries. Surgical practices, inoculation. Current revival of Ayurveda and Yoga.	
Unit II	**Ayurveda pharmacopeia**	**07**
	Important Texts of Ayurveda. Selected extracts from Astāngahrdaya (selections from Sūtrasthāna) and Suśruta-Samhitā (sections on plastic surgery, cataract surgery and anal fistula). The large pharmacopeia of Ayurveda.	
Unit III	**Foundations of Ayurveda**	**08**
	Vedic foundations of Ayurveda. Ayurveda is concerned both with maintenance of good health and treatment of diseases. Basic concepts of Ayurveda. The three Gunas and Three Doshas, Pancha-mahabhuta and Sapta-dhatu.	
Unit IV	**Ayurveda: A health prospective**	**07**
	The importance of Agni (digestion). Six Rasas and their relation to Doshas. Ayurvedic view of the cause of diseases. Dinacharya or daily regimen for the maintenance of good health. Ritucharya or seasonal regimen.	

Learning Outcome : The students will be able to…

1. Discuss Charaka and Sushruta in Ayurveda

2. Explain importance of Ayurveda
3. Describe Suśruta-Samhitā
4. Explain health prospective of Ayurveda

References:

1. Baladev Upadhyaya, Samskrta Śāstrom ka Itihās, Chowkhambha, Varanasi, 2010.
2. D. M. Bose, S. N. Sen and B. V. Subbarayappa, Eds., A Concise History of Science in India, 2nd Ed., Universities Press, Hyderabad, 2010.
3. Astāngahrdaya, Vol. I, Sūtrasthāna and Śarīrasthāna, Translated by K. R. Srikantha Murthy, Vol. I, Krishnadas Academy, Varanasi, 1991.
4. Dharampal, Some Aspects of Earlier Indian Society and Polity and Their Relevance Today, New Quest Publications, Pune, 1987.
5. Dharampal, Indian Science and Technology in the Eighteenth Century: Some Contemporary European Accounts, Dharampal Classics Series, Rashtrotthana Sahitya, Bengaluru, 2021
6. Dharampal, The Beautiful Tree: Indian Indigenous Education in the Eighteenth Century, Dharampal Classics Series, Rashtrotthana Sahitya, Bengaluru, 2021.
7. J. K. Bajaj and M. D. Srinivas, Indian Economy and Polity in Eighteenth century Chengalpattu, in J. K. Bajaj ed., Indian Economy and Polity, Centre for Policy Studies, Chennai, 1995, pp. 63-84.
8. J. K. Bajaj and M. D. Srinivas, Annam Bahu Kurvita Recollecting the Indian Discipline of Growing and Sharing Food in Plenty, Centre for Policy Studies, Chennai, 1996.
9. J. K. Bajaj and M. D. Srinivas, Timeless India Resurgent India, Centre for Policy Studies, Chennai, 2001.

CC Course for Biotechnology

BBTTCC 1: Anchoring

Credits: 02 **Lectures: 30**

Couse objectives: Student should be able to…

1. understand the basics of anchoring and comparing
2. learn the skills required for anchoring
3. know scientific script writing
4. know scientific demonstrations

Credits 02	SEMESTER – I BBTTCC 1: Anchoring	No. of hrs.
Unit I	**Elements of Anchoring and Compering**	**08**
	Types of anchoring, voice modulation, body language, listing skill, Difference between anchoring and comparing	
Unit II	**Anchoring Script**	**08**
	Word choice, language style, figures of speech, opening and closing, use of poems, quotation	
Unit III	**Anchoring for dissemination of Biotech research**	**07**
	Anchoring for conferences, research presentations, demonstrations	
Unit IV	**Anchoring for Biotech Product Launch**	**07**
	Script writing for marketing the biotechnology product; Various aspects covered during script writing, scientific writing of product information, marketing of product	

Course outcome: Student will be able to…

1. describe basics of anchoring and comparing
2. describe skills in anchoring
3. learn the art of script writing for anchoring
4. write a script for product launch

Reference Books:

1. Earl R. Hinz. The Complete Book of Anchoring and Mooring 1994 Cornell Maritime Press
2. Richa Jain Kalra 2012 ABC OF NEWS ANCHORING Pearson Education; First Edition
3. Bindiya Dutt 2013 ANCHORING TV & LIVE EVENTS Pustak Mahal
4. Faith Sidlow, Kim Stephens, 2022 Broadcast News in the Digital Age: A Guide to Reporting, Producing and Anchoring Online and on TV Routledge; 1st edition

SEMESTER II

Major Course

BBTT121: Bio-techniques and Instrumentation

Credits: 02 **Lectures: 30**

Learning Objectives: The students should be able to…

1. Study Principles and working of instruments.
2. Learn applicability of instruments in biology
3. Understand the concepts of bioinstrumentation.
4. Learn uses and applications of biophysics in biotechnology.

Credits :2	**SEMESTER II** **BBTT121: Bio-techniques and Instrumentation**	**No. of hrs .**
Unit I	**Chromatography**	**08**
	Introduction, Theory, Principle and applications of Thin layer chromatography, Paper chromatography, Column chromatography, Adsorption column chromatography, Size exclusion chromatography, Ion exchange chromatography, Affinity chromatography, HPLC, GLC	
Unit II	**Electrophoresis**	**07**
	Introduction, Principle, theory and applications of paper electrophoresis, Agarose gel Electrophoresis, SDS PAGE, Pulse field electrophoresis, 2D PAGE. Isoelectric focusing (IEF).	
Unit III	**Centrifugation**	**08**
	Basic principles, RCF, Sedimentation coefficient, Svedberg's constant, Types of centrifuge: High speed and Ultracentrifuge, Differential and density gradient centrifugation, application of preparative & analytical centrifuges, gradient centrifuge.	
Unit IV	**Microscopy:**	**07**
	General principles of microscopy-Image formation, magnification, numerical aperture (Uses of oil immersion objective), resolving power of microscope and working. Ray diagram, special features, applications and comparative study of compound microscope and Electron Microscope (Scanning and Transmission Electron Microscope), Dark field and bright microscope, Phase contrast microscope.	

Learning Outcomes: The students will be able to…

1. Explain basic concepts of Instruments and its Application
2. Apply this knowledge in the laboratory
3. Handle instruments during project.
4. Discuss principle behind the instruments.

Reference Books:

1. Reilly. M.J. (2016) CBS Publishers & Distributors Pvt Ltd, India ; First

Edition,Bioinstrumentation .

2. Fulekar. M.H. Pandey.B. 2013, I K International Publishing House Bioinstrumentation 0th Edition, Kindle Edition
3. Bejugam S , Rao V. M. 2012 BioInstrumentation LAP Lambert Academic Publishing
4. Webster. J. G. 2011 , Bioinstrumentation , Wiley India
5. Nath and Upadhya, (2010) Biophysical Chemistry Himalaya Publication House.
6. Miller .J. Wiley.J and Sons, Inc. Chromatography (2009) : Concepts and Contrasts John Wiley & Sons Inc .
7. Webster 2007 , Bioinstrumentation , Wiley
8. VeeraKumari. L. 2006 , Bioinstrumentation , M J P Publishers
9. Wilson and Walker, (2000) Practical biochemistry principles and techniques, Cambridge University Press.
10. Jain .A ; Kalasariya .H ; Tailor.V , Patel.N.B 2020 Bioinstrumentation techniques-Basics and applications, Notion Press

BBTT 122: Proteins & Enzymes

Credits: 02 **Lectures: 30**

Learning Objectives: The students should be able to…

1. Learn basic concepts of proteins, enzymes and vitamins.
2. Understand basics of chemical science in relevance to biological systems.
3. Study 3D structures of enzymes relevance to catalytic properties.
4. Learn techniques of protein purification .

Credits 2	**SEMESTER II** **BBTT122: Proteins & Enzymes**	**No. of hrs.**
Unit I	**Proteins and Amino Acids**	**08**
	Classification of amino acids based on Properties, Proteins: Classification based on Structure and Functions, Denaturation of protein Structure of Peptides, Titration Curve of Amino Acids, Concept of Isoelectric pH, Zwitter ion. Types of Protein: Globular, Fibrous, Elastic Proteins	
Unit II	**Enzymes**	**07**
	Introduction, IUB classification, active site, energy of activation, transition state hypothesis, lock and key hypothesis, induced fit hypothesis, enzyme inhibition types competitive, non-competitive, un-competitive. M-M equation	
Unit III	**Vitamins**	**08**
	Classification and deficiency diseases of Vitamins, RDA, source, structure of Vitamin and Coenzymes of - Ascorbic acid, thiamine, riboflavin, folic acid, pyridoxine, niacin, pantothenic acid, biotin, lipoic acid, folic acid and cyanocobalamin	
Unit IV	**Protein purification**	**07**
	Method of cell disruption - Blenders, grinding with abrasives, French press, enzymatic method, sonication; Salt participation- Salting in, salting out, organic solvent precipitation, dialysis, ultrafiltration	

Learning Outcomes: Student will be able to…

1. Explain basic of role of vitamins as coenzymes
2. Discuss purification of proteins/enzymes
3. Explain techniques of protein purification .
4. Classify amino acid based on structure and function .

Reference Books:

1. Voet J. G., Voet D., Pratt C.W., (2016) Fundamentals of Biochemistry, 5th Ed. John Wiley and Sons Inc, New York, USA
2. Satyanarayanan U. (2013) Biochemistry Elsevier; 4th edition
3. Com E.E & Stumpf P.K.(2010).Outlines of Biochemistry.5th Ed. John Wiley Publications
4. Purohit S.S. (2009), Biochemistry - Fundamentals and Applications, Agrobios, Jodhpur
5. Palmer T., Philip B. (2007) Enzymes: Biochemistry, Biotechnology, and clinical Chemistry, 2nd

Edition, Woodhead Publishing,

6. Nelson D.L., Cox M.M. Lehninger (2004) Principles of Biochemistry, 5th Edition, WHF reeman and Company, New York, USA
7. Jain J. L. (2004) Fundamentals of Biochemistry, S. Chand Pub
8. Rastogi S. C..(2003) - Biochemistry Tata McGraw-Hill Education, New Delhi
9. Rama Rao A. V. S. S., (2002) A Textbook of Biochemistry. Edition, 9, illustrated. Publisher, Sangam Books Limited, New Delhi.
10. Berg J. M., Tymoczko J. L., Lubert Stryer and Gregory J. Gatto, 2002.Biochemisry, 7th Ed. W.H. Freeman and Company, NY, USA
11. Manickam S. S. (1996) Biochemical methods. 2nd edition, New Age International (p) Ltd. Publisher, New Delhi

BBTT 124 : Animal science

Credits: 02 **Lectures: 30**

Course Objectives: The students should be able to**…**

1. Interpret the general concept of classification system of Animal kingdom.
2. Classify the Application of animal science to study the Host and parasite relationship.
3. Compare Human anotomy and physiology with referance to Tissues and Histologyof different mammalian organs.
4. Reconize the Application of animal science with referance to vermiculture, sericulture, apiculture andpisciculture.

Credits 2	**SEMESTER II** **BBTT124 : Animal science**	**No. of hrs.**
Unit I	**Taxonomy**	**08**
	General classification of animal kingdom.(General characteristics and one representative example) Non-chordates –Study of phylum Porifera, Ceolenterata, Platyhelmenthes, Nemathelmenthes, Arthropoda, Mollusca & Echinodermata – General characters with representative examples- Sycon, Hydra, Liver fluke/Taenia, Earthwarm / Nereis, Cockroach, Pearl oister / Pila, Starfish Chordates:-Study of class Pisces, Amphibia, Reptilia & Mammalia – General characterswith representative examples – Lebeo, Frog, Cobra, Alligator, Fowl and Rat.	
Unit II	**Host and Parasite Relationship**	**07**
	Protozoan parasite- Plasmodium (Morphology, parasiticadaptations, Life cycle), Nematode parasite- Ascaris (Morphology, parasitic adaptations, Life cycle), Platehelminthes parasite- Liver fluke (Morphology, parasitic adaptations	
Unit III	**Tissues**	**08**
	Definition and types of tissues (Epithelial, Muscular, Nervous, Connective tissue). Blood Plasma, Serum, Corpuscles, Bone, Cartilage. Histological Architecture of Skin, Stomach/Intestine, Uterus	
Unit IV	**Applied zoology**	**07**
	Vermiculture :- species/types of earthworms , stages of vermiculture, various models/methods, economic importance, Apiculture: Types/ species of Honey bees, castes of Honey bees, Economic Importance ., Sericulture : Types of Silkworms, Life cycle, economic importance., Pisciculture: History ,Inland ,Marine and culture fisheries, Economic importance.	

Learning Outcomes: Student will be able to…

1. Discuss applied biological sciences.
2. Illustrate of classification of animal kingdom.
3. Memorize and Relate host and parasite relationship which may useful to develop an interest in diagnosis and modern reasarch in parasitology.

4. Summarize Human physiology and anatomy.

Reference Books:

1. Kotpal R .L., (2019) Modern Textbook of Zoology : Vertibrates India, Rastogi Publications
2. Chatterjee K D ,Parasitology (2019) (Protozoology and Helminthology) ,CBS publications,India,; 13thedition
3. Derrickson B.H. ,Torotora, (2017) Principles of Anatomy and Physiology,wiley,15Th edition ,
4. Shukla G.S. and Upadhyay V.B., (2014) Appliedand Economic Zoology, Rastogi Publications; FirstEdition ,
5. Bardarch J.E, J.H.Ryther ,W.O.Mclarney, (2013) Aquaculture:The farming and Husbandary of freshwater and Marine organisms,Wiley India PvtLtd,
6. Kotpal R.L.., (2012) Modern Text Book of Zoology: Invertebrates , Rastogi Publications,
7. Gyton A. C. , Hall J.E. , (1995) Textbook of medical Physiology (Gyton Physiology) Saunders;9th edition ,
8. Cox F.E.G, Wiley-Blackwell & Sons (1993) Modern Parasitology : A Textbook of Parasitology , USA, ,2nd edition ,
9. Jhingran V .G , (1991) Fish and Fishreis of india, Hindusthan Pub.Corporation, Delhi, India,
10. Jordan E.L, and. Verma P.S (1978) (i) Chordate Zoology S. Chand & Company Ltd. Ram Nagar.New Delhi.
11. Jordan E.L.and Verma P.S (ii) Invertebrate Zoology. S. Chand &Company Ltd. Ram Nagar. New Delhi.(1978)

BBTT 125: Biostatistics

Credits:02 **Lectures:30**

Learing Objectives: The students should be able to…

1. Understand data analysis of given samples.
2. Recognize concept of correlation and regression
3. Make inference about a sample based on information we get from a population
4. Study concept of statistic and its use in biological field

Credits 2	**SEMESTER II** **BBTT125: Biostatistics**	**No. of hrs.**
Unit I	**Introduction to statistics and collection of data**	**08**
	Meaning of statistics, Scope of statistics in Biological and medical sciences, Classification of data: Primary and Secondary data, Discrete and Continuous frequency Distribution, Cumulative frequencies, Graphical representation: - Histogram and Ogive Curves	
Unit II	**Descriptive Statistics**	**07**
	Measure of central tendency Mean (Definition & simple problems) Mode, Median, Quartiles (Definition, Graphical calculation), Measures of dispersion: Variance (Definition, simple problems) Standard deviation, Coefficient of variance, Skewness (Definition, types of skewness , real life example), Kurtosis (Definition, types of Kurtosis, real life example)	
Unit III	**Correlation and Regression**	**08**
	Concept of correlation between two variables and types of correlation, Method of obtaining correlation (i) by scattar diagram method ii) By Karl Pearson Correlation coefficient Properties of correlation coefficient, Concept of regression, Lines of regression coefficients and properties without proof, Examples on ungrouped data.	
Unit IV	**Probability and Sampling**	**07**
	Definition of sample space, Outcomes, events, exhaustive events, mutually exclusive events, certain events, impossible events. Independent events, Definition of probability, Limits of probability, Probability of complementary event, Additive law of Probability. Simple illustrative examples, Idea of population and sample, Simple Random Sampling and Stratified Random sampling, Advantages and disadvantages of both the method, Testing of hypothesis, Null and alternative hypothesis, types of errors, Critical region, Acceptance region, level of significance., Tests of significance: t test.	

Learning Outcome: Student will be able to…

1. Memorize the basic fundamentals of the statistics.
2. Explain the data analysis statistically.

3. Represent the data in tabular format and graphical representation of the data.
4. Illustrate the basic Probability and sampling.

Reference Books:

1. Gupta S.C. & Kapoor V. K., (2014) Fundamental of mathematicalstatistics Sultan chand & sons
2. Prayag V. R. and Dixit P. G., (2020) A text book of paper- I for B.Sc. I, Nirali Publication, Pune,
3. Walker H.M. and Lev J, (2010) Elementary Statistical methods , Holt,Rinehart & Winston of Canada Ltd; 3rd Revised edition,
4. Rohatgi V. K. and Ehsanes A. K. Md, ., (2008) An Introduction to probability and statistics , Wiley India Pvt. Ltd
5. Meyer P. L., (1970) Introduction, probability, and statistical Application. Addisionwesly. Generic Publications,
6. Cochran W.G., (1977) Sampling Techniques, Wiley Estern Ltd., New Delhi.
7. Des Raj, Pramod Chandak, (2013). Sampling theory (Createspace Independent Pub.,
8. Hampton R. E , John E. Havel, (2018) Introductory Biological Statistics, 3rd Edition,
9. Jan Lepš , Petr Šmilauer, (2000) Biostatistics : An Introductory Guide for Field Biologists 1st Edition ,
10. Catherine Legrand , (2021). Advanced Survival Models (Chapman & Hall/CRC Biostatistics Series) 1st Edition,

BBTT 127: Farm Management

Credits:02
Lectures:30
Course Objectives: Students should be able to…

1. Learn farm management
2. Understand Management of farm Resources
3. Know Principles of Equi-Marginal Returns
4. Know Principle of Comparative Advantage.

Credits 02	SEMESTER – II BBTT 127: Farm Management	No. of hrs.
Unit - I	**Economics of Farm Management**	15
	Farm management: Scope and Objectives, Farm management decisions ,Types of Farming- Farm Size and Productivity – Farm Efficiency Measures ,Management of farm Resources: Land, Labour and Capital	
Unit – II	**Principles of farm management**	15
	Principles of farm management: Principles of Factor Substitution**,** Principles of Equi-Marginal Returns – Opportunity Cost Principle**,** Minimum Loss Principle, Principle of Comparative Advantage Time Comparison Principle	

Course Outcomes: Students will be able to…

1. Discuss obout farm management
2. Discribe types of farming
3. Explain principles of factor substitutions, Equi-marginal returns
4. Explain minimum loss Principle, time comparison principle

Reference Books :

1. Reddy, Ram, Sastry & Devi (2010): Agricultural Economics Oxford & IBH publishing Co. Pvt. Ltd, New Delhi.
2. Jaya S. Anand (1999), Co-operative Agricultural and Rural Development Banks, Atlantic (1 January 1999)
3. Nirmalendu Sarkar (2012), Pattern Change in Agricultural Land Productivity, LAP Lambert Academic Publishing (31 August 2012)
4. Kumar K N R (2015): Agricultural Production Economics, Volume-I, Daya Publishing House, A Division of Astral International Pvt. Ltd, New Delhi.
5. Helen Atthowe, Paul Muller (2023), The Ecological Farm, Chelsea Green Publishing Co (17 August 2023)
6. Desai R G (2001): Agricultural Economics - Models Problems and Policy Issues, Himalaya Publishing House, Mumbai.
7. Kym Anderson (2016), Agricultural trade, policy reforms, and global food security, 1st edition 2016, Palgrave Macmillan
8. Ghatak, S. and K. Ingerscent (1984), Agriculture and Economic Development, Select books, New Delhi.
9. Nirmalendu Sarkar (2012), Pattern Change in Agricultural Land Productivity, LAP Lambert Academic Publishing (31 August 2012)
10. Donald J. Epp & John W. Malone (1981), Introduction to Agricultural Economics, Mc- Million Publishing Company, Inc. New York

BBTT 128: Agricultural Risk Management

Credits:02
Lectures:30
Course Objectives: Students should be able to…

1. Know nature of uncertainty in Agriculture
2. Study Risks in Agriculture
3. Study Risk Management Strategies
4. Know different government schemes for agriculture

Credits 02	SEMESTER – I BBTT 128: Agricultural Risk Management	No. of hrs
Unit - I	**Agricultural Risk**	08
	Nature of Uncertainty in Agriculture: Price, Yield and Technological. Risks in Agriculture Types of Risks: Climate, Drought,Production, Price, Financial , Market &Management Strategy.	
Unit – II	**Risk Management Strategies**	08
	Risk Management Strategies: National Agricultural Insurance Scheme (NAIS), Pradhan Mantri Fisal Bima Yojana, Crop Insuranceas Risk Mitigation Tool Crop Insurance, Weather Insurance Farm Income Insurance, Lives to ck Insurance and Package Insurance	

Course Outcomes: Students will be able to…

1. Explain nature of uncertainty in Agriculture
2. Describe Risks in Agriculture
3. Discuss Risk Management Strategies
4. Explain different government schemes for agriculture

Reference Book :.

1. Bhende, M.J., (2005), Agricultural Insurance in India: Problems and Prospects, NABARD, Occasional Paper-44
2. GOI (2007), Report of The Working Group on Risk Management in Agriculture for the Eleventh Five Year Plan (2007-2012) , GOI, New Delhi
3. Bilgram, S. A. R. (1996), Agricultural Economics, Himalaya Publishing House, Delhi
4. Lekhi R K & Singh Jogindar (2013): Agricultural Economics, Kalyani Publisher, New Delhi. Publishing House, Bombay.
5. Christopher Ritson (1977), Agricultural Economics – Principles and Policy, Czos by Luckwood Staples, London
6. Sadhu A. N. & Singh Amarjit, Fundamentals of Agricultural Economics, (1996), Himalaya
7. Soni, R. N. (1995), Leading Issues in Agricultural Economics, Arihant Press, Jalandhar.
8. Muniraj Singh Rathore (2010), General Agriculture, Jain Brothers; 27th Edition 2018 (1 January 2010)
9. Avery Elizabeth Hurt (2017), Corporate Farming, Greenhaven Publications (15 August 2017)
10. Dhyan kaur (1993), Changing patterns of Agricultural Land Use, South Asia Books Publications

BBTP123: Lab exercise based on Bio-techniques & Instrumentation and Proteins & Enzymes

Credits: 02 **Lectures: 60**

Learning Objectives: The students should be able to…

1. Understand principles and basics of instrumentations.
2. Learn about different Bioassay.
3. Understand about screening technique.
4. Know the protein purification techniques.

Sr. No.	SEMESTER-II BBTP123: Lab exercise based on Bio-techniques & Instrumentation and Proteins & Enzymes	No. of practical
1.	Use, care and study of compound microscopy	4
2.	To Separate amino acid by using Paper Electrophoresis	4
3.	To Demonstrate (Principle, working, construction) of pH meter & Conductivity meter	4
4.	To Demonstrate (Principle,working,construction) of Centrifuge.	4
5.	To Demonstrate (Principle,working,construction) of Incubator	4
6.	To Demonstrate (Principle,working,construction) of Autoclave.	
7.	To Demonstrate (Principle, working, construction) of Hot air oven	4
8.	To Demonstrate (Principle, working, construction) of Laminar Air Flow .	4
9.	Spectrophotometric determination of nucleic acid purity and concentration	4
10.	To Separate and identification of plant pigments by using Ascending paper chromatography	4
11.	To Separate and identification of amino acids using TLC	4
12.	To estimate Protein by Lowry's method	4
13.	To estimate of amino acid by Ninhydrin method	4
14.	To estimate protein by biuret method	4
15.	Purification of Protein by precipitation & dialysis method.	4

Learning Outcomes: Student should be able to…

1. Apply principles and basics of instrumentations
2. Perform different Bioassay.

3. Ilustrate screening technique
4. Perform various separation techniques.

Reference Books:

1. Upadhyay A., Upadhaya K.,Nath N., (2020) Himalaya Publishing House Pvt. Ltd. Edition Fourth Edition Biophysical Chemistry
2. Nagamani. B .BioInstrumentation Paperback–(2016) Margham Publications; 2016 th edition
3. Veerakumari. L. Bioinstrumentation Paperback–(2011) Mjp Publishers; 1st edition
4. Wilson K. and Walker L.(2010) ,Principles and Techniques of Biochemistry and Molecular Biology .
5. G. D. Fasman (1989) Practical Handbook of Biochemistry and Molecular Biology Hardcover–Important
6. Burgess R. R , Deutscher M. P. (2009) Guide to Protein Purification Methods in Enzymology, Volume 436) 2nd Edition Academic Press.
7. Springer M. G.; (2005) "Measurement Uncertainties in Science and Technology" 5th edition
8. Wiley J. & Sons Inc; 1st edition (2000)Analytical Instrumentation - Performance Characteristics & Quality: Performance Characteristics and Quality: 1 (Analytical Techniques in the Sciences (AnTs))
9. Arumugam N. (Author), Kumaresan V.(2015) Biophysics and Bioinstrumentation.
10. Philip B.(2019) Protein Purification 2nd Edition .

BBTP126: Lab exercise based on Animal science and Biostatistics

Credits: 02 **Lectures: 60**

Learning Objectives: The students should be able to…

1. Interpret dissection and microscopy needed for research work in animalsciences.
2. Recognize the basics of Parasitology.
3. Illustrate practical knowledge related to Blood.
4. Memorize applied zoology like –Sericulture, Apiculture,Vermiculture.

Sr. No.	SEMESTER-II BBTP126: Lab exercise in Animal science and Biostatistics	No. of practical
1.	Classification and Identification of Non-chordates & Chordates. (One animal each). Non- chordates- Sycon, Hydra, Liver fluke/ Earthwarm / Nereis, Cockroach, Pearl oister/Pila, Starfish. Chordates- Lebeo, Frog, Cobra, Alligator, Fowl and Rat	4
2.	Earthworm Dissection -Digestive system,	4
3.	Study of Plasmodium, Ascaris, Liver Fluke, Taenia- Salium	4
4	Blood slide Preparation and Identification of Blood cells	4
5	Blood cell count: Differential count of W. B. Cs. & R. B. Cs	4
6	Preparation of Haemin Crystals.	4
7	Determination of Hemoglobin	4
8	Demonstration of : Bee keeping – Study of instruments	4
9	Study tour –Visit to Biodiversity spot, Sericulture, Apiculture, Vermicomposting	4
10	Frequency distribution – Graphical, Histogram, ogive curve [less & greater than]	4
11	Measures of central tendency (Grouped and Ungrouped) A. M., Median, Mode.	4
12	Correlation, Regression. Scattered diagram R software	4
13	Statistical analysis using SPSS software,	4
14	Sericulture –Study of different stages	4
15	Karl Pearson’s correlation coefficient, eqn of Regression line	4

Learning Outcomes: Students will be able to …

1. Describe and Develop the skill in dissection and microscopy which is highly needed for any type ofresearch work in animal sciences.
2. Relate and meet Basics of Parasitology.
3. Classify and compare practical knowledge related to Blood.
4. Acquire discover in applied zoology like –Sericulture, Apiculture,Vermiculture.

Reference Books:

1. Jasrai L. , (2020) Data Analysis Using SPSS Paperback
2. Scott H. (2015) Hypothesis Testing: A Visual Introduction To Statistical Significance Kindle Edition.
3. S .S. Lal, (2015) Practical zoology Vertebrate, Rastogi Publications,India,
4. Thigale T. K. and Dixit P. G., A (2003) text book Of paper II for B.Sc. I.
5. Rohatgi V. K. and Sauh A. K. Md E. (2002) An Introduction to probability and statistics.
6. Jhon Himmelman (2001) Children's Press An Earthworm's Life (Nature Upclose)
7. Prabha shekhar, Martin Hardingham (1995) Sericulture and silk production intermediate technology publication's.
8. Cochran, W.G. (1997) Sampling Techiniques, Wiley Estern Ltd., New Delhi,
9. Meyer P. L(1970) Introduction, probability and statistical Application. Addisionwesly. .
10. Waiker and Lev: (1958). Elementary Statistical methods.,