



Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3 (6) of MPUA 2016)

Syllabus for

B. Sc. I Biotechnology

Under

Faculty of Science and Technology

(As per NEP 2020)

With Effect from Academic Year 2024 - 2025

Syllabus for Bachelor of Science (B.Sc.) Part–I Biotechnology

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 vigour 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.

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

GENERAL OUTCOMES

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 a job in the government sector

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.

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.

DURATION: 01 year

PATTERN: Semester wise

MEDIUM OF INSTRUCTION: English

ELIGIBILITY OF THE STUDENT: Higher Secondary Certificate (HSC/10+2) Examination or an Equivalent Examination from a Recognized Board with the Science Stream

NUMBER OF STUDENTS: A batch shall consist of 60 students and additional 20 % of seats will be allotted as per Karmaveer Bhaurao Patil University norms.

ELIGIBILITY OF CORE FACULTY: The eligibility of faculty shall be as per the university grant commission (UGC) regulations and guidelines

ELIGIBILITY FOR PROFESSOR OF PRACTICE OR PROFESSIONAL TRAINER: Any other eligibility as per the Guidelines and Regulations Passed by the Board of Concerned Studies, Academic Council of the College / University and Rules and Regulations of Karmaveer Bhaurao Patil University, Satara, Government of Maharashtra, and UGC norms

SEMESTER, CREDIT FRAMEWORK NSQF LEVEL AND EXIT POINTS

Sr. No	Semester	Year	Year	Credits	Level	Exit Points &Award
1	Sem. I & II	2026-27	1 Year	44	4.5	UG Certificate (Biotechnology)
2	Sem. III & IV	2027-28	2 Year	44	5.0	UG Diploma (Biotechnology)
3	Sem. V & VI	2028-29	3 Year	44	5.5	UG Degree (Biotechnology)
4	Sem VII & VIII	2029-30	4 Year	44	6.0	UG Honors Degree/ Honors with research (Biotechnology)

STRUCTURE OF COURSE: CREDIT DISTRIBUTION

Semester (Level)	Course			OE	AEC/VEC/IKS	TOTAL CREDITS	Degree/cum Cr. MEME
	Course I	Course II	Course III				
Semester I (4.0)	DSC I (2) DSC II (2) DSC P I (2)	DSC I (2) DSC II (2) DSC P I (2)	DSC I (2) DSC II (2) DSC P I (2)	OE 1	IKS (2) (Generic)	22	UG Certificate: 44 CREDITS
Semester II (4.5)	DSC III (2) DSC IV (2) DSC P II (2)	DSC III (2) DSC IV (2) DSC P II (2)	DSC III (2) DSC IV (2) DSC P II (2)	OE 2	VEC I DEGG and IIC	22	
	12	12	12	04	04	44	

STRUCTURE OF COURSE B.Sc. I AS PER NEP 2020 (2.0)

Semester I				
Sr. No.	Course	Course Code	Course Title	Credits
1	Course 1	BBTT 111	Fundamental of Biotechnology	2
		BBTT 112	Biomolecules	2
		BBTP 113	Practical based on BBTT 111 and BBTT 112	2
2	Course 2	BBTT 114	Microbiology I	2
		BBTT 115	Plant Science	2
		BBTP 116	Practical based on BBTT 114 and BBTT 115	2
3	Course 3	BBTT 117	Basics in computer	2
		BBTT 118	Basics in Bioinformatics	2
		BBTP 119	Practical based on BBTT 117 and BBTT 118	2
4	OE	BBTTOE1	Agriculture economics I	2
5	IKS	BBTTIKS1	Introduction to Indian Knowledge System I	2
			Total	22

Semester II				
Sr. No.	Course	Course Code	Course Title	Credits
1	Course 1	BBTT 121	Environmental Biotechnology	2
		BBTT 122	Proteins and Enzymes	2
		BBTP 123	Practical based on theory paper BBTT 121 and BBTT 122	2
2	Course 2	BBTT 124	Microbiology II	2
		BBTT 125	Animal science	2
		BBTP 126	Practical based on BBTT 124 and BBTT 125	2
3	Course 3	BBTT 127	Biostatistics	2
		BBTT 128	Cell biology I	2
		BBTP 129	Practical based on BBTT 127 and BBTT 128	2
4	OE	BBTT OE2	Agriculture economics II	2
5	VEC	BBTT VEC 1	Democracy, Election and Indian Constitution	2
			Total	22

EVALUATION STRUCTURE

Semester I

Course	Course Category	Course Code	Internal Evaluation (Best of two CCE marks will be considered)			ESE	Total Marks	Credits
			CCE-I	CCE-II	CCE-III			
Course 1	T	BBTT111	10	10	10	30	50	02
	T	BBTT112	10	10	10	30	50	02
	P	BBTP113	20 (Attendance & Student performance, Attendance and Journal & Viva)			30	50	02
Course 2	T	BBTT114	10	10	10	30	50	02
	T	BBTT115	10	10	10	30	50	02
	P	BBTP116	20 (Attendance & Student performance, Attendance and Journal & Viva)			30	50	02
Course 3	T	BBTT117	10	10	10	30	50	02
	T	BBTT 118	10	10	10	30	50	02
	P	BBTP119	20 (Attendance & Student performance, Attendance and Journal & Viva)			30	50	02
OE	T	BBTTOE1	10	10	10	30	50	02
IKS	T	BBTTIKS1	10	10	10	30	50	02
	Total						550	22

Semester II

Course	Course Category	Course Code	Internal Evaluation (Best of two CCE marks will be considered)			ESE	Total Marks	Credits
			CCE-I	CCE II	CCE-III			
Course 1	T	BBTT121	10	10	10	30	50	02
	T	BBTT122	10	10	10	30	50	02
	P	BBTP123	20 (Attendance & Student performance, Attendance and Journal & Viva)			30	50	02
Course 2	T	BBTT124	10	10	10	30	50	02
	T	BBTT125	10	10	10	30	50	02
	P	BBTP 126	20(Attendance & Student performance, Attendance and Journal & Viva)			30	50	02
Course 3	T	BBTT127	10	10	10	30	50	02
	T	BBTT128	10	10	10	30	50	02
	P	BBTP 129	20 (Attendance & Student performance, Attendance and Journal & Viva)			30	50	02
OE	T	BBTTOE2	10	10	10	30	50	02
VEC	T	BBTTVEC1	10	10	10	30	50	02
Total							550	22

OTHER FEATURES:

A) LIBRARY:

Reference books, Textbooks, Attendance and Journals, and Periodicals are available in Institute and Departmental Library.

(Separate reference lists are attached along with the respective course syllabus)

B) EQUIPMENTS:

a) Computer, LCD projector, visualizer, smart board

b) Laboratory Equipment:

1. Atomic Absorption Spectrometer
2. Autoclave Vertical
3. Bacteriological Incubator
4. Binocular Research Microscope CX 21i
5. BOD Incubator

6. Centrifuge Remi R-4C
7. COD refluxing unit
8. Colorimeter
9. Combined pH and Conductivity Meter
10. Compound Microscope
11. Conductivity Meter
12. Deep freezer
13. Dissection microscope
14. Distillation assembly
15. Flame Photometer
16. Hemocytometer
17. Horizontal Electrophoresis unit
18. Horizontal Laminar Airflow
19. Hot Plate
20. Lux Meter
21. Microcentrifuge
22. Microscope camera device
23. Microwave Oven
24. Mini Centrifuge Remi
25. Mixer
26. pH Meter
27. Refractometer
28. Refrigerator
29. Rotary Shaker
30. Sonicator Waterbath

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	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Biotechnology	
	Programme: B.Sc.	B. Sc. I, Semester - I
	Type : DSC I	Marks: 50
	Credits : 2	From: A. Y. 2024-25
Name of the Course: BBTT 111 Fundamentals of Biotechnology		
Course Objectives: Student should be able to... 1) know about biotechnology 2) understand different areas in biotechnology 3) learn the applications of biotechnology in health care 4) remember different research institutes from all over India.		
Course Outcomes: Students will be able to... 1) evaluate milestones of biotechnology. 2) discuss the application of biotechnology in health care, disease diagnosis, tissue culturing method 3) interpret the use of advance technology in food and agriculture sector. 4) implement biotechnological application in enhancement of food and different areas in biotechnology.		
Module	Title and Contents	Hrs
Module -1	About Biotechnology 1.1 Introduction, Milestones in the History of Biotechnology, Traditional & modern Biotechnology, Branches of Biotechnology, commercial potential of biotechnology, 1.2 Biotechnology in India, Renounced Biotechnology institutes in India (IIT, IISER, NCL, NCCS, ARI, NIV, CCMB, CDFD etc.)	6
Module -2	Biotechnology and Healthcare 2.1 Disease diagnosis, detection of genetic diseases, disease treatment (Any two examples) 2.2 Stem cell technology	8
Module -3	Agricultural Biotechnology 3.1 Introduction, Plant Tissue culture, genetically modified crops,(Any two examples), 3.2 GMOs in Agriculture 3.3 Plant based vaccines	8
Module -4	Food Biotechnology 4.1 Biotechnological applications in enhancement of Food Quality, Food	8

	Products, 4.2 Microbial role in food products Yeast, Bacterial and other Microorganisms based process and products. 4.3 Modern Biotechnological Regulatory Aspects in Food Industries.	
Reference Books:- 1) Singh, B. D. <i>Biotechnology</i> . 4th ed., Kalyani Publishers, 2020. 2) Razdan, M. K. <i>Introduction to Plant Tissue Culture</i> . 3rd ed., Oxford & IBH Publishing Co. Pvt. Ltd., 2019. 3) Arora, M. P. <i>Biotechnology</i> . Himalaya Publishing House, 2017. 4) Lanza, Robert, and Anthony Atala. <i>Essentials of Stem Cell Biology</i> . 3rd ed., Academic Press, 2013. 5) Clark, David P., and Nanette J. Pazdernik. <i>Biotechnology</i> . 2nd ed., Elsevier, 2012. 6) Hermann, Kamal, Ashok Kumar, and Jafargholi Imani. <i>Plant Cell and Tissue Culture: A Tool in Biotechnology</i> . Springer-Verlag, 2009. 7) De, Kalyan Kumar. <i>Plant Tissue Culture</i> . New Central Book Agency, 2008. 8) Dubey, R. C. <i>A Textbook of Biotechnology</i> . S. Chand & Company Ltd., 2006. 9) Hartl, Daniel L., and Elizabeth W. Jones. <i>Genetics: Analysis of Genes and Genomes</i> . Jones and Bartlett Publishers, 2001. 10) James, M. J. <i>Modern Food Biotechnology</i> . 6th ed., Aspen Publishers, 2000.		
Evaluation Pattern: 60:40		
Total Marks: 50		
Internal Continuous Evaluation: 20 Marks CCE I : 10 Marks: Home assignment CCE II : 10 Marks: Short and long answer questions test/ Seminar/ Open book test/ quiz/ Case study/ book review/ Field work/ Industry visit CCE III : 10 Marks: Compulsory MCQ test Note: Best of two CCE marks will be considered	End Semester Examination: 30 Marks Question-1: Solve the following questions (Five questions of 2 marks) 10 M Question-2: Attempt any two questions (Three questions of 10 marks) 20 M Question-3: Attempt any four questions (Five questions of 5 marks) 20 M Note: Conversion of 50 marks of ESE to 30 marks	

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	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Biotechnology	
	Programme: B.Sc.	Semester - I
	Type : DSC II	Marks: 50
	Credits : 2	From: A. Y. 2025-26
	Name of the Course: BBTT 112 Biomolecules	
Course Objectives: Student 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		
Course Outcomes: Students will be able to... 1) interpret basics of chemical science in relevance to biological systems 2) describe the concept of evolution 3) discuss the biomolecules 4) classify the biomolecules		
Module	Title and Contents	Hrs
Module 1:	Origin of life 1.1. Basic concept, A.I. Oparin concept, Urey Miller's experiment, 1.2. Concept of Biomolecules-in general about Carbohydrate, amino acids, protein, lipid just definition with at least one example. pH, pk value definition, 1.3. Biological buffer systems- e.g. Phosphate, Bicarbonate, Hemoglobin buffer system.	7
Module 2:	Nucleic Acids 2.1. Structure and functions of Nucleic acids, purines and pyrimidines, 2.2. Nucleosides & Nucleotides, Biologically important nucleotides, 2.3. Double helical model of DNA structure and forces responsible for A, B & Z – DNA, denaturation and renaturation of DNA, 2.4. RNA and its Types (rRNA, tRNA, mRNA). 2.5. Cell synchronization- Cell separation by physical means, cell separation by chemical blockade	8
Module 3:	Carbohydrates 3.1. Structure, Function, Classification, 3.2. Characteristic Reactions, Physical and Chemical Properties, D&L Glyceraldehydes, structure of Monosaccharide, Disaccharides, and Polysaccharides.	7

	3.3. Chemical/Physical Properties of Carbohydrate, Chemical Reactions for Detection of Monosaccharides, Biological functions of carbohydrates	
Module 4:	Lipid 4.1 Classification of Lipids, Properties of Saturated, Unsaturated Fatty Acids, Rancidity, and Hydrogenation of Oils 4.2 Phospholipids: Lecithin, Cephalin structure and function 4.3 Cholesterol: Structure and Function, Lipoproteins: Structure and Function, Storage Lipids, Structural Lipids	8
Reference Books:- 1) Voet, Judith G., Donald Voet, and Charlotte W. Pratt. <i>Fundamentals of Biochemistry: Life at the Molecular Level</i>. 5th ed., John Wiley & Sons, 2016. 2) Satyanarayana, U. <i>Biochemistry</i>. 4th ed., Elsevier, 2013. 3) Conn, Eric E., and Paul K. Stumpf. <i>Outlines of Biochemistry</i>. 5th ed., John Wiley & Sons, 2010. 4) Purohit, S. S. <i>Biochemistry: Fundamentals and Applications</i>. Agrobios (India), 2009. 5) Palmer, Trevor, and Philip L. Bonner. <i>Enzymes: Biochemistry, Biotechnology, and Clinical Chemistry</i>. 2nd ed., Woodhead Publishing, 2007. 6) Jain, J. L. <i>Fundamentals of Biochemistry</i>. S. Chand & Company Ltd., 2004. 7) Nelson, David L., and Michael M. Cox. <i>Lehninger Principles of Biochemistry</i>. 5th ed., W. H. Freeman and Company, 2004. 8) Rastogi, S. C. <i>Biochemistry</i>. Tata McGraw-Hill Education, 2003. 9) Berg, Jeremy M., John L. Tymoczko, Lubert Stryer, and Gregory J. Gatto Jr. <i>Biochemistry</i>. 7th ed., W. H. Freeman and Company, 2002. 10) Rama Rao, A. V. S. S. <i>A Textbook of Biochemistry</i>. 9th ed., Sangam Books Ltd., 2002.		
Evaluation Pattern:60:40		
Total Marks: 50		
Internal Continuous Evaluation: 20 Marks CCE I : 10 Marks: Home assignment CCE II : 10 Marks: Short and long answer questions test/ Seminar/ Open book test/ quiz/ Case study/ book review/ Field work/ Industry visit CCE III : 10 Marks: Compulsory MCQ test Note: Best of two CCE marks will be considered		End Semester Examination: 30 Marks Question-1: Solve the following questions (Five questions of 2 marks) 10 M Question-2: Attempt any two questions (Three questions of 10 marks) 20 M Question-3: Attempt any four questions (Five questions of 5 marks) 20 M Note: Conversion of 50 marks of ESE to 30 marks

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	Board of Studies in Biotechnology		
	Programme: B.Sc.	B. Sc. I Semester - I	
	Type : DSC P I	Marks: 50	
	Credits : 2	From: A. Y. 2024-25	
	Name of the Course: BBTP 113 Practical Based on BBTT 111 and BBTT 112		
Course Objectives: Student should be able to... 1) understand concepts of solutions and buffers 2) learn about various biomolecules 3) gain knowledge on biomolecules detection techniques 4) know different Research organizations in India			
Course Outcomes: Students will be able to... 1) analyse Various biomolecules & their qualitative analysis 2)prepare buffer , Standardized and calibrate pH meter. 3)discuss various institutes in India 4) apply knowledge in working of various instruments related to biotechnology			
Sr. No	Name of the Practical	Hrs	
1.	Detection of blood group of given sample	60	
2.	Preparations of molar / normal solutions		
3.	Study of plant / Animal tissue culture lab layout		
4.	Study of methods of sterilization		
5.	Study of different research organizations in India		
6.	Preparation of buffers (Phosphate buffer, acetate buffer) and determination of pH with pH meter		
7.	Study and Identification of different instruments Used in the biotechnology laboratory		
8.	Detection of sugars by Molisch test, Benedict's test & Barfoed's test.		
9.	Detection of sugars by Resorcinol (Seliwanoff's test)		
10.	Identification of sugars by Fehling's test		
11.	Perform qualitative tests for Non - Reducing Sugars		
12.	Estimation of Glucose by DNSA method		
13.	Determination of iodine number of oil sample		
14.	Determination of saponification value of oil		

15.	Estimation of vitamin C (Ascorbic acid)	
Reference Books:- 1) Upadhyay, A., K. Upadhyay, and N. Nath. <i>Biophysical Chemistry</i>. 4th ed., Himalaya Publishing House Pvt. Ltd., 2020. 2) Wilson, Keith, and John Walker. <i>Principles and Techniques of Biochemistry and Molecular Biology</i>. 8th ed., Cambridge University Press, 2018. 3) Plummer, David T. <i>An Introduction to Practical Biochemistry</i>. 3rd ed., McGraw Hill Education, 2017. 4) Nagamani, B. <i>Bioinstrumentation</i>. Margham Publications, 2016. 5) Veerakumari, L. <i>Bioinstrumentation</i>. MJP Publishers, 2011. 6) Champe, Pamela C., Richard A. Harvey, and Denise R. Ferrier. <i>Biochemistry</i>. 3rd ed., Lippincott Williams & Wilkins, 2004. 7) Sadasivam, S., and A. Manickam. <i>Biochemical Methods</i>. 2nd ed., New Age International (P) Ltd., 1996. 8) Fasman, Gerald D. <i>Practical Handbook of Biochemistry and Molecular Biology</i>. CRC Press, 1989. 9) Plummer, David T. <i>An Introduction to Practical Biochemistry</i>. 3rd ed., Tata McGraw-Hill, 1988. 10) Jayaram, T. <i>Laboratory Manual in Biochemistry</i>. Wiley Eastern Ltd., 1981.		
Evaluation Pattern: 60:40		
Total Marks:50		
Internal Continuous Evaluation: 20 Marks Attendance and Journal : 10 Marks Student Performance and Viva: 10 Marks		End Semester Examination: 30 Marks Question-1: 10 Marks Question-2: 10 Marks Question-3: 10 Marks

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	Programme: B.Sc.	Semester - I
	Type : DSC I	Marks: 50
	Credits : 2	From: A. Y. 2024-25
Name of the Course: BBTT 114 Microbiology I		
Course Objectives: 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) learn the Principles of physical and chemical methods used in the control of microorganisms and applications for the prevention and control of infectious diseases. 4) study the Laboratory and techniques for isolation, staining, identification and control of microorganisms.		
Course Outcomes: 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) discuss Basic terms in sterilization, Principles of sterilization and Various agents of sterilization		
Module	Title and Contents	Hrs
Module -1:	Introduction of Microbiology 1.1 Definition, Discovery of microscope (Anton von Leeuwenhoek and Robert Hooke), Contributions of various Scientists (Aristotle, Francesco Redi, Louis Pasteur, Tyndall), 1.2 Introduction to types of Microorganisms – Bacteria, Algae, Fungi, Protozoa and Viruses Morphology of Bacteria– i) Size, ii) Shape, iii) Arrangements 1.3 Cytology of Bacteria , Structure and functions of :i) Cell wall ii) Cell membrane iii) Capsule and slime layer iv) Flagella v) Pilli vi) Nuclear material vii) Mesosome viii) Ribosome ,Cell inclusions (PHB granules, metachromatic granules and glycogen bodies) 1.4 Viruses-General characteristics and lytic cycle of T4 bacteriophage	8
Module -2:	Bacterial taxonomy 2.1 General principles of bacterial nomenclature: Taxonomic ranks, Common or Vernacular name, Scientific or International name, 2.2 Criteria for bacterial classification - Morphological, cultural, biochemical & serological characters.	7

	2.3 Microbial nutrition: Nutritional requirements of microorganisms: Water; Micronutrients; Macronutrients; Carbon, Oxygen, Hydrogen, Nitrogen, Sulphur and Phosphorous and growth factors. auxotroph, prototroph and fastidious organisms, 2.4 Nutritional types of microorganism based on carbon and energy sources (Autotrophs, Heterotrophs, Phototrophs, Chemotrophs, Photoautotrophs, Chemoautotrophs, Photoheterotrophs, Chemoheterotrophs.	
Module -3:	Concept of sterilization 3.1 Definitions: Sterilization, Disinfection, Antiseptic, Germicide, Microbiostasis, Asepsis, Sanitization. 3.2 Methods of sterilization by Physical agents : (i) Temperature-dryheat, moist heat ii) Radiation- U.V, Gamma radiation iii) Bacteriaproof filter- membrane filter) 3.3 Chemical agents Phenol & Phenolic compounds, Alcohol, Heavy metals e.g. mercury), 3.4 Gaseous agents- Ethyleneoxide, formaldehyde. Checking of Efficiency of Sterilization– Biological and Chemical Indicators	8
Module -4:	Staining Techniques 4.1 Definitions: dye and stain (Basic and Acidic), Fixative, Mordant, Decoloriser, Accentuator 4.2 Classification of stains– Acidic, Basic and Neutral, Principles, Procedure, Mechanism and application of staining procedures- Monochrome staining and Negative staining 4.3 Differential staining- Gram staining and Acid fast staining, Special staining techniques – Spore, Capsule, Cell wall staining	7
Reference Books:- 1) Swarna, G. <i>A Textbook of Microbiology</i>. Florence Publications, 2022. 2) Bisset, Kenneth Alexander. <i>The Cytology and Life History of Bacteria</i>. Hassell Street Press, 2021. 3) Arora, D. R., and Brij Bala Arora. <i>Textbook of Microbiology</i>. 6th ed., CBS Publishers & Distributors Pvt. Ltd., 2020. 4) Sharma, P. D. <i>Microbiology</i>. Rastogi Publications, 2010. 5) Ananthanarayan, R., and C. K. Jayaram Paniker. <i>Textbook of Microbiology</i>. 7th ed., Universities Press, 2005. 6) Prescott, Lansing M., John P. Harley, and Donald A. Klein. <i>Microbiology</i>. 6th ed., McGraw-Hill Higher Education, 2005. 7) Ingraham, John L., and Catherine A. Ingraham. <i>Introduction to Microbiology: A Case-History Study Approach</i>. 3rd ed., Brooks/Cole Publishing Company, 2004. 8) Pelczar, Michael J., E. C. S. Chan, and Noel R. Krieg. <i>Microbiology</i>. 5th ed., McGraw-Hill, 1993. 9) Stanier, Roger Y., Edward A. Adelberg, and John L. Ingraham. <i>General Microbiology</i>. 5th ed., Macmillan Press Ltd., 1987. 10) Frobisher, Martin. <i>Fundamentals of Microbiology</i>. 9th ed., W. B. Saunders Company, 1974.		
Evaluation Pattern: 60:40		
Total Marks: 50		

Internal Continuous Evaluation: 20 Marks CCE I : 10 Marks: Home assignment CCE II : 10 Marks: Short and long answer questions test/ Seminar/ Open book test/ quiz/ Case study/ book review/ Field work/ Industry visit CCE III : 10 Marks: Compulsory MCQ test Note: Best of two CCE marks will be considered	End Semester Examination:30 Marks Question-1: Solve the following questions (Five questions of 2 marks) 10 M Question-2: Attempt any two questions (Three questions of 10 marks) 20 M Question-3: Attempt any four questions (Five questions of 5 marks) 20 M Note: Conversion of 50 marks of ESE to 30 marks
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	Programme: B.Sc.	Semester - I
	Type : DSC II	Marks: 50
	Credits : 2	From: A. Y. 2024-25
Name of the Course: BBTT 115 Plant science		
Course Objectives: Student should be able to... 1) understand general classification of plant kingdom. 2) know morphology and anatomy of plants. 3) learn basic knowledge of angiosperm and its reproduction. 4) study the basic knowledge of plant cloning.		
Course Outcomes: Students will be able to... 1) analyse 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.		
Module	Title and Contents	Hrs
Module -1:	Plant Diversity 1.1. Outline of General Classification of Plant Kingdom. 1.2. General characters and economic importance of Algae, Fungi, Lichens, Bryophytes, Pteridophytes, Gymnosperms, Angiosperms.	8
Module -2:	Taxonomy of Angiosperms 2.1 Taxonomy:-Definition, Aims, objectives and functions 2.2 Binomial nomenclature and its significance 2.3 Principles of ICBN, Study of outline of Bentham and Hooker's system of Classification of plants.	7
Module -3:	Sexual Reproduction in Angiosperms 3.1 Structure of Typical Flower– Floral whorls and functions:-Calyx, corolla, Androecium, Gynoecium, 3.2 Pollination- Definition, Types–Self and Cross, Advantages of Self and Cross Pollination, Development of male and female gametophyte, 3.3 Fertilization:- Definition, Double fertilization and its significance, 3.4 Parthenocarpy- Definition and significance. Cloning of plants:-Bulbs, corns, tubers, Bulblets and Rhizomes, Runners, Cuttings, Layering, Grafting and mericlone.	8
Module -4:	Seed and Plant Anatomy	7

	4.1 Seed–Definition, Formation, structure of Monocot and Dicot seed, 4.2 Dormancy of seed, Causes and Breaking of seed dormancy. 4.3 Seed germination- Concept, Types- Epigeal and Hypogeal, factors affecting seed germination. 4.4 Plant Anatomy Tissues-Simple and complex (Xylem and Phloem)	
Reference Books:- 1) Dube, H. C. <i>A Textbook of Fungi, Bacteria and Viruses</i>. Agrobios, 2009. 2) Naik, V. N. <i>Taxonomy of Angiosperms</i>. Tata McGraw-Hill Publishing Company, 1984. 3) Chopra, G. L. <i>Angiosperms: Systematics and Life Cycle</i>. Pradeep Publications, 1984. 4) Chopra, G. L., and V. Verma. <i>Textbook of Fungi</i>. Pradeep Publications, 1983. 5) Devlin, Robert M. <i>Fundamentals of Plant Physiology</i>. Macmillan Publishing Company, 1983. 6) Chopra, G. L. <i>A Textbook of Algae</i>. Pradeep Publications, 1978. 7) Chang, Shu-ting, and W. A. Hayes. <i>The Biology and Cultivation of Edible Mushrooms</i>. Academic Press, 1978. 8) Bold, Harold C. <i>The Plant Kingdom</i>. Prentice-Hall of India, 1977. 9) Dutta, A. C. <i>A Class Book of Botany</i>. Oxford University Press, 1959. 10) Eames, Arthur J., and Laurence H. MacDaniels. <i>An Introduction to Plant Anatomy</i>. McGraw-Hill, 1947.		
Evaluation Pattern: 60:40		
Total Marks: 50		
Internal Continuous Evaluation: 20 Marks CCE I : 10 Marks: Home assignment CCE II : 10 Marks: Short and long answer questions test/ Seminar/ Open book test/ quiz/ Case study/ book review/ Field work/ Industry visit CCE III : 10 Marks: Compulsory MCQ test Note: Best of two CCE marks will be considered	End Semester Examination:30 Marks Question-1: Solve the following questions (Five questions of 2 marks) 10 M Question-2: Attempt any two questions (Three questions of 10 marks) 20 M Question-3: Attempt any four questions (Five questions of 5 marks) 20 M Note: Conversion of 50 marks of ESE to 30 marks	

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology	
	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Biotechnology	
	Programme: B.Sc.	B. Sc. I Semester - I
	Type : DSC P I	Marks: 50
	Credits : 2	From: A. Y. 2024-25
	Name of the Course: BBTP 116 Practical based on BBTT114 and BBTT 115	
Course Objectives: Student 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 anatomy		
Course Outcomes: Students will be able to... 1) perform handling 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.		
Sr. No.	Name of the Practical	Hrs
1.	Introduction to laboratory-rules and procedures, laboratory equipment and apparatus.	60
2.	Preparation of bacteriological culture media-1) Nutrient agar media2) Nutrient agar broth	
3.	Preparation of bacteriological and fungal culture media- 1)Peptone water 2) Sabouraud’s agar	
4.	Isolation of bacteria by spread plate technique.	
5.	Isolation of bacteria by streak plate technique.	
6.	Microscopic examination of bacteria by, Monochrome staining, Gram staining	
7.	Observation of motility by hanging drop technique	
8.	Mounting and identification of Aspergillus, Mucor	
9.	Study of algae (<i>Nostoc</i> , <i>Sargassum</i>)	
10.	Study of bryophyte (<i>Riccia/ Anthoceros</i>)	
11.	Study of Pteridophyte (<i>Selaginella</i>)	
12.	Study of Gymnosperms (<i>Pinus</i>)	
13.	Study of Angiosperms (Sunflower, Maize)	
14.	Study of root, stem, leaf anatomy of dicot plant.	

15.	Study of root, stem, leaf anatomy of monocot plant.	
Reference Books:- 1) Sarvanan, R., D. Dhachinamoorthi, and M. M. Ch. Prasadaraao. <i>A Handbook of Microbiology</i>. Lambert Academic Publishing, 2019. 2) Aneja, K. R. <i>Laboratory Manual of Microbiology and Biotechnology</i>. MedTech Publishers, 2018. 3) Johnson, Ted, and Christine Case. <i>Laboratory Experiments in Microbiology (What's New in Microbiology)</i>. Spiral-bound ed., 2018. 4) Goldman, Emanuel, and Florence H. Green. <i>Practical Handbook of Microbiology</i>. 3rd ed., CRC Press, 2015. 5) Colbert, J. Bruce, and Luis S. Gonzalez. <i>Microbiology: Practical Application and Infection Prevention</i>. 2nd ed., Cengage Learning, 2015. 6) Zothansanga, and B. Senthilkumar. <i>Practical Microbiology: A Laboratory Manual</i>. Panima Publishing Corporation, 2013. 7) Leboffe, J. Michael, and E. Burton Pierce. <i>Microbiology Laboratory Theory & Application</i>. Brief Loose-Leaf ed., 2012. 8) Kaufman, Peter B. <i>Practical Botany</i>. 1983. 9) Mathur, R. C. <i>Systematic Botany: Angiosperms</i>. Agra Book Store, 1963. 10) Eames, A. J., and Laurence H. MacDaniels. <i>An Introduction to Plant Anatomy</i>. McGraw-Hill, 1947.		
Evaluation Pattern: 60:40		
Total Marks:50		
Internal Continuous Evaluation: (20 Marks) Attendance and Journal : 10 Marks Student Performance and Viva: 10 Marks		End Semester Examination: 30 Marks Question-1: 10 Marks Question-2: 10 Marks Question-3: 10 Marks

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology	
	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Biotechnology	
	Programme: B.Sc	Semester - I
	Type : DSC I	Marks: 50
	Credits : 2	From: A. Y. 2024-25
Name of the Course: BBTT 117 Basics in Computer		
Course Objectives: Student should be able to... 1) aware of basics of computer 2) know Basic Formulas in excel 3) understand different file formats 4) study basic networking		
Course Outcomes: Students will be able to... 1) demonstrate basics of computer 2) create a word document 3) make use of formulas 4) access Internet		
Module	Title and Contents	Hrs
Module -1:	Introduction to Computer 1.1. Knowing computer: What is Computer, Basic Applications of Computer; Components of Computer System, 1.2. Central Processing Unit (CPU), VDU, Keyboard and Mouse, Other input/output Devices, Computer Memory, 1.3. Concepts of Hardware and Software; Concept of Computing, Data and Information; Connecting keyboard, mouse, monitor and printer to CPU and checking power supply.	8
Module -2:	MS Word 2.1. Overview of MS Word, Creating and saving documents, - Typing and editing text, Selecting and formatting text, Cutting, copying, and pasting, Undo and redo, Creating headings and subheadings, Using sections and breaks, 2.2. Creating tables of contents, Creating and formatting tables, - Font styles and sizes, Alignment and spacing, Numbering and bullets, Margins and indentation Inserting images and graphics, Resizing and formatting images, 2.3. Printing documents, Saving documents in different formats (PDF, RTF, etc.), Sharing documents via email or online storage.	7
Module -3:	MS Excel	8

	3.1. Introduction to MS Excel, Overview of MS Excel, Creating and saving workbooks, - Entering and editing data, Selecting and formatting cells, 3.2. Basic calculations (sum, average, count), Undo and redo, - Creating formulas (arithmetic, comparison, logical) Using functions (SUM, AVERAGE, COUNT, IF), 3.3. Organizing and formatting data. Using filters and sorting, Creating and managing pivot tables, Using conditional formatting	
Module -4:	Introduction to Internet 4.1 Introduction to Internet WWW and Web Browsers: Basic of Computer networks; LAN, WAN; 4.2 Concept of Internet; Applications of Internet; connecting to internet; What is ISP; Knowing the Internet; 4.3 Basics of internet connectivity related troubleshooting, World Wide Web; Web Browsing softwares, Search Engines; Understanding URL; Domain name; IP Address; Using e-governance website	7
Reference Books:- 1) Patterson, David A., and John L. Hennessy. <i>Computer Organization and Design: The Hardware/Software Interface</i>. 5th ed., Morgan Kaufmann, 2013. 2) Silberschatz, Abraham, Peter B. Galvin, and Greg Gagne. <i>Operating System Concepts</i>. 9th ed., John Wiley & Sons, 2012. 3) Harvard University, and Massachusetts Institute of Technology. <i>edX: Online Courses from the World's Best Universities</i>. edX, 2012. 4) Sims, Zach, and Ryan Bubinski. <i>Codecademy</i>. Codecademy, 2011. 5) Tanenbaum, Andrew S., and David J. Wetherall. <i>Computer Networks</i>. 5th ed., Pearson, 2010. 6) Cormen, Thomas H., Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein. <i>Introduction to Algorithms</i>. 3rd ed., MIT Press, 2009. 7) Grossmann, Jeremy. <i>GNS3: Graphical Network Simulator</i>. GNS3 Technologies, 2008. 8) Refsnes, Jan Egil. <i>W3Schools</i>. Refsnes Data, 1999. 9) Greene, Diane, and Mendel Rosenblum. <i>VMware</i>. VMware, Inc., 1998. 10) Microsoft Corporation. <i>Microsoft Visual Studio</i>. Microsoft Corporation, 1997.		
Evaluation Pattern: 60:40		
Total Marks: 50		
Internal Continuous Evaluation: 20 Marks CCE I : 10 Marks: Home assignment CCE II : 10 Marks: Short and long answer questions test/ Seminar/ Open book test/ quiz/ Case study/ book review/ Field work/ Industry visit CCE III : 10 Marks: Compulsory MCQ test Note: Best of two CCE marks will be considered	End Semester Examination: 30 Marks Question-1: Solve the following questions (Five questions of 2 marks) 10 M Question-2: Attempt any two questions (Three questions of 10 marks) 20 M Question-3: Attempt any four questions (Five questions of 5 marks) 20 M Note: Conversion of 50 marks of ESE to 30 marks	

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology	
	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Biotechnology	
	Programme: B.Sc.	Semester - I
	Type : DSC II	Marks: 50
	Credits : 2	From: A. Y. 2024-25
	Name of the Course: BBTT 118 Basics in Bioinformatics	
Course Objectives: Student should be able to... 1) Learn the basics of Bioinformatics. 2) study the computational tools to analyze the biological data. 3) know the sequence techniques and gene annotation 4) understand application of bioinformatics		
Course Outcomes: Students will be able to... 1) apply the various bioinformatics tools and techniques for the analysis of the biological data . 2) interpret the sequence techniques for evolutionary study 3) discuss the application of bioinformatics 4) describe bioinformatics tools for DNA and protein study		
Module	Title and Contents	Hrs
Module -1:	Introduction to Bioinformatics 1.1 Definition, Introduction, History, application Study of NCBI 1.2 All Database - Nucleotide, Protein, SNP 1.3 Popular resource -Pub Med ,PubMed Central, Pubchem Study of - NLM,NIH,EMBL,PDB,DDBJ,EBI	8
Module -2:	Bioinformatics tool 2.1 NCBI -study protein and nucleotide PubMed- full text article 2.2 Entrez-Retrieve the sequences of protein and nucleotide 2.3 Clustal Omega - phylogenetic tree analysis	7
Module -3:	Introduction to sequence alignment 3.1Gene, nucleotide, amino acid, protein Sequence alignment 3.2 Global alignment ,Local Alignment 3.3 Pairwise sequence alignment :Dot Matrix,BLAST,FASTA 3.4 Multiple Sequence alignment .	8

Module -4:	Introduction to Internet 4.1 Human Genome Project and its goals, 4.2 Applications of Bioinformatics in various fields ,Environment, biotechnology, molecular biology, neurobiology, agriculture, drug designing, biomedical genome medicines, medical microbiology	7
Reference Books:- 1. Campbell, A. Malcolm, and Laurie J. Heyer. <i>Discovering Genomics, Proteomics, and Bioinformatics</i>. 2nd ed., Benjamin Cummings, 2007. 2. Campbell, A. Malcolm, and Laurie J. Heyer. <i>Discovering Genomics, Proteomics, and Bioinformatics</i>. Benjamin Cummings, 2006. 3. Peter, Y. V. <i>Trends in Bioinformatics Research</i>. Nova Science Publishers, 2006. 4. Xiong, Jin. <i>Essential Bioinformatics</i>. 1st ed., Cambridge University Press, 2006. 5. Graham, D. R. M., et al. <i>Broad-Based Proteomics Strategies: A Practical Guide to Proteomics and Functional Screening</i>. Humana Press, 2005. 6. Baxevanis, Andreas D., and B. F. Francis Ouellette, editors. <i>Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins</i>. 3rd ed., John Wiley & Sons, 2005. 7. Miller, Webb. "Comparative Genomics." <i>Annual Review of Genomics and Human Genetics</i>, vol. 5, 2004, pp. 15–56. 8. Mount, David W. <i>Bioinformatics: Sequence and Genome Analysis</i>. 2nd ed., Cold Spring Harbor Laboratory Press, 2004. 9. Baldi, Pierre, and G. Wesley Hatfield. <i>DNA Microarrays and Gene Expression: From Experiments to Data Analysis and Modeling</i>. Cambridge University Press, 2002. 10. Lengauer, Thomas, editor. <i>Bioinformatics: From Genomes to Drugs</i>. 1st ed., Wiley-VCH, 2001.		
Evaluation Pattern: 60:40		
Total Marks: 50		
Internal Continuous Evaluation: 20 Marks CCE I : 10 Marks: Home assignment CCE II : 10 Marks: Short and long answer questions test/ Seminar/ Open book test/ quiz/ Case study/ book review/ Field work/ Industry visit CCE III : 10 Marks: Compulsory MCQ test Note: Best of two CCE marks will be considered	End Semester Examination:30 Marks Question-1: Solve the following questions (Five questions of 2 marks) 10 M Question-2: Attempt any two questions (Three questions of 10 marks) 20 M Question-3: Attempt any four questions (Five questions of 5 marks) 20 M Note: Conversion of 50 marks of ESE to 30 marks	

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology	
	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Biotechnology	
	Programme: B.Sc.	Semester – I
	Type : DSC P I	Marks: 50
	Credits : 2	From: A. Y. 2024-25
	Name of the Course: BBTP 119 Practical Based on BBTP 117 and BBTP 118	
Course Objectives: Student should be able to... 1) aware of basics of computer 2) know Basic Formulas in excel 3) study the computational tools to analyse the biological data. 4) Understand sequence techniques and gene annotation.		
Course Outcomes: Students will be able to... 1) describe different file formats 2) interpret basic networking concept 3) discuss the application of bioinformatics 4) apply bioinformatics tools for protein study		
Sr. No.	Name of the Practical	Hrs
1	Study opening and closing Documents (Opening documents Save and Save as ,Page setup ,Print preview , Printing of documents)	60
2	Perform text creation and manipulation (Document creation,Editing text ,Text selection , Cut, Copy and Paste ,Spell check	
3	Demonstrate Formatting the Text (Font and size selection , Alignment of text , Paragraph indenting ,Bullets and Numbering, Changing case)	
4	Study of table manipulation (Draw table ,changing cell width and height ,Alignment of text in cell ,Delete / Insertion of row and column ,Border and shading)	
5	Demonstrate Word Processing Basics(Opening word processing package,Menu bar ,Using the help ,Using the icons below menu bar)	
6	Study the Elements of Electronic Spread Sheet (Opening of spread sheet ,Addressing of cells, Printing of spread Sheet, Saving Workbooks)	
7	Perform Manipulation of Cells (Entering Text, Numbers and Dates ,Creating Text, Number and Date Series ,Editing Worksheet Data ,Inserting and Deleting Rows, Column, Changing Cell Height and Width)	
8	Study Opening of Email account	

9	Introduction to PubMed central database	
10	Retrieval of amino acid sequence from NCBI database	
11	Retrieval of Nucleic acid sequence from NCBI database	
12	Similarity search for nucleotide using the BLASTn	
13	Similarity search for protein using the BLASTn	
14	Perform multiple sequence alignment	
15	Perform Phylogenetic tree construction.	

Reference Books:-

- 1) Cormen, Thomas H., Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein. *Introduction to Algorithms*. 3rd ed. Cambridge, MA: MIT Press, 2009.
- 2) Grossmann, Jeremy. *GNS3: Graphical Network Simulator*. Houston, TX: GNS3 Technologies, 2008.
- 3) Campbell, A. Malcolm, and Laurie J. Heyer. *Discovering Genomics, Proteomics, and Bioinformatics*. San Francisco: Benjamin Cummings, 2006.
- 4) Peter, Y. V. *Trends in Bioinformatics Research*. New York: Nova Science Publishers, 2006.
- 5) Xiong, Jin. *Essential Bioinformatics*. 1st ed. Cambridge: Cambridge University Press, 2006.
- 6) Graham, D. R. M., et al. *Broad-Based Proteomics Strategies: A Practical Guide to Proteomics and Functional Screening*. Totowa, NJ: Humana Press, 2005.
- 7) Mount, David W. *Bioinformatics: Sequence and Genome Analysis*. 2nd ed. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press, 2004.
- 8) Refsnes, Jan Egil. *W3Schools*. Sandnes, Norway: Refsnes Data, 1999.
- 9) Greene, Diane, and Mendel Rosenblum. *VMware*. Palo Alto, CA: VMware, Inc., 1998.
- 10) Microsoft Corporation. *Microsoft Visual Studio*. Redmond, WA: Microsoft Corporation, 1997.

Evaluation Pattern: 60:40

Total Marks:50

Internal Continuous Evaluation: 20 Marks	End Semester Examination: 30 Marks
Attendance and Journal : 10 Marks	Question-1: 10 Marks
Student Performance and Viva:10 Marks	Question-2: 10 Marks
	Question-3: 10 Marks



Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Interdisciplinary Studies

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Humanities

Programme: B.Sc.

Semester – I

Type: Open Elective Course

Marks: 50

Credits: 2

From: A. Y. 2025-26

Name of the Course: BBTTOE 1 Agricultural Economics I

Course Objectives: Students should be able to.....

1. introduce the fundamental concepts, scope, and significance of agricultural economics.
2. develop an understanding of the role of agriculture in the Indian and rural economy.
3. familiarize students with agricultural policies, land reforms, and their contribution to economic development.
4. provide knowledge of agricultural reforms, food security measures, and major development programmes in India.

Course Outcomes: Students will be able to.....

1. explain the basic concepts, scope, and importance of agricultural economics.
2. analyze the role of agriculture in the Indian economy and compare different farming systems.
3. evaluate agricultural policies, land reforms, and changing land use and cropping patterns.
4. assess the impact of agricultural reforms, food security initiatives, and major agricultural development programmes on farmers and the economy.

Module	Title and Contents	Hrs
Module -1:	Introduction of Agricultural Economics 1.1 Introduction of Agricultural Economics: Definition, Nature and Scope for the separate study of agricultural economics 1.2 Utility of agricultural economics 1.3 Nature of uncertainty in agriculture 1.4 Characteristics of agriculture	08
Module -2:	Indian Agriculture 2.1 Role of Agriculture in Indian Economy 2.2 Place of agriculture in rural Economy 2.3 Difference between agriculture and industry Systems of Cultivation – Peasant, Co-operative 2.4 State Farming, Corporate, Contract, Precision and Organic Farming, Farmers Club	07

Module -3:	Agriculture and Economic Development 3.1 Role of agriculture in economic development 3.2 Agricultural Policy During Plan Period and Recent National Agricultural Policy 3.3 Land Reforms in India 3.4 Land Utilization in India – Change in Cropping Pattern.	08
Module -4:	Agriculture Reforms 4.1 Food security - Buffer Stock and Public Distribution System (PDS) 4.2 Green Revolution, White Revolution, Blue Revolution, Yellow Revolution 4.3 Waste Land Development Programmes 4.4 National Commission on farmers and Agriculture	07
Reference Books: - Gardner, Bruce L., and Gordon C. Rausser, eds. Handbook of Agricultural Economics. Vol. 1. Elsevier, 2001. - Knutson, Ronald D., James L. Outlaw, and H. L. “Drew” Anderson. Agricultural Economics: Concepts, Issues, and Policy. Wiley, 2011. - Singh, K. R. Indian Agriculture: A Sectoral Analysis. ICFAI University Press, 2007. - Sharma, Ramesh Chand, and P. K. Joshi. Indian Agriculture: Performance and Policies. Academic Foundation, 2007. - Dantwala, M. L., and P. R. Brahmananda. Agricultural Development in India Since Independence. Oxford University Press, 1996.		
Evaluation Pattern: 60:40		
Total Marks: 50		
Internal Continuous Evaluation: 20 Marks CCE I : 10 Marks: Home assignment CCE II : 10 Marks: Short and long answer questions test/ Seminar/ Open book test/ quiz/ Case study/ book review/ Field work/ Industry visit CCE III : 10 Marks: Compulsory MCQ test Note: Best of two CCE marks will be considered		End Semester Examination:30 Marks Question-1: Solve the following questions (Five questions of 2 marks) 10 M Question-2: Attempt any two questions (Three questions of 10 marks) 20 M Question-3: Attempt any four questions (Five questions of 5 marks) 20 M Note: Conversion of 50 marks of ESE to 30 marks

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Humanities	
	Yashwantrao Chavan Institute of Science, Satara	
	Board of Studies in English	
	Programme: B.Sc.-I (All General & Professional)	Semester- I
	Type: IKS (Generic)	Marks: 50
	Credits: 02	From: A.Y. 2026-27
	Name of the Course: BBTT IKS Introduction to Indian Knowledge System	

Course Objectives: Student should be able to...

- 1) Understand the concept of Indian Knowledge system
- 2) Study the various Indian Art and Culture and their influence
- 3) know the heritage of Indian Science and Technology
- 4) learn the global influences of IKS

Course Outcomes: Students will be able to...

- 1) explain the concept of Indian Knowledge system.
- 2) identify the various Indian Art and Culture and their influence.
- 3) recognize the heritage of Indian Science and Technology
- 4) describe the global influences of IKS.

Module	Title and Contents	Hrs.
Module –1:	Fundamentals of Indian Knowledge System 1.1 Definition, Concept and Scope of IKS 1.2 Overview of Indian Knowledge systems 1.3 IKS based approaches on knowledge paradigms 1.4 Applications of Indian knowledge systems in modern times	07
Module –2:	Indian Art and Culture 2.1 Overview of Indian Art and Culture 2.2 Tribal art and culture 2.3 Folk art and craft traditions 2.4 Influence of Indian Art on western art movements	08
Module –3:	Indian Science and Technology in IKS 3.1 Indian Science and Technology Heritage 3.2 Case studies of Indian Scientists and technologists 3.3 Applications of Indian Science and technology in modern times 3.4 Relevance of Indian Science and technology in global context	08

Module –4:	Indian Knowledge Systems: Global Influence 4.1 Contemporary global interest in Indian culture and spirituality 4.2 Indian influence on global cuisine, Art, music and dance 4.3 Case studies of global leaders and thinkers influenced by ancient Indian knowledge systems 4.4 Relevance of Indian Knowledge systems in addressing global challenges	07
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Reference Books:-

- 1) Singhanian, Nitin. *Indian Art and Culture*. 5th ed., McGraw Hill Education, 2022.
- 2) Avari, Burjor. *India: The Ancient Past: A History of the Indian Subcontinent from c. 7000 BCE to CE 1200*. Routledge, 2016.
- 3) Chakrabarty, Dilip K., and Makkhan Lal. *History of Ancient India*. 5 vols., Aryan Books International, 2014.
- 4) Jha, Amit. *Traditional Knowledge System in India*. Atlantic Publishers, 2014.
- 5) Nair, Shantha N. *Echoes of Ancient Indian Wisdom*. Hindology Books, 2008.
- 6) Kapur, K., and A. K. Singh, editors. *Indian Knowledge Systems*. Vol. 1, Indian Institute of Advanced Study, 2005.
- 7) Satprakashananda. *The Methods of Knowledge According to Advaita Vedanta*. Advaita Ashrama, 2005.
- 8) Potter, Karl H. *Encyclopaedia of Indian Philosophies*. Vol. 3, Motilal Banarsidass, 2000.
- 9) *Tatvabodh of Sankaracharya*. Central Chinmay Mission Trust, 1995.

Evaluation Pattern: 60:40

Total Marks: 50

Internal Continuous Evaluation: 20 Marks CCE I : 10 Marks: Home assignment CCE II : 10 Marks: Short and long answer questions test/ Seminar/ Open book test/ quiz/ Case study/ book review/ Field work/ Industry visit CCE III : 10 Marks: Compulsory MCQ test Note: Best of two CCE marks will be considered	End Semester Examination: 30 Marks Question-1: Solve the following questions (Five questions of 2 marks) 10 M Question-2: Attempt any two questions (Three questions of 10 marks) 20 M Question-3: Attempt any four questions (Five questions of 5 marks) 20 M Note: Conversion of 50 marks of ESE to 30 marks
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SEMESTER II

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology	
	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Biotechnology	
	Programme: B.Sc.	Semester - II
	Type : DSC III	Marks: 50
	Credits : 2	From: A. Y. 2024-25
	Name of the Course: BBTT121 Environmental Biotechnology	
Course Objectives: Student should be able to... 1) understand concept of Environmental Biotechnology 2) study of Environmental Impact Assessment. 3) know the strategies for Environmental Survey for different approaches. 4) learn various effluent treatment system.		
Course Outcomes: Students will be able to... 1) implement recycling, and remediation methods of different pollutants. 2) apply the technique of remediation method for pollution control. 3) analyse various techniques for Environmental Impact Assessment 4) evaluate about effluent treatment system.		
Module	Title and Contents	Hrs
Module -1:	Environmental Toxicology: 1.1 Definition, classification and concept 1.2 Pesticide Toxicity –Classification (Organic and Inorganic) 1.3 Mode of action of toxicants (Metals, organophosphates, carbamates and mutagens) Bioconcentration, Bioaccumulation, Biomagnification, Potentiation and Synergism 1.4 Control of Toxic effects- Biotransformation and excretion,Toxicants removal techniques with examples	8
Module -2:	Bioremediation Techniques: 2.1 Introduction of bioremediation, Definition, Principle, Insitu and Exsitu Bioremediation, Bioremediation of waste waters 2.2 Activated Sludge Process, Solid Waste Treatment, Slurry Phase Treatment 2.3 Agricultural Bioremediation- Microbial Composting, Biogas, Land Farming and Pest Control Bioremediation of Industrial wastes, Xenobiotics	7
Module -3:	Biogeochemical cycle: 3.1. Carbon cycle and its types -Marine carbon cycle, terrestrial carbon cycle)	8

	3.2.Nitrogen cycle, Sulphur cycle, Phosphorus cycle- Significance and importance of cycles 3.3.Bio augmentation and Bio filtration Environmental Impact Assessment (EIA)	
Module -4:	Waste water treatment: 4.1 Introduction, sources of water pollution, Stages of waste water treatment- Preliminary, Primary, Secondary – Aerobic and anaerobic treatment, Tertiary treatment. 4.2 Waste water treatment for industry water recycling process (dairy, distillery, sugar industry) 4.3 Waste water treatment for industry water recycling process in dairy distillery,sugar industry (raw process, differences in processing between all bio remedial	7
Reference Books:- 1) Azubuiké, Chikere C., Chikere B. Chikere, and G. C. Okpokwasili. "Bioremediation Techniques: Classification Based on Site of Application, Principles, Advantages, Limitations, and Prospects." <i>World Attendance and Journal of Microbiology and Biotechnology</i>, vol. 32, no. 11, article 180, 2016 2) Glick, Bernard R. <i>Beneficial Plant-Bacterial Interactions</i>. Springer, 2015. 3) Verma, P. S., and V. K. Agarwal. <i>Environmental Biology</i>. 2nd ed., S. Chand Publishing, 2015. 4) Metcalf & Eddy, Inc. <i>Wastewater Engineering: Treatment and Resource Recovery</i>. 5th ed., edited by George Tchobanoglous, H. David Stensel, and Ryujiro Tsuchihashi, McGraw-Hill Education, 2014. 5) Sharma, B. K. <i>Environmental Chemistry</i>. 2nd ed., Krishna Prakashan Media (P) Ltd., 2014. 6) Chatterji, A. K. <i>Environmental Biotechnology</i>. 3rd ed., Prentice Hall India Learning Private Limited, 2011. 7) Juwarkar, Asha A., Rakesh Singh, and Priti Mudhoo. <i>Bioremediation of Pollutants</i>. CRC Press, 2010. 8) Odum, Eugene P., and Gary W. Barrett. <i>Fundamentals of Ecology</i>. 5th ed., Thomson Brooks/Cole, 2005. 9) Asthana, D. K., and M. S. Asthana. <i>Environmental Problems and Solutions</i>. S. Chand Publishing, 2001. 10) Vidali, Mauro. "Bioremediation: An Overview." <i>Pure and Applied Chemistry</i>, vol. 73, no. 7, pp. 1163–1172, 2001.		
Evaluation Pattern:60:40		
Total Marks: 50		
Internal Continuous Evaluation: 20 Marks CCE I : 10 Marks: Home assignment CCE II : 10 Marks: Short and long answer questions test/ Seminar/ Open book test/ quiz/ Case study/ book review/ Field work/ Industry visit CCE III : 10 Marks: Compulsory MCQ test Note: Best of two CCE marks will be considered		End Semester Examination:30 Marks Question-1: Solve the following questions (Five questions of 2 marks) 10 M Question-2: Attempt any two questions (Three questions of 10 marks) 20 M Question-3: Attempt any four questions (Five questions of 5 marks) 20 M Note: Conversion of 50 marks of ESE to 30 marks

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology	
	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Biotechnology	
	Programme: B.Sc.	Semester – II
	Type : DSC IV	Marks: 50
	Credits : 2	From: A. Y. 2024-25
	Name of the Course: BBTT 122 Proteins and Enzymes	
Course Objectives: Student 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) know techniques of protein purification		
Course Outcomes: Students will be able to... 1) acquire knowledge of basic of role of vitamins as coenzymes 2) interpret basics idea of purification of proteins/enzymes 3) applythe techniques of protein purification . 4) classify amino acid based on structure and function		
Module	Title and Contents	Hrs
Module -1:	Proteins and Amino Acids: 1.1. Classification of amino acids based on Properties, Proteins: Classification based on Structure and Functions, 1.2. Denaturation of protein Structure of Peptides, Titration 1.3. Curve of Amino Acids, Concept of Isoelectric pH, Zwitter ion. 1.4. Types of Protein: Globular, Fibrous, Elastic Proteins	7
Module -2:	Enzyme: 2.1. Introduction, IUB classification, active site, energy of activation, transition state hypothesis, 2.2. lock and key hypothesis, induced fit hypothesis, 2.3. Enzyme inhibition types- competitive, non-competitive, un-competitive. M-M equation	7
Module -3:	Vitamins: 3.1 Classification and deficiency diseases of, RDA, source, structure of Vitamin and Coenzymes of - Ascorbic acid, thiamine, riboflavin, folic acid, pyridoxine, niacin, pantothenic acid, biotin, lipoic acid, folic acid andCyanocobalamin	8

Module -4:	Purification of protein 4.1 Method of cell disruption - Blenders, grinding with abrasives, French press, enzymatic method, sonication; 4.2 Salt participation- Salting in, salting out, organic solvent precipitation, dialysis, ultrafiltration	8
Reference Books:- 1) Voet, Judith G., Donald Voet, and Charlotte W. Pratt. <i>Fundamentals of Biochemistry: Life at the Molecular Level</i> . 5th ed., John Wiley & Sons, 2016. 2) Satyanarayana, U. <i>Biochemistry</i> . 4th ed., Elsevier, 2013. 3) Berg, Jeremy M., et al. <i>Biochemistry</i> . 7th ed., W. H. Freeman and Company, 2012. 4) Conn, Eric E., and Paul K. Stumpf. <i>Outlines of Biochemistry</i> . 5th ed., John Wiley & Sons, 2010. 5) Purohit, S. S. <i>Biochemistry: Fundamentals and Applications</i> . Agrobios (India), 2009. 6) Nelson, David L., and Michael M. Cox. <i>Lehninger Principles of Biochemistry</i> . 5th ed., W. H. Freeman and Company, 2008. 7) Palmer, Trevor, and Philip L. Bonner. <i>Enzymes: Biochemistry, Biotechnology, and Clinical Chemistry</i> . 2nd ed., Woodhead Publishing, 2007. 8) Jain, J. L. <i>Fundamentals of Biochemistry</i> . S. Chand Publishing, 2004. 9) Rastogi, S. C. <i>Biochemistry</i> . Tata McGraw-Hill Education, 2003. 10) Rama Rao, A. V. S. S. <i>A Textbook of Biochemistry</i> . 9th ed., Sangam Books Ltd., 2002.		
Evaluation Pattern:60:40		
Total Marks: 50		
Internal Continuous Evaluation: 20 Marks CCE I : 10 Marks: Home assignment CCE II : 10 Marks: Short and long answer questions test/ Seminar/ Open book test/ quiz/ Case study/ book review/ Field work/ Industry visit CCE III : 10 Marks: Compulsory MCQ test Note: Best of two CCE marks will be considered		End Semester Examination:30 Marks Question-1: Solve the following questions (Five questions of 2 marks) 10 M Question-2: Attempt any two questions (Three questions of 10 marks) 20 M Question-3: Attempt any four questions (Five questions of 5 marks) 20 M Note: Conversion of 50 marks of ESE to 30 marks

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology	
	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Biotechnology	
	Programme: B.Sc.	Semester - II
	Type : DSC P II	Marks: 50
	Credits : 2	From: A. Y. 2024-25
	Name of the Course: BBTP 123 Practical Based on BBTP 121 and BBTP 122	
Course Objectives: Student should be able to...		
1) understand the techniques used to assess water quality. 2) study the bacteriology of water resources. 3) learn about screening techniques. 4) know protein purification techniques. s		
Course Outcomes: Students will be able to...		
1) apply principles and basics of bacteriological analysis of water 2) evaluate different test for water quality. 3) illustrate screening technique 4) perform various separation techniques		
Sr. No.	Name of the Practical	Hrs
1.	Determine total and permanent hardness of water sample.	60
2.	Estimation of COD of water sample.	
3.	Estimation of BOD of water sample.	
4.	Determination of percentage purity of soda ash sample.	
5.	Determination of TDS of water.	
6.	Demonstration of biogas plant.	
7.	Estimation of dissolved oxygen (DO) in water	
8.	Visit to biodiversity site and ETP site.	
9.	Spectrophotometric determination of nucleic acid purityandconcentration.	
10.	Separation and identification of plant pigments by using Ascendingpaper chromatography	
11.	Separation and identification of amino acids using TLC	
12.	Estimation of Protein by Lowry’s method	
13.	Estimation of amino acid by ninhydrin method	

14.	Estimation of protein by biuret method	
15.	Purification of Protein by precipitation & dialysis method.	
Reference Books:- 1) Thatoi, Hrudayanath, and Supriya Dash. <i>Practical Biochemistry: Principles and Protocols</i> . 2nd ed., Dreamtech Press, 2021. 2) Bonner, Philip L. R. <i>Protein Purification</i> . 2nd ed., CRC Press, 2019. 3) Jördening, Hans J., and Josef Winter. <i>Environmental Biotechnology: Concepts and Applications</i> . Margham Publications, 2016. 4) Evans, G. M., and J. C. Furlong. <i>Environmental Biotechnology: Theory and Application</i> . 2nd ed., John Wiley & Sons, 2011. 5) Lakshmi, G. Swarajya. <i>Environmental Science: A Practical Manual</i> . 1st ed., BS Publications, 2011. 6) Wilson, Keith, and John Walker, editors. <i>Principles and Techniques of Biochemistry and Molecular Biology</i> . 7th ed., Cambridge University Press, 2010. 7) Bhattacharyya, B. C., and Ranadhir Banerjee. <i>Environmental Biotechnology</i> . Oxford University Press, 2007. 8) Springer, M. G. <i>Measurement Uncertainties in Science and Technology</i> . 5th ed., 2005. 9) Kellner, R., et al. <i>Analytical Chemistry: A Modern Approach to Analytical Science</i> . John Wiley & Sons, 2000. 10) Fasman, Gerald D., editor. <i>Practical Handbook of Biochemistry and Molecular Biology</i> . CRC Press, 1989.		
Evaluation Pattern:60:40		
Total Marks:50		
Internal Continuous Evaluation: (20 Marks) Attendance and Journal : 10 Marks Student Performance and Vivaand Viva: 10 Marks		End Semester Examination: 30 Marks Question-1: 10 Marks Question-2: 10 Marks Question-3: 10 Marks



Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Biotechnology

Programme: B.Sc.

Semester - II

Type : DSC III

Marks: 50

Credits : 2

From: A. Y. 2024-25

Name of the Course: BBT 124 Microbiology II

Course Objectives: Student should be able to...

- 1) learn culture media, their types, and pure culture isolation methods.
- 2) study the phases of bacterial growth.
- 3) understand the role of indicator bacteria in water quality monitoring.
- 4) gain knowledge of microorganisms, disease transmission, and control

Course Outcomes: Students will be able to...

- 1) explain microbial nutrition, growth, and control.
- 2) demonstrate pure culture isolation and microbial preservation techniques.
- 3) analyse water bacteriology and soil microorganisms with applications
- 4) describe basic medical microbiology terms.

Module	Title and Contents	Hrs
Module -1:	Culture media and pure culture techniques: 1.1 Common components of media and their functions (peptone, yeast extract, NaCl, agar and sugar techniques of enrichment). 1.2 culture media – a) Living media - (Lab. animals, plants, bacteria, embryonated eggs) b) Nonliving media- i) Natural, ii) Synthetic, iii) Semisynthetic, iv) Differential, v) Enriched, vi) Enrichment, vii) Selective. 1.3 Methods for isolation of pure culture - Introduction to concept of pure culture and methods for pure culture - i) Streak plate ii) Pour plate iii) Spread plate	8
Module -2:	Microbial growth 2.1 Growth Kinetics and growth curve; definitions of Growth, Generation time, Growth rate, specific growth rate 2.2 Growth curve and phases of growth curve (Continuous culture, Synchronous growth, Diauxic growth). 2.3 Effect of environmental factors on growth- temperature, pH, osmotic pressure.	7
Module -3:	Water Microbiology and Soil Microbiology 3.1 Water Microbiology Sources of microorganisms in water, fecal pollution of water, Routine bacteriological analysis of water (SPC, Tests for coliforms- Qualitative: detection and differentiation of coliforms, Quantitative: MPN	8

	technique.) 3.2 Soil Microbiology: Types of microorganisms in soil and their role in soil fertility, Microbial interactions in soil (Symbiosis, commensalism, amensalism, parasitism and predation.)	
Module -4:	Medical Microbiology 4.1 Definitions - Host, parasite, Saprophytes, Commensals, Infection, Etiological agent, Disease, Pathogen, Opportunistic pathogen, True pathogen, Virulence, Pathogenicity, Fomites, Incubation period, Carriers, Morbidity rate, Mortality rate, 4.2 Epidemiology, Etiology, Prophylaxis, Antigen, Antibody	7
Reference Books:- 1) Stanbury, Peter F., Allan Whitaker, and Stephen J. Hall. <i>Principles of Fermentation Technology</i>. 3rd ed., Butterworth-Heinemann, 2016. 2) Tortora, Gerard J., Berdell R. Funke, and Christine L. Case. <i>Microbiology: An Introduction</i>. 12th ed., Pearson, 2014. 3) Patel, A. H. <i>Industrial Microbiology</i>. Macmillan Publishers India Ltd., 2011. 4) Madigan, Michael T., et al. <i>Brock Biology of Microorganisms</i>. 11th ed., Pearson Prentice Hall, 2006. 5) Ananthanarayan, R., and C. K. JayaramPaniker. <i>Textbook of Microbiology</i>. 7th ed., Universities Press, 2005. 6) Prescott, Lansing M., et al. <i>Microbiology</i>. 6th ed., McGraw-Hill Higher Education, 2004. 7) Ingraham, John L., and Catherine A. Ingraham. <i>Introduction to Microbiology: A Case History Study Approach</i>. 3rd ed., Brooks/Cole, 2003. 8) Pelczar, Michael J., et al. <i>Microbiology</i>. 5th ed., Tata McGraw-Hill Publishing Company, 1993. 9) Stanier, Roger Y., et al. <i>General Microbiology</i>. 5th ed., Macmillan Education, 1987. 10) Salle, A. J. <i>Fundamental Principles of Bacteriology</i>. 7th ed., McGraw-Hill Book Company, 1984.		
Evaluation Pattern: 60:40		
Total Marks: 50		
Internal Continuous Evaluation: 20 Marks CCE I : 10 Marks: Home assignment CCE II : 10 Marks: Short and long answer questions test/ Seminar/ Open book test/ quiz/ Case study/ book review/ Field work/ Industry visit CCE III : 10 Marks: Compulsory MCQ test Note: Best of two CCE marks will be considered		End Semester Examination:30 Marks Question-1: Solve the following questions (Five questions of 2 marks) 10 M Question-2: Attempt any two questions (Three questions of 10 marks) 20 M Question-3: Attempt any four questions (Five questions of 5 marks) 20 M Note: Conversion of 50 marks of ESE to 30 marks



Karmaveer Bhaurao Patil University, Satara

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Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Biotechnology

Programme: B.Sc.

Semester –II

Type : DSC IV

Marks: 50

Credits : 2

From: A. Y. 2026-27

Name of the Course: BBTT125 Animal Science

Course Objectives: Student should be able to...

- 1) understand the general concept of classification system of Animal kingdom.
- 2) know the Host and parasite relationship.
- 3) learn Human anatomy and physiology with reference to Tissues and Histology of different mammalian organs.
- 4) study the Application of animal science with reference to vermiculture, sericulture, apiculture and pisciculture.

Course Outcomes: Students will be able to ...

- 1) discuss applied biological sciences.
- 2) illustrate of classification of animal kingdom.
- 3) interpret and Relate host and parasite relationship.
- 4) summarize Human physiology and anatomy.

Module	Title and Contents	Hrs
Module -1:	Taxonomy 1.1. General classification of animal kingdom.(General characteristics and one representative example) 1.2. Non- chordates –Study of phylum Porifera, Coelenterata, Platyhelminthes, Nematelminthes, Arthropoda, Mollusca & Echinodermata 1.3. General characters with representative examples- Sycon, Hydra, Liver fluke/Taenia, Earthworm / Nereis, Cockroach, Pearl oyster/ Pila, Starfish 1.4. Chordates:-Study of class Pisces, Amphibia, Reptilia& Mammalia – General characters with representative examples – Lebeo, Frog, Cobra, Alligator, Fowl and Rat.	8
Module -2:	Host and Parasite Relationship 2.1. Protozoan parasite- Plasmodium (Morphology, parasitic adaptations, Life cycle) 2.2. Nematode parasite- Ascaris (Morphology, parasitic adaptations, Life cycle), 2.3. Platyhelminthes parasite- Liver fluke (Morphology, parasitic adaptations	7
Module -3:	Tissues 3.1 Definition and types of tissues (Epithelial, Muscular, Nervous, Connective	8

	tissue). 3.2 Blood Plasma, Serum Corpuscles, Bone, Cartilage. 3.3 Histological Architecture of Skin, Stomach/Intestine, Uterus	
Module -4:	Applied zoology 4.1 Vermiculture :- species/types of earthworms , stages of vermiculture, various models/methods, economic importance 4.2 Apiculture: Types/ species of Honey bees, castes of Honey bees, Economic Importance 4.3 Sericulture : Types of Silkworms, Life cycle, economic importance. 4.4 Pisciculture: History ,Inland ,Marine and culture fisheries,Economic importance.	7

Reference Books:-

- 1) Chatterjee, K. D. *Parasitology (Protozoology and Helminthology)*. 13th ed., CBS Publishers & Distributors, 2019.
- 2) Kotpal, R. L. *Modern Textbook of Zoology: Vertebrates*. Rastogi Publications, 2019.
- 3) Derrickson, Bryan H., and Gerard J. Tortora. *Principles of Anatomy and Physiology*. 15th ed., John Wiley & Sons, 2017.
- 4) Shukla, G. S., and V. B. Upadhyay. *Applied and Economic Zoology*. 1st ed., Rastogi Publications, 2014.
- 5) Bardach, John E., John H. Ryther, and William O. McLarney. *Aquaculture: The Farming and Husbandry of Freshwater and Marine Organisms*. Wiley India Pvt. Ltd., 2013.
- 6) Kotpal, R. L. *Modern Textbook of Zoology: Invertebrates*. Rastogi Publications, 2012.
- 7) Guyton, Arthur C., and John E. Hall. *Textbook of Medical Physiology*. 9th ed., W. B. Saunders, 1995.
- 8) Cox, F. E. G. *Modern Parasitology: A Textbook of Parasitology*. 2nd ed., Blackwell Scientific Publications, 1993.
- 9) Jhingran, V. G. *Fish and Fisheries of India*. 3rd ed., Hindustan Publishing Corporation, 1991.
- 10) Jordan, E. L., and P. S. Verma. *Chordate Zoology*. S. Chand & Company Ltd., 1978.

Evaluation Pattern:60:40

Total Marks: 50

Internal Continuous Evaluation: 20 Marks CCE I : 10 Marks: Home assignment CCE II : 10 Marks: Short and long answer questions test/ Seminar/ Open book test/ quiz/ Case study/ book review/ Field work/ Industry visit CCE III : 10 Marks: Compulsory MCQ test Note: Best of two CCE marks will be considered	End Semester Examination:30 Marks Question-1: Solve the following questions (Five questions of 2 marks) 10 M Question-2: Attempt any two questions (Three questions of 10 marks) 20 M Question-3: Attempt any four questions (Five questions of 5 marks) 20 M Note: Conversion of 50 marks of ESE to 30 marks
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	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology		
	Yashavantrao Chavan Institute of Science, Satara		
	Board of Studies in Biotechnology		
	Programme: B.Sc.	Semester - V	
	Type : DSC P II	Marks: 50	
	Credits : 2	From: A. Y. 2026-27	
	Name of the Course: BBTP 126 Practical based on BBTT124 and BBTT 125		
Course Objectives: Student should be able to... 1) learn dissection and microscopy needed for research work in animal sciences. 2) Understand the basics of Parasitology. 3) gain practical knowledge related to Blood. 4) Study applied zoology like –Sericulture, Apiculture, Vermiculture.			
Course Outcomes: Students will be able to... 1) develop the skill in dissection and microscopy which is highly needed for any type of research work in animal sciences. 2) relate and meet Basics of Parasitology. 3) classify and compare practical knowledge related to Blood. 4) Acquire discovery in applied zoology like –Sericulture, Apiculture, Vermiculture.			
Sr. No.	Name of the Practical	Hrs	
1.	Mounting and identification of <i>Aspergillus</i> , algae	60	
2.	Enumeration of bacteria by total viable count from soil by spread plate technique and pour plate technique		
3.	Isolation of pure cultures of bacteria by four quadrant streaking method and study of colony characteristics, Gram staining & motility of <i>E.coli</i>		
4	Isolation of pure cultures of bacteria by four quadrant streaking method and study of colony characteristics <i>Staphylococcus aureus</i>		
5	Perform biochemical test for given specimen- H ₂ S production Test		
6	Perform biochemical test for given specimen- Catalase test.		
7	Classification and Identification of Non-chordates& Chordates. Non-chordates- Sycon, Hydra, Liver fluke/ Earthworm / Nereis, Cockroach, Pearl oyster/ Pila, Starfish. Chordates- Lebeo, Frog, Cobra, Alligator, Fowl and Rat		
8	Earthworm Dissection -Digestive system,		
9	Study of Plasmodium, Ascaris, Liver Fluke, Taenia- Solium		
10	Blood slide Preparation and Identification of Blood cells		

11	Blood cell count: Differential count of W. B. Cs. & R. B. Cs	
12	Preparation of Haemin Crystals.	
13	Determination of Hemoglobin	
14	Demonstration of : Beekeeping – Study of instruments	
15	Study tour–Visit to Biodiversity spot	
Reference Books:- 1) Jasrai, L. <i>Data Analysis Using SPSS</i> . New Delhi: Paperback Edition, 2020. 2) Lal, S. S. <i>Practical Zoology: Vertebrates</i> . Meerut: Rastogi Publications, 2015. 3) Scott, H. <i>Hypothesis Testing: A Visual Introduction to Statistical Significance</i> . Kindle ed., 2015. 4) Thigale, T. K., and P. G. Dixit. <i>A Textbook of Paper II for B.Sc. I</i> . Pune: NiraliPrakashan, 2003. 5) Rohatgi, Vijay K., and A. K. Md. EhsanesSaleh. <i>An Introduction to Probability and Statistics</i> . 2nd ed. New York: John Wiley & Sons, 2002. 6) Himmelman, John. <i>An Earthworm's Life</i> . Nature Upclose Series. New York: Children's Press, 2001. 7) Cochran, William G. <i>Sampling Techniques</i> . 3rd ed. New Delhi: Wiley Eastern Ltd., 1997. 8) Hardingham, Martin, and Prabhashekhar. <i>Sericulture and Silk Production</i> . London: Intermediate Technology Publications, 1995. 9) Jhingran, V. G. <i>Fish and Fisheries of India</i> . 3rd ed. New Delhi: Hindustan Publishing Corporation, 1991. 10) Meyer, Paul L. <i>Introduction to Probability and Statistical Applications</i> . Reading, MA: Addison-Wesley Publishing Company, 1970.		
Evaluation Pattern: 60:40		
Total Marks: 50		
Internal Continuous Evaluation: 20 Marks Attendance and Journal : 10 Marks Student Performance and Vivaand Viva: 10 Marks		End Semester Examination: 30 Marks) Question-1: 10 Marks Question-2: 10 Marks Question-3: 10 Marks

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	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Biotechnology	
	Programme: B.Sc.	Semester - II
	Type : DSC III	Marks: 50
	Credits : 2	From: A. Y. 2024-25
	Name of the Course: BBTT127 Biostatistics	
Course Objectives: Student should be able to... 1) understand data analysis of given samples. 2) learn the concept of correlation and regression 3) study inference about a sample based on information we get from a population 4) know the concept of statistic and its use in biological field		
Course Outcomes: Students will be able to... 1) describe 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.		
Module	Title and Contents	Hrs
Module -1:	Introduction to statistics and collection of data : 1.1 Meaning of statistics, Scope of statistics in Biological and medical sciences, 1.2 Classification of data: Primary and Secondary data, Discrete and Continuous frequency Distribution, Cumulative frequencies 1.3 Graphical representation: - Histogram and Ogive Curves	8
Module -2:	Descriptive Statistics 2.1 Measure of central tendency Mean (Definition & simple problems) 2.2 Mode, Median, Quartiles (Definition, Graphical calculation) 2.3 Measures of dispersion: Variance (Definition, simple problems) Standard deviation, Coefficient of variance, 2.4 Skewness (Definition, types of skewness , real life example), Kurtosis (Definition, types of Kurtosis, real life example)	7
Module -3:	Correlation and Regression 3.1 Concept of correlation between two variables and types of correlation, 3.2 Method of obtaining correlation (i) by scattar diagram method ii) By Karl Pearson Correlation coefficient Properties of correlation	8

	coefficient, 3.3 Concept of regression, Lines of regression coefficients and properties without proof, Examples on ungrouped data.	
Module -4:	Probability and Sampling 4.1 Definition of sample space, Outcomes, events, exhaustive events, mutually exclusive events, certain events, impossible events. 4.2 Independent events, Definition of probability, Limits of probability, Probability of complementary event, Additive law of Probability. 4.3 Simple illustrative examples, Idea of population and sample, Simple Random Sampling and Stratified Random sampling, Advantages and disadvantages of both the method, 4.4 Testing of hypothesis, Null and alternative hypothesis, types of errors, Critical region, Acceptance region, level of significance., Tests of significance: t test.	7

Reference Books:-

- 1) Legrand, Catherine. *Advanced Survival Models*. Chapman & Hall/CRC Biostatistics Series. 1st ed. Boca Raton, FL: CRC Press, 2021.
- 2) Prayag, V. R., and P. G. Dixit. *A Textbook of Paper I for B.Sc. I*. Pune: NiraliPrakashan, 2020.
- 3) Hampton, Richard E., and John E. Havel. *Introductory Biological Statistics*. 3rd ed. Long Grove, IL: Waveland Press, 2018.
- 4) Gupta, S. C., and V. K. Kapoor. *Fundamentals of Mathematical Statistics*. New Delhi: Sultan Chand & Sons, 2014.
- 5) Des Raj, and PramodChandak. *Sampling Theory*. Lexington, KY: CreateSpace Independent Publishing Platform, 2013.
- 6) Walker, Helen M., and Joseph Lev. *Elementary Statistical Methods*. 3rd rev. ed. Toronto: Holt, Rinehart and Winston of Canada Ltd., 2010.
- 7) Rohatgi, Vijay K., and A. K. Md. EhsanesSaleh. *An Introduction to Probability and Statistics*. New Delhi: Wiley India Pvt. Ltd., 2008.
- 8) Lepš, Jan, and PetrŠmilauer. *Biostatistics: An Introductory Guide for Field Biologists*. 1st ed. Cambridge: Cambridge University Press, 2000.
- 9) Cochran, William G. *Sampling Techniques*. 3rd ed. New Delhi: Wiley Eastern Ltd., 1977.
- 10) Meyer, Paul L. *Introduction to Probability and Statistical Applications*. Reading, MA: Addison-Wesley Publishing Company, 1970.

Evaluation Pattern:60:40

Total Marks: 50

Internal Continuous Evaluation: 20 Marks CCE I : 10 Marks: Home assignment CCE II : 10 Marks: Short and long answer questions test/ Seminar/ Open book test/ quiz/ Case study/ book review/ Field work/ Industry visit CCE III : 10 Marks: Compulsory MCQ test Note: Best of two CCE marks will be considered	End Semester Examination:30 Marks Question-1: Solve the following questions (Five questions of 2 marks) 10 M Question-2: Attempt any two questions (Three questions of 10 marks) 20 M Question-3: Attempt any four questions (Five questions of 5 marks) 20 M Note: Conversion of 50 marks of ESE to 30 marks
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	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology	
	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Biotechnology	
	Programme: B.Sc.	Semester - II
	Type : DSC IV	Marks: 50
	Credits : 2	From: A. Y. 2024-25
	Name of the Course: BBT 128 Cell Biology I	
Course Objectives: Student should be able to... 1) understand the importance of the cell as a structural and functional unit of life. 2) know and compare between the prokaryotic and eukaryotic system and extrapolate life to the aspect of development. 3) learn the dynamism of bio membranes indicates the dynamism of life. Its working mechanism and precision are responsible for our performance in life. 4) study the cellular mechanisms and its functioning depend on endo-membranes and structures.		
Course Outcomes: Students will be able to... 1) explain key experiments in the history of cell biology. 2) describe the structure and function of membranes, especially the phospholipid bilayer. 3) identify membrane-bound organelles found in eukaryotic and Prokaryotic cell cells. 4) interpret and explain the structure and function of membranes.		
Module	Title and Contents	Hrs
Module -1:	Introduction To Cell 1.1 Cell Theory, Types of Cell: Structure and function of Prokaryotic cell (bacteria) 1.2 Structure and function of Eukaryotic cell (Plant and animal cell),Cellular Diversity: Cell structure & related functions	8
Module -2:	Cell membrane 2.1 Chemical components of biological membranes, Structure and functions of Plasma membrane, 2.2 Fluid Mosaic Model, membrane as a dynamic entity 2.3 Functions of cell membrane	7
Module -3:	Cell Organelle 3.1 Structure, components and function of: Nucleus: Structure of Nucleus, Nuclear envelope, Nuclear pore complex, Nucleoplasm, Nucleolus and function, 3.2 Ultrastructure and function of Mitochondria , Chloroplast, Peroxisomes	8
Module -4:	Endomembrane system: 4.1 Structure, location and Functions of Endoplasmic reticulum, Lysosomes , Golgi	7

	Bodies, vacuoles 4.2 Cytoskeleton: Microtubules, Microfilaments, Intermediate filaments	
Reference Books:- 1) Cooper, Geoffrey M., and Robert E. Hausman. <i>The Cell: A Molecular Approach</i> . 6th ed. Sunderland, MA: Sinauer Associates; Washington, DC: ASM Press, 2013. 2) Lodish, Harvey, Arnold Berk, Chris A. Kaiser, Monty Krieger, Anthony Bretscher, Hidde Ploegh, Angelika Amon, and Matthew P. Scott. <i>Molecular Cell Biology</i> . 7th ed. New York: W. H. Freeman and Company, 2012. 3) Karp, Gerald. <i>Cell and Molecular Biology: Concepts and Experiments</i> . 6th ed. Hoboken, NJ: John Wiley & Sons, 2010. 4) Lodish, Harvey, David Baltimore, Arnold Berk, S. Lawrence Zipursky, Paul Matsudaira, and James Darnell. <i>Molecular Cell Biology</i> . 5th ed. New York: W. H. Freeman and Company, 2010. 5) Becker, Wayne M., Lewis J. Kleinsmith, Jeff Hardin, and Gregory Paul Bertoni. <i>The World of the Cell</i> . 7th ed. San Francisco: Pearson Benjamin Cummings, 2009. 6) Alberts, Bruce, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter. <i>Molecular Biology of the Cell</i> . 5th ed. New York: Garland Science, 2007. 7) De Robertis, Eduardo D. P., and Eduardo M. F. De Robertis. <i>Cell and Molecular Biology</i> . 8th ed. Philadelphia: Lippincott Williams & Wilkins, 2006. 8) Himmelman, John. <i>An Earthworm's Life</i> . Nature Upclose Series. New York: Children's Press, 2001. 9) Cochran, William G. <i>Sampling Techniques</i> . 3rd ed. New Delhi: Wiley Eastern Ltd., 1997. 10) Hardingham, Martin, and Prabhashekhkar. <i>Sericulture and Silk Production</i> . London: Intermediate Technology Publications, 1995.		
Evaluation Pattern:60:40		
Total Marks: 50		
Internal Continuous Evaluation: 20 Marks CCE I : 10 Marks: Home assignment CCE II : 10 Marks: Short and long answer questions test/ Seminar/ Open book test/ quiz/ Case study/ book review/ Field work/ Industry visit CCE III : 10 Marks: Compulsory MCQ test Note: Best of two CCE marks will be considered	End Semester Examination:30 Marks Question-1: Solve the following questions (Five questions of 2 marks) 10 M Question-2: Attempt any two questions (Three questions of 10 marks) 20 M Question-3: Attempt any four questions (Five questions of 5 marks) 20 M Note: Conversion of 50 marks of ESE to 30 marks	

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	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Biotechnology	
	Programme: B.Sc.	Semester - II
	Type : DSC P II	Marks: 50
	Credits : 2	From: A. Y. 2024-25
	Name of the Course: BBTP 129 Practical based on BBTT127 and BBTT 128	
Course Objectives: Student should be able to... 1) learn basic statistical tools and their biological applications. 2) understand data analysis using graphical and inferential methods. 3) studybasic microbiological and cell biology techniques. 4) know skills in fungal isolation, characterization, and microscopic observation.		
Course Outcomes: Students will be able to... 1) analyse biological data using frequency distribution, central tendency, dispersion, correlation, regression, and statistical tests. 2) apply probability concepts and interpret statistical results using software tools. 3) perform cell counting, viability assessment, and microscopic visualization of cells and organelles. 4) isolate, purify, characterize fungi, and study fungal structures and spore germination.		
Sr. No.	Name of the Practical	Hrs
1.	Frequency distribution – Graphical, Histogram, ogive curve [less & greater than]	60
2.	Measures of central tendency (Grouped and Ungrouped) A. M., Median, Mode.	
3.	Measures of Dispersion	
4	Correlation in between given data.(KarlPearson’s,spearman’s/Scattered diagram R software)	
5	Equation of Regression lines	
6	Test based on TF and Chi square test	
7	Application of probability	
8	Cell Counting and viability from given sample	
9	Isolation of fungus from soil	
10	Purification and characterisation of fungal body	
11	Staining and visualization of mitochondria by janus green stain	
12	Visualization of plant cell	
13	Visualization of animal cell	
14	Study of fruiting body of fungi/conoidal structure	

15	Study of fungal spore germination	
Reference Books:- 1) Thigale, T. K., and P. G. Dixit. <i>A Textbook of Paper II for B.Sc. I</i>. NiraliPrakashan, 2003. 2) Rohatgi, Vijay K., and A. K. Md. EhsanesSaleh. <i>An Introduction to Probability and Statistics</i>. 2nd ed., John Wiley & Sons, 2002. 3) Himmelman, John. <i>An Earthworm's Life</i>. Nature Up Close Series, Children's Press, 2001. 4) Cochran, William G. <i>Sampling Techniques</i>. 3rd ed., Wiley Eastern Ltd., 1997. 5) Hardingham, Martin, and Prabhashekhar. <i>Sericulture and Silk Production</i>. Intermediate Technology Publications, 1995. 6) Freshney, R. Ian. <i>Culture of Animal Cells: A Manual of Basic Technique</i>. 2nd ed., Alan R. Liss, 1987. 7) Berlin, Jerry D. <i>Cell Biology Laboratory Manual</i>. Kendall/Hunt Publishing Company, 1987. 8) Pearse, A. G. E. <i>Histochemistry: Theoretical and Applied</i>. 3rd ed., Churchill Livingstone, 1968. 9) Meyer, Paul L. <i>Introduction to Probability and Statistical Applications</i>. Addison-Wesley Publishing Company, 1970. 10) Walker, Helen M., and Joseph Lev. <i>Elementary Statistical Methods</i>. Henry Holt and Company, 1958.		
Evaluation Pattern:60:40		
Total Marks: 50		
Internal Continuous Evaluation: 20 Marks Attendance and Journal : 10 Marks Student Performance and Viva: 10 Marks		End Semester Examination: 30Marks Question-1: 10 Marks Question-2: 10 Marks Question-3: 10 Marks



Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Interdisciplinary Studies

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Humanities

Programme: B.Sc.

Semester – II

Type: Open Elective Course

Marks: 50

Credits: 2

From: A. Y. 2025-26

Name of the Course: BBTTOE 1 Agricultural Economics II

Course Objectives: Students should be able to.....

1. introduce the concepts, scope, and objectives of farm management and efficient utilization of farm resources.
2. develop an understanding of the economic principles and decision-making processes in farm management.
3. familiarize students with the nature and types of agricultural risks affecting farm enterprises.
4. provide knowledge of risk management strategies and agricultural insurance schemes for sustainable farming.

Course Outcomes: Students will be able to.....

1. explain the concepts, objectives, and resource management practices in farm management.
2. apply the principles of farm management for efficient farm planning and decision-making.
3. analyze different types of agricultural risks and their impact on farm productivity and income.
4. evaluate agricultural risk management strategies and insurance schemes for mitigating farm risks.

Module	Title and Contents	Hrs
Module -1:	Economics of Farm Management 1.1 Farm management: Scope, Objectives 1.2 Farm management decisions 1.3 Types of Farming- Farm Size and Productivity – Farm Efficiency Measures 1.4 Management of farm Resources: Land, Labour and Capital.	08
Module -2:	Principles of Farm Management 2.1 Principles of farm management: Principles of Factor Substitution 2.2 Principles of Equi-Marginal Returns – Opportunity Cost Principle 2.3 Minimum Loss Principle – Principle of Comparative Advantage 2.4 Time Comparison Principle	07
Module -3:	Agricultural Risk 3.1 Nature of Uncertainty in Agriculture: Price, Yield and Technology. 3.2 Risks in Agriculture 3.3 Types of Risks: Climate, Drought, Production, Price, Financial	08

	3.4 Market & Management Strategy	
Module -4:	Risk Management Strategies 4.1 Risk Management Strategies: National Agricultural Insurance Scheme (NAIS), Pradhan Mantri Fisal Bima Yojana 4.2 Crop Insurance as Risk Mitigation Tool 4.3 Crop Insurance, Weather Insurance 4.4 Farm Income Insurance, Livestock Insurance and Package Insurance	07

Reference Books:

1. Gardner, Bruce L., and Gordon C. Rausser, eds. Handbook of Agricultural Economics. Vol. 1. Elsevier, 2001.
2. Knutson, Ronald D., James L. Outlaw, and H. L. “Drew” Anderson. Agricultural Economics: Concepts, Issues, and Policy. Wiley, 2011.
3. Singh, K. R. Indian Agriculture: A Sectoral Analysis. ICFAI University Press, 2007.
4. Sharma, Ramesh Chand, and P. K. Joshi. Indian Agriculture: Performance and Policies. Academic Foundation, 2007.
5. Dantwala, M. L., and P. R. Brahmananda. Agricultural Development in India Since Independence. Oxford University Press, 1996.

Evaluation Pattern: (60:40)

Total Marks: 50

Internal Continuous Evaluation: 20 Marks CCE I : 10 Marks: Home assignment CCE II : 10 Marks: Short and long answer questions test/ Seminar/ Open book test/ quiz/ Case study/ book review/ Field work/ Industry visit CCE III : 10 Marks: Compulsory MCQ test Note: Best of two CCE marks will be considered	End Semester Examination:30 Marks Question-1: Solve the following questions (Five questions of 2 marks) 10 M Question-2: Attempt any two questions (Three questions of 10 marks) 20 M Question-3: Attempt any four questions (Five questions of 5 marks) 20 M Note: Conversion of 50 marks of ESE to 30 marks
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	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology	
	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Biotechnology	
	Programme: B.Sc.	Semester - II
	Type : VEC	Marks: 50
	Credits : 2	From: A. Y. 2024-25
	Name of the Course: BBTVEC 1 Democracy, Election and Indian Constitution	
Course Objectives: Student should be able to... 1) define the concept of democracy and explain its importance. 2) know the election procedure followed in India. 3) understand the philosophy and principles of the Constitution of India. 4) learn the Fundamental Rights and Duties of Indian citizens.		
Course Outcomes: Students will be able to... 1) define the concept, features, and dimensions of democracy in India. 2) explain the election process, local governance institutions, and responsibilities of citizens. 3) describe the philosophy, values, and objectives of the Indian Constitution. 4) identify fundamental rights and duties of Indian citizens and their importance in democracy.		
Module	Title and Contents	Hrs
Module -1:	Democracy in India 1.1 Introduction: Meaning, Definition of democracy 1.2 Classification: Direct democracy and representative democracy, features of direct and representative democracy 1.3 Dimensions of Democracy: Social, Economic and Political Decentralization: Grassroots Level Democracy	8
Module -2:	Election 2.1 73 rd and 74 th Constitutional Amendment Acts: Institutions at the local level and Role of State Election commission 2.2 Local Body Elections: Urban & Rural 2.3 Duties of an Individual toward select oral process	8
Module -3:	Philosophy Of The Indian Constitution 3.1 Constitutional History of India, Role of Dr. B. R. Ambedkar in Constituent Assembly 3.2 Preamble-Source and Objects, Sovereign and Republic, Socialist and Secular, Democratic-Social and Economic Democracy 3.3 Justice-Social, Economic and Political, Liberty-Thought, Expression, Belief, Faith and Worship	7

	3.4 Equality-Status and Opportunity, Fraternity, Human Dignity, Unity and Integrity of the Nation	
Module -4:	Fundamental Rights and Duties 4.1 Fundamental Rights :Right to Equality, Freedom, Protection against Exploitation, Freedom of Religion, Cultural and Educational Rights, and Right to Constitutional Remedies. 4.2 Fundamental Duties: Respect for the Constitution and national ideals, protection of the nation and heritage, promotion of scientific temper and humanism, safeguarding public property, avoiding violence, and striving for excellence.	7
Reference Books:- 1) Ambedkar, B. R. The Constitution of India. New Delhi: Government of India Press, 1950. 2) Basu, Durga Das. Introduction to the Constitution of India. Calcutta: S. C. Sarkar & Sons, 1960. 3) Austin, Granville. The Indian Constitution: Cornerstone of a Nation. Oxford: Clarendon Press, 1966. 4) Ghai, Yash. The Rule of Law, Legitimacy and Governance in India. New Delhi: Oxford University Press, 1997. 5) Kashyap, Subhash C. Our Constitution: An Introduction to India's Constitution and Constitutional Law. New Delhi: National Book Trust, 1999. 6) Laxmikanth, M. Indian Polity. New Delhi: McGraw Hill Education, 2014. 7) Dutta, Prabhat. Democracy and Decentralization in India. New Delhi: Concept Publishing Company, 2014. 8) Choudhry, Sujit, MadhavKhosla, and PratapBhanu Mehta, eds. The Oxford Handbook of the Indian Constitution. New Delhi: Oxford University Press, 2016. 9) Jayal, NirajaGopal. Citizenship and Its Discontents: An Indian History. Cambridge: Harvard University Press, 2018. 10) Fadia, B. L., and KuldeepFadia. Indian Government and Politics. New Delhi: SahityaBhawan Publications, 2022.		
Evaluation Pattern:60:40		
Total Marks: 50		
Internal Continuous Evaluation: 20 Marks CCE I : 10 Marks: Home assignment CCE II : 10 Marks: Short and long answer questions test/ Seminar/ Open book test/ quiz/ Case study/ book review/ Field work/ Industry visit CCE III : 10 Marks: Compulsory MCQ test Note: Best of two CCE marks will be considered	End Semester Examination:30 Marks Question-1: Solve the following questions (Five questions of 2 marks) 10 M Question-2: Attempt any two questions (Three questions of 10 marks) 20 M Question-3: Attempt any four questions (Five questions of 5 marks) 20 M Note: Conversion of 50 marks of ESE to 30 marks	