



Karmaveer Bhaurao Patil University, Satara

(A State public university Est. u/s 3(6) of MPUA 2016)

Syllabus for B. Sc. II Biotechnology

**Under
Faculty of Science and Technology**

(As per NEP 2020)

With Effect From Academic Year 2025-2026

Syllabus for Bachelor of Science (B.Sc.) Part-II 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 academic and industrial exposure simultaneously. Introduction of life science subjects will help to form a basic foundation of concepts for students. The interdisciplinary approach with vigor and depth is compatible to the syllabi of other universities, and 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 suit 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) Appropriate to peruse post graduate study in abroad
- 4) Authorized to appear for the examination for a job in the government sector.

PROGRAMSPECIFIC 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.

PROGRAMSPECIFIC 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) Perform job in various fields like food, pharmaceutical, agriculture, healthcare, public services and business etc.

DURATION: One Year

PATTERN: Semester wise

MEDIUM OF INSTRUCTION: English

ELIGIBILITY OF STUDENTS: B.Sc. I Passed

NUMBER OF STUDENTS: A batch shall consist of 40 students. An additional 20% of seats will be allotted as per Karmaveer Bhaurao Patil University, Satara Norms.

ELIGIBILITY OF THE CORE FACULTY: The eligibility of the faculty shall be as per the university grants 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 EXITS POINT

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	5.5	UG Diploma (Biotechnology)
3	Sem. V & VI	2028-29	3 Year	44	6.5	UG Degree (Biotechnology)
4	Sem VII & VIII	2029-30	4 Year	44	6.0	UG Honors Degree/ Honors with research (Biotechnology)
			Total	176		Bachelor of Science (Biotechnology)

STRUCTURE OF COURSE: CREDIT DISTRIBUTION

Sem (Level)	Courses		OE	VSC/ SEC	AEC/ VEC/ IKS	OJT/ FP/ CEP/ CC/ RP	Total credit
	Course I	Course II					
SEM III (5.0)	DSC V (2) DSC VI (2) DSC P III (2)	DSC V (2) DSC VI (2) DSC P III (2)	OE III (2)	VSC I (2) P SEC I (2) P	AEC I(2) ENGLISH IKS (2)	-	22
SEM IV (5.5)	DSC VII (2) DSC VIII (2) DSC P IV (2)	DSC VII (2) DSC VIII (2) DSC P IV (2)	OE IV (2)	VSC II (2) P SEC II (2) P	AEC I(2) ENGLISH IKS (2)	-	22
Credits	12	12	04	08	08	-	44

Note: DSC: Discipline Specific Course, VSC:-Vocational Skill Courses, SEC:-Skill Enhancement Course, AEC:-Ability Enhancement Course, IKS: Indian knowledge system, OE : open elective

STRUCTURE OF COURSE BSC II AS PER NEP 2020 (2.0)

Semester III			
Course	Course Code	Name of the paper	Credits
Course I	BBTT 231	Molecular Biology	2
	BBTT 232	Metabolic Pathways	2
	BBTP 233	Laboratory exercise based on Molecular Biology and Metabolic pathways	2
Course II	BBTT 234	Developmental Biology	2
	BBTT 235	Cell Biology II	2
	BBTP 236	Laboratory exercise based on Developmental Biology and Cell Biology	2
OE	BBTPOE 3	Artificial Intelligence Studies	2
VSC	BBTPVSC 1	Laboratory exercise in Basics of Biotechnology in Nursery Management	2
SEC I	BBTPSEC1	Laboratory exercise based on Advances in Hydroponics	2
AEC	BBTTAEC 1	English for Communication I & English for Communication II	2
VEC	BBTTIKS 2	Indian Health Sciences IKSII	2
		Total Credits	22

Semester IV			
Course	Course Code	Name of the paper	Credits
Course I	BBTT 241	Plant Tissue Culture	2
	BBTT 242	Plant Physiology & Biochemistry	2
	BBTP 243	Laboratory exercise based on Plant Tissue Culture & Plant Physiology & Biochemistry	2
Course II	BBTT 244	Genetics	2
	BBTT 245	Immunology	2
	BBTP 246	Laboratory exercise based on Genetics & Immunology	2
OE	BBTPO E IV	Defence studies	2
VSC	BBTPVS II	Laboratory exercise based on Tools and Techniques of Biotechnology in Nursery Management	2
SEC II	BBTPSEC II	Laboratory exercise based on Applications in Hydroponics	2
AEC	BBTTAEC II	English for Communication III & English for Communication IV	2
VEC	BBTTVEC II	Environmental Awareness for Biotechnologist	2
		Total Credits	22

EVALUATION STRUCTURE

Semester III

Course	Course Category	Course Code	Internal Evaluation (Best two CCE out of three)			ESE	Total Marks	Credits
			CCE-I	CCE-II	CCE-III			
Major	T	BBTT 231	10	10	10	30	50	02
	T	BBTT 222	10	10	10	30	50	02
	P	BBTP 233	20			30	50	02
Minor	T	BBTT 234	10	10	10	30	50	02
	T	BBTT 235	10	10	10	30	50	02
	P	BBTP 236	20 (student performance and attendance, journal, viva)			30	50	02
OE	P	BBTPOE 3	20			30	50	02
VSC	P	BBTPVSC 1	20			30	50	02
SEC	P	BBTPSEC 1	20			30	50	02
AEC I	T	BBTTAEC 1	10	10	10	30	50	02
IKS II	T	BBTTIKS 2	10	10	10	30	50	02
Total							550	22

Semester IV

Course	Course Category	Course Code	Internal Evaluation(Best two CCE out of three)			ESE	Total Marks	Credits
			CCE-I	CCE-II	CCE-III			
Major	T	BBTT 241	10	10	10	30	50	02
	T	BBTT 242	10	10	10	30	50	02
	P	BBTP 243	20			30	50	02
Minor	T	BBTT 244	10	10	10	30	50	02
	T	BBTT 245	10	10	10	30	50	02
	P	BBTP 246	20 (student performance and attendance, journal, viva)			30	50	02
OE	P	BBTPOE 4	20			30	50	02
VSC	P	BBTPVSC 2	20			30	50	02
SEC	P	BBTPSEC 2	20			30	50	02
AEC II	T	BBTTAEC 2	10	10	10	30	50	02
VEC II	T	BBTTVEC 2	10	10	10	30	50	02
Total							550	22

OTHER FEATURES:

A) LIBRARY:

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

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

B) EQUIPMENT:

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. MiniCentrifuge Remi
25. Mixer
26. pH Meter
27. Refractometer
28. Refrigerator
29. Rotary Shaker
30. Sonicator Waterbath



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Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Biotechnology

Programme: B.Sc.

Semester - III

Type : DSC V

Marks: 50

Credits : 2

From: A. Y. 2025-26

Name of the Course : BBT 231 Molecular Biology

Course Objectives: Students should be able to...

- 1) explain the origin, structure DNA and RNA.
- 2) examine the DNA replication and repair
- 3) understand process of synthesis of RNA
- 4) learn concept of synthesis of protein

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

- 1) explain History of DNA and RNA
- 2) analyze the mechanisms involved in DNA replication and DNA repair.
- 3) describe the process of transcription and its role in gene expression.
- 4) interpret the mechanism of protein synthesis and its role in cellular function.

Module	Title and Contents	Hrs.
Module -1:	Experimental Evidences for DNA 1.1 Experimental evidences for DNA as a genetic material: Griffith's Exp. 1.2 Avery, Macleod McCarty Exp., Blender Exp. 1.3 RNA as a genetic material. (Gierer and Schram expt.)	07
Module -2:	DNA Replication and Repair 2.1 DNA Replication: Semi conservative model of replication (M.S Expt.) 2.2 Mechanism of DNA replication and replication model. 2.3 DNA damage and types of DNA damage in brief –Base substitution, Frameshift mutation, Chemical damage, Physical breakdown 2.4 DNA repair mechanisms and types in brief - Excision repair, 2.5 Mismatch repair, SOS repair, Photo reactivation, Recombination repair	08
Module -3:	Transcription and Regulation of Gene Expression 3.1 RNA polymerase, Transcription (Initiation, Elongation, termination) 3.2 Post transcriptional Modification - Capping, splicing, and RNA editing, polyadenylation 3.3 Developmental and environmental regulation of gene expression: i) Lac operon ii) Tryptophan operon 3.4 Regulation of gene expression: Promoter, Enhancers, Activators, Repressor, Co repressors	08

Module -4:	Translation 4.1 Genetic Code Triplet nature, Salient feature of genetic code, 4.2 Decipheration of genetic code - Methods of assignment of codons with Unknown sequences and known sequences 4.3 Technique Wobble Hypothesis. 4.4 Translation in prokaryote and Eukaryote Structure and role of ribosome in translation	07
Reference Books:- 1) Nadeem, Asif, Faiz-ul Hassan, and Maryam Javed. <i>Introduction to Molecular Genomics</i> . Bentham Science Publishers, 2021. 2) Craig, Neil, Rachel Green, Carol Greider, and Oliver Cohen. <i>Molecular Biology: Principles of Genome Function</i> . 2nd ed. Oxford University Press, 2014. 3) Lewin, Benjamin. <i>Genes XI</i> . 11th ed. Jones & Bartlett Inc., 2012. 4) Tropp, Burton E. <i>Molecular Biology: Genes to Proteins</i> . 4th ed. Jones & Bartlett Learning, 2011. 5) Weaver, Robert. <i>Molecular Biology</i> . 5th ed. McGraw-Hill Science, 2011. 6) Wilson, Keith, and John Walker, eds. <i>Principles and Techniques of Biochemistry and Molecular Biology</i> . 7th ed. Cambridge University Press, 2010. 7) Pal, Jayanta K., and Saroj S. Ghaskadbi. <i>Fundamentals of Molecular Biology</i> . Oxford University Press, 2009. 8) Watson, James D., Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, and Richard Losick. <i>Molecular Biology of the Gene</i> . 6th ed. Pearson Education Inc. and Dorling Kindersley Publishing Inc., 2008. 9) Twyman, Richard M., and William Wisden. <i>Advanced Molecular Biology: A Concise Reference</i> . BIOS Scientific, 1998. 10) Brown, T. A. <i>Essential Molecular Biology: Volume I</i> . IRL Press, Oxford, 1995.		
Evaluation Pattern 60:40		
Total Marks: 50		
Internal Evaluation: 20 Marks CCE-I : Home Assignment : 10 Marks CCE –II : Short and long answer questions test/Seminar/ Open book test / Quiz / Case study / Book review / Field work / Industry visit: 10 Marks CCE – III MCQ Test : 10 Marks (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 Marks Question -2 –Attempt any two questions (three question of 10 marks) 20 Marks Question -3 – Attempt nay four questions (five questions of 5 marks) 20 Marks Note : Conversion of 50 marks of ESE to 30 marks	



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Faculty of Science and Technology

Yashavantrao Chavan Institute of Science Satara

Board of Studies in Biotechnology

Programme: B.Sc.

Semester - III

Type : DSC VI

Marks: 50

Credits : 2

From: A. Y. 2025-26

Name of the Course : BBTT 232 Metabolic Pathways

Course Objectives: Students should be able to...

- 1) explain the fundamental principles and significance of metabolism..
- 2) differentiate the various types of metabolism and the methods used to study metabolic processes..
- 3) understand the concepts of metabolism of Biomolecules.
- 4) analyze metabolic pathways, their regulation, and associated bioenergetics.

Course Outcomes: Students will be able to...

- 1) explain the principles and different types of metabolism.
- 2) describe the parameters and experimental approaches used to study metabolism.
- 3) illustrate the biosynthetic pathways of lipids, carbohydrates, and hormones.
- 4) analyse the regulation and energetics of major metabolic pathways.

Module	Title and Contents	Hrs.
Module -1:	Metabolism 1.1 Introduction to metabolism, Anabolism & catabolism, 1.2 Catabolism & its three stages 1.3 Types of metabolic reactions 1.4 Methods employed to study metabolism (using auxotrophic mutants, radioisotopes), High energy compounds.	07
Module -2:	Carbohydrates Metabolism 2.1 Reactions and energetics of Glycolysis, TCA cycle, Glyoxylate cycle 2.2 Gluconeogenesis 2.3 Glycogenesis and Glycogenolysis 2.4 HMP and its significance.	08
Module -3:	Lipid Metabolism 3.1 Biosynthesis of fatty acid with respect to Palmitic acid 3.2 Degradation of fatty acid (β -oxidation) with respect to Palmitic acid.	07
Module -4:	Introduction to Hormones 4.1 Definition , Types as Steroid, Peptide, Amino acid 4.2 Metabolism of amino acids 4.3 Transamination reactions, Deamination, Urea cycle	08

Reference Books:-

1. Nadeem, Asif, Faiz-ul Hassan, and Maryam Javed. *Introduction to Molecular Genomics*. Bentham Science Publishers, 2021.
2. Craig, Neil, Rachel Green, Carol Greider, and Oliver Cohen. *Molecular Biology: Principles of Genome Function*. 2nd ed. Oxford University Press, 2014.
3. Lewin, Benjamin. *Genes XI*. 11th ed. Jones & Bartlett Inc., 2012.
4. Gropp, Burton E. *Molecular Biology: Genes to Proteins*. 4th ed. Jones & Bartlett Learning, 2011.
5. Weaver, Robert. *Molecular Biology*. 5th ed. McGraw-Hill Science, 2011.
6. Wilson, Keith, and John Walker, eds. *Principles and Techniques of Biochemistry and Molecular Biology*. 7th ed. Cambridge University Press, 2010.
7. Pal, Jayanta K., and Saroj S. Ghaskadbi. *Fundamentals of Molecular Biology*. Oxford University Press, 2009.
8. Watson, James D., Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, and Richard Losick. *Molecular Biology of the Gene*. 6th ed. Pearson Education Inc. and Dorling Kindersley Publishing Inc., 2008.
9. Twyman, Richard M., and William Wisden. *Advanced Molecular Biology: A Concise Reference*. BIOS Scientific, 1998.
10. Brown, T. A. *Essential Molecular Biology: Volume I*. IRL Press, Oxford, 1995.

Evaluation Pattern: 60:40**Total Marks: 50****Internal Evaluation: 20 Marks**

CCE-I : Home Assignment : 10 Marks

CCE –II : Short and long answer questions
test/Seminar/ Open book test / Quiz / Case
study / Book review / Field work / Industry
visit: 10 Marks

CCE – III MCQ Test : 10 Marks

**(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 Marks

Question -2 – Attempt any two questions (three question of 10 marks) 20 Marks

Question -3 – Attempt nay four questions (five questions of 5 marks) 20 Marks

Note : Conversion of 50 marks of ESE to 30 marks



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Faculty of Science and Technology

Yashavantrao Chavan Institute of Science Satara

Board of Studies in Biotechnology

Programme: B.Sc.

B. Sc. II, Semester - III

Type : DSC P III

Marks: 50

Credits : 2

From: A. Y. 2025-26

Name of the Course : BBTP 233 - Lab exercise based on Molecular Biology & Metabolic Pathways

Course Objectives: Student should be able to...

- 1) analyze experimental systems required in biochemical research.
- 2) learn techniques used to purification of biomolecules.
- 3) know how to use the instruments.
- 4) update with analysis methods

Course Outcomes: Students will be able to...

- 1) analyze biomolecules with techniques used in laboratories.
- 2) examine various biochemical methods to study biomolecules.
- 3) apply knowledge of instruments for molecular study.
- 4) examine biomolecules with different methods.

Sr. No.	Name of the Practical (Any fifteen)	Hrs.
1.	Preparation of chemicals required in molecular biology laboratory.	60
2.	To perform Restriction digestion of DNA /Plasmid	
3.	To isolate bacterial genomic DNA	
4.	To isolate Eukaryotic DNA from- Plant Material	
5.	To isolate Eukaryotic DNA from	
6.	Qualitative analysis of DNA by agarose gel electrophoresis	
7.	Quantification of Genetic material	
8.	Isolation of RNA from animal tissue.	
9.	Plasmid isolation byalkaline lysis methods.	
10.	To determine the melting temperature of DNA.	
11.	Paper chromatographic separation of amino acids from mixture.	
12.	Paper chromatographic identification of amino acids byusing RF value.	
13.	Paper chromatographic separation of sugars from binary mixture.	
14.	Study of column packaging by using gel beads.	
15.	Perform gel filtration chromatography.	
16.	Estimation of nitrate reductase enzyme activity.	
17.	Study of lipase activity.	
18.	Immobilization of baker's yeast cells bygel entrapment method.	
19.	Study of invertase activity byusing immobilized yeast cells.	
20.	Study of carcinogen signs and symbols.	

Reference Books:-

1. adasivam, S., and A. Manickam. *Biochemical Methods*. 3rd ed. New Delhi: New Age International Publishers, 2018.
2. Plummer, David. *An Introduction to Practical Biochemistry*. 3rd ed. New Delhi: McGraw Hill Education, 2017.
3. Watson, James D., Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, and Richard Losick. *Molecular Biology of the Gene*. 7th ed. Noida: Pearson Education, 2017.
4. Sawhney, S. K., and Randir Singh. *Introductory Practical Biochemistry*. 1st ed. New Delhi: Alpha Science International Ltd., 2015.
5. Rajgopal, and Toora. *Practical Biochemistry*. 3rd ed. New Delhi: Ahuja Publishing House, 2014.
6. Deb, A. C. *Viva and Practical Biochemistry*. 1st ed. Kolkata: New Central Book Agency (P) Ltd., 2013.
7. Jayaraman, J. *Laboratory Manual in Biochemistry*. 2nd ed. New Delhi: New Age International Publishers, 2011.
8. Swamy, P. M. *Laboratory Manual on Biotechnology*. 1st ed. New Delhi: Rastogi Publications, 2008.
9. Harisha, S. *Biotechnology Procedures and Experiments Handbook*. 1st ed. New Delhi: Laxmi Publications, 2008.
10. Brown, T. A. *Essential Molecular Biology*. Vol. 1. Oxford: IRL Press, 1995.

Evaluation Pattern 60:40**Total Marks: 50****Internal Evaluation: 20 Marks**

Journal : 10 Marks

Students Performance : 05Marks

Viva : 05 Marks

End Semester Examination:30 Marks

Question I: 10 Marks

Question II: 10 Marks

Question III: 10 Marks

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	Board of Studies in Biotechnology	
	Programme: B.Sc.	B. Sc. II, Semester - III
Type : DSC V	Marks: 50	
Credits : 2	From: A. Y. 2025-26	
Name of the Course : BBTT 234 Developmental Biology		
Course Objectives: Students should be able to... 1) study the concepts of plant and animal embryology. 2) understand different developmental stages in plants and animals. 3) imbibe the concept of animal embryology. 4) learn the concept of Differentiation and Regeneration.		
Course Outcomes: Students will be able to... 1) explain the concept of plant embryology. 2) describe the different developmental stages in plants and animals. 3) discuss the concept of animal embryology with reference to chick. 4) analyze differentiation and Regeneration in plants and animals.		
Module	Title and Contents	Hrs.
Module -1:	Plant Embryology 1.1 Gametogenesis and Fertilization in plants: Introduction of Development of male and female Gametophyte, Gametogenesis in Plants, Development of male and female Gametophyte, Process of fertilization in Angiosperms. 1.2 Development of Embryo and Endosperm: Development of embryo and endosperm, Types of endosperm in Angiosperm 1.3 Apomixis : Introduction, Definition, Types 1.4 Polyembryony: Introduction, Definition, Types	07
Module -2:	Pollen Germination and Meristem organization 2.1 Introduction of pollen germination: Pollen germination Pollen germination, factors affecting. 2.2 Self-incompatibility: Definition, types and its genetic control. 2.3 Plant Meristem: Plant Meristem- organization and differentiation, Organization of shoot apical Meristem, Organization of root apical Meristem.	08
Module -3:	Animal Embryology 3.1 Structure of gametes Gametogenesis in animals, 3.2 Fertilization in animals. 3.3 Early development in animals: Types and patterns of cleavages in animals, Blastulation, gastrulation in chick up-to the Formation of three germ layers 3.4 Embryonic induction, fetal membrane, Types and significance of placenta.	07
Module -4:	Differentiation and Regeneration 4.1 Differentiation: Differentiation, Dedifferentiation 4.2 Redifferentiation, Commitment 4.3 Tran’s differentiation, Developmental Plasticity. 4.4 Regeneration: Definition, mechanism, factors affecting regeneration.	08

Reference Books:-

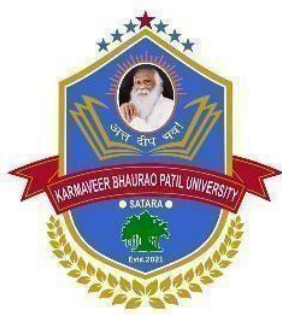
- 1) Arumugam, N. *Developmental Biology*. 1st ed. Chennai: Saras Publications, 2019.
- 2) Bhojwani, S. S., and S. P. Bhatnagar. *The Embryology of Angiosperms*. 2nd ed. New Delhi: Vikas Publishing House, 2018.
- 3) Subramanyam, S. *Textbook of Bryophytes, Pteridophytes, Gymnosperms, and Paleobotany*. New Delhi: I.K. International Publishing House, 2013.
- 4) Maheswari, P. *An Introduction to the Embryology of Angiosperms*. 2nd ed. Nabu Press, 2011.
- 5) Patten, B. M., and B. M. Carlson. *Foundations of Embryology*. 6th ed. New York: McGraw-Hill, 2003.
- 6) Gilbert, S. F. *Developmental Biology*. 6th ed. Sunderland, MA: Sinauer Associates, 2001.
- 7) Verma, P. S., and V. K. Agarwal. *Developmental Biology*. 2nd ed. New Delhi: S. Chand & Company, 2000.
- 8) Twyman, R. *Instant Notes in Developmental Biology*. 1st ed. London: Taylor & Francis, 2000.
- 9) Pandey, S. N., and A. Chadha. *Plant Anatomy and Embryology*. 1st ed. New Delhi: Vikas Publishing House, 1997.
- 10) Arnold, E., and E. Cutter. *Plant Anatomy*. 1970.

Evaluation Pattern 60:40**Total Marks: 50****Internal Evaluation: 20 Marks**

CCE-I : Home Assignment : 10 Marks
CCE –II : Short and long answer questions
test/Seminar/ Open book test / Quiz / Case
study / Book review / Field work / Industry
visit: 10 Marks
CCE – III MCQ Test : 10 Marks
(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 Marks
Question -2 –Attempt any two questions (three question of 10 marks) 20 Marks
Question -3 – Attempt nay four questions (five questions of 5 marks) 20 Marks
Note : Conversion of 50 marks of ESE to 30 marks



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Faculty of Science and Technology

Yashavantrao Chavan Institute of Science Satara

Board of Studies in Biotechnology

Programme: B.Sc. II

Semester - III

Type : DSC VI

Marks: 50

Credits : 2

From: A. Y. 2025-26

Name of the Course: BBTT 235 Cell Biology II

Course Objectives: Students should be able to...

- 1) understand the concept of cell signaling.
- 2) learn how proteins are transported to the various organelles.
- 3) study of cell cycle and their control.
- 4) explain the concept of membrane transport.

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

- 1) discuss principles and transduction pathways of cell signaling and cell surface receptor proteins.
- 2) explain secretory pathways and transport of proteins into various organelles.
- 3) illustrate cell cycle, cell division and cellular events.
- 4) study phases of cell division, Cancer cells, and tumor suppressor genes.

Module	Title and Contents	Hrs.
Module -1:	Membrane Transport And Its Types 1.1 Cell, cell membrane, Passive transport- simple diffusion, facilitated diffusion, osmosis. 1.2 Active transport- primary and secondary transport, Sodium potassium pump, Calcium pump, ATPase pump. 1.3 Bulk transport -endocytosis and exocytosis, pinocytosis.	07
Module -2:	Cell Division Cycle 2.1 Introduction, definition, phases of cell cycle. Control of cell cycle and its checkpoints 2.2 Molecular events of cell cycle- CDK and cyclins, s-phase, CDK cyclins Complex, M-phase CDK cyclins complex, anaphase promoting complex. 2.3 Programmed cell death, Necrosis	08
Module -3:	Cell Signaling 3.1 Introduction Types of cell signaling-contact dependent signaling, autocrine, paracrine, synaptic, endocrine, gap junctions, combinatorial signaling, 3.2 Secondary Messengers 3.3 Cell surface receptor proteins, Ion channel linked receptors, G-protein linked receptors, and enzyme linked receptors. 3.4 Signaling through G-protein linked receptors - IP3 and DAG Pathway	07
Module -4:	Secretory Pathway and Protein Trafficking 4.1 Secretary pathway 4.2 ER associated ribosomal translation Co-translational transport of nascent polypeptide chain to ER lumen.	08

	4.3 Transport of proteins to- mitochondria, chloroplast, peroxisomes, nucleus, Golgi apparatus	
Reference Books:- 1. Berg, Jeremy M., John L. Tymoczko, and Lubert Stryer. <i>Biochemistry</i>. 8th ed. New York: W. H. Freeman, 2015. 2. Karp, G. <i>Cell Biology</i>. 7th ed. Hoboken, NJ: Wiley, 2013. 3. Levin, B. <i>Gene XI</i>. 7th–11th ed. Jones & Bartlett Inc., 2012. 4. Lodish, Harvey, Arnold Berk, Chris A. Kaiser, Monty Krieger, Matthew P. Scott, and Alexander J. Lewis. <i>Molecular Cell Biology</i>. 7th ed. New York: W. H. Freeman, 2012. 5. Michal, Gerhard, and Dietmar Schomburg. <i>Biochemical Pathways: An Atlas of Biochemistry and Molecular Biology</i>. 2nd ed. Hoboken, NJ: Wiley, 2012. 6. Powar, C. B. <i>Cell Biology</i>. 3rd ed. Mumbai: Himalaya Publishing House, 2010. 7. Alberts, Bruce, Alexander Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Roberts, and Peter Walter. <i>Molecular Biology of the Cell</i>. 5th ed. New York: Garland Science, 2008. 8. Verma, P. S., and V. K. Agarwal. <i>Cell Biology, Genetics, Molecular Biology</i>. Reprint ed. New Delhi: S. Chand & Company, 2006. 9. Salway, J. G. <i>Metabolism at a Glance</i>. 3rd ed. Oxford: Wiley-Blackwell, 2004. 10. Alberts, Bruce, Alexander Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Roberts, and Peter Walter. <i>Molecular Biology of the Cell</i>. 5th ed. New York: Garland Science, 2002		
Evaluation Pattern 60:40		
Total Marks: 50		
Internal Evaluation: 20 Marks CCE-I : Home Assignment : 10 Marks CCE –II : Short and long answer questions test/Seminar/ Open book test / Quiz / Case study / Book review / Field work / Industry visit: 10 Marks CCE – III MCQ Test : 10 Marks (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 Marks Question -2 –Attempt any two questions (three question of 10 marks) 20 Marks Question -3 – Attempt nay four questions (five questions of 5 marks) 20 Marks 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. II

B. Sc. II, Semester - III

Type : DSC P III

Marks: 50

Credits : 2

From: A. Y. 2025-26

Name of the Course : BBTP 236 - Laboratory exercises in Developmental Biology and Cell Biology

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

- 1) study the concept of plant and animal embryology.
- 2) understand different developmental stages in plants and animals
- 3) perform pollen germination incompatibility.
- 4) study the different techniques of Membrane permeability.

Course Outcomes: Students will be able to...

- 1) explain different developmental stages in plants and animals.
- 2) describe plant and animal embryology.
- 3) apply knowledge of isolation techniques for various organelles.
- 4) demonstrate the different techniques of Membrane permeability.

Sr. No.	Name of the Practical (Any 15)	Hrs.
1.	Methods of studying plant development (a) Maceration (b) Sectioning (c) Staining (d) Mounting (e) Dissection	60
2.	Study of apices and meristem –Root apical meristem & Shoot apical meristem	
3.	Microsporogenesis : anther squash technique Development of male gametophytes & female gametophytes	
4.	Dissection of seed and excision of young embryo and endosperm (monocot and dicot).	
5.	Examination of pollen grain morphology using acetolysis method.	
6.	To study the types of placenta in animals with charts and photographs	
7.	Study of ultrastructure of Sperm and Ovum of Mammal.	
8.	Study of different types of eggs.	
9.	Study of holoblastic, meroblastic cleavage and its types with the help of Slide / Photograph / Chart / Model	
10.	Study of staging & staining of Chick embryos with whole mount slides (18h, 24h, 48h, 72h)	
11.	Measurement of size of plant cell/animal cell by micrometry	
12.	Effect of temperature on membrane permeability of cells.	
13.	Effect of organic solvent on membrane permeability of cells	
14.	Study of mitosis and preparation of slides and identification of different stages.	

15.	Study of Meiosis and preparation of slides and identification of different stages.
16.	Isolation of chloroplast.
17.	Estimation of amount of chlorophyll present in the leaf disc
18.	Isolation of nucleus.
19.	Study of methodology of cell lyses.
20.	Study of plasmolysis in leaf plant cell.

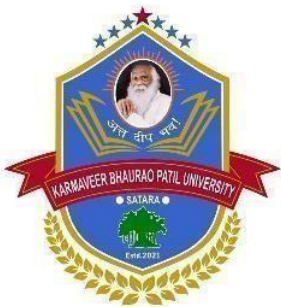
Reference Books:-

1. Maheswari, P., and Nabu. *An Introduction to the Embryology of Angiosperms*. 2nd ed. SRM University, 2011.
2. Twyman, Richard. *Instant Notes in Developmental Biology*. 1st ed. Taylor & Francis, 2000.
3. Pandey, S. N., and A. Chadha. *Plant Anatomy and Embryology*. 1st ed. New Delhi: S. Chand & Company, 1997.
4. Freshney, R. Ian. *Culture of Animal Cells: A Manual of Basic Technique*. 2nd ed. New York: A.R. Liss, 1987.
5. Freshney, R. Ian. *Culture of Animal Cells: A Manual of Basic Technique*. 2nd ed. New York: A.R. Liss, 1987.
6. Pollack, R. *Readings in Mammalian Cell Culture*. 2nd ed. Cold Spring Harbor Laboratory, 1981.
7. Crowe, R., H. Ozer, and Dr. Rifkin. *Experiments with Normal and Transformed Cells*. Cold Spring Harbor Laboratory, 1978.
8. Pollack, R., and S. Pfeiffer. *Animal Cell Culture*. 1st ed. Cold Spring Harbor Laboratory, 1971.
9. Arnold, Edward, and E. Cutter. *Plant Anatomy*. 1970.
10. Merchant, D. J., R. H. Kahn, and W. H. Murphy. *Handbook of Cell and Organ Culture*. 2nd ed. Minneapolis: Burgess Publishing Company, 1969.

Evaluation Pattern 60:40

Total Marks: 50

Internal Evaluation: 20 Marks Journal : 10 Marks Students Performance : 05 Marks Viva : 05 Marks	End Semester Examination: 30 Marks Question I : 10 Marks Question II : 10 Marks Question III : 10 Marks
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	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 Artificial Intelligence	
	Programme: B.Sc.	Programme: B.Sc.
	Type: OE III	Type: OE III
	Credits: 2	Credits: 2
Name of the Course: BBTPOE III : Artificial Intelligence Studies		
Course Objectives: Students Should be able to: 1. explain the fundamentals of defence organization and national security concepts. 2. differentiate between the roles and responsibilities of armed forces, paramilitary forces, and civil defence organizations. 3. apply knowledge of defence technologies, procedures, and safety protocols in relevant situations.. 4. develop respect, awareness, and interest in india’s defence services and career opportunities.		
Course Outcomes: Student will be able to: 1. describe the structure, organization, and roles of indian defence and paramilitary forces.. 2. demonstrate basic drills, formations, and flag-based communication techniques. 3. analyze eligibility criteria and entry pathways for armed forces and paramilitary services.. 4. create group-based models of mock defence operations and emergency response scenarios.		
Sr. No	Title and Contents	Hrs.
1.	Using concepts of data used in python	60
2.	Understanding how to collect data using differnet techniques	
3.	Collecting data from open source websites.	
4.	Collecting data from Kaggle webite	
5.	Collecting data using Google Forms.	
6.	To create CSV file with sample data	
7.	Creating python program and converting it into JSON file.	
8.	Converting JSON file to CSV file.	
9.	Organizing data of CSV file using sorting .	
10.	Creating basic visualization using Matplotlib.	
11.	Reading data from a text file and displaying it line by line.	
12.	Creating and writing sample student data into a CSV file using Python.	
13.	Reading and displaying data from a CSV file using the csvor pandasmodule.	
14.	Creating a Python dictionary and converting it into a JSON file.	
15.	Converting JSON data back into a CSV file using Python.	
16.	Sorting data from a CSV file in ascending and descending order using Python.	
17.	Creating a bar chart using Matplotlib to show marks of students.	
18.	Creating a line graph using Matplotlib to show sales growth over months.	

19.	Creating a pie chart using Matplotlib to show percentage of students in different courses.
20.	Collecting open-source dataset from Kaggle and loading it into Python using pandas.
Reference Books: - 1) Géron, Aurélien. <i>Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow</i> . 3rd ed. Sebastopol, CA: O'Reilly Media, 2022. 2) McKinney, Wes. <i>Python for Data Analysis: Data Wrangling with pandas, NumPy, and Jupyter</i> . 3rd ed. Sebastopol, CA: O'Reilly Media, 2022. 3) Russell, Stuart, and Peter Norvig. <i>Artificial Intelligence: A Modern Approach</i> . 4th ed. Hoboken, NJ: Pearson, 2020.10 4) Goodfellow, Ian, Yoshua Bengio, and Aaron Courville. <i>Deep Learning</i> . Cambridge, MA: MIT Press, 2016. 5) VanderPlas, Jake. <i>Python Data Science Handbook: Essential Tools for Working with Data</i> . Sebastopol, CA: O'Reilly Media, 2016. 6) Rich, Elaine, Kevin Knight, and Shivashankar B. Nair. <i>Artificial Intelligence</i> . 3rd ed. New Delhi: Tata McGraw-Hill Education, 2010. 7) Luger, George F. <i>Artificial Intelligence: Structures and Strategies for Complex Problem Solving</i> . 6th ed. Boston: Pearson Education, 2009. 8) Bishop, Christopher M. <i>Pattern Recognition and Machine Learning</i> . New York: Springer, 2006. 9) Nilsson, Nils J. <i>Artificial Intelligence: A New Synthesis</i> . San Francisco: Morgan Kaufmann, 1998. 10) Mitchell, Tom M. <i>Machine Learning</i> . New York: McGraw-Hill, 1997.	
Evaluation Pattern:60:40	
Total Marks: 50	
Internal Evaluation: 20 Marks Journal : 10 Marks Students Performance : 05Marks Viva : 05 Marks	End Semester Examination:30 Marks Question I : 10 Marks Question II : 10 Marks Question III : 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. II	B. Sc. II, Semester - III	
	Type : VSC 1	Marks: 50	
	Credits : 2	From: A. Y. 2025-26	
Name of the Course: BBTPVSC 1: Lab exercise in basics of biotechnology in nursery management			
Course Objectives: By the end of the course, Students should be able to... 1) understand the importance of nursery and basic infrastructure to establish it 2) know various facilities required to set up of a nursery 3) learn the basic concepts of plant tissue culture and garden designing. 4) study methods of biotechnology and its applications of Nursery			
Course Outcomes: By the end of the course, Students will be able to... 1) discuss nursery management. 2) explain different technique of plant tissue culture used in nursery management 3) understand nursery management techniques. 4) demonstrate techniques used in nursery.			
Sr. No.	Name of the Practical (Any 15)	Hrs.	
1.	To study the layout of a nursery.	60	
2.	Handling of nursery tools, equipment and types of containers		
3.	To study types of nurseries, its classification.		
4.	Preparation and application of biofertilizer-Azotobacter.		
5.	Preparation and application of biofertilizer-Rhizobium.		
6.	Preparation and application of biofertilizer- PSB (Phosphate solubilizing bacteria)		
7.	Preparation and application of compost - cow dung slurry.		
8.	Preparation and application of compost – Vermicompost.		
9.	Preparation and application Green manure.		
10.	To study application of Biopesticide in nursery management.		
11.	Nursery bed preparation.		
12.	To study calculation of seed germination parameters.		
13.	To study nursery technology of commercially important tree species.		
14.	To study nursery diseases and its management.		
15.	Watering, weeding and management of nursery.		
16.	Seed collection, treatment and rising of seedlings on nursery bed.		
17.	Handling of grafting and layering techniques in the nursery.		
18.	Maintaining of the seedlings / cuttings in the nursery.		
19.	To study the technique pricking and transplanting from mother bed.		
20.	To study the propagation technique and management practices in nursery.		
Reference Books:- 1. Panda, H. <i>Biofertilizer and Organic Farming</i> . Nir Project Consultancy Services, 2023.			

2. Lokare, Priya. *Plant Nursery Development & Management: An Innovative Way of Self Employment*. 1st ed. Notion Press, 2022.
3. Rajamanickam, C., A. Subbiah, J. Rajangam, et al. *Principles & Practices of Plant Propagation and Nursery Management*. 2021.
4. Pears, Pauline. *Organic Book of Compost: Easy and Natural Techniques to Feed Your Garden*. Paperback import ed., 2020.
5. Ray, P. K. *Essentials of Plant Nursery Management*. 2020.
6. Dwivedi, Deepa H., and Navaldey Bharti. *A Handbook for Skill Development: Nursery Management*. 2019.
7. Kumar, Vikas, and Anjali Tiwari. *Practical Manual of Nursery Management*. 2018.
8. Krishnan, M. Ratha, Rajwant K. Kalia, J. C. Tewari, et al. *Plant Nursery*. 2014.
9. Roy, M. M. *Plant Nursery Management: Principles and Practices*. Central Arid Zone Research Institute, ISO 9001:2008. Indian Council of Agricultural Research, 2014.
10. Ray, P. K. *How to Start and Operate a Plant Nursery*. 2012

Evaluation Pattern: 60:40

Total Marks: 50

Internal Evaluation: 20 Marks Journal : 10 Marks Students Performance : 05Marks Viva : 05 Marks	End Semester Examination:30 Marks Question I : 10 Marks Question II : 10 Marks Question III : 10 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. II	B. Sc. II, Semester - III
	Type : SEC 1	Marks: 50
	Credits : 2	From: A. Y. 2025-26
	Name of the Course : BBTPSEC1 : Laboratory exercise based on Advances in Hydroponics	

Course Objectives: Students should be able to...

- 1) understand successful cultivation of crops using hydroponics techniques.
- 2) know basic farming practices; and some experience in crop farming.
- 3) learn to apply key principles of plant science, soil and water chemistry, and mathematics to the production of sustainable hydroponic and greenhouse crops.
- 4) aware to diagnose, problem-solve, and prevent common production issues in hydroponic crops

Course Outcomes: Students will be able to...

- 1) establish hydroponics set up.
- 2) run a hydroponics setup for crop cultivation.
- 3) acquire the basics of several common hydroponic systems.
- 4) evaluate crop quality/performance, and diagnose and correct/prevent common plant nutritional and physiological disorders

Sr. No.	Name of the Practical (Any 15)	Hrs.
1.	Study of the use and properties of hydroponic clay pebbles.	60
2.	Selection of suitable plant species for hydroponic cultivation.	
3.	Cleaning and maintenance procedures for hydroponic clay pebbles.	
4.	Methods to prevent algal growth in hydroponic systems.	
5.	Procedure for changing and replenishing water in hydroponic systems.	
6.	Management of insect pests in hydroponic cultivation.	
7.	Management of plant diseases in hydroponic systems.	
8.	Separation and recycling of clay pebbles and nutrient solution.	
9.	Preparation of seedlings for hydroponic transplantation.	
10.	Study of the structure and working of Deep Water Culture (DWC) systems.	
11.	Study of the design and operation of Nutrient Film Technique (NFT) systems.	
12.	Study of the principles and functioning of Ebb and Flow systems.	
13.	Preparation of standard hydroponic nutrient solution (Hoagland's or Knop's solution).	
14.	Study of the setup and operation of Drip irrigation systems in hydroponics.	
15.	Cleaning and sanitization of Nutrient Film Technique (NFT) systems.	
16.	Study of integrated pest management (IPM) practices in hydroponic systems.	
17.	Study of safety measures and precautions in hydroponic laboratories.	
18.	Study of the structure and operation of Aeroponic systems.	
19.	Procedure for changing and managing nutrient solution in NFT systems.	
20.	Study of water-use efficiency in hydroponic cultivation.	

Reference Books:-

1. an der Lugt, Geerten, Harmen Tjalling Holwerda, Katja Hora, Griselli Durant, Mauricio Uribe, Camila Miranda, Marcel Bugter, and Peter de Vries. *Nutrient Solution for Greenhouse Crops*. 2016.
2. Pardossi, A., G. Carmassi, C. Diara, L. Incrocci, R. Maggini, and D. Massa. *Fertigation and Substrate Management in Closed Soilless Culture*. Dipartimento di Biologia delle Piante Agrarie, Università di Pisa, 2011.
3. Sabir, Naved, Balraj Singh, M. Hasan, R. Sumitha, Sikha Deka, R. K. Tanwar, D. B. Ahuja, B. S. Tomar, O. M. Bambawale, and E. M. Khah. *Good Agricultural Practices (GAP) for IPM in Protected Cultivation*. Technical Bulletin No. 23. National Centre for Integrated Pest Management, New Delhi, 2010.
4. Anon. *Hydroponics: Soil-less Culture Book*. Department of Agriculture, Ministry of Agriculture, 2009.
5. Prasad, S., and R. J. Kumar. *Green House Management for Horticultural Crops*. Agro-Bios India, 2005. ISBN-13: 978-8177541243.
6. Jones, J. Benton. *Hydroponics: A Practical Guide for the Soilless Grower*. 2nd ed. CRC Press, 2004. ISBN: 9780849331671.
7. Resh, Howard M. *Hobby Hydroponics*. 1st ed. CRC Press, 2003.
8. Roberto, L. Keith. *How to Hydroponics*. 4th ed. The Future Garden Press, 2003.
9. Dahama, A. K. *Organic Farming for Sustainable Agriculture*. 2nd ed., reprint. Agrobios (India), 2002.
10. Subbarao, N. S. *Biofertilizers in Agriculture and Forestry*. 3rd rev. ed. Oxford & IBH Publishing Company Pvt. Ltd., 1995

Evaluation Pattern 60:40**Total Marks: 50****Internal Evaluation: 20 Marks**

Journal : 10 Marks

Students Performance : 05Marks

Viva : 05 Marks

End Semester Examination:30 Marks

Question I : 10 Marks

Question II : 10 Marks

Question III : 10 Marks

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Humanities	
	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in English	
	Programme: B.Sc.-II	Semester - III
	Type : AEC I	Marks: 50
	Credits : 02	From: A. Y. 2024-25
Name of the Course: BBTAECE I : English for Communication P-I		
Course Objectives : Students should be able to... 1. understand basics of communication 2. study the non-verbal communication 3. learn the reading strategies for fast reading 4. know the comprehension skills		
Course Outcomes :, Students will be able to... 1. apply techniques to improve communication. 2. use the reading strategies for fast reading. 3. identify the note making and note taking skills 4. enhance the comprehension skills.		
Module	Title and Contents	Hrs.
Module- I	Introduction to Communication Skills 1.1 Definition 1.2 Process of communication 1.3 Elements 1.4 Types of communication 1.5 Barriers of communication 1.6 Good communication gateways: 7c's of communication	07
Module- II	Non-verbal communication 2.1 Overview of non -verbal communication 2.2 Facial expressions and gestures 2.3 Eye contact 2.4 Body language 2.5 Voice and paralinguistic cues 2.6 Non -verbal communication in context	07
Module -III	Reading Skills 3.1 Definition 3.2 Scheming and scanning techniques, 3.3 Effective strategies for reading 3.4 Reading material: 3.4.1 Tree by Kalpana Chitnis 3.4.2 Facebook is making us miserable by Daniel Gulati	08

Unit -IV	Comprehension Skills 4.1 Definition 4.2 Types 4.3 Strategies 4.4 Summarising 4.5 Paragraphs for Comprehension	08
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Reference Books:

1. Kumar, Sanjay, and Pushp Lata. *Communication Skills*. 1st ed. New Delhi: Oxford University Press, 2018.
2. Lester, Mark. *Handbook of English Grammar and Usage*. New Delhi: Tata McGraw Hill Publishing Company, 2018.
3. Pearson. *Business English: Language, Literature and Creativity*. New Delhi: Orient Blackswan, 2013.
4. Aggarwal, Shalini. *Essential Communication Skills*. 1st ed. New Delhi: Ane Books Pvt. Ltd., 2009.
5. Dutt, P. Kiramani, and Geetha Rajeevan. *Basic Communication Skills*. 1st ed. New Delhi: Cambridge University Press India Pvt. Ltd., 2007; reprint, 2010.
6. Turton, N. D., and J. B. Heaton. *Longman Dictionary of Common Errors*. Harlow: Longman, 1998.
7. Inthira, S. R., and V. Saraswathi. *Enrich Your English*. New Delhi: Oxford University Press, 1997.
8. Wood, John East. *Oxford Practice Grammar*. 2nd ed. New Delhi: Oxford University Press, 1999.
9. Thomson, A. J., and A. V. Martinet. *A Practical English Grammar*. 4th ed. New Delhi: Oxford University Press, 1986.
10. Leech, Geoffrey, and Jan Svartvik. *A Communicative Grammar of English*. 2nd ed. London: Longman, 1994.

Evaluation Pattern 60:40

Total Marks: 50

Internal Evaluation: 20 Marks CCE-I : Home Assignment : 10 Marks CCE –II : Short and long answer questions test/Seminar/ Open book test / Quiz / Case study / Book review / Field work / Industry visit: 10 Marks CCE – III MCQ Test : 10 Marks (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 Marks Question -2 –Attempt any two questions (three question of 10 marks) 20 Marks Question -3 – Attempt nay four questions (five questions of 5 marks) 20 Marks 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. II	Semester - III
	Type : IKS 2	Marks: 50
	Credits : 2	From: A. Y. 2025-26
Name of the Course: BBTIKS 2: Indian Health Sciences		
Course Objectives: Students should be able to... 1) explore the most fundamental ideas that have shaped Indian knowledge traditions over the centuries. 2) understand various aspects of IKS which are related to their study fields. 3) to promote interest in knowing and exploring more. 4) study the methods of ancient systems of treatment with Ayurveda.		
Course Outcomes: Students will be able to... 1) apply knowledge of Ayurveda pharmacopeia. 2) implement Ayurvedic perspective in diseases diagnosis. 3) demonstrate knowledge of human physiological systems. 4) discuss the ancient medical treatment with Ayurveda.		
Module	Title and Contents	Hrs.
Module -1:	Introduction of Bharatavarsha Vaidya 1.1 Charaka and Sushruta on the qualities of a Vaidya. The whole world is a teacher of the good Vaidya. Charaka's description of a hospital. 1.2 Hospitals in ancient and medieval India. How Ayurveda continued to flourish till 18/19th centuries. Surgical practices, inoculation. Current revival of Ayurveda and Yoga.	07
Module -2:	Ayurveda pharmacopeia 2.1 Important Texts of Ayurveda. 2.2 Selected extracts from Astāngahrdaya (selections from Sūtrasthāna) and Suśruta-Samhitā (sections on plastic surgery, cataract surgery and anal fistula). 2.3 The large pharmacopeia of Ayurveda.	08
Module -3:	Foundations of Ayurveda 3.1 Vedic foundations of Ayurveda. Ayurveda is concerned both with maintenance of good health and treatment of diseases. Basic concepts of 3.2 Ayurveda. The three Gunas and Three Doshas, Pancha-mahabhuta and Sapta-dhatu.	07
Module -4:	Ayurveda: A health perspective 4.1 The importance of Agni (digestion). Six Rasas and their relation to Doshas. Ayurvedic view of the cause of diseases. 4.2 Dinacharya or daily regimen for the maintenance of good health. Ritucharya or seasonal regimen.	08

Reference Books:-

1. Dharampal. *Indian Science and Technology in the Eighteenth Century: Some Contemporary European Accounts*. Dharampal Classics Series, Rashtrarthana Sahitya, Bengaluru, 2021.
2. Dharampal. *The Beautiful Tree: Indian Indigenous Education in the Eighteenth Century*. Dharampal Classics Series, Rashtrarthana Sahitya, Bengaluru, 2021.
3. Baladev Upadhyaya. *Sanskṛta Śāstramka Itihāsa*. Chowkhambha, Varanasi, 2010.
4. D. M. Bose, S. N. Sen, and B. V. Subbarayappa, eds. *A Concise History of Science in India*. 2nd ed. Universities Press, Hyderabad, 2010.
5. Sabir, Naved, Balraj Singh, M. Hasan, R. Sumitha, Sikha Deka, R. K. Tanwar, D. B. Ahuja, B. S. Tomar, O. M. Bambawale, and E. M. Khah. *Good Agricultural Practices (GAP) for IPM in Protected Cultivation*. Technical Bulletin No. 23. National Centre for Integrated Pest Management, New Delhi, 2010.
6. J. K. Bajaj and M. D. Srinivas. *Timeless India Resurgent India*. Centre for Policy Studies, Chennai, 2001.
7. Chawla, H. S. (Not included — no reference provided).
8. J. K. Bajaj and M. D. Srinivas. *Annam Bahu Kurvita: Recollecting the Indian Discipline of Growing and Sharing Food in Plenty*. Centre for Policy Studies, Chennai, 1996.
9. J. K. Bajaj and M. D. Srinivas. *Indian Economy and Polity in Eighteenth Century Chengalpattu*, in J. K. Bajaj (ed.), *Indian Economy and Polity*, Centre for Policy Studies, Chennai, 1995, pp. 63–84.
10. Astāngahrdaya. Vol. I, *Sūtrasthāna and Śarīrasthāna*. Translated by K. R. Srikantha Murthy. Vol. I, Krishnadas Academy, Varanasi, 1991.

Evaluation Pattern 60:40**Total Marks: 50****Internal Evaluation: 20 Marks**

CCE-I : Home Assignment : 10 Marks
CCE –II : Short and long answer questions
test/Seminar/ Open book test / Quiz / Case
study / Book review / Field work / Industry
visit: 10 Marks
CCE – III MCQ Test : 10 Marks
(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 Marks
Question -2 –Attempt any two questions (three question of 10 marks) 20 Marks
Question -3 – Attempt nay four questions (five questions of 5 marks) 20 Marks
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. II	Semester - IV
	Type: DSC VII	Marks: 50
	Credits : 2	From: A. Y. 2025-26
Name of the Course : BBT 241 Plant Tissue Culture		
Course Objectives: Students should be able to... 1) aware Of Fundamentals Of Plant Tissue Culture 2) understand Of Laboratory Organization For Plant Tissue Culture. 3) demonstrate Callus, Organ, Anther And Pollen Culture Technique. 4) study Of Suspension ,Protoplast Culture And Micropropagation		
Course outcomes: Students will be able to... 1) awareness about laboratory organization for plant tissue culture 2) know technique of preparation of plant tissue culture media. 3) knowledge about various techniques for plant tissue culture. 4) job oriented skill developments of students to start or work in a commercial plant tissue culture laboratory.		
Module	Title and Contents	Hrs.
Module -1:	Introduction to plant tissue culture 1.1 Introduction to plant tissue culture- Definition, History, Cellular totipotency, techniques in plant tissue culture. 1.2 Aseptic Techniques- Washing and preparation of glassware's, packing and sterilization, media sterilization, surface sterilization, aseptic workstation, precautions to maintain aseptic conditions. 1.3 Culture Medium- Nutritional requirements of explants, Plant Growth Regulator and their <i>invitro</i> roles, composition of basal Murashige and Skoog medium and media preparation.	07
Module -2:	Culture Techniques 2.1 Callus Culture Techniques- Introduction, principle, protocol, morphology and internal structure, genetic variations, applications. 2.2 Anther & Pollen Culture Technique- Introduction, principle, protocol, factors affecting, applications. 2.3 Organ Culture Technique- Introduction, principle, protocol, applications, with respect to root tip culture, leaf culture, ovary and ovule culture.	08
Module -3:	Micropropagation 3.1 Micropropagation- Introduction, stages of Micropropagation, factors affecting, advantages and applications (with suitable examples) 3.2 Different Pathways of Micropropagation- Axillary bud proliferation, somatic embryogenesis, organogenesis, meristem culture (Introduction, principle, protocol, factors affecting, applications, limitations). 3.3 Somaclonal Variation- Introduction, terminology, origin, selection at plant level, selection at cell level, mechanism, assessment, applications and Limitations.	07

Module -4:	Suspension Culture Technique 4.1 Suspension Culture Technique- Introduction, principle, protocol, types, growth measurement, viability test, synchronization, applications. 4.2 Production of Secondary Metabolites- Introduction, types of secondary metabolites, principle, systems of culture, optimization of yield, commercial aspects, applications, limitations. 4.3 Plant Protoplast Culture:- History, Principle, protocol for isolation-Mechanical and Enzymatic, protoplast culture methods, viability test and Applications.	08
Reference Books:- 1. De, K. K. <i>Plant Tissue Culture</i> . Kolkata: New Central Book Agency (P) Ltd., 2017. 2. Sharma, G. K. <i>General Techniques of Plant Tissue Culture</i> . 1st ed. Raleigh, NC: Lulu Press Inc., 2015. 3. Razdan, M. K. <i>Introduction to Plant Tissue Culture</i> . 2nd ed. New Delhi: Science Publishers, 2003. 4. Smith, R. H. <i>Plant Tissue Culture: Concepts and Laboratory Exercises</i> . Boca Raton: CRC Press, 2000. 5. Chawla, H. S. <i>Introduction to Plant Biotechnology</i> . 2nd ed. New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd., 2000. 6. Kumar, U. <i>Methods in Plant Tissue Culture</i> . New Delhi: Agro-Botanica Publishers, 1999. 7. Bhojwani, S. S., and M. K. Razdan. <i>Plant Tissue Culture: Theory and Practice</i> . 1st ed. Amsterdam: Elsevier Science, 1996. 8. Gamborg, O. L., and G. C. Phillips, eds. <i>Plant Cell, Tissue and Organ Culture: Fundamental Methods</i> . Berlin: Springer, 1995. 9. Debergh, P., and R. H. Zimmerman, eds. <i>Micropropagation: Technology and Application</i> . Dordrecht: Springer, 1991. 10. Jain, S. M., and H. C. Häggman, eds. <i>Plant Tissue Culture: Techniques and Applications</i> . Dordrecht: Springer, 2007.		
Evaluation Pattern 60:40		
Total Marks: 50		
Internal Evaluation: 20 Marks CCE-I : Home Assignment : 10 Marks CCE –II : Short and long answer questions test/Seminar/ Open book test / Quiz / Case study / Book review / Field work / Industry visit: 10 Marks CCE – III MCQ Test : 10 Marks (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 Marks Question -2 –Attempt any two questions (three question of 10 marks) 20 Marks Question -3 – Attempt nay four questions (five questions of 5 marks) 20 Marks 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 II	Semester - IV
	Type : DSC VIII	Marks: 50
	Credits : 2	From: A. Y. 2025-26
Name of the Course : BBTT 242: Plant Physiology & Biochemistry		
Course Objectives: Students should be able to... 1) understand basics of physiology of plants. 2) study biochemistry in growth and development of plant. 3) know biosynthesis and role of plant hormones in plant. 4) imbibe the concept of photosynthesis and oxidative photophosphorylation.		
Course Outcomes: Students will be able to... 1) understand mechanism of plant growth and development. 2) know about photosynthesis, respiration and biosynthesis. 3) explain synthesis and applications of secondary metabolites 4) apply basic concept of plant -water relation and related theories.		
Module	Title and Contents	Hrs.
Module -1:	Plant Water Relationship 1.1 Introduction, Absorption of water- Mechanism, Theories (Active and Passive), 1.2 Translocation of water- Mechanism, Ascent of Sap, Root pressure theory, Vital theory 1.3 Bohm's Theory, Transpiration- Types, Mechanism of Transpiration and factors affecting transpiration	07
Module -2:	Photosynthesis 2.1 Ultra structure of chloroplast, Photosynthetic pigments, red drop and Emerson's enhancement effect, 2.2 Mechanism of photosynthesis- Cyclic and non-cyclic flow of electron transfer, light reaction, dark reaction, 2.3 C-3 pathway, C-4 pathway, CAM, photorespiration.	08
Module -3:	Respiration 3.1 Aerobic-Flow of electrons through reducing power in ETC, Complexes of electron transport, 3.2 Redox potential components of ETC, Mechanism of ATP generation-Chemiosmotic hypothesis ATP synthase complex. 3.3 Anaerobic Respiration: - Alcoholic and Lactic acid fermentation	07

Module -4:	Introduction to Plant Hormones 4.1 Chemistry, Biosynthesis, Distribution, mode of action and physiological effects of - Auxin, 4.2 Cytokinin, Gibberellins, Abscissic acid, Ethylene 4.3 Secondary Metabolites: Biosynthesis of plant secondary metabolites (Shikimate pathway, 4.4 Mevalonate pathway, MEP pathway)	08
Reference Books:- 1. Stryer, Lubert, Jeremy M. Berg, Gregory J. Gatto Jr., and John L. Tymoczko. <i>Biochemistry</i> . 9th ed. New York: W. H. Freeman and Company, 2019. 2. Wilson, Keith, and John Walker, eds. <i>Principles and Techniques of Biochemistry and Molecular Biology</i> . 8th ed. Cambridge: Cambridge University Press, 2018. 3. Buchanan, Bob B., Wilhelm Gruissem, and Russell L. Jones, eds. <i>Biochemistry and Molecular Biology of Plants</i> . 2nd ed. Chichester: Wiley-Blackwell, 2015. 4. Taiz, Lincoln, Eduardo Zeiger, Ian M. Møller, and Angus Murphy. <i>Plant Physiology and Development</i> . 6th ed. Sunderland, MA: Sinauer Associates, 2015. 5. Nelson, David L., and Michael M. Cox. <i>Lehninger Principles of Biochemistry</i> . 6th ed. New York: W. H. Freeman and Company, 2013. 6. Voet, Donald, Judith G. Voet, and Charlotte W. Pratt. <i>Fundamentals of Biochemistry: Life at the Molecular Level</i> . 4th ed. Hoboken, NJ: John Wiley & Sons, 2013. 7. Satyanarayana, U., and U. Chakrapani. <i>Biochemistry</i> . 4th ed. Kolkata: Books and Allied (P) Ltd., 2009. 8. Salisbury, Frank B., and Cleon W. Ross. <i>Plant Physiology</i> . 4th ed. Belmont, CA: Wadsworth Publishing Company, 1992. 9. Devlin, Robert M. <i>Plant Physiology</i> . 4th ed. Boston: PWS Publishers, 1983. 10. Jain, J. L. <i>Fundamentals of Biochemistry</i> . Revised ed. New Delhi: S. Chand Publishing, 1982		
Evaluation Pattern 60:40		
Total Marks: 50		
Internal Evaluation: 20 Marks CCE-I : Home Assignment : 10 Marks CCE –II : Short and long answer questions test/Seminar/ Open book test / Quiz / Case study / Book review / Field work / Industry visit: 10 Marks CCE – III MCQ Test : 10 Marks (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 Marks Question -2 –Attempt any two questions (three question of 10 marks) 20 Marks Question -3 – Attempt nay four questions (five questions of 5 marks) 20 Marks 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. II

Semester - IV

Type : DSC P IV

Marks: 50

Credits : 2

From: A. Y. 2025-26

Name of the Course - BBTP 243 : Lab exercise based on Plant Tissue Culture and Plant Physiology and Biochemistry

Course Objectives: Students should be able to...

- 1) study of laboratory organization for plant tissue culture.
- 2) explain the callus and various micropropagation culture techniques
- 3) know effect of different parameter on photosynthesis
- 4) learn the different extraction techniques of secondary metabolites

Course Outcomes: Students will be able to...

- 1) explain about laboratory organization for plant tissue culture.
- 2) know technique of preparation of plant tissue culture media.
- 3) estimate chlorophyll content.
- 4) demonstrate the osmosis process.

Sr. No.	Lab exercise based on Plant Tissue Culture and Plant Physiology and Biochemistry (Any Fifteen)	Hrs.
1.	Preparation of Murashige and Skoog (MS) Stock Solutions and Medium.	60
2.	Aseptic seed germination techniques.	
3.	Embryo culture methodology.	
4.	Micropropagation stage.	
5.	Callus culture techniques: Initiation and Morphological analysis.	
6.	Study of isolation of Protoplasts.	
7.	Anther culture technique: Initiation and Development.	
8.	Cell Suspension Culture: Initiation and Maintenance.	
9.	Pollen Culture Technique: Induction of Haploid Embryos.	
10.	Study of Ovary and Ovule Culture.	
11.	Study of extraction of plant secondary metabolites by Continuous shaking method.	
12.	Study of extraction of plant secondary metabolites by steam bath assistant method.	
13.	Study of extraction of plant secondary metabolites by ultrasound- assisted extraction.	
14.	Study of extraction of plant secondary metabolites by microwave extraction method.	
15.	To demonstrate osmosis in living plant cells by potato osmoscope.	
16.	Extraction of Protein from plant material using suitable extraction Method.	
17.	Extraction of Carbohydrates from plant material using suitable extraction Method.	
18.	Extract starch from potatoes and detection by iodine method.	
19.	Determination of Tannins.	
20.	To demonstrate the process of inhibition	

Reference Books:-

1. De, K. K. *Plant Tissue Culture*. Kolkata: New Central Book Agency (P) Ltd., 2017.

2. Sharma, G. K. *General Techniques of Plant Tissue Culture*. New Delhi: Centrum Press, 2015.
3. Pandey, B. P. *Practical Plant Physiology*. New Delhi: S. Chand Publishing, 2011.
4. Jain, V. K. *Fundamentals of Plant Physiology: A Laboratory Manual*. 2nd ed. New Delhi: S. Chand Publishing, 2010.
5. Sadasivam, S., and A. Manickam. *Biochemical Methods*. 3rd ed. New Delhi: New Age International Publishers, 2008.
6. Srivastava, H. S. *Practical Plant Physiology: Experimental Plant Physiology*. New Delhi: Narosa Publishing House, 2006.
7. Chawla, H. S. *Introduction to Plant Biotechnology*. 2nd ed. New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd., 2000.
8. Pattabiraman, T. N. *Laboratory Manual in Biochemistry*. New Delhi: All India Publishers and Distributors, 2000.
9. Smith, R. H. *Plant Tissue Culture: Concepts and Laboratory Exercises*. Boca Raton, FL: CRC Press, 2000.
10. Kumar, U. *Methods in Plant Tissue Culture*. Bikaner: Agro-Botanica Publishers, 1999..

Evaluation Pattern: 60:40

Total Marks: 50

Internal Evaluation: 20 Marks

Journal : 10 Marks

Students Performance : 05Marks

Viva : 05 Marks

End Semester Examination:30 Marks

Question I : 10 Marks

Question II : 10 Marks

Question III : 10 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 II

Semester - IV

Type : DSC VII

Marks: 50

Credits : 2

From: A. Y. 2025-26

Name of the Course: BBTT 244 –Genetics

Course Objectives: Students should be able to...

- 1) study principles of mendelian genetics.
- 2) understand gene interaction and gene expression.
- 3) learn to analyze concepts of cytogenetics.
- 4) explain basic concepts of microbial genetics.

Course Outcomes: Students will be able to...

- 1) explain the inheritance biology.
- 2) describe gene interaction and gene expression.
- 3) analyze structural and numerical changes in chromosomes.
- 4) discuss mechanisms of bacterial genetics such as:-transformation, conjugation, transduction and recombination.

Module	Title and Contents	Hrs.
Module -1:	Mendelian Genetics 1.1 Introduction, History and terminologies used in genetics. 1.2 Mendel's laws of Inheritance: Principles of segregation, independent assortment and dominance. 1.3 Variety of gene expression: modifiers, suppressors, pleiotropic gene, multiple allele. 1.4 Interaction of gene:- Epistasis, complementary gene, duplicate gene	07
Module -2:	Linkage and Crossing Over 2.1 Linkage:-Introduction and definition, coupling and repulsion hypothesis, linkage groups. 2.2 Gene mapping methods- linkage maps and Tetrad analysis. 2.3 Crossing over- Mechanism and theory. 2.4 Transposable Genetic elements (Definition, characteristics and types).	08
Module -3:	Cytogenetics 3.1 Study of chromosomes –Structure and types of chromosomes. 3.2 Chromosomal Aberrations:-Structural and numerical changes in chromosomes. 3.3 Extra chromosomal inheritance-mitochondria and plastids. 3.4 Human karyotype	07
Module -4:	Microbial Genetics 4.1 Plasmid- Introduction to plasmid. 4.2 Genetic recombination in bacteria- Definition, fate of exogenote in recipient 4.3 Cell transformation. 4.4 Transduction- mechanism of recombination.	08

Reference Books:-

1. Hartl, Daniel L. *Essential Genetics: A Genomics Perspective*. 7th ed. Burlington, MA: Jones & Bartlett Learning, 2018.
2. Hartwell, Leland H., Michael L. Goldberg, Janice A. Fischer, and Leroy Hood. *Genetics: From Genes to Genomes*. 6th ed. New York: McGraw-Hill Education, 2017.
3. Griffiths, Anthony J. F., Susan R. Wessler, Sean B. Carroll, and John Doebley. *Introduction to Genetic Analysis*. 11th ed. New York: W. H. Freeman, 2015.
4. Snustad, D. Peter, and Michael J. Simmons. *Principles of Genetics*. 7th ed. Hoboken, NJ: John Wiley & Sons, 2015.
5. Strickberger, Monroe W. *Genetics*. 3rd ed. New Delhi: Pearson Education, 2015.
6. Watson, James D., Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, and Richard Losick. *Molecular Biology of the Gene*. 7th ed. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press, 2014.
7. Snyder, Larry, Joseph Peters, Tina M. Henkin, and Wendy Champness. *Molecular Genetics of Bacteria*. 4th ed. Washington, DC: ASM Press, 2013.
8. Verma, P. S., and V. K. Agarwal. *Cell Biology, Genetics, Molecular Biology, Evolution and Ecology*. 1st ed. New Delhi: S. Chand Publishing, 2013.
9. Clark, David, and Nanette Pazdernik. *Molecular Biology*. 2nd ed. Amsterdam: Academic Press, 2012.
10. Maloy, Stanley, John Cronan, and David Freifelder. *Microbial Genetics*. 2nd ed. Boston: Jones and Bartlett Publishers, 2008.

Evaluation Pattern: 60:40**Total Marks: 50****Internal Evaluation: 20 Marks**

CCE-I : Home Assignment : 10 Marks

CCE –II : Short and long answer questions

test/Seminar/ Open book test / Quiz / Case

study / Book review / Field work / Industry

visit: 10 Marks

CCE – III MCQ Test : 10 Marks

(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 Marks

Question -2 –Attempt any two questions (three question of 10 marks) 20 Marks

Question -3 – Attempt nay four questions (five questions of 5 marks) 20 Marks

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 II

Semester - IV

Type : DSC VIII

Marks: 50

Credits : 2

From: A. Y. 2025-26

Name of the Course: BBT 245-Immunology

Course Objectives: Students should be able to...

- 1) study the overview of vertebrates immune system to understand the types and mechanism of defense.
- 2) know the cells and organs of the immune system.
- 3) understand antigen and antibody reactions.
- 4) explain immune response and parasitic immunology

Course Outcomes: Students will be able to...

- 1) explain vertebrates immune system.
- 2) discuss types and mechanisms of defense.
- 3) describe cells and organs of the immune system.
- 4) illustrate antigen and antibody reaction.

Module	Title and Contents	Hrs.
Module -1:	Overview of Immune System 1.1 Introduction:- Introduction and history of vertebrates immune system Classification of immune system 1.2 Innate (Specific and non-specific) 1.3 Acquired (Active and Passive)	08
Module -2:	Introduction to Cells and Organs of Immune System 2.1 Cells of the immune system. 2.2 Broad categories of leukocytes -their role and properties. 2.3 B-lymphocytes. 2.4 T-Cells –subsets of other cells (Antigen presenting cell, Null cell, Natural killer cell.) 2.5 Organs of the immune system –primary and secondary lymphoid organs –structure and their role	07
Module -3:	Antigen and Antibody 3.1 Antigen- Definition, Nature, types of antigens, factors affecting Antigenicity 3.2 Antibody-Definition ,Nature, Basic structure of immunoglobulin 3.3 Major human immunoglobulin classes (Their properties and functions).	08
Module -4:	Immune Response 4.1 Immune response- Primary and secondary immune response. 4.2 Antigen Antibody reactions –Principle and applications of agglutination, b)precipitation c)complement fixation d) ELISA e) neutralization	08

	4.3 Parasitic immunology:-Immune response against Bacterial infection with reference to suitable example.	
Reference Books:- 1. Snyder, Larry, Joseph E. Peters, Tina M. Henkin, and Wendy Champness. <i>Molecular Genetics of Bacteria</i>. 5th ed. Washington, DC: ASM Press, 2020. 2. Ananthanarayan, R., and C. K. J. Paniker. <i>Textbook of Microbiology</i>. 9th ed. Hyderabad: Universities Press (India) Pvt. Ltd., 2018. 3. Delves, Peter J., Seamus J. Martin, Dennis R. Burton, and Ivan M. Roitt. <i>Roitt's Essential Immunology</i>. 13th ed. Chichester: Wiley-Blackwell, 2017. 4. Fatima, D., and N. Arumugam. <i>Immunology</i>. Chennai: Saras Publication, 2014. 5. Kumar, Arvind. <i>Textbook of Immunology</i>. New Delhi: TERI Press, 2013. 6. Heinen, Etienne, Marie-Paule Defresne, Jacques Boniver, and Vincent Geenen. <i>In Vivo Immunology</i>. New York: Springer, 2012. 7. Male, David, Jonathan Brostoff, David B. Roth, and Ivan M. Roitt. <i>Immunology</i>. 8th ed. St. Louis, MO: Mosby Elsevier, 2012. 8. Reddy, K. Rajeshwar. <i>Textbook of Immunology</i>. 3rd ed. Hyderabad: Paras Medical Publisher, 2012. 9. Kindt, Thomas J., Richard A. Goldsby, Barbara A. Osborne, and Janis Kuby. <i>Kuby Immunology</i>. 6th ed. New York: W. H. Freeman and Company, 2006. 10. Stanier, Roger Y., Edward A. Adelberg, and John L. Ingraham. <i>General Microbiology</i>. 5th ed. London: Macmillan Press, 1999.		
Evaluation Pattern: 60:40		
Total Marks: 50		
Internal Evaluation: 20 Marks CCE-I : Home Assignment : 10 Marks CCE –II : Short and long answer questions test/Seminar/ Open book test / Quiz / Case study / Book review / Field work / Industry visit: 10 Marks CCE – III MCQ Test : 10 Marks (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 Marks Question -2 –Attempt any two questions (three question of 10 marks) 20 Marks Question -3 – Attempt nay four questions (five questions of 5 marks) 20 Marks 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. II

Semester - IV

Type : DSC P IV

Marks: 50

Credits : 2

From: A. Y. 2025-26

Name of the Course: BBTP 246 -Laboratory exercise based on Genetics & Immunology

Course Objectives: Students should be able to...

- 1) understand mendelian genetics concept with numerical examples
- 2) study the basic concepts of hardness of water sample.
- 3) Describe antigen antibody reactions..
- 4) learn the serological tests.

Course Outcomes: Students will be able to...

- 1) describe the karyotyping experiments.
- 2) explain the concept of mendelian inheritance with numerical.
- 3) analyze antigen antibody reactions.
- 4) demonstrate serological tests.

Sr. No.	Laboratory exercise based on Genetics & Immunology (Any fifteen)	Hrs.
1.	Isolation of Lac negative mutants of <i>E. coli</i> by visual detection method (Media preparation & Maintenance of <i>E.coli</i> culture)	60
2.	Isolation of Lac negative mutants of <i>E. coli</i> by visual detection method (UV treatment & Incubation)	
3.	Isolation of streptomycin resistant mutants by gradient plate technique (Media preparation & Maintenance of <i>E.coli</i> culture)	
4.	Isolation of streptomycin resistant mutants by gradient plate technique (UV treatment and Gradient preparation of <i>Streptomycine</i>)	
5.	U.V survival curve of <i>E.coli</i> (Media preparation & Maintenance of <i>E.coli</i> culture)	
6.	U.V survival curve of <i>E.coli</i> (UV treatment and obtaining survival curve)	
7.	Study of problems based on Mendelian Inheritance -Monohybrid cross	
8.	Study of problems based on Mendelian Inheritance -Dihybrid cross	
9.	Study of problems based on Mendelian Inheritance- Test cross	
10.	Study of problems based on linkage.	
11.	laboratory safety practices for immunology	
12.	To study antigen -antibody reaction by Quantitative Widal test.	
13.	To study Radial immunodiffusion Assay.	
14.	To study Qualitative Immuno electrophoresis.	
15.	To study Double Immunodiffusion Technique.	
16.	To study Enzyme linked immunosorbent assay ELISA-dot ELISA	

17.	To study Rapid Plasma Reagin (RPR) card test
18.	Qualitative analysis of human chorionic gonadotropin hormone(HCG)
19.	Diagnostic test for Rheumatoid arthritis (RA test).
20.	Demonstration of antigen-antibody interaction: Ouchterlony method

Reference Books:-

1. Kumar, Yogesh. *A Handbook of Immunology and Immunological Techniques*. 2024.
2. Tobili, Y., and Sam-Yellowe. *Immunology: Overview and Laboratory Manual*. 2022.
3. Panigrahi, Kaushik Kumar. *Practical Manual on Fundamentals of Genetics (PBG-121)*. Bhubaneswar: Odisha University of Agriculture and Technology, 2019.
4. Ray, Dennis, and Mark Shotwell. *Genetics Laboratory Manual*. 3rd ed. Dubuque, IA: Kendall Hunt Publishing, 2018.
5. Balakrishnan, Senthilkumar. *Practical Immunology: A Laboratory Manual*. 1st ed. Academic Publishing, 2017.
6. Kaliaperumal, Karthik, Senbagam Duraisamy, and Senthilkumar Balakrishnan. *Practical Immunology: A Laboratory Manual*. Academic Publishing, 2017.
7. Joshi, Sunita. *A Laboratory Manual of Genetics*. New Delhi: I.K. International Publishing House, 2016.
8. Richard, C., and Geoffrey S. *Immunology*. 6th ed. Chichester: Wiley-Blackwell Publishing, 2009.
9. Goldsby, Richard A., Thomas J. Kindt, and Barbara A. Osborne. *Kuby Immunology*. 6th ed. New York: W. H. Freeman and Company, 2007.
10. Myers, L. Richard. *Immunology: A Laboratory Manual*. 1st ed. Dubuque, IA: William C. Brown Publishers, 1989.

Evaluation Pattern 60:40

Total Marks: 50

Internal Evaluation: 20 Marks Journal : 10 Marks Students Performance : 05Marks Viva : 05 Marks	End Semester Examination:30 Marks Question I : 10 Marks Question II : 10 Marks Question III : 10 Marks
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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 Interdisciplinary Studies

Programme: B.Sc.

Programme: B.Sc.

Type: OE IV

Type: OE IV

Credits: 2

Credits: 2

Name of the Course: BBTPOE IV : Defence Studies

Course Objectives: Students Should be able to:

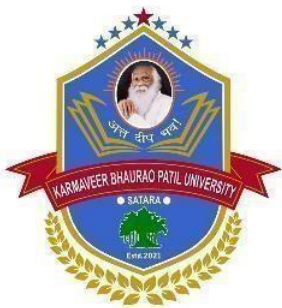
1. explain the fundamentals of defence organization and national security concepts.
2. differentiate between the roles and responsibilities of armed forces, paramilitary forces, and civil defence organizations.
3. apply knowledge of defence technologies, procedures, and safety protocols in relevant situations..
4. develop respect, awareness, and interest in india's defence services and career opportunities.

Course Outcomes: Student will be able to:

1. describe the structure, organization, and roles of indian defence and paramilitary forces..
2. demonstrate basic drills, formations, and flag-based communication techniques.
3. analyze eligibility criteria and entry pathways for armed forces and paramilitary services..
4. create group-based models of mock defence operations and emergency response scenarios.

Sr. No	Title and Contents	Hrs.
1.	Drawing Indian Armed Forces Organizational Charts	60
2.	Differentiating Army, Navy, Air Force, and Paramilitary Roles	
3.	Identifying Gallantry Awards and Eligibility Criteria	
4.	Introduction to Sentry Duties and Guard of Honour Format	
5.	Conducting Basic Command Voice Practice	
6.	Learning Different Types of Formations (Arrowhead, Diamond)	
7.	Understanding Borders: LOC, LAC, and IB on Indian Map	
8.	Designing a Mock "Operation Flood Relief"	
9.	Preparing Visual Chart on Indian Missiles and Weapons	
10.	Use of Sand Models to Simulate Attack and Defence Positions	
11.	Explaining the National Security Council and its Functions	
12.	Difference between Civilians, Paramilitary, and Police Behavior	
13.	First Aid Role Play in Battlefield Scenario	
14.	Flag Signaling with Colored Cloth/Paper Flags	

15.	Flag Hoisting and National Anthem Protocol
16.	Basic Fitness with Daily Exercises
17.	Basic Map Grid Reference Calculation
18.	Mock Press Interview on National Security Threats
19.	Creating Defence Career Path Charts
20.	Training in SSB Group Planning Exercises
Reference Books: - Government of India, Ministry of Defence. <i>Annual Report 2024–2025</i>. New Delhi: Ministry of Defence, Government of India, 2025. - Government of India, Ministry of Home Affairs. <i>Annual Report 2023–2024</i>. New Delhi: Ministry of Home Affairs, Government of India, 2024. - Government of India, Ministry of Defence. <i>Defence Acquisition Procedure (DAP) 2020</i>. New Delhi: Ministry of Defence, Government of India, 2020. - Baylis, John, James J. Wirtz, and Colin S. Gray, eds. <i>Strategy in the Contemporary World: An Introduction to Strategic Studies</i>. 6th ed. Oxford: Oxford University Press, 2019. - Freedman, Lawrence. <i>Strategy: A History</i>. Oxford: Oxford University Press, 2013. - Karnad, Bharat. <i>India's Nuclear Policy</i>. Westport, CT: Praeger Security International, 2008. - Cohen, Stephen P. <i>India: Emerging Power</i>. Washington, DC: Brookings Institution Press, 2001. - Tellis, Ashley J., C. Christine Fair, and Jamison Jo Medby. <i>Limited Conflicts under the Nuclear Umbrella: Indian and Pakistani Lessons from the Kargil Crisis</i>. Santa Monica, CA: RAND Corporation, 2001. - Singh, Jaswant. <i>Defending India</i>. New Delhi: Macmillan India, 1999. - Government of India, Ministry of Defence. <i>Indian Armed Forces: An Overview</i>. New Delhi: Directorate of Public Relations, Ministry of Defence, 1998.	
Evaluation Pattern: 60:40	
Total Marks: 50	
Internal Evaluation: 20 Marks Journal : 10 Marks Students Performance : 05Marks Viva : 05 Marks	End Semester Examination:30 Marks Question I : 10 Marks Question II : 10 Marks Question III : 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. II	Semester - IV
	Type: VSC II	Marks: 50
	Credits : 2	From: A. Y. 2025-26
	Name of the Course: BBTP VSC 2 -Lab exercise based on Tools and Techniques of Biotechnology in Nursery Management	

Course Objectives: Student should be able

- 1) understand different types of tools in nurseries
- 2) know various facilities required to set up of a nursery
- 3) commiserate with various practices in a nursery
- 4) learn the methods and applications of grafting

Course Outcomes: Students will be able to...

- 1) explain nursery management.
- 2) apply the technique of different tools used in nursery management
- 3) analyze various techniques for nursery management
- 4) illustrate the demonstrate techniques used in grafting

Sr. No.	Lab exercise based on Tools and Techniques of Biotechnology in Nursery Management (Any fifteen)	Hrs.
1.	To study criteria for nursery site selection	60
2.	Preparation and application of potting media.	
3.	To study presowing treatments	
4.	To study intermediate nursery management operations	
5.	Calculation of nursery area and seedlings quantity	
6.	To study economics of nursery to plantation establishment	
7.	To study seed sowing methods in nursery	
8.	To study importance of macro and micro nutrients, phytohormones, growth factors in Nursery technology.	
9.	To study extension of shelf life of fruits and flowers	
10.	Identification of organic manures and chemical fertilizers used in nursery.	
11.	To study seed Certification procedures	
12.	To know seed collection timing, location and quantity of seed and method of seed collection	
13.	To demonstrate stump preparation and planting	
14.	To preparation and application for production by planning for bare root and containerized nursery plantation	

15.	To preparation and application nursery management calender
16.	To know sowing methods for different seed size
17.	To know technique of pricking and transplanting from mother beds
18.	To identify natural seed production areas and plant artificial seed production areas for abundant seed production
19.	To study methods of irrigation and drainage for the cultivation of plants.
20.	To study nursery management practices for healthy propagule production.

Reference Books:-

1. Smith, Miranda June. *Plant Propagator's Bible: A Step-by-Step Guide to Propagating Every Plant in Your Garden*. Annotated ed. Beverly, MA: Cool Springs Press, 2021.
2. Kumar, Tarai Ranjan. *Plant Propagation and Nursery Management*. New Delhi: New India Publishing Agency, 2020.
3. Ray, P. K. *Essentials of Plant Nursery Management*. New Delhi: Scientific India Publisher, 2020.
4. Kumar, Vikas, and Anjali Tiwari. *Practical Manual of Nursery Management*. New Delhi: Agri-Biotech Press, 2018.
5. Central Arid Zone Research Institute (ICAR). *Management: Principles and Practices*. Jodhpur, Rajasthan: Central Arid Zone Research Institute, 2015.
6. Krishnan, M. Ratha, et al. *Plant Nursery*. Jodhpur: ICAR–Central Arid Zone Research Institute, 2014.
7. Ray, P. K. *How to Start and Operate a Plant Nursery*. Jodhpur: Scientific Publishers, 2012.
8. Trigiano, Robert N., and Dennis J. Gray, eds. *Plant Tissue Culture, Development, and Biotechnology*. Boca Raton, FL: CRC Press, 2010.
9. Razdan, M. K. *Introduction to Plant Tissue Culture*. 2nd ed. New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd., 2004.
10. Hammond, John, Peter McGarvey, and Vidadi Yusibov. *Plant Biotechnology*. New York: Springer-Verlag, 2000.

Evaluation Pattern: 60:40

Total Marks: 50

Internal Evaluation: 20 Marks Journal : 10 Marks Students Performance : 05Marks Viva : 05 Marks	End Semester Examination: 30 Marks Question I : 10 Marks Question II : 10 Marks Question III : 10 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. II

Semester - IV

Type :SEC: SEC II

Marks: 50

Credits : 2

From: A. Y. 2025-26

Name of the Course-BBTPSEC 2: Lab exercise based on application in Hydroponics

Course Objectives: Students should be able to...

1. understand successful cultivation of crops using hydroponics techniques.
2. know basic farming practices; and some experience in crop farming.
3. learn to apply techniques for production of sustainable hydroponic and greenhouse crops.
4. aware to harvest the plant which is cultivated in hydroponics.

Course Outcomes: Students should be able to...

1. explain nursery management.
2. apply the technique of different tools used in nursery management
3. analyze various techniques for nursery management
4. illustrate the demonstrate techniques used in grafting

Sr. No.	Application in Hydroponics (Any fifteen)	Hrs.
1.	Construction of a simple hydroponic unit using locally available materials.	60
2.	Study of the mineral nutrient requirements of hydroponic plants.	
3.	Study of nutrient deficiency symptoms in hydroponic plants.	
4.	Study of different types of hydroponic systems (NFT, DWC, Ebb & Flow, Wick, Aeroponics).	
5.	Effect of pH variation on nutrient uptake and plant growth.	
6.	Study of different growth media (cocopeat, perlite, vermiculite, rockwool, LECA).	
7.	Cost analysis of small-scale hydroponic setup.	
8.	Observation of root morphology in hydroponic versus soil-grown plants	
9.	Measurement of growth parameters (root length, shoot height, leaf area) in hydroponic plants.	
10.	Design and working of a deep-water culture (DWC) system..	
11.	Study of recirculating versus non-recirculating hydroponic systems.	
12.	Demonstration of nutrient film technique (NFT) system setup.	
13.	Cleaning and sterilization techniques for hydroponic equipment.	
14.	Preparation and application of organic biocontrol agents in hydroponics.	
15.	Study of microbial contamination in hydroponic nutrient solutions.	
16.	Observation of algal growth and its control in hydroponic tanks.	
17.	Use of beneficial microbes (e.g., Azospirillum, Trichoderma) in hydroponic cultivation.	
18.	Determination of biomass yield in hydroponically grown plants.	
19.	Analysis of chlorophyll content in hydroponic plant leaves.	
20.	Visit to advanced/industrial hydroponic unit	

Reference Books:-

1. Van der Lugt, Geerten, Harmen Tjalling Holwerda, Katja Hora, Griselli Durant, Mauricio Uribe, Camila Miranda, Marcel Bugter, and Peter de Vries. *Nutrient Solution for Greenhouse Crops*. Wageningen, Netherlands: Wageningen University & Research, 2016.
2. Pardossi, Alberto, Giacomo Carmassi, Chiara Diara, Luca Incrocci, Rossana Maggini, and Davide Massa. *Fertigation and Substrate Management in Closed Soilless Culture*. Pisa, Italy: Dipartimento di Biologia delle Piante Agrarie, Università di Pisa, 2011.
3. Sabir, Naved, Balraj Singh, M. Hasan, R. Sumitha, Sikha Deka, R. K. Tanwar, D. B. Ahuja, B. S. Tomar, O. M. Bambawale, and E. M. Khah. *Good Agricultural Practices (GAP) for IPM in Protected Cultivation*. Technical Bulletin No. 23. New Delhi: National Centre for Integrated Pest Management, 2010.
4. Anonymous. *Hydroponics: Soil-less Culture Book*. New Delhi: Department of Agriculture, Ministry of Agriculture, 2009.
5. Prasad, S., and R. J. Kumar. *Greenhouse Management for Horticultural Crops*. Jodhpur: Agrobios (India), 2005.
6. Jones, J. Benton. *Hydroponics: A Practical Guide for the Soilless Grower*. 2nd ed. Boca Raton, FL: CRC Press, 2004.
7. Resh, Howard M. *Hobby Hydroponics*. 1st ed. Boca Raton, FL: CRC Press, 2003.
8. Roberto, L. Keith. *How-To Hydroponics*. 4th ed. New York: Futuregarden Press, 2003.
9. Dahama, A. K. *Organic Farming for Sustainable Agriculture*. 2nd ed. Jodhpur: Agrobios (India), 2002.
10. Subba Rao, N. S. *Biofertilizers in Agriculture and Forestry*. 3rd ed. New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd., 1999.

Evaluation Pattern: 60:40

Total Marks: 50

Internal Evaluation: 20 Marks

Journal : 10 Marks

Students Performance/ Tour report :
05Marks

Viva : 05 Marks

End Semester Examination:30 Marks

Question I : 10 Marks

Question II : 10 Marks

Question III : 10 Marks

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Humanities	
	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in English	
	Programme: B.Sc.-II	Semester - IV
	Type : AEC II	Marks: 50
	Credits : 02	From: A. Y. 2024-25
Name of the Course: BBTAECE 2 : English for Communication P-II		
Course Objectives: Students should be able to... 1. learn the language skills 2. understand expansion of an idea 3. learn the note making and note taking skills 4. study the various methods of professional communication		
Course Outcomes : Students will be able to... 1. identify the language skills. 2. expand an idea. 3. use the various methods for effective professional communication 4. describe the global influences of iks.		
Module	Title and Contents	Hrs.
Module- I	Language Skills 1.1 Word building 1.2 Grammar 1.3 Language and style	07
Module- II	Expansion of an Idea 2.2 Definition, 2.3 Sentence building 2.4 Paragraph writing 2.5 Expansion of an idea	07
Module -III	Professional Communication 3.1 Definition 3.2 Professional communication 3.3 Report writing 3.4 Letter writing	08
Module -IV	Conversation Skills 4.1 Art of conversation 4.2 Manners and Etiquettes 4.3 Telephonic communication 4.4 Professional conversation	08

REFERENCE BOOKS:

1. Raman, Meenakshi, and Sangeeta Sharma. *Technical Communication: Principles and Practice*. 3rd ed. New Delhi: Oxford University Press, 2015.
2. Guffey, Mary Ellen, and Dana Loewy. *Essentials of Business Communication*. 9th ed. Boston: Cengage Learning, 2013.
3. Kumar, Sanjay, and Pushp Lata. *Communication Skills*. New Delhi: Oxford University Press, 2012.
4. Lesikar, Raymond V., Marie E. Flatley, Kathryn Rentz, and Paula Lentz. *Business Communication: Making Connections in a Digital World*. 12th ed. New York: McGraw-Hill, 2012.
5. Das, Bikram K. *Functional Grammar and Spoken and Written Communication in English*. Kolkata: Orient Blackswan, 2011.
6. Rizvi, M. Ashraf. *Effective Technical Communication*. 2nd ed. New Delhi: Tata McGraw Hill Education, 2010.
7. Bovee, Courtland L., John V. Thill, and Barbara E. Schatzman. *Business Communication Today*. 10th ed. Boston: Pearson Education, 2010.
8. Farhathullah, T. M. *English for Business Communication*. Bangalore: Prism Publishers, 2009.
9. Wren, P. C., and H. Martin. *High School English Grammar and Composition*. New Delhi: S. Chand Publishing, 2000.
10. Murphy, Herta A., Herbert W. Hildebrandt, and Jane P. Thomas. *Effective Business Communications*. 7th ed. New York: McGraw-Hill, 1997.

Evaluation Pattern: 60:40**Total Marks: 50****Internal Evaluation: 20 Marks**

CCE-I : Home Assignment : 10 Marks

CCE –II : Short and long answer questions

test/Seminar/ Open book test / Quiz / Case

study / Book review / Field work / Industry

visit: 10 Marks

CCE – III MCQ Test : 10 Marks

(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 Marks

Question -2 –Attempt any two questions (three question of 10 marks) 20 Marks

Question -3 – Attempt nay four questions (five questions of 5 marks) 20 Marks

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 - IV
	Type : VEC II	Marks: 50
	Credits : 2	From: A. Y. 2025-26
Name of the Course: BBTTVEC-II- Environmental awareness for Biotechnologist		
Course Objectives: Students should be able to... 1) understand the environmental issues. 2) relate those laws made to safe guard the environment. 3) know the importance of sustainable development. 4) correlate knowledge of sustainable development with plant sciences.		
Course Outcomes: Students will be able to... 1) explain the causes of environmental issues 2) discuss concepts related to environmental laws and ethics. 3) understand the sustainable development goals. 4) compare and analyze the importance of plant sciences in meeting the sustainable development goals.		
Module	Title and Contents	Hrs.
Module -1:	Environmental issues 1.1 Pollution (Air, Water and Land) 1.2 Fresh-water overuse 1.3 Natural disasters 1.4 Fuel and Energy shortage due to overuse 1.5 Increase in wasteland 1.6 Biodiversity loss 1.7 Global warming and climate change (Causes and intensity of the problem)	09
Module -2:	Environmental laws and ethics 2.1 Environmental Protection Act 2.2 Wildlife Protection Act 2.3 Forest Conservation Act 2.4 Prevention and Control of Pollution Act (Air, water and Land) 2.5 From unsustainable to sustainable development 2.6 Responsibilities of an Environmentally aware citizen	07
Module -3:	Sustainable goals 3.1 Introduction, History and terminologies used 17 global sustainable goals. 3.2 No Poverty, Zero Hunger, Good Health and Well-being, Quality Education 3.3 Gender Equality, Clean Water and Sanitation, Affordable and Clean Energy, Decent Work and Economic Growth 3.4 Industry, Innovation and Infrastructure, Reduced Inequalities, Sustainable Cities and Communities 3.5 Responsible Consumption and Production, Climate Action, Climate Action, Life on Land, Peace, Justice and Strong Institutions	07

Module -4:	Role of Biotechnology in meeting the sustainable development goals. 4.1 Examples and case studies 4.2 Enhancing Food Security through Genetically Modified Crops: A Case Study on Golden Rice 4.3 Waste to Energy: Application of Microbial Biotechnology in Sustainable Biofuel Production 4.4 Bioremediation for a Cleaner Environment: A Study on Oil Spill Degradation by Genetically Modified Bacteria 4.5 Sustainable Healthcare Solutions: Case Study of Recombinant Insulin Production Bio fertilizers and Sustainable Agriculture: Application of Rhizobium in Legume Cultivation	07
Reference Books:- 1. Rawat, Hemant. <i>Environmental Biotechnology</i>. 1st ed. New Delhi: Oxford Book Company, 2024. 2. Salvatore, H. <i>Environmental Biotechnology: Principles and Applications</i>. London: White Press Academic Publications, 2020. 3. Kumar, Rajan, and Satya S. S. <i>Environmental Biotechnology: A New Approach</i>. New Delhi: Daya Publishing House, 2020. 4. Ranbir C. S., Naveen Kumar A., and Richa K. <i>Environmental Biotechnology: For Sustainable Future</i>. 1st ed. Singapore: Springer, 2019. 5. Garima, K. <i>Applied Environmental Biotechnology: Present Scenario and Future Trends</i>. Singapore: Springer, 2015. 6. Eric, Y. <i>Environmental Biotechnology: Principles and Applications</i>. New Delhi: Delve Publications, 2015. 7. Ramesh, C. K., and Ajay Singh. <i>Biotechnology for Environmental Management and Resource Recovery</i>. New Delhi: Springer India Pvt. Ltd., 2013. 8. Joshi, Navneet, K. C. Sharma, and M. Sharma. <i>Environmental Biotechnology</i>. Saarbrücken: LAP Lambert Academic Publishing, 2012. 9. Sukanta, M., Shivesh Pratap S., and Yugendra Kumar L. <i>Emerging Trends in Environmental Biotechnology</i>. Boca Raton, FL: Taylor & Francis, 2009. 10. Agarwal, S. K. <i>Advanced Environmental Biotechnology</i>. New Delhi: Ashish Publishing House, 2005		
Evaluation Pattern: 60:40		
Total Marks: 50		
Internal Evaluation: 20 Marks CCE-I : Home Assignment : 10 Marks CCE –II : Short and long answer questions test/Seminar/ Open book test / Quiz / Case study / Book review / Field work / Industry visit: 10 Marks CCE – III MCQ Test : 10 Marks (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 Marks Question -2 –Attempt any two questions (three question of 10 marks) 20 Marks Question -3 – Attempt nay four questions (five questions of 5 marks) 20 Marks Note : Conversion of 50 marks of ESE to 30 marks	