

तार : विश्वविद्यालय
Gram : UNIVERSITY



टेलीफोन : कार्या0 : 2320496
कुलसचिव : निवास : 2321214
फैक्स : 0510 : 2321667
मेल नं.: registrar.bujhansi@gmail.com

बुन्देलखण्ड विश्वविद्यालय, झाँसी

BUNDELKHAND UNIVERSITY, JHANSI (U.P.)


संदर्भ. BU/Milw/2022/BOS-2


झाँसी (उ.प्र.) 284128

The Minutes of Meeting of BOS

दिनांक. 24.06.2022

In reference of the Board of Studies (BOS) of Department of Microbiology , Institute of Life Science held on 24.06.2022 regarding the revision of syllabus in tune with CBCS/ NEP-2020 and subsequent approval from Academic Council, This is to certify that the syllabus is 100% revised.


Dr. Pankaj Kumar Sagar
(Coordinator)


Prof. R. K. Saini
(Dean, Science)

बुन्देलखण्ड विश्वविद्यालय, झाँसी

सूचना


एदत् द्वारा सूचित किया जाता है कि माइक्रोबायोलॉजी पाठ्यक्रम समिति की बैठक दिनांक 24/06/2022 को अपरान्ह 03.00 बजे विश्वविद्यालय के सभागार में ऑनलाइन/ऑफलाइन के माध्यम से आहूत की गयी है। अतः आपसे अनुरोध है कि बैठक में निर्धारित तिथि एवं समय पर उपस्थित होने का कष्ट करें।

कार्यसूची :-

1. उत्तर प्रदेश शासन के पत्र संख्या-नि.-401/सत्तर-3-2022 दिनांक 09/02/2022 के अनुसार उच्च शिक्षण संस्थानों में पाठ्यक्रम पुनर्संरचना की राज्य स्तरीय समिति द्वारा प्रदेश के समस्त विश्वविद्यालयों एवं महाविद्यालयों में राष्ट्रीय शिक्षा नीति-2020 को स्नातक (शोध सहित), स्नातकोत्तर एवं पी0एच0डी0 स्तर पर लागू किये जाने हेतु सुझाव।
2. माइक्रोबायोलॉजी विभाग में बी0एस0सी0 (ऑनर्स) माइक्रोबायोलॉजी एवं एम0एस0सी0 माइक्रोबायोलॉजी कोर्स/प्रोग्राम में सत्र 2022-2023 से राष्ट्रीय शिक्षा नीति-2020 को लागू करने एवं इन कोर्स/प्रोग्राम के पाठ्यक्रम का निर्माण करने हेतु पाठ्यक्रम समिति की बैठक आहूत करने के सम्बन्ध में।
3. अन्य मद अध्यक्ष की अनुमति से।

सेवा में,

1	प्रो0 आर0के0सैनी, सांकायाध्यक्ष विज्ञान बुन्देलखण्ड विश्वविद्यालय, परिसर, झाँसी	संकायाध्यक्ष/संयोजक
2	डॉ0 ऋषि कुमार सक्सेना, बुन्देलखण्ड विश्वविद्यालय, परिसर, झाँसी	सदस्य
3	डॉ0 संगीता लाल, बुन्देलखण्ड विश्वविद्यालय, परिसर, झाँसी	सदस्य
4	डॉ0 पंकज कुमार सागर, बुन्देलखण्ड विश्वविद्यालय, परिसर, झाँसी	सदस्य
5	डॉ0 देवेन्द्र मणि त्रिपाठी, बुन्देलखण्ड विश्वविद्यालय, परिसर, झाँसी	सदस्य
6	डॉ0 रंजना भाटी, बुन्देलखण्ड विश्वविद्यालय, परिसर, झाँसी	सदस्य
7	डॉ0 संजय कुमार, बुन्देलखण्ड विश्वविद्यालय, परिसर, झाँसी	सदस्य
8	प्रो0 नवीन काँगो, डॉ0 हरीसिंह गौर विश्वविद्यालय, सागर, म0प्र0	वाह्य विशेषज्ञ
9	श्री भानुप्रताप सिंह, पराग डेयरी, झाँसी, 7838857301	वाह्य विशेषज्ञ


सहा0कुलसचिव(एक0)
कृते कुलसचिव

बुन्देलखण्ड विश्वविद्यालय, झाँसी


पत्रांक:- बु0वि0/एके0/2022/7507-7517

दिनांक:- 13/7/2022

प्रतिलिपि - निम्नलिखित को सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित।

1. उपर्युक्त समस्त सदस्यगण
2. अध्यक्ष, एन0ई0पी0 टास्क फोर्स।
3. संकायाध्यक्ष- विज्ञान को सूचनार्थ।
4. वित्त अधिकारी।
5. सहायक कुलसचिव (अतिगोपनीय)।
6. कुलपति जी के निजी सचिव।
7. कुलसचिव के आशुलिपिक।

सहा0कुलसचिव
कृते कुलसचिव

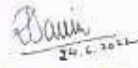

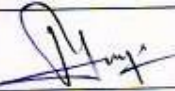

24.6.2022

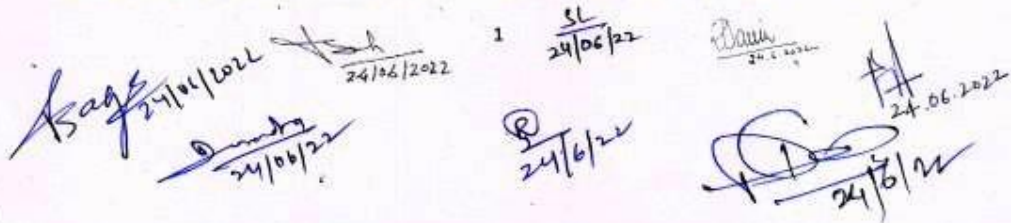
**Department of Microbiology
Bundelkhand University, Jhansi-284128 (UP)**

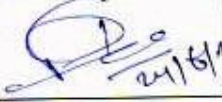
As per the notification given regarding the Board of Studies (BOS) of Microbiology session 2022-2023 vide Letter No -पत्रांक - बु० वि०/ए के०/2022/7507-7517, दिनांक: 12/07/2022.

Agenda of the Board of Studies (BOS) of Microbiology, session 2022-2023 on 24th June 2022:

1. Implementation of National Education Policy (NEP) - 2020 in B.Sc. (Hons.) Microbiology (undergraduate) and M.Sc. Microbiology (post graduate) course/ programmes from academic session 2022-23.
2. Developing curriculum and syllabus of B.Sc. (Hons.) Microbiology (undergraduate) and M.Sc. Microbiology (post graduate) course / programme under National Education Policy (NEP) - 2020.
3. Panel of experts for the Undergraduate and post graduate programme/course under NEP-2020.
4. Panel of experts of B.Sc. (Hons.) Microbiology (old pattern) and M.Sc. Microbiology (old pattern) for academic session 2022-23.
5. Panel of experts for Advance Post Graduate (P.G.) Diploma entitled as 'Advance P.G. Diploma in Microbiology and Food Technology' for academic session 2022-23.

Sr. No.	Name and address of Members of BOS	Signature
External Members: The external members have joined BOS 'ONLINE MODE'		
1.	Prof. Naveen Kango Department of Microbiology Dr. Harisingh Gour Vishwavidyalaya Sagar (M.P.)	 24.6.2022
2.	Sh. Bhanu Pratap Singh Parag Dairy, Jhansi (U.P.)	 24/06/2022
Convener of Board of Studies		
3.	Prof R. K.Saini Dean Science Bundelkhand University, Jhansi	
Internal Members (06)		


B.K.S. 24/06/2022
S. 24/06/2022
S. 24/06/2022
S. 24/06/2022
S. 24/06/2022
S. 24.06.2022

4.	Dr Rishi Kumar Saxena Associate Professor, Department of Microbiology, Bundelkhand University, Jhansi	 24/6/22
5.	Dr Sangeeta Lal Assistant Professor, Department Microbiology, Bundelkhand University, Jhansi	SL 24/06/22
6.	Dr. Pankaj Kumar Sagar Assistant Professor, Department of Microbiology, Bundelkhand University, Jhansi	Bayer 24/06/2022
7.	Dr Devendra Mani Tripathi, Assistant Professor, Department of Microbiology, Bundelkhand University, Jhansi	Devendra 24/06/22
8.	Dr Ranjana Bhati Assistant Professor, Department of Microbiology, Bundelkhand University, Jhansi.	R 24/6/22
9.	Dr Sanjay Kumar Assistant Professor, Department of Microbiology, Bundelkhand University, Jhansi	SA 24.06.2022

Devendra
24/06/22

SL
24/06/22

SA
24-06-2022

Bayer
24/06/2022

SL
24/06/2022

SL
24/06/2022

R
24/6/22


RKS

2 

Department of Microbiology
Bundelkhand University, Jhansi-284128 (UP)

Minutes of Board of Studies (BOS) of Microbiology on 24th June 2022.

As per the notification given regarding the Board of Studies (BOS) of Microbiology session 2022-2023 vide Letter No -पत्रांक - बु० वि०/ए के० 7507-7517, दिनांक: 12/07/2022 the BOS has been held on 24th June 2022 at Bundelkhand University, Jhansi in the presence of BOS members.

The following decision have been made in the BOS meeting and approved by all the BOS members.

1. Ordinance and general rules, regulation & guidelines as per National Education Policy (NEP) 2020 for the **Bachelor in Honours (semester system) programme in Microbiology** will be provided by Bundelkhand University, Jhansi (U.P.) and will be implemented accordingly from 2022 onwards.

2. The ordinance which will be provided (and implemented from 2022 onwards) by Bundelkhand University, Jhansi (U.P.) supersedes all the previous relevant ordinances, rules and regulations.

3. The syllabus, course content and panel of expert for Major III (DSE) (Table 3a), Minor - I (GE) (Table 4), Minor-II (SEC/AEC) (Table 5), Minor- III (VAC) (Table 6) except syllabus of Agricultural Microbiology (Table 3a: Major -III for science (DSE) for Under Graduate Course (Science discipline) and Industrial Microbiology (Table 5: Skill enhancement/ ability enhancement course (SEC/AEC) or Minor -II for science, commerce and arts disciplines (for Under Graduate Course) will be as provided by Bundelkhand University, Jhansi (U.P.) and implemented accordingly.

4. The syllabus and panel of experts for Syllabus of Agricultural Microbiology (Table 3a: Major - III for science (DSE) for Under Graduate Course (Science discipline) and Industrial Microbiology (Table 5: Skill enhancement/ ability enhancement course (SEC/AEC) or Minor -II for science, commerce and arts disciplines (for Under Graduate Course) has been submitted and approved by the BOS members which will be implemented by Bundelkhand University for the courses of science, commerce and arts disciplines as required.

5. The syllabus and panel of experts for Major I (DSC I), Major II (DSCII) and Major III (DSC III) as well as practical (Lab course) I, II and III and training for undergraduate programme has been submitted and approved by the BOS members for academic session 2022-2023 (as Per National Education Policy-2020).

6. The panel of experts for B.Sc. (Hons.) Microbiology (as old pattern) has been submitted and approved by the BOS members for academic session 2022-2023.

3

Handwritten signatures and dates at the bottom of the page:

- Signature: [Handwritten] Date: 24/06/22
- Signature: [Handwritten] Date: 24/06/22
- Signature: [Handwritten] Date: 24/06/2022
- Signature: [Handwritten] Date: 24/06/2022
- Signature: [Handwritten] Date: 24/06/22
- Signature: [Handwritten] Date: 24/06/22

7. The syllabus, course content and panel of expert for Minor elective for post graduate programme will be as provided by Bundelkhand University, Jhansi (U.P.) and implemented accordingly.

8. The syllabus and panel of experts for Major I (DSC I), Major II (DSCII), Major III (DSC III), Major IV (DSCIV), Major V (DSCV) as well as practical (Lab course) I, II and research project / training for post graduate programme has been submitted and approved by the BOS members for academic session 2022-2023 (as Per National Education Policy-2020).

9. The panel of experts for M.Sc. Microbiology (as old pattern) has been submitted and approved by the BOS members for academic session 2022-2023.



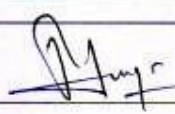
10. The duration of training and report submission for undergraduate and post graduate programme (programme under NEP-2020) shall be of three weeks as per departmental time table schedule.

11. The curriculum and syllabus of undergraduate and post graduate programme (under NEP-2020) have been approved by BOS members.


12. Panel of experts for Advance Post Graduate (P.G.) Diploma entitled as 'Advance P.G. Diploma in Microbiology and Food Technology' have been submitted and approved by BOS members for academic session 2022-23.

13. All the suggestions and directions provided by BOS members have been incorporated.

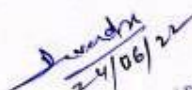
All the decision mentioned above have been incorporated and approved by BOS members.


Sr. No.	Name and address of Members of BOS	Signature
External Members: The external members have joined BOS 'ONLINE MODE'		
1.	Prof. Naveen Kango Department of Microbiology Dr. Harisingh Gour Vishwavidyalaya Sagar (M.P.)	 24/6/2022
2.	Sh. Bhanu Pratap Singh Parag Dairy, Jhansi (U.P.)	 24/06/2022
Convener of Board of Studies		
3.	Prof R. K.Saini Dean Science Bundelkhand University, Jhansi	
Internal Members (06)		

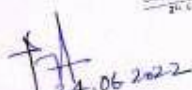
SL
24/06/22



24/06/2022


4



24/06/22


24/6


24.06.2022


24/6/22


24/06/2022

4.	Dr Rishi Kumar Saxena Associate Professor, Department of Microbiology, Bundelkhand University, Jhansi	 24/06/22
5.	Dr Sangeeta Lal Assistant Professor, Department Microbiology, Bundelkhand University, Jhansi	<u>SL</u> 24/06/22
6.	Dr. Pankaj Kumar Sagar Assistant Professor, Department of Microbiology, Bundelkhand University, Jhansi	<u>ksagar</u> 24/06/2022
7.	Dr Devendra Mani Tripathi, Assistant Professor, Department of Microbiology, Bundelkhand University, Jhansi	<u>Devendra</u> 24/06/22
8.	Dr Ranjana Bhati Assistant Professor, Department of Microbiology, Bundelkhand University, Jhansi.	<u>R</u> 24/06/22
9.	Dr Sanjay Kumar Assistant Professor, Department of Microbiology, Bundelkhand University, Jhansi	<u>Sanjay</u> 24.06.2022

Sanjay
24/06/22

SA
24/06/2022

SA
24/06/2022

R
24/6/22

Sanjay
24.6.2022

SL
24/06/22

ksagar
24/06/2022

Sanjay

BUNDELKHAND UNIVERSITY, JHANSI-284128
CURRICULUM for B. Sc. (H) MICROBIOLOGY
(CERTIFICATE IN MICROBIOLOGY in completion of 1 Year; DIPLOMA IN MICROBIOLOGY in completion 1 and 2 Year,
BACHELOR OF SCIENCE (Hons.) IN MICROBIOLOGY in completion of 1, 2 and 3 Year)

Year	Course	Major/Minor/Training	Title and Code of the paper	Type	Credits	External Assessment	Internal Assessment	Total Marks
I st Year	SEM - I	Major 1 (DSC 1)	General Microbiology	Major 1 Core	04	75	25	100
		Major 2 (DSC 2)	Bioinstrumentation	Major 2 Core	04	75	25	100
		Practical DSC 1	Practical I/ Lab course I	Core	02	75	25	100
		Practical DSC 2	Practical II/ Lab course II	Core	02	75	25	100
		Major-III (DSE)	Student has to opt the paper from Table 3a (list of Subject for Science discipline). Select anyone except the major stream given in table 2.	Major III Elective	06	75	25	100
		Minor-I(GE)	Student has to opt the paper from Table 4 (list of Subject of GE / Minor –I for science, Commerce and Arts). Select one subject for first year and other subject for second year from interdiscipline or from other faculty.	Minor- I Elective	04	75	25	100
		Minor-II (SEC /AEC)	Student has to opt the paper from Table 5 (list of Skill enhancement courses for science, commerce and Arts disciplines). Select one course in each Semester for first two year (Sem –I, II, III and IV only)	Minor- II Elective	03	75	25	100
		Minor-III (VAC)	Food and Nutrition (from table 6)	Qualifying	-	-	-	-
					Total Credits: 25	Total Marks 700		
	SEM - II	Major 1 (DSC 1)	Microbial Genetics	Major 1 Core	04	75	25	100
		Major 2 (DSC 2)	Microbial Biochemistry	Major 2 Core	04	75	25	100
		Practical DSC 1	Practical I/ Lab course I	Core	02	75	25	100
		Practical DSC 2	Practical II/ Lab course II	Core	02	75	25	100
		Major-III (DSE)	Student has to opt the paper from Table 3a (list of Subject for Science discipline). Select anyone except the major stream given in table 2.	Major III Elective	06	75	25	100
Minor-II (SEC 2/AEC 2)		Student has to opt the paper from Table 5 (list of Skill enhancement courses for science, commerce and Arts disciplines). Select one course in each Semester for first two year (Sem –I, II, III and IV only)	Minor- II Elective	03	75	25	100	
Minor-III (VAC 2)		First Aid and Health (from table 6)	Qualifying	-	-	-	-	
				Total Credits : 21	Total Marks 600			
Total credits in first year : 46								
After completion of first year awarded for CERTIFICATE IN MICROBIOLOGY (Total Credits: 46)								

DSC: Discipline Specific Core

DSE: Discipline Specific Elective

GE: Generic Elective

AEC/ SEC: Ability Enhancement Course / Skill Enhancement Course

VAC: Value Added Course

IInd Year	SEM - III	Major 1 (DSC 1)	Microbial Metabolism	Major 1 Core	04	75	25	100
		Major 2 (DSC 2)	Environmental Microbiology	Major 2 Core	04	75	25	100
		Practical DSC 1	Practical I/ Lab course I	Core	02	75	25	100
		Practical DSC 2	Practical II/ Lab course II	Core	02	75	25	100
		Major-III (DSE)	Student has to opt the paper from Table 3a (list of Subject for Science discipline). Select anyone except the major stream given in table 2.	Major III Elective	06	75	25	100
		Minor-I(GE 2)	Student has to opt the paper from Table 4 (list of Subject of GE / Minor –I for science, Commerce and Arts). Select one subject for first year and other subject for second year from interdiscipline or from other faculty.	Minor I Elective	04	75	25	100
		Minor-II (SEC 3/AEC 3)	Student has to opt the paper from Table 5 (list of Skill enhancement courses for science, commerce and Arts disciplines). Select one course in each Semester for first two year (Sem –I, II, III and IV only)	Minor II Elective	03	75	25	100
		Minor-III (VAC 3)	Human Values and Environment Studies (from table 6)	Qualifying	-	-	-	-
			Total Credits : 25			Total Marks	700	
	SEM - IV	Major 1 (DSC 1)	Food Microbiology	Major 1 Core	04	75	25	100
		Major 2 (DSC 2)	Industrial Bioprocess Technology	Major 2 Core	04	75	25	100
		Practical DSC 1	Practical I/ Lab course I	Core	02	75	25	100
		Practical DSC 2	Practical II/ Lab course II	Core	02	75	25	100
		Major-III (DSE)	Student has to opt the paper from Table 3a (list of Subject for Science discipline). Select anyone except the major stream given in table 2.	Major III Elective	06	75	25	100
		Minor-II (SEC 4/AEC 4)	Student has to opt the paper from Table 5 (list of Skill enhancement courses for science, commerce and Arts disciplines). Select one course in each Semester for first two year (Sem –I, II, III and IV only)	Minor II Elective	03	75	25	100
Minor-III (VAC 4)		Physical Education and Yoga (from table 6)	Qualifying	-	-	-	-	
			Total Credits : 21			Total Marks	600	
Total credits in second year :46								
After completion of first and second year awarded for DIPLOMA IN MICROBIOLOGY (Total Credits: 92)								

DSC: Discipline Specific Core

DSE: Discipline Specific Elective

GE: Generic Elective

AEC/ SEC: Ability Enhancement Course / Skill Enhancement Course

VAC: Value Added Course

IIIrd Year	SEM V	Major 1 (DSC 1)	Molecular Biology	Major 1 Core	04	75	25	100	
		Major 2 (DSC 2)	Medical Microbiology and Immunology	Major 2 Core	04	75	25	100	
		Major 3 (DSC 3)	Enzymology	Major 3 Core	04	75	25	100	
		Practical DSC 1	Practical I/ Lab course I	Core	02	75	25	100	
		Practical DSC 2	Practical II/ Lab course II	Core	02	75	25	100	
		Practical DSC 3	Practical III/ Lab course III	Core	02	75	25	100	
		Minor-III (VAC 4)	Analytic Ability and Digital Awareness (from table 6)	Qualifying	-	-	-	-	
				Total Credits 18			Total Marks 600		
	SEM VI	Major 1 (DSC 1)	Microbial Ecology	Major 1 Core	04	75	25	100	
		Major 2 (DSC 2)	Genetic Engineering	Major 2 Core	04	75	25	100	
		Major 3 (DSC 3)	Agro-Technology & Sustainable Agriculture	Major 3 Core	04	75	25	100	
		Practical DSC 1	Practical I/ Lab course I	Core	02	75	25	100	
		Practical DSC 2	Practical II/ Lab course II	Core	02	75	25	100	
Practical DSC 3		Practical III/ Lab course III	Core	02	75	25	100		
Minor-III (VAC 4)		Communication Skills and Personality Development or Character Building (from table 6)	Qualifying	-	-	-	-		
Industrial Training		Industrial Training	Core	04	75	25	100		
			Total Credits: 22			Total Marks : 700			
Total credits in third year : 40									
After completion of first, second and third year awarded for BACHELOR OF SCIENCE (Hons.) IN MICROBIOLOGY (Total Credits: 132)									

DSC: Discipline Specific Core

DSE: Discipline Specific Elective

GE: Generic Elective

AEC/ SEC: Ability Enhancement Course / Skill Enhancement Course

VAC: Value Added Course



**DEPARTMENT OF MICROBIOLOGY
BUNDELKHAND UNIVERSITY, JHANSI**

National Education Policy -2020

**DEPARTMENT OF MICROBIOLOGY
BUNDELKHAND UNIVERSITY, JHANSI**

SYLLABUS FOR THE “CERTIFICATE IN MICROBIOLOGY”

(B.Sc. First year)

(Total Credits in First Year: 46)

(with effective from: academic session 2022-2023)

Programme Name: Certificate in Microbiology

Year of programme: B. Sc. (H) Microbiology, First Year

Programme Objective:

The programme has been designed in such a way so that the students will gain theoretical as well as practical knowledge on various domains of Microbiology. This programme includes the theoretical as well as laboratory/ practical details of General Microbiology, Bioinstrumentation, Microbial Genetics and Microbial Biochemistry.

Programme Outcome (POs):

PO1: After the completion of programme the students will be able to gain the theoretical as well as practical knowledge on various aspects of Microbiology and related field.

PO2: The practical /lab courses will be helpful to expertise the students with the laboratory skills in basic microbiology and course related topics.

PO3: The major focus of the programme is to develop the ability to design and conduct experiments, as well as to analyze and interpret scientific data.

PO4: The programme will provide the knowledge and laboratory skills to the students to undertake further studies in the field of microbiology and related areas or in multidisciplinary areas such as biotechnology, biochemistry and molecular biology.

PO5: The programme will help to develop a range of generic skills that are relevant in enhancing entrepreneurship skills among students.

Programme Specific Outcome (PSOs): After the completion of programme the students will be able to

PSO1: Gain knowledge on structure of bacteria and microbial growth kinetics and learn about the different bacteriological media, bacterial cultivation methods and various sterilization methods.

PSO2: Acquire information about microbial diversity and different system of classification and knowledge on bacterial ultra structure and microbial growth kinetics.

PSO3: Get knowledge about principle and procedure of laboratory instruments such as centrifuge, pH meter, colorimeter, Chromatography, SDS-PAGE, Microscope, spectrophotometer.

PO4: Explain the microbial genetic material, recombination methods and also explains the meaning, types and applications of mutation.

PO5: Understand the basics of principles of aqueous environment in biological systems, and structure as well as structure and function of different biomolecules.

PO6: Develop laboratory skills in techniques related to course curriculum and also expertise basic instruments related to microbiology.

BUNDELKHAND UNIVERSITY, JHANSI
DEPARTMENT OF MICROBIOLOGY

SYLLABUS FOR THE “CERTIFICATE IN MICROBIOLOGY”

(Total Credits: 46)

Ist SEMESTER

(1) Major 1 (DSC 1) CORE: GENERAL MICROBIOLOGY

Title of paper: General Microbiology

Type: Major 1 (DSC 1) CORE

Total Credit: 04

Total hours (L/T/P): 60 Hours

Course objectives: The main objective of the course is to provide fundamental and basic concepts of microbiology with special emphasis on microbial diversity.

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

1. Be acquainted with the historical account and development of microbiology
2. Acquire information about microbial diversity and different system of classification.
3. Gain knowledge on structure of bacteria and microbial growth kinetics.
4. Learn about the different bacteriological media and bacterial cultivation methods.
5. Gain knowledge about various sterilization methods.

Sr. No.	Unit No.	Syllabus Content	Hours (L/T/P)
1.	Unit-I	<ol style="list-style-type: none"> 1. Historical development of Microbiology. 2. Contributions of Anton Von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister and Edward Jenner, Alexander Fleming. 3. Scope of Microbiology, Importance and use of microbes. 	10 L/ 2T
2.	Unit-II	<ol style="list-style-type: none"> 1. Difference between prokaryotes and eukaryotes. 2. Morphology and ultra-structure of bacteria, cell membrane of Eubacteria and Archaeobacteria, Structure and function of Flagella, Fimbriae, Pili and Capsule. 3. Bacterial reproduction and Microbial growth kinetics. 	10 L/ 2T
3.	Unit-III	<ol style="list-style-type: none"> 1. Staining: Nature of strains, principles, methodology and types of staining: Simple, Differential, Gram staining, Acid fast staining, staining of capsule, cell wall, endospore. 2. Methods for studying microorganisms, Culture media, preparation and types of defined, differential, selective and enrichment culture, 3. Isolation techniques: Pour plate, spread plate, streak plate. Preservation and maintenance of culture. 	8L/2T
4.	Unit-IV	<ol style="list-style-type: none"> 1. Algae: Importance, Distribution, Morphology, Reproduction, Classification and Ultra structure. 2. Fungi: Importance, Distribution, Morphology, Reproduction, Classification and Ultra structure, Mycorrhiza and Lichen. 3. Protozoa: Distribution, Group, Morphology, Nutrition and Morphology. 	12L/ 2T
5.	Unit-V	<ol style="list-style-type: none"> 1. Viruses Structure and composition of viruses, polyhedral symmetry, Helical symmetry and Complex symmetry. 2. Lytic and lysogenic cycles, Bacteriophage 3. General characteristics, structure and importance of <i>Mycoplasma</i>, <i>Cyanobacteria</i> and <i>Actinomycetes</i>. 	10L/ 2T

List of Reference Books

1. Microbiology: Michael J. Pelczar, JR VthEds, Tata Mc. Graw- Hill Publishing Company limited.
2. General Microbiology by Stanier RY, Ingrahm JI, Wheelis ML and Painter PR. McMillan Press.
3. Brock's Biology of Microorganisms.
4. A text Book of Microbiology by R. C Dubey and D K Maheshwari.

Teaching Methodology

- | | |
|------------------------------------|-------------------------------|
| (1) Classroom lectures | (2) Online classes/ E-content |
| (3) Power point presentation (PPT) | (4) Assignment |

Evaluation Criteria:

- (1) Internal sessional examination
- (2) Final semester examination
- (3) Classroom seminar presentation and Viva-voce

(2) **Major 2 (DSC 2): BIOINSTRUMENTATION**

Title of paper: Bioinstrumentation

Type: Major 2 (DSC 2) CORE

Total Credit: 04

Total hours (L/T/P): 60 Hours

Course objectives: This course provides the knowledge of various tools and techniques, their principle, working and their applications used in Microbiology.

Course learning Outcomes:

After the completion of this course students will be able to get knowledge:

1. About principle and working procedure of Instruments such as centrifuge, pH meter, colorimeter, Chromatography, SDS-PAGE, Microscope, spectrophotometer.
2. About Principles and mechanisms of different sterilization methods.

Sr. No.	Unit No.	Syllabus Content	Hours (L/T/P)
1.	Unit-I	1. Principles and Applications of Microscopy. 2. General principle and working of Microscopes. 3. Light Microscope: Bright field, Dark field, Phase contrast. Microscopy, Electron Microscopy (TEM and SEM).	8 L/ 2T
2.	Unit-II	1. Beer-Lambert law. 2. Basic principle of Colorimeter (Instrumentation and Application). 3. Basic principle of UV-Vis Spectrophotometer.	12 L/ 2T
3.	Unit-III	1. Introduction of pH. 2. pH meter principle and its function. 3. Principles of glass and reference electrodes.	10L/2T
4.	Unit-IV	1. Hydrodynamic techniques. 2. Principle of Centrifugation, Difference between centrifugation and sedimentation 3. Types of Centrifugation : Centrifuge (Types and instrumentation)	10L/ 2T
5.	Unit-V	1. Sterilization: Principles and mechanisms of sterilization 2. Physical methods of sterilization: Temperature (dry and moist heat), Filtration, Radiation 3. Chemical methods of Sterilization.	10L/ 2T

List of Reference Books

1. Research Methodology for Biological Sciences by N. Gurumani, MJP Publishers.
2. Tools and Techniques by Bisen and Shrutti, CBS Publication, New Delhi.
3. Basic Experimental Microbiology by R. M. Atlas, A. E. Brown, K. W. Dobra and L. Miller, Prentice Hall.
4. A Biologists guide to principles and techniques of practical biochemistry. Wilson and Goulding.

Teaching Methodology

- | | |
|------------------------------------|-------------------------------|
| (1) Classroom lectures | (3) Online classes/ E-content |
| (2) Power point presentation (PPT) | (4) Assignment |

Evaluation Criteria:

- (1) Internal sessional examination
- (2) Classroom seminar presentation and Viva-voce
- (3) Final semester examination

Title of paper: DSC Practical I/ Lab Course I

Type: DSC Practical I CORE

Total Credit: 02

Total hours (Hrs): L/T/P (0 Hrs. / 0 Hrs. /60 Hrs)

Practical:

List of Practical	Hours
<ol style="list-style-type: none">1. Microbiology good laboratory practices and biosafety2. Preparation of different culture media-nutrient agar/nutrient broth, PDA for fungal cultures3. Sterilization of culture media and glassware4. Isolation of pure cultures of bacteria by streak plate method5. Serial dilution of soil and water samples for enumeration of microbes by spread plate method6. Colony characteristics of common microbes on agar plate7. Staining of Bacteria: Simple staining, Gram's staining Negative staining8. Staining of fungi using Lacto phenol and cotton blue	60 Hours

List of Reference Books

1. Microbiology: A laboratory manual by J. Cappucino and C.T. Welsh. 11th edition, Pearson education, USA. 2016 2.
2. Aneja K.R., Experiments in Microbiology, plant pathology, Tissue culture and Mushroom Cultivation, New Age International, New Delhi.
3. Dubey R.C. and Maheshwari D.K., Textbook of practical microbiology, S Chand Publications.
4. Stanier RY, Ingraham JL, Wheelis ML and Painter PR. (2005). General Microbiology, 5th edition McMillan.

Methodology for practical/experiment

- (1) Laboratory assignment
- (2) Power point presentation (PPT)
- (3) Laboratory practical / experiments
- (4) Practical record preparation

Evaluation Criteria:

- (1) Internal assignment
- (2) Final semester practical examination
- (3) Evaluation of practical record

Title of paper: DSC Practical II/ Lab Course II

Type: DSC Practical II CORE

Total Credit: 02

Total hours (Hrs): L/T/P (0 Hrs. / 0 Hrs. /60 Hrs)

Practical:

List of Practical	Hours
<ol style="list-style-type: none">1. Microbiology good laboratory practices and biosafety. Neutralization and cleaning of glassware.2. Design and handling equipments of general microbiology laboratory.3. Practice of different types of sterilization.4. Study of principle, functioning and precaution different instrument/ apparatus of microbiology laboratory including<ol style="list-style-type: none">1. Microscope2. Hot air oven3. Autoclave4. Laminar flow bench5. Incubator6. Colony counter7. Centrifuge8. Inoculation loop/needle9. Bunsen burner + Sprit lamp10. Glasswares (Identification and use)11. Pipette-Micropipette12. BOD Incubator	60 hours

List of Reference Books

1. Microbial Technology. Vol I- Microbial processes and Vol II – Fermentation technology edited by H.J. Peppler and D. Perlman, 2nd edition. Academic Press, USA, 2009.
2. James G Cappucino and Natalie Sherman, Microbiology: A laboratory manual. 6th edition, Published by Pearson education. 2004.
3. Rajan S and Selvi Christy. Experimental procedures in life sciences. Anjana Book House, publishers and distributors, Chennai. 2011.
4. Kannan N, Handbook of laboratory culture media, Reagents, Stains and buffers. Panima Publishing Corporation, New Delhi.2003.

Methodology for practical/experiment

- | | |
|------------------------------------|--|
| (1) Laboratory assignment | (2) Laboratory practical / experiments |
| (3) Power point presentation (PPT) | (4) Practical record preparation |

Evaluation Criteria:

- | | |
|--|------------------------------------|
| (1) Internal assignment | (2) Evaluation of practical record |
| (3) Final semester practical examination | |

IInd SEMESTER

(1) Major 1 (DSC 1) CORE: MICROBIAL GENETICS

Title of paper: Microbial Genetics

Type: Major 1 (DSC 1) CORE

Total Credit: 04

Total hours: L/T/P

Course objectives: The course introduces the microbial genetic material and recombination methods. The course also explains the meaning, types and application of mutation.

Course learning outcome: At the end of the course, the student will be able to:

1. Structure of DNA and various units of a gene.
2. Describe various methods of bacterial genetic recombination.
3. Know about the types of mutation at molecular level and its application.
4. Gain an understanding about the types of extra chromosomal genetic material of bacteria.
5. Describe the various types of transposable elements and their uses.

Sr. No.	Unit No.	Syllabus Content	Hours (L/T/P)
1.	Unit-I	Concept of gene. Mutation, Recombination, Cistron, genomic size, Nucleic acid as a genetic information carrier, experimental evidence. Structure and types of DNA. DNA denaturation and renaturation.	10 L/ 2T
2.	Unit-II	Plasmids: Types of plasmids – F plasmid, R Plasmids, colicinogenic plasmids, Ti plasmids, linear plasmids, yeast- 2 μ plasmid, Plasmid replication.	8 L/ 2T
3.	Unit-III	Bacterial Genetic Recombination: Transformation; Conjugation, Hfr and F' strains; Transduction - Generalized transduction, specialized transduction	10L/2T
4.	Unit-IV	Mutations and mutagenesis: Definition and various types of Mutations; Physical and chemical mutagens; Molecular basis of mutations, Ames test, Uses of mutations.	10L/ 2T
5.	Unit-V	Transposable elements: Prokaryotic transposable elements – Insertion Sequences, composite and non-composite transposons, Replicative and Non replicative transposition, Mu transposon Eukaryotic transposable elements, Uses of transposons and transposition.	10L/ 2T

List of Reference Books

1. Microbial Genetics by S. R Maloy, D. Freifelder and J.E Cronan, Jones and Berlet Publishers.
2. Principles of Genetics by Eldon J. Gardner, 12th Eds.
3. Genetics: Analysis and Principles by Robert J. Brooker, IIIrd Eds.
4. Malacinski GM, Essential of Molecular Biology, Jones and Bartlett publishers, USA IV th Edition.
5. Brock, T.D. 1990. The Emergence of Bacterial Genetics, Cold Spring Harbor Lab Press.

Teaching Methodology

- | | |
|------------------------------------|-------------------------------|
| (1) Classroom lectures | (2) Online classes/ E-content |
| (2) Power point presentation (PPT) | (4) Assignment |

Evaluation Criteria:

- (1) Internal sessional examination
- (2) Final semester examination
- (3) Classroom seminar presentation and Viva-voce

(2) Major 2 (DSC 2) CORE: MICROBIAL BIOCHEMISTRY

Title of paper: Microbial Biochemistry

Type: Major 1 (DSC 1) CORE

Total Credit: 04

Total hours: L/T/P

Course objectives: The course introduces Structure, Classification and Functional role of Biomolecules in Biological system.

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

1. Understand the basics of Principles of aqueous environment in biological systems and concept of pH, Buffer solutions, Weak and Strong interactions
2. Structure and Function of Carbohydrates and Lipids.
3. Structure, classification and Function of Amino acids and protein.
4. Structure and Function of Nucleic acids and Vitamins.
5. Enzymes and their role in biological systems.

Sr. No.	Unit No.	Syllabus Content	Hours (L/T/P)
1.	Unit-I	1. Water: Structure and properties, Handerson – Hasselbalch equation, Ionic product of water. 2. Concept of pH, Buffer solutions, Weak and Strong interactions.	8 L/ 2T
2.	Unit-II	1. Carbohydrates: Classification (Monosaccharides, Oligosaccharides and Polysaccharides), Stereoisomerism, Structures and Biological functions. Homo and Hetero Polysaccharides. 2. Lipids: Classification (Saturated and Unsaturated), Structures, Nomenclature and Biological functions	10 L/ 2T
3.	Unit-III	1. Amino acids: Classification (Standard and Non-standard), Structures and Acid base property. 2. Proteins: Structures (Primary, Secondary, Tertiary and Quaternary), Classification and biological functions	10L/2T
4.	Unit-IV	1. Nucleic acids: Types and Structures of nucleotides, Types and Structures of DNA and RNA 2. Vitamins: Sources, Classification (Fat soluble and Water soluble) and Functions	10L/ 2T
5.	Unit-V	1. Enzymes: Structure, Classification and Mode of action, 2. Factors affecting enzyme activity, Allosteric enzyme, Coenzymes	10L/ 2T

List of Reference Books

1. Lehninger, Principles of Biochemistry. Nelson and Cox.
2. J.L Jain, Biochemistry, S Chand
3. Stryer L. Biochemistry. Freeman & Co. New York
4. Plummer Mu, David T. Plummer, Introduction to Practical Biochemistry. Tata McGraw-Hill Education.

Teaching Methodology

- | | |
|------------------------------------|-------------------------------|
| (1) Classroom lectures | (2) Online classes/ E-content |
| (3) Power point presentation (PPT) | (4) Assignment |

Evaluation Criteria:

- | | |
|------------------------------------|--|
| (1) Internal sessional examination | (3) Classroom seminar presentation and Viva-voce |
| (2) Final semester examination | |

Title of paper: DSC Practical I/ Lab course I

Type: DSC Practical I CORE

Total Credit: 02

Total hours (Hrs): L/T/P (0 Hrs. / 0 Hrs. /60 Hrs)

Practical:

List of Practical	Hours
<ol style="list-style-type: none">1. Preparation of Master and Replica Plates.2. Isolation of bacterial DNA.3. Determination of melting temperature of DNA sample.4. Demonstration of Photorepair of mutant bacterial culture.5. Quantification of DNA6. To check the purity of DNA sample	60 hours

List of Reference Books

1. Sambrook J and Russell DW. (2001). Molecular Cloning: A Laboratory Manual. 4th Edition, Cold Spring Harbour Laboratory press.
2. Maloy SR, Cronan JE and Friefelder D(2004) Microbial Genetics 2nd EDITION., Jones and Barlett Publishers
3. Pierce BA (2011) Genetics: A Conceptual Approach, 4th Ed., Macmillan Higher Education Learning
4. Miller, J.R. 1992. A Short Course in Bacterial Genetics: Lab Manual, Cold Spring Harbor Laboratory Press
5. Microbiology: A laboratory manual by J. Cappucino and C.T. Welsh. 11th edition, Pearson education, USA.

Methodology for practical/experiment

- | | |
|------------------------------------|--|
| (1) Laboratory assignment | (3) Laboratory practical / experiments |
| (2) Power point presentation (PPT) | (4) Practical record preparation |

Evaluation Criteria:

- | | |
|--|------------------------------------|
| (1) Internal assignment | (3) Evaluation of practical record |
| (2) Final semester practical examination | |

Title of paper: DSC Practical/ Lab course II

Type: DSC Practical II CORE

Total Credit: 02

Total hours (Hrs): L/T/P (0 Hrs. / 0 Hrs. /60 Hrs)

Practical:

List of Practical	Hours
<ol style="list-style-type: none">1. Concept of pH and buffers and Numerical problems to explain the concepts, Preparation of stock and working solutions, Handling of basic instruments of biochemistry laboratory.2. pH measurement3. Buffer preparation.4. Starch iodine test.5. Estimation of the chlorophyll.6. Study effect of temperature, pH and Heavy metals on enzyme activity	60 hours

List of Reference Books

1. S. K. Sawhney, Randhir Singh, Introductory Practical Biochemistry, 2000, Narosa.
2. Sambrook J and Russell DW., Molecular Cloning: A Laboratory Manual. 4th Edition, 2004, Cold Spring Harbour Laboratory press.
3. Campbell, MK (2012) Biochemistry, 7th ed., Published by Cengage Learning
4. Campbell, PN and Smith AD (2011) Biochemistry Illustrated, 4th ed., Published by Churchill Livingstone 3

Methodology for practical/experiment

- | | |
|------------------------------------|--|
| (1) Laboratory assignment | (2) Laboratory practical / experiments |
| (3) Power point presentation (PPT) | (4) Practical record preparation |

Evaluation Criteria:

- | | |
|--|------------------------------------|
| (1) Internal assignment | (2) Evaluation of practical record |
| (3) Final semester practical examination | |

Table -2 List of Honours Course

Major Bachelor in Honours Course –Major I and II) for Arts, commerce and Science (DSC)	
1	Environmental science
2	Biotechnology
3	Biochemistry
4	Microbiology
5	Biomedical sciences
6	Life sciences
7	Forensic science
8	Earth science
9	Food technology
10	B Com
11	Hindi
12	Education
13	English
14	Social work
15	Economics

Table 3a: list of Subject for Science discipline. Select anyone except the major stream given in table 2.

Major –III for Science (DSE)	
1	Environmental science
2	Biotechnology
3	Chemistry
4	Mathematics
5	Home science
6	Zoology
7	Forensic science
8	Earth sciences
9	Food technology
10	Agriculture microbiology
11	Agriculture biotech
12	Botany
13	Physics

Table 4 list of Subject of GE / Minor –I for science, Commerce and Arts

Select one subject for first year and other subject for second year from interdisciplinary or from other faculty.

Subject Other faculty Minor -I (GE)		
1	Agro forestry	Interdisciplinary
2	Horticulture	Interdisciplinary
3	Disaster management	Interdisciplinary
4	Fundamentals of entrepreneurship	Interdisciplinary
5	Business economics	Commerce
6	Modern political thoughts	Arts
7	Indian national movement	Arts
8	Ghandhian philosophy	Arts
9	Tribal culture	Arts
10	Social security	Arts
11	Indian arts and culture	Arts
12	Village and Panchayatiraj	Arts
13	Manuscript conservation	Arts
14	Traditional knowldge in Indian medicine and medicinal plants	Interdisciplinary
15	Alternative medicine	Science
16	Basics of electronic media	Science
17	Tools and techniques in bioinformatics	Science
18	Urban development & economic growth	Interdisciplinary
19	Non-conventional energy resource	Interdisciplinary
20	Cyber crime (cryptography)	Interdisciplinary
21	Dirking water quality assessment	Interdisciplinary
22	Water conservation and river linking	Interdisciplinary
23	Energy and environment	Interdisciplinary
24	Hindi shahitya ka	Interdisciplinary
25	History of English literature	Interdisciplinary

Table 5: list of Skill enhancement courses for science, commerce and Arts disciplines. Select one course in each Semester for first two year (Sem –I, II, III and IV)

(SEC/AEC) or Minor –II	
1	Hand writing document examination
2	Vedic math
3	Astrology
4	Gen stone and dimensional stone
5	Computer hardware & networking
6	Soft skill
7	Tour guide and heritage
8	Hospital management0
9	Clinical diagnostics
10	Bakery and value added production
11	Telly
12	Food processing
13	Industrial microbiology
14	photography
15	Chemical sale marketing
16	Seed technology
17	Rural development
18	Community health
19	Health and hygiene
20	Organic farming

Table 6: list of Co-curricular courses common for science, commerce and Arts disciplines. Select one course in each Semester for three years (Sem I, II, III, IV, V and VI)

1	Food and Nutrition	(Semester-I)
2	First Aid and Health	(Semester-II)
3	Human Values and Environment Studies	(Semester-III)
4	Physical Education and Yoga	(Semester-IV)
5	Analytic Ability and Digital Awareness	(Semester-V)
6	Communication Skills and Personality Development or Character Building	(Semester-VI)

Note:

1. Ordinance and general rules, regulation & guidelines as per National Education Policy (NEP) 2020 for the **Bachelor in Honours (semester system) programme in Microbiology** will be provided by Bundelkhand University, Jhansi (U.P.) and will be implemented accordingly from 2022 onwards. The ordinance which will be provided (and implemented from 2022 onwards) by Bundelkhand University, Jhansi (U.P.) supersedes all the previous relevant ordinances, rules and regulations.
2. Syllabus and course content of Major III (DSE)(Table 3a), Minor – I (GE) (Table 4), Minor-II (SEC/AEC) (Table 5), Minor- III (VAC) (Table 6) as per provided by Bundelkhand University, Jhansi (U.P.)
3. After completion of First year “Certificate in Microbiology” will be awarded.



**DEPARTMENT OF MICROBIOLOGY
BUNDELKHAND UNIVERSITY, JHANSI**

National Education Policy -2020

**DEPARTMENT OF MICROBIOLOGY
BUNDELKHAND UNIVERSITY, JHANSI**

SYLLABUS FOR THE “DIPLOMA IN MICROBIOLOGY”

(In continuation of first year)

(Total Credits in Second Year: 46)

TOTAL CREDITS FOR “DIPLOMA IN MICROBIOLOGY” = 92 (First Year +Second Year)

(with effective from: academic session 2022-23)

Programme Name: Diploma in Microbiology
Year of Programme: B. Sc. (H) Microbiology, Second Year

Programme Objective:

The programme has been designed in such a way so that the students will gain theoretical as well as practical knowledge on various aspects of Microbiology and related fields. The programme includes the theoretical as well as laboratory/ practical details of Microbial Metabolism, Environmental Microbiology, Food Microbiology and Industrial Bioprocess Technology.

Programme Outcome (POs):

PO1: After the completion of programme the students will be able to gain the theoretical as well as practical knowledge on various domains of Microbiology such as Microbial Metabolism, Environmental Microbiology, Food Microbiology and Industrial Bioprocess Technology.

PO2: The practical /lab courses related to the course/syllabus will be helpful to expertise the students with the laboratory skills and practical knowledge of the subject.

PO3: The major focus of the programme is to develop the ability to design and conduct experiments, as well as to analyze and interpret scientific data.

PO4: The student will gain the knowledge and laboratory skills and further higher studies in the field of microbiology and related areas or in various multidisciplinary.

PO5: Enhancement the entrepreneurship skills among students.

Programme Specific Outcome (PSOs): After the completion of programme the students will be able to

PSO1: Get fundamental and basic knowledge of microbial physiology and metabolism along with bacterial growth parameters and culture methods.

PSO2: Aware the different types of microbes play an important role in bio-geochemical cycling of essential elements occurring within an ecosystem and its significance.

PSO3: Introduces applications of concepts of Microbiology in our Environment and its impact on humans.

PSO4: Study general principles of food microbiology fermented foods, food preservation, food spoilage and Foodborne diseases.

PSO5: Get information of various aspects of fermentation and bioprocess technology and also production of various industrially important products.

PO6: Get laboratory skills and practical knowledge of the course related subjects.

BUNDELKHAND UNIVERSITY, JHANSI
DEPARTMENT OF MICROBIOLOGY

SYLLABUS FOR THE “DIPLOMA IN MICROBIOLOGY” (In the continuation of first year)

(Total Credits in second year: 46)

IIIrd SEMESTER

(1) Major 1 (DSC 1) CORE: Microbial Metabolism

Title of paper: Microbial Metabolism

Type: Major 1 (DSC 1) CORE

Total Credit: 04

Total hours (L/T/P): 60 Hours

Course objectives: The main objective of the course is to provide fundamental and basic knowledge of microbial physiology and metabolism along with bacterial growth parameters and culture methods.

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

1. Explain the various metabolic mechanisms of bacteria.
2. Acquire information about nutritional requirements of bacteria growth and the parameters affect its growth. .
3. Gain information about kinds of nitrogen fixing bacteria and nitrogen cycle.
4. Gain knowledge about methane oxidation process.
5. Learn about the different bacteriological media used for bacterial cultivation.

Sr. No.	Unit No.	Syllabus Content	Hours (L/T/P)
1.	Unit-I	1. An overview of metabolic process. Chemistry of microbial cell (Bacteria, Virus, Algae and Fungi) 2. Physiology of growth, Microbial nutrition and growth dynamics in solid liquid, batch, continuous and chemostate cultures, Effect of physical and chemical factors on growth of microorganisms. 3. Culture media: Type of culture media, Routine & specialized media, Selective media, Differential media, Enriched media, Enrichment media, Enumeration media, Assay media and Maintenance.	12 L/ 2T
2.	Unit-II	1. Historical account of photosynthesis, Diversity of phototrophic bacteria, anoxygenic and oxygenic photosynthesis. 2. Bacterial photosynthesis: Structure of chloroplast, light and dark reaction, photosynthetic pigments and generation of reducing power by cyclic and noncyclic photophosphorylation	8 L/ 2T
3.	Unit-III	1. Carbohydrate metabolism- Glycolysis and its regulation, Feeder pathway of glycolysis and carbohydrate homo and heterofermentation. 2. Electron transport and oxidative phosphorylation in microbes- a general survey.	8L/2T
4.	Unit-IV	1. Nitrogen fixation – Physiology of Nitrogen cycle, Assimilatory and dissimilatory nitrate reduction, Biological nitrogen fixation. Role of microbes in cycling of nitrogen in nature, Nitrification and denitrification. 2. Properties and function of nitrogenase enzyme.	10L/ 2T
5.	Unit-V	1. Methalotrophs and pathways of methane oxidation. 2. Secondary metabolism: A general account 3. Vitamins, Hormones, Toxins, Bacteriocins with and their application.	12L/ 2T

List of Reference Books

1. Bacterial Metabolism by Gottschalk G. Springer Verlag.
2. Prescott and Dunn's Industrial Microbiology by Reed, G, CBS Publishers & Distributors.
3. Stanier RY, Ingraham JL, Wheelis ML and Painter PR. (2005). General Microbiology. 5th edition McMillan.
4. Brock's Biology of Microorganisms

Teaching Methodology

- | | |
|------------------------------------|-------------------------------|
| (1) Classroom lectures | (2) Online classes/ E-content |
| (3) Power point presentation (PPT) | (4) Assignment |

Evaluation Criteria:

- (1) Internal sessional examination
- (2) Final semester examination
- (3) Classroom seminar presentation and Viva-voce

(2) MAJOR 2 (DSC 2) ENVIRONMENTAL MICROBIOLOGY

Title of paper: Environmental Microbiology

Type: Major 2 (DSC 2) CORE

Total Credit: 04

Total hours (L/T/P): 60 Hours

Course objectives: The course introduces applications of concepts of Microbiology in our Environment and its impact on humans.

Course learning outcome: The student at the completion of the course will be able to:

1. Get basic and historical background of Environmental Microbiology and acquainted with soil microbiological properties.
2. Understand how microbes interact among themselves and with higher plants and animals with the help of various examples.
3. Become aware of the important role microbes play in bio-geochemical cycling of essential elements occurring within an ecosystem and its significance.
4. Gain in depth knowledge of biological aspect of water pollution, its bacteriological analysis and management.
5. Know about the diverse microbial populations in various natural habitats like soil, air, water.
6. Gain knowledge of the Bioremediation, Acid mine drainage, Microbial methylations, Biomagnification etc.

Sr. No.	Unit No.	Syllabus Content	Hours (L/T/P)
1.	Unit-I	1. Introduction and historical background of Environmental Microbiology, 2. Soil Physico-chemical and biological properties, Weathering and soil formation. Components, classification and soil profile.	10 L/ 2T
2.	Unit-II	1. Microbial flora of Soil, Role of Microbes in Biogeochemical Cycling (N,P,S), 2. Interactions among soil microorganisms- Neutral, Beneficial & Harmful interactions	10 L/ 2T
3.	Unit-III	1. Microbiology of drinking water and water pollution, Bacteriological analysis & Sampling techniques of water 2. Physico-Chemical and Microbial Characteristics of sewage, Sewage treatment and Disposal	8L/2T
4.	Unit-IV	1. Microbiology of air, Microbial Air Pollution, sampling and air borne transmission. 2. Bioremediation, techniques and application.	10L/ 2T
5.	Unit-V	1. Acid mine drainage. Microbial accumulation of heavy metals. Microbial conversion of nitrate 2. Microbial methylations, Biomagnification and Role of microbes in Biofertilizers	12L/ 2T

List of Reference Books

1. Environmental Microbiology by Maier, RM, Pepper, IL, Gerba, CP, Edition 2nd, Academic Press.
2. Microbial Ecology: Fundamentals & Applications by Atlas RM and Bartha R. Benjamin/Cummings Science Publishing, USA.
3. Principles of Microbial Ecology by Brock, TD, Edition 3rd, Prentice-Hall.
4. Microbiology of Extremes Environments by Edward, C, McGraw Hill, New York.
5. A text book of Ecology and Environment by P D Sharma.

Teaching Methodology

- | | |
|------------------------------------|-------------------------------|
| (1) Classroom lectures | (3) Online classes/ E-content |
| (2) Power point presentation (PPT) | (4) Assignment |

Evaluation Criteria:

- (1) Internal sessional examination
- (2) Classroom seminar presentation and Viva-voce
- (3) Final semester examination

Title of paper: DSC Practical I/ Lab course I

Type: DSC Practical I CORE

Total Credit: 02

Total hours (Hrs): L/T/P (0 Hrs. / 0 Hrs. /60 Hrs)

Practical:

List of Practical	Hours
<ol style="list-style-type: none">1. Study and plot of bacterial growth curve.2. Calculations of generation time and specific growth rate of bacteria.3. Effect of temperature on bacterial growth.4. Effect of pH on bacterial growth.5. Effect of carbon and nitrogen sources on growth.6. Isolation of the photosynthetic pigment.	60 hours

List of Reference Books

1. Reddy SR and Reddy SM. (2005). Microbial Physiology. Scientific Publishers India
2. Gottschalk G. (1986). Bacterial Metabolism. 2nd edition. Springer Verlag
3. Stanier RY, Ingrahm JI, Wheelis ML and Painter PR. (1987). General Microbiology. 5th edition, McMillan Press.
4. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott's Microbiology. 9th edition. McGraw Hill Higher Education.
5. Bacterial Metabolism by Gottschalk G. Springer Verlag.

Methodology for practical/experiment

- | | |
|------------------------------------|--|
| (1) Laboratory assignment | (3) Laboratory practical / experiments |
| (2) Power point presentation (PPT) | (4) Practical record preparation |

Evaluation Criteria:

- | | |
|--|------------------------------------|
| (1) Internal assignment | (3) Evaluation of practical record |
| (2) Final semester practical examination | |

Title of paper: DSC Practical / Lab course II

Type: DSC Practical II CORE

Total Credit: 02

Total hours (Hrs): L/T/P (0 Hrs. / 0 Hrs. /60 Hrs)

Practical:

List of Practical	Hours
<ol style="list-style-type: none">1. Isolation and enumeration of bacteria and fungi from air and soil.2. Biochemical tests to identify the unknown microbial culture in the given sample.3. Isolation of Auxotroph bacteria.4. Determination of BOD and COD.5. Estimation of TDS/TSS.6. Estimation of physico chemical properties of soil.	60 hours

List of Reference Books

1. Maier RM, Pepper IL and Gerba CP. (2009). Environmental Microbiology. 2nd edition, Academic Press
2. Atlas RM and Bartha R. (2000). Microbial Ecology: Fundamentals & Applications. 4th edition. Benjamin/Cummings Science Publishing, USA
3. Microbiology of Extremes Environments by Edward, C, McGraw Hill, New York.
4. Stolp H. (1988). Microbial Ecology: Organisms Habitats Activities. Cambridge University Press, Cambridge, England.
5. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott's Microbiology. 9th edition. McGraw Hill Higher Education

Methodology for practical/experiment

- | | |
|------------------------------------|--|
| (1) Laboratory assignment | (2) Laboratory practical / experiments |
| (3) Power point presentation (PPT) | (4) Practical record preparation |

Evaluation Criteria:

- | | |
|--|------------------------------------|
| (1) Internal assignment | (2) Evaluation of practical record |
| (3) Final semester practical examination | |

IVth SEMESTER

(2) Major 1 (DSC 1) CORE (FOOD MICROBIOLOGY)

Title of paper: Food Microbiology

Type: Major 1 (DSC 1) CORE

Total Credit: 04

Total hours (L/T/P): 60 Hours

Course objectives:

To study general principles of food microbiology fermented foods, food preservation, spoilage and Foodborne diseases

Course learning outcome:

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

1. Get acquired with sufficient knowledge of relationship between food and microbes and fermented food products
2. Explain the different methods of food preservation
3. gain knowledge about microbiology of milk, identify the role of microbes in the production of dairy products
4. Gain knowledge on Foodborne diseases and their control
5. know about microbial spoilage in foods with detection and characterization

Sr. No.	Unit No.	Syllabus Content	Hours (L/T/P)
1.	Unit-I	1. Food and microbes: Food as substrate for microbial growth, Sources for food Contamination 2. Fermented Foods: Bread, Malt beverages, Wine, Soy sauce, Tempeh and Idli.	10 L/ 2T
2.	Unit-II	1. Principles, physical methods of food preservation: temperature (low, high, canning, drying), irradiation, 2. chemical methods of food preservation: salt, sugar, organic acids, SO ₂ , nitrite and nitrates, ethylene oxide, antibiotics and bacteriocins	10 L/ 2T
3.	Unit-III	1. Microbiology of milk: Sources of microorganisms in milk Microbial examination of milk, Standard Plate Count, Direct Microscopic Count, phosphatase test, Grading of milk by dye reduction test: MBRT and Resazurin test 2. Dairy products from microorganisms: Butter, Yoghurt, Cheese and Cultured milk.	8L/2T
4.	Unit-IV	1. Food intoxications: <i>Staphylococcus aureus</i> , <i>Clostridium botulinum</i> and mycotoxins; 2. Food infections: <i>Bacillus cereus</i> , <i>Escherichia coli</i> , Salmonellosis, Shigellosis, <i>Yersinia enterocolitica</i> ,	10L/ 2T
5.	Unit-V	1. Microbial spoilage of food, Chemical changes caused by microorganisms during spoilage. Factors affecting microbial growth, Detection and characterization of spoilage. 2. Spoilage of fish, Meat, Poultry, Fruits and Vegetables.	12L/ 2T

List of Reference Books

1. Food Microbiology Fundamentals and Frontiers By Doyle, MP, Beuchat, LR & Montville, TJ ASM Press.
2. Food Microbiology by Adams AR, & Moss MO Third edition, Royal Society of Chemistry publishing.
3. Food Microbiology by Frazier, WC, and Westhoff, DC. Fourth edition, Mac Graw Hills publication.
4. Tortora GJ, Funke BR, and Case CL. (2008). *Microbiology: An Introduction*. Pearson Education.

Teaching Methodology

- | | |
|------------------------------------|-------------------------------|
| (1) Classroom lectures | (3) Online classes/ E-content |
| (2) Power point presentation (PPT) | (4) Assignment |

Evaluation Criteria:

- (1) Internal sessional examination
- (2) Classroom seminar presentation and Viva-voce
- (3) Final semester examination

Major 2 (DSC 2): FERMENTATION AND BIOPROCESS TECHNOLOGY

Title of paper: Fermentation and Bioprocess Technology Type: Major 2 (DSC 2) CORE

Total Credit: 04

Total hours (L/T/P): 60 Hours

Course objectives:

The course introduces various aspects of fermentation and bioprocess technology with industrial applications.

Course learning outcome:

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

1. Understand the scope and history of industrial microbiology and the role of microorganisms in industry
2. Gain knowledge of isolation, maintenance, preservation and handling of industrially important microbial cultures
3. Develop understanding about the different types of fermentation media, fermenter design and function
4. Know about different types of fermentation processes
5. Learn about scale up of fermentation and techniques involved in downstream processing
6. Gain knowledge about production of various industrially important products.

Sr. No.	Unit No.	Syllabus Content	Hours (L/T/P)
1.	Unit-I	1. Scope and history of industrial microbiology. 2. Isolation, Maintenance and Preservation of industrial strains. 3. Methods of strain improvement	12 L/ 2T
2.	Unit-II	1. Fermentation media, Medium sterilization, Inoculum Preparation 2. Fermenter design, body construction and types 3. Fermentation and types of fermentation	8 L/ 2T
3.	Unit-III	1. Scale up of fermentation Process 2. Downstream Processing: Cell disintegration: Physical and chemical methods. 3. Removal of microbial cells and other solid matter, foam separation, precipitation, filtration, centrifugation.	10L/2T
4.	Unit-IV	1. Industrial production of Penicillin and Streptomycin 2. Production of Amylase and Protease enzyme. 3. Industrial production of organic acids: Lactic acid and Citric acid.	10L/ 2T
5.	Unit-V	1. Industrial production of Vitamin B12 and Riboflavin. 2. Industrial production of Lysine and ethanol 3. Industrial production of ethanol and alcoholic beverages.	10L/ 2T

List of Reference Books

1. Principles of fermentation Technology by Stanbury PF, Whitaker A and Hall SJ. (2006).
2. Industrial Microbiology by Casida LE. (1991). 1st edition. Wiley Eastern Limited.
3. Biotechnology - A text book of Industrial Microbiology Wulf Crueger & Anneliese Crueger.
4. Prescott and Dunn's Industrial Microbiology by Reed, G, CBS Publishers & Distributors.
5. Industrial Microbiology: An introduction by Waites, MJ, Morgan, NL, Rockey, JS, Highton, G, Edition .1st, Wiley-Blackwell.

Teaching Methodology

- | | |
|------------------------------------|-------------------------------|
| (1) Classroom lectures | (3) Online classes/ E-content |
| (2) Power point presentation (PPT) | (4) Assignment |

Evaluation Criteria:

- (1) Internal sessional examination
- (2) Final semester examination
- (3) Classroom seminar presentation and Viva-voce

Title of paper: DSC Practical I/ Lab course I

Type: DSC Practical I CORE

Total Credit: 02

Total hours (Hrs): L/T/P (0 Hrs. / 0 Hrs. /60 Hrs)

Practical:

List of Practical	Hours
<ol style="list-style-type: none">1. Determination of quality of milk samples by MBRT2. Enumeration of bacterial colonies in milk samples by Standard Plate Count3. Production of Sauerkraut by microorganisms.4. Detection and enumeration of microorganisms in bakery products.5. Isolation and staining of molds from bread.6. Preparation of Soymilk and Tofu.	60 hours

List of Reference Books

1. Microbiology: A laboratory manual by J. Cappucino and C.T. Welsh. 11th edition, Pearson education, USA. 2016 2.
2. Aneja K.R., Experiments in Microbiology, plant pathology, Tissue culture and Mushroom Cultivation, New Age International, New Delhi.
3. Dubey R.C. and Maheshwari D.K., Textbook of practical microbiology, S Chand Publications.
4. Mukerji K.G., Laboratory Manual of Food Microbiology, IK Publishers.

Methodology for practical/experiment

- | | |
|------------------------------------|--|
| (1) Laboratory assignment | (3) Laboratory practical / experiments |
| (2) Power point presentation (PPT) | (4) Practical record preparation |

Evaluation Criteria:

- | | |
|--|------------------------------------|
| (1) Internal assignment | (3) Evaluation of practical record |
| (2) Final semester practical examination | |

Title of paper: DSC Practical II/ Lab course II

Type: DSC Practical II CORE

Total Credit: 02

Total hours (Hrs): L/T/P (0 Hrs. / 0 Hrs. /60 Hrs)

Practical:

List of Practical	Hours
<ol style="list-style-type: none">1. Principle and functioning of instruments in Microbiology laboratory (Autoclave, Laminar flow, Incubator, types of fermenters)2. Isolation of yeast from grape samples3. Isolation of lactic acid bacteria from curd4. Isolation of antibiotic producing microorganisms from soil5. Antibiotic sensitivity test.6. Ethanol/Citric acid production7. Isolation of photosynthetic pigments	60 hours

List of Reference Books

1. Microbiology: A laboratory manual by J. Cappucino and C.T. Welsh. 11th edition, Pearson education, USA. 2016 2.
2. Aneja K.R., Experiments in Microbiology, plant pathology, Tissue culture and Mushroom Cultivation, New Age International, New Delhi.
3. Dubey R.C. and Maheshwari D.K., Textbook of practical microbiology, S Chand Publications.

Methodology for practical/experiment

- | | |
|------------------------------------|--|
| (1) Laboratory assignment | (2) Laboratory practical / experiments |
| (3) Power point presentation (PPT) | (4) Practical record preparation |

Evaluation Criteria:

- | | |
|--|------------------------------------|
| (1) Internal assignment | (2) Evaluation of practical record |
| (3) Final semester practical examination | |

Table -2 List of Honours Course

Major Bachelor in Honours Course –Major I and II) for Arts, commerce and Science (DSC)	
1	Environmental science
2	Biotechnology
3	Biochemistry
4	Microbiology
5	Biomedical sciences
6	Life sciences
7	Forensic science
8	Earth science
9	Food technology
10	B Com
11	Hindi
12	Education
13	English
14	Social work
15	Economics

Table 3a: list of Subject for Science discipline. Select anyone except the major stream given in table 2.

Major –III for Science (DSE)	
1	Environmental science
2	Biotechnology
3	Chemistry
4	Mathematics
5	Home science
6	Zoology
7	Forensic science
8	Earth sciences
9	Food technology
10	Agriculture microbiology
11	Agriculture biotech
12	Botany
13	Physics

Table 4 list of Subject of GE / Minor –I for science, Commerce and Arts

Select one subject for first year and other subject for second year from interdiscipline or from other faculty.

Subject Other faculty Minor -I (GE)		
1	Agro forestry	Interdisciplinary
2	Horticulture	Interdisciplinary
3	Disaster management	Interdisciplinary
4	Fundamentals of entrepreneurship	Interdisciplinary
5	Business economics	Commerce
6	Modern political thoughts	Arts
7	Indian national movement	Arts
8	Ghandhian philosophy	Arts
9	Tribal culture	Arts
10	Social security	Arts
11	Indian arts and culture	Arts
12	Village and Panchayatiraj	Arts
13	Manuscript conservation	Arts
14	Traditional knowldge in Indian medicine and medicinal plants	Interdisciplinary
15	Alternative medicine	Science
16	Basics of electronic media	Science
17	Tools and techniques in bioinformatics	Science
18	Urban development & economic growth	Interdisciplinary
19	Non-conventional energy resource	Interdisciplinary
20	Cyber crime (cryptography)	Interdisciplinary
21	Dirking water quality assessment	Interdisciplinary
22	Water conservation and river linking	Interdisciplinary
23	Energy and environment	Interdisciplinary
24	Hindi shahitya ka	Interdisciplinary
25	History of English literature	Interdisciplinary

Table 5: list of Skill enhancement courses for science, commerce and Arts disciplines. Select one course in each Semester for first two year (Sem –I, II, III and IV)

(SEC/AEC) or Minor –II	
1	Hand writing document examination
2	Vedic math
3	Astrology
4	Gen stone and dimensional stone
5	Computer hardware & networking
6	Soft skill
7	Tour guide and heritage
8	Hospital management0
9	Clinical diagnostics
10	Bakery and value added production
11	Telly
12	Food processing
13	Industrial microbiology
14	photography
15	Chemical sale marketing
16	Seed technology
17	Rural development
18	Community health
19	Health and hygiene
20	Organic farming

Table 6: list of Co-curricular courses common for science, commerce and Arts disciplines. Select one course in each Semester for three years (Sem I, II, III, IV, V and VI)

1	Food and Nutrition	(Semester-I)
2	First Aid and Health	(Semester-II)
3	Human Values and Environment Studies	(Semester-III)
4	Physical Education and Yoga	(Semester-IV)
5	Analytic Ability and Digital Awareness	(Semester-V)
6	Communication Skills and Personality Development or Character Building	(Semester-VI)

Note:

1. Ordinance and general rules, regulation & guidelines as per National Educational Policy (NEP) 2020 for the **bachelor in honours (semester system) programme in Microbiology** will be provided by Bundelkhand University, Jhansi (U.P.) and will be implemented accordingly from 2022 onwards. The ordinance which will be provided (and implemented from 2022 onwards) by Bundelkhand University, Jhansi (U.P.) supersedes all the previous relevant ordinances, rules and regulations.
2. Syllabus and course content of Major III (DSE)(Table 3a), Minor – I (GE) (Table 4), Minor-II (SEC/AEC) (Table 5), Minor- III (VAC) (Table 6) as per provided by Bundelkhand University, Jhansi (U.P.).
3. In continuation of first year, after the completion of second year “**Diploma in Microbiology**” will be awarded.



**DEPARTMENT OF MICROBIOLOGY
BUNDELKHAND UNIVERSITY, JHANSI**

National Education Policy -2020

**DEPARTMENT OF MICROBIOLOGY
BUNDELKHAND UNIVERSITY, JHANSI**

SYLLABUS FOR THE DEGREE OF

“BACHELOR OF SCIENCE (Hons.) IN MICROBIOLOGY”

“B.Sc. (Hons.) Microbiology”

(In continuation of Second year)

(Total Credits in Third Year: 40)

TOTAL CREDITS FOR THE DEGREE OF “BACHELOR OF SCIENCE (Hons.) IN MICROBIOLOGY”

**= (First Year (46 Credits) + Second Year (46 Credits) + Third Year 40 (Credits))
= 132 Credits**

(with effective from: academic session 2022-2023)

Programme Name: Bachelor of Science (Hons.) in Microbiology

Year of Programme: B. Sc. (H) Microbiology, Third Year

Programme Objective:

The programme has been designed in such a way so that the students will gain theoretical as well as practical knowledge on various aspects of Microbiology and related fields. The programme includes the theoretical as well as laboratory/ practical details Molecular Biology, Medical Microbiology and Immunology, Enzymology, Microbial Ecology, Genetic Engineering, Agro-Technology & Sustainable Agriculture.

Programme Outcome (POs):

PO1: After the completion of programme the students will be able to gain the theoretical as well as practical knowledge on various domains of Microbiology

PO2: The practical courses have been designed to equip the students with the laboratory skills in Microbiology. The practical /lab courses related to the course/syllabus will be helpful to expertise the students with the laboratory skills and practical knowledge of the subjects.

PO3: Students can develop their critical thinking skills as well as their ability to read and interpret scientific literature.

PO4: The students will be exposed to a wide range of careers that in the field of microbiology and related areas or in various multidisciplinary.

PO5: Enhancement the entrepreneurship skills among students.

PO6: The Degree courses will enable students to go for higher studies in Microbiology and other related / allied subjects leading to Post Graduation and Ph.D. degrees.

Programme Specific Outcome (PSOs): After the completion of programme the students will be able:

PSO1: To explain the molecular mechanism of replication, transcription and translation in bacteria and also define the basic concept of gene and mutation.

PSO2: To explain the various immunological reaction and antigen antibody interaction that reflects the immunology/immune system and various microorganism related to infections as well as diagnosis and treatment strategies.

PSO3: To gain knowledge of fundamentals of enzymes, factor affecting the activity of enzymes and enzymes kinetics, immobilization enzymes and large scale production of enzymes.

PSO4: To gain knowledge on earth origin and generation of microbial diversity, interactions of microbial populations, biogeochemical Cycling and some important microbial activities.

PSO5: To explain the methods of various techniques such as recombinant DNA Technology, polymerase chain reaction, gene transfer, gene libraries production and it's important in agriculture, health and industry.

PSO6: To gain knowledge of the bio-fertilizer and their role in plant growth.

PSO7: To acquire and demonstrate expertise in good laboratory practices in a microbiological laboratory and also be able to explain the theoretical knowledge and laboratory / practical skills of the tools and techniques of field of Microbiology and related field.

BUNDELKHAND UNIVERSITY, JHANSI
DEPARTMENT OF MICROBIOLOGY

SYLLABUS FOR THE DEGREE OF
“BACHELOR (Hons.) IN MICROBIOLOGY/ B.Sc. (Hons.) Microbiology”
(In continuation in Second Year)
Vth SEMESTER

(1) Major 1 (DSC 1) CORE: MOLECULAR BIOLOGY

Title of paper: Molecular Biology

Type: Major 1 (DSC 1) CORE

Total Credit: 04

Total hours (L/T/P): 60 Hours

Course objectives: The main objective of the course is to explain the molecular mechanism of replication, transcription and translation in bacteria and also define the basic concept of gene and mutation.

Course learning outcome: At the completion of the course, the student will be able to:

1. Explain the basic concept of gene and its functional units and the process involved in central dogma.
2. Describe the replication, transcription and translation process of prokaryotic bacteria.
3. Describe the characters of genetic codes and relation with mutation.
4. Explain the types of Mutation at phenotypic level, biochemical level and molecular level.
5. Describe the processes of post transcription.

Sr. No.	Unit No.	Syllabus Content	Hours (L/T/P)
1.	Unit-I	1. Basic concept of gene, Central dogma of molecular biology, Reverse transcription. 2. DNA denaturation and renaturation.	10 L/ 2T
2.	Unit-II	1. DNA Polymerase : Types and properties of DNA Polymerases, <i>E. Coli</i> DNA polymerases DNA polymerases as Proof reader. 2. DNA replication – general principles, various modes of replication.	10 L/ 2T
3.	Unit-III	1. Transcription in Prokaryotes and Eukaryotes, initiation, elongation and termination, RNA Polymerase, Promoters, Operators, 2. Post-transcriptional processing of RNA in eukaryotes.	8L/2T
4.	Unit-IV	1. Genetic code- Basic features of genetic code, codon and anticodon Wobble hypothesis. 2. Mechanism of translation in prokaryotes and eukaryotes- initiation, elongation and termination.	12L/ 2T
5.	Unit-V	1. DNA damage and repair: Types of DNA damage, Repair mechanism: Mismatch repair, Nucleotide excision repair, Recombination repair, SOS repair. 2. Mutation at phenotypic level, biochemical level and molecular level, Application of Mutation.	10L/ 2T

List of Reference Books

1. Principles of Genetics by Eldon J. Gardner, 12thEds.
2. Molecular Biology of gene by Watson, 12th Eds.
3. Modern Genetic Analysis: Integrating Genes and Genomes by Anthony J.F. Griffiths.
4. Benard R. Glick, Molecular Biotechnology, Principles Application of Biotechnology 3rd Edition,2003. ASM Press.
5. Prescott and Dunn's Industrial Microbiology by Reed, G, CBS Publishers & Distributors.
6. John M Walker and Ralph Rapley , Molecular Biology and Biotechnology, Fourth Edition.

Teaching Methodology

- | | |
|------------------------------------|-------------------------------|
| (1) Classroom lectures | (2) Online classes/ E-content |
| (3) Power point presentation (PPT) | (4) Assignment |

Evaluation Criteria:

- (1) Internal sessional examination
- (2) Final semester examination
- (3) Classroom seminar presentation and Viva-voce

(2) Major 2 (DSC 2) CORE: MEDICAL MICROBIOLOGY AND IMMUNOLOGY

Title of paper: Medical Microbiology and Immunology

Type: Major 2 (DSC 2) CORE

Total Credit: 04

Total hours (L/T/P): 60 Hours

Course objectives: The main objective of this course to explain the various immunological reaction and antigen antibody interaction that reflects the immunology/immune system. This course also focus on the various microorganism related to infections.

Course learning outcome: The student at the completion of the course will learn:

1. The historical development of Medical Microbiology & Immunology.
2. Antigen –Antibody interaction.
3. The microorganisms associated with various infectious diseases.
4. The diagnosis and treatment strategies followed for the infectious diseases.

Sr. No.	Unit No.	Syllabus Content	Hours (L/T/P)
1.	Unit-I	<ol style="list-style-type: none">1. History of medical microbiology and immunology, cells and organs of immune system2. Antigen: Hapten, Epitopes and Adjuvant, Immunoglobulins: Structure, Types and Functions.3. Hybridoma technology and Monoclonal antibody production.	10 L/ 2T
2.	Unit-II	<ol style="list-style-type: none">1. Antigen and antibody interactions2. Major Histocompatibility complex (MHC).3. Hypersensitivity reaction: Type I, II, III & IV	10 L/ 2T
3.	Unit-III	<ol style="list-style-type: none">1. Transplantation immunology.2. Autoimmunity: Autoimmune diseases,3. Immunodeficiency diseases: SCID & AIDS.	8L/2T
4.	Unit-IV	<ol style="list-style-type: none">1. Bacterial diseases: Typhoid, Tuberculosis, Cholera and Tetanus.2. Fungal diseases: Dermatiomycosis, Candidiasis and Aspergillosis.3. Viral diseases: Influenza, Rabies, Pox, Hepatitis	12L/ 2T
5.	Unit-V	<ol style="list-style-type: none">1. General account of protozoan diseases: Symptoms and clinical diagnosis of Kala-azar, Malaria and Dengue2. Diagnostic tests in microbial diseases -Anti-microbial testing, ELISA & RIA.	10L/ 2T

List of Reference Books

1. Textbook of Microbiology by Ananthanarayan R and Paniker CKJ. University PressPublication.
2. Immunology: Kubey, VIth Eds.
3. Textbook of Immunology and Immunotechnology by B. Annadurai. S Chand.
4. Medical Microbiology by Patrick R. Murray *et al.*

Teaching Methodology

- | | |
|------------------------------------|-------------------------------|
| (1) Classroom lectures | (3) Online classes/ E-content |
| (2) Power point presentation (PPT) | (4) Assignment |

Evaluation Criteria:

- (1) Internal sessional examination
- (2) Final semester examination
- (3) Classroom seminar presentation and Viva-voce

(3) Major 3 (DSC 3) CORE : ENZYMOLOGY

Title of paper: Enzymology

Type: Major 3 (DSC 3) CORE

Total Credit: 04

Total hours (L/T/P): 60 Hours

Course objectives: The main objective of this course to explain the fundamentals of enzymes, factor affecting the activity of enzymes and enzymes kinetics. This course also focuses on the large scale production of enzymes and enzyme engineering.

Course learning outcome: The student at the completion of the course will be able to:

1. Explain basic concept of enzymes and its classification
2. Know the enzymes kinetics.
3. Explain the method for large-scale production of enzymes and immobilization enzymes.
4. Discuss mechanism for modification of active sites of enzymes.

Sr. No.	Unit No.	Syllabus Content	Hours (L/T/P)
1.	Unit-I	Introduction of enzyme, Enzyme classification and nomenclature. Concept of enzyme-substrate complex; active site, specificity; factors affecting the rate of enzyme-catalysed reactions; mechanism of enzyme action; enzyme units.	10 L/ 2T
2.	Unit-II	Concept of order of reactions; kinetics of enzyme activity, Michaelis-Menten equation and its derivation; different plots for the determination of Km and Vmax and their physiological significance; two substrate reactions; enzyme inhibition: types of inhibition.	10 L/ 2T
3.	Unit-III	Kinetics of allosteric enzymes and its cooperativity effect; allosteric enzymes; enzyme-enzyme interaction; protein-ligand binding; isoenzymes: multiple forms of enzymes with special reference to lactate dehydrogenase; multienzyme complexes e.g. fatty acid synthase; ribozymes.	10L/2T
4.	Unit-IV	Methods for large-scale production of enzymes; immobilized enzymes and their comparison with soluble enzymes; methods for immobilization of enzymes; applications of immobilized and soluble enzymes in health and industry; applications to fundamental studies of Biotechnology	12L/ 2T
5.	Unit-V	Thermal stability and catalytic efficiency of enzyme; site directed mutagenesis and enzyme engineering: modification of active site of an enzyme	8L/ 2T

List of Reference Books

1. Voet, D and Voet, J 1995. Biochemistry, 2nd ed. John Wiley and Sons.
2. Nelson, DL and Cox, MM 2005. Lehninger Principles of Biochemistry, 4th ed. WH Freeman and Company, New York.
3. Rodwell, VW, Bender, DA, Botham, KM, Kennelly, PJ and Weil, PA 2015. Harper's Illustrated Biochemistry, 30th ed. McGraw Hill Education.
4. Stryer, L 2006. Biochemistry, 6th ed. WH Freeman

Teaching Methodology

- | | |
|------------------------------------|-------------------------------|
| (1) Classroom lectures | (2) Online classes/ E-content |
| (3) Power point presentation (PPT) | (4) Assignment |

Evaluation Criteria:

- (1) Internal sessional examination
- (2) Final semester examination
- (3) Classroom seminar presentation and Viva-voce

Title of paper: DSC Practical I/ Lab course I

Type: DSC Practical I CORE

Total Credit: 02

Total hours (Hrs): L/T/P (0 Hrs. / 0 Hrs. /60 Hrs)

Practical:

List of Practical	Hours
<ol style="list-style-type: none">1. Understand the fundamentals of molecular biology and genetic research.2. Study about basic equipment in a molecular biology laboratory.3. Isolation of Genomic DNA from Bacterial Cell.4. Quantification of DNA.5. Determination of melting temperature of DNA.6. Agarose Gel Electrophoresis.	60 hours

List of Reference Books

1. Michael Wink, An Introduction to Molecular Biotechnology (2nd), 2012. ISBN: 9783527326372, TX Wiley-Blackwell.
2. Seidman & Moore, Basic Laboratory Methods for Biotechnology: Textbook & Laboratory Reference, 2nd edition. 2009. Prentice Hall. ISBN: 0321570146.
3. Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics. 8th Ed. Wiley-India
4. Sambrook J and Russell DW., Molecular Cloning: A Laboratory Manual. 4th Edition, 2004, Cold Spring Harbour Laboratory press.
5. Russell PJ. (2009). i Genetics- A Molecular Approach. 3rd Ed, Benjamin Cumming

Methodology for practical/experiment

- | | |
|------------------------------------|--|
| (1) Laboratory assignment | (3) Laboratory practical / experiments |
| (2) Power point presentation (PPT) | (4) Practical record preparation |

Evaluation Criteria:

- | | |
|--|------------------------------------|
| (1) Internal assignment | (3) Evaluation of practical record |
| (2) Final semester practical examination | |

Title of paper: DSC Practical II/ Lab course II

Type: DSC Practical II CORE

Total Credit: 02

Total hours (Hrs): L/T/P (0 Hrs. / 0 Hrs. /60 Hrs)

Practical:

List of Practical	Hours
<ol style="list-style-type: none">1. Antibiotic sensitivity test using agar well and disc diffusion method.2. To check the efficiency of disinfectants by paper disk method.3. Evaluation of alcohol effectiveness as skin antiseptic.4. Blood group estimation.5. Slide agglutination test.6. Microscopic study of pathogens by preparing slides.7. Isolation and characterization of skin normal microflora.	60 hours

List of Reference Books

1. Medical Microbiology by Patrick R. Murray *et al.*
2. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication
3. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
4. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4th edition. Elsevier
5. Richard C and Geffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.

Methodology for practical/experiment

- | | |
|------------------------------------|--|
| (1) Laboratory assignment | (2) Laboratory practical / experiments |
| (3) Power point presentation (PPT) | (4) Practical record preparation |

Evaluation Criteria:

- | | |
|--|------------------------------------|
| (1) Internal assignment | (3) Evaluation of practical record |
| (2) Final semester practical examination | |

Title of paper: DSC Practical III/ Lab course III

Type: DSC Practical III CORE

Total Credit: 02

Total hours (Hrs): L/T/P (0 Hrs. / 0 Hrs. /60 Hrs)

Practical:

List of Practical	Hours
<ol style="list-style-type: none">1. Study of basic instruments/ equipments of laboratory.2. Concept of pH and buffers, preparation of buffers and numerical problems to explain the concepts, preparation of stock and working solutions.3. Effect of pH, Temperature, Substrates, Inhibitor on enzyme activity.4. Determination of Km, Vmax, Specific activity and activity determination.5. Determination of catalase activity6. Determination of amylase activity.	60 hours

List of Reference Books

1. Voet, D and Voet, J 1995. Biochemistry, 2nd ed. John Wiley and Sons.
2. Nelson, DL and Cox, MM 2005. Lehninger Principles of Biochemistry, 4th ed. WH Freeman and Company, New York.
3. Rodwell, VW, Bender, DA, Botham, KM, Kennelly, PJ and Weil, PA 2015. Harper's Illustrated Biochemistry, 30th ed. McGraw Hill Education.
4. Aneja K.R., Experiments in Microbiology, plant pathology, Tissue culture and Mushroom cultivation, New Age International, New Delhi
5. S. K. Sawhney, Randhir Singh, Introductory Practical Biochemistry, 2000, Narosa.

Methodology for practical/experiment

- | | |
|------------------------------------|--|
| (1) Laboratory assignment | (3) Laboratory practical / experiments |
| (2) Power point presentation (PPT) | (4) Practical record preparation |

Evaluation Criteria:

- | | |
|--|------------------------------------|
| (1) Internal assignment | (3) Evaluation of practical record |
| (2) Final semester practical examination | |

VIth SEMESTER

(2) Major 1 (DSC 1) CORE: MICROBIAL ECOLOGY

Title of paper: Microbial Ecology

Type: Major 1 (DSC 1) CORE

Total Credit: 04

Total hours (L/T/P): 60 Hours

Course objectives: The course introduces the fundamental and important concepts of Microbial Ecology.

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

1. Be acquainted with the historical account and development of microbial ecology as a scientific discipline.
2. Gain knowledge on earth origin and generation of microbial diversity.
3. Explain the various biogeochemical Cycling and some important microbial activities.
4. Gain knowledge on interactions of microbial populations.
5. Explain the Ecosystem and Biosphere and associated terminology.

Sr. No.	Unit No.	Syllabus Content	Hours (L/T/P)
1.	Unit-I	1. Historical developments and the significance of microbial ecology. 2. A brief history of Earth origin, Chemical and Cellular evolution; Microbial Adaptations and Diversification.	10 L/ 2T
2.	Unit-II	1. Interactions among Microbial Populations (Neutralism, Commensalism, Mutualism, Amensalism, Symbiosis, Competition, Parasitism and Predation). 2. Interactions between Microorganisms and Plants (Rhizosphere and Mycorrhizae, Nodulation and Nitrogen fixation)	10 L/ 2T
3.	Unit-III	1. Biogeochemical Cycling (Nitrogen, Carbon and Sulphur) 2. Microbes in Action (Bioremediation, Microbial Methylations, and Biofertilizers)	8L/2T
4.	Unit-IV	1. Basic concept of Ecosystem and Biosphere, Habitat and Niche, Population growth, Food chain- Food web and Energy flow; 2. Microbial Diversity, Alpha and Beta Diversity, Microbial Communities and Community Dynamics, Succession.	12L/ 2T
5.	Unit-V	1. Concept of Culturability, Determination of Total and Viable Microbial Number, Biomass and Activity 2. Characterization of Microbial Communities: (Culture-based methods, PCR, Molecular Fingerprints, FISH and General Idea of Sequencing)	10L/ 2T

List of Reference Books

1. Environmental Microbiology by Maier, RM, Pepper, IL, Gerba, CP, Edition 2nd, Academic Press.
2. Microbial Ecology: Fundamentals & Applications by Atlas RM and Bartha R. Benjamin/Cummings Science Publishing, USA.
3. Principles of Microbial Ecology by Brock, TD, Edition 3rd, Prentice-Hall.
4. Microbiology of Extremes Environments by Edward, C, McGraw Hill, New York.
5. A text book of Ecology and Environment by P D Sharma.

Teaching Methodology

- | | |
|------------------------------------|-------------------------------|
| (1) Classroom lectures | (3) Online classes/ E-content |
| (2) Power point presentation (PPT) | (4) Assignment |

Evaluation Criteria:

- (1) Internal sessional examination
- (2) Final semester examination
- (3) Classroom seminar presentation and Viva-voce

Major 2 (DSC 2) CORE: GENETIC ENGINEERING

Title of paper: Genetic Engineering

Type: Major 2 (DSC 2) CORE

Total Credit: 04

Total hours (L/T/P): 60 Hours

Course objectives: The course introduces the method of various techniques such as recombinant DNA Technology, polymerase chain reaction, gene transfer, gene libraries production and it's important in agriculture, health and industry.

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

1. Gain knowledge about recombinant DNA Technology and its application.
2. Explain different types of cloning vectors used in recombinant DNA Technology.
3. Explain the method of polymerase chain reaction and its application.
4. Gain knowledge about the various gene transfer methods.
5. Explain the methods for production of gene libraries.

Sr. No.	Unit No.	Syllabus Content	Hours (L/T/P)
1.	Unit-I	1. Basic concept of recombinant DNA technology. 2. Enzymes used in DNA technology: DNA manipulating enzymes (Restriction Endonucleases , Polymerases, Ligase, Kinases and Phosphatases Nucleases). Linker, Adaptor.	10 L/ 2T
2.	Unit-II	1. Cloning vectors: Plasmids, Phasmids, Cosmids, Artificial chromosomes, Shuttle vectors and Expression vectors. 2. Application of Recombinant DNA technology in agriculture, health and industry.	10 L/ 2T
3.	Unit-III	1. Polymerase Chain Reaction (PCR): Principle, types and its application. 2. Principle and techniques of hybridization: Western, Northern and Southern blotting.	8L/2T
4.	Unit-IV	1. Isolation and purification of DNA, Gel electrophoresis. 2. Molecular Markers: Principles, types and application, Restriction Fragment Length Polymorphism (RFLP), Amplified Fragment Length Polymorphism (AFLP). Random Amplified Polymorphic DNA (RAPD).	10L/ 2T
5.	Unit-V	1. Gene transfer methods: Electroporation, Microinjection, calcium phosphate co-precipitation, lipofection. 2. DNA libraries: construction of genomic and cDNA, screening method of DNA libraries.	12L/ 2T

List of Reference Books

1. Gene Cloning and DNA Analysis by TA Brown. Blackwell Publishing, Oxford, U.K.
2. Molecular Biotechnology by Glick BR and Pasternak JJ. ASM Press Washington D.C.
3. Principle of gene cloning by Old and primrose VthEds.
4. S B Primrose and R M Twyman Principles of Gene Manipulation and Genomics Seventh edition 2006 Blackwell Publisher, Australia.
5. Watson JD, Candy AA, Myers RM and Witkowski JA, Recombinant DNA (Gene and Genome – A short course) WH Freeman and Company, New York, IInd Edition 1992.
6. Biotechnology. Singh, B. D.

Teaching Methodology

- | | |
|------------------------------------|-------------------------------|
| (1) Classroom lectures | (3) Online classes/ E-content |
| (2) Power point presentation (PPT) | (4) Assignment |

Evaluation Criteria:

- (1) Internal sessional examination
- (2) Classroom seminar presentation and Viva-voce
- (3) Final semester examination

Major 3 (DSC 3) CORE: AGRO -TECHNOLOGY & SUSTAINABLE AGRICULTURE

Title of paper: Agro -Technology & Sustainable Agriculture

Type: Major 3 (DSC 3) CORE

Total Credit: 04

Total hours (L/T/P): 60 Hours

Course objectives: Gain knowledge of the bio-fertilizer and their role in plant growth.

Course learning outcome:

1. The student at the completion of the course will be able to:
2. Get acquainted with Soil and Microbe relation.
3. Understand how Biogeochemical cycle and microbial interaction among themselves and with higher plants and animals.
4. Become aware of the important role microbes play in bio-geochemical cycling of essential elements occurring within an ecosystem and its significance.
5. Amelioration in knowledge about diverse microbial populations and heavy metals exposure and adverse impact.

Sr. No.	Unit No.	Syllabus Content	Hours (L/T/P)
1.	Unit-I	1. Soil: concept and types in India 2. Crop Rotation and production 3. Biogeochemical Cycles	10 L/ 2T
2.	Unit-II	1. Biofertilizers and crop production 2. Organic Farming 3. Rhizosphere & associated Microbial flora	10 L/ 2T
3.	Unit-III	1. Integrated Pest Management 2. Weed and their control measures 3. Heavy metal contamination and Biomagnification	8L/2T
4.	Unit-IV	1. Nutritional value of Cereals 2. Probiotics 3. Blue economy and food security	12L/ 2T
5.	Unit-V	1. Agro practices and use of ICT 2. Agriculture policies in India 3. Sustainable farming and future prospects	10L/ 2T

List of Reference Books

1. Advanced Agro-Technology by Ashok Kumar
2. Soil microbiology and soil biotechnology, Bhagat Dushyant
3. Fundamental Agricultural Microbiology by K.R. Aneja
4. Organic Farming and Compost Technology by S.N. Pandey
5. Dubey, R.C and Maheshwari, D.K., A Text Book of Microbiology, S. Chand Publications, New Delhi

Teaching Methodology

- (1) Classroom lectures
- (2) Power point presentation (PPT)
- (3) Online classes/ E-content
- (4) Assignment

Evaluation Criteria:

- (1) Internal sessional examination
- (2) Classroom seminar presentation and Viva-voce
- (3) Final semester examination

Title of paper: DSC Practical I/ Lab course I

Type: DSC Practical I CORE

Total Credit: 02

Total hours (Hrs): L/T/P (0 Hrs. / 0 Hrs. /60 Hrs)

Practical:

List of Practical	Hours
<ol style="list-style-type: none">1. Demonstration of the presence of microflora in the environment by exposing agar plates to air.2. Isolation of bacteria from water.3. Culture transfer techniques, isolation of pure cultures.4. Isolation of antibiotic producing organism.5. Extracellular activities of micro organisms- amylase, gelatinase, lipase, caseinase.6. Microbial activity measurement from soil sample.	60 hours

List of Reference Books

1. Cappucino J and Sherman N. (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson Education Limited
2. Wiley JM, Sherwood LM and Woolverton CJ. (2013) Prescott's Microbiology. 9th Edition. McGraw Hill International
3. Atlas RM. (1997). Principles of Microbiology. 2nd edition. WM.T.Brown Publishers.
4. Principles of Microbial Ecology by Brock, TD, Edition 3rd, Prentice-Hall.
5. Microbial Ecology: Fundamentals & Applications by Atlas RM and Bartha R. Benjamin/Cummings Science Publishing, USA.

Methodology for practical/experiment

- | | |
|------------------------------------|--|
| (1) Laboratory assignment | (3) Laboratory practical / experiments |
| (2) Power point presentation (PPT) | (4) Practical record preparation |

Evaluation Criteria:

- | | |
|--|------------------------------------|
| (1) Internal assignment | (3) Evaluation of practical record |
| (2) Final semester practical examination | |

Title of paper: DSC Practical II/ Lab course II

Type: DSC Practical II CORE

Total Credit: 02

Total hours (Hrs): L/T/P (0 Hrs. / 0 Hrs. /60 Hrs)

Practical:

List of Practical	Hours
<ol style="list-style-type: none">1. Study of basic instruments/equipment used in genetic engineering laboratory.2. Isolation of Genomic DNA from Bacterial Cell.3. Agarose Gel Electrophoresis.4. Elution of DNA from agarose gel.5. Determination of purity and quantity of DNA sample.6. Determination of DNA denaturation.	60 hours

List of Reference Books

1. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.
2. S. K. Sawhney, Randhir Singh, Introductory Practical Biochemistry, 2000, Narosa.
3. Sambrook J and Russell D. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press 5
4. Primrose SB and Twyman RM. (2008). Genomics: Applications in human biology. Blackwell Publishing, Oxford, U.K.
5. Brown TA. (2010). Gene Cloning and DNA Analysis. 6th edition. Blackwell Publishing, Oxford, U.K.

Methodology for practical/experiment

- | | |
|------------------------------------|--|
| (1) Laboratory assignment | (2) Laboratory practical / experiments |
| (3) Power point presentation (PPT) | (4) Practical record preparation |

Evaluation Criteria:

- | | |
|--|------------------------------------|
| (1) Internal assignment | (2) Evaluation of practical record |
| (3) Final semester practical examination | |

Title of paper: DSC Practical III/ Lab course III

Type: DSC Practical III CORE

Total Credit: 02

Total hours (Hrs): L/T/P (0 Hrs. / 0 Hrs. /60 Hrs)

Practical:

List of Practical	Hours
1. Good laboratory practice in Microbiology and awareness about safety measures. 2. Preparation of different agar and other media required for agriculturally important microorganisms. 3. Isolation of Rhizospheric bacteria using spread plate and pour plate techniques. 4. Staining of Rhizospheric Microbial flora. 5. Study of Probiotics under Microscope. 6. Isolation of different microbial strains working as Biofertilizers as Nitrogen fixer- Free living and symbiotic. 7. Staining and slant preparation of microbial strains.	60 hours

List of Reference Books

1. Maier RM, Pepper IL and Gerba CP. (2009). Environmental Microbiology. 2nd edition, Academic Press
2. Okafor, N (2011). Environmental Microbiology of Aquatic & Waste systems. 1st edition, Springer, New York
3. Singh A, Kuhad, RC & Ward OP (2009). Advances in Applied Bioremediation. Volume 17, Springer-Verlag, Berlin Hedeilberg.
4. Stolp H. (1988). Microbial Ecology: Organisms Habitats Activities. Cambridge University Press, Cambridge, England.
5. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott's Microbiology. 9th edition. McGraw Hill Higher Education.

Methodology for practical/experiment

- | | |
|------------------------------------|--|
| (1) Laboratory assignment | (3) Laboratory practical / experiments |
| (2) Power point presentation (PPT) | (4) Practical record preparation |

Evaluation Criteria:

- | | |
|--|------------------------------------|
| (1) Internal assignment | (3) Evaluation of practical record |
| (2) Final semester practical examination | |

Table -2 List of Honours Course

Major Bachelor in Honours Course –Major I and II) for Arts, commerce and Science (DSC)	
1	Environmental science
2	Biotechnology
3	Biochemistry
4	Microbiology
5	Biomedical sciences
6	Life sciences
7	Forensic science
8	Earth science
9	Food technology
10	B Com
11	Hindi
12	Education
13	English
14	Social work
15	Economics

Table 3a: list of Subject for Science discipline. Select anyone except the major stream given in table 2.

Major –III for Science (DSE)	
1	Environmental science
2	Biotechnology
3	Chemistry
4	Mathematics
5	Home science
6	Zoology
7	Forensic science
8	Earth sciences
9	Food technology
10	Agriculture microbiology
11	Agriculture biotech
12	Botany
13	Physics

Table 4 list of Subject of GE / Minor –I for science, Commerce and Arts

Select one subject for first year and other subject for second year from interdisciplinary or from other faculty.

Subject Other faculty Minor -I (GE)		
1	Agro forestry	Interdisciplinary
2	Horticulture	Interdisciplinary
3	Disaster management	Interdisciplinary
4	Fundamentals of entrepreneurship	Interdisciplinary
5	Business economics	Commerce
6	Modern political thoughts	Arts
7	Indian national movement	Arts
8	Ghandhian philosophy	Arts
9	Tribal culture	Arts
10	Social security	Arts
11	Indian arts and culture	Arts
12	Village and Panchayatiraj	Arts
13	Manuscript conservation	Arts
14	Traditional knowldge in Indian medicine and medicinal plants	Interdisciplinary
15	Alternative medicine	Science
16	Basics of electronic media	Science
17	Tools and techniques in bioinformatics	Science
18	Urban development & economic growth	Interdisciplinary
19	Non-conventional energy resource	Interdisciplinary
20	Cyber crime (cryptography)	Interdisciplinary
21	Dirking water quality assessment	Interdisciplinary
22	Water conservation and river linking	Interdisciplinary
23	Energy and environment	Interdisciplinary
24	Hindi shahitya ka	Interdisciplinary
25	History of English literature	Interdisciplinary

Table 5: list of Skill enhancement courses for science, commerce and Arts disciplines. Select one course in each Semester for first two year (Sem –I, II, III and IV)

(SEC/AEC) or Minor –II	
1	Hand writing document examination
2	Vedic math
3	Astrology
4	Gen stone and dimensional stone
5	Computer hardware & networking
6	Soft skill
7	Tour guide and heritage
8	Hospital management0
9	Clinical diagnostics
10	Bakery and value added production
11	Telly
12	Food processing
13	Industrial microbiology
14	photography
15	Chemical sale marketing
16	Seed technology
17	Rural development
18	Community health
19	Health and hygiene
20	Organic farming

Table 6: list of Co-curricular courses common for science, commerce and Arts disciplines. Select one course in each Semester for three years (Sem I, II, III, IV, V and VI)

1	Food and Nutrition	(Semester-I)
2	First Aid and Health	(Semester-II)
3	Human Values and Environment Studies	(Semester-III)
4	Physical Education and Yoga	(Semester-IV)
5	Analytic Ability and Digital Awareness	(Semester-V)
6	Communication Skills and Personality Development or Character Building	(Semester-VI)

Note:

1. Ordinance and general rules, regulation & guidelines as per National Educational Policy (NEP) 2020 for the **bachelor in honours (semester system) programme in Microbiology** will be provided by Bundelkhand University, Jhansi (U.P.) and will be implemented accordingly from 2022 onwards. The ordinance which will be provided (and implemented from 2022 onwards) by Bundelkhand University, Jhansi (U.P.) supersedes all the previous relevant ordinances, rules and regulations.
2. Syllabus and course content of Major III (DSE)(Table 3a), Minor – I (GE) (Table 4), Minor-II (SEC/AEC) (Table 5), Minor- III (VAC) (Table 6) as per provided by Bundelkhand University, Jhansi (U.P.).
3. In continuation of first and second year, after the completion of third year the degree of “**B.Sc. (Hons.) in Microbiology**” will be awarded.