"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) Reconstruction 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**
    1) The students will graduate with proficiency in the biotechnology
    2) The students will be eligible to continue higher studies in the subject
    3) The students will be eligible to peruse higher education abroad
    4) The students will be eligible to appear for the examination for job in government sector
    5) The students will be eligible to appear for jobs with minimum requirement for B.Sc. program.

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.

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	BBTT 117	Basics of Anatomy	2		101		102
	BBTT 112	Biomolecules	2	BBTT 115	Plant Science	2	BBTT 118	Naturopathy paper I	2				
	BBTP 113	Lab exercise based on Fundamental of biotechnology and Biomolecules	2	BBTP 116	Lab exercise based on Microbiology and Plant Science	2	BBTP 119	Lab exercise based on Anatomy and Naturopathy I	2				
II	BBTT 121	Bio-techniques and Instrumentation	2	BBTT 124	Animal science	2	BBTT 127	Human Physiology and Pathology	2	103		104	
	BBTT 122	Proteins and Enzymes	2	BBTT 125	Biostatistics	2	BBTT 128	Naturopathy paper II	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	Lab exercise based on Human Physiology and Pathology and Naturopathy II	2				
	Total		**12**			**12**			**12**	**2**	**2**	**2**	**2**

IKS 101: Indian health System; SEC: Basics in Hydroponics ; VEC 104: Digital technology; CC 102: NCC / Cultural/

Semester I

Major Courses

BBTT111: Fundamentals of Biotechnology

Credit: 02 **Lectures: 30**

Learning Objectives: The students should be able to…

1. Aware of biotechnology
2. Introduce different areas in biotechnology
3. Introduce the applications of biotechnology in health care
4. List different research institutes from all over india.

Credits 02	SEMESTER-I BBTT111: 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.	

Learning Outcomes: The students will be able to…

1. Apply there knowledge in health care, disease diagnosis, tissue culturing method
2. Implement biotechnological applications in enhancement of Food and Different areas in biotechnology
3. Discuss milestones of biotechnology .
4. Apply the 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**

Learning Objectives: The students should be able to…

1. Define basics of chemical science in relevance to biological systems
2. Know concept oF evaluaion
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 importance of carbohydrates.	
Unit IV	**Lipids**	**07**
	Classification of Lipids, Properties of Saturated, Unsaturated Fatty Acids, Rancidity, and Hydrogenation of Oils Phospholipids: Lecithin, Cephalin. Sterols: Cholesterol: Structure and Function, Lipoproteins: Structure and Function, Storage Lipids, Structural Lipids, Steroids	

Learning Outcomes: The students will be able to…

1. Illustrate basics of chemical science in relevance to biological systems
2. Describe the concept o evaluaion
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 Courses

BBTT114:Basics in Microbiology

Credits:02 **Lectures:30**

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

1. Understand Generalbacteriologyand microbial techniques
2. Know the importance of the field of microbiology to other areas of biology and to generalhumanwelfare
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 ofmicroorganisms.

Credits 2	**SEMESTER-I** **BBTT114: 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	

Learning Outcomes: The students will be able to…

1. Classify microorganisms according to Microbialnutrition.
2. Understand nutritionalrequirementofmicroorganism
3. Know Basic components of Nutrient medium and their role
4. Apply Basic terms in sterilization, Principls of sterilization, 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 basicknowledge 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: Basics of Anatomy

Credits:02 **Lectures: 30**

Course Objectives: Students should be able to…

1. Define Naturopathy
2. List organs in anatomy
3. Explain general features of different organs
4. Illustrate functions and working of different organs

Credits 02	**SEMESTER – I BBTT 117: Basics of Anatomy**	**No. of hrs.**
Unit I	**Introduction to Nature cure**	**08**
	Definitions of Nature Cure and History of Naturopathy, Three fold constitution of man, Two fold attitude of mind and soul, Symphony of life	
Unit II	**General Anatomy**	**08**
	Introduction of Anatomy, Anatomical Terms, different branches of anatomy, Introduction of bones, its classification, functions, applied anatomy; cartilage-types, action, basics of all the tissues and systems of the human body, Sharir panch bhautic tatava, Anatomical knowledge of Ida, Pingla, Sushumna and Shat Chakra	
Unit III	**Arthrology (Head & Neck, upper and lower limb)**	**07**
	General features of different types of joints. Brief study of the following joints of the body with movements, shoulder, elbow, Wrist and other smaller joint of Head & Neck, Upper Limb (lumbar triangle, triangle of auscultation, bursa of upper limb, bones of upper limb) and lower limb	
Unit IV	**Osteology and Thorax study**	**07**
	Osteology: (Bones of Skull & Upper limb) Names of the bones and their positions; general features, skull – all normal and interior of skull & mandible **Thorax:** General introduction pericardium, thorax wall, position and parts of the heart , conducting system, blood supply and nerve supply of the heart, names of the blood vessels and their distribution in the body, lungs & pleura-general features, surface marketing, broncho-pulmonary segments, applied anatomy, mediastinum, diaphragm, esophagus, thoracic duct.	

Course Outcomes: Students will be able to…

1. Apply naturopathy knowledge
2. Describe the anatomy of human body
3. Explain general features of different organs
4. Analyse the abnormality in the anatomy

Reference Books:

1. Chaurasia B.D. 2009 Text book of anatomy (Vol-I, II, III), CBS Publishers & Distributors,
2. Hamilton W. J. (Ed.) 1976 Text books of anatomy. (2nd Ed.), C. V. Mosby company,
3. Chunnigham. 2019 Cannigham's Text book of anatomy, W. Wood. Oxford
4. Gray H, Holden L. 2007 Text books of anatomy. H. C. Lea.
5. Eroschenko V. P. 2017 Atlas of Histology. Wolters Kluwer.
6. Assefa N, Tsige Y, 2003, Human Anatomy and Physiology, The Carter Center
7. Open Stax College, Anatomy & Physiology, Rice University, ISBN-13 978-1-938168-13-0

8. An Open Education resource, Anatomy & Physiology, ISBN-978-1-304-84002-8
9. Waugh A and Grant A, 2001 Ross and Wilson, Anatomy & Physiology in Health and illness 9th Edition, Churchill Livingstone An imprint of Elsevier Limited
10. Bachheti P, Singh A, 2014 Anatomy & Physiology 1st Edition, Vayu Education Of India

BBTT 118: Naturopathy Paper I

Credits:02 **Lectures:30**

Course Objectives: Students should be able to…

1. Understand our body nutritional needs
2 Know the importance of a well balanced diet, including the importance of fluids
3 Recognize their body at a spiritual level
4 Identify common diseases

Credits 02	**SEMESTER – I** **BBTT 118: Naturopathy Paper I**	**No. of hrs.**
Unit I	**Nutrition and Health**	**08**
	Classification of food, vitamin, mineral, carbohydrate, protein, fat, energy balance, balanced diet, nutritional problems in public health low birth N+ Pem, xeropthalmia, Nutritional anaemia, IDP, Endomic fiurosis, Lathyrism, Nutritional factors in selected disease. Assessment of Nutritional status, Nutritional surveillance. Social aspects of Nutritional food hygine, food borne disease.	
Unit II	**Personal Hygiene**	**08**
	1) Sun Bathing, 2) Hygiene of eating and drinking, 3) Rest, sleep, recreation and work, 4) Personal Cleanliness, 5) Mental Hygiene, 6) Health Destroying Habits Pan, Suspan, Ganga, Drinks, Smoking, Coffee, Tea etc.; Mental Health; Health Programmes in India.	
Unit III	**Psycho – physiological effects of meditation**	**07**
	Religious methods, Zen Meditation, Gurujapa, Transcendental meditation, Preksha meditation, Om meditation, Brahma meditation and Vipassana meditation. The basic of yoga science and kundalini, Different Chakras, its seat, its qualities and methods to awaken different charkas, Physiology and psychology of kundalini Yoga, Misunderstanding about kundalini and sexuality, Symptoms of kundalini, Kundalini charkas – innage Lifestyle.	
Unit IV	**Diagnostic methods in common disease**	**07**
	Meningitis, UTI, PUO, Gastroenteritis, Respiratory infection, Urogenital infection, Phogenic infections, nosocomia infection, infections of Ear, Eye and Oral Cavity.	

Course Outcomes: Students will be able to…

1. Apply knowledge for having healthy diet
2. Analyse their nutritional need
3. Experience the body at a spiritual level through medication
4. Treat their common disease with naturopathy remedies

Reference Books :

1. Bedi YP, Sharma P, Handbook of Preventive and Social Medicine, Community Health/Community Medicine. CBS Publishers & Distributors. 2018
2. Park K.. Text Book of preventive and Social Medicine. Bhanot Publishers. 2017
3. Bakhru H.K. (1991) A Complete Handbook of Nature Cure 5th Edition, Jaico Publishing House
4. Bakhru H.K. (1999) Naturopathy for Longevity: 1, Jaico Publishing House
5. Assefa N, Tsige Y, 2003, Human Anatomy and Physiology, The Carter Center
6. Open Stax College, Anatomy & Physiology, Rice University, ISBN-13 978-1-938168-13-0
7. An Open Education resource, Anatomy & Physiology, ISBN-978-1-304-84002-8

8. Waugh A and Grant A, 2001 Ross and Wilson, Anatomy & Physiology in Health and illness 9th Edition, Churchill Livingstone An imprint of Elsevier Limited
9. Hamilton W. J. (Ed.) 1976 Text books of anatomy. (2nd Ed.), C. V. Mosby company,
10. Chunnigham. 2019 Cannigham's Text book of anatomy, W. Wood. Oxford

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. Understand 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

BBTP 119: Lab. Exercise based on Basics of Anatomy and Naturopathy I

Credits:02 **Lectures:60**

Course Objectives: Students should be able to…

1. Understand the body parts
2. Understand the various joints in body
3. know healthy and balance diet
4. Understand the mental amity

Credits 02	**SEMESTER – I** **BBTP 119: Lab. Exercise on Basics of Anatomy and Naturopathy I**	**No. of hours**
1.	To study Symphony of life	4
2.	To study Arthrology ,osteology, thorax anatomy	4
3.	To study different body joints	4
4.	To study Assessment of nutritional status of given food	4
5.	To study Analyses of various food born disease	4
6.	To study Practises of personal cleanliness	4
7.	To study Social aspects of Nutritional food hygine	4
8.	To study Practical's based on mental hygiene	4
9.	To study Awareness about the health programmes in India	4
10.	To perform Practical's based on "Gurujapa"	4
11.	To perform Practical's based on "Om meditation" and "Vipassana meditation"	4
12.	To perform Practical's based on Kundalini	4
13.	To study collection of blood, study of fresh drop of blood, effects of isotonic, hyper tonic and hypo tonic saline on RBCs	4
14.	To determination of clotting time and bleeding time	4
15.	To determine vital capacity and maximum ventilator volume with spirometry	4

Course Outcomes: Students will be able to…

1. Apply their knowledge in corrective their body towards health
2. Analyse their nutritional need and calorie balance
3. Implementation of meditation in their daily life
4. Demonstrate effect of saline on blood cells

Reference Books:

1. Bedi YP, Sharma P, 2018 Handbook of Preventive and Social Medicine, Community Health/Community Medicine. CBS Publishers & Distributors.
2. Bachheti P, Singh A, 2014 Anatomy & Physiology 1st Edition, Vayu Education Of India
3. Chaurasia B.D. Text book of anatomy (Vol-I, II, III), CBS Publishers & Distributors, 2009

4. Gray H, Holden L. Text books of anatomy. H. C. Lea. 2007.
5. Assefa N, Tsige Y, 2003, Human Anatomy and Physiology, The Carter Center
6. Anne Waugh and Allison Grant, 2001 Ross and Wilson, Anatomy & Physiology in Health and illness 9th Edition, Churchill Livingstone An imprint of Elsevier Limited
7. Chunnigham. Cannigham's Text book of anatomy, W. Wood. 1981
8. Park. K. Text Book of preventive and Social Medicine. Bhanot Publishers. 2017
9. Bakhru H.K. (1991) A Complete Handbook of Nature Cure 5th Edition, Jaico Publishing House
10. Bakhru H. K. (1999) Naturopathy for Longevity: 1, Jaico Publishing House

SEMESTER II

Major Courses

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. Understand basic concepts of Instruments and its Application
2. Apply this knowledge in the laboratory
3. Handle instruments during project.
4. Understand 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

BBTT122: 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. Aquire knowledge of basic of role of vitamins as coenzymes
2. Apply basics idea of purification of proteins/enzymes
3. Understand the 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

BBTT124 : Animal science

Credits: 02 **Lectures: 30**

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, variousmodels/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 should 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 U p a d h y a y 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)

BBTT125: Biostatistics

Credits:02 **Lectures:30**

Learing Objectives: The students should be able to…

- Understand data analysis of given samples.
- Recognize concept of correlation and regression
- Make inference about a sample based on information we get from a population
- 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: Human Physiology and Pathology

Credits:02 **Lectures:30**

Course Objectives: Students should be able to…

1. Learn the various cells and tissues of different systems of human body
2. Understand the gross morphology, structure and functions of bones and various organs of the human body
3. Enables you to use the knowledge gained for prevention, diagnostics, therapy and rehabilitation of the human organism
4. Learn the various techniques and tests in human physiology and pathology.

Credits 02	**SEMESTER – II** **BBTT 127: Human Physiology and Pathology**	**No. of hrs.**
Unit - I	**Respiratory and Cardio-Vascular System**	08
	Pulmonary circulation; ventilation –perfusion relationship; Diffusion of gases across pulmonary membrane; Oxygen uptake, transport and delivery; Carbon – dioxide uptake , transport and delivery Historical perspective and organization of cardiovascular system; **Heart** - Position, Surface anatomy and its description; **Great vessels** - Aorta, Pulmonary trunk, superior vena cava, inferior vena cava and their branches; **Arteries and Veins** - Structure of arteries and veins, important arteries & veins of the body; Regeneration and spread of cardiac impulse, Electrocardiography (Various ECG leads, normal ECG and its interpretation)	
Unit – II	**Digestive System and Reproductive System**	08
	Oral cavity, Teeth, Hard palate, Soft palate. Esophagus, Stomach, Small Intestine (Duodenum, Jejunum & lleum) Large intestine (Casecum, Appendix, ascending colon, transverse colon, descending colon, sigmoid colon, rectum), Anal canal, Anus, Liver, Gall bladder, Bile duct, Pancreas, Spleen, Peritoneum, Mesentery and their position in the abdominal quadrant Infertility and their related complications; Diagnosis; various test involved; Possible treatments; Assisted reproductive technology (IVF, ICSI, IUI, etc.), Complications of treatment; Coping and support	
Unit – III	**Hematology and Body Fluids**	07
	ESR, Methods, Factors – Affecting ESR, Normal Values, Importance, RBC – Indices, WBC, Platelets **Body Fluids**: (a) Urine (Method of Collection, Normal Constitutents, Physical Examination, Chemical Examination); (b) Stool Examination [Method of Collection, Normal Constituents and appearance, Abnormal Constituents (Ova, Cyst)]; (c) Cerebrospinal Fluid (CSF) Examination (Physical Examination, Chemical Examination, Microscopy, Cell 1 Count and Staining); (d) Semen Analysis (Collection, Examination and Special Tests)	
Unit - IV	**Epidemiology of non-communicable diseases**	07
	Cancer, Cardio-vascular, diseases, diabetes, obesity, blindness, Accidents, Hypertension, Stoke, Rheumatic Heart Disease.	

Course Outcomes: Students will be able to…

1. Analyse various blood disorders
2. Apply gained knowledge in various digestive disorders
3. Analyse different blood parameters abnormality
4. Apply gained knowledge in various Respiratory and reproductive system

Reference Book :

1. Brunzel N. (2022), Fundamentals of Urine and body fluid analysis, Elsevier publishers.
2. Barrett KE, Barman SM, Yuan J, Brooks HL. Ganong's [2019]Review of Medical Physiology, Twenty Sixth Edition. McGraw Hill LLC.
3. John NA. CC Chatterjee[2019] Human Physiology, Volume 2. CBS Publishers & Distributors.
4. Hall John E. Guyton and Hall [2015] Textbook of Medical Physiology E-Book. Elsevier Health Sciences.
5. Kawthalkar S. [2012], Essentials of heametology, Jaypee brothers medical publishers pvt limited.
6. Webb P., Bain C. [2010] Essential epidemiology E- book Cambridge University Press.
7. Thews G., Mutschler E., Vaupel P. [2008] Human anatomy, physiology and pathophysiology, Elsevier publication.
8. Chaudhuri S K. [2006] Concise Medical Physiology. New Central Book Agency (P) Limited.
9. Bonita R., Beaglehole R., Kjellstrom T. [2006] Basic epidemiology, World Health Organizations Publishers .
10. Carpenter W. B. [1946], Principles of human physiology, Churchill publications.

BBTT 128: Naturopathy paper II

Credits:02 **Lectures:30**

Course Objectives: Students should be able to…

1. Introduction, Definition & scope of Pharmacology and Principles of general Pharmacology
2. Gain brief knowledge of drugs
3. Understand naturopathic treatment
4. Remember natural herbs in the daily life

Credits 02	**SEMESTER – I** **BBTT 128: Naturopathy paper II**	**No. of hrs**
Unit - I	**Knowledge of Dravya for Naturopathic treatment**	**08**
	General information of Dravya, its essence, characteristics, strength, effects and side effects and its usage; Name of Dravya and alternative name, method of storage, impurities found in them and their purification; General knowledge of internal and external method of usage of Dravya and their dosage, Knowledge of usage of various Dravya being used in therapy	
Unit – II	**Guna-karma of Annapana varga**	**08**
	Introduction, knowledge of guna-karma of following groups of Annapana varga (Jala Varga, Dugdha Varga, Madhu Varga, kshu Varga, Taila Varga; Madya Varga, Mutra Varga; Sukadhanya Varga, Simbidhanya Varga, Phala Varga, Shaka Varga; Mamsa Varga, Lavana Varga, Kritanna varga (Processed food))	
Unit – III	**Pharmacology Theory**	**07**
	Introduction, Definition & scope of Pharmacology and Principles of general Pharmacology. Brief Knowledge of following - Anaesthetics, CNS depressants, Sedatives, Hypnotics, Tranquilisers, Antipyretics, Analgesics, Antiepileptics, Antihypertensive, Antianginal,Antiplatelet, Hypolipidaemic, Haemopoetic, Coagulants, Bronchodialators, Aerosols/Inhalants, Expectorants, Digestants, Carminatives, Antacids, Antiulcer, Laxatives,Antidiarrhoeals, Antiemetic, Hepatoprotective, Diuretic, Antidiuretic, Lithotriptic,Antiinflammatory, Hormonal therapy, Antiobesity, Antidiabetic, Antithyroid, Oxytocic. Galactagogues, Contraceptives, Styptics, Antihistamins, Antimicrobial, Antibiotics, Antimalarial, Amoebicidal, Antifilarial, Anthelmentic, Antifungal, Vitamins, Minerals, Water imbalance and IV fluids, Vaccines, antivenom, antirabbies serum, Local anti septics, drugs in ophthalmic practice, Anti cancer drugs and immunomodulators etc	
Unit - IV	**Important of natural herbs in the daily life**	**07**
	The following herbs are to be studies with respect to their therapeutic uses (*Phyllanthus Niruri*, *Trigonella Foenum – Graecum*, *Allium Sativum*, *Acorus Calamus*, *Rauwolfia Serpentina*, *Terminalia Chebula*, *Syzygium Aramaticulum*, *Gingiber Officinalis*, *Piper Nigrum*, *Santahlum Album*, *Mimosa Pudica*, *Asparagus Racemosus*, *Curcuma Longa*, *Ferula Narthex*, *Terminalia Belerica*)	

Course Outcomes: Students will be able to…

1. Apply drugs knowledge for prescribe medication by practisers
2. Use herbal medicine for common diseases as primary treatment
3. Apply Annapana varga
4. Discuss pharmacology

Reference Book :.

1. Dravyagun vigyan- Acharya Priyavat Sharma
2. Dravya gun hastamalak- Vaidh Banwarilal mishr
3. Bhavaprakash ke sandharbhitansh
4. Bedi YP, Sharma P, Handbook of Preventive and Social Medicine, Community Health/Community Medicine. CBS Publishers & Distributors. 2018
5. Park K.. Text Book of preventive and Social Medicine. Bhanot Publishers. 2017
6. Bakhru H.K. (1991) A Complete Handbook of Nature Cure 5th Edition, Jaico Publishing House
7. Bakhru H.K. (1999) Naturopathy for Longevity: 1,Jaico Publishing House
8. Chaudhuri S K. [2006] Concise Medical Physiology. New Central Book Agency (P) Limited.
9. Bonita R., Beaglehole R., Kjellstrom T. [2006] Basic epidemiology, World Health Organizations Publishers .
10. Carpenter W. B. [1946], Principles of human physiology, Churchill 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. Learn 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.
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6. Jhon Himmelman (2001) Children's Press An Earthworm's Life (Nature Upclose)
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BBTP129: Lab exercise based on Human Physiology and Pathology and Naturopathy paper II

Credits: 02 **Lectures: 30**

Learning Objectives: The students should be able to…

1. Know the dravya preparation
2. Understand various herbs used in the naturopathy
3. Recognize various symptoms of diseases
4. Understand the various body organ functions

Sr. No.	SEMESTER-II BBTP129: Lab exercise in Human Physiology and Pathology and Naturopathy paper II	No. of practical
1	Introduction to various Dravya and their preparation	4
2	Preparation of various kashay	4
3	Preparation of Lepa	4
4	Identification of Various natural herbs used in the therapeutic	4
5	Identification and administrations of various fluide in body (demo)	4
6	Study of various techniquies / equipments for non-communicable disease detection	4
7	Study of hypertention and fasting and PP blood glucose levels	4
8	Analysis and identification of Urine parameters	4
9	Analysis and identification of cerebrospinal fluidparameters	4
10	To study the ESR of individuals	4
11	Identification of various parts of digestive system	4
12	Identification of human lymphatic system	4
13	Study of pulmonary circulation	4
14	Study of various ECG leads, normal ECG and its interpretation	4
15	Study of individuals BMI	4

Learning outcomes: Students will be able to…

1. Prepare various dravya
2. Apply knowledge of herbs used in the naturopathy

3. Discribe the organ fuctioning in detailed
4. Disscuss various symptoms of the naturopathy

Reference Books:

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5. GeraldD.Fasman Practical Handbook of Biochemistry and Molecular Biology Hardcover–Import, (1989)
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