முதல் பருவம்

24LSUT101	**Language I: Tamil I**	**4H - 3C**
Instruction Hours/week: L:4 T:0 P:0	**Marks:** Internal**:40** External**:60** Total**:100**	
	End Semester Exam: 3 Hours	

பாடத்திட்டப் பொதுநோக்கம்

- மாணவர்களுக்குத் தமிழ்மொழி வரலாறு மற்றும் இலக்கியங்களின் வழியாக வாழ்வியல் மதிப்புகளை உணர்த்துதல்.
- சிந்தனைத் திறனையும், படைப்பாக்கத் திறனையும், கருத்து வெளிப்பாட்டுத் திறனையும் மேம்படுத்துதல்.
- வேலைவாய்புக்குரிய வகையில் மொழித்திறனை மேம்படுத்துதல்.

பாடத்திட்டப் பயன்விளைவு

- தமிழ்மொழி வரலாறு குறித்த தெளிந்த அறிவு பெற்றிருத்தல்.
- வாழ்வியல் மதிப்புகளைப் பேணுவதற்குக் கருவியாக இலக்கியங்களை நாடுகின்ற மனப்பான்மை பெற்றிருத்தல்.
- படைப்பிலக்கியத்திறன் பெற்றிருத்தல்.
- இந்தியக் குடியுரிமைப்பணி முதலான போட்டித் தேர்வுகளில், விருப்பப்பாடமாக இடம்பெறுகின்ற,'தமிழ் இலக்கியவரலாறு' தமிழ் இலக்கண அறிவு மேம்பாடு பெற்றிருத்தல்.
- மொழிபெயர்ப்பியல், கணினித்தமிழ் சார்ந்த வேலைவாய்ப்புத்திறன் மேம்பாடு.

அலகு – I **(10 மணிநேரம்)**

சங்க இலக்கியம்–எட்டுத்தொகை-முச்சங்கங்கள் பற்றிய செய்திகள் சங்க இலக்கியத்தின் தோற்றுவாய் – எட்டுத்தொகை அறிமுகம்

சங்க இலக்கியம் - நற்றிணை - நின்ற சொல்லர் –குறிஞ்சி – தலைவி கூற்று–1

சங்க இலக்கியம் - குறுந்தொகை - நிலத்தினும் பெரிதே–குறிஞ்சி – தலைவி கூற்று- 3 **றஇலக்கியம் - திருவள்ளுவர் – திருக்குறள் (எண்கள்-திருக்குறள் வரிசை எண்ணைக் குறிப்பன**)

பாயிரம் – 8 அறவாழி அந்தணன்,13 - விண்இன்று பொய்ப்பின், 34 - மனத்துக்கண் மாசிலன் ஆதல்

இல்லற இயல் - இல்வாழ்க்கை - 41- அன்பும் அறனும் உடைத்தா 50- வையத்துள்வாழ்வாங்கு

அன்புடைமை - 80 - அன்பின்வழியது, **விருந்தோம்பல் -** 90 – மோப்பக்குழையும்,

இனியவைகூறல் - 95 – பணிவுடையன் இன்சொலன்,

செய்நன்றி அறிதல் - 103 – பயன் தூக்கார்,

புறங்கூறாமை - 190 – ஏதிலார் குற்றம், **ஒப்புரவுஅறிதல் -** 216 – பயன்மரம்

ஈகை: 228 – ஈத்துவக்கும் இன்பம், **துறவற இயல் - தவம் -** 261 – உற்றநோய்

வாய்மை - 291 – வாய்மை எனப்படுவது, **வெகுளாமை -** 306 - சினமென்னும்

இன்னாசெய்யாமை : 316-இன்னா எனத்தான் உணர்ந்தவை
நிலையாமை - 331 – நில்லாதவற்றை, **ஊழியல் - ஊழ் -** 373 – நுண்ணியநூல்
ஆள்வினை உடைமை - 618 –பொறியின்மை யார்க்கும், 620-ஊழையும் உப்பக்கம்
நட்பு - 792-ஆய்ந்தாய்ந்து, 794-குடிப்பிறந்து, 797-ஊதியம் என்பது.
காப்பியம் - சிலப்பதிகாரம்: மங்கலவாழ்த்துப் பாடல் - பொதியில்ஆயினும் – 'கோவலன் என்பான்மன்னோ' (14-38), 'நீலவிதானத்து' – 'நோன்புஎன்னை'(48-53).
மனையறம்படுத்த காதை - 'வார்ஒலிகூந்தலை' – 'சிறப்பின் கண்ணகிதனக்குஎன்' (84-90)
அரங்கேற்று காதை -'மாமலர்நெடுங்கண்' - 'அகம்மறந்து' (170-175).
மதுரைக்காண்டம் -கொலைக்களக்காதை,'இருமுதுகுரவர்'- 'எழுந்தனன்யான்' (67-83),'வினைவிளைகாலம்' - ' கொணர்கஈங்குஎன' (148-153)
கட்டுரை காதை - 'கடிபொழில்' - 'இல்சாபம்பட்டனிர்' (138-170)
வழக்குரைக் காதை - 'அல்லவை செய்தார்க்கு' - 'தோற்றான்உயிர்' (82-93)
வஞ்சிக் காண்டம் - நடுகல்காதை - 'மதுரைமூதூர்' - 'மன்னவர்ஏறு' (218-234)
வாழ்த்துக் காதை - 'என்னேஇஃது' - 'தோன்றுமால்' (9)
எழுத்திலக்கணம் - முதல் மற்றும் சார்பெழுத்துகள்

அலகு- 2 **(10 மணிநேரம்)**
சங்க இலக்கியம் – பத்துப்பாட்டு அறிமுகம்
சங்க இலக்கியம் - பதிற்றுப்பத்து : ஏழாம்பத்து- எறிபிணம் இடறிய செம்மறுக்– 65
சங்க இலக்கியம் - கலித்தொகை : அகன்ஞாலம் விளக்கும் - நெய்தல்கலி – தலைவிகூற்று- 119.
அற இலக்கியம் -முன்றுறையரையனார் - பழமொழி நானூறு 5 பாடல்கள்
காப்பியம் -மணிமேகலை : விழாவறைகாதை : 'தேவரும் மக்களும்' - 'மருங்குஎன்' (66-72)
ஊரலர் உரைத்தகாதை : 'நாவல்ஓங்கிய' - 'உண்டுகொல்'(1-17), 'கற்றுத்துறைபோகிய' – 'தீத்தொழில்படாஅள்' (32-57).
பாத்திரம் பெற்றகாதை : 'போதிநீழல்' - 'நல்அறம்கண்டனை' (73-98)
சிறைக்கோட்டம் அறக்கோட்டம் ஆக்கியகாதை -'வாழிஎம்கோ' - 'அரசுஆள்வேந்துஎன்' (129-163)
சொல்இலக்கணம் - பெயர், வினை, இடை, உரிச்சொல்-விளக்கமும்பயிற்சியும்

அலகு– 3 **(10 மணிநேரம்)**
அறஇலக்கியங்கள் அறிமுகம்
சங்க இலக்கியம் - பரிபாடல்: வையை : பாடல்-6. - நிறைகடல் முகந்து உராய் – சேறுஆடுபுனலதுசெலவு 1-50.
சங்க இலக்கியம் -அகநானூறு - ஈன்று புறம்தந்த எம்மும் உள்ளாள் – பாலை– நற்றாய்கூற்று-35

அற இலக்கியம் -ஔவையார்- கொன்றை வேந்தன் (1-50 பாடல்கள்)

காப்பியம் - சூளாமணி–அரசியல்சருக்கம்- 1. நாவியே கமழும்(1131), 2. கண்மிசை கனிந்த (1132),3. விரைசெலலிவுளித்(1133), 4. அரைசர்கள் வருக (1134), 5. அருளுமாறடிகள் (1135), 6. விஞ்சையருலக (1136), 7. சொரிகதிர் (1137), 8. கரியவன் வளைந்த(1138), 9. மடித்தவா யெயிறு (1139),10. விஞ்சயரதனைக் (1140), **துறவுச்சருக்கம்** – பயாபதி மன்னனின் துறவுநெறி -1. மன்னிய புகழி(1840), 2. திருமகிழலங்கன் (1841) , 3. ஆங்கவ ரணைந்த (1842),4. அலகுடன் விளங்கு (1843), 5. தன்னையோர் அரசனாக்கி (1844), 6. சென்றநாள்(1845), 7. எரிபுரை (1846.), 8. பிறந்தனர்(1847), 9. பிறந்தநாம் (1848), 10. தொகைமலர் (1849) 11. ஒழுகிய(1850).

பொருள் இலக்கணம் - அகத்திணை மற்றும் புறத்திணை இலக்கணங்கள்.

அலகு- 4 **(10 மணிநேரம்)**

சிற்றிலக்கியங்கள் தோற்றமும் வளர்ச்சியும்

சங்க இலக்கியம் - ஐங்குறுநூறு : தாய்சாப்பிறக்கும் – தோழிகூற்று – மருதம் - களவன்பத்து: 24

சங்க இலக்கியம் - புறநானூறு : உற்றுழிஉதவியும்-183, பல்சான்றீரே – பொதுவியல்-195

அற இலக்கியம் – வேதநாயகம் பிள்ளை -நீதி நூல்- தேர்ந்தெடுக்கப்பட்ட 5 பாடல்கள் மட்டும்

சின்னவோர் பொருள், கடவுளை வருத்தி, எப்புவிகளும், வைத்தவர், ஈன்றவர்.

காப்பியம் – கம்பராமாயணம் – சுந்தரகாண்டம் (தேர்ந்தெடுக்கப்பட்ட பாடல்கள் மட்டும்) வண்மையில்லை 84 - தாய் ஒக்கும் 171 - ஒரு பகல் 284 - எதிர் வரும் 314 – தருவனத்துள் 327 - எண் இலா 328 - சொல் ஒக்கும் 413 – இவ்வண்ணம் 559 - எண் அரு 598 - தடுத்து இமையாமல் 1979 - தோள் கண்டார் 1008 – மைந்தரை 1339 – அந்நகர் 1445 - சிவந்த வாய் 1550 - ஏய வரங்கள் 1593 – நின்மகன் 1526 – ஆழிசூழ் 1601 – மன்னவன் 1604 – பின்னும் 1752 – கிள்ளையொடு 1701 – எந்தையும் 2159 - பஞ்சி ஒளிர் 2762 - மயில் உடை 3248 – ஆண்டு 3390 –மற்றுஇனி 3812- கண்டனன் 5249 – வேலையுள் 6037 –மண்ணொடும் 6038- வாங்கிய 6170 – இங்குஉள 6172 – கண்டனென் 6031 - பைய பைய 6174 – அந்நெறி 6185 – குகனொடும் 6507 –கூவி 7131 –மாக்கூடு 7760 – அற்றவன் 9168 - ஆள் ஐயா 7271 - கார்நின்ற-10043.

கடிதப்பயிற்சி

1. வேலைவேண்டி விண்ணப்பம் எழுதுதல்

2.பல்கலைக்கழகப் பன்னாட்டுக் கருத்தரங்கச் செய்தியை நாளிதழில் வெளியிட வேண்டி நாளிதழின் பதிப்பாசிரியருக்குக் கடிதம்

3. கருத்தரங்கப் பங்கேற்புக்கான அனுமதிக் கடிதம்

4. பல்கலைக்கழக விழாவுக்குத் தலைமையேற்க வேண்டி, மாவட்ட ஆட்சியருக்கு விண்ணப்பம்.

அலகு – 5 **(8 மணிநேரம்)**

காப்பியங்கள் - தோற்றமும் வளர்ச்சியும்

சங்க இலக்கியம் - பத்துப்பாட்டு: சிறுபாணாற்றுப்படை

வானம் வாய்த்த – யாம் அவண்நின்றும் வருதும் (அடிகள்: 84-143),

செய்நன்றி அறிதலும் – நல்லியக்கோடனை நயந்தனிர் செலினே (207-269).

அற இலக்கியம் – குமரகுருபரர் - நீதி நெறி விளக்கம் (தேர்ந்தெடுக்கப்பட்ட 5 பாடல்கள் மட்டும்)

உறுதி பயப்ப, முயலாது வைத்து, உலையாமுயற்சி, காலம் அறிந்து, மெய்வருத்தம்

கடிதப்பயிற்சி

5. கல்விக் கடன்வேண்டி வங்கிமேலாளருக்கு விண்ணப்பம்
6. வசிப்பிடத்திற்கு அடிப்படை வசதிவேண்டி வட்டாட்சியருக்கு விண்ணப்பம்
7. விருதுபெற்ற நண்பனுக்குப் பாராட்டுக் கடிதம்
8. புத்தகங்கள் அனுப்பி உதவவேண்டி, பதிப்பகத்தாருக்கு விண்ணப்பம்.

மொத்த மணிநேரம் 48

பார்வை நூல்கள்

1. **கற்பகச் சோலை – தமிழ்ப்பாட நூல், இலக்கிய நெறிகள்,** தமிழ்த்துறை வெளியீடு, கற்பகம் உயர்கல்விக்கழகம், கோயம்புத்தூர் – 21.
2. **தமிழ் இலக்கிய வரலாறு, முனைவர் கா.கோ. வேங்கடராமன்,** கலையக வெளியீடு, நாமக்கல்.

இணையதளம்

1. www.tvu.org.in
2. www.maduraitamilproject.com

இதழ்கள்

1. International Research Journal of Indian Literature, irjil.in
2. International Tamil Research Journal, iorpress.in

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**3**	**2.4**	2.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester I

24LSUH101 **Language I: HINDI-PAPER- I** **4H-3C**

(Prose, Non-detailed, Nibandh, Grammar)

Instruction Hours/week: L:4 T:0 P:0 **Marks:** Internal**:40** External**:60**
Total**:100** **End Semester Exam:** 3 Hours

PREREQUISITE:

- Not Required

COURSE OBJECTIVES (CO):

- Understand the text styles and grammatical elements
- Discuss the content of a reading passage
- Develop an interest in the appreciation of short stories

COURSE OUTCOMES (COs):

- Develop an interest in the appreciation of literature.
- Discuss and respond to content of a reading passage.
- Learning the literacy knowledge of Hindi specially reading and writing.
- Learning the literary knowledge specially reading and understanding of Hindi short Stories
- Learning the history of Hindi literature.

UNIT -I a) Prose - Bharathiya Sangrah
b) Non-Detailed - Naya Mehman
c) Nibandh - Anushasan
d) Grammar - Bhasha Aur Vyakaran

UNIT -II a) Prose - Pahtha Pani Nirmal
b) Non-Detailed - Eakankki ki Visheshatha
c) Nibandh - Onam
d) Grammar – Varna Vichar , Sangya

UNIT -III a) Prose – Rashtriya Pitha Mahathma
b) Non-Detailed – Maha Bharat ki Eak Sanjh
c) Nibandh – Eakatha Ka Mahathva
d) Grammar – Sarvanam , Gender

UNIT-IV a) Prose – Gapshap
b) Non-Detailed – Yahang Sona Mana Hai
c) Nibandh – Ganga Pradhushan Ki Samasya
d) Grammar – Number , Karak , Visheshan

UNIT-V a) Prose – Nindha Ras
b) Non – Detailed Eakanki ki Katha Vasthu
c) Nibandh – Paropkar
c) Nibandh – Paropkar
d) Grammar - Kriya , Kriya Visheshan

REFERENCE BOOKS:

I. Prose :Nuthan Gathya Sangrah (lesson-1,5,6,8,9).

Editor : Jayaprakash

Publisher : Sumithra Prakasan,

16|5.Hasting Road,

Illahabad.211001.

II. Non-detailed: Naveen Ekhanki Sangrah

Editor : Dr. Srimathi Malathi Tiwari

Publisher: Sumithra Prakashan,

204.Leela Apartment,

Ashok Nagar, Illahabad-211001.

III. Nibandh : Subod Hindi Nibandh

Editor : Dr. Braj Kishor Prasad Sing

Publisher: Manoj Publication

1583-84 Dariba Kala, Chandni Chouk,

Delhi – 110006.

IV Grammar: Sugam Hindi Vyakaran

Writer: Pro. Vamshidhar & Dharmapal

Publication: Shiksha Bharathi, Kashmir Gat, Delhi - 110006

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO14	PO14	PO15	PSO2	PSO1
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**3**	**2.4**	**2.4**	**-**	**-**	**-**	**-**	**-**	-	-	-	-	-	-	-	-	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester I

24LSUM101 **Language I: MALAYALAM I** **4H-3C**

Instruction Hours/week: L:4 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**
End Semester Exam: 3 Hours

PREREQUISITE:

Not required

COURSE OBJECTIVE (CO):

- Improves grammatical knowledge
- Will continue to read and learn about articles and think about them
- It is possible to read and understand short stories and understand the thoughts and life ofthe people of this state.

COURSE OUTCOME (COs):

- Understand the text styles and grammatical elements
- Discuss the content of a reading passage
- Develop an interest in the appreciation of short stories
- Comprehend the grammatical structures and sentence making
- Understand the language and developing English to Malayalam translation skill

	PART I MALAYALAM PAPER I	
Unit No.		**HOURS**
I	Novel – Pathummayude Aadu - Vaikam Muhammed Basheer	**10**
II	Novel- - Pathummayude Aadu - Vaikam Muhammed Basheer	**10**
III	Short Story - Ente Priyappeta Kadhakal – Akbar Kakkattil)	**09**
IV	Short Story - Ente Priyappeta Kadhakal – Akbar Kakkattil)	**10**
V	Composition & Translation (English to Malayalam)	**09**
	TOTAL	**48**

TEXT BOOKS:

1. Novel- PathummayudeAadu - Vaikam Muhammed Basheer(D.C.Books, Kottayam, Kerala)
2. Short Story - Ente Priyappeta Kadhakal – Akbar Kakkattil)(D.C. Books, Kottayam, Kerala)
3. Expansion of ideas, General Eassay and Translation. (A simple passage)

REFERENCE BOOKS:

1.Malayala Novel Sahithya Charitram-K.M.Tharakan (N.B.S.Kottayam)
2.Cherukatha Innale Innu-M.Achuyuthan (D.C Books, Kottayam)
3.Sahithya CharitramPrasthanangalilude- Dr.K.M George, (D.C.Books Kottayam)
4. MalayalaSahithyavimarsam-Sukumar Azheekode (D.C.books)

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO 13	PO 14	PO15	PSO1	PSO2
CO1	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
Average	-	3	3	-	-	-	3	-	-	-	-	2	-	-	-	-	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester I

24LSUS101 **Language I: SANSKRIT I** **4H-3C**
(POETRY, GRAMMAR AND TRANSLATION)

Instruction Hours/week: L:4 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**
End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- The fundamental objective of the curriculum is to impart effective science education at the undergraduate level, exposing them to recent trends and developments in the subject.
- Creating scientific temper is another major objective of this curriculum.
- Another major thrust given here is to develop an environmental concern in all activities ofthe students. 'Go green', the motto of the syllabus emphasizes the urgent need to conserve nature without destruction of natural resources.

COURSE OUTCOMES (COs):

- **Critical Thinking**: Take informed actions after identifying the assumptions that frame students' thinking and actions.
- **Problem Solving**: Understand and solve problems of relevance to society to meet the specified needs using the knowledge, skills and attitudes acquired.
- **Effective Communication**: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
- **Effective Citizenship**: Demonstrate empathetic social concern and equity centered national development.
- **Environment and Sustainability**: Understand the issues of environmental contexts and sustainable development.

UNIT I **9 HOURS**

Introduction to Poetry, Definition of Poetry

UNIT II **9 HOURS**

Five Maha Kavyas

UNIT III **10 HOURS**

Text Prescribed : Raghuvamsa (Canto – 1) First Ten Slokas

UNIT IV **10 HOURS**

Text Prescribed : Raghuvamsa (Canto – 1) Slokas Eleven to Thirty

UNIT V **10 HOURS**

Text Prescribed : Raghuvamsa (Canto – 1) Slokas Thirty One to Fifty

Grammar: Text prescribed : Sanskrit Self Teacher
By Dr.V.Varadhachari
(Present tense and Declension of „a" endingnouns (Masculine)

TOTAL: 48 HOURS

TEXT BOOKS:

1.Raghuvamasa (Canto – 1)R.S.Vadhyar and Sons Palghat, Kerala

2.Sanskrit Self Teacher By Dr.V.VaradhachariT.S.Sriraman 32, Tank Bund Road
Near Loyola College, Nungambakkam Chennai 600 034.

CO, PO, PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PSO 1	PSO 2
CO1	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**2.6**	**2.6**	**2.8**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester I

24LSUF101 **Language I: FRENCH I** **4H-3C**

(Leçon, Communication, Grammaire, Verbes, Lexique, Culture)

Instruction Hours/week: L:4 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not Required

COURSE OBJECTIVES (CO):

The objectives of this course are:

- To enable the learner to communicate effectively and appropriately.
- To develop and integrate the use of the four language skills.
- To train students to acquire proficiency in French by reading different genres ofliterature and learning grammar.

COURSE OUTCOMES (COs):

At the end of this course, students will be able to

COs	Course Outcomes	Blooms Level
CO1	retrieve fundamentals of French language to construct error free sentences.	Apply
CO2	construct and maintain social relationships.	Analyze
CO3	construct business letters, proposals and E-Mail communication	Apply
CO4	Adopt the skills of planning, structuring, and delivery techniques in group discussions and presentations.	Understand
CO5	classify communication skills in business environment	Understand

Unite – I

a) Leçon – Bienvenue

b) Communication –Un cours de francais,Entrer en contact saluer,

c) Verbes - être ou avoir

d) Lexique –Les couleurs, l' alphabet

e) Culture – La France

Unité - II

a) Leçon -Bonjour ça va ?

b) Communication -Demander et dire,Comment ça va

c) Verbes – Les verbes réguliers en –er.

d) Lexique - Les Pays et les nationalités , Les animaux domestiques,

Les jours de la semaine.

e) Culture – La France et la Francophonie

Unité - III

a) Leçon - Salut ! Je m'appelle Agnès

b) Communication - Se présenter et présenter quelqu'un Demander et dire la date

c) Grammaire - Les pronoms personnels sujets ,Les verbes être et avoir , Les articles définis et indéfinis

d) Verbes - Les verbes aller et venir

e) Lexique - Les mois de l'année, Les nombres de 0 à 69 » La famille (1)

f) Culture - La France physique et politique

Unité IV

a) Leçon - Qui est-ce ? Dans mon sac, j ' ai

b) Communication - Demander et répondre poliment ,Demander des informations Personnelles

c) Grammaire - La formation du feminine, La formation du pluriel , Le adjectifs possessifs

d)Verbes -Les verbes ir et re

e)Lexique -Les professions ,Quel ques objets ,La fiche d'identité

f)Culture -Les symbols de la France,

Unité V

a) Leçon - Il est comment ? Allô ?

b)Communication - Décrire l'aspect physique et le caractère Parler au téléphone

c)Grammaire - La formation du féminin , La phrase interrogative Qu'est-ce que... ? La phrase négative

d)Verbes - Le verbe Faire

e) Lexique - L'aspect physique , Le caractère, Les prépositions de lieu , Les nombres à partir de 70

f) Culture - Les frontiers de la france,les villes connues en france.

REFERENCE BOOKS:

1. Cocton Marie –Noëlle , Duplex Dorothée, Heu Elodie , Kasazian Emilie, Ripaud Delphine, **Saison 1- Méthode de francais**, Didier, paris.2015.
2. Cocton Marie – Noëlle, Dupleix, Heu Elodie, Kasazian Emilie ,Ripaud **Deldphin, Saison 1 –**
3. **Cahier d'activites** , Dider ,Paris , 2015

4. Anne Akyüz,Bernadette Bazelle- Shahmael,JoëlleBonenfant, Marie- Françoise Gliemenn,**Les exercices de grammaire**,Hachette FLE, Paris,2005
5. Christian Beaulieu, Je **pratique, Exercises de grammaire A1**, Dider,Paris,2015
6. Nathalie BIE, philippe SANTINAN,**Grammaire pour adolescents-250 exercises,** CLE International , Paris , 2005

WEBSITES :

1. http:// enseigner.tv5 monde.com/
2. bonjourdumonde.com /exercises/contenu/le – francais-du- tourisme.html
3. http://www.bonjurdefrance.com/
4. https://www.lepointdufle.net/

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
Average	**-**	**3**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester I

24ENU101 **ENGLISH I** **3H - 3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To enable the learner to communicate effectively and appropriately.
- To develop and integrate the use of the four language skills.
- To train students to acquire proficiency in English by reading different genres ofliterature and learning grammar.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Retrieve fundamentals of English language to construct error free sentences.	Apply
CO2	Construct and maintain social relationships.	Analyze
CO3	Construct business letters, proposals and E-Mail communication	Apply
CO4	Adopt the skills of planning, structuring, and delivery techniques in group discussions and presentations.	Understand
CO5	Classify communication skills in business environment	Understand

UNIT I **8 HOURS**

LISTENING: Listening –Types of Listening
SPEAKING: Face to Face Conversation
READING: Reading – Types of Reading
WRITING: Jumbled Sentences
LITERATURE: Ode on a Grecian Urn by John Keats
GRAMMAR: Parts of Speech

UNIT II **7 HOURS**

LISTENING: Principles of Listening Skills
SPEAKING: Descriptions
READING: Reading Techniques
WRITING: Paragraph Writing
LITERATURE: Of Friendship by Francis Bacon
GRAMMAR: Articles

UNIT III **7 HOURS**

LISTENING: Barriers of Listening
SPEAKING: Telephone Conversations
READING: Reading Comprehension Passages
WRITING: Precise Writing
LITERATURE: The Umbrella man by Roald Dahl
GRAMMAR: Tense

UNIT IV **7 HOURS**

LISTENING: Story Narrations
SPEAKING: Group Discussion
READING: Reading Reports and Profiles
WRITING: Letter Writing
LITERATURE: Tyger by Wiiliam Blake
GRAMMAR: Subject and Predicate – Question Tags

UNIT V **7 HOURS**

LISTENING: Listening Strategies
SPEAKING: Interview Skills
READING: Tips for MOC- Anchoring
WRITING: Circular Writing and Summary Writing
LITERATURE: Short story: Rapunzel by the Brothers Grimm
GRAMMAR: Framing Questions

Total: 36 HOURS

TEXT BOOK

1. Board of Editors (2024), *Acrostic I*. Karpagam Academy of Higher Education

REFERENCE BOOKS:

1. Oxford Handbook of Writing: *St. Martins Handbook of Writing* 2013 Cambridge University Press
2. Julian Treasure (2012), *Sound Business*, Oxford University Press
3. Hornby, A,S. (1975) *The Guide to patterns and usage in English*: oxford university Press.
4. Ellis, R. (1990). *Instructed second language acquisition*. Oxford: oxford university Press.

WEB SITES:

1. https://langster.org/en/blog/fundamentals-of-english-grammar-everything- you- need-to-know/
2. https://medium.com/@phonicstandardvideo.am/fundamentals-of-english-grammar-for-novices-24b355d2cd83

CO, PO, PSO Mapping

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
Average	-	**3**	**3**	-	-	-	**3**	-	-	-	-	**2**	-	-	-	-	-

24MBU101 INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY 6H- 5C

Instruction Hours/week: L:5 T:1 P:0 **Marks: Internal:40 External:60 Total:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To provide knowledge about history of microbiology and classification of microorganisms
- To understand the working principle, components, types and applications of microscope
- To provide an overview on algae, virus and protozoa

COURSE OUTCOMES (COs):

Upon completion of this course the students will be able to:

COs	Course Outcomes	Blooms Level
CO1	Understand the contributions of various scientists for development of microbiology field and skills associated with it.	Understand
CO2	Explain the diversity of microbes and their applications.	Understand
CO3	Discuss the working principle, components, types and applications of microscope	Analyze
CO4	Interpret the viral genome, Replication and Cultivation	Understand
CO5	Compare the features of algae, fungi, virus and protozoa	Analyze

Unit I History of microbiology **15 HOURS**

Development of microbiology as a discipline, spontaneous generation vs biogenesis. Contribution of Anton von Leewenhoek, Golden era of Microbiology Louis Pasteur, Robert Koch, Joseph Lister, Alexander Flemming. Germ theory of disease, Establishment of fields of medical microbiology and immunology through the work of Paul Ehrlich, Ellie Metchnikoff, Edward Jenner. Role of microorganism in fermentation, Application in industries, medicine, agriculture, biotechnology and biology.

Unit II Microscopes **12 HOURS**

Microscope – principles and application – simple and compound microscope – dark field –phase contrast, fluorescent microscope, SEM and TEM.

Unit III Classification of microorganisms **15 HOURS**

Bergey's Manual, Binomial Nomenclature. Classification system: Phenetic and Phylogenetic, Whittaker's Five Kingdom and Carl Woese's three kingdom classification system and their utility. Difference between prokaryotic and eukaryotic microorganism. Major diversity of microbial life. General characteristics of Bacteria, Bacterial ultra-structure and Nutrients. General characteristics of Actinobacteria.

Unit IV Algae & Fungi **15 HOURS**

General characteristics of algae including algal cell ultra-structure. Classification of algae- Chlamydomonas, Volvox, Diatoms, red algae and brown algae. Algal cell cultivation and preservation Application of Algae in agriculture, industry, environment and food. General characteristics of fungi including habitat, distribution, nutritional requirements, fungal cell ultra- structure. Economic importance of fungi. Virulence factors of fungi causing infection. Classification of fungi.

Unit V Virus & Parasites **15 HOURS**

General properties of viruses – Structure, Genome, Replication and Cultivation. Morphology, classification, characteristics of Protozoa, Platyhelminthes – Amoeba, Apicomplexa, Coelenterata, Porifera.

Total: 72 HOURS

TEXT BOOKS:

1. Duby, R.C. (2014) *Textbook of Microbiology*. 5th edition. S. Chand Publishing.
2. Madigan, M.T., Martinko J.M., Dunlap, P.V., and Clark, D.P. (2014). *Brock Biology of Microorganisms*. 14th edition. Pearson International Edition.
3. Pelczar, M.J., Chan, E.C.S., and Krieg, N.R. (1993). *Microbiology*. 5th edition. McGraw Hill Book Company.
4. Wiley, J.M., Sherwood, L.M., and Woolverton, C.J. (2013*). Prescott's Microbiology*. 9th edition. McGraw Hill International.

REFERENCE BOOKS:

1. Tortora, G.J., Funke, B.R., and Case CL. (2014). *Microbiology: An Introduction*. 9thedition. Pearson Education.
2. Atlas, R.M. (1997). *Principles of Microbiology*. 2ndedition. WM.T. Brown Publishers.
3. Stanier, R.Y., Ingraham, J.L., Wheelis, M.L., and Painter, P.R (2005). *General Microbiology*. 5th edition. McMillan.
4. Talaro., Kathleen, P.T., Chess., and Berry, C., (2018). *Foundations in Microbiology*. (10thEd). McGraw-Hill Higher Education, United States.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	2	-	-	-	2	-	-	3	-	1	-	-	3	-
CO2	3	-	-	-	2	-	-	2	-	-	-	-	-	-	-	3	-
CO3	3	-	-	2	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	-	-	2	-	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	-	-		-	-	-	-	-	-	-	-	-	-	-	3	-
Average	**3**	**-**	-	**2**	**2**	-	-	**2**	-	-	**3**	-	**1**	-	-	**3**	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester I

24MBU102 BIOCHEMISTRY I 5H–3C

Instruction Hours/week: L:4 T:1 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To understand about storage and structural polysaccharides and lipids
- To summarize the structure and classification of proteins and enzymes
- To state the Structure and types of DNA and RNA and functions and properties of vitamins

COURSE OUTCOMES (COs):

Upon completion of this course the students will be able to:

COs	Course Outcomes	Blooms Level
CO1	Gain knowledge the structures and functions of carbohydrates	Understand
CO2	Describe the types and functions of lipids	Understand
CO3	Comprehend the structure and functions of proteins and amino acids	Understand
CO4	Discuss the structure, classification of enzymes and specificity of enzymes	Understand
CO5	Understand the nucleic acids' structure and types and vitamin functions	Understand

Unit I Carbohydrates **12 HOURS**

Monosaccharides-families, stereo isomerism, epimers, Mutarotation and anomers. Forms of glucose and fructose, Fischer and Haworth projection. Sugar derivatives. Disaccharides- occurrence, concept of reducing and non-reducing sugars. Polysaccharides-storage and structural polysaccharides.

Unit II Lipids **12 HOURS**

Classification and functions of lipids. Storage lipids- structure and function of fatty acids. Triacylglycerols. Saponification. Structural lipids- structure, functions and properties of phosphoglyceride; glycolipids and sphingolipids.

Unit III Proteins **12 HOURS**

Classification and functions of proteins and amino acids, Structure of amino acids and concept of zwitterion. Ninhydrin reaction. Natural modifications of amino acids in proteins. Non protein amino acids, Primary and Secondary structure of proteins- alpha helix, beta pleated sheet. Tertiary and quaternary structures of proteins. Structure of haemoglobin in mammals.

Unit IV Enzymes **12 HOURS**

Structure and classification of enzymes, specificity of enzymes. Michaelis-Menten equation, Km, Vmax, isoenzymes. Allosteric enzyme and its mechanism. Multienzyme complex. Enzyme inhibition.

Unit V Nucleic Acids **12 HOURS**

Nucleic Acids-Purines & Pyrimidines nucleotides, RNA, & DNA base pairing schemes, types of RNA: mRNA, rRNA, tRNA, Secondary structure of DNA, Watson and Crick model, Vitamins and its types.

Total: 60 HOURS

TEXT BOOKS:

1. David L Nelson, Michael M cox, WH Freeman (2022). *Leininger Principles of Biochemistry*, 8th edition.
2. Chakarapani. V, Sathyanarayana V. (2020). *Biochemistry*, 5th edition, Elsevier.
3. Campbell, M.K. (2012). *Biochemistry*, 7th edition. Published by Cengage Learning.

REFERENCE BOOKS:

1. Campbell, P.N., and Smith, A.D., (2011). *Biochemistry Illustrated*, 4thedition. Published by Churchill Livingstone.
2. Tymoczko, J.L., Berg, J.M., and Stryer, L. (2012). *Biochemistry: A short course*, 2ndedition. W.H.Freeman.
3. Berg, J.M., Tymoczko, J.L., and Stryer, L. (2011). *Biochemistry*, W.H. Freeman and Company.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	2	-	-	-	-	-	-	1	-	-	-	1	2	3
CO2	3	-	-	-	-	-	-	2	-	-	-	-	-	-	-	2	3
CO3	3	-	-	2	-	-	-	-	-	-	-	-	-	-	-	2	3
CO4	3	-	-	2	-	-	1	-	-	-	-	-	-	-	-	2	3
CO5	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	2	-
Average	**3**	**-**	**-**	**2**	**-**	**-**	**1**	**2**	**-**	**3**	**1**	**-**	**-**	**-**	**1**	**2**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester I

24MBU111 INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY PRACTICAL **4H–2C**

Instruction Hours/week: L:0 T:0 P:4 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 6 Hours

PREREQUISITE:

- Introduction To Microbiology and Microbial Diversity (24MBU101)

COURSE OBJECTIVES (CO):

- To learn techniques and methods used in the cultivation and isolation of bacteria.
- To learn about bacterial specialized structure using staining methods
- To learn the bacterial special structure capsule and spore

COURSE OUTCOMES (COs):

Upon completion of this course the students will be able to:

COs	**Course Outcomes**	**Blooms Level**
CO1	Learn and practice practical skills in staining procedures	Understand /Apply
CO2	Prepare culture media for microbes	Apply
CO3	Perform microbial culture techniques to obtain isolation of pure cultures of bacteria	Apply
CO4	Differentiate Bacterial endospore and capsule	Analyze
CO5	Analyze the bacterial structure, capsule and spore, motility	Analyze

EXPERIMENTS **48 HOURS**

1. Preparation of different media: synthetic media BG-11, Complex media - Nutrient agar, Mac Conkey agar, EM Bagar.
2. Examination of bacterial colony with morphological features.
3. Estimation of Colony Forming Unit (CFU) count by spread plate method/pour plate method.
4. Isolation of pure cultures of bacteria by streaking method - Quadrant, Continuous and T-streaking.
5. Preservation of bacterial cultures by various techniques - Agar slants and deeps - Mineral Oil, Glycerol stocks
6. Micrometry.
7. Motility by hanging drop method.
8. Simple staining
9. Negative staining
10. Gram's staining
11. Acid fast staining – demonstration permanent slide only.
12. Capsule staining 13. Endospore staining.

TEXT BOOKS: **Total :48 HOURS**

1. Madigan, M.T., Kelly, S.B., Daniel, H.B, Mathew, S and David, A.S (2017). *Brock Biology of Micro- organisms*. 15th edition. Parker J. Prentice Hall International, Inc.

2. Cappucino, J., and Sherman. N. (2010). *Microbiology: A Laboratory Manual.* 9thedition. Pearson Education Limited
3. Benson's Microbiological Applications Laboratory Manual-Complete Version, (2015). 13th Edition, McGraw Hill.

REFERENCE BOOKS:

1. Willey, J.M., Sherwood, L.M., and Woolverton, C.J. (2019). *Prescott's Microbiology*. 11th edition. McGraw Hill.
2. Talaro., Kathleen, P.T., Chess., and Berry, C., (2018). *Foundations in Microbiology*, 10thEd., McGraw Hill.
3. Kathleen Park Talaro and Barry Chess, (2018). *Foundations in Microbiology: Basic Principles*, 10th Edition, Mc Graw Hill.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	2	-	-	-	2	-	-	3	-	-	-	-	-	-	-	3	-
CO2	-	-	-	-	3	-	-	2	-	-	-	-	-	-	-	3	-
CO3	2	-	-	-	3	-	-	2	-	-	-	-	-	-	-	3	**3**
CO4	-	-	-	-	3	-	-	2	-	-	-	-	-	-	-	3	-
CO5	3	-	-	-	2	-	-	2	-	-	-	-	-	-	-	3	-
Average	**2.3**	-	-	-	**2.6**	-	-	**2.2**	-	-	-	-	-	-	-	**3**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester I

24MBU112 **BIOCHEMISRY I - PRACTICAL** **4H–2C**

Instruction Hours/week: L:0 T:0 P:4 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 6 Hours

PREREQUISITE:

- Biochemistry I (24MBU112)

COURSE OBJECTIVES (CO):

- To familiarize the students with numerical problems in molarity and normality
- To expertise in Qualitative/Quantitative tests of carbohydrates, reducing sugars, Protein and lipids and vitamins
- To study the effect of temperature, pH and heavy metals on enzyme activity.

COURSE OUTCOMES (COs):

Upon completion of this course the students will be able to:

COs	Course Outcomes	Blooms Level
CO1	Solve the numerical problems in molarity and normality	Apply
CO2	Analyse the qualitative estimation of biomolecules	Analyze
CO3	Practice the quantitative estimation of biomolecules	Apply
CO4	Examine the effects of various factors in enzyme activity	Analyze
CO5	Apply techniques in the estimation different vitamins	Apply

EXPERIMENTS **48 HOURS**

1. Properties of water, concept of pH and buffers, preparation of buffers and numerical problems to explain the concepts of molarity, normality and their calculation.
2. Numerical problems on calculations of standard free energy change and equilibrium constant.
3. Standard free energy change of coupled reactions.
4. Qualitative tests for carbohydrates, reducing sugars, and non-reducing sugars.
5. Qualitative tests for lipids and proteins.
6. Quantitative tests for carbohydrates.
7. Quantitative tests for proteins.
8. Study effect of temperature, pH and heavy metals on enzyme activity.
9. Estimation of any four vitamins.

TEXT BOOKS: **Total: 48 HOURS**

1. David L Nelson, Michael M cox, WH Freeman 2022. *Lehninger Principles of Biochemistry*, 8th edition.
2. Chakarapani. V, Sathyanarayana V 2020. *Biochemistry*, 5th edition, Elsevier.
3. Campbell, M.K. (2012). *Biochemistry*, 7th edition. Published by Cengage Learning

REFERENCE BOOKS:

1. Campbell, P.N., and Smith, A.D., (2011). *Biochemistry Illustrated*, 4th edition. Published by Churchill Livingstone.

2. Tymoczko, J.L., Berg, J.M., and Stryer, L. (2012). *Biochemistry: A short course*, 2ndedition. W.H.Freeman.
3. Berg, J.M., Tymoczko, J.L., and Stryer, L. (2011). *Biochemistry*, W.H. Freeman and Company.
4. Nelson, D.Land Cox, M.M. (2008). *Lehninger Principles of Biochemistry*, 5thedition. W.H. Freeman and Company.

CO, PO, PSO Mapping

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PO13	PO14	PO15	PSO 1	POS 2
CO1	3	-	-	-	-	-	-	-	-	-	1	-	-	-	1	3	-
CO2	-	-	-	2	-	-	-	2	-	-	-	-	-	-	-	3	-
CO3	3	-	1	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	-	-	2	-	-	-	-	-	-	-	-	-	-	-	3	3
CO5	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	3	3
Average	**3**	**-**	**1**	**2**	**-**	**-**	**-**	**2**	**-**	**3**	**1**	**-**	**-**	**-**	**1**	**3**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester I

24VAC101 YOGA FOR YOUTH EMPOWERMENT 2H–2C

Instruction Hours/week: L:0 T:0 P:0 **Marks:** Internal**:100** External**: - T**otal**:100**

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To create awareness about Yoga and Physical Health
- To providing Value Education to improve the students character understanding Greatness of Life force and Mind
- To know about five aspects of life and to develop good Qualities and eliminating bad ones
- To Learn introspection practices like Analysis of Thoughts, Moralization of Desires, Neutralization of Anger and Eradication of Worries Diversity in Men (Why Men Differ).
- To understand about the yoga, life and practice Yogasanas.

COURSE OUTCOMES (COs):

Upon completion of this course the students will be able to

COs	**Course Outcomes**	**Blooms Level**
CO1	Understand the concepts of about Yoga and Physical Health	Understand
CO2	Study the concepts a Greatness of Life force and Mind	Understand
CO3	Learn the aspects of Personality Development - Sublimation	Understand
CO4	Practices Human Resource Development	Apply
CO5	Understand about the yoga, life and Law of Nature	Apply

UNIT I YOGA AND PHYSICAL HEALTH 8 HOURS

Manavalakalai (SKY) Yoga: Introduction Education as a means for youth empowerment-Greatress of Education Yoga for youth Empowerment. Simplified Physical Exercises Hand, Leg, Breathing, Eye exercises Kapalabathi, Makarasana Part I, Makarasana Part II, Body Massage, Acupressure, Relaxation exercises Benefits Yogasanas 1: Pranamasana Hastha Uttanasana Pada Hasthasana - AswaSanjalana Asana ThuvipathaasvaSarjalana asana AstangaNamaskara - Bhujangasana Atha Muktha Savasana AswaSanjalanaAsara Pada Hasthasana-Hastha UttanasanaPranamasana - Pranayama: Naddisudei-Clearance Practice-Benefits - Simplified Physical Exercise-Kayakalpa Practices - Meditation Practices.

Philosophy of life: Purpose of life Philosophy of life (Needs Protections Virtues Development of knowledge) Five Types of duties-Protection of the natural resources

UNIT II GREATNESS OF LIFE FORCE AND MIND 7 HOURS

Reasons for Diseases Natural reasons (Genetic/imprints, Planetary Position, Natural calamities and climatic changes) Unnatural reasons (Food habits, Thoughts, Deeds) Philosophy of Kaya Kalpa: Physical body-Sexual vital fluid-Life force- Bio-Magnetism-Mind Maintaining youthfulness: Postponing old age seven components -

Importance of sexual vital fluid Transformation of food into Measure and method in five aspects of life-Controlling undue Passion. Kayakalpa practice: Aswini Mucra-Ojas breath-Benefits of Kaya Kapa.

UNIT III PERSONALITY DEVELOPMENT – SUBLIMATION 7 HOURS

Mental Frequencies: Beta, Alpha, Theta and Delta wave Agna Meditation explanation benefits. Shanti meditation: Shanthi Meditation explanation-benefits - Thuriya Meditation: Thuriya Meditation explanation-benefits - Benefits of Blessing Self blessing (Auto suggestion) Family blessing Blessing the others World blessing- Divine protection

Human Values: Set-cortio- Sell-confidence Honesty Contentment Humility Modesty To erance Adjustment-Sacrifice-Forgiveness Punty (Bocy, Dress, Enviorment) Physica purity- Mental purity-Spiritual purity. Social Values: Nonviolence-Service Patriotism-Equality Respect for parents and elders care and protection Respect for teacher Punctuality-Time Management

UNIT IV HUMAN RESOURCE DEVELOPMENT 7 HOURS

Morality (virtues):Importance of Introspection: 1 Mine (Ego, Possessiveness) Six Evi Temperaments-Greed-Anger-Miserliness Immoral sexual passion - Inferionty and superiority Complex - Vengeance Maneuvering of Six Temperaments: Contentment-Tolerance-Charity-Chastity -Equality-Pardon (Forgiveness) - Five essential Qualities acquired through Meditation: Perspicacity Magnanimity Receptivity Adaptability-Creativity (Improved Memory Power)

UNIT V LAW OF NATURE 7 HOURS

Ten stages of the Mind - Five kosas of the mind Maintaining good Relationships Thought- Importance of thoughts - Reasons for Thoughts Practice of Analysis of ThoughtsDefinition of Desire-Root causes for desires Types of desires Desires Essential for success Practice for Moralization of Desires Thought-Reformation-Frugality. Anger- Reasons for Anger-Anger and Peace Ill effects of anger Tolerance and Forgiveness - Neutralization of Anger- practice. Diversity in Men (Why Men Differ) Love and compassion, Eradication of Worries: Reasons for Worries-Fout types of worries Il effects-results-Practice for Eradication of Worries

YOGA PRACTICES: Thandasana Chakrasana (sideways) Vruchasana Thirikonasana Varasana

Total: 36 HOURS

REFERENCE BOOKS:

1. Kayakapam Thathuvagnani Vethathiri Maharishi
2. Light on yoga BKS.lyenger
3. ManavalakalaPart-1-Thathuvagnani Vethathiri Maharishi.
4. Manavalakala part-2-Thathuvagnani Vethathiri Maharishi
5. Mind ThathuvagnariVethathir Maharishi
6. Simplified Physical Exercises- ThathuvagnaniVethathiri Maharishi
7. Sound Health through yoga - Dr.Chandrasekaran
8. The world orcer of Holistic unity- ThathuvagnaniVethathiri Mahanshi
9. Thirukkural-Rev. Dr.G.U.pope
10. Yoga for modern age ThathuvagnaniVethathin Maharishi

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	-	-	2	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-		2	-
CO3	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	**3**
CO4	-	-	-	-	-	-	2				-	-	-	-	-	-	-
CO5	-	-	-	-	-	-		-	-	3	-	-	-	-	-	-	-
Average	**3**	**-**	**2**	**3**	-	-	**2**	-	-	**3**	-	-	-	-	**2**	**2**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

இரண்டாம் பருவம்

24LSUT201 Language II: Tamil II 4H - 3C

Instruction Hours/week: L:4 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

பாடத்திட்டப் பொதுநோக்கம்

- மாணவர்களுக்குத் தமிழ்மொழி வரலாறு மற்றும் இலக்கியங்களின் வழியாக வாழ்வியல் மதிப்புகளை உணர்த்துதல்.
- சிந்தனைத் திறனையும், படைப்பாக்கத் திறனையும், கருத்து வெளிப்பாட்டுத் திறனையும் மேம்படுத்துதல்.
- வேலைவாய்புக்குரிய வகையில் மொழித்திறனை மேம்படுத்துதல்.

பாடத்திட்டப் பயன்விளைவு

- தமிழ்மொழி வரலாறு குறித்த தெளிந்த அறிவு பெற்றிருத்தல்.
- வாழ்வியல் மதிப்புகளைப் பேணுவதற்குக் கருவியாக இலக்கியங்களை நாடுகின்ற மனப்பான்மை பெற்றிருத்தல்.
- படைப்பிலக்கியத்திறன் பெற்றிருத்தல்.
- இந்தியக் குடியுரிமைப்பணி முதலான போட்டித் தேர்வுகளில், விருப்பப்பாடமாக இடம்பெறுகின்ற,'தமிழ் இலக்கியவரலாறு' தமிழ் இலக்கண அறிவு மேம்பாடு பெற்றிருத்தல்.
- மொழிபெயர்ப்பியல், கணினித்தமிழ் சார்ந்த வேலைவாய்ப்புத்திறன் மேம்பாடு.

அலகு – I **(8 மணிநேரம்)**

நாயன்மார்கள் : தமிழ் இலக்கிய வரிசையில் திருமுறைகளும் நாலாயிரத் திவ்யப்பிரபந்தமும் – பன்னிரு திருமுறைகள் அறிமுகம் – திருமுறை ஆசிரியர்களின் இலக்கியப் பங்களிப்பு

சைவம்-பெரியபுராணம் - காரைக்கால் அம்மையார் புராணம் .

முக்கூடற்பள்ளு - 2 பாடல்கள் - சித்திரக்காலிவாலான் (நெல் வகைகள்)
குற்றாலத் திரிகூடமால்வரை (மீன்வகைகள், காளை வகைகள்)

கவிதை : மகாகவி பாரதியார் - யோகசித்தி

கவிதை : கவிமணி தேசிக விநாயகம் பிள்ளை - வாழ்க்கைத் தத்துவங்கள்

கவிதை : கவிஞர் சுகந்திசுப்பிரமணியம் - புதையுண்டவாழ்க்கை

சிறுகதை : மகாமசானம் - புதுமைப்பித்தன்

இலக்கணம் - வாக்கியஅமைப்பு : தனிவாக்கியம் – தொடர்வாக்கியம் – கலவைவாக்கியம் -தன்வினை வாக்கியம் – பிறவினை வாக்கியம்- செய்வினை, செயப்பாட்டு வினைவாக்கியம், கட்டளைவாக்கியம் – வினாவாக்கியம் – உணர்ச்சி வாக்கியம். நன்னூல் – பொதுவியல் - அறுவகைவினா (385) - எண்வகைவிடை (386).

அலகு– 2 **(12 மணிநேரம்)**

ஆழ்வார்கள் : இலக்கியப் பங்களிப்பு - திவ்யப் பிரபந்தத்தில் பக்திநெறியும் இலக்கிய நயமும்

உரைநடை : தோற்றமும் வளர்ச்சியும்

வைணவம் : பெரியாழ்வார் திருமொழி: 3 -ஆம் பத்து – பத்தாம் திருமொழி

'நெறிந்தகருங்குழல் மடவாய்' – சீதைக்கு அனுமன் தெரிவித்த அடையாளம்.

கவிதை - கவிஞர் வைரமுத்து - வித்தியாசமான தாலாட்டு

சிற்பி பாலசுப்பிரமணியன் - பாரதி எங்கள் கண்மணி

அரங்க பாரி - கண்ணீர்! கண்ணீர்!

தமிழலங்காரம் – வண்ணச்சரபம் தண்டபாணி சுவாமிகள் - 10 பாடல்கள் 1. கடல் நீரில் கல்மிதக்கும், 2. வண்டமிழ் ஆற்றுதி, 3. கோளத்தை முட்டி 4. எக்காலம்என்று, 5. கடவூர் மயானத்தொர், 6. தேவாதிதேவன், 7. விண்மாரி, 8. தேவர்முனிவர், 9. அழுதேங்கிநஞ்சிட்ட, 10. அத்தனை பொத்து.

சிறுகதை : ஆர். சூடாமணி - அந்நியர்கள்

கட்டுரை : ஆளுமைத்திறன் அறிவோம்- தன்னம்பிக்கை மாதஇதழிலிருந்து

அணிஇலக்கணம் : உவமையணி – பிறிதுமொழிதல் அணி – சிலேடை அணி – தீவக அணி- ஏகதேச உருவக அணி – வேற்றுமையணி – பின்வருநிலையணி

அலகு - 3 **(10 மணிநேரம்)**

புதுக்கவிதை - தோற்றமும் வளர்ச்சியும்

சிற்றிலக்கியம் -தோற்றமும்வளர்ச்சியும்

மதுரைசொக்கநாதர் - தமிழ்விடுதூது – தமிழின் சிறப்பு பாடியருள பத்துப்பாட்டும் - விளம்பக்கேள்.

கவிதை- ஈரோடுதமிழன்பன் – இன்னொரு சுதந்திரம்

சிறுகதை - கு. அழகிரிசாமி - இருவர் கண்ட ஒரேகனவு

கட்டுரை - ஔவைதுரைசாமி - ஏட்டில் இல்லாத இலக்கியம்

படைப்பிலக்கியப் பயிற்சிகள் - மரபுக்கவிதை, புதுக்கவிதை, சிறுகதை, கட்டுரை படைப்பாக்க உத்திகள் –பயிற்சிகள்

அலகு – 4 **(10 மணிநேரம்)**

சிறுகதை - தோற்றமும் வளர்ச்சியும்

கலிங்கத்துப்பரணி – தேவாசுரம், உடலின்மேல், நெடுங்குதிரை மிசைக்கலணை, விருந்தினரும் வறியவரும், தரைமகள் தன்கொழுநன்றன், பொருதடக்கை வாளெங்கே, வெயில்தாரை.

அருள்தரும் பூங்கோதையன்னை அந்தாதி - 11பாடல்கள் 1. பகவன்பெயரை, 2. மெல்லியல்மேலை, 3.வாலின்குரங்கு, 4.தவளேஇவள், 5.சுரக்கும் திருவருட், 6. வதிவாய்விளைபயில், 7. உறைவான், 8.பச்சைப்பேர், 9.வித்தகம், 10.துணையாய், 11.கலந்தார். **கவிதை - கவிஞர்தாமரை** - தொலைந்துபோனேன்

சிறுகதை – அம்பை - ஜ - வல்லூறுகள்

கட்டுரை- முனைவர் ப. தமிழரசி - நொய்யல்,

சொல்லின் செல்வர் ரா.பி.சேதுப்பிள்ளை - காளத்திவேடனும் கங்கைவேடனும்
மொழிபெயர்ப்புப் பயிற்சிகள் : தமிழ்-ஆங்கில மொழிபெயர்ப்புப் பயிற்சிகள் -2.

அலகு – 5 **(8 மணிநேரம்)**
நாட்டுப்புற இலக்கியங்கள் – அறிமுகம்
கவிதை – புரட்சிக்கவிஞர் பாரதிதாசன் - தமிழின் இனிமை
கவிதை - கவிஞர் அறிவுமதி - நட்புக்காலம்
சிறுகதை - நாஞ்சில்நாடன் - இந்நாட்டு மன்னர்
கீழடி - வைகை நதிக்கரையில் சங்ககால நகரநாகரிகம்
மொழிபெயர்ப்புப் பயிற்சிகள் : ஆங்கிலம் - தமிழ் மொழிபெயர்ப்புப் பயிற்சிகள்-2.

மொத்த மணிநேரம் 48

பார்வை நூல்கள்

1. **கற்பகச் சோலை – தமிழ்ப்பாட நூல், இலக்கிய நெறிகள்,** தமிழ்த்துறை வெளியீடு, கற்பகம் உயர்கல்விக்கழகம், கோயம்புத்தூர் – 21.
2. **தமிழ் இலக்கிய வரலாறு, முனைவர் கா.கோ. வேங்கடராமன்,** கலையக வெளியீடு, நாமக்கல்.

இணையதளம்

1. www.tvu.org.in
2. www.maduraitamilproject.com

இதழ்கள்

1. International Research Journal of Indian Literature, irjil.in
2. International Tamil Research Journal, iorpress.in

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	-	-	-	-	-	-	-	-	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

24LSUH201 **Language II: HINDI-PAPER- II** **4H-3C**

(Modern Poetry, Drama, Novel, Grammar)

Instruction Hours/week: L:4 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not Required

COURSE OBJECTIVES (CO):

- Understand the text styles and grammatical elements
- Discuss the content of a reading passage
- Develop an interest in the appreciation of short stories

COURSE OUTCOMES (COs):

- Basic knowledge of Hindi language will be improved.
- Knowledge of glossaries will increase.
- Hindi language expression will rise.
- Learners will enrich their grammar in Hindi.
- The desire to read literature, such as the essay on a poem, develops.

UNIT-I
a) Poetry - Nagarjun
b) Drama -Dhruva Swamini
c) Novel - Nirmala , Thotharam
d) Grammar – Kaal , Theen Prakar

UNIT-II
a) Poetry – Sita , Ram
b) Drama – Mandhakini , Koma
c) Novel – Mansaram , Jiyaram
d) Grammar – Upsarg, Prathyay

UNIT-III
a) Poetry – Lakshman, Valmiki
b) Drama – Ramaguptha , Chandhraguptha
c) Novel – Sudha, Bhuvan Mohan Singh
d) Grammar – Sabda Vyutpathi

UNIT-IV
a) Poetry -Vishvaamithra, Thrijada
b) Drama –Sikhar Swami,Shakraj
c) Novel – Udhaybanulaal, Siyaram
d) Grammar – Sambandh Chochak

UNIT-V
a) Poetry – Bhagirath , Sagar
b) Drama – Khingal , Mihirdev , Prohith
c) Novel – bhalchandra Sinha,Kalyani, Rangili Bai
d) Samuchchaybodhak, Vishmayathibodhak

REFERENCE BOOKS:

1. Modern Poetry : Bhoomija

Writer : Nagarjun

Editors : Somdev & shobhakanth

Publisher : Rdha Krishna Publication

New Delhi - 110051

2. Drama : Dhruva Swamini
   Writer : Jaysankar Prasad
   Publisher : Sakshi Publication
   S 16,Naveen Shahdhara
   Delhi – 110032
3. Novel : Nirmala
   Writer : Premchandh
   Publisher : Prabhath Prakashan
   4/19 Asaf Ali Road
   New Delhi – 110002

4. Grammar : Sugam Hindi Vyakaran
   Writer : Pro. Vamsidhar & Dharmapal
   Publisher : Siksha Bharathi
   Madharsa Road
   New Delhi – 110006.

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**3**	**2.4**	**2.4**	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester II

24LSUM201 **Language II: MALAYALAM II** **4H-3C**

Instruction Hours/week: L:4 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVE (CO):

- A basic understanding of contemporary poetry can be gained and the nature ofmodern poetry can be realized.
- Realizing the nature of drama and its nature and improving the knowledge ofreading and understanding the nature of contemporary plays.
- Understands the benefits of correspondence and can enhance thecorrespondence you need.

COURSE OUTCOME (COs):

- Get a basic understanding of Memories
- It will create basic knowledge about Environmental Psychology.
- It will create awareness about our environment.
- Knowledge is gain about our country, culture etc.
- It will be an eye opener to the students towards our Mother Earth.

	PART I – MALAYALAM II	
Unit No.		**Hours**
I	Novel -Enmakaje	**10**
II	Novel – Enmakaje	**10**
III	Memmories – Neermaathalam Pootthakaalam	**10**
IV	Memmories – Neermaathalam Pootthakaalam	**9**
V	Translation(English to Malayalam)	**9**
	TOTAL	**48**

TEXT BOOKS:

1.Emakaje – AmbikasuthanMangad – DC Books Kottayam,Kerala

2. NeermaathalamPootthakaalam - Madhavikutty -DC Books Kottayam, Kerala

REFERENCE BOOKS:

1. Athmakathasahithyam Malayalathil-Dr.Vijayalam Jayakumar (N.B.S.Kottayam) Malayala Novel SahithyaCharitram-K.M.Tharakan (N.B.S.Kottayam) SahithyaCharitramPrasthanangalilude- Dr.K.M George,
2. (D.C.Books Kottayam)
3. MalayalaSahithyavimarsam-Sukumar Azheekode (D.C.books)

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
Average	-	3	3	-	-	-	3	-	-	-	-	2	-	-	-	-	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester II

24LSUS201 **Language II: SANSKRIT II** **4H-3C**

(PROSE, GRAMMAR AND TRANSLATION)

Instruction Hours/week: L:4 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

Not required

COURSE OBJECTIVES (CO):

- The fundamental objective of the curriculum is to impart effective science education at the undergraduate level, exposing them to recent trends and developments in the subject.
- Creating scientific temper is another major objective of this curriculum.
- Another major thrust given here is to develop an environmental concern in all activities ofthe students. 'Go green', the motto of the syllabus emphasizes the urgent need to conserve nature without destruction of natural resources.

COURSE OUTCOMES (COs):

- **Critical Thinking**: Take informed actions after identifying the assumptions that frame students' thinking and actions.
- **Problem Solving**: Understand and solve problems of relevance to society to meet the specified needs using the knowledge, skills and attitudes acquired.
- **Effective Communication**: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
- **Effective Citizenship**: Demonstrate empathetic social concern and equity centered national development.
- **Environment and Sustainability**: Understand the issues of environmental contexts and sustainable development.

UNIT I **9 HOURS**

Introduction to Sanskrit Prose, Important prose works in Sanskrit

UNIT II **9 HOURS**

Balaramayana – Balakanda

UNIT III **10 HOURS**

Balaramayana – Ayodhyakanda

UNIT IV **10 HOURS**

Balaramayana – Aranyakanda

UNIT V **10 HOURS**

Athmanepada Declension of ending nouns (feminine)

Passages from Sanskrit Self Teacher (Simple sentences)

TOTAL: 48 HOURS

TEXT BOOK:

1. Balaramayana – a simple prose version.R.S. Vadhyar and sons, Palghat, Kerala.

CO, PO, PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PSO 1	PSO 2
CO1	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**2.6**	**2.6**	**2.8**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

24LSUF201 **Language II: FRENCH II** **4H-3C**

(Leçon, Communication, Grammaire, Verbes, Lexique, Culture)

Instruction Hours/week: L:4 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

Not Required

COURSE OBJECTIVES (CO):

The objectives of this course are:

- To make the students to speak and write errors free French.
- To help the students develop their listening, speaking, reading and writing skills.
- Introducing literary works to the students to enhance their analytical and aesthetic skills.

COURSE OUTCOMES (COs):

At the end of this course, students will be able to

COs	Course Outcomes	Blooms Level
CO1	strengthen the foundation of the language.	Remember
CO2	standardize and demonstrate understanding of LSRW skills.	Understand
CO3	utilize fundamentals of language for reading, writing and effective communication.	Apply
CO4	enhancing the reading skill to build the leadership quality.	Apply
CO5	Develop the moral and aesthetic values.	Evaluate

Unité I	a) Leçon	- Les loisirs
	b) Communication	- Parler de ses goûts et de ses préférences
	c) Grammaire	- Les adjectifs interrogatifs , Les nombres ordinaux, L'heure, Les pronoms personnels COD
	d) Verbes	-savoir et connaitre
	e) Lexique	- Les loisirs, Les activités quotidiennes ,Les matières
	f) Culture	- les grands fleuves de france.
Unité II	a) Leçon	- La routine
	b) Communication	- Décrire sa journée
	c) Grammaire	- Les verbes pronominaux, Les verbes du premier groupe en -e_er, -é_er, - eler, -eter, Le verbe prendre
	d) Verbes	- manger, boire
	e) Lexique	- Le temps et l'heure ,La fréquence
	f) Culture	- les bandes dessinees.
Unité III	a) Leçon	-Où faire ses courses
	b) Communication	- Au restaurant : commander et commenter
	c) Grammaire	- Les articles partitifs, Le pronom en (la quantité) très ou beaucoup ? La phrase négative
	d) Verbes	- les verbs irregulliers

	e) Lexique	- Les aliments, Les quantités, Les commerces et les commerçants
	f) Culture	-Les plats francais
Unité IV	a) Leçon	- Decourvez et dégustez
	b) Communication	- Inviter et répondre ,à une invitation
	c) Grammaire	- L'impératif ,Il faut, c'est/ il est,future proche
	d) Verbes	- Les verbes devoir, pouvoir, savoir, vouloir
	e) Lexique	- Demander et dire le prix, Les services, Les moyens de paiement
	f) Culture	- Le festival du mot
Unité V	a) Leçon	- Tout le monde s'amuse, Les ados au quotidien
	b) Communication	- Décrire une tenue , Écrire un message amical
	c) Grammaire	-Les adjectifs demonstratives, La formation du féminin Le pronom indéfini on, passé compose'.
	d) Verbes	- Les verbes du premier groupe en –yer, Les verbes voir et sortir
	e) Lexique	- Les sorties Situer dans le temps, La famille ,(2) Les vêtements et les accessoires
	f) Culture	- Le pays des gourmands

REFERENCE BOOKS:

1. Cocton Marie –Noëlle , Duplex Dorothée, Heu Elodie , Kasazian Emilie, Ripaud Delphine, **Saison 1- Méthode de francais,** Didier, paris.2015.
2. Cocton Marie – Noëlle, Dupleix, Heu Elodie, Kasazian Emilie ,Ripaud Deldphin, **Saison 1 –**
3. **Cahier d'activites ,** Dider ,Paris , 2015
4. Anne Akyüz,Bernadette Bazelle- Shahmael,JoëlleBonenfant, Marie- Françoise Gliemenn,**Les exercices de grammaire,**Hachette FLE, Paris,2005
5. Christian Beaulieu, Je **pratique, Exercises de grammaire A1,** Dider,Paris,2015
6. Nathalie BIE, philippe SANTINAN,**Grammaire pour adolescents-250 exercises,** CLE International , Paris , 2005

WEBSITES :

1. http:// enseigner.tv5 monde.com/
2. bonjourdumonde.com /exercises/contenu/le – francais-du- tourisme.html
3. http://www.bonjurdefrance.com/
4. https://www.lepointdufle.net/

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO1	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
Average	--	2.5	2.5	-	-	-	-	-	2	-	-	-	-	-	-	-	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester II

24ENU201 **ENGLISH II** **3H–3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To make the students to speak and write errors free English.
- To help the students develop their listening, speaking, reading and writing skills.
- Introducing literary works to the students to enhance their analytical and aesthetic skills.

COURSE OUTCOMES (COs):

Upon completion of this course the students will be able to:

COs	Course Outcomes	Blooms Level
CO1	strengthen the foundation of the language.	Remember
CO2	standardize and demonstrate understanding of LSRW skills.	Understand
CO3	utilize fundamentals of language for reading, writing and effective communication.	Apply
CO4	enhancing the reading skill to build the leadership quality.	Apply
CO5	Develop the moral and aesthetic values.	Evaluate

UNIT-I **8 HOURS**

LISTENING : Listening for Pleasure
SPEAKING : Developing speaking skills
READING : Reading strategies
WRITING : Developing a story with pictures
LITERATURE: Refuge Mother and Child by Chinua Achebe (Poetry)
GRAMMAR : Voice

UNIT- II **7 HOURS**

LISTENING : Listening for Pleasure (Story)
SPEAKING : Oral presentation
READING : Reading Passages
WRITING : Essay writing
LITERATURE : Prose: Dimensions of Creativity by A.P.J. Abdul Kalam (Story)
GRAMMAR : Subject, verb, agreement

UNIT-III **7 HOURS**

LISTENING : Dictation
SPEAKING : Public speaking and secrets of good delivery
READING : Note Making
WRITING : Writing agendas, memos and minutes
LITERATURE: River by A.K. Ramanujan
GRAMMAR : Degrees of comparison

UNIT- IV **7 HOURS**

LISTENING : Listening to instructions and announcements
SPEAKING : Debating
READING : Silent reading and methods of reading
WRITING : Writing Notices
LITERATURE: Two Gentlemen of Verona by A.J. Cronin
GRAMMAR : Phrases and clauses

UNIT-V **7 HOURS**

LISTENING : Testing listening
SPEAKING : Situational Conversation
READING : Developing reading activities
WRITING : E - Mail Writing
LITERATURE: The Postmaster by Rabindranath Tagore
GRAMMAR : Direct and indirect speech

Total: 36 HOURS

TEXT BOOK

1. Board of Editors (2024), Acrostic II. Karpagam Academy of Higher Education

REFERENCE BOOKS:

5. Oxford Handbook of Writing: *St. Martins Handbook of Writing* 2013 Cambridge University Press
6. Julian Treasure (2012), *Sound Business,* Oxford University Press
7. Hornby, A,S. (1975) *The Guide to patterns and usage in English*: oxford university Press.
8. Ellis, R. (1990). *Instructed second language acquisition*. Oxford: oxford university Press.

WEB SITES:

1. https://shortstoryproject.com/stories/the-postmaster/
2. https://www.gradesaver.com/rabindranath-tagore-short-stories/study- guide/summary-the-postmaster

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
Average	-	**2.5**	**2.5**	-	**2**	-	**2**	-	-	-	-	-	-	**2**	-	-	-

1**- Low, 2 - Medium, 3 - High, '-' - No Correlation**

Semester II

24MBU201 MICROBIAL PHYSIOLOGY AND METABOLISM 6H–5C

Instruction Hours/week: L:5 T:1 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Introduction To Microbiology and Microbial Diversity (24MBU101)

COURSE OBJECTIVES (CO):

- To explain photosynthesis and photosynthetic bacteria
- To study the structure, function, growth, and regulatory mechanisms of microorganisms.
- To learn about the metabolic diversity and growth of the microorganism.

COURSE OUTCOMES (COs):

Upon completion of this course the students will be able to:

COs	Course Outcomes	Blooms Level
CO1	Understand the concepts of microbial nutrition and physiology	Understand
CO2	Analyse the microbial growth and fermentation processes	Analyze
CO3	Discuss carbohydrate metabolism Prokaryotes and Eukaryotes	Understand
CO4	Paraphrase Physiology of nitrogen cycle and mechanism of nitrogen fixation	Understand
CO5	Explain bacterial Phototrophic metabolism	Understand

Unit I Microbial nutrition 15 HOURS

Microbial nutrition– Nutritional groups of microorganisms, (Carbon, energy and electron source), Nutrient requirements: Macro and micronutrients with their physiological functions. Uptake of nutrients by cell – Passive, Facilitated diffusion, Active transport- Uniport, Symport, Antiport. Group translocation and Iron uptake.

Unit II Microbial growth and concept of Fermentation 15 HOURS

Growth; bacterial cell division, Growth curve - Different phases of growth curve - generation time, growth rate and growth kinetics. Methods of measuring microbial growth. Batch, fed-batch, Continuous and Synchronous culture, Diauxic growth, Influence of environmental factors on growth (Temperature, pH, solute, water activity, oxygen and pressure). Fermentation - Alcohol fermentation and Pasteur effect; Lactate fermentation (homofermentative and heterofermentative pathways), concept of linear and branched fermentation pathways.

Unit III Carbohydrate metabolism 13 HOURS

Carbohydrate metabolism – EMP, ED, Pentose phosphate pathway, TCA cycle, Aerobic respiration, oxidative phosphorylation, electron transport chain (Prokaryotic and Eukaryotic), substrate level phosphorylation. Uncouplers, inhibitors and ionophores.

Unit IV Nitrogen metabolism 14 HOURS

Nitrogen Fixation – Nitrogen fixers, Physiology of nitrogen cycle and mechanism of nitrogen fixation-Symbiotic and non symbiotic Assimilatory and dissimilatory nitrate reduction, biological nitrogen fixation. Anaerobic respiration with special reference to dissimilatory nitrate reduction – Denitrification: nitrate/nitrite and nitrate/ammonia respiration; fermentative nitrate reduction.

Unit V Phototrophic metabolism **15 HOURS**

Phototrophic metabolism- Historical account of photosynthesis, diversity of phototrophic bacteria, Photosynthesis – bacteria and blue green algae: anoxygenic (Purple, green bacteria) and oxygenic (cyanobacterial) photosynthesis. Photosynthetic pigments: action and absorption spectrum, type, structure and location, physiology of bacterial photosynthesis: light reactions, cyclic and non-cyclic photophosphorylation.

Total: 72 HOURS

TEXT BOOKS:

1. Madigan, M.T., Kelly, S.B., Daniel, H.B, Mathew, S and David, A.S (2017). *Brock Biology of Micro-organisms*. 15th edition. Parker J. Prentice Hall International, Inc.
2. Willey, J.M., Sherwood, L.M., and Woolverton, C.J. (2019). *Prescott's Microbiology*. 11th12 the edition. McGraw Hill.

REFERENCE BOOKS:

1. Talaro., Kathleen, P.T., Chess., and Berry, C., (2018). *Foundations in Microbiology*, 10th Ed., McGraw Hill.
2. Benson's Microbiological Applications Laboratory Manual Complete Version, 2015,13th Edition, Mc Graw Hill.
3. Moat, A. G., and Foster, J.W. (2002). *Microbial Physiology*. 4thedition. John Wiley& Sons. Reddy,
4. S.R., and Reddy, M. (2007). *Microbial Physiology*. Scientific Publishers India

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	-	2	-	2	-	-	-	-	-	-	-	3	-
CO2	-	-	-	3	-	-	-	2	-	-	-	-	-	-	-	-	3
CO3	3	-	2	2	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO5	2	-	-	-	-	2	-	-	-	-	-	-	-	-	-	3	-
Average	**2.7**	-	**2**	**2.5**	-	**2**	-	**2**	-	-	-	-	-	-	-	**3**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester II

24MBU202 **BIOCHEMISTRY II** **6H–4C**

Instruction Hours/week: L:5 T:1 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Biochemistry I (24MBU102)

COURSE OBJECTIVES (CO):

- To study the various metabolic pathways and energy generation.
- To understand the free energy and electron carriers
- To gain knowledge on carbohydrate, lipid and protein metabolism

COURSE OUTCOMES (COs):

Upon completion of this course the students will be able to:

Cos	Course Outcomes	Blooms Level
CO1	Understand and analyse the thermodynamics concepts and metabolism	Understand /Analyze
CO2	Explain the carbohydrate metabolism and regulation.	Understand
CO3	Analyze lipid metabolism and biosynthesis	Analyze
CO4	Describe the synthesis of various amino acids	Understand
CO5	Interpret nucleic acid metabolism and synthesis	Analyze

Unit I Introduction to metabolism **15 HOURS**

Anabolism and catabolism - Definition. Bioenergetics - Thermodynamics principles, Concepts of free energy, Standard free energy, Mitochondrial Electron Transport Chain: electron carriers, chemiosmotic theory and ATP production, High Energy phosphate compounds, Inhibitors of electron transport chain and Redox potential and uncouplers of oxidative phosphorylation.

Unit II Carbohydrate metabolism **14 HOURS**

Glycolysis, TCA cycle, Glycogenesis, Glycogenolysis, HMP shunt, Gluconeogenesis, Glucuronic acid pathway. Regulation of glycogen metabolism. Oxidative Phosphorylation.

Unit III Lipid metabolism **14 HOURS**

Fatty acid oxidation – α, β, ω oxidation. Biosynthesis of saturated and unsaturated fatty acids. Metabolism of cholesterol, triglycerides and ketone bodies.

Unit IV Protein metabolism **15 HOURS**

Synthesis of Aliphatic and aromatic amino acids. Degradation of proteins: Deamination, Transamination and Decarboxylation, Urea cycle. Synthesis of ketogenic and glucogenic amino acid.

Unit V Nucleic acid metabolism and Biological oxidation **14 HOURS**

Biosynthesis and degradation of purine and pyrimidine nucleotides. Interconversion of nucleotides.

Total: 72 HOURS

TEXT BOOKS:

1. Jain, J.L. (2004). *Fundamentals of Biochemistry*, Chand publications.
2. Nelson, David l. and Cox, M.M. (2000). *Lehninger's Principles of Biochemistry*. Macmillan /Worth, NY.

3. K. Murray, Daryl K. Granner, Peter A. Mayes, Victor W. Rodwell, *Harper's Biochemistry* Robert. 24th edition, Prentice Hall International Inc.

REFERENCE BOOKS:

1. Geoffrey L. Zubay, (1995). *Principles of Biochemistry*, 3rd edition William W. Parson, Dennis E. Vance, W.C. Brown Publishers.
2. Lubert Stryer, (1995). *Biochemistry*, 4th edition, W.H. Freeman & Co.
3. Donald Voet, Judith G. Voet and Charlotte W Pratt. (1999). Biochemistry. John Wiley & Sons, NY.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	-	2	-	2	-	-	-	-	-	-	-	3	-
CO2	-	-	-	3	-	-	-	2	-	-	-	-	-	-	-	-	3
CO3	3	-	2	2	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	-	-	-	-	2	-	-	-	-	-	-	-	-	-	3	-
Average	**3**	**-**	**2**	**2.5**	**-**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester II

24MBU211 MICROBIAL PHYSIOLOGY AND METABOLISM - PRACTICAL 5H–2C

Instruction Hours/week: L:0 T:0 P:5 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 9 Hours

PREREQUISITE:

- Microbial Physiology and Metabolism (24MBU201)

COURSE OBJECTIVES (CO):

- To improve their skills in handing of microorganisms
- To analyze the growth condition of the bacteria.
- To demonstrate the fermentation technique

COURSE OUTCOMES (COs):

Upon completion of this course the students will be able to:

COs	Course Outcomes	Blooms Level
CO1	Analyze the bacterial growth and growth conditions	Analyze
CO2	Identify the various factors for optimal growth of *E. coli*.	Analyze
CO3	Utilize various techniques for microbial identification	Apply
CO4	Experiment with carbohydrate fermentation methods	Apply
CO5	Perform alcoholic fermentation method for alcohol production	Apply

EXPERIMENTS **60 HOURS**

1. Study and plot the growth curve of E. *coli* by turbidimetric and standard plate count methods.
2. Calculations of generation time and specific growth rate of bacteria from the graph plotted with the given data
3. Effect of temperature on growth of E. *coli*
4. Effect of pH on growth of E. *coli*
5. Effect of carbon and nitrogen sources on growth of E. *coli*
6. Effect of NaCl on growth of E. *coli*
7. Biochemical Characterization:
8. IMViC test
9. TSI Test
10. Nitrate reduction Test
1. Urease production Test
2. Catalase Test
3. Oxidase Test
4. Carbohydrate fermentation Test
15. Demonstration of alcoholic fermentation
16. Demonstration of the thermal death time and decimal reduction time of E. *coli*.
17. Lecithinase and gelatin liquefaction activity.

Total: 60 HOURS

TEXT BOOKS:

1. Madigan, M.T., Kelly, S.B., Daniel,H.B, Mathew, S and David, A.S. (2017). *Brock Biology of Micro- organisms*. 15th edition. Parker J. Prentice Hall International, Inc.
2. Willey, J.M., Sherwood, L.M., and Woolverton, C.J. (2019). *Prescott's Microbiology*. 11th edition. McGraw Hill.

REFERENCE BOOKS:

1. Talaro., Kathleen, P.T., Chess., and Berry, C. (2018). *Foundations in Microbiology*, 10th Ed., McGraw Hill.
2. Benson's Microbiological Applications Laboratory Manual- (2015). Complete Version, 13th Edition, McGraw Hill.
3. Reddy, S.R., and Reddy, S.M. (2007). *Microbial Physiology*. Scientific Publishers India.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	3	-	-	-	-	-	-	-	-	-	-	1	3	-
CO2	3	-	-	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO5	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	3
Average	**2.33**	**-**	**-**	**2.5**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester II

24MBU212 **BIOCHEMISTRY II - PRACTICAL** **4H–1C**

Instruction Hours/week: L:0 T:0 P:4 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 6 Hours

PREREQUISITE:

- Biochemistry II (24MBU202)

COURSE OBJECTIVES (CO):

- To gain knowledge with these techniques used for separation of biomolecules
- To know principle behind the compound purification
- To measure the protein, cholesterol, chlorophyll and phosphorous

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Learn and practice separation of biomolecules using chromatography	Apply
CO2	Experiment with estimation of biomolecules	Apply
CO3	Analyze measurement of cholesterol and phosphorous	Analyze
CO4	Practice extraction of starch	Apply
CO5	Apply techniques for estimation of chlorophyll in plant tissue	Apply

EXPERIMENTS **48 HOURS**

1. Separation of sugar by paper chromatography
2. Separation of amino acid by thin layer chromatography
3. Separation of plant pigments by thin layer / column chromatography
4. Estimation of carbohydrate by anthrone method
5. Estimation of Protein by Lowry's method
6. Estimation of Cholesterol by Zak's method
7. Estimation of Phosphorus by Fiske Subbarow method
8. Estimation of starch.
9. Extraction and estimation of chlorophyll in plant tissue

Total: 48 HOURS

TEXT BOOKS:

1. S. Sadasivam and A. Manickam. (1992). *Biochemical Methods*, Second Edition, New Age International Publishers, New Delhi.
2. J. Jayaraman, (1981). *Laboratory Manual in Biochemistry*, New Age International publishers, New Delhi.
3. Shivaraja Shankara. (2013). *Laboratory Manual for Practical Biochemistry*, 2nd Edition. Jaypee Publishers.
4. Akhtar Inam. (2012). *A Laboratory Manual of Plant Physiology, Biochemistry and Ecology*. Agrobios Publisher, India.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	-	-	-	-	-	2	-	3	-	-	-	1	-	-	1	3	-
CO2	2	-	-	-	-	-	-	3	-	-	-	-	-	-	-	3	-
CO3	-	-	-	-	-	1	-	2	-	-	-	-	-	-	-	3	-
CO4	-	-	-	-	-	2	-	3	-	-	-	-	-	-	-	3	-
CO5	2	-	-	-	-	-	-	2	-	-	-	-	-	-	-	3	-
Average	**2**	**-**	**-**	**-**	**-**	**1.66**	**-**	**2.6**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**3**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester II

24VAC201 **ENVIRONMENTAL STUDIES** **2H–2C**

Instruction Hours/week: L:2 T:0 P:0 **Marks:** Internal**:100** External**: - T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE: Student should know about fundamentals of environment.

COURSE OBJECTIVES (CO):

- To create awareness about structure and functions of various ecosystems.
- To learn about the environment, resources available, biodiversity and its conservation.
- To understand the current scenarios- to find ways for protection and betterment of or habitat.

COURSE OUTCOMES (COs):

On completion of the course, students are able to

COs	Course Outcomes	Blooms Level
CO1	Define the structure and functions of various ecosystems	Remember
CO2	Learn the ethical, cross-cultural, and historical context of natural resources and the methods for conservation	Understand
CO3	Predict current scenarios and find ways for the protection and betterment of habitat	Analyze
CO4	Analyze the interactions between social and environmental problems	Apply
CO5	Develop systems concepts and methodologies to analyze and understand interactions between social and Environmental processes	Create

UNIT I INTRODUCTION - ENVIRONMENTAL STUDIES & ECOSYSTEMS: 5 HOURS

Environment Definition, Scope and Importance; Ecosystem, Structure, classification, and functions of ecosystem. Energy flow, Food chains and food webs, Ecological succession. Forest ecosystem, Grassland Ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

UNIT II NATURAL RESOURCES - RENEWABLE AND NON-RENEWABLE RESOURCES: 5 HOURS

Natural resources - Renewable and Non–renewable resources. Land resources, Land degradation, desertification. Forest resources – Deforestation: Causes and impacts due to mining. Water resources- Use and over-exploitation of surface and groundwater.

UNIT III BIODIVERSITY AND ITS CONSERVATION: 5 HOURS

Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity. Values of Biodiversity - Ecological, economic, social, ethical, aesthetic value. Bio-geographical classification of India. Hot-spots of biodiversity. Endangered and endemic species of India. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.

UNIT IV ENVIRONMENTAL POLLUTION: 4 HOURS

Definition, causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution. Nuclear hazards and human health risks.

UNIT V SOCIAL ISSUES AND THE ENVIRONMENT: 5 HOURS

Concept of sustainability and sustainable development. Climate change, global warming, ozone layer depletion, acid rain and its impacts on human communities and agriculture. Environment Laws (Environment Protection Act, Air Act, Water Act, Wildlife Protection Act, Forest Conservation Act).

Total: 24 HOURS

TEXT BOOKS:

1. Anonymous. 2004. *A Text book for Environmental Studies, University Grants Commission and Bharat Vidypeeth Institute of Environmental Education Research,* New Delhi.
2. Anubha Kaushik., and Kaushik, C.P.(2008). *Perspectives in Environmental Studies*, 3rd Edition, New Age International Pvt. Ltd. Publications, New Delhi.
3. Arvind Kumar,(2009). *A Textbook of Environmental Science,* APH Publishing Corporation, New Delhi.
4. Mishra, D.D,(2010). *Fundamental Concepts in Environmental Studies*. S. Chand & Company Pvt. Ltd., New Delhi.
5. Odum, E.P., Odum, H.T. and Andrews, J. (1971*). Fundamentals of Ecology*, Philadelphia: Saunders.
6. Sing, J.S., Sing. S.P. and Gupta, S.R.(2014). *Ecology, Environmental Science and Conservation*, S. Chand & Publishing Company, New Delhi.
7. Tripathy. S.N., and Sunakar Panda. (2011). *Fundamentals of Environmental Studies*, 3rd Edition, Vrianda Publications Private Ltd, New Delhi.
8. Uberoi, N.K. (2010). *Environmental Studies*, 2nd Edition, Excel Books Publications, New Delhi.

REFERENCE BOOKS:

1. Botkin., and Keller, (2014). *Environmental Science: Earth as a Living Planet*. 9th Edition, Wiley
2. Rajagopalan, R. (2016). *Environmental Studies: From Crisis to Cure*, Oxford University Press.
3. Singh, M.P., Singh, B.S., and Soma, S. Dey,(2004). *Conservation of Biodiversity and Natural Resources*, Daya Publishing House, New Delhi.
4. Verma, P.S., and Agarwal V.K(2016). *Environmental Biology (Principles of Ecology).* S. Chand and Company Ltd, New Delhi.
5. Bruce Rittmann and Perry Mc Carty, *Environmental Biotechnology: Principles and Applications*,(2020). 2nd Edition.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	3	-	-	-	-	-	-	2	2	-	2	2	2	-	2	2	2
CO2	3	-	-	-	-	-	-	2	2	-	2	2	2	-	2	2	2
CO3	3	-	-	-	-	-	-	2	2	-	2	2	2	-	2	2	2
CO4	3	-	-	-	-	-	-	2	2	-	2	2	2	-	2	2	2
CO5	3	-	-	-	-	-	-	2	2	-	2	2	2	-	2	2	2
Avg	3	-	-	-	-	-	-	2	2	-	2	2	2	-	2	2	2

1-Low; 2-Medium; 3-High; '-' No correlation

மூன்றாம் பருவம்

24LSUT301 **Language III: Tamil III** **4H - 3C**

Instruction Hours/week: L:4 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

பாடத்திட்டப் பொதுநோக்கம்

- தமிழ் மொழியின் சிறப்புகளை அறியச் செய்தல்.
- முச்சங்கங்கள் சங்ககால இலக்கண நூல்கள் பற்றித் தெரிந்து கொள்ளுதல்.
- பல்வேறு சமயம் சார்ந்த இலக்கியங்களை ஒப்பீடு செய்தல்,தொன்ம இலக்கியங்களை அறியச் செய்தல்

பாடத்திட்டப் பயன்விளைவு

- சங்க இலக்கிய மேன்மைகள்- திணைக்கோட்பாடுகள் அறிவு பெற்றிருத்தல்.
- வேற்றுமொழிப் படையெடுப்புகளுக்குஈடுகொடுத்து நிற்கும்திறன் குறித்து அறிதல்.
- ஐம்பெருங்காப்பியங்கள் ஐஞ்சிறுகாப்பியங்களின் சிறப்பை உணர்தல்.
- பிற அறநூல்களின் கருத்துக்களைத் தெரிந்து கொள்ளுதல்.
- செம்மொழியின் சிறப்பையும், தொன்மையையும் அறிதல்.

அலகு:1 சங்க இலக்கியம் (10 மணிநேரம்)

தமிழ் இலக்கிய வரிசை-அறிமுகம்-முச்சங்க வரலாறு-பாட்டும் தொகையுமாகிய சங்க இலக்கியத் தொகுப்பு-அறிமுகம்-எட்டுத்தொகையில் அகத்திணை-புறத்திணை-பத்துப்பாட்டில் அமைந்த ஆற்றுப்படை இலக்கியங்கள்-பத்துப்பாட்டில் அகமும் புறமும்-புலவர்களும் பாடல்களும்-பெண்பாற் புலவர்கள்.

அலகு: 2 அற இலக்கியமும் காப்பியமும் (10 மணிநேரம்)

திருக்குறள்-அமைப்பு-இலக்கியச் சிறப்பு-உலகப் பொதுமைத் தன்மை-பொருட் சிறப்பு-இலக்கியச் சிறப்பு-நாலடியார் முதலாக குமரகுருபரரின் நீதிநெறிவிளக்கம் ஈறாக அமைந்த நீதி இலக்கியங்கள்-நீதி நூல்களில் அகமும் புறமும்-தமிழ் இலக்கிய வரிசையில் ஐம்பெருங் காப்பியங்களும், ஐஞ்சிறு காப்பியங்களும்- சிலம்பும் மணிமேகலையும் – இரட்டைக்காப்பியங்கள்- கம்பராமாயணம்-பெரியபுராணம் - சீறாப்புராணம்-தேம்பாவணி-இராவண காவியம்.

அலகு:3 திருமுறைகளும் திவ்யப்பிரபந்தமும் (10 மணிநேரம்)

தமிழகத்தில் பக்தி இயக்கத்தின் தோற்றமும் வளர்ச்சியும்-பன்னிரு திருமுறைகளும், பதிநான்கு சித்தாந்த சாத்திரங்களும்-திவ்யப்பிரபந்தமும், இராமானுஜ நூற்றந்தாதி முதலான வைணவ இலக்கியங்களும்.

அலகு: 4 சிற்றிலக்கியங்களும் இக்கால இலக்கியங் (10 மணிநேரம்)

குற்றாலக்குறவஞ்சி, முக்கூடற்பள்ளு, மதுரை மீனாட்சியம்மை பிள்ளைத்தமிழ், மதுரை சொக்கநாதர் தமிழ்விடு தூது, அழகர் கிள்ளைவிடு தூது முதலான சிற்றிலக்கிய வரிசை-தமிழில் புதுக்கவிதை இயக்கங்களின் தோற்றமும் வளர்ச்சியும்-தமிழ்ப் புதுக்கவிதை வடிவங்கள்-தமிழின் நாடக இலக்கியங்கள்- மனோண்மணீயம் – தமிழின் உரைநடை இலக்கிய வளர்ச்சி-தமிழின்பம் முதலான உரைநடை நூல்கள்-தமிழில்

சிறுகதை இலக்கிய வளர்ச்சி-இருபதாம் நூற்றாண்டுச் சிறுகததைகள்-தமிழில் புதின இலக்கியங்கள்-இக்கால இலக்கியங்களில் காலந்தோறும் தனி மனிதப் பதிவுகளும், சமுதாயப் பதிவுகளும்.

அலகு: 5 தமிழின் ஐந்திலக்கணம் **(8 மணிநேரம்)**

தமிழின் எழுத்து – சொல் – பொருள் – யாப்பு - அணி இலக்கணச் சிந்தனைகள் .

பாடநூல்:

தமிழ் இலக்கிய வரலாறு - மொழிகள் துறை - தமிழ்ப்பிரிவு, கற்பகம் உயர்கல்விக்கழகம், கோயம்புத்தூர் -21.

மொத்த மணிநேரம் 48 மணிநேரம்

பார்வை நூல்கள்:

1. தமிழ் இலக்கிய வரலாறு – தமிழண்ணல், மீனாட்சி புத்தக நிலையம்- மதுரை.
2. தமிழ் இலக்கிய வரலாறு – வேங்கடராமன்.கா.கோ. கலையகம் பதிப்பகம், நாமக்கல்.
3. புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு-சுந்தரமூர்த்தி.செ, அவ்வை பதிப்பகம், திருவாரூர்.
4. தற்காலத் தமிழ் இலக்கிய வரலாறு - கவிஞர் திலகம் மானூர் புகழேந்தி, நிலாப் பதிப்பகம், 63,பாரதிதாசன் நகர், இராமநாதபுரம், கோவை – 641045.

இணையதளம்

1. www.tvu.org.in
2. www.maduraitamilproject.com

இதழ்கள்

1. International Research Journal of Indian Literature, irjil.in
2. International Tamil Research Journal, iorpress.in

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**3**	**2.6**	**2.6**	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester III

24LSUH301 **Language III: HINDI-PAPER- III** **4H-3C**

(Story, History of Hindi Literature, Novel, Letter Writing)

Instruction Hours/week: L:4 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not Required

COURSE OBJECTIVES (CO):

- Knowledge of contemporary drama contents of Hindi literature
- Learn novels and its techniques. The ability to read novels and express criticism about it and the ability to express social thoughts will improve
- There will also be litigation messages in Hindi and news on speech techniques

COURSE OUTCOMES (COs):

- Develop an interest in the appreciation of literature.
- Discuss and respond to content of a reading passage.
- Learning the literacy knowledge of Hindi specially reading and writing .
- Learning the literary knowledge specially reading and understanding of Hindi short Stories
- Learning the history of Hindi literature

UNIT-I a) Story – Bade Ghar Ki Beti

b) Hindi Bhasha Ka Vikas

c) Novel – Ramnath,Jalpa

d) Letter Writing –Personal Letter

UNIT-II a) Story – Puraskar

b) Kaal Vibhajan , Char Prakar

c) Ramesh Babu ,Devdeen

d) Letter Writing – Leave Letter

UNIT-III a) Story – Usne Kaha Tha

b) Literature – Adhikaal

c) Indhubhooshan, Rathna,Johra

d) Letter Writing – Letter for the Publisher

UNIT-IV a) Story – Paanchminte

b) Poorva Madhya Kaal

c) Manibhooshan,Dhayanath,Rameshwari

d) Letter Writing – Application for job

UNIT-V a) Story – kafan

b) Reethi Kaal,Adhunik Kaal

c) Dheen Dhayal,Manaki,

d) Letter Writing – Complaint Letter

REFERENCE BOOKS

1.Story : Kahani Manjari

Publisher : D.B.Hindi Prachar Sabha

T.Nagar , Chennai – 600017

2.History of Hindi

Literature : Hindi Sahithya ka Saral Ithihas

Writer : Rajnath Sharma.A

Publisher : Vinoth Pusthak Mandir

Aagra – 02

3.Novel : Gaban

Writer : Premchandh

Publisher : Rajkamal Prakashan

New Delhi – 110002

4.Letter Writing : Sumitha Hindi Nibandh Aur Pathra Lekhan

Writer : Sri Sharan

Publisher : Kalda Publication

Mukhar Ji Nagar, Delhi - 09

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**2.6**	**2.6**	**2.8**	**-**	**-**	**-**	**-**	**-**	-	-	-	-	-	-	-	-	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester III

24LSUM301 Language III: MALAYALAM III 4H-3C

Instruction Hours/week: L:4 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**
End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVE(CO):

- May have knowledge of the contents of primitive poetryLearn about contemporary poetry and its techniques.
- Interest in reading poetry and the ability to express social thoughts will improve
- This will help you to understand the basics of Malayalam Poetry and to understand Malayalam literature properly

COURSE OUTCOME(COs):

- Get a basic knowledge of the history of Malayalam literature.
- Enhances the art and taste of Malayalam literary works
- Literary genres can be learned
- Create more to read and enjoy Malayalam poetry
- Get the basic Knowledge of poetry techniques

Unit No	PART I – MALAYALAM III	Hours
I	Poetry – Chinthavishtayaya Seetha	**10**
II	Poetry – Chinthavishtayaya Seetha	**10**
III	Poetry – Mrugasikshakan-(Murgasikshakan,Kausalya,Varavu,Vittupoku Ekalavyan,Mazha) 6 poetries	**10**
IV	Poetry – Mrugasikshakan-(Kayal,Karkkadakam,Bhagavatham,Vazhivakkile naikutty,Edavelayil oru nimisham,Verumoru kathu) 6 poetries	**09**
V	Poetry - Aayisha	**09**
	TOTAL	**48**

TEXT BOOKS:

1. Chinthavishtayaya Seetha –Kumaranasan,Kerala Book Store Publishers.
2. Mrugasikshakan – Vijayalakshmi,DC Books, Kottayam
3. Aayisha – VayalarRamavarma - Kerala Book Store Publishers

REFERENCE BOOKS:

1. Kavitha SahithyaCharitram-Dr.M.Leelavathi (Kerala SahithyaAcademy,Trichur)
2. Kavitha Dwani-Dr.M.Leelavathi (D.C.Books, Kottayam)
3. Aadhunika SahithyacharithramPrasthanangalilude-Dr.K.M.George (D.C.Books, Kottayam)
4. Padya SahithyaCharithram – T.M.Chummar (Kerala SahithyaAcademy,Trichur)

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	3	2.5	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester III

24LSUS301 **Language III: SANSKRIT III** **4H-3C**

(Drama and History of Sanskrit Literature)

Instruction Hours/week: L:4 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

Not required

COURSE OBJECTIVES(CO):

- The fundamental objective of the curriculum is to impart effective science education at the undergraduate level, exposing them to recent trends and developments in the subject.
- Creating scientific temper is another major objective of this curriculum.
- Another major thrust given here is to develop an environmental concern in all activities ofthe students. 'Go green', the motto of the syllabus emphasizes the urgent need to conserve nature without destruction of natural resources.

COURSE OUTCOMES (COs):

- **Critical Thinking**: Take informed actions after identifying the assumptions that frame students' thinking and actions.
- **Problem Solving**: Understand and solve problems of relevance to society to meet the specified needs using the knowledge, skills and attitudes acquired.
- **Effective Communication**: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
- **Effective Citizenship**: Demonstrate empathetic social concern and equity centered national development.
- **Environment and Sustainability**: Understand the issues of environmental contexts and sustainable development.

UNIT I **9 HOURS**

History of Sanskrit Drama and its origin.

UNIT II **9 HOURS**

Important Sanskrit Dramas and important authors.

UNIT III **10 HOURS**

Text Prescribed: "Dutavakyam" of Bhasa, (First half)

UNIT IV **10 HOURS**

Text Prescribed: "Dutavakyam" of Bhasa, (Second half)

UNIT V **10 HOURS**

Translation : From the known passages of the above text.

TOTAL: 48 HOURS

TEXT BOOK :

1."Dutavakyam of Bhasa" R.S.Vadhyar and Sons Palghat, Kerala.

CO, PO, PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PSO 1	PSO 2
CO1	2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**2.6**	**2.6**	**2.8**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester III

24LSUF301 **Language III: FRENCH III** **4H-3C**

(Histoire, histoire de la littérature frencais,roman, rédaction de lettres)

Instruction Hours/week: L:4 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not Required

COURSE OBJECTIVES (CO):

The objectives of this course are

- To enable students to recognizenative accent and usage of French language.
- To help students to become autonomous and self-directed French language learners.
- To produce entrepreneurs among students by making them French language trainers and tocommunicative French to schools and colleges around.

COURSE OUTCOMES (COs):

At the end of this course, students will be able to

COs	Course Outcomes	Blooms Level
CO1	Identify new words by employing vocabulary building techniques.	Apply
CO2	Build correct sentence structures and grammatical patterns in oral and written communication	Apply
CO3	develop the ability to speak French language with the way of pronunciation.	Understand
CO4	Follow leadership, work ethics and management principles	Analyze
CO5	express values and skills gained through effective communication to other disciplines.	Analyze

Unite – I a) Leçon – Vivre la ville,,Visiter une ville

b) Communication - Indiquer le chemin

c) Grammaire - La comparaison,Les prépositions avec les noms géographiques,Les pronoms personnels COI

d) Lexique –La ville, Les lieux de la ville, Les transports

e) Culture – Le français : une ouverture sur le monde

Unité – II **a)** Leçon -• On vend ou on garde ?

b) Communication - Demander des renseignements touristiques

c) – Grammaire - Le pronom y (le lieu), La position des pronoms complémentsLes verbes du premier groupe en -ger et -cer,

d) Les verbes ouvrir et accueillir

e) Lexique - Les points cardinaux,Les prépositions de lieu (2)

f) Culture –Le français : une ouverture sur le monde

Unité – III a) Leçon -

b) Communication- permetter,defendre.

c) Grammaire -La formation du pluriel (2)

Les adjectifs de couler, Les adjectifs beau, nouveau, vieux

d) Lexique - Les couleurs, Les formes,Les me

e) culture – les grandes fleuves en Francais.

Unite – IV a) Leçon – Félicitations !

b) Communication - Décrire un objet

c) Grammaire - Les pronoms relatifs qui et que,

. L'imparfait, Les verbes connaître, écrire, mette et vendre

d) Lexique – Les mesures, L'informatique

DIRE, LIRE, ECRIRE , Les sons [E] / [O] / [Œ]

e) Culture –Les lieux de la ville.

Unité - V a) Leçon -En voyage !

b) Communication -• Présenter ses vœux, Faire une réservation

c) Grammaire - Les pronoms démonstratifs,La question avec Inversion,Les adverbes de manière,

d) Lexique -Les voyages,L'aéroport et l'avion,Les fêtes

e) Culture –Noël

REFERENCE BOOKS:

1. Cocton Marie –Noëlle , Duplex Dorothée, Heu Elodie , Kasazian Emilie, Ripaud Delphine, **Saison 1- Méthode de franca**is, Didier, paris.2015.
2. Cocton Marie – Noëlle, Dupleix, Heu Elodie, Kasazian Emilie ,Ripaud Deldphin, S**aison** 1 –
3. **Cahier d'activites** , Dider ,Paris , 2015
4. Anne Akyüz,Bernadette Bazelle- Shahmael,JoëlleBonenfant, **Marie- Françoise Gliemenn,Les exercices de grammaire,Hachette FLE, Paris,200**5
5. Christian Beaulieu, **Je pratiqu**e, Exercises de grammaire A1, Dider, Paris,2015
6. Nathalie BIE, philippe SANTINAN,**Grammaire pour adolescents-250 exercises, CLE International , Paris , 2005**

WEBSITES :

- http:// enseigner.tv5 monde.com/

- bonjourdumonde.com /exercises/contenu/le – francais-du- tourisme.html
- http://www.bonjurdefrance.com/
- https://www.lepointdufle.net/

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**3**	**2.5**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester III

24ENU301 **ENGLISH III** **3H–3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To enable students to recognizenative accent and usage of English language.
- To help students to become autonomous and self-directed English language learners.
- To produce entrepreneurs among students by making them English language trainers and thecommunicative English to schools and colleges around.

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Identify new words by employing vocabulary building techniques.	Apply
CO2	Build correct sentence structures and grammatical patterns in oral and written communication	Apply
CO3	develop the ability to speak English language with the correct pronunciation.	Understand
CO4	Follow leadership, work ethics and management principles	Analyze
CO5	express values and skills gained through effective communication to other disciplines.	Analyze

UNIT I **8 HOURS**

Listening: Listening Comprehension-Listening for Specific Information- Interpreting Charts and Diagrams

UNIT II **7 HOURS**

Speaking: Essentials of effective Communication- **Telephone Skills**: Understanding Telephone Conversation - Handling Calls-Leaving Messages-Making Requests-Giving Instructions and Orders.

UNIT III **7 HOURS**

Reading: Reading with a purpose-Skimming and Scanning-Locating Main Points- Reading Critically-Sequencing of Sentences-Reading Comprehension

UNIT IV **7 HOURS**

Writing: Descriptive and Narrative-Safety Instructions- Suggestions-Expansion of Abbreviations-Spellings Rules Translation- Translating Short Sentences and Passages from English to Tamil

UNIT V **7 HOURS**

Vocabulary: Synonyms-Antonyms-Prefixes-Suffixes- Idioms- Different Types of English-Homonyms and Homophones (British and American)

Total: 36 HOURS

TEXT BOOKS

1. Board of Editors (2024). *Proficiency in Communication I*. Karpagam Academy of Higher Education

REFERENCE BOOKS:

1. Martins St. (2013). *Oxford Handbook of Writing: Handbook of Writing* Cambridge University Press.
2. Wren & Martin, (2008). *High School English Grammar & Composition*, S. Chand & Company Ltd, Board of Editors,
3. Krashen, Stephen D. (1982). Principles and practice in second language acquisition. New York: Pergamon Press.

WEB SITES:

1. https://www.scribbr.com/
2. https://www.quora.com/

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**3**	**2.5**	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester III

24MBU301 **VIROLOGY** **5H–4C**

Instruction Hours/week: L:4 T:1 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Introduction to Microbiology and Microbial Diversity (24MBU101)

COURSE OBJECTIVES (CO):

- To study general aspects of viruses, classification, replication, interactions and immunity to virus
- To explain the virus classification based on host, genome, mode of replication and structure or shape
- To study the vaccine development, antiviral drug and interferons in therapy

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand of types of virus that infect plant, microbes and animals	Understand
CO2	Describe virus entry, gene expression and regulation	Apply
CO3	Comprehend the intricate interaction between viruses and host cells	Understand
CO4	Explain mechanisms of antiviral drugs, interferons and immunotherapy	Understand
CO5	Learn and practice viral vaccines and vaccine development	Apply

Unit I History of viruses, virus multiplication and replication **10 HOURS**

History of viruses. Properties of virus. Origin of virus. Structure, Classification, nomenclature of viruses. Viral replication strategies as per Baltimore classification. DNA virus, RNA virus and retrovirus replication.

Unit II Bacteriophages **10 HOURS**

Diversity, classification, one step multiplication curve, lytic and lysogenic life cycle of lambda phage, Genome of lambda phage, F2 phage, Ff phage concept of early and late proteins, regulation of transcription in lambda phage.

Unit III Transmission of virus, genome organization of virus **10 HOURS**

Modes of viral transmission in plant and animals. Viral genome size and organization. Salient features of viral nucleic acid (unusual bases, overlapping genes, splicing genes, terminal redundancy, cohesive ends, capping and tailing).

Unit IV Viral infection diagnosis and prevention **15 HOURS**

Oncogenic viruses and its types, General characters, epidemiology, pathogenicity, disease caused mechanism. Prevention and control of viral diseases. Laboratory diagnosis of emerging respiratory virus. Concept of viroids, virusoids, satellite viruses, Virophage and Prions.

Unit V Antiviral compounds **15 HOURS**

Antiviral compounds and their mode of action. Interferon and their mode of action. Viral vaccines and vaccine development. Use of viral vectors, gene cloning, expression in development of viral vaccines, Applications of gene therapy and phage display in disease control.

Total: 60 HOURS

TEXT BOOKS:

1. Dimmock, N.J., Easton., A.L., Leppard, K.N. (2007). *Introduction to Modern Virology*. 6th edition, Blackwell Publishing Ltd.
2. Wagner, E.K., Hewlett, M.J. (2004). *Basic Virology*. 2nd edition. Blackwell Publishing.
3. Nayud, M.V. (2008). *Plant Viruses*. Tata McGraw Hill, India.
4. Ananthanarayanan R and CK Jayaram Panicker. (2017). *Textbook of Microbiology* 10th Ed. Orient Longman.

REFERENCE BOOKS:

1. Carter J., and Saunders, V. (2007). *Virology: Principles and Applications*. John Wiley and Sons.
2. Flint, S.J., Enquist, L.W., Krug, R.M., Racaniello, V.R., Skalka, A.M. (2004). *Principles of Virology, Molecular biology, Pathogenesis and Control*. 2nd edition. ASM press Washington DC.
3. Levy, J.A., Conrat, H.F., Owens, R.A. (2000). *Virology*. 3rd edition. Prentice Hall publication, New Jersey.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	2	-	-	-	2	-	-	-	-	-	-	-	3	-
CO3	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5	-	-	3	3	-	-	-	3	-	-	-	-	-	-	-	3	-
Average	**2.3**	**-**	**2.5**	**2.6**	**2**	**-**	**-**	**2.5**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester III

24MBU302 **MICROBIAL GENETICS** **4H–4C**

Instruction Hours/week: L:4 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Introduction to Microbiology and Microbial Diversity (24MBU101)

COURSE OBJECTIVES (CO):

- To discuss the microbial genes, genomes, and expression in microorganism
- To understand the Transcription and Translation Process.
- To impart knowledge about the transposable elements and their importance.

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand the Molecular Biology with unique reference to microbial genome.	Understand
CO2	Describe the nature of molecular world and its application in modern Microbiological sectors.	Understand
CO3	Comprehend the process of Mutation and mutagenesis.	Understand
CO4	Acquire knowledge about the central dogma of biology.	Understand
CO5	Explain the concepts of genetic recombination techniques.	Apply

Unit I History of genetics **9 HOURS**

Concept of Genetics, Mendelian principles, DNA as a genetic material, Experimental evidence Chromosomal theory of inheritance. DNA structure, models of DNA, RNA structure and types. DNA replication in Prokaryotes, and eukaryotes Proof reading, Enzymes involved in replication.

Unit II Plasmids **9 HOURS**

Types of plasmids- replication, partitioning, host range, plasmid-incompatibility, amplification, pBR322 plasmid, pUC18 plasmids and its application as a vector. curing and application. Cosmid- types of cosmids with examples. Cloning vectors and expression vectors.

Unit III Genetic code **9 HOURS**

Central dogma of biology-transcription, translation, RNA editing, t-RNA charging, m RNA splicing, peptidyl transferase. Aminoacyl t-RNA. Genetic code- Operon concept- Lactose, tryptophan. Genetic recombination in bacteria- Conjugation, Transformation-Transduction and its types. Gene Mapping techniques-gene and chromosome walking.

Unit IV Mutations **9 HOURS**

Mutations and mutagenesis, types of mutations and mutagens. Identification of mutants- Ames test, Luria Delbruck experiments. DNA repair mechanisms and its types.

Unit V Transposons **12 HOURS**

Transposons-definition, types of Transposons, mechanism of transposition and application. Mu transposon elements and eukaryotic transposable elements and applications.

Total: 48 HOURS

TEXT BOOKS:

1. Klug, W.S., Cummings, M.R., Spencer, C., Palladino, M. (2011). *Concepts of Genetics*,10th edition, Benjamin Cummings.
2. Gardner, E.J., Simmons, M.J., Snustad, D, P. (2018). *Principles of Genetics*. 8th edition, Wiley- India.

REFERENCE BOOKS:

1. Krebs, J., Goldstein, E., Kilpatrick, S. (2013). *Lewin's Essential Genes*, 3rd edition, Jones and Bartlett Learning.
2. Pierce, B.A. (2011). *Genetics: A Conceptual Approach*, 4th edition, Macmillan Higher Education Learning.
3. Watson, J, D., Baker, T.A., Bell, S.P., et al. (2008). *Molecular Biology of the Gene*, 6th edition, Benjamin Cummings.
4. David P. Clark, Michelle R. McGehee, and Nanette J. Pazdernik. *Molecular genetics* 3RD edition.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	3	2	-	-	-	2	-	-	-	-	-	-	3	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO5	2	-	-	-	-	-	-	2	-	-	-	-	-	-	-	3	3
Average	**3**	**-**	**-**	**3**	**2**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester III

24MBU303A **ENVIRONMENTAL MICROBIOLOGY** **3H–3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Introduction to Microbiology and Microbial Diversity (24MBU101)

COURSE OBJECTIVES (CO):

- To comprehend the role of microbes in waste water treatment
- To understand the methods in Solid waste management using microorganisms.
- To gain knowledge about the Biogas and biodegradation technology.

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	**Course Outcomes**	**Blooms Level**
CO1	Understand different environment levels and environmental monitoring.	Understand
CO2	Apply the role of microbes in waste water treatment	Apply
CO3	Comprehend and practice Artificial Intelligence in Environmental sustainability	Apply
CO4	Perform Solid waste management using microorganisms	Analyze
CO5	Gain knowledge in air pollution and apply techniques to isolate air borne microbes and using microbes in Bioremediation process	Apply

Unit I Microbes in Environment **8 HOURS**

Terrestrial Environment- soil profile and soil microflora. Biogenesis and Abiogenesis in environment Aquatic Environment- Microflora of fresh water and marine habitat. Atmosphere- Aero microbes and dispersal of microbes. Development of microbial communities. Environmental monitoring through microorganisms, monitoring of water and soil.

Unit II Microbial role and diagnosis **7 HOURS**

Physiological ecology of micro-organisms. C, N, P nutrient cycle. Clean water and Sanitation (SDG 6): Treatment and safety of drinking (potable) water, membrane filter technique, Microbial interaction. Bio-films-surface colonization, Biofilm structure, Biofouling and Biotechnological applications. Xenobiotics. Artificial Intelligence in Environmental sustainability.

Unit III Waste Management **7 HOURS**

Solid waste management- sources and types, methods of disposal (composting sanitary landfill), Liquid Waste Management – Composition and strength of sewage (BOD and COD), Primary, Secondary (Oxidation ponds, trickling filter and activated sludge process) and tertiary sewage treatment.

Unit IV Air Pollution **7 HOURS**

Introduction, Microbial Contamination of Air, Sources of Contamination, Enumeration and Isolation of Bacteria in Air, Air samplers and sampling techniques, Effects and control measures of air pollution.

Unit V Biogas and biodegradation technology **7 HOURS**

Biogas Technology- Plant design, construction, operation. Biogas from organic wastes. GMO impact and their important - Use in environmental management recycling technology. Principles and biodegrading of common pesticides, organic (Hydrocarbons and Oil spills) and inorganic (Heavy Metal), Biosurfactants., bioremediation.

Total: 36 HOURS

TEXT BOOKS:

1. Tripathy, S.N., and Panda, S., (2011). *Fundamentals of Environmental Studies*; 3rdEdition, Vrianda Publications Private Ltd., New Delhi.
2. Kumar, A., (2004). *A Textbook of Environmental Science*; APH Publishing Corporation, New Delhi.
3. Verma, P.S., Agarwal, V.K., (2001). *Environmental Biology (Principles of Ecology*); S. Chand and Company Ltd., New Delhi.
4. Kaushik, A., Kaushik, C.P., (2006). *Perspectives in Environmental Studies*, New Age International Pvt. Ltd. Publications, New Delhi

REFERENCE BOOKS:

1. Singh, M.P., Singh, B.S., and Dey, S.S., (2004). *Conservation of Biodiversity and Natural Resources.* Daya Publishing House, Delhi.
2. Uberoi, N.K., (2010). *Environmental Studies*, Excel Books Publications, New Delhi, India.
3. Maier RM, Pepper IL, Gerba CP (2019). *Environmental Microbiology*, Elsevier.
4. Bruce E Rittmann and Perry L McCarty. *Environmental Biotechnology. Principles and Applications*. McGraw-Hill International (2020) 2ndedition.
5. Ljungdahl LG, Adams MW, Barton LL, Ferry JG, Johnson MK (2003). *Biochemistry and Physiology of Anaerobic Bacteria*, Springer. 8. Madigan MT, Martinko JM, Dunlap PV, Clark DP (2012)

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-		-	-	-	-	-	-	-	-	-	-	-	2	3
CO2		-	-	2	-	-	-	2	-	-	-	-	1	-	-	-	3
CO3	3	-	-		-	-	-	3	-	3	-	-	-	-	-	-	3
CO4		-	-	2	2	-	-	3	-	-	-	-	-	-	-	-	3
CO5		-	-	3	2	-	-	3	-	-	1	-	-	-	-	-	3
Average	**3**	**-**	**-**	**2.33**	**2**	**-**	**-**	**3**	**-**	**3**	**1**	**-**	**1**	**-**	**-**	**2**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester III

24MBU303B BIOSAFETY AND INTELLECTUAL PROPERTY RIGHTS 3H–3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To learn the basic handling of microorganisms.
- To emphasize on IPR issues and need for knowledge in patents in biotechnology.
- To gain knowledge on steps of a patenting process and the role of biosafety committee.

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand safety aspects in biological laboratory.	Understand
CO2	Comprehend Biosafety guidelines and regulations of international standard	Understand
CO3	Criticize agreements and Treaties on safety aspects	Evaluate
CO4	Acquire in-depth knowledge in Intellectual Property Rights and its importance	Understand
CO5	Analyze the principles of quantitative and qualitative patenting methods for paten filing.	Analyze/Apply

Unit I Biosafety: **7 HOURS**

Introduction; biosafety issues in biotechnology; Biological Safety Cabinets & their types; Primary Containment for Biohazards; Biosafety Levels of Specific Microorganisms.

Unit II Biosafety Guidelines: **7 HOURS**

Biosafety guidelines and regulations (National and International); GMOs/LMOs- Concerns and Challenges; Role of Institutional Biosafety Committees (IBSC), RCGM, GEAC etc. for GMO applications in food and agriculture; Environmental release of GMOs; Risk Analysis; Risk Assessment; Risk management and communication; Overview of International Agreements - Cartagena Protocol. Bio Rap, safety regulation for handling lab microbes.

Unit III AERB/RSD/RES guidelines **7 HOURS**

AERB/RSD/RES guidelines for using radioisotopes in laboratories and precautions. Agreements and Treaties: GATT, TRIPS Agreements; Role of Madrid Agreement; Hague Agreement; WIPO Treaties; Buda pest Treaty on international recognition of the deposit of microorganisms; UPOV& Berne conventions; Patent Co-operation Treaty (PCT); Indian Patent Act 1970 & recent amendments.

Unit IV Introduction to Intellectual Property **7 HOURS**

Introduction to Intellectual Property: Patents, Types, Trademarks, Copyright & Related Rights, Industrial Design and Rights, Traditional Knowledge, Geographical Indications-importance of IPR– patentable and nonpatentable– patenting life–legal protection of biotechnological inventions–World Intellectual Property Rights Organization (WIPRO).

Unit V Grant of Patent **8 HOURS**

Grant of Patent and Patenting Authorities: Types of patent applications: Ordinary, PCT, Conventional, Divisional and Patent of Addition; An introduction to Patent Filing Procedures; Patent licensing and agreement; Patent infringement -meaning, scope, litigation, case studies, Rights and Duties of patent owner.

Total: 36 HOURS

TEXT BOOKS:

1. Bare Act, (2007). *Indian Patent Act 1970 Acts & Rules*, Universal Law Publishing Co. Pvt. Ltd., New Delhi.
2. Kankanala C . (2007). *Genetic Patent Law & Strategy*,1st Edition, Manupatra Information Solution Pvt. Ltd. New Delhi.
3. Mittal, D.P. (1999). *Indian Patents Law*, Taxmann, Allied Services (p) Ltd.
4. Singh K K. (2015). *Biotechnology and Intellectual Property Rights*: Legal and Social Implications, Springer India.

WEBSITES:

1. https://biorrap.gov.in/Home/FAQ

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	2	-	-	-	-		-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	2	-	-	-	-	-	-	-	-	-	2	-
CO3	3	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	2	-	-	-	-	-	-	2	-	-	-	-
CO5	2	-	-	-	2		-	1	-	-	-	-	-	-	-	-	-
Average	**3**	**-**	**-**	**-**	**2**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester III

24MBU304 COMMUNITY ENGAGEMENT AND SOCIAL RESPONSIBILTY 2H–2C

Instruction Hours/week: L:2 T:0 P:0 **Marks:** Internal**:40** External**:60T**otal**:100**

End Semester Exam: 3 Hours

PRE-REQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To gain insights into the structures, challenges, and opportunities within communities
- To explore ethical frameworks and dilemmas related to community engagement and social responsibility
- To develop skills in monitoring, evaluating, and reporting on the outcomes of community engagement efforts to ensure effectiveness and accountability.

COURSE OUTCOMES (COs):

At the end of this course, students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand the concept, ethics, and spectrum of community engagement	Understand
CO2	Recognize the significance in local community development and rural culture.	Understand
CO3	Know the rural development programs, institutions	Understand
CO4	Comprehend methods for waste management	Understand
CO5	Implement policies for hygiene and sanitation among waste management workers	Apply

UNIT I INTRODUCTION AND PRINCIPLES 5 HOURS

Concept, Ethics and Spectrum of Community engagement, Local community, Rural culture and Practice of community engagement - Stages, Components and Principles of community development, Utility of public resources. Contributions of self-help groups

UNIT II RURAL DEVELOPMENT 5 HOURS

Rural Development Programs and Rural institutions Local Administration and Community Involvement-Social contribution of community networking, Various government schemes. Programmes of community engagement and their evaluation.

UNIT III COMMUNITY AND RESEARCH 5 HOURS

Community Engaged Research and Ethics in Community Engaged Research Rural Distress, Rural Poverty, Impact of COVID-19 on Migrant Laborers, Mitigation of Disaster.

UNIT IV WASTE MANAGEMENT 5 HOURS

Waste management in rural and sub-urban areas; Government schemes on waste management; Types of waste. Collection, segregation, handling and dispersion of waste. Biomedical waste – Color code. The role of microorganisms in Waste management.

UNIT V PERSONAL CARE **4 HOURS**

Personal care and hygiene for the waste management workers. Psychological wellbeing of the workers. Women folk health care and sanitary practices.

Total: 24 HOURS

TEXT BOOK:

1. *Principles of Community Engagement*, (2011).2nd Edition, NIH Publication No. 11-7782.
2. Tripathy, S.N., and Panda, S., (2011). *Fundamentals of Environmental Studies*; 3rdEdition, Vrianda Publications Private Ltd., New Delhi.
3. Kumar, A., (2004). *A Textbook of Environmental Science*; APH Publishing Corporation, New Delhi.

REFERENCE BOOKS:

1. Singh, M.P., Singh, B.S., and Dey, S.S., (2004). *Conservation of Biodiversity and Natural Resources*. Daya Publishing House, Delhi.
2. Uberoi, N.K., (2010). *Environmental Studies*, Excel Books Publications, New Delhi, India.
3. Maier RM, Pepper IL, Gerba CP (2019). *Environmental Microbiology*, Elsevier.
4. Bruce E Rittmann and Perry L McCarty. *Environmental Biotechnology*. *Principles and Applications*. McGraw-Hill International (2020) 2nd edition.

WEBSITES:

1. https://youtu.be/-SQK9RGBt7o
2. https://www.uvm.edu/sites/default/files/community_engagement_handout.pdf (Community Engagement)
3. https://www.atsdr.cdc.gov/communityengagement/pce_concepts.html (Perspectives of Community)
4. https://egyankosh.ac.in/bitstream/123456789/59002/1/Unit1.pdf (community concepts)
5. https://sustainingcommunity.wordpress.com/2013/07/09/ethics-and-community-engagement/(Ethics of community engagement)
6. https://www.preservearticles.com/sociology/what-are-the-essential-elements-of-community/4558 (Elements of Community)
7. https://www.yourarticlelibrary.com/sociology/rural-sociology/rural-community-top-10-characteristics-of-the-rural-community-explained/34968 (features of rural community)
8. https://www.mapsofindia.com/my-india/government/schemes-for-rural-development-launched-by-government-of-india (Government programmes for rural development)
9. https://www.yourarticlelibrary.com/sociology/rural-sociology/rural-community-top-10-characteristics-of-the-rural-community-explained/34968 (rural lifestyle)
10. https://www.insightsonindia.com/social-justice/issues-related-to-rural-development/government-schemes-for-rural-development-in-india/ (schemes for rural development)
11. https://www.mpgkpdf.com/2021/09/community-development-plan-in-hindi.html?m=1
12. https://images.app.goo.gl/sNF2HMWCuCfkqYz56
13. https://images.app.goo.gl/VaMNNMEs77XyPMrP7

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PO S2
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	2	-	-	-	-	-	-	-	-	-	2	2	-
CO5	-	-	-	3	2	-	-	-	-	-	-	-	2	-	-	2	-
Average	-	-	-	**3**	**2**	-	-	-	-	-	-	-	**2**	-	**2**	**2-**	-

1- Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester III

24MBU311 VIROLOGY AND GENETICS - PRACTICAL 4H–2C

Instruction Hours/week: L:0 T:0 P:4 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 6 Hours

PREREQUISITE:

- Virology (24MBU301**)**
- Microbial Genetics (24MBU302)

COURSE OBJECTIVES (CO):

- To demonstrate general aspects of virus structure and classification
- To teach the students about the virus isolation, propagation of various viruses.
- To study isolation and quantification of DNA.

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	**Course Outcomes**	**Blooms Level**
CO1	Demonstrate the structure of plants, animal, bacteria viruses using electron micrographs	Understand
CO2	Practice isolation, propagation of various viruses.	Apply
CO3	Perform isolation and quantification of DNA	Apply
CO4	Distinguish the viruses according to their characteristic features.	Evaluate
CO5	Use techniques for bacterial conjugation, transformation and transduction.	Apply

EXPERIMENTS **48 HOURS**

1. Study of the structure of important animal viruses (rhabdo, influenza, paramyxo hepatitis B and retroviruses) using electron micrographs–Demonstration.
2. Study of the structure of important plant viruses (Caulimo, Gemini, tobacco ring spot, cucumber mosaic and alpha-alpha mosaic viruses) using electron micrographs–Demonstration.
3. Study of the structure of important bacterial viruses (φX174, T4, λ) using electron micrograph – Demonstration.
4. Isolation and enumeration of bacteriophages (PFU) from water/sewage sample using double agar layer technique.
5. Isolation, purification and assay of virus - Demonstration.
6. Preparation of Master and Replica Plates.
7. Perform Bacterial Conjugation.
8. Perform bacterial transformation.
9. Perform transduction with bacteriophage.
10. Isolation of total DNA from environmental sample.
11. Quantification of DNA using agarose gel electrophoresis.
12. Studying isolation and propagation of animal viruses by chick embryo technique. (Demo)
13. Study of cytopathic effects of viruses using photographs.
14. Perform local lesion technique for assaying plant viruses.

TEXT BOOKS: **Total: 48 HOURS**

1. Klug, W.S., Cummings, M.R., Spencer, C., Palladino, M. (2011). *Concepts of Genetics*,10th edition, Benjamin Cummings.
2. Wagner, E.K., Hewlett, M.J. (2004). *Basic Virology*. 2nd edition. Blackwell Publishing.
3. Ananthanarayanan R and CK Jayaram Panicker. (2017). *Textbook of Microbiology* 10th Ed. Orient Longman.

REFERENCE BOOKS:

1. David P. Clark, Michelle R. McGehee, and Nanette J. Pazdernik. *Molecular genetics* 3RD edition.
2. Flint, S.J., Enquist, L.W., Krug, R.M., Racaniello, V.R., Skalka, A.M. (2004). *Principles of Virology, Molecular biology, Pathogenesis and Control*. 2nd edition. ASM press Washington DC.
3. 3. Levy, J.A., Conrat, H.F., Owens, R.A. (2000). *Virology*. 3rd edition. Prentice Hall publication, New Jersey.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	3
CO2	2	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	3
CO3	2	-	-	-	-	-	-	3	-	-	-	-	-	-	-	3	-
CO4	2	-	-	-	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5	1	-	3	2	-	-	-	2	1	-	-	-	-	-	-	-	3
Average	2	-	3	2	2	2	-	3	1	-	-	-	-	-	-	3	3

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester III

24MBU312A ENVIRONMENTAL MICROBIOLOGY PRACTICAL 3H–1C

Instruction Hours/week: L:0 T:0 P:3 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 6 Hours

PREREQUISITE:

- Microbial Biotechnology (24MBU303A)

COURSE OBJECTIVES (CO):

- To make students understand the aspects of Enzyme immobilization.
- To acquire technical knowledge inn Pigment production
- To familiarize in Production of Microbial Biomass in bioreactor and single cell protein

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	**Course Outcomes**	**Blooms Level**
CO1	Evaluate yeast cell and enzyme immobilization techniques	Evaluate
CO2	Exercise pigment production from Bacteria	Apply
CO3	Experiment with xylanase production by bacteria	Apply
CO4	Perform lipase production using bacteria	Apply
CO5	Practice production of algal single cell proteins	Apply

EXPERIMENTS **36 HOURS**

1. Analysis of soil - pH, moisture content, water holding capacity, percolation, capillary action.
2. Isolation of microbes (bacteria &fungi) from rhizosphere and rhizoplane.
3. Analysis of potable water- MPN method.
4. Determination of BOD and COD of wastewater sample.
5. Isolation of phosphate solubilizing bacteria from soil and study.

TEXT BOOKS: **Total: 36 HOURS**

1. Okafor, N (2011). *Environmental Microbiology of Aquatic & Waste systems*. 1st edition, Springer, New York.
2. Atlas RM and Bartha R (2000). *Microbial Ecology: Fundamentals & Applications*. 4th edition. Benjamin/Cummings Science Publishing, USA
3. Barton LL & Northup DE (2011). *Microbial Ecology*. 1stedition, Wiley Blackwell, USA Campbell RE. (1983). Microbial Ecology. Black well Scientific Publication, Oxford, England.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	2	3	-	-	-	3	-	-	-	-	-	-	-	-	3
CO2	-	-	-	2	-	-	-	2	-	-	-	-	-	-	-	-	3
CO3	2	-	-	3	-	-	-	3	-	-	-	-	-	-	-	-	3
CO4	-	-	-	2	-	-	-	3	-	-	-	-	-	-	-	-	3
CO5	-	-	-	2	2	-	-	3	-	-	-	-	-	-	-	-	3
Average	**2.5**	**-**	**2**	**2.4**	**2**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester III

24MBU312B BIOSAFETY AND INTELLECTUAL PROPERTY RIGHTS - PRACTICAL 3H–1C

Instruction Hours/week: L:0 T:0 P:3 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Biosafety and Intellectual Property Rights (24MBU303B)

COURSE OBJECTIVES (CO):

- To understand the various biological containments.
- To emphasize on IPR issues and need for knowledge in patents in biotechnology.
- To gain knowledge on steps of a patenting process and the role of biosafety committee.

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Perform basic techniques in standard Microbiological practices	Apply
CO2	Understand and practice biosafety procedures	Apply
CO3	Execute microbial decontamination and risk management practices	Apply
CO4	Get trained in techniques for primary applications of patents	Apply
CO5	Analyze critically the bioethical principles	Analyze

EXPERIMENTS **36 HOURS**

1. Study of components and design of a BSL-III laboratory
2. Perform Standard Microbiological practices
3. Biosafety Levels of Specific Microorganisms; Recommended Biosafety Levels for Infectious Agents.
4. Decontamination in Microbiological Laboratory
5. Risk management methodology.
6. Filing applications for approval from biosafety committee
7. Filing primary applications for patents
8. Study on step sofa patenting process
9. Principles of biomedical ethics.

TEXT BOOKS: **Total**: **36 HOURS**

1. Mittal, D.P. *Indian Patents Law*, Taxmann, Allied Services(p)Ltd. 1999.
2. Singh K K *Biotechnology and Intellectual Property Rights: Legal and Social Implications*, Springer India. 2015.

REFERENCE BOOKS:

1. Bare Act. Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd., New Delhi.
2. Kankanala C. Genetic Patent Law & Strategy,1st Edition, Manupatra Information Solution PvtLtd . New Delhi. 2007.
3. Goel D & Prashar S IPR, Biosafety and Bioethics. Pearson. 2013.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	2	-	-	2	-	-	-	3	-	-	-	-	-	-	-	3	-
CO2	3	-	-	2	-	-	-	2	-	-	-	-	-	-	-	-	3
CO3	3	-	-	-	2	-	-	3	-	-	-	-	-	-	-	-	3
CO4	3	-	-	-	-	-	-	3	-	-	-	-	2	-	-	-	3
CO5	-	-	-	3	-	-	-	3	-	-	-	-	-	-	-	-	3
Average	**3**	**-**	**-**	**2.33**	**2**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester III

24VAC301 **INDIAN KNOWLEDGE SYSTEM** **2H–1C**

Instruction Hours/week: L:2 T:0 P:0 **Marks:** Internal**:100** External**: - T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To introduce students to foundational concepts in Indian Knowledge Systems (IKS), including philosophical schools, texts, and cultural practices.
- To explore the contributions of Indian mathematics, astronomy, and technology to global knowledge systems and their interdisciplinary connections.
- To analyze the ethical, philosophical, and practical implications of ancient Indian sciences and humanities in contemporary contexts.

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Identify and describe key components of Indian Knowledge Systems (IKS), including Vedic and non-Vedic philosophical schools, texts such as Puranas and Itihasa, and Niti Sastras.	Understand
CO2	Analyze and evaluate the contributions of Indian mathematics and astronomy to scientific knowledge, demonstrating an understanding of their historical development and modern relevance.	Analyze
CO3	Apply foundational linguistic and phonetic principles from Sanskrit texts like Panini's Astadhyayi to understand their computational and linguistic significance.	Apply
CO4	Demonstrate proficiency in calculating and applying geometric, trigonometric, and algebraic principles from ancient Indian mathematical texts.	Apply
CO5	Critically assess the cultural, philosophical, and ethical implications of Indian sciences and humanities, including their role in shaping societal norms and values.	Analyze

UNIT 1: INTRODUCTION TO IKS **5 HOURS**

Caturdaśa Vidyāsthānam, 64 Kalas, Shilpa Śāstra, Four Vedas, Vedāṅga, Indian Philosophical Systems, Vedic Schools of Philosophy (Sāṃkhya and Yoga, Nyaya and Vaiśeṣika, Pūrva-Mīmāṃsā and Vedānta), Non-Vedic schools of Philosophical Systems (Cārvāka, Buddhist, Jain), Puranas (Maha-puranas, Upa-Puranas and Sthala-Puranas),Itihasa (Ramayana, Mahabharata), Niti Sastras, Subhasitas

UNIT 2: FOUNDATION CONCEPT FOR SCIENCE & TECHNOLOGY **5 HOURS**

Linguistics & Phonetics in Sanskrit (panini's), Computational concepts in Astadhyayi Importance of Verbs, Role of Sanskrit in Natural Language Processing, Number System and Units of Measurement, concept of zero and its importance, Large numbers & their representation, Place Value of Numerals, Decimal System, Measurements for time, distanceand weight, Unique approaches to represent numbers (Bhūta Saṃkhya System, KaṭapayādiSystem), Pingala and the Binary system, Knowledge Pyramid, Prameya – A Vaiśeṣikan approach to physical reality, constituents of the physical reality, Pramāṇa, Saṃśaya

UNIT 3: INDIAN MATHEMATICS & ASTRONOMY **5 HOURS**

Indian Mathematics, Great Mathematicians and their contributions, Arithmetic Operations,Geometry (Sulba Sutras, Aryabhatiya-bhasya), value of π, Trigonometry, Algebra, Chandah Sastra of Pingala,
Indian Astronomy, celestial coordinate system, Elements of the Indian Calendar Aryabhatiya and the Siddhantic Tradition Pancanga – The Indian Calendar System Astronomical Instruments (Yantras) Jantar Mantar or Raja Jai Singh Sawal.

UNIT 4: INDIAN SCIENCE & TECHNOLOGY **5 HOURS**

Indian S & T Heritage, sixty-four art forms and occupational skills (64 Kalas) Metals and Metalworking technology (Copper, Gold, Zinc, Mercury, Lead and Silver), Iron & Steel, Dyes and Painting Technology), Town & Planning Architecture in India, Temple Architecture, Vastu Sastra,

UNIT 5: HUMANITIES & SOCIAL SCIENCES **4 HOURS**

Health, Wellness & Psychology, Ayurveda Sleep and Food, Role of water in wellbeing Yoga way of life Indian approach to Psychology, the Triguṇa System Body-Mind-Intellect- Consciousness Complex. Governance, Public Administration & Management reference to ramayana, Artha Sastra, Kauṭilyan State.

Total: 24 HOURS

TEXT BOOKS:

1. Kapur K and Singh A. K (Eds) (2005). *Indian Knowledge Systems*, Vol. 1. Indian Institute of Advanced Study, Shimla.
2. Nair, Shantha N. (2008) *Echoes of Ancient Indian Wisdom.* Hindology Books, New Delhi

REFERENCE BOOKS:

1. Reshmi ramdhoni,(2018). *Ancient Indian Culture and Civilisation*, star publication
2. DK Chakkrabarty, Makkhan Lal,(2014) *History of Ancient India*, Aryan bookInternational publication,
3. Dr. Girish Nath Jha, Dr. Umesh Kumar Singh and Diwakar Mishra,(2016). *Science and Technologyin Ancient Indian Texts,* DK Print World limited,
4. Swami BB Vishnu, (2015). *Vedic Science and History - Ancient Indian's Contribution to the ModernWorld*, Gosai publication.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	-	-	-	-	-	-	-	-	-	-	3	3	-	-	2	-	2
CO2	-	-	-	-	-	-	-	-	2	-	3	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	2
CO4	-	-	-	-	-	-	-	-	2	-	3	3	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	3	3	1	-	2	-	2
Average	-	-	-	-	-	-	-	-	2	-	3	3	1	-	2	-	2

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester III

24MBU391	**INTERNSHIP**	**0H- 2C**

Instruction Hours/week: L:0 T:0 P:0

நான்காம் பருவம்

24LSUT401 Language IV: Tamil IV 4H - 3C

Instruction Hours/week: L:4 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

பாடத்திட்டப் பொதுநோக்கம்

- வரலாற்றுக்கு முற்பட்ட தமிழகத்தின் சிறப்பை அறியச்செய்தல்.
- தமிழின் தொன்மையை மாணர்களுக்கு எடுத்துரைத்தல்.
- பழந்தமிழர் வாழ்க்கை முறையை உணர்த்துதல்.

பாடத்திட்டப் பயன்விளைவு

- தமிழ்மொழி வரலாறு குறித்த தெளிந்த அறிவு பெற்றிருத்தல்.
- தமிழரின் மரபு சார்ந்த மொழியின் செல்வாக்கை அறிதல்.
- பழந்தமிழ் இலக்கியங்களின்வழி பண்பாடு கலாச்சாரம் போன்றவற்றை அறிதல்.
- ஐவகை நிலஅமைப்பு, வாழ்வியல் ஒழுக்கலாறுகளைப் பெற்றிருத்தல்.
- இலக்கியங்களின்வழி கலைகளின் வளர்ச்சி மற்றும் அமைப்பு முறையை அறிதல்.

அலகு – I வரலாற்றுக்கு முற்பட்ட தமிழகமும் சங்ககால வரலாறும்

(10 மணிநேரம்)

வரலாறும் நிலஅமைப்பும் – வரலாற்றின் செல்வாக்கு – பல்வேறு காலங்களில் வரலாறு உண்டாக்கிய நாட்டுப் பிரிவுகள் - பழைய கற்காலம் – புதிய கற்காலம் – இரும்புக் காலம்.

அலகு – 2 தமிழின் தொன்மை (10 மணிநேரம்)

தமிழ் தோன்றிய இடம் – குமரிக்கண்டத் தமிழ் நாடுகள் – தமிழ் என்னும் பெயர் வரலாறு – திராவிட மொழிக்குடும்பம் – தமிழ்மொழிச் சிறப்பு – தமிழுக்குத் தமிழ் நாட்டவர் செய்ய வேண்டியவை – தமிழுக்கு வெளிநாட்டிற் செய்ய வேண்டியவை.

அலகு – 3 தமிழர் வாழ்வியல் (10 மணிநேரம்)

ஐவகை நிலங்கள் – களவு வாழ்க்கை – கற்பு வாழ்க்கை – அரசர் கடமை – கல்வி நிலை – தொழில் நிலை – ஆடவர் நிலை – பெண்டிர் நிலை.

அலகு – 4 கட்டடக்கலையும் தமிழர் பண்பாடும் (10 மணிநேரம்)

கட்டடக்கலை தோற்றுவாய் – முதற்கலை – கட்டடக்கலையின் பழைமை – புதிய கற்காலம் – சங்ககாலம் – கோயில்கள் – அரண்மனைகள் – கோட்டைகள் – வீடுகள் – நீர்ப்பாசனக் கட்டடக்கலை – தமிழர் கட்டடக் கலையின் தனிச்சிறப்பு.

அலகு – 5 ஆற்றங்கரை நாகரிகம் (8 மணிநேரம்)

ஆறும் நாகரிகமும் – ஆறுகளின் தோற்றமும் நீளமும் – காவிரிக்கரை நாகரிகம் – இலக்கியச் சிறப்பு – கலைச்சிறப்பு – வைகைக்கரை நாகரிகம் - இலக்கியச் சிறப்பு – கலைச்சிறப்பு , நொய்யல்கரை நாகரிகம்.

மொத்த மணிநேரம் 48

பார்வை நூல்கள்

1. முனைவர் அரங்க இராமலிங்கம் (பதிப்பாசிரியர்), தமிழர் நாகரிகமும் தமிழ் மொழிவரலாறும் (தொகுதி -1, 6, 2, 5, 10), வர்த்தமானன் பதிப்பகம், தியாகராயநகர், சென்னை-17.
2. கே.கே.பிள்ளை, தமிழக வரலாறு மக்களும் பண்பாடும், உலகத்தமிழ் ஆராய்ச்சி நிறுவனம் தரமணி, சென்னை-13.
3. நா.வானமாமலை, தமிழர் வரலாறும் பண்பாடும், நியூசெஞ்சுரி புக்ஹவுஸ், சென்னை -98.

இணையதளம்

1. www.tvu.org.in
2. www.maduraitamilproject.com

இதழ்கள்

1. International Research Journal of Indian Literature, irjil.in
2. International Tamil Research Journal, iorpress.in

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**2.6**	**2.6**	**2.8**	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	-	-	-	-	-	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester IV

24LAUH401/24LSUH401 **Language IV: HINDI-PAPER- IV** **4H-3C**
(Modern Poetry, One Act, Essay, Translation)

Instruction Hours/week: L:4 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not Required

COURSE OBJECTIVES(CO):

- Develop an interest in the appreciation of short stories
- Comprehend the grammatical structures and sentence making
- Understand the language and developing English to Hindi translation skill

COURSE OUTCOMES (COs):

- Learning the literacy knowledge of Hindi specially reading and writing .
- Learning the literary knowledge specially reading and understanding of Hindi short Stories
- Learning the history of Hindi literature.
- The ability to translate from Hindi to English and from English to Hindi will be improved.
- Develop a skill in spoken Hindi.

UNIT-I a) Poetry – Lakshmanan ke Bare Me

b) Bharath ka Bhagya

c) Essay – Dhokha

d) Translation – Lesson – 1 to 3

UNIT-II a) Poetry – Soorpanakha Ki Visheshatha

b) Bahu Ki Vida

c) Essay – Jabaan

d) Translation– Lesson – 4 to 6

UNIT-III a) Poetry– Kavya Ke AdharPar

b) Reed Ki Haddi

c) Essay – Kya Janvar Bhee Sochthi Hai

d) translation– Lesson – 7 to 9

UNIT-IV a) Khanda Kavya Ke Adhar Par Panchavati

b) Rajputhni Ka Badhala

c) Essay – Shradha-Bhakthi

d) Translation– Lesson – 10 to 12

UNIT-V a) Kavya Ke Adhar Par Prakruthik Varnan

b) Bheem Aur Raakshas

c) Essay – Adhunik Nari

d) Translation – Lesson –13 to 15

REFERENCE BOOKS:

1.Poetry : Panchavati

Writer : Mythili Sharan Guptha

Publisher : Bharathiya Sahithya Sangrah

Kanpur – 208002, Uttar Pradesh

2.One Act Play : Adarsh Akanki

Publisher : D.B.Hindi Prachar Sabha

T. Nagar,Chennai – 600017, Tamil Nadu

3.Essay : Nibandh Nishchay

Editor : Dr.Sharadh Ranjan

Publisher : Hindi Sahithya Sammelan Prayag

12.Sammelan Marg, Illahabadh

4.Translation : Anuvadh Abhyas – III

Publisher : D.B.Hindi Prachar Sabha

T.Nagar, Chennai – 600017, Tamil Nadu

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**3**	**2.6**	**2.6**	**-**	**-**	**-**	**-**	**-**	-	-	-	-	-	-	-	-	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester IV

24LSUM401 **Language IV: MALAYALAM IV** **4H-3C**

Instruction Hours/week: L:4 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**
End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVE(CO):

- Knowledge of contemporary drama contents of Malayalam literature
- Learn Screen play and its techniques. The ability to read drama and expresscriticism about it and the ability to express social thoughts will improve
- There will also be litigation messages in Malayalam and news on speech techniques

Able to write articles on their own and improve their creative skills.

COURSE OUTCOME(COs):

- Get a basic knowledge of drama
- Can read and critique Screenplay
- Create interest in art literature courses
- The hope of writing a Drama or a Screen Play
- The idea of creating new works and critique knowledge willimprove.

Unit No.	PART I – MALAYALAM IV	Hours
I	Screen Play - Perumthachan	10
II	Screenplay - Perumthachan	10
III	Drama - Saketham	10
IV	Drama - Saketham	09
V	Drama - Saaketham	09
	TOTAL	48

TEXT BOOKS:

1. Perumthachan – M.T.VasudevanNair,DC Books
2. Saketham – C.N.SreekandanNair,DC Books

REFERENCE BOOKS:

1.MalayalaNatakaSahithyaCharithram. G Sankara Pillai (Kerala SahithyaAkademi, Trissur) 2. Malayala Nataka Sahithya Charithram, Vayala Vasudevan Pillai (Kerala Sahithya AkademiThrissur).

3. Natakam- OruPatanam (C.J. SmarakaPrasanga Samithi, Koothattukulam)
Natakaroopacharcha, Kattumadam Narayanan (NBS, Kottayam)

4.Chalachithrasameeksha–Vijayakrishanan.

5. Cinemayude Paadangal-VisakalanavumVeekshanavum – Jose-K.Manual.

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	3	3	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester IV

24LSUS401	**Language IV: SANSKRIT IV** (Lyrics, Grammar and Translation)	**4H-3C**

Instruction Hours/week: L:4 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

Not required

COURSE OBJECTIVES(CO):

- The fundamental objective of the curriculum is to impart effective science education at the undergraduate level, exposing them to recent trends and developments in the subject.
- Creating scientific temper is another major objective of this curriculum.
- Another major thrust given here is to develop an environmental concern in all activities ofthe students. 'Go green', the motto of the syllabus emphasizes the urgent need to conserve nature without destruction of natural resources.

COURSE OUTCOMES(COs):

- **Critical Thinking**: Take informed actions after identifying the assumptions that frame students' thinking and actions.
- **Problem Solving**: Understand and solve problems of relevance to society to meet the specified needs using the knowledge, skills and attitudes acquired.
- **Effective Communication**: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
- **Effective Citizenship**: Demonstrate empathetic social concern and equity centered national development.
- **Environment and Sustainability**: Understand the issues of environmental contexts and sustainable development.

UNIT I **9 HOURS**

Introduction to Sanskrit Lyrics and erotic literature.

UNIT II **9 HOURS**

Devotional Literature, Important works

UNIT III **10 HOURS**

Krishnakarnamrita of Leelasuka (Second Section only)

UNIT IV **10 HOURS**

Grammar – Past tense, Declension of personal pronouns

UNIT V **10 HOURS**

Simple sentences from Sanskrit Self Teacher

TOTAL: 48 HOURS

TEXT BOOK:

Krishnakarnamrita of LeelasukaSri Ramakrishna Mud Mylapore, Chennai.

CO, PO, PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PSO 1	PSO 2
CO1	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**2.6**	**2.6**	**2.8**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester IV

24LSUF401 **Language IV: FRENCH IV** **4H-3C**

(Comprehension, Tradusion, Reduction, Une act)

Instruction Hours/week: L:4 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not Required

COURSE OBJECTIVES (CO):

The objectives of this course are:

- To provide the students with an ability to build and enrich their communication skills.
- To help them think and write imaginatively and critically.
- To strengthen their professional skills.

COURSE OUTCOMES (COS):

At the end of this course, students will be able to

COs	Course Outcomes	Blooms Level
CO1	make the students proficient communicators in French.	Apply
CO2	develop learners' ability to understand French.	Understand
CO3	understand the nuances of listening, speaking and reading French.	Understand
CO4	prepare the learners to face situations with confidence and toseek employment in the modern globalized world.	Apply
CO5	build the students' ability to listen and to speak French better.	Apply

Unite – I	a) Leçon	–	On fait le ménage !
	b) Communication	-	Protester et réagir
	c) Grammaire	-	Le présent progressif, Les pronoms possessifs La phrase négative (3)
	d) Lexique	–•	Le logement,La maison,Les pièces
	e) Culture	–	Paris et ses symboles
Unite – II	a) Leçon	–	À propos de logement
	b) Communication	-	Exprimer l'intérêt et l'indifférence
	c) Grammaire	-	Quelques adjectifs et pronoms indéfinis
			Les verbes lire, rompre et se plaindre
	d) Lexique	–	Meubles et équipement,Les tâches ménagères
	e) Culture	-	Les fêtes et les traditions en France

Unite – III a) Leçon – Tous en forme ! Accidents et catastrophes

b) Communication - Raconter au passé

c) Grammaire - Le passé composé et l'imparfait
Le passé récent, L'expression de la durée,

d) Lexique – Le corps humain : l'extérieur,Le corps humain : l'intérieur Les maladies et les remèdes

e) Culture - La longue histoire de la Francophonie

Unite – IV

a) Leçon – Faire ses études à l'étranger

b) Communication -• Exprimer la peur et rassurer

c) Grammaire - Les adjectifs et les pronoms ,indéfi nis : rien, personne, aucun Les verbes dire, courir et mourir

d) Lexique – Les accidents,Les catastrophes naturelles

e) Culture - Les jeux de la Francophonie .

Unite – V a) Leçon – Bon voyage !La mété

b) Communication - Exprimer son opinion, Parler de la météo

c) Grammaire -• Les pronoms démonstratifs neutres
Le futur simple, Situer dans le temps

d) Lexique – Le système scolaire,Les formalités pour partir à l'étranger
• La météo

e) Culture- Le français hors de France

REFERENCE BOOKS:

- Cocton Marie –Noëlle , Duplex Dorothée, Heu Elodie , Kasazian Emilie, Ripaud Delphine, **Saison 1- Méthode de francais**, Didier, paris.2015.
- Cocton Marie – Noëlle, Dupleix, Heu Elodie, Kasazian Emilie ,Ripaud Deldphin**, Saison 1 –**
- **Cahier d'activites ,** Dider ,Paris , 2015
- Anne Akyüz,Bernadette Bazelle- Shahmael,JoëlleBonenfant, Marie- Françoise Gliemenn,Les **exercices de grammaire,Hachette FLE,** Paris,2005
- Christian Beaulieu, **Je pratique**, **Exercises de grammaire A**1, Dider,Paris,2015
- Nathalie BIE, philippe SANTINAN,Gra**mmaire pour adolescents-250 exercises, CLE International , Paris , 2005**

WEBSITES :

- http:// enseigner.tv5 monde.com/
- bonjourdumonde.com /exercises/contenu/le – francais-du- tourisme.html
- http://www.bonjurdefrance.com/
- https://www.lepointdufle.net/

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester IV

24ENU401 **ENGLISH IV** **3H–3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To provide the students with an ability to build and enrich their communication skills.
- To help them think and write imaginatively and critically.
- To strengthen their professional skills.

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	make the students proficient communicators in English.	Apply
CO2	develop learners' ability to understand English.	Understand
CO3	understand the nuances of listening, speaking and readingEnglish.	Understand
CO4	prepare the learners to face situations with confidence and toseek employment in the modern globalized world.	Apply
CO5	build the students' ability to listen and to speak English better.	Apply

UNIT-I **8 HOURS**

Concept of Communication- Barriers to Communication- Body Language-Personality Development-Etiquette and Manners-Soft Skills

UNIT- II **7 HOURS**

Listening Comprehension-Reading Comprehension-Paragraph Writing-Precis Writing-Collocation

UNIT-III **7 HOURS**

Writing-Writing Resume and Covering Letter- Types of Letter Writing-Writing MoU- Dicto Composition--Term Paper-Book Reviews

UNIT- IV **7 HOURS**

Speaking-Interview Skills-Preparing Welcome address and Vote of Thanks-Compering -

UNIT-V **7 HOURS**

Punctuation Marks- Figures of Speech

Total: 36 HOURS

TEXT BOOK:

1. Board of Editors (2024). *Proficiency in Communication II*, Karpagam Academy of Higher Education

REFERENCE BOOKS:

1. Martin's, St (2013). *Oxford Handbook of Writing: Handbook of Writing*. Cambridge. University Press.
2. Wren & Martin, *(*2008). *High School English Grammar & Composition*, S.Chand & Company Ltd, Board of Editors,
3. Krashen, Stephen D (1982). *Principles and Practice in Second Language Acquisition*. New York: Pergamon Press.

WEB SITES:

1. https://www.skillsbuilder.org/blog/top-5-speaking-skills-for-success-in-interviews
2. https://www.coursera.org/articles/interviewing-skills

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	**3**	**3**	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester IV

24MBU401 **IMMUNOLOGY** **5H–4C**

Instruction Hours/week: L:5 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To provide overview of immune system, antigen antibody structure and interactions.
- To develop understanding of innate and adaptive immunity along with major cells and molecules involved.
- To integrate immunology with health and enrich the knowledge for autoimmune disorders, hypersensitivity reaction

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Comprehend types of immune systems and mechanism of immune activation and autoimmunity.	Understand
CO2	Develop understanding about antigen - antibody interactions.	Understand
CO3	Analyse disease conditions generated due to interplay of immune system components.	Analyze
CO4	Explain primary and secondary Immune response and immune deficiencies	Understand
CO5	Apply techniques in vaccine production and practice different immunoassays	Apply

UNIT I **12 HOURS**

Concept of Innate and Adaptive immunity; Contributions of following scientists to the development of field of immunology – Edward Jenner, Karl Landsteiner, Robert Koch, Paul Ehrlich, Elie Metchnikoff, Peter Medawar, MacFarlane Burnet, Neils K Jerne, Rodney Porter and Susumu Tonegawa. Structure, Functions and Properties of: Immune Cells – Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, dendritic cell; and Immune Organs – Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT, CALT.

Unit II **12 HOURS**

Antigens – Characteristics of an antigen (Foreignness, Molecular size and Heterogeneity); Haptens; Epitopes (T & B cell epitopes); T-dependent and T-independent antigens; Adjuvants. Antigenicity, Immunogenicity and Factors influencing Immunogenicity. Antibodies – Structure, Types, Functions and Properties of antibodies; Antigenic determinants on antibodies (Isotypic, allotypic, idiotypic); Monoclonal and Chimeric antibodies.

Unit III **10 HOURS**

MHC – Organization of MHC locus; Structure and Functions of MHC I & II molecules; Antigen processing and presentation (Cytosolic and Endocytic pathways). Complement system – Components of the Complement system; Activation pathways (Classical, Alternative); Biological consequences of complement Activation

Unit IV **14 HOURS**

Primary and Secondary Immune Response; Generation of Humoral Immune Response (Plasma and Memory cells); Generation of Cell Mediated Immune Response (Self MHC restriction, T cell activation, Co-stimulatory signals); Killing Mechanisms by CTL and NK cells, Introduction to tolerance. Types of Autoimmunity and Hypersensitivity with examples; Immuno deficiencies – Animal models (Nude and SCID mice), DiGeorge syndrome, Chediak-Higashi syndrome. Transplantation immunology, Graft versus host reaction, Graft rejection.

Unit V **12 HOURS**

Types of tumors, tumor Antigens, causes and therapy for cancers. Types of vaccine and their vaccination schedule in Practice. Principles of precipitation, agglutination, complement fixation, Immunodiffusion, Immuno electrophoresis, ELISA, ELISPOT, Western blotting, Immuno fluoresence, Flow cytometry, Immunoelectron microscopy. Immunological biosensors.

Total: 60 HOURS

TEXT BOOKS:

1. Goldsby RA, Kindt TJ, Osborne BA. *Kuby's Immunology*. 6thedition. W.H. Freeman and Company, New York. (2007).
2. Delves P, Martin S, Burton D, Roitt IM. Roitt's *Essential Immunology*. 11th edition Wiley-Blackwell Scientific Publication, Oxford. (2006).

REFERENCE BOOKS:

1. Murphy K, Travers P, Walport M. (2008). Janeway's *Immunobiology*. 7thedition Garland Science Publishers, New York.
2. Abbas AK, Lichtman AH, Pillai S. (2007). *Cellular and Molecular Immunology*. 6th edition, Saunders Publication, Philadelphia.
3. Peakman M, and Vergani D. (2009). *Basic and Clinical Immunology*. 2ndedition Churchill Livingstone Publishers, Edinberg.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	3	-	-	2	-	-	-		-	-	-	-	-	-	-	-	3
CO2	3	-	-	2	2	-	-	2	-	-	-	-	-	-	-	-	3
CO3	3	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	3
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO5	2	-	-	3	-	-	-	3	-	-	-	-	-	-	-	-	3
Average	**3**	-	-	**2.33**	**2**	-	-	**2.5**	-	-	-	-	-	-	-	-	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester IV

24MBU402 **MEDICAL MICROBIOLOGY** **5H–3C**

Instruction Hours/week: L:4 T:1 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To introduce basic principles and applications of various clinical diseases and their epidemiology.
- To characterize, isolate and identify different microbes under a wide range of host pathogen interaction.
- To understand etiology, clinical systems and laboratory diagnosis of disease- causing microorganisms.

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand microflora in the body and microbe-based infections	Understand
CO2	Gain knowledge on various bacterial infections of different organs of the body	Understand
CO3	Analyse various viral diseases in human beings	Analyze
CO4	Comprehend transmission, symptoms and prevention of fungi causing diseases	Understand
CO5	Evaluate microbial diagnosis and Artificial Intelligence in microbial diagnosis.	Evaluate

Unit I Introduction to Medical Microbiology **12 HOURS**

Normal micro flora of the human body: skin, throat, gastrointestinal tract, gut flora, urogenital tract. Definitions – Infection, Invasion, Pathogen, Pathogenicity, Virulence, Toxigenicity. Transmission of infection, Carriers and their types, Opportunistic infections, Nosocomial infections. Collection, transport and processing of clinical samples – Blood, Sputum, Stool, Urine and CSF.

Unit II Medical Bacteriology **12 HOURS**

List of diseases of various organ systems and their causative agents. Respiratory pathogens: Streptococcus pyogenes, Haemophilus influenzae, Mycobacterium tuberculosis. Gastrointestinal pathogen Escherichia coli, Salmonella typhi, Vibrio cholerae, Helicobacter pylori. Others: Staphylococcus aureus, Bacillus anthracis, Clostridium tetani, Treponema pallidum Klebsiella pneumonia

Unit III Virology **12 HOURS**

Study of following diseases – Causative agents, Mode of transmissions, Pathogenicity, Symptoms and prophylaxis of Polio, Herpes, Hepatitis, Rabies, Dengue, AIDS, Influenza with brief description of Adeno virus, swine flu, Ebola, Chikungunya, Japanese Encephalitis, Coronavirus (COVID-19) and omicron virus.

Unit IV Medical Mycology and Parasitology **12 HOURS**

Study of mycoses- transmission, symptoms and prevention. Cutaneous mycoses: Tinea pedis (Athlete's foot). Systemic mycoses: Histoplasmosis. Opportunistic mycoses: Candidiasis. The detailed study of following

diseases– Causative agents, Mode of transmissions, Pathogenicity, Symptoms and prophylaxis of Amoebiasis, Giardiasis, Elephantiasis, Taeniasis, Malaria, Kala- azar.

Unit V Antimicrobial agents **12 HOURS**

Antibacterial agents: Five modes of action with one example each: Inhibitor of nucleic acid synthesis; Inhibitor of cell wall synthesis; Inhibitor of cell membrane function; Inhibitor of protein synthesis; Antibiotic resistance - MDR, XDR, MRSA, NDM-1 and PDR resistance mechanisms. Antifungal agents: Mechanism of action of Amphotericin B, Griseofulvin. Antiviral agents: Mechanism of action of Amantadine, Acyclovir, Azidothymidine. Molecular Diagnosis of infectious diseases. Artificial Intelligence in microbial diagnosis.

Total: 60 HOURS

TEXT BOOKS:

1. Ananthanarayan R. and Paniker C.K.J. (2022). *Textbook of Microbiology*. 12th edition, University Press Publication.
2. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). *Brock Biology of Microorganisms*. 14th edition. Pearson International Edition.

REFERENC BOOKS:

1. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. Jawetz, Melnick, (2013). *Adelberg's Medical Microbiology*. 27th edition. McGraw Hill Publication.
2. Greenwood D, Slack R, Barer M, and Irving W. *Medical Microbiology*, 19th Edition. Churchill Living stone. (2018).
3. Goering R., Dockre ll H. Zuckerman M and Wakelin D. (2007). Mims' Medical Microbiology. 4th edition. Elsevier.
4. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott, Harley and Klein's *Microbiology*. 9th edition. McGraw Hill Higher Education.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	-	-	3	2	-	-	2	-	-	-	-	-	-	-	-	-	3
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	-	-	2	-	-	-	-	-	-	2	-	-	-	-	-	3
CO4	-	-	3	-	2	-	-	-	-	-	-	-	-	-	-	-	3
CO5	-	-	-	2	2	-	-	-	3	3	-	-	-	-	-	-	3
Average	**3**	-	**3**	**2.33**	**2**	-	**2**	-	**3**	**3**	**2**	-	-	-	-	-	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester IV

24MBU403A MOLECULAR BIOLOGY 3H–3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Biochemistry (24MBU101)

COURSE OBJECTIVES (CO):

- To study on structure and organization of chromosome and mutagenesis.
- To expose the students on the basic understanding of various techniques used in molecular studies.
- To gather information to know mechanism of DNA replication and protein synthesis

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand structure and types of DNA	Understand
CO2	Describe the processes of DNA replication	Understand
CO3	Explain transcription and transcriptional control in prokaryotes and eukaryotes	Understand
CO4	Narrate concept of RNA splicing and mRNA and its significance.	Understand
CO5	Illustrate translation and regulation of gene expression in prokaryotes	Understand

Unit I DNA Structure 8 HOURS

DNA Structure: Miescher to Watson and Crick - historical perspective, DNA Structure, Salient features of double helix, Chargaff's rule, Types of DNA, Conformations of nucleic acids, Stability of nucleic acid structure, Types of genetic material, Organization of DNA Prokaryotes, Viruses, Eukaryotes. RNA Structure, Organelle DNA—mitochondria and chloroplast DNA.

Unit II DNA Replication 8 HOURS

DNA replication, prokaryotic and Eukaryotic replication, Mechanism of DNA replication: Enzymes and proteins involved in DNA replication–DNA polymerases, DNA ligase, primase, telomerase– for replication of linear ends. DNA topology –linking number, proof reading mechanism.

Unit III DNA Transcription 6 HOURS

Transcription and transcriptional control in prokaryotes and eukaryotes, initiation, elongation, termination, promoter sequences, TATA box, Hogness Box, CAAT box, Enhancers, upstream activating sequences, Post-transcriptional modification, splicing, spliceosomes, nuclear transport of mRNA.

Unit IV DNA Translation 8 HOURS

Translational machinery, charging of tRNA, amino acyl tRNA synthetases, Mechanisms of initiation, elongation and termination of polypeptide s in both prokaryotes and eukaryotes, Fidelity of translation, Inhibitors of protein synthesis in prokaryotes and eukaryote and post translational modifications. Regulation of gene expression in prokaryotes lacoperon and trp operon.

Unit V Molecular Biology Techniques **6 HOURS**

Extraction of DNA, Extraction of RNA, Isolation of plasmid, DNA purification and estimation, PCR, Gel electrophoresis, Blotting techniques, SDS-PAGE. Expression Cloning, CRISPR Cas.

Total: 36 HOURS

TEXT BOOKS:

1. Gardner EJ, Simmons MJ, Snustad DP (2008). *Principles of Genetics*. 8th Ed. Wiley-India.
2. De Robertis EDP and De Robertis EMF (2006). *Cell and Molecular Biology*, 8th edition. Lippin Cott Williams and Wilkins, Philadelphia.
3. Sambrook J and Russell DW (2001). *Molecular Cloning: A Laboratory Manual* 4thEdition, Cold Spring Harbour Laboratory press.

REFERENCE BOOKS:

1. Watson JD, Baker TA, Bell SP, GannA, Levine Mand Losick R (2008). *Molecular Biology of the Gene*, 6th edition, Cold Spring Harbour Lab. Press, Pearson Publication
2. Becker WM, Kleinsmith L J, Hardin. J and Bertoni GP (2009). *The World of the Cell*,7th edition, Pearson Benjamin Cummings Publishing, San Francisco.
3. Karp G. (2010). *Cell and Molecular Biology: Concepts and Experiments*, 6th edition, John Wiley & Sons. Inc
4. Krebs J, Goldstein E, Kilpatric KS (2013). *Lewin's Essential Genes*, 3rd Ed., Jones and Bartlett Learning.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	3	-	-	-		-	-	-	-	-	-	-	3	-
CO2	2	-	-	3	-	-	-		-	-	-	-	-	-	2	3	-
CO3	-	-	-	2	-	-	-		-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	2	-	-	-	-	-	-	-	3	-
CO5	2	-	-	2	-	-	-		-	-	-	-	-	-	-	3	-
Average	**2.33**	**-**	**-**	**2.6**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester IV

24MBU403B PLANT TISSUE AND ANIMAL TISSUE CULTURE 3H–3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To learn the conventional methods of breeding
- To understand the concepts of Tissue culture media, micropropagation, plant hardening transfer to soil, green house technology
- To emphasize tissue culture techniques in secondary metabolites production.

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

Cos	Course Outcomes	Blooms Level
CO1	Understand the basics in conventional and non-conventional plant breeding techniques	Understand
CO2	Learn and practice tissue culture media preparation, develop new combinations of media for micropropagation	Apply
CO3	Apply techniques for different culture techniques and hardening	Apply
CO4	Comprehend animal culture techniques	Apply
CO5	Explain transgenic animal production	Apply

UNIT-I **7 HOURS**

Principles of Plant Breeding: Important conventional methods of breeding – self, cross pollinated and vegetatively propagated crops. Non-conventional methods. Polyploidy, Genetic variability. Genome organization in plants – mitochondria and chloroplast. Cytoplasmic male sterility.

UNIT-II **8 HOURS**

Tissue culture media – composition and preparation, Callus and suspension culture, somaclonal variation, micropropagation, organogenesis, somatic embryogenesis, Embryo culture and embryo rescue. Haploidy; protoplast fusion and somatic hybridization; cybrids; anther, pollen and ovary culture for production of haploid plants and homozygous lines. Plant hardening transfer to soil, green house technology.

UNIT-III **7 HOURS**

Chloroplast, Mitochondria, and Nucleus Strategies in bioconversion. Production of pharmaceutical compounds. Mass cultivation of plant cells. Secondary metabolite Production from Suspension Culture, Bioreactors – Photo bioreactor. Production of secondary metabolite in plants, stages of secondary metabolite production, uses of tissue culture techniques in secondary metabolites.

UNIT-IV **7 HOURS**

Animal Tissue Culture: Biology of cultured cells; Aseptic techniques, safety and biohazards. Cell lines. Cell culture media – preparation and types, sterilization techniques. Primary cell culture – isolation of tissues from chick embryo, mouse and human biopsies.

UNIT-V **7 HOURS**

Organ culture: Cell separation techniques, cryopreservation, cell-cell interaction. Transgenic animals – production and applications, Knockout animals. Biopharming. Ethical issues in animal biotechnology.

Total: 36 HOURS

TEXT BOOKS:

1. Slater, A., Scott, N.W., & Fowler, M. R. (2008). *Plant Biotechnology*. Oxford: Oxford University Press.
2. Ignacimuthu, S. (2004). *Plant Biotechnology*. New Delhi: Oxford and IBH Publishing House.
3. Chawla, H.S. (2002). *Introduction to Plant Biotechnology*. New Delhi: Oxford and IBHP Publishing Co. Pvt. Ltd.
4. Freshney, R. I. (2000). *Animal Cell Culture. A practical approach*. John Wiley Publishers. New York.

REFERENCE BOOKS:

1. Kumar, U. (2008). *Plant Biotechnology and biodiversity conservation*. Jodhpur: Agrobios.
2. Stewart, N.C. (2008). *Plant Biotechnology and Genetics*. New Jersey: John Wiley & Sons,Inc.
3. Halford, N., & Halford, N. G. (2006). *Plant Biotechnology: Current and Future Applications of Genetically Modified Crops*. New Jersey: John Wiley &Sons.
4. Davis T. M. (2002). *Basic cell culture – A practical approach*, Oxford University Press, London.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	-	-	-	3	-	-	-	-	-	-	-	2	-
CO2	3	-	-	-	-	-	-	2	-	-	-	-	-	-	-	3	-
CO3	3	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	3
CO4	3	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	3
CO5	3	-	-	-	-	-	-	3	-	-	-	-	2	-	-	-	3
Average	**3**	-	-	-	-	-	-	**3**	-	-	-	-	**2**	-	-	**2.5**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester IV

24MBU411 IMMUNOLOGY - PRACTICAL 4H–2C

Instruction Hours/week: L:0 T:0 P:4 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 6 Hours

PREREQUISITE:

- Immunology (24MBU401)

COURSE OBJECTIVES (CO):

- To strengthen the knowledge of students in immunodiagnostics on skill basis.
- To integrate immunology with health and enrich the knowledge for autoimmune disorders, hypersensitivity reaction.
- To develop the basic skills on handling immunological tests

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

Cos	Course Outcomes	Blooms Level
CO1	Learn and apply skills in identification of human blood groups	Apply
CO2	Practice Leukocyte Count of the given blood sample	Apply
CO3	Perform separation of serum and plasma from the blood sample	Apply
CO4	Execute immunodiffusion by Ouchterlony method	Apply
CO5	Experiment with DOT-ELISA test and immune electrophoresis assay	Apply

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EXPERIMENTS **48 HOURS**

1. Identification of human blood groups - ABO Blood grouping, Rh Typing.
2. Perform Total Leukocyte Count of the given blood sample.
3. Perform Differential Leukocyte Count of the given blood sample.
4. Separate serum and plasma from the blood sample.
5. WIDAL test, RPR and CRP.
6. Perform immunodiffusion by Ouchterlony method.
7. Perform DOT-ELISA.
8. Perform immune electrophoresis.

TEXT BOOKS: **Total: 48 HOURS**

1. Ananthanarayan R. and Paniker C.K.J (2009). *Textbook of Microbiology*. 8th edition, University Press Publication.
2. Peakman M and Vergani D (2009). *Basic and Clinical Immunology*. 2nd edition Churchill Livingstone Publishers, Edinberg.

REFERENCE BOOKS:

1. 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.
2. Greenwood D, Slack R, Barer M and Irving W. (2012). *Medical Microbiology*, 18th Edition. Churchill Livingstone.
3. Ryan KJ and Ray CG. (2014). *Sherris Medical Microbiology*, 6th Edition. McGraw-Hill Professional.
4. Richard C and Geiffrey S. (2009). *Immunology* 6th edition. Wiley Blackwell Publication.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	2	-	-	3	-	-	-	3	-	-	-	-	-	-	-	3	-
CO2	1	-	-		-	-	-	3	-	-	2	-	-	-	-	3	-
CO3	3	-	-	2	-	-	-	3	-	-	-	-	-	-	-	3	-
CO4	3	-	-	2	-	-	-	3	-	-	-	-	-	-	-	-	3
CO5	-	-	-	3	-	-	-	3	-	-	-	-	-	-	1	-	3
Average	**2.25**	**-**	**-**	**2**	**-**	**-**	**-**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**1**	**3**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester IV

24SEC412 **MEDICAL MICROBIOLOGY- PRACTICAL** **4H–2C**

Instruction Hours/week: L:0 T:0 P:4 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 9 Hours

PREREQUISITE:

- Medical Microbiology (24MBU402)

COURSE OBJECTIVES (CO):

- To introduce the medically important microorganisms, microbial morphology and the characterization,
- To cover all biology of bacteria, viruses and other pathogens related with infectious diseases in humans.
- To develop the basic skills on handling clinical pathogens

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Practice to characterize, isolate and identify medically important microbes.	Apply
CO2	Make use of important differential media for identification of bacteria	Apply
CO3	Execute technique of swab method to study bacterial flora	Apply
CO4	Perform antimicrobial activity using agar or disc diffusion and MIC method	Apply
CO5	Examine various stages of malarial parasite in RBCs using permanent mounts	Evaluate

EXPERIMENTS **48 HOURS**

1. Identify bacteria (any three of *E. coli*, *Salmonella*, *Pseudomonas*, *Staphylococcus*, *Bacillus*) using laboratory strains on the basis of cultural, morphological and biochemical characteristics: IMViC, TSI, nitrate reduction, urease production and catalase tests.
2. Study of composition and use of important differential media for identification of bacteria: EMB Agar, MacConkey agar, Mannitol salt agar, Deoxycholate citrate agar, TCBS, Salmonella Shigella/ BSA Agar.
3. Study of bacterial flora of skin by swab method.
4. Antibacterial sensitivity assay by Kirby- Bauer method.
5. Determination of minimal inhibitory concentration (MIC) of an antibiotic.
6. Study symptoms of the diseases with the help of photographs: Polio, anthrax, herpes, chickenpox, HPV warts, AIDS (candidiasis), dermatomycoses (ringworms).
7. Study of various stages of malarial parasite in RBCs using permanent mounts.

Total: 48 HOURS

TEXT BOOKS:

1. Ananthanarayan R.and Paniker C.K.J. (2009) *Textbook of Microbiology*. 8th edition, University Press Publication.

2. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). *Brock Biology of Microorganisms*. 14th edition. Pearson International Edition.

REFERENCE BOOKS:

1. Green wood D, Slack R, Barer M, and Irving W. (2012). *Medical Microbiology*, 18th Edition. Churchill Livingstone.
2. 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
3. Ryan KJ and Ray CG.(2014). *Sherris Medical Microbiology*, 6th Edition . McGraw-Hill Professional.
4. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007*). Mims' Medical Microbiology*. 4th edition. Elsevier
5. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott, Harley and Klein's *Microbiology*. 9th edition. McGraw Hill Higher Education

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	2	-	-	3	-	-	-	3	-	-	2	-	-	-	-	-	3
CO2	3	-	1	2	-	-	-	-	-	-	2	-	-	-	-	3	-
CO3	2	-	-	3	-	-	-	3	2	-	3	-	-	-	-	3	-
CO4	2	-	-	-	-	-	-	3		-	-	-	-	-	-	3	-
CO5	1	-	3	-	-	-	-	3	2	-	-	-	-	-	-	-	3
Average	**2**	-	**2**	**2.6**	-	-	-	**3**	**2**	-	**2.33**	-	-	-	-	**3**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester IV

24VAC401 UNIVERSAL HUMAN VALUES 2H-1C

Instruction Hours/week: L:2 T:0 P:0 **Marks:** Internal**:100** External**: - T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not Required

COURSE OBJECTIVES (CO):

- To develop the holistic perspective based on self-exploration about themselves, family, society and nature/existence.
- To understand harmony in themselves, family, society and nature/existence.
- To strengthen the self-reflection.
- To develop the commitment and courage to act.

COURSE OUTCOMES (COs):

At the end of this course, students will be able to

COs	Course Outcomes	Blooms Level
CO1	Become more aware of themselves and their surroundings (family, society, nature).	Understand
CO2	Be more responsible in life.	Apply
CO3	Deal with problems with sustainable solutions, while keeping human relationship and human nature in mind.	Analyze
CO4	Develop consciousness of themselves through the control of mind.	Evaluate
CO5	Nurture human to live with mutual happiness and prosperity with rest of nature	Analyze

UNIT I INTRODUCTION 5 HOURS

Purpose and motivation for the course, recapitulation from universal human values I. Self-exploration-what is it? – its content and process; 'Natural Acceptance' and Experiential Validation- as a process for self-exploration. Continuous Happiness and prosperity. A look at basic human Aspiration. Right understanding, Relationship and physical Facilities-the basic requirements for fulfillment of aspirations of every human being with their correct priority. Understanding Happiness and prosperity correctly- A critical appraisal of the current scenario. Method of fulfill the above human aspirations: understanding and living in harmony at various levels.

UNIT II UNDERSTANDING HARMONY IN THE HUMAN BEING – HARMONY IN MYSELF 5 HOURS

Understanding human being as a co-existence of the sentiment 'I' and the material 'Body'. Understanding the needs of self ('I') and 'Body' – sukh and Suvidha. Understanding the body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and helth; correct appraisal of physical needs, meaning of prosperity in detail. Programs to ensure Sanyam and health.

UNIT III UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY-HARMONY IN HUMANHUMAN RELATIONSHIP 5 HOURS

Understanding values in human-human relationship; meaning of justice (nine universal values in relationship) and program for its fulfillment to ensure mutual happiness; Trust and respect as the foundational values of relation, Understanding the meaning of trust; Difference between intention and competence understanding the meaning of respect, Difference between respect and differentiation; the other salient values in relationship. understanding harmony in the family and society (society being an extension of family):

Resolution, prosperity, fearlessness and coexistence as comprehensive human goals. Visualizing a universal harmonious order in society- undivided society, universal order- from family to world family.

UNIT IV UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE- WHOLE EXISTENCE AS CO- EXISTENCE 4 HOURS

Understanding harmony in the nature, Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature. Understanding existence as co-existence of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence.

UNIT V IMPLICATION OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS 5 HOURS

Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics: a) Ability to utilize the professional competence for augmenting universal human order b) Ability to identify the scope and characteristics of people-friendly and ecofriendly production systems, c) Ability to identify and develop appropriate technologies and management patters for above production systems. Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers b) At the level of society: as mutually enriching institutions and organizations.

Total: 24 HOURS

TEXT BOOKS:

1. Gaur,R.R, Sangal,R and Bagaria,G.P,(2010). A foundation course in Human Values and professional Ethics, Excel books, New Delhi.
2. Schumacher. E.F, Small is Beautiful: Economics as If People Mattered, Perennial Library.
3. Cecile Andrews, (2006). Slow is Beautiful, New Society Publishers.

REFERENCE BOOKS:

1. Joseph Cornelius Kumaruppa, (Digitized 30 Oct 2019). The Economy of Permanence.
2. Mahatma Gandhi, (1983). The Story of My Experiments with Truth.
3. Maulana Abul Kalam Azad, (2017). India Wins Freedom, Create Space Independent Publishing Platform.
4. Romain Rolland, (1952). The Life of Vivekananda and the Universal Gospel, Advaita ashrama.

WEB SITES:

1. http://www.arvindguptatoys.com/arvindgupta/gandhiexperiments.pdf
2. http://www.sanipanhwar.com/India%20Wins%20Freedom%20%20Maulana%20Abul%20Kalam%20Azad
3. https://estudantedavedanta.net/The-Life-Of-Vivekananda-And-The-Universal-Gospel.pdf

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	-	-	2	1	-	-	-	-	-	-	-	3	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	
CO3	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	3	-	-	-	-	-	-	-	-	-	-	3	2	-
Average	-	-	2	2	2		3	-	-	-	-	-	-	-	3	2.5	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester V

24MBU501 INDUSTRIAL MICROBIOLOGY AND BIOTECHNIQUES 5H-4C

Instruction Hours/week: L:5 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Microbial Physiology and Metabolism (24MBU201)

COURSE OBJECTIVES (CO):

- To empower for the employability skill by the use of microorganisms in the production of food or industrial products.
- To cover the principles of various processes associated with the production and recovery of different bio-products derived from microorganisms.
- To deliver the large-scale production of microbial products techniques in advanced level.

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Comprehend and apply fermentation processes for the production of microbial products	Apply
CO2	Perform microbial product extraction, separation and recovery	Apply
CO3	Learn and practice instrumentation and biotechniques	Apply
CO4	Execute microbial production of industrial products	Apply
CO5	Develop designer microbes for food, energy and health care products	Create

Unit I Screening of Industrial Important Microbes 12 HOURS

Exploitation of microbes and their products. Sources of industrially important microbes and methods for their isolation, primary and secondary screening methods. Strain improvement method (protoplast fusion, mutation and recombinant DNA technology). Preservation and maintenance of industrial strains. Cell growth kinetics- Kinetics of Substrate utilization.

Unit II Upstream Process 12 HOURS

Media formulation. Types of fermentation processes – Solid-state and liquid-state (stationary and submerged) fermentations; batch, fed-batch and continuous fermentations. Design of laboratory bioreactor. Types of bioreactors – Laboratory, pilot- scale and production fermenters, constantly stirred tank and air-lift fermenters.

Unit III Downstream Process 12 HOURS

Downstream processing-techniques and methods: Stages in downstream processing. Separation of cells– filtration and centrifugation. Cell disruption– physical, chemical and enzymatic methods. Product separation-solvent extraction and precipitation. Lyophilization and spray drying, freeze drying and vacuum drying. Immobilization, Methods of immobilization, advantages and applications of immobilization.

Unit IV Instrumentation 10 HOURS

Principle, Instrumentation and application of spectrophotometer, colorimeter and turpido meter. MALDI-TOF, FTIR, MS, Nuclear Magnetic Resonance, ESR. Principles and applications of paper chromatography (including Descending and 2-D), Thin layer chromatography. Column Chromatography - packing types (IEC, AC, SEC), fraction collection. Nano LC, CGMS, LCMS, HPLC and Gel filtration chromatography.

Unit V Microbial production of industrial products **14 HOURS**

Citric acid, Ethanol, Penicillin, Bacitracin, Chloramphenicol, monoclonal antibodies, Glutamic acid, Vitamin B12, Enzymes (DHA, amylase, protease, lipase, chitinase) Wine, Beer, probiotics (*Lactobacillus*, *Bacillus* and yeast) Development of designer microbes for food, energy and health care products.

Total: 60 HOURS

TEXT BOOKS:

1. Crueger W and Crueger A. (2017). *Biotechnology: A textbook of Industrial Microbiology*. 3rd edition. Panima Publishing Co. New Delhi.
2. Stanbury F, Whitaker A and Hall SJ. (2016). *Principles of Fermentation Technology*.3rd edition, Elsevier Science Ltd

REFERENCE BOOKS:

1. Nduka Okafor, Benedict C. Okeke (2017). *Modern Industrial Microbiology and Biotechnology*, 2nd Edition, CRC Press.
2. Geoffrey MGadd, Sima Sariaslani (2015). *Advances in Applied Microbiology*, CRC Press.
3. Mansi El-Mansi (2012). *Fermentation Microbiology and Biotechnology*, CRC Press.
4. E M T El-Mansi, Jens Nielsen, David Mousdale (2019). *Fermentation Microbiology and Biotechnology*, Fourth Edition, CRC Press

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	2	-	-	2	-	-	-	3	-	-	-	-	-	-	-	-	3
CO2	3	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	3
CO3	-	-	-	2	-	-	-	3	-	-	-	-	-	-	-	-	3
CO4	2	-	-	3	-	-	-	3	-	-	-	-	-	-	-	-	3
CO5	1	-	1	3	-	-	-	3	2	-	-	-	-	-	-	-	3
Average	**1.6**	-	**1**	**2.5**	-	-	-	**3**	**2**	-	-	-	-	-	-	-	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester V

24MBU502 **MICROBIAL BIOTECHNOLOGY** **5H-4C**

Instruction Hours/week: L:5 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Microbial Physiology and Metabolism (24MBU201)

COURSE OBJECTIVES (CO):

- To gain knowledge about the Industrially important microorganisms &nutritional requirements.
- To understand the industrially important microorganisms' commercial value and importance of patent and IPR.
- To describe about different sewage treatment methods employed in waste water treatment. know the microorganisms responsible for water pollution.

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand the role of microorganisms in fermentation technology	Understand
CO2	Learn and practice techniques in the production of vaccines, polymers and bioplastics	Apply
CO3	Apply techniques in production of microbe-based products such as vitamins, organic acids and antibiotics	Apply
CO4	Use downstream process techniques in purification and recovery of microbial products	Apply
CO5	Practice valorisation techniques for waste management and production of biofue	Apply

Unit I **12 HOURS**

Microbial biotechnology and its applications in human therapeutics, agriculture (Biofertilizers, PGPR, Mycorrhizae), biostimulants environmental, and food technology. Use of prokaryotic and eukaryotic microorganisms in biotechnological applications. Genetically engineered microbes for industrial application: Bacteria and yeast. Brief history of fermentation- Fermentation, general concepts and application of fermentation.

Unit II **12 HOURS**

Recombinant microbial production processes in pharmaceutical industries - Streptokinase, recombinant vaccines (Hepatitis B vaccine). Microbial polysaccharides and polyesters, Microbial production of bio-pesticides, bioplastics, Microbial biosensors. Biotechnological application of microalgae- Food, Feed, colorant, fuel and aquaculture feed.

Unit III **12 HOURS**

Microbial based transformation of steroids and sterols. Bio- analytic processes and their industrial applications: Production of high fructose syrup and production of cocoa butter substitute. Phage typing, gene therapy. Biotransformation of antibiotics. Industrial production of organic acids & vitamins. Importance of microbes in industry-microbial biomass, microbial enzymes and microbial recombinant products.

Unit IV **12 HOURS**

Microbial product purification: filtration, ion exchange &affinity chromatography techniques Immobilization metho and their application: Whole cell immobilization. drug resistance, therapeutics and host pathogen interactions. MDR, XDR and PDR resistance mechanism.

Unit V **12 HOURS**

Bioethanol and bio-diesel production: commercial production from lignocellulosic waste and algal biomass. Biogas production: Methane and hydrogen production using microbial culture. Microorganisms in bioremediation: Degradation of xenobiotics, mineral recovery, removal of heavy metals from aqueous effluents. Microbial Valorization of Plastic Wastes.

Total: 60 HOURS

TEXT BOOKS:

1. Ratledge, Cand Kristiansen, B. (2001). Basic Biotechnology, 2nd edition, Cambridge University Press.
2. Prescott, Harley and Klein's Microbiology (2014). Willey J.M., Sherwood L. M, Woolverton CJ. 9th edition, Mc Graw Hill Publishers.
3. Gupta PK (2009). *Elements of Biotechnology* 2nd edition, Rastogi Publications.
4. Satyanarayana T. and Johri B.N. (2015). *Microbial diversity, Current Perspectives and Potential Applications*, IK international.

REFERENCE BOOKS:

1. Swartz, J.R. (2001). Advances in *Escherichia coli* production of therapeutic proteins. Current Opinion inBiotechnology,12, 195–201.
2. Glazer A N and Nikaido H. (2007). *Microbial Biotechnology*, 2nd edition, Cambridge University Press.
3. Glick B. R., Pasternak J. J. and Patten C L. (2010.). *Molecular Biotechnology* 4th edition, ASM Press.
4. Poonam Singh and Ashok Pandey, (2019). *Biotechnology for agro-Industrial residues* utilization. Springer.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	2	-	-	-	-	2	-	-	2	-	-	-	-	3
CO2	2	-	-	3	3	-	-	3	-	-	-	-	-	-	-	-	3
CO3	2	-	-	3	3	-	-	3	-	-	-	-	-	-	-	-	3
CO4	1	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	3
CO5	3	-	-	3	3	-	-	3	-	-	2	-	-	-	-	-	3
Average	**2.2**	**-**	**-**	**3**	**3**	**-**	**-**	**3**	**2**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester V

24MBU503 RECOMBINANT DNA TECHNOLOGY 5H-4C

Instruction Hours/week: L:5 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Molecular Biology (24MBU403A)

COURSE OBJECTIVES (CO):

- To understand the various concepts of cloning vectors and cloning strategies
- To familiarize the students to tools and techniques in genetic engineering and recombinant DNA technology.
- To offer applications of DNA modifying enzymes, cloning strategies, vector types, host genotype specificities for selection and screening of recombinants and/or recombinant transformants

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Explore the role of various enzymes in cloning techniques	Apply
CO2	Learn and practice methods in gene transformation	Apply
CO3	Apply PCR, sequencing techniques and microarray techniques in Genetic engineering	Apply
CO4	Analyse the products of recombinant technology	Analyze
CO5	Perform modern techniques in gene therapy, gene editing, protein engineering and gene silencing	Apply

Unit I **12 HOURS**

Milestones in genetic engineering and Biotechnology cloning Tools - Restriction modification systems – Types I, II and III. Mode of action, nomenclature, applications of Type II restriction enzymes in genetic engineering. DNA modifying enzymes and their applications – DNA polymerases, DNA ligases, Topoisomerase, gyrases, Terminal deoxynucleotidyl transferase, kinases and phosphatases.

Unit II **12 HOURS**

Cloning Vectors: - Definition and Properties Plasmid vectors – pBR 322 and pUC Vector, Bacterio phage – lambda(λ) and M13 based vectors Cosmids, BACs, YACs. Use of linkers and adaptors. Expression vectors- *E. coli* lac and T7 promoter - based vectors, yeast – YIp, Yep and YCp vectors, Baculovirus based vectors, mammalian – SV- 40- based expression vectors

Unit III **12 HOURS**

Transformation of DNA – Chemical method, Electroporation. Gene delivery – Micro injection, electroporation, biolistic method (gene gun), liposome and viral – mediated delivery, *Agrobacterium*- mediated delivery DNA, RNA and Protein analysis – Agarose gel electrophoresis, Blotting techniques - Southern, Northern, Western blotting, dot blot, SDS - PAGE.

Unit IV **10 HOURS**

PCR – Basics of PCR, RT - PCR, Real - Time PCR(Quantitative), Multiplex PCR, Sybr Green PCR, Sanger's method of DNA Sequencing, traditional and automated sequencing. Primer walking and shotgun sequencing, Methylation sequencing and RNA sequencing. Microarrays – DNA and Protein microarray.

Unit V **14 HOURS**

Construction of Genomic and cDNA libraries, screening of libraries: Colony hybridization and colony PCR, Chromosome walking and chromosome jumping. Products of recombinant DNA technology – Products of human therapeutic interest - insulin, hGH. Bt transgenic-cotton, brinjal, recombinant vaccines, protein engineering and site directed mutagenesis. Gene therapy, Replacement and augmentation, gene correction, gene editing, gene silencing, SiRNA, miRNA, Antisense RNA, CRISPR/Cas9.

Total: 60 HOURS

TEXT BOOKS:

1. Brown TA. (2010). *Gene Cloning and DNA Analysis*. 6th edition. Blackwell Publishing, Oxford, U. K.
2. Sambrook J and Russell D. (2001). *Molecular Cloning-A Laboratory Manual*. 3rd edition. Cold Spring Harbor Laboratory Press.

REFERENCE BOOKS:

1. Clark DP and Pazdernik NJ. (2009). *Biotechnology: Applying the Genetic Revolution*. Elsevier Academic Press, USA.
2. Primrose SB and Twyman RM. (2006). *Principles of Gene Manipulation and Genomics*, 7th edition. Blackwell Publishing, Oxford, U.K.
3. Wiley JM, Sherwood LM and Woolverton CJ. (2008). Prescott, Harley and Klein's *Microbiology*. McGraw Hill Higher Education.
4. Primrose SB and Twyman RM. (2008). *Genomics: Applications in human biology*. Blackwell Publishing, Oxford, U.K.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	3	-	-		-	-	-	-	-	-	-	-	3
CO2	-	-	-	2	-	-	-	3	-	-	-	-	-	-	-	-	3
CO3	-	-	-	2	-	-	-	3	-	3	2	-	-	-	-	-	3
CO4	-	-	-	-	3	-	-	2	-	-	2	-	-	-	-	-	3
CO5	-	-	-	-	2	-	-	3	-	2	1	-	-	-	-	-	3
Average	**3**	**-**	**-**	**2**	**3**	**-**	**-**	**3**	**-**	**2.5**	**2**	**-**	**-**	**-**	**-**	**-**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester V

24MBU504A **BIOINFORMATICS** **5H-4C**

Instruction Hours/week: L:4 T:1 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To detail the importance of computer in field of life sciences
- To provide an overview of various bioinformatics tools, databases available and sequence analysis
- To provide knowledge on database concept, management, retrieval along with utilization in gene and protein analysis

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Provide computational skill on search engines and various software tools involved in bioinformatics	Understand
CO2	Make use of biological databases for nucleic acid, genome, protein sequence and structure	Apply
CO3	Retrieve information from available databases and use them for microbial identifications and drug designing	Apply
CO4	Analyse modification gene and protein structures in simulated systems.	Analyze
CO5	Understand and perform sequence alignment and analysis and Protein structure prediction	Apply

Unit I **10 HOURS**

History of computers, Basics of Computer and operating systems, Data Representation, Data Abstraction, Concepts of flowcharting and algorithm development. Database, Database Management system, RDBMS - Definition of relational database. Mode of data transfer (FTP, SFTP, SCP), advantage of encrypted data transfer.

Unit II **12 HOURS**

Biological databases – nucleic acid, genome, protein sequence and structure, gene expression databases, Database of metabolic pathways, Mode of data storage - File formats - FASTA, Genbank and Uniprot, Data submission & retrieval from NCBI, EMBL, DDBJ, Uniprot, PDB, SWISS- Prot, Specialized Databases. Gene prediction tools, ORF Prediction tool.

Unit III **14 HOURS**

Local and Global Sequence alignment, pairwise and multiple sequence alignment. Scoring an alignment, scoring matrices, PAM & BLOSUM series of matrices. Types of phylogenetic trees, Different approaches of phylogenetic tree construction - UPGMA, Neighbor joining, Maximum Parsimony, Maximum likelihood. Introduction to Genomics, Proteomics, Transcriptomics, Systems biology and Infectomics.

Unit IV **12 HOURS**

Diversity of Genomes: Viral, prokaryotic & eukaryotic genomes Genome, transcriptome, proteome, 2-D gel electrophoresis, MaldiT of spectroscopy. Major features of completed genomes: *E.coli, S.cerevisiae*, Arabidopsis, Human. Genomic database SGD, TIGR.

Unit V **12 HOURS**

Hierarchy of protein structure - primary, secondary and tertiary structures, modeling. Structural Classes, Motifs, Folds and Domains. Protein structure prediction in presence and absence of structure template Energy minimizations and evaluation by Ramachandran plot Protein structure and rational drug design. Recent software and tools.

Total: 60 HOURS

TEXT BOOKS:

1. Saxena Sanjay (2003). *A First Course in Computers*, Vikas Publishing.
2. Lesk M.A. (2008). *Introduction to Bioinformatics*. Oxford Publication, 3rd International Student Edition.
3. Pradeep and Sinha Preeti (2007). *Foundations of Computing*, 4th ed., BPB Publications.

REFERENCE BOOKS:

1. Rastogi S.C., Mendiratta N. and Rastogi P. (2007). *Bioinformatics: methods and applications, genomics, proteomics and drug discovery*, 2nd ed. Prentice Hall India Publication.
2. Primrose and Twyman (2003). *Principles of Genome Analysis & Genomics*. Blackwell.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	2	-	-	-	-	2	2	3	-	-	-	-	-	3	-
CO2	-	-	-	-	-	-	-	2	-	3	-	-	-	-	-	-	3
CO3	2	-	-	2	-	-	-	-	-	2	-	-	-	-	-	-	3
CO4	-	-	-	-	2	-	-	-	-	2	-	-	-	-	-	-	3
CO5	3	-	-	-	2	-	-	-	-	2	-	-	-	-	-	-	3
Average	**2.66**	**-**	**2**	**2**	**2**	**-**	**-**	**2**	**2**	**2.4**	**-**	**-**	**-**	**-**	**-**	**3**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester V

24MBU504B METAGENOMICS AND FORENSIC MICROBIOLOGY 5H-4C

Instruction Hours/week: L:4 T:1 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Bioinformatics (24MBU504A)

COURSE OBJECTIVES (CO):

- To teach the students to basic and high throughput techniques in Genomics and Proteomics and their applications.
- To Teach Sequencing of DNA and its applications in human health.
- To present methods and experimental tools used in modern genomics with emphasis on prokaryotes and eukaryotes.

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Comprehend the basic concepts of genomics, transcriptomics and proteomics and metagenomics techniques	Understand/ Apply
CO2	Understand and analyse the Human genome project	Analyze
CO3	Make use of molecular and epidemiological tools for identifying pathogens	Apply
CO4	Experiment with Computational methods for identification of polypeptides	Apply
CO5	Utilize various databases for analysis of protein- protein interactions	Apply

UNIT I Introduction about metagenomics **12 HOURS**

Need of Metagenomics, Omics: Stream of omics- Proteomics, Genomics, Metabolomics, Lipidomics and Epigenomics. Role of omics in Microbiology, Application of Metagenomics.

UNIT II Metagenomic Techniques **12 HOURS**

Introduction – Shot gun sequencing Vs 16S sequencing. Metagenomics Technique: Sample processing, Metagenomic DNA extraction, NGS (Next generation sequencing), Binning, Annotation, Data analysis.

UNIT III Genomics **12 HOURS**

Genome projects: The Human genome project, Structural genomics: Assembly of a contiguous DNA sequence- shotgun method, clone contig method, and whole –genome shotgun sequencing. Determining the functions of individual genes and by studying the activity of a protein coded of an unknown gene. Synthetic genomes and their applications

UNIT IV Molecular and Epidemiological tools **10 HOURS**

Nucleic amplification and molecular epidemiological techniques are essential tools in clinical microbiology for identifying pathogens. Typing tools for Phylogenetic study.

UNIT V Protein arrays **14 HOURS**

Basic principles. Computational methods for identification of polypeptides from mass spectrometry. Protein arrays: bioinformatics-based tools for analysis of proteomics data (Tools available at ExPASy Proteomics

server); databases (such as InterPro) and analysis tools. Protein-protein interactions: databases such as DIP, PPI server and tools for analysis of protein- protein interactions.

Total: 60 HOURS

TEXT BOOKS:

1. Brown T. A. 2007, *Genomes 3*. Garland Science Publishing, New York.
2. Primrose, S. B., and R. M. Twyman. 2006. *Principles of gene manipulation and Genomics*, Blackwell Publishing MA. USA.
3. Graur, D and W H Li, 2000. *Fundamentals of molecular evolution*. Sinauer Associates.
4. Pevsner, J. (2003). *Bioinformatics and Functional Genomics* by John Wiley and Sons, New Jersey, USA.

REFERENCE BOOKS:

1. Dunham, I., 2003. *Genome Mapping and sequencing*. Horizon Scientific
3. Hartwell, L. H., L. Hood, M. L. Goldberg, A. E. Reynolds, L. M. Silver and R. G. Veres. 2004. *Genetics from Genes to Genomes*. McGraw Hill.
4. Lewin B. 2003. *Genes VIII*. Oxford University Press. Oxford.
5. A. Malcolm Campbell and Laurie J. Heyer (2006). *Discovering Genomics, Proteomics and Bioinformatics* 2nd edition - by by Cold Spring Harbor Laboratory Press.
6. Primrose, S.B. and Twyman, R.M. (2003). *Principles of Genome Analysis and Genomics* (3rd Ed.) by Blackwell Publishing Company, Oxford, UK.
7. Liebler, D.C. (2002). *Introduction to Proteomics – Tools for the new biology* (1st Ed.). Humana Press Inc., New Jersey, USA.
8. Mount, D. (2004). *Bioinformatics: Sequence and Genome Analysis*. Cold Spring Harbor Laboratory Press, New York.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	2	-	-	-	1	-	2	-	-	-	-	-	-	3
CO2	-	-	2	-	-	-	-		-	1	-	-	-	-	-	-	3
CO3	3	-	-	-	3	-	-	2	-	-	-	-	-	-	-	-	3
CO4	2	-	-	-	-	-	-	2	-	3	-	-	-	-	-	-	3
CO5	-	-	-	2	-	-	-	2	-	2	2	-	-	-	-	-	3
Average	**2.66**	**-**	**2**	**2**	**3**	**-**	**-**	**1.75**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester V

24MBU504C DIOGNOSTIC MICROBIOLOGY 5H-4C

Instruction Hours/week: L:4 T:1 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To introduces basic principles and then applies clinical relevance of manyetiological agents.
- To provide the basic principles of medical microbiologyand infectious disease, and mechanisms of infectious disease transmission, principles of aseptic practice
- To focus on pathogenic mechanisms in order to foster a student's ability to solve problemsin their future clinical career

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	**Course Outcomes**	**Blooms Level**
CO1	Demonstrate an advanced level of microbial virulence mechanisms and host response to infection.	Understand
CO2	Apply molecular techniques to medical microbiology	Apply
CO3	Demonstrate skin and respiratory tract infections to identify a unknown organisms in clinical samples	Understand/ Apply
CO4	Apply diagnostic skills, and interpretation of laboratory tests in the diagnosis of infectious diseases.	Apply
CO5	Understand pathogenic bacteria in human disease with respect to infections of the respiratory tract, gastrointestinal tract, urinary tract, skin and soft tissue.	Understand

Unit I Isolation and identification of pathogens **13 HOURS**

Laboratory precaution and guidelines - Collection of clinical specimens - Blood, Urine, Sputum, Pus, CSF, Stool, Throat swab, Semen, Dental plaque - transport Media and its types - handling and examination of pathological specimens - Routine Laboratory diagnosis of bacterial pathogen -Antibiotic susceptibility testing. Quality control in microbiology lab, clean room maintenance and surveillance, face mask porosity testing- Bacterial Filtration Efficiency (BFE).

Unit II Infections **12 HOURS**

Infections - types of infections - methods of infections - Sources of infections - infectious disease cycle. Biomedical waste management. Definitions of Epidemics, Endemics Pandemics and investigation of epidemics and control. Definition of pathogens, Saprophytes and Commensal.

Unit III Gram positive organisms **11 HOURS**

Morphology, cultural characteristics, antigenic property, pathogenicity, laboratory diagnosis and treatment. *Staphylococcus* sp., *Streptococcus* sp., *Bacillus* sp., *Corynebacterium* sp., *Clostridium sp. Mycobacterium* sp.

Unit IV Gram negative organisms **12 HOURS**

Morphology, cultural characteristics, antigenic property, pathogenicity, laboratory diagnosis andtreatment. *E.coli*, *Klebsiella* sp., *Proteus* sp., *Pseudomonas* sp., *Vibrio* sp., *Salmonella* sp., *Shigella* sp.,*Treponema* sp., *Leptospira* sp; *Neisseria* sp. and *Haemophilus* sp.

Unit V Infection and Therapy **12 HOURS**

Nosocomial infection - Urinary tract infection, Respiratory tract infection, sexually transmitteddisease - Monoprophylaxis - Antimicrobial chemotherapy and antibiotics. Antibacterial resistance- Inhibitors of nucleic acid synthesis, inhibitors of protein synthesis and inhibitors of cell membrane synthesis. Vaccines - Types - Vaccination schedule.

TOTAL: 60 HOURS

TEXT BOOKS:

1. Ananthanarayanan, R., and Panicker, C.K.J. (2017). *Text Book of Microbiology* (10thed.).The Orient Blackswan.
2. Carl Fraenkel (2012). *Text book of bacteriology*. Printing company publishers, NewYork.

REFERENCE BOOKS:

1. Salle, A.J. (2008). *Fundamentals principles of bacteriology*. T.M.H. Ed.). McGraw Hill.
2. Brook,G.F., J., Butel, S., Stephen, A., and Morse, A., (2003). *Medical Microbiology*,(22nded.). McGraw Hill.
3. Jawetz, E., Melnic, J.L., and Adelberg, E.A., (2019). *Medical Microbiology*. (28thed.).Lange Medical Publishers. NY.

CO, PO, PSO Mapping

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PO1 3	PO1 4	PO1 5	PSO 1	POS 2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	3
CO2	2	-	2	3	-	-	-	2	-	-	-	-	-	-	-	2	3
CO3	3	-	-	2	-	-	-	-	-	-	-	-	-	-	-	3	2
CO4	-	-	-	3	-	-	-	-	-	2	-	-	-	-	-	3	-
CO5	3	-	3	2	-	-	-	2	-	-	-	-	-	-	-	-	3
Average	**3**	**-**	**2.5**	**2.5**	**-**	**-**	**-**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**2.5**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester V

24MBU511 INDUSTRIAL MICROBIOLOGY AND BIOTECHNIQUES - PRACTICAL 4H-2C

Instruction Hours/week: L:0 T:0 P:4 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 9 Hours

PREREQUISITE:

- Industrial Microbiology and Biotechniques (24MBU501)

COURSE OBJECTIVES (CO):

- To use chromatographic techniques
- To know about electrophoresis techniques for protein separation
- To understand centrifuge techniques for separation of various components

COURSE OUTCOME (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Demonstrate different fermenter types	Understand
CO2	Use fermentation techniques for enzyme and organic acid production	Apply
CO3	Evaluate the quality of probiotics in tablets and nutritional supplements	Evaluate
CO4	Utilize chromatography techniques for separation of mixtures	Apply
CO5	Make use of electrophoresis and centrifuge techniques for protein separation	Apply

EXPERIMENTS (48 HOURS)

1. Study of different parts of fermenter
2. Microbial fermentation – Production and estimation of enzyme – Amylase and Protease
3. Microbial fermentation – Production and estimation of organic acid- Citric acid
4. Assess quality of probiotics in tablets and nutritional supplements, stability of vials at different time.
5. Perform Cell growth kinetics.
6. Separation of mixtures by paper/thin layer chromatography.
7. Demonstration of column chromatography packing.
8. Separation of protein mixtures by SDS- Poly Acrylamide Gel Electrophoresis (SDS - PAGE).
9. Separation of components of a given mixture using a laboratory scale centrifuge.

TEXT BOOKS: **Total: 48 HOURS**

1. Nigam A and Ayyagari A. (2007). *Lab Manual in Biochemistry, Immunology and Biotechnology*. Tata McGraw Hill

2. Crueger Wand Crueger A. (2017). *Biotechnology: A textbook of Industrial Microbiology*. 3rd edition. Panima Publishing Co. New Delhi.
3. Geoffrey M Gadd, Sima Sariaslani (2015). *Advances in Applied Microbiology*, CRC Press.

REFERENCE BOOKS:

1. Nduka Okafor, Benedict C. Okeke (2017). *Modern Industrial Microbiology and Biotechnology*, 2nd Edition, CRC Press.
2. Stanbury PF, Whitaker A and Hall SJ. (2006). *Principles of Fermentation Technology*.2nd edition, Elsevier Science Ltd.
3. E.M TEl-Mansi, Jens Nielsen, David Mousdale (2009). *Fermentation Microbiology and Biotechnology*, Fourth Edition, CRC Press.

4. Karp G. (2010). *Cell and Molecular Biology: Concepts and Experiments*. 6th edition. John Wiley & Sons. Inc.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	2	-	-	2	-	-	-	3	-	-	-	-	-	-	-	-	3
CO3	3	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	3
CO4	2	-	-	3	-	-	-	2	-	-	-	-	-	-	-	-	3
CO5	3	-	-	2	-	-	-	2	-	-	-	-	-	-	-	-	3
Average	**2.6**	**-**	**-**	**2**	**-**	**-**	**-**	**2.25**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester V

24MBU512 MICROBIAL BIOTECHNOLOGY AND RECOMBINANT DNA - PRACTICAL4H-2C

Instruction Hours/week: L:0 T:0 P:4 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 6 Hours

PREREQUISITE:

- Environmental Microbiology (24MBU502)
- Recombinant DNA Technology (24MBU503)

COURSE OBJECTIVES (CO):

- To Impart a skill-based knowledge on bacterial and fungal isolation.
- To appreciate the diversity of microbial communities in water samples and the potability of water
- To learn competent cell preparation and DNA isolation from microbes

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

Cos	**Course Outcomes**	**Blooms Level**
CO1	Examine soil - pH, moisture content, water holding capacity, percolation, capillary action, isolation of bacteria and fungi from rhizosphere	Analy
CO2	Measure potability, BOD and COD of wastewater sample	Analy
CO3	Make use of Gel Electrophoresis for protein resolution and visualization	Apply
CO4	Practice competent cell preparation	Apply
CO5	Experiment with isolation of genomic and plasmid DNA from microbes	Apply

EXPERIMENTS **(48 HOURS)**

1. Yeast cell immobilization in calcium alginate gels and storage stability.
2. Enzyme immobilization by sodium alginate method and storage stability.
3. Pigment production from Bacteria.
4. Enzyme estimation - Isolation of *xylanase* or *lipase* producing bacteria.
5. Production of Microbial Biomass in bioreactor.
6. Production of algal Single Cell Proteins.
7. Resolution and visualization of proteins by SDS – Polyacrylamide Gel Electrophoresis (SDS-PAGE).
8. Competent cell preparation
9. Isolation of genomic DNA from *E. coli.*
10. Isolation of plasmid from *E. coli.*

TEXTBOOKS: **Total: 48 HOURS**

1. Maier RM, Pepper IL and Gerba CP. (2009). *Environmental Microbiology*. 2nd edition, Academic Press.

2. Coyne MS. (2001). *Soil Microbiology: An Exploratory Approach*. Delmar Thomson Learning.

3. Madigan MT, Martinko JM and Parker J. (2014). *Brock Biology of Microorganisms*. 14th edition. Pearson/Benjamin Cummings.

4. Willey JM, Sherwood LM, Woolverton CJ, Prescott, Harley (2014). Klein's *Microbiology* by 9th edition, McGraw Hill Publishers.
5. Ratledge, C and Kristiansen, B. (2001). *Basic Biotechnology*, 2nd edition, Cambridge University Press.

6. Gupta PK. (2009). *Elements of Biotechnology* 2nd edition, Rastogi Publications.

REFERENCE BOOKS:

1. Glazer AN and Nikaido H (2007). *Microbial Biotechnology*, 2nd edition, Cambridge University Press.
2. Glick BR, Pasternak JJ, and Patten CL (2010). *Molecular Biotechnology* 4th edition, ASM Press.
3. Corinne Whitby, Torban Lund Skovhus, (2018). *Applied Microbiology and molecular biology in oil field systems*, Springer.
4. Head, Steven R., Ordoukhanian, Phillip, Salomon, Daniel R (2018*). Next Generation Sequencing Methods and Protocol*. Springer.
5. Izard, Jacques., Rivera, Maria. (2014). *Metagenomics for Microbiology*. Elsevier.
6. Willey JM, Sherwood LM, and Woolverton CJ. (2013). *Prescott's Microbiology*. 9thedition. McGraw Hill Higher Education.
7. Singh A, Kuhad, RC & Ward OP (2009). *Advances in Applied Bioremediation*. Volume17, Springer-Verlag, Berlin Hedeilberg.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	2	3	-	-	-	2	-	-	-	-	-	-	-	3	-
CO2	3	-	1	2	2	-	-	2	-	-	-	-	-	-	1	3	-
CO3	2	-	1	2	-	-	-	3	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	3	-	-	-	-	1	-	-	-	3
CO5	3	-	-	-	-	-	-	3	2	-	-	-	-	-	-	-	3
Average	**2.33**	**-**	**1.33**	**2.5**	**2**	**-**	**-**	**2.6**	**2**	**-**	**-**	**-**	**1**	**-**	**1**	**3**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester V

24MBU591	**INTERNSHIP**	**2C**

Instruction Hours/week: L:0 T:0 P:4 **Marks:** Internal**:100** External**:0 T**otal**:100**

End Semester Exam: -

Semester VI

24MBU601 **FOOD AND DAIRY MICROBIOLOGY** **5H-4C**

Instruction Hours/week: L:5 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To understand food spoilage microorganisms.
- To understand the microbiology of food preservation and food commodities; fermented and microbial foods;
- To study the micro biological quality control, and quality schemes.

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Comprehend the existence of microbes in food and food spoilage	Understand
CO2	Make use of methods of food preservation in industries	Apply
CO3	Develop fermented dairy products and probiotics and prebiotics	Create
CO4	Analyse the characteristics of food-borne, waterborne and spoilage microorganisms, and methods for their isolation, detection and identification.	Analyze
CO5	Experiment with Biosensors in food processing	Apply

Unit I **(12 HOURS)**

Food and microorganisms – Important microorganisms in food (bacteria, molds and yeast). Sources of contamination of food. Intrinsic and extrinsic factors that affect growth and survival of microbes in foods. Microbial spoilage of various foods–Spoilage of vegetables, fruits, meat, eggs, milk and butter, bread, canned Foods and sea food.

Unit II **(12 HOURS)**

General principles of food preservation. Physical methods of food preservation: asepsis, removal of microorganism, drying, temperature (low, high), radiation, Chemical methods of food preservation, Canning, food additives, flavoring agents and enzyme preparation.

Unit III **(10 HOURS)**

Fermented dairy products: yogurt, acidophilus milk, kumiss, kefir and cheese. Other fermented foods: Idly, sauerkraut, soy sauce and tampeh. Prebiotics and Probiotics: Health benefits, types of microorganisms used, probiotic foods available in market. Beneficial uses of microorganisms in food industry.

Unit IV **(14 HOURS)**

Causative agents, foods involved, symptoms and preventive measures of the following diseases, Food intoxications: *Staphylococcus aureus, Clostridium botulinum* and mycotoxins. Food infections: *Bacillus cereus, Vibrio parahaemolyticus, Escherichia coli*, Salmonellosis, Shigellosis, *Yersinia enterocolitica, Listeria monocytogenes* and *Campylobacter jejuni*, fungal diseases (Mycotoxins, Aflatoxins, *Alternaria* toxins).

Unit V **(12 HOURS)**

Cultural and rapid detection methods of food borne pathogens in foods and introduction to predictive microbiology. HACCP, FSSAI (ISO9001:2008) Indices of food sanitary quality (record maintenance and standards) sanitizers. Quality control of milk – MBRT, Litmus Milk – Alkaline phophatase tests. Biosensors in food processing.

Total: 60 HOURS

TEXT BOOKS:

1. Jay JM, Loessner MJ and Golden DA. (2005). *Modern Food Microbiology*. 7th edition, CBS Publishers and Distributors, Delhi, India.
2. Frazier W.C. and Westhoff D.C. (2008). *Food Microbiology*, 4th Edn. Tata McGraw Hill Publishing Co., New Delhi.
3. Robinson R.K. (2018). *Dairy Microbiology*: *Milk and Milk Products*, 6rd Edn. Wiley Publishers.

REFERENCE BOOKS:

1. Lund BM, Baird Parker AC, and Gould GW. (2000). *The Microbiological Safety and Quality of Foods*.Vol.1-2, ASPEN Publication, Gaithersberg, MD.
2. Bamforth C.W. (2005) *Food, Fermentation and Microorganisms*, Blackwell Science.
3. Doyle M.P. and Buchanan R.L. (Ed.) (2013) *Food Microbiology*: Fundamentals and Frontiers, 4th Edn.ASM press.
4. James M Jay (2003). *Modern Food Microbiology*. Fourth edition, CBS Publishers, New Delhi.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	2	-	-	-	1	-	-	-	-	-	-	-	2	-
CO2	-	-	2	-	-	-	-	2	-	-	-	-	-	-	-	-	3
CO3	2	-	-	-	2	-	3	-	-	-	-	-	-	-	-	-	3
CO4	2	-	-	2	-	-	3	-	-	-	-	-	-	-	-	-	3
CO5	-	-	-	2	2	-	3	3	-	3	-	-	-	-	-	-	3
Average	**1.33**	**-**	**2**	**2**	**2**	**-**	**3**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**2**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VI

24MBU602 MICROBES IN SUSTAINABLE AGRICULTURE AND DEVELOPMENT 5H-4C

Instruction Hours/week: L:5 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Microbial Physiology and Metabolism (24MBU201)

COURSE OBJECTIVES (CO):

- To be aware of the role of microbes which make crop output more and increase the fertility of crops.
- To gain the knowledge of physiological processes that advocating microbial development and evolution
- To make them to understand issues related to plant nutrition, quality improvement, environmental adaptation, transgenic crops and their use in agriculture

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	**Course Outcomes**	**Blooms Level**
CO1	Comprehend the role of microbes in soil fertility and other parameters	Understand
CO2	Make use of microbes as and biocontrol agents and for Bioconversion of organic wastes	Apply
CO3	Produce biofertilizers using various microorganisms	Create
CO4	Develop novel combinations of microbes as biofertilizers	Create
CO5	Explore microbes for Biotech feed, Silage, Bio manure, biogas, biofuels and in transgenics	Apply

Unit I **11 HOURS**

Soil as Microbial Habitat, Soil profile and properties, Soil formation, Role of microbes in soil fertility, Factors influencing the microbial density in the soil Mineralization of cellulose, hemicelluloses, lignocelluloses, lignin and humus, phosphate, nitrate, silica and potassium

Unit II **11 HOURS**

Role of microbes in production and control of carbon dioxide, methane, nitrous oxide and nitric oxide, Microbial interactions- Mutualism, Protocooperation, Commensalism, Neutralism, Competition, Amensalism, Parasitism, Predation, Syntrophism,

Unit III **14 HOURS**

Biocontrol mechanisms and ways- direct antagonism, indirect antagonism and mixed path antagonism Microorganisms used as biocontrol agents against Microbial plant pathogens, Insects, Weeds. Recycling of agriculture waste, Bioconversion of organic wastes-sugarcane wastes. Role of microbes in composting process –coir-pith composition-composting, principles and applications.

Unit IV **12 HOURS**

Plant growth promoting bacteria, biofertilizers – symbiotic (*Bradyrhizobium, Rhizobium, Frankia,* VAM, potash solubilizer), Non-Symbiotic (*Azospirillum, Azotobacter*, Mycorrhizae, MHBs, Phosphate solubilizers, algae), Novel combination of microbes as biofertilizers, PGPRs, Marine resource biofertilizers, vermicomposting.

Unit V **12 HOURS**

Biotech feed, Silage, Bio manure, biogas, biofuels – advantages and processing parameters, Advantages, social and environmental aspects, GM crops, Bt crops, golden rice, transgenic animals.

Total: 60 HOURS

TEXT BOOKS:

1. Stephen Burchett, Sarah Burchett (2018) *Plant Pathology*, 1st Edition, Garland Science.
2. Sangita Sahni, Bishun Deo Prasad, Prasant Kumar (2017) *Plant Biotechnology*, Volume 2: Transgenics, Stress Management, and Biosafety Issues, 1st Edition, Apple Academic Press.
3. Pradeep Kumar, Jayanta Kumar Patra, Pranjal Chandra (2018) *Advances in Microbial Biotechnology: Current Trends and Future Prospects*, 1st Edition, Apple Academic Press.
4. Tanya E. Cheeke, David C. Coleman, Diana H. Wall (2012) *Microbial Ecology in Sustainable Agroecosystems*, 1st Edition, CRC Press.

REFERENCE BOOKS:

1. Ching T. Hou, Jei-Fu Shaw (2019). *Biocatalysis and Agricultural Biotechnology*, 1st Edition, CRC Press.
2. Parmjit S. Panesar, Satwinder S. Marwaha (2017). *Biotechnology in Agriculture and Food Processing: Opportunities and Challenges*, 1st Edition, CRC Press.
3. Noureddine Benkeblia (2019). *Sustainable Agriculture and New Biotechnologies*, 1st Edition CRC Press.
4. Allen I. Laskin (2017). *Microbial Ecology*, 1st Edition, CRC Press.
5. Glick BR, Pasternak JJ, and Patten CL (2010). *Molecular Biotechnology*, 4th Edition, ASM Press.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	2	-		-	2	-	-	-	-	-	-	-	2	-
CO2	-	-	-	3	-	3	-	-	-	-	3	-	-	-	2	-	3
CO3	3	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	3
CO4	2	-	1	2	-	3	-	-	-	-	3	-	-	-	2	-	3
CO5	2	-		2	-	3	-	2	-	-	-	-	-	-	-	-	3
Average	**2**	-	**1**	**2.25**	-	**3**	-	**2**	-	-	**3**	-	-	-	**2**	**2**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VI

24MBU603A **BIOPHARMACY** **5H-4C**

Instruction Hours/week: L:5 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To know about the biological substance which has the medicinal value.
- To improve the biopharmaceutical components and technical knowledge.
- To study isolation and purification techniques of biomolecules

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand the biosynthesis and classification of biological substances with medicinal values	Understand
CO2	Utilize chromatography techniques in isolation of phytochemicals and apply chemical fingerprinting	Apply
CO3	Apply techniques for production of secondary metabolites from cultured plant cells	Apply
CO4	Perform bioactivity studies of phytochemicals to in vitro and in vivo	Apply
CO5	Explain the role of plant polyphenolic as antioxidants against free radicals	Understand

UNIT I Phytochemistry **(12 HOURS)**

Biosynthesis of primary and secondary metabolites - alkaloids, terpenoids. glycosides, Phenolic compounds and coumarins. Classification and sources of alkaloids. Major classes in phenolic compounds – carotenoids, flavonoids, tannins and phenolic acids. Classification of terpenoids.

UNIT II Extraction Techniques **(12 HOURS)**

General extraction and isolation techniques for compounds from plants. Techniques involved in extraction of phytochemicals – Percolation, Soxhlet extraction, Supercritical Fluid extraction, Pilot scale extraction, reflux and other methods.

UNIT III Isolation and purification techniques **(12 HOURS)**

Thin layer and Column chromatography, Liquid Chromatography, Gas chromatography, Affinity chromatography and super critical fluid chromatography. Chemical fingerprinting – HPLC and HPTLC, Mass Spectroscopy.

UNIT IV Biotechnology of medicinal plants **(12 HOURS)**

Production of secondary metabolites from cultured plant cells, elicitation, immobilization and biotransformation. Medicinal plants – Plant DNA isolation.

UNIT V Bioactive studies **(12 HOURS)**

Anticancer, antidiabetic, anti-inflammatory, hepatoprotectives, antimicrobials from medicinal plants. Antioxidants of plant origin – Reactive Oxygen Species (ROS), antioxidant polyphenols.

Total: 60 HOURS

TEXT BOOKS:

1. Harborne, J.B. (1998). *Phytochemical methods to modern techniques of plant analysis*. Chapman & Hall, London.

REFERENCE BOOKS:

1. Trease G.E. and M.C. Evans, (1979). *Textbook of Pharmacognosy* 12th Edition. Balliere-Tindal, London.
2. Irfan A. Khan and Atitya Khanum, (Eds.) 2004. *Role of Biotechnology in medicinal and Aromatic plants*, Vols. I-X. Ukaaz Publications, Hyderabad.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	-	-	2	-	-	-	3	-	-	-	-	-	-	-	-	3
CO3	3	-	2	2	-	-	-	3	-	-	-	-	-	-	-	-	3
CO4	2	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	3
CO5	2	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	3
Average	**3**	-	**2**	**2**	-	-	-	**3**	-	-	-	-	-	-	-	-	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VI

24MBU603B BIO NANOTECHNOLOGY 5H-4C

Instruction Hours/week: L:5 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To provide knowledge about the Bio nanomaterials and its advancement.
- To learn biosynthesis and characterization of various Nanoparticles.
- To understand in applications of Bio nanomaterials.

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand the concepts of bionanomaterials and apply techniques Molecular design for nanotechnology	Understand / Apply
CO2	Comprehend Structural principles of Bio nanotechnology	Understand
CO3	Analyse the characterization of nanomaterials	Analyze
CO4	Explore the applications of Bio Nanotechnology	Understand
CO5	Apply knowledge in chemical transformation and biomolecular sensing	Apply

UNIT I Nano particles (11 HOURS)

Biotechnology to Bio nanotechnology: Bio nanomachines – Modern bio nanomaterials – protein, nucleic acid, lipids used for carrying information – polysaccharides use in special structural roles – Present status of bionanotechnology.

UNIT II Bionanomachines (11 HOURS)

Molecular design for nanotechnology: – X-ray crystallography, NMR spectroscopy and electron microscopy, use in nanotechnology – Computer modelling to bio nanomachines and computer assisted molecular design.

UNIT III Natural bio nanotechnology designing (14 HOURS)

Structural principles of Bionanotechnology: Natural bio nanotechnology design for specific environment– Biomolecular structure as low materials – Hierarchical strategy in construction of nanomachines – protein folding – self organization – molecular recognition – flexibility.

UNIT IV Principles of Nanotechnology (10 HOURS)

Functional principles of Bionanotechnology: Information driven nano assembly – chemical transformation – bio molecular sensing – self application – machine phase bio nanotechnology.

UNIT V Ethics of Nanotechnology (14 HOURS)

Future of Bionanotechnology: Problems in bio nanotechnology – Abide finger problem – Sticky finger problem – role of enzyme to solve these problems – Core studies – nomotuble synthesis, nano scale assembler, nanosurveillance – ethical consideration – respect for life, potential dangers, fuel.

Total: 60 HOURS

TEXT BOOKS:

1. David, S. (2004). *Bionanotechnology.* Goodsell. Wiley-Blackwell.
2. Rakesh Kumar, and Tiwari, K., (2013). *A Textbook of Nanoscience*. Publisher: S.K. Kataria& Sons.
3. Ausubel, F.M., Breut, R., Kingston, R.E., Moore, D.D., Siedman, J.G., Smith, J.A., and Struhl K., (1999). *Short protocols in Molecular Biology*. (4th ed.). Wiley, New York.
4. Goosell, D.S. (2004). *Bionanotechnology: Lessons from nature*. John Wiley & Sons Inc. publication.

REFERENCE BOOKS:

1. Gonsalves, K., Halberstadt, C., Laurencin, C.T., (2007). *Biomedical Nanostructures*. Wiley-Blackwell.
2. Sabliov, C., Hongda, A., Yada, R., (2015). *Nanotechnology and Functional Foods*. Wiley-Blackwell Publishers
3. Goodsell, D.S. (1996). *Biomolecules and Nanotechnology*. Ancient Scientist, 88, 230 – 237.
4. Blundell, T.L., and Johnson, L.N., (1976). *Protein crystallography*. New York.
5. Eisenberg, D., and Crothers, D., (1979). *Physical Chemistry with Applications to the Life Sciences*. Benjamin Cummings, Menlo Park, California.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO2	3	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	3
CO3	2	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	3
CO4	2	-	-	2	-	-	-	3	-	3	-	-	-	-	-	-	3
CO5	3	-	-	2	-	-	-	3	-	-	-	-	-	-	-	-	3
CO6	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	3
Average	**2.5**	-	-	**2.33**	-	-	-	**3**	-	**2.5**	-	-	-	-	-	-	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VI

24MBU603C **BIOFERTILZERS** **5H-4C**

Instruction Hours/week: L:5 T:0 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To provide the student knowledge about ecofriendly product.
- To understand the crucial role in environmental management.
- To learn the production and application of biofertilizers to control plant diseases.

COURSE OUTCOMES (COs)

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand the importance of biofertilizers	Understand
CO2	Learn and use techniques for sterilization and media preparation	Understand
CO3	Apply techniques for production and quality control of biofertilizers	Apply
CO4	Comprehend applications of biofertilizers	Understand
CO5	Utilize the biofertilizers for crop development	Apply

UNIT – I **(12 HOURS)**

Introduction to Biofertilizers- Different types – its Application in Agriculture – Advantages of Biofertilizers over chemical fertilizers

UNIT – II **(11 HOURS)**

Types of carrier material used – its sterilization and processing – Glassware sterilization – Packing materials – Media preparation.

UNIT – III **(15 HOURS)**

Strain selection – Inoculum development – Mass production – Packaging – Quality control of different Biofertilizers (*Rhizobium*, Phosphate solubilizers, Azotobacter, *Azospirillum*, Mycorrhizae, Azolla, Algae)

UNIT – IV **(11 HOURS)**

Methods of application of Biofertilizers – Effects of Biofertilizer on crop yield – N_2 Fixation, phosphate solubilization – pot experiment – field trials.

UNIT – V **(11 HOURS)**

Methods and application of Biofertilizers in different crops – Groundnut, Rice and Vegetables

TEXT BOOKS **TOTAL: 60 HOURS**

1. Subba Rao, N.S., 1999. Biofertilizers in Agriculture and Agroforestry. Oxford and IBH, New Delhi.
2. Rangaswami, G. and D.J. Bhagyaraj, 2001. Agricultural Microbiology. 2nd Edition. Prentice Hall, New Delhi.
3. Rao, N.S., 1995. Soil Microorganisms and plant Growth. Oxford and IBH Publishing Co., New Delhi.

REFERENCE BOOKS:

1. Alexander, M. 1977. Introduction to soil Microbiology, NY, John Wiley & Sons.

2. Atlas.R.M and Bartha.R 1992. Microbial ecology. Fundamentals and applications. 3rd Edition. Red Wood City. C.A. Benjamin
3. Bagyaraj and Rangasamy. 2002. Agricultural Microbiology. 2nd Edition. Prentice Hall, India
4. Paul. E.A. and Clark F.E., 1986. Soil Microbiology and Biochemistry. Academic Press, New York.
6. Robert, L.Tate, 1995. Soil microbiology. 1st Edition, John Wiley & Sons, Inc, New York.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO2	3	-	-	-	-	-	-	1	-	-	-	-	-	-	-	3	-
CO3	3	-	-	2	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	-	-	3	-	-	-	3	-	3	-	-	-	-	-	-	3
CO5	2	-	-	3	-	-	-	3	-	-	-	-	-	-	-	-	3
CO6	-	-	-	-	-	-	-	3	-	2	-	-	-	-	-	-	3
Average	**3**	-	-	**2.33**	-	-	-	**3**	-	**2.5**	-	-	-	-	-	-	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VI

24MBU611 FOOD AND DAIRY MICROBIOLOGY - PRACTICAL 4H-2C

Instruction Hours/week: L:0 T:0 P:4 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Food and Dairy Microbiology (24MBU601)

COURSE OBJECTIVES (CO):

- To obtain understanding of food and dairy products and become qualified as microbiologist in food and dairy industries.
- To recognize the characteristics of important pathogens and spoilage microorganisms in foods.
- To apply methods for their isolation, detection and identification of microorganisms in food and employ in industries.

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	**Course Outcomes**	**Blooms Level**
CO1	Analyse milk samples for efficiency of pasteurization and Standard plate count	Analyze
CO2	Perform techniques in isolation of food borne pathogen from food products and count	Apply
CO3	Utilize techniques in isolation of spoilage microorganisms from spoiled food	Apply
CO4	Experiment with isolation of microorganisms from curd and production of yogurt	Apply
CO5	Observe and learn the unit operation procedures in food and dairy industries	Understand

EXPERIMENTS (48 HOURS)

1. Methylene Blue Dye Reduction Test and Resazurin test for testing the Raw milk quality
2. Standard plate count of milk sample.
3. Alkaline phosphatase test to check the efficiency of pasteurization of milk.
4. Isolation of food borne pathogen from food products.
5. Microbial count from packed food.
6. Isolation of spoilage microorganisms from spoiled vegetables/fruits.
7. Production of yogurt.
8. Isolation of microorganisms from curd (*Lactobacillus* observation).
9. Visit to microbiology-based Food and dairy industry and observe the unit operation procedures.

TEXT BOOKS: **Total: 48 HOURS**

1. Jay JM, Loessner MJ and Golden DA. (2005). *Modern Food Microbiology*. 7thedition, CBS Publishers and Distributors, Delhi, India.
2. Lund BM, Baird Parker AC, and Gould GW. (2000). *The Microbiological Safety and Quality of Foods*. Vol. 1-2, ASPEN Publication, Gaithersberg, MD.
3. Tortora GJ, Funke BR, and Case CL. (2008). *Microbiology: An Introduction*. 9thedition. Pearson Education.
4. Diane Roberts (2013). *Practical Food Microbiology*, Third Edition, Blackwell Publishing Ltd.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO2	3	-	1	2	-	-	-	2	-	-	-	-	-	-	-	-	3
CO3	2	-	3	2	-	-	-	3	-	-	1	-	-	-	-	-	3
CO4	1	-	2	2	-	-	-	2	-	-	1	-	-	-	-	-	2
CO5	2	-	1	2	-	-	1	2	-	-	-	-	-	-	-	-	2
CO6	1	-	2	-	-	-	-	2	-	-	-	-	-	-	2	-	3
Average	**2**	-	**2**	**2**	-	-	**1**	**2.2**	-	-	**1**	-	-	-	**2**	-	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VI

24MBU612 MICROBES IN SUSTAINABLE AGRICULTURE AND MANAGEMENTPRACTICAL

4H-2C

Instruction Hours/week: L:0 T:0 P:4 **Marks:** Internal**:40** External**:60** **T**otal**:100**

End Semester Exam: 6 Hours

PREREQUISITE:

- Microbes in Sustainable Agriculture and Management (24MBU602)

COURSE OBJECTIVES (CO):

- To evaluate the application of ecological principles and concepts in sustainable agriculture system.
- To know the role of microbes which make crop output more and increase the fertility of crops**.**
- To design a biogas plant.

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	**Course Outcomes**	**Blooms Level**
CO1	Study the microflora of different types of soils and its physical and chemical properties	Analyze
CO2	Learn and practice biofertilizer production and develop entrepreneur skill related to agriculture field.	Apply
CO3	Device biogas plant	Create
CO4	Practice techniques in isolation of urea decomposers and nitrate utilizers	Apply
CO5	Learn and Isolate various degrading microorganisms like PHB; analyse soil microbe activity	Apply

EXPERIMENTS **(48 HOURS)**

1. Study of soil profile – Physical and Chemical
2. Study the microflora of different types of soils
3. Preparation of compost
4. *Rhizobium* and *Azotobacter* as soil inoculants characteristics
5. Design and functioning of a biogas plant
6. Isolation of cellulose degrading organisms, urea decomposers and nitrate utilizers
7. Screening of bacterial isolates for PHB production by using “Sudan black B” method
8. Estimation of soil microbial activity- CO_2 evolution method

TEXT BOOKS: **Total: 48 HOURS**

1. Sangita Sahni, Bishun Deo Prasad, Prasant Kumar (2017) *Plant Biotechnology*, Volume 2: Transgenics, Stress Management, and Biosafety Issues, 1st Edition, Apple Academic Press.

2. Allen I. Laskin (2017) *Microbial Ecology*, 1st Edition, CRC Press.

3. Tanya E. Cheeke, David C. Coleman, Diana H. Wall (2012) *Microbial Ecology in Sustainable Agro ecosystems*, 1st Edition, CRC Press

4. Pradeep Kumar, PhD., Jayanta Kumar Patra, Pranjal Chandra (2018) *Advances in Microbial Biotechnology: Current Trends and Future Prospects*, 1st Edition, Apple Academic Press.

REFERENCE BOOKS:

1. Stephen Burchett, Sarah Burchett (2018). *Plant Pathology*, 1st Edition, Garland Science.

2. Ching T. Hou, Jei-Fu Shaw (2019) *Biocatalysis and Agricultural Biotechnology***,** 1st Edition, CRC Press.
3. Parmjit S. Panesar, Satwinder S. Marwaha (2017) *Biotechnology in Agriculture and Food Processing: Opportunities and Challenges*, 1st Edition, CRC Press.
4. Noureddine Benkeblia (2019) *Sustainable Agriculture and New Biotechnologies*, 1st Edition CRC Press.
5. Glick BR, Pasternak JJ, and Patten CL (2010) *Molecular Biotechnology*, 4th Edition, ASM Press.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	2	-	-	-	-	-	-		-	-	-		3	-
CO2	1	-	-	3	-	2	-	3	-	-	2	-	-	-	2	-	3
CO3	1	-	-	3	-	3	-	3	-	-	3	-	-	-	2	-	3
CO4	-	-	-		2	3	-	3	-	-		-	-	-		-	3
CO5	3	-	-	2		3	-	2	-	-	1	-	-	-	1	-	3
Average	**2**	**-**	**-**	**2.5**	**2**	**3**	**-**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**2**	**-**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VI

24MBU691	**PROJECT**	**7H-4C**

Instruction Hours/week: L:0 T:0 P:7 **Marks:** Internal**:80** External**:120 T**otal**:200**

End Semester Exam: 3 Hours

24EAU601 **NATIONAL SERVICE SCHEME** **0H-2C**

Instruction Hours/week: L:0 T:0 P:0 **Marks:** Internal**:100** External**:00 T**otal**:100**

I YEAR

Orientation – NSS origin – motto – symbol – NSS administration at different levels – programme planning – Rural Projects – Urban projects – Government schemes – Career guidance – Self help groups – Environment protection – Use of natural energy – Conventional energy resources – Soil and Water conservation – Community health programmes – Women and child welfare – Education for all.

II YEAR

Popularization of agro techniques – Self employment opportunities – Animal health, Dairy and Poultry farming – Road safety – Training on First aid and emergency cell. Popularization of small savings – communal harmony and National integration – Care of Senior citizens – Personality development – meditation, Yoga Art of living – Activities on the preservation of National monuments, cultural heritage and folklore – special camp activities

PRACTICAL SCHEDULE

Semester-I

1. Orientation of NSS volunteers and programme coordinator and Programme officers.
2. Origin of NSS in India and its development
3. NSS motto, symbol and NSS awards
4. Organizational set up of NSS at Central, State University and college levels.
5. Programme planning – Theme of the year – planning implementation at PC, PO and NSS volunteer level.
6. Visit to selected village - gathering basic data on socio economic status.
7. Participatory rural appraisal – studying the needs of the target group.
8. Visit of urban slum and gathering data on socio economic status.
9. Self involvement and methods of creating rapport with the target group.
10. Awareness campaign on welfare schemes of the central and state government.
11. Formation career guidance group with NSS volunteers and students welfare unit
12. Cycle rally on environmental protection.
13. Campus development activities – clean environment campaign, formation of plastic free zones.
14. Campus development,
15. Tree planting maintenance and greening
16. Campus cleaning.
17. FINAL EXAMINATION.

Semester - II

1. Motivation of rural and urban youth for formation of SHG (Self Help Groups) in collaboration with Government machineries and NGOs.
2. Campaign on ill effects of plastics in the adjoining campus areas – Villages / urban areas.
3. Campaign on *Parthenium* eradication.
4. Cycle rally on air pollution – Vehicle exhaust and other means.

5. Popularization of biogas and smokeless chulah.
6. Demonstration on the use of wind energy and solar energy.
7. Demonstration of water harvesting techniques.
8. Demonstration on soil conservation techniques wherever possible.
9. Campaign on Community health programmes of central and state Government – involving Health department officials.
10. AIDS awareness campaign ; campaign on diabetes and healthy food habits and drug abuse
11. Planing formation of blood donors club – involving NGOs.
12. Campaign on gender equality and women empowerment.
13. Campaign on child health care – immunization, food habits and child labour abolition.

III Semester

1. Conducting field days with KVK to popularize improved agro techniques.
2. Conducing seminar / workshop in a nearby village to motivate the youth on agribusiness (involving DEE, KVK, NGO and local agripreneurs).

3–5 Campaign on self employment opportunities like Apiculture, mushroom cultivation, Food processing and value addition, production of biocontrol agents and biofertilizers, nursery techniques, seed production, tissue culture, vermicompost, manufacture of small gadgets and agricultural implements as per local needs and feasibility.

6. Animal health care campaign – Dairy and poultry farming - Forage production techniques and silage making.
7. Training the NSS volunteers on road safety measures in involving traffic wardens and RTO.
8. Training NSS volunteers on First AID and emergency call involving NGOs and organizations like St. John's Ambulance, Red Cross, etc.,
9. Organizing Road safety rally.
10. Motivating NSS Volunteers on small savings concept and conveying the message to the public through them.
12. Observation of National integration and communal harmony.

14 – 16 : Campus development and greening activities

4. Examination.

Semester-IV

1 – 3: Visit to orphanages and old age homes to look after their needs.

4. Personality development programmes – Building up self confidence in youth.

5 – 7: Teaching NSS volunteers on mediation Yoga and art of healthy living with trained teachers

8 – 9 : Visit of nearby National Monument / Places of tourist importance and campaign on cleanliness and preservation.

10–11: Exploration of hidden talents of village youth and public on folklore, traditional art, sports, martial arts and cultural heritage.

12–13. Campus improvement activities

14–16: Visit to special camp village and pre camp planning.

5. Examination

- Besides the above NSS volunteers will attend work during important occasions like Convocation,

Farmers Day, Sports meet and other University / College functions. NSS Volunteers will attend one special camp in the selected village for a duration of 10 days and undertake various activities based on the need of that village people.

- For all out door regular activities villages / slums nearby the campus may be selected to avoid transport cost (Cyclable distance)
- Special camp activity may be carried out in a village situated within a radius of 15 – 20 KM.

Semester VII

24MBU701 **TEXTILE MICROBIOLOGY** **6H-5C**

Instruction Hours/week: L:5 T:1 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To understand the manufacturing process of textile fibers and yarns.
- To gain knowledge about the fabric weaving methods.
- To know about the innumerable applications of enzymes and antimicrobial finishes.

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	**Course Outcomes**	**Blooms Level**
CO1	Classify fibers and explain fiber properties and manufacturing processes	Understand
CO2	Learn and apply extraction and fabrication of natural fibers and biomaterials	Apply
CO3	Explain Enzymes in textile processing and for treatment of dye effluent and to manufacture eco-friendly detergents	Understand
CO4	Practice synthesis of Microbial Pigments in textile industry	Apply
CO5	Analyse antimicrobial finishing methods on fabrics	Analyze

Unit I Introduction to fiber Science **(15 HOURS)**

Classification of textile fibres according to their nature and origin, manufacturing process of end uses of various fibers. Essential and desirable properties of textile fibres. Natural fibres: Vegetable fibers (bast, leaf and seed fibres), animal fibers (wool and silk) and mineral fibers (glass, asbestos and metallic fibres). classification, distinctive properties and end uses. Man-made fibres- Rayon & Bamboo.

Unit II Extraction and Fabrication of Natural Fibers and Biomaterials **(15 HOURS)**

Introduction, Need, and Classification of retting – Mechanical, running water, pool retting, and dew retting, stagnant retting and enzymatic retting. Yarn making and fabrication weaving, knitting and non woven. Biomaterials utilized in medical textiles – an overview. Definition and classification of biomaterials, Structure of biomaterials, Mechanical properties - Elastic behaviour, Stress and Strain, Tension and Compression, Shear, Isotropy -Fatigue- Toughness - Effect of Fabrication on Strength.

Unit III Enzymes in textile industry **(12 HOURS)**

Enzymes in textile processing- cellulosic fibres- desizing, scouring, bleaching, biopolishing, flax retting, denim fading. Protein fibres degumming, wool deprickling, shrink proofing. Enzymes in treatment of textile dye effluent.

Unit IV Enzyme based eco-friendly detergents **(15 HOURS)**

Introduction, disadvantages of conventional detergents, role of enzymes in detergents. Immobilized enzymes- preparation and industrial applications. Enzymes as fermentation products- amylases, proteases, pectinases and cellulases.

Unit V Microbial applications in textile field **(15 HOURS)**

Microbial Pigments - Extraction of bacterial pigments. Application of microbes - decolourization of textile dye effluent, Extraction and softening of fibres. Antimicrobial Finish- Impact of microbial growth on textiles

and need for antimicrobial finish. Assessment of antimicrobial activity: Antimicrobial finishing methods on fabrics.

Total: 72 HOURS

TEXT BOOKS:

1. Deepali Rastogi and Sheetal Chopra, (2017). *Textile Science*, Orient Black Swan Private Limited, Hyderabad.
2. Satyanarayana.U and Chakrapani.U , (2006). *Biochemistry*, Third Edition, Arunabha Sen Books and Allied P Ltd., Kolkata.
3. Purohit. S,S, (2008). *Microbiology Fundamentals and Applications*, 7 Th Edition, AGROBIOS, India.

REFERENCE BOOKS:

1. Seema Sekhri, (2011). *Textbook of Fabric Science: Fundamentals to Finishing*, PHI Learning Pvt Limited, New Delhi.
2. Trever Palmer, (2004). *Enzymes, Biochemistry, Biotechnology Clinical Chemistry*: Affiliated East- West Press Ltd., New Delhi.
3. V Nierstrasz A Cavaco-Paulo, (2010). *Advances in Textile Biotechnology*, Woodhead Publishing Ltd., U.K.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	2	-	-	-	2	-	-	-	-	-	-	-	-	2
CO2	2	-	3	2	2	-	-	3	-	-	-	-	-	-	-	-	3
CO3	3	-	3	2	-	-	-	2	-	-	1	-	-	-	-	-	3
CO4	3	-	-	-	2	-	-	2	-	-	-	-	-	-	-	-	3
CO5	-	-	2	3	2	-	-	2	-	-	-	-	-	-	-	-	2
Average	**3**	**-**	**3**	**2.25**	**2**	**-**	**-**	**2.2**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VII

24MBU702 POULTRY AND VETERNARY MICROBIOLOGY 6H-5C

Instruction Hours/week: L:5 T:1 P: **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To understand the role of microorganisms in animal health.
- To Identify a variety of types of pathogenic microorganisms and the diseases they produce in the host.
- To perform basic microbiological techniques used in the laboratory setting of a veterinary hospital.

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand pathogenesis, laboratory diagnosis and treatment of infection in cattle	Understand
CO2	Comprehend pathogenicity and diagnosis of bacterial and fungal diseases	Understand
CO3	Explain viral infection in cattle and the host response to infection.	Understand
CO4	Elucidate epidemiology of infections, treatment and control of infections	Understand
CO5	Analyse and generate animal feed	Evaluate

UNIT I Introduction to Veterinary Microbiology (12 HOURS)

Introduction- etiology, pathogenesis, laboratory diagnosis and treatment of infection in the individual. Epizootiology - prevention and control of infection in the community.

UNIT II Veterinary Bacteriology & Mycology (15 HOURS)

Study of pathogenic bacteria and fungi in relation to their morphology, isolation, growth, colonial, biochemical characteristics, Pathogenicity and diagnosis of bacterial and fungal diseases: Bacteria - Staphylococcus, Streptococcus, Bacillus, Clostridium, Mycobacterium, Enterobacteriaceae, Campylobacter, Brucella, Pasteurella, Listeria, Actinomyces, Mycoplasma, Rickettsia, Chlamydia. Fungi - Dermatophytes, Candida, Aspergillus, Zygomycetes, Mycotic mastitis and Mycotoxicosis.

UNIT III Cell interaction and cell damage (15 HOURS)

Virus –cell interactions, types of interactions, Cytocidal changes in virus infected cells, mechanisms of cell damage., Inclusion bodies, ultrastructural changes in virus infected cells, interferons. Viral persistence, viral strategies to evade host defense mechanisms, persistent infection and chronic damage to tissues and organs, infection induced damage to immune system, autoimmune disease, hypersensitivity.

UNIT IV Veterinary Parasitology (15 HOURS)

Principles of Taxonomy, Physiology and Parasite Identification. Animal Parasitic diseases - Parasite morphology, parasite life cycles, host pathology, epidemiology of infections, treatment and control of infections- Platyhelminthes, Nemat helminthes and Acanthocephala.

UNIT V Livestock Management (15 HOURS)

Animal nutrition- Energy sources. Dairy production and Management. Taxonomy, anatomy and biology of commercially important fishes. Most common cattle, sheep, goat, poultry and pig diseases. Types of animal vaccines-Live, Inactivated, Recombinant, synthetic peptide, genetically modified vaccines etc.

Total: 72 HOURS

TEXT BOOKS:

1. Fenner.S, (2016). *Veterinary virology* (5th Edition). Academic Press.
2. Tortora GJ, Funke BR & Case CL. (2004). *Microbiology: An Introduction*. Benjamin/Cummins 4. Publications.

REFERENCE BOOKS:

1. Glen Sonder J amp; Karen W Post (2005). *Veterinary Microbiology: Bacterial and Fungal Agents of Animal Diseases*. Cold Spring Harbor Lab. Press.
2. Prescot LM, Harley JP & Klen DA. (2005). *Microbiology*. Wm. C. Brown Publications.
3. C.L. Gyles, J..F Prescott, J.G. Songer, C.O. Thoen. (2004). *Pathogenesis of Bacterial Infections in Animals*. Wiley.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	1	-	-	-	-		-	-	-	-	-	-	-	3	-
CO2	3	-	-	3	2	-	-	2	-	-	-	-	-	-	-	3	-
CO3	2	-	1	2	-	-	-	2	-	-	-	-	-	-	-	3	-
CO4	2	-	2	2	1	-	-	2	-	-	-	-	-	-	-	2	-
CO5	-	-	3	2	-	-	-	3	-	-	-	-	-	-	-	-	3
Average	**2**	**-**	**2**	**2.25**	**1.5**	**-**	**-**	**2.25**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VII

24MBU703A DRUG DESIGN AND DEVELOPMENT 5H-4C

Instruction Hours/week: L:4 T:1 P: **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To learn the course, introduce the basic principles of modern drug design, discovery and development.
- To know the different source of drug with specific focus on microbial source
- To understand the drug manufacturing process and to identify the Lead compound series

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Describe current approaches and philosophies in drug design and Explore microbes as source of drug	Understand
CO2	Analyse the impact of genomics and related technologies upon drug discovery	Analyze
CO3	Generate different traditional vaccine preparations	Create
CO4	Make use of nucleic acid as gene therapy	Apply
CO5	Practice drug manufacturing process using fermentation	Apply

UNIT I Introduction to drug design (12 HOURS)

Introduction- History of drug design, Current approaches and philosophies in drug design, Molecular mechanisms of diseases and drug action with examples. Pharmaceutical products, Pharmaceuticals of microbial origin (macrolides, ansamycins, Peptide and other antibiotics) animal origin (sex hormones androgens), plant origin (Alkaloids Atropine and scopolamine)

UNIT II Microbial drugs (12 HOURS)

Sources of Drugs- Microbial drugs, E. coli as a source of recombinant therapeutic proteins. Expression of recombinant proteins in yeasts, animal cell culture systems. Transgenic animals, Transgenic plants and Insect cell-based systems. Rational drug design and Combinatorial approaches to drug discovery, Antibody Drug Conjugates.

UNIT III Drug production (12 HOURS)

Drug development process- Impact of genomics and related technologies upon drug discovery: Gene chips, Proteomics, Structural genomics and Pharmacogenetics, Model systems in the development of drugs, Nano scaffolds for Drug Delivery. Drug manufacturing process- Guides to good manufacturing practice, Production of final product - Cell banking systems, Upstream processing, Microbial cell fermentation, Mammalian cell culture systems, Downstream processing, Final product formulation, Freeze drying, Labelling and packing

UNIT IV Vaccines and adjuvant (10 HOURS)

Traditional vaccine preparations, attenuated, dead or inactivated bacteria, Attenuated and inactivated viral vaccines, Toxoids, antigen-based and other vaccine preparations. Impact of genetic engineering on vaccine technology. Peptide vaccines Vaccine vectors. Development of an AIDS vaccine, Difficulties associated with vaccine development, AIDS vaccines in clinical trials, Cancer vaccines, Recombinant veterinary

vaccines. Adjuvant technology: Adjuvant mode of action, Mineral-based adjuvants, Oil-based emulsion adjuvants Bacteria/bacterial products as adjuvants, Biosimilars.

UNIT V Applications of drugs (14 HOURS)

Nucleic acid as drugs- Gene therapy: Basic approach to gene therapy, Vectors used in gene therapy - Retroviral vectors, Additional viral-based vectors, Manufacture of viral vectors, Non-viral vectors. Gene therapy and genetic disease, cancer, Gene therapy and AIDS. Gene based vaccines, Repurposing of drugs.

Total: 60 HOURS

TEXT BOOKS:

1. Kristian Stromgaar, Povl Krogsgaard-Larsen and Ulf Madsen (2017). *Textbook of Drug Design and Discovery*, Fifth Edition, CRC press,2017.
2. David B. Weiner and William V. Williams. *Biological Approaches to Rational Drug Design* (Handbooks in Pharmacology and Toxicology) CRC press,1994

REFERENCE BOOKS:

1. Thomas J. Dougherty and Steven J. Projan. (2003). *Microbial Genomics and Drug Discovery*, Taylor andFrancis,
2. Kenneth M. Merz, Dagmar Ringe and Charles H. Reynolds. (2010). *Drug Design: Structure- and Ligand- Based Approaches*, Cambridge University press,
3. Gary Wlash (2004). *Biopharmaceuticals, Biochemistry and Biotechnology*. 2nd edition. Wiley publisher.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	2	2	-	-	-	3	-	-	-	-	-	-	-	-	3
CO2	-	-	-	3	-	-	-	2	-	-	-	-	-	-	-	-	2
CO3	-	-	3	2	-	-	-	2	-	-	-	-	-	-	-	-	3
CO4	-	-	-	3	-	-	-	2	-	-	1	-	-	-	-	-	3
CO5	-	-	2	2	-	-	-	3	-	-	-	-	-	-	-	-	3
Average	**3**	**-**	**2.33**	**2.4**	**-**	**-**	**-**	**2.4**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**

1 **- Low, 2 - Medium, 3 - High, '-' - No Correlation**

Semester VII

24MBU703B BIOPRODUCT DEVELOPMENT AND ENTREPRENEURIAL MICROBIOLOGY

5H-4C

Instruction Hours/week: L:4 T:1 P: **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To obtain good understanding about the interpretation of biological products.
- To provide knowledge on manufacturing and production of bioproducts.
- To get introduced to Regulatory aspects of Quality Assurance and Quality control

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand and apply several entrepreneurial ideas and business theories in practical framework	Understand
CO2	Practice production of single cell proteins and express the importance of mushroom cultivation and probiotics	Apply
CO3	Exercise the mass production of microbial inoculants used as Biofertilisers and Bioinsecticides	Apply
CO4	Analyze the application and commercial production of Monoclonal antibodies, Cytokines. TPH and teaching kits	Analyse
CO5	Describe Regulatory aspects of Quality Assurance and Quality control, and FDA guidelines for drugs	Understand

Unit I **12 HOURS**

Entrepreneurship: Notions and theories of Entrepreneurship, Entrepreneurial traits and motivation- Nature and importance of Entrepreneurs, - Financial Analysis Investment process, Break even analysis, Profitability analysis, Budget and planning process. Government schemes for commercialization of technology - Funding and support mechanisms for entrepreneurship. Professional ethics in entrepreneurship.

Unit II **12 HOURS**

Production of microbial metabolites and Single cell proteins: Metabolic pathways and control mechanisms of primary and secondary metabolites; Commercially important metabolites: Primary – ethanol, citric acid; Secondary –β exotoxin; Single Cell Protein: Algae (*Spirullina maxima, Chlorella pyrenoidosa*) and Yeast (*Candida tropicana*) as SCP, Mushroom Cultivation and Probiotics.

Unit III **12 HOURS**

Biofertilizers and Biopesticides: Production of Rhizobium, Azotobacter, *Azospirillum*, Phospho bacterium, BGA (*Anabena, Nostoc*); Packing, Quality assurance, Field Application and Crop Response. Bioinsecticide: Mass Production, field Application, and Crop Response of Bacteria (*Bacillus thuringiensis, Bacillus papillae, Pseudomonas fluorescens*), Fungi (*Verticillium lecanii, Coelomyces*) and Viruses (Bacuulo viruses, NPV, Granulosis virus).

Unit IV **10 HOURS**

Commercial Products: Production and Application of TPA, HGH, Cytokines and Monoclonal Antibodies; Production of enzymes – Cellulase, Protease, Amylase and lipase Production of teaching kits-DNA isolation,

Industrial Production and Application of biogas, bio-diesel, hydrogen fuel, gasoline; Bioplastics - PHB, PHA; Biopigments – Lycopene, Betacarotene, and its applications.

Unit V **14 HOURS**

Government regulatory practices and policies: Regulatory aspects of Quality Assurance and Quality control. Sterilization control and sterility testing- Chemical and biological indicators. Regulatory authorities for introduction of medicines in market – Role of Food and Drug Administration, FDA guidelines for drugs / biologicals, Validation (GMP, GLP, GCP, etc.). Finished product shelf-life analysis, formulation and packing of finished product.

TOTAL: 60 HOURS

TEXT BOOKS:

1. Stockholm, K.T.H., Sven-Olo f Enfors, and Lena Haggstrom. (2000), *Bioprocess Technology: Fundamentals and Applications*, Royal Institute of Technology: Sweden.
2. Crueger, W, and Crueger. A. (2000), *Biotechnology: A Text Book of Industrial microbiology*, 2nd Edition, Sinauer Associates: Sunderland. Mass.

REFERENCE BOOKS:

1. Stanbury, P.F, and Whitekar. A. (1999), *Principles of Fermentation Technology*, 2nd Edition. Butterworth-Heinemann: Oxford.
2. Ashton Acton, Q., (2012). *Biological Pigments– Advances in Research and Application*. Scholarly Editions: Atlanta, Georgia.
3. Hugo, W.B. and Russel, A.D. (2003), *Pharmaceutical Microbiology*, 6th Edition. Blackwell Scientific Publications: U K.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	2	2	-	-	1	-	-	-	-	-	-	-	-	3
CO2	3	-	-	2	2	-	-	2	-	-	-	-	-	-	-	-	3
CO3	-	-	-	3	-	-	-	2	-	-	1	-	-	-	-	-	3
CO4	-	-	3	2	2	-	-	1	-	-	-	-	-	-	-	-	3
CO5	-	-	-	3	2	-	-	2	-	-	-	-	-	-	-	-	3
Average	**3**	-	**3**	**2.4**	**2**	-	-	**2**	-	-	**1**	-	-	-	-	-	**3**

1- Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VII

24MBU704A **INHERITANCE BIOLOGY** **5H-4C**

Instruction Hours/week: L:4 T:1 P: 0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To make students understand the principles of Genetics and inheritance biology.
- To expose on transportations through cell membrane.
- To know the inherited characters and response.

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Gain knowledge on model organisms in genetic analyses and experimentation	Understand
CO2	Explain Mendel's laws and Chromosome theory of inheritance	Understand
CO3	Comprehend the concepts of extra-chromosomal inheritance and human genetics	Understand
CO4	Describe Linkage and recombination of genes and Structural organization of chromosomes	Analyze
CO5	Understand variation in chromosomal number and structural abnormalities	Apply

UNIT I Introduction to Genetics (12 HOURS)

Historical developments: Model organisms in genetic analyses and experimentation: *Escherichia coli, Saccharomyces cerevisiae, Neurospora crassa, Caenorhabditis elegans Drosophila melanogaster, Arabidopsis thaliana.*

UNIT II Mendelian Principles (12 HOURS)

Mendel's Laws: Dominance, segregation, independent assortment, deviation from Mendelian inheritance, Rediscovery of Mendel's principles, Chromosome theory of inheritance: Allele, multiple alleles, pseudoallele, complementation tests, Extensions of Mendelian genetics: Allelic interactions, concept of dominance, recessiveness, Incomplete dominance and co-dominance, Multiple alleles, Epistasis, penetrance and expressivity.

UNIT III Linkage and Crossing over & Recombination (12 HOURS)

Linkage and recombination of genes, Cytological basis of crossing over, crossing over at four-strand stage, Molecular mechanism of crossing over, mapping Homologous and non-homologous recombination, including transposition, site-specific recombination.

UNIT IV Extra-Chromosomal Inheritance & Human genetics (8 HOURS)

Rules of extra nuclear inheritance, Organelle heredity - Chloroplast mutations in Chlamydomonas, mitochondrial, mutations in Saccharomyces, Maternal effects – Shell coiling in Limnaeaperegra Infectious heredity - Kappa particles in Paramecium. Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders. Polygenic inheritance, heritability and its measurements, QTL mapping.

UNIT V Characteristics of Chromosomes (14 HOURS)

Structural organization of chromosomes - centromeres, telomeres and repetitive DNA, Packaging DNA molecules into chromosomes, Concept of euchromatin and heterochromatin, Normal and abnormal karyotypes of human chromosomes, Chromosome banding, Giant chromosomes: Polytene and lamp brush chromosomes, Variations in chromosome structure: Deletion, duplication, inversion and translocation, Variation in chromosomal number and structural abnormalities -Klinefelter syndrome, Turner syndrome, Down syndrome.

Total: 60 HOURS

TEXT BOOKS:

1. Gardner EJ, Simmons MJ, Snustad DP (2008). *Principles of Genetics*. 8th Ed. Wiley-India.
2. Weaver RF, Hedrick PW (1997). *Genetics*. 3rd Ed. McGraw-Hill Education.
3. Griffith AJF, Wessler SR, Lewontin RC, Carroll SB. (2007). *Introduction to Genetic Analysis*. 9th Ed. W. H. Freeman and Co., New York.

REFERENCE BOOKS:

1. Snustad DP, Simmons MJ (2011). *Principles of Genetics*. 6th Ed. John Wiley and Sons Inc.
2. Klug WS, Cummings MR, Spencer CA, Palladino M (2012). *Concepts of Genetics*. 10th Ed. Benjamin Cummings.
3. Hartl DL, Jones EW (2009). *Genetics: Analysis of Genes and Genomes*. 7th Ed, Jones and Bartlett Publishers.
4. Russell PJ. (2009). *Genetics - A Molecular Approach*. 3rd Ed, Benjamin Cummings.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	-	-	-		-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	-	-		-	-	-	-	-	-	-	3	-
CO3	2	-	-	-	-	-	-	3	-	-	-	-	-	-	-	3	-
CO4	-	-	3	-	2	-	-	2	-	-	-	-	-	-	-	3	-
CO5	-	-	-	3	-	-	-	2	-	-	-	-	-	-	-	3	-
Average	**3**	-	**3**	**3**	**2**	-	-	**3**	-	-	-	-	-	-	-	**3**	-

1- Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VII

24MBU704B BIOSTATISTICS AND RESEARCH METHODOLOGY 5H-4C

Instruction Hours/week: L:4 T:1 P:0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To study introduction to Biostatistics, Basic Measures, the analytics of data, Correlation and Regression
- To understand research problem identification and hypothesis setting, t-test and ANOVA
- To know research designs, features of good research designs and sampling.

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand and apply basic statistical concepts such as regression and correlation	Understand/Apply
CO2	Analyse data using multivariate statistics such as Chi Square test and ANOVA	Understand
CO3	Analyse Problems in Research and set hypothesis	Analyze
CO4	Learn and make use techniques in research design and sampling	Apply
CO5	Write proposals, research papers and dissertations	Apply

UNIT I Introduction of Biostatistics and Correlation 12 HOURS

Introduction to Biostatistics, Basic Measures - Central Tendency and Dispersion, Variables in Bioscience, Correlation – Meaning and definition - Scatter diagram –Karl Pearson's Correlation Coefficient. Rank Correlation. Regression: Regression in two variables – Properties of Regression, uses of Regression

UNIT II Test of Significance 12 HOURS

Sampling parameters- Difference between sample and Population, Censoring, difference between parametric and non-parametric statistics. Sampling Distributions, Standard Error, Testing of Hypothesis, Level of Significance and Degree of Freedom, Confidence Interval, Small sample test based on t - test, Large Sample Test based on Normal Distribution – Z – test and F test.

UNIT III Analysis of Variance 12 HOURS

Distribution - free test - Chi-square test; Basic Introduction to Multivariate statistics, etc. Test of significance: Tests based on Means only-Both Large sample and Small sample tests –Chi-square test –the goodness of fit. Analysis of Variance – one-way and two-way classification, CRD, RBD Designs.

UNIT IV Research 10 HOURS

Research: Scope and significance – Types of Research – Research Process – Characteristics of good research – Problems in Research – Identifying research problems.

UNIT V Sampling Design **14 HOURS**

Research Designs – Features of good research designs. Sampling Design: Meaning – Concepts – Steps in sampling – Criteria for good sample design. Scaling measurements - Types of scale, Types of sampling – random sampling and non-random sampling. Sampling Errors.

TOTAL: 60 HOURS

TEXT BOOK

1. Jerrold H. Zar. (2003). *Biostatistical Analysis*. (4th ed.). Pearson Education(P) Ltd, New Delhi. 2. Kothari. C.R. (2004). *Research Methodology – Methods and Techniques*. (2nded.). New Age International Pvt. Ltd, New Delhi.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	3	2	-	-	2	-	-	2	-	-	-	-	3	-
CO2	-	-	-	-	3	-	-	2	-	-	-	-	-	-	-	-	3
CO3	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	3
CO4	-	-	2	-	-	3	-	-	-	-	2	-	-	-	-	3	-
CO5	-	-	--	-	-	3	-	-	-	-	2	-	-	-	-	-	3
Average	**3**	-	**2**	**3**	**2.5**	**3**	-	**2**	-	-	**2**	-	-	-	-	**3**	**3**

1- Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VII

24MBU711 **TEXTILE MICROBIOLOGY- PRACTICAL** **3H-1C**

Instruction Hours/week: L:0 T:0 P: 3 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 9 Hours

PREREQUISITE:

- Textile Microbiology (24MBU701)

COURSE OBJECTIVES (CO):

- To understand the manufacturing process of textile fibres.
- To gain knowledge about the fabric dyeing methods.
- To understand microbial enzyme technology in textile field.

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Practice Antibacterial activity assessment of textile materials	Apply
CO2	Analyze the microbial based textile dyeing.	Analyze
CO3	Apply a technique in antimicrobial activity assessment of Textiles against Fungi	Apply
CO4	Learn and practice Microbial Enumeration test in fabrics	Apply
CO5	Apply technique in Textile dye degradation using micro-organisms	Apply

EXPERIMENTS **(36 HOURS)**

1. Antibacterial activity assessment of textile materials: Parallel Streak Method (AATCC 147).
2. Antibacterial Activity of Fabrics: Agar Plate Method (AATCC 90)
3. Antimicrobial activity assessment of Textiles against Fungi (AATCC 30)
4. Demonstration of fabric dyeing by pad dry cure method
5. Microbial Enumeration test in fabrics
6. Textile dye degradation using micro-organisms

TEXT BOOKS: **Total: 36 HOURS**

1. Deepali Rastogi and Sheetal Chopra, (2017). *Textile Science*, Orient Black Swan Private Limited, Hyderabad.

2. Satyanarayana. U and Chakrapani. U, (2006). *Biochemistry*, Third Edition, Arunabha Sen Books and Allied P Ltd., Kolkata.

3. Seema Sekhri, (2011). *Textbook of Fabric Science: Fundamentals to Finishing*, PHI Learning Pvt Limited, New Delhi.

REFERENCE BOOKS:

1. Trever Palmer, (2004). *Enzymes, Biochemistry, Biotechnology Clinical Chemistry*: Affiliated East-WestPress Ltd., New Delhi.

2. V Nierstrasz A Cavaco-Paulo, (2010). *Advances in Textile Biotechnology*, Woodhead Publishing Ltd.,U.K.

3. Purohit. S,S, (2008). *Microbiology Fundamentals and Applications*, 7 Th Edition, AGROBIOS, India.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	-	-	-	-	2	1	-	3	-	-	2	-	-	-	-	3	-
CO2	-	-	2	2	2	-	-	-	-	-	2	-	-	-	-	-	3
CO3	-	-	-	-	-	-	-	3	-	-	2	-	-	-	-	-	3
CO4	-	-	-	-	2	-	-	3	-	-	2	-	-	-	-	-	3
CO5	-	-	-	-	2	-	-	3	-	-	2	-	-	-	-	-	3
Average	**-**	**-**	**2**	**2**	**2**	**1**	**-**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**3**	**3**

1- Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VII

24MBU712A DRUG DESIGN AND DEVELOPMENT- PRACTICAL 3H-1C

Instruction Hours/week: L:0 T:0 P: 3 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 6 Hours

PREREQUISITE:

- Drug Design and Development (24MBU703A)

COURSE OBJECTIVES (CO):

- To know the different routes of drug delivery to lab animals
- To understand the drug design and Computer Aided Design.
- To study the structure-based drug design and protein structure analysis and molecular basis of drugs

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	**Course Outcomes**	**Blooms Level**
CO1	Learn the routes of drug administration to laboratory animals	Understand/Apply
CO2	Practice Drug design and development and computer aided drug design	Apply
CO3	Apply freely available molecular modelling tools for structure-based drug design	Apply
CO4	Analyse Molecular basis of drugs	Analyze
CO5	Exercise Pharmacophore design and search	Apply

EXPERIMENTS **(36 HOURS)**

1. Routes of drug administration to laboratory animals
2. To evaluate the analgesic potency of drug by tail flick method
3. Screening of anti-inflammatory drugs using hind paw method
4. Drug design and development and computer aided drug design
5. Study the effect of drugs on spontaneous motor activity (SMA) and evaluate their nature as CNS stimulants using drugs
6. Structure based drug design using freely available molecular modelling tools
7. Protein structure analysis
8. Ligand selectivity analysis
9. Molecular basis of drugs
10. Homology modeling
11. Pharmacophore design and search

TEXT BOOKS: **Total: 36 HOURS**

1. Kristian Stromgaar, Povl Krogsgaard-Larsen and Ulf Madsen (2017). *Textbook of Drug Design and Discovery*, Fifth Edition, CRC press,2017.

2. David B. Weiner and William V. Williams. (1994). *Biological Approaches to Rational Drug Design (Handbooks in Pharmacology and Toxicology*), CRC press.

REFERENCE BOOKS:

1. Thomas J. Dougherty and Steven J. Projan. (2003). *Microbial Genomics and Drug Discovery*, Taylor and Francis,
2. Kenneth M. Merz, Dagmar Ringe and Charles H. Reynolds. (2010). *Drug Design: Structure- and Ligand- Based Approaches*, Cambridge University press,
3. Gary Wlash (2004). *Biopharmaceuticals, Biochemistry and Biotechnology*. 2nd edition. Wiley publisher.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	2	2	2	-	-	2	-	-	-	-	-	-	-	-	3
CO2	3	-	-	-	-	-	-	1	-	3	-	-	-	-	-	-	3
CO3	-	-	-	-	2	-	-	1	-	3	-	-	-	-	-	-	3
CO4	-	-	2	-	-	-	-	2	-	2	-	-	-	-	-	-	3
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Average	**3**	-	**2**	**2**	**2**	-	-	**1.5**	-	**3**	-	-	-	-	-	-	**3**

1- Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VII

24MBU712B BIOPRODUCT DEVELOPMENT AND ENTPRENEURIAL MICROBIOLOGY - PRACTICAL **3H-1C**

Instruction Hours/week: L:0 T:0 P: 3 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 6 Hours

PREREQUISITE:

- Bioproduct Development and Entrepreneurial Microbiology (24MBU703B)

COURSE OBJECTIVES (CO):

- To obtain on the biological products of microbial origin.
- To provide knowledge on manufacturing and production of antibiotics and biofertilizers.
- To get introduced to models of IFS for rainfed and irrigated farming system and conditions.

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	**Course Outcomes**	**Blooms Level**
CO1	Practice production of bioproducts- Biofertilizers, antibiotics and probiotics	Apply
CO2	Perform Organic Farming- Vermicompost	Apply
CO3	Learn and apply Quality control in biofertilizers	Apply
CO4	Analyse and apply integrated farming system	Analy
CO5	Analyse and apply models of IFS for rainfed and irrigated farming system and conditions	Apply

EXPERIMENTS **36 HOURS**

1. Production of bioproducts- Biofertilizers.
2. Production of bioproducts- Probiotics.
3. Production of Antibiotics – (Any antibiotic Eg: Penicillin)
4. Organic Farming- Vermicompost.
5. Quality control in biofertilizers
6. Study on integrated farming system
7. Study of models of IFS for rainfed and irrigated farming system and conditions.
8. Government schemes - NPOF, NPOF, NHM, HMNEH, NPMSH&F and RKVY

REFERENCE BOOKS: **Total: 36 HOURS**

1. Masanobu Fukuoka, Frances Moore Lappé Wendell Berry, (2009). *The One-Straw Revolution: An Introduction to Natural Farming*, YRB Classics; Main edition,
2. Subba Rao, N. S. (2002). Soil Microbiology. 4th ed. *Soil Microorganisms and Plant Growth*. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Dubey, R. C. (2008). *A Textbook of Biotechnology*. S. Chand & Co., New Delhi

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	2	-	-	-	2	-	-	-	-	-	-	-	-	3
CO2	2	-	-	2	-	-	-	2	-	-	3	-	-	-	2	-	3
CO3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO4	-	-	2	2	-	-	-	1	-	-	-	-	-	-	-	-	3
CO5	-	-	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
Average	**2.33**	-	**2.5**	**2**	-	-	-	**2**	-	-	**1**	-	-	-	**2**	-	**3**

1- Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VIII

24MBU801 **BIOPROCESS ENGINEERING** **5H-4C**

Instruction Hours/week: L:4 T:1 P: 0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Microbial Physiology and Metabolism (24MBU201)

COURSE OBJECTIVES (CO):

- To elucidate the significance of transgenic plants as bioreactors for the production of enzymes.
- To address downstream processes of fermented products
- To learn product formation and inhibition pathways and their regulations

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Learn and design basic fermenter, bioreactor configuration, design features	Understand/Create
CO2	Understand and analyse Growth of cultures in the fermenter	Analyze
CO3	Practice Transport phenomena in fermentation	Apply
CO4	Learn and analyse Enzymes and Enzyme Kinetics	Analyze
CO5	Perform down streaming process of microbial products	Apply

UNIT I Fermenter **10 HOURS**

Design of a basic fermenter, bioreactor configuration, design features, computer control of fermentation process, measurement and control of process. Types of Bioreactors and its functions.

UNIT II Cultures in the fermenter **12 HOURS**

Growth of cultures in the fermenter. Importance of media in fermentation, media formulation and modification. Isolation, selection and improvement of important strains and pathways –Mutation, Protoplast fusion, parasexual cycle and genetic engineering for strain improvements. Kinetics of growth in batch culture, continuous culture with respect to substrate utilization, specific growth rate, steady state in a chemostat, fed-batch fermentation, yield of biomass, product, calculation for productivity.

UNIT III Physical factors and scale-up **12 HOURS**

Transport phenomena in fermentation: Gas- liquid exchange and mass transfer, oxygen transfer, critical oxygen concentration, heat transfer, aeration/agitation, its importance. Sterilization of Bioreactors, nutrients, air supply, products and effluents, process variables and control, scale-up of bioreactors.

UNIT IV Microbial Products and Downstream process **14 HOURS**

Enzymes- Introduction, Enzyme Kinetics, Immobilized Enzyme system, large scale production, Vitamins (Vitamin C), Amino acids, Enzymes, Antibiotics, Organic acids, Vaccines, Cheese, and Exopolysaccharides. Biotransformation product (steroid). Down streaming process of microbial products (Peptides, Biopolymers, surfactants, Enzymes) - separation, centrifugation, filtration, extraction, purification, crystallization, crystal washing, drying of crystals, freeze-drying, spray drying.

UNIT V Preservation **12 HOURS**

Product formation and inhibition pathways and their regulations; applications in medicine, agriculture and industry. Role of plant and animal cells in bioprocess. Industrially important microorganisms, preservation, national and international culture collection centers.

Total: 60 HOURS

TEXT BOOKS:

1. Shuler, M.L., Kargi F., and DeLisa, M. (2017). *Bioprocess Engineering: Basic concepts*, 3rd Edition, Prentice Hall, Engelwood Cliffs.
2. Casida, L.E.J.R. *Industrial Microbiology*, 2nd Edition, (2019), New Age International Private Limited
3. El-Mansi, E. M. T., Bryce, C. F. A., Arnold L. Demain., Allman, A.R. (2011). *Fermentation Microbiology and Biotechnology*, 3rd Edition, CRC Press.

REFERENCE BOOKS:

1. Peter Stanbury, Allan Whitaker., S, Stephen Hall. (2016). *Principles of Fermentation Technology*, 3rd Edition, Elsevier Science and technology.
2. Richard H. Baltz., Arnold L. Demain., Julian E. Davies. (2010). *Manual of Industrial Microbiology and Biotechnology*, 3rd edition, American Society for Microbiology.
3. Michael J. Waites., Neil L. Morgan. (2001). *Industrial Microbiology: An Introduction*, Wiley-Blackwell

CO, PO, PSO Mapping

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	2	1	-	-	2	-	-	1	-	-	-	-	-	3
CO2	2	-	3	-	2	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	3
CO4	3	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO5	-	-	-	-	2	-	-	3	-	-	-	-	-	-	-	-	3
Average	**3**	**-**	**2.5**	**2**	**2**	**-**	**-**	**2.5**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**

1- Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VIII

24MBU802 MICROBIAL ENZYMOLOGY 5H-4C

Instruction Hours/week: L:4 T:1 P: 0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Biochemistry (24MBU101)

COURSE OBJECTIVES (CO):

- To present methods and experimental tools used in enzymology with an emphasis on prokaryotes and eukaryotes.
- To deal with enzyme structure, stability, organization, and expression.
- To know the production and purification of microbial enzymes.

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand Enzyme properties and kinetics	Understand
CO2	Learn and analyse enzyme regulation	Analyze
CO3	Learn and practice Isolation and purification of enzymes	Apply
CO4	Apply assay techniques for microbial enzymes	Apply
CO5	Analyse and apply enzyme engineering in industries	Apply

UNIT I Bio energetics: **12 HOURS**

Enzyme nomenclature, classification, general properties of enzymes, factors affecting enzyme activity, activation energy, transition state, turnover number, enzyme co-factors. Enzyme kinetics; General kinetic principles; steady-state enzyme kinetics, Michelis-Menton equation, importance of Km and Vmax.

UNIT II Enzyme regulation: 11 HOURS

Allosteric and cooperative effects, conquered model of Monod et al, and sequential model of Koshl and et al, Principles of metabolic regulations; feedback regulations of multifunctional pathway.

UNIT III Isolation and purification of enzymes: 12 HOURS

Enzyme extraction –soluble enzymes, membrane bound enzymes, purification-precipitation methods, concentration of biomolecules: salting with ammonium sulphate precipitation, dialysis, lyophilisation, chromatographic methods, total activity and specific activity.

UNIT IV Assay techniques for microbial enzymes: 10 HOURS

Amylases, proteases, cellulases, and lipases, Basic principles of cell and enzyme immobilization.

UNIT V Uses of enzymes in analysis 15 HOURS

Enzyme electrodes. Enzyme as biosensor, potentiometric biosensor, industrial applications of enzymes. Commercial value: steroidal conversions, penicillin and antibiotic conversion, immunosensor. Recent advances and future prospects of enzyme engineering; artificial enzymes. Enzymes in organic solvents, enzyme targeting using liposomes, isoenzymes.

Total: 60 HOURS

TEXT BOOKS:

1. Watson D, Baker TA, Bell SP, Gann A, Levine Mand Losick R (2008). *Molecular Biology o f the Gene,* 6th edition, Cold Spring Harbour Lab. Press, Pearson Publication.
2. DeRobertis EDP and DeRobertis EMF (2006) *Cell and Molecular Biology*, 8thedition. Lippin ott Williams and Wilkins, Philadelphia.
3. Sambrook J and Russell DW. (2001). *Molecular Cloning: A Laboratory Manual*.4TH Edition, Cold Spring Harbour, Laboratory press.

REFERENCE BOOKS:

1. Becker WM, Kleinsmith LJ, Hardin J and Bertoni GP (2009). *The World of the Cell*,7th edition, Pearson Benjamin Cummings Publishing, San Francisco.
2. Karp G (2010) *Cell and Molecular Biology: Concepts and Experiments*, 6th edition, John Wil ey & Sons. Inc.
3. Krebs J, Goldstein E, Kilpatrick S (2013). *Lewin's Essential Genes*,3rdEd.,Jones and Bartlett Learning.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	2	-	-	2	-	-	-	-	-	-	-	3	-
CO3	2	-	-	-	-	-	-	3	-	-	-	-	-	-	-	1	3
CO4	2	-	-	-	-	-	-	3	-	-	-	-	-	-	-	1	3
CO5	-	-	2	-	3	-	-	1	-	-	-	-	-	-	-	-	3
Average	**2.5**	-	**2**	-	**2.33**	-	-	**2.25**	-	-	-	-	-	-	-	**2**	**3**

1- Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VIII

24MBU803 MARINE MICROBIOLOGY 5H-4C

Instruction Hours/week: L:4 T:1 P: 0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To provide students with basic knowledge on the biology and ecology of marine microorganisms, and their ecological role.
- To impart modern techniques for the characterization and study of marine microorganisms and microbial communities.
- To understand the ecological role of marine microorganisms and marine microbial communities.

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Explore important and their significance of Marine bio-diversity	Understand
CO2	Analyse and explore Marine food pathogenic microorganisms	Analyze
CO3	Learn and apply Microbiology of degradation of xenobiotic environment	Apply
CO4	Exploit Marine Microbes bioproducts as Food and Biomedical products	Apply
CO5	Discuss industrial application of Marine Microbes like bioethanol production and biopigment products	Analyze

UNIT I Marine microorganisms 12 HOURS

Introduction of coastal, shallow and deep sea. Marine microorganisms- important and their significance. Marine micro and macro-organisms-Collection, enumeration, identification based on morphological, physiological and biochemical characteristics and preservation. International and national collection centres.

UNIT II Extremophiles and Marine bio-diversity 12 HOURS

Thermopiles, basophiles, halophiles, psychrophiles, alkalinophiles, oligotroph, toxi tolerant, xero tolerant, endolith – Extremophiles and their environment. Coral reefs, Sea grass, Mangroves, Hydrothermal vents and water currents.

UNIT III Marine food pathogens and microbial toxin 12 HOURS

Marine food pathogenic microorganisms, distribution, indicator organism's prevention and control. Microbiology of processed -finfish and shellfish products. Microbial diseases- diagnosis and control. Introduction, microbial toxin, algal blooms, types. Harmful effect- Human health, Economic impact and Environmental impact, Potential remedies.

UNIT IV Xenobiotics and Marine nutrient cycles 12 HOURS

Microbiology of degradation of xenobiotic environment: Ecological considerations, decay behavior, degradative plasmids, hydrocarbons, oil pollution, surfactants, plastics and heavy metals. Factors affecting bioremediation – role of microbes in the marine nutrient cycles.

UNIT V Marine Microbes bioproducts **12 HOURS**

Microalgae and seaweeds – Food products- Human food and animal feed, Biomedical Products- Antimicrobial, antioxidant, antiviral and anticancer activity. Aquaculture feed inoculants -Industrial Application-bioethanol production. Biopigment products - Phytoplanktons, Bioluminescence.

Total: 60 HOURS

TEXT BOOKS:

1. Colin Munn. (2011). *Marine Microbiology: Ecology & Applications*. (2nded.). Black Well Publishers.
2. Dube, H.C. (1994). *A text book of fungi, bacteria and viruses*. Vikas Publishing House, New Delhi.
3. David Sigee. (2005). *Freshwater Microbiology: Biodiversity and Dynamic Interactions of Microorganisms in the Aquatic Environment*. (1sted.). Black well Publishers.
4. Dale, J.W. (1994). *Molecular genetics of Bacteria*. John Wiley and Stones.
5. Joanne, M.W., Linda, S., and Christopher, J.W., (2008). Prescott, Harley, and Klein's *Microbiology*. (7thEd). McGraw-Hill Higher Education, United States.

REFERENCE BOOKS:

1. Se-Kwon Kim. (2013). *Bioactive compounds and biotechnological applications*. CLS Publishers.
2. Pelczar, M., JR., Chan, E.C.S., and Noel, R. K., (2006). *Microbiology*. Tata McGraw, Hill. Co. (5thed.).New Delhi.
3. Presscott, L.N., Harley, J.P. and Klein, D.A., (1999). *Microbiology*. W.C. Brown Publishers.
4. Stanier, R.Y., Ingharam, J.L., Wheelis, M.L., and Painter, P.R., (1986). *General Waste water engineering Treatment, Disposal and Reuse*. Metcaff and Eddy. Inc., Tata Mc Grew Hill, New Delhi.
5. Rheinheimer, G., (1980). *Aquatic Microbiology-an Ecological Approach*. Blackwell Scientific Publications.
6. Kirchman, L (2000). *Microbial Ecology of the Oceans*, John Wiley and Sons.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	-	-	-	3	-	-	-	-	-	2	-	-	-	-	3	-
CO3	2	-	-	3		-	-	2	-	-	-	-	-	-	-	3	-
CO4	-	-	-	-	2	-	-	3	-	-	2	-	-	-	-	-	3
CO5	-	-	-	-	2	-	-	2	-	-	1	-	-	-	-	3	-
Average	**2.5**	-	-	**3**	**2.25**	-	-	**2.33**	-	-	**2**	-	-	-	-	**3**	**3**

1- Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VIII

24MBU804 **LABORATORY ANIMAL MANAGEMENT** **5H-4C**

Instruction Hours/week: L:4 T:1 P: 0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To provide training on various methods of animal handling.
- To discuss with the amended act on the Animal Welfare.
- To describe the concept, availability and use of research or testing methods that limit the use of animals or minimize animal distress.
- To study the role of microbes in lab animals and animal houses

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Learn and practice the proper handling and care for animals used in research, testing, and in education.	Understand/ Apply
CO2	Perform handling and care for guinea pigs used in research, testing, and in education	Apply
CO3	Analyse various routes of inoculation in mice	Analyze
CO4	Practice disposal of animal house wastes, safety measures in animal house	Apply
CO5	Understand ethical knowledge for use of animals in research.	Understand

UNIT I Responsibilities of institution and chief investigators **14 HOURS**

General introduction - responsibilities of institution and chief investigators, Aspects of rabbit behaviour relevant to housing, Rabbit Group housing in pens, advantages and disadvantages, Pens, design of pens environment, Rabbit care management – Regrouping, catching and identification in pens and cages, Rabbit care management – food, water, health and breeding in pens and cages, Cage design and environment, Environment enrichment for rabbits in pens and cages, Ethical guidelines for use of animals in research.

UNIT II Mice **12 HOURS**

Introduction-behaviour, anatomic and physiological features of mice in lab, Husbandry- Housing, nutrition and breeding requirements and management of lab mice, occupational health and zoonotic diseases, treatment of disease in mice, regulatory agencies and complain associates with management of lab mice, Restraining and sample collection methods from lab mice, Physical, examination of mice for disease conditions, anesthesia and analgesia -mice, Euthanasia in veterinary care.

UNIT III Rat **10 HOURS**

Introduction to anatomical and physiological features of laboratory rat, major colour groups and varieties of rats, regulatory management housing of laboratory rats-equipment, feed formulation, ailments & disease management of laboratory rats, disease management and ailments of laboratory rats, restraining and sample collection in lab rats, anesthesia and analgesia of lab rats, breeding of laboratory rats.

UNIT IV Guinea pig **12 HOURS**

Introduction – history and classification of guinea pigs, varieties and characteristics of guinea pigs used in labs, characteristics and behaviours of the guinea pig used in labs, housing, nutrition and feeding of guinea pigs, care and handling of guinea pigs in lab, zoonoses of guinea pigs, reproduction and breeding managements in guinea pigs –gnotobiotic animals.

UNIT V Role in microbiology **12 HOURS**

Various routes of inoculation in mice & rats, various routes of inoculation in mice & rats, handling and routes of inoculation in rabbits, guinea pigs, laboratory use of animals –role in microbiology, antibody production in animals, disposal of animal house wastes, safety measures in animal house. National animal house Facilities in India.

Total: 60 HOURS

TEXT BOOKS:

1. The IACUC Handbook (2006)., 2nd ed., eds. Silverman, Murthy, Suckow. CRC Press,
2. Bar Harbor, Maine, (2009). Ed. Joanne Currer, *Handbook on Genetically Standardized Mice*. (6th ed.). The Jackson Laboratory,
3. Pelczar, Jr. M.J., Chan, E.C.S., and Kreig, N.R., (1993). *Microbiology* McGraw-Hill Inc. New York.
4. Suckow, Weisbroth and Franklin. Elsevier, (2006).*The Laboratory Rat*, (2nd ed.). American College of Laboratory Animal Medicine. eds.
5. Yadav, M. (2004). *Applied Entomology*. (1st ed.). Discovery Publishing House, New Delhi.

REFERENCE BOOKS:

1. Richard Fish, Peggy Danneman, Marilyn Brown, and Alicia Karas. (2008). Academic Press, *Anesthesia and Analgesia in Laboratory Animals*. American College of Laboratory Animal Medicine, second ed.).
2. James G. Fox, Muriel T. Davisson, Fred W. Quimby, Stephen W. Barthold, Christian E. Newcomer and Abigail L. Smith. Elsevier, (2007). *The Mouse in Biomedical Research*, second ed.).
3. Fox, Anderson, Lowe, Quimby, (2002). *Laboratory Animal Medicine*, (2nd ed.). American College of Laboratory Animal Medicine, eds.. Academic Press,
4. Percy, D.H., and Barthold, S.W., (2007). *Pathology of Laboratory Rodents and Rabbits*, (3rd ed.). Blackwell Publishing Company.
5. Nalinasundari, M.S., and Santhi, R., (2006). *Entomology*. MJP Publishers, Chennai.
6. Warren, D. M. (2002). *Small Animal Care and Management*. (2nd ed.). Delmar – Thomson Learning, Columbia, NY.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	1	2	-	2	-	-	2	-	-	-	-	2	3
CO2	3	-	-	-	1	2	-	2	-	-	2	-	-	-	-	2	3
CO3	-	-	-	-	-	-	-	3	-	-	2	-	-	-	-	-	3
CO4	-	-	-	-	-	-	-	3	-	-	2	-	-	-	-	-	3
CO5	2	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	3
Average	**2.66**	-	-	-	**1**	**2**	-	**2.5**	-	-	**2**	-	**3**	-	-	**2**	**3**

1- Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VIII

24MBU805 MEDICAL CODING AND PHARMACOVIGILANCE 5H-4C

Instruction Hours/week: L:4 T:1 P: 0 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 3 Hours

PREREQUISITE:

- Not required

COURSE OBJECTIVES (CO):

- To train students to properly locate, document, and validate appropriate diagnostic and procedure codes.
- To teach conventions, General Coding Guidelines for various diseases and infections
- To impart knowledge in Pharmacovigilance, Management of adverse drug reactions and Pharmacovigilance methods

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Understand and analyse importance and significance of coding	Analyzig
CO2	Apply coding guidelines for Infections and Parasitic Diseases	Applying
CO3	Evaluate adverse drug reactions	Evaluating
CO4	Learn and apply Pharmacovigilance methods	Applying
CO5	Gain knowledge of medical legal and ethical responsibilities, as well as anatomy and medical terminology	Understanding

UNIT I Introduction to US Healthcare 10 HOURS

Healthcare in India and US, Patient, Provider and Payers Relationship, Importance and significance of coding in today's world

UNIT II ICD-10-CM 12 HOURS

History, Volumes, Conventions, General Coding Guidelines, Chapter Specific Guidelines, Infections and Parasitic Diseases, Neoplasms, Endocrine, Nutritional and metabolic diseases and immunity disorders. Diseases of blood and blood forming organs. Mental disorders

UNIT III Introduction to Pharmacovigilance 10 HOURS

History and development of Pharmacovigilance, Importance of safety monitoring of Medicine. WHO international drug monitoring programme, Pharmacovigilance Program of India (PvPI).

UNIT IV Introduction to adverse drug reactions 14 HOURS

Definitions and classification of ADRs, Detection and reporting, Methods in Causality assessment, Severity and seriousness assessment, Predictability and preventability assessment Management of adverse drug reactions. Drug and disease classification Anatomical, therapeutic and chemical classification of drugs, International classification of diseases, daily defined doses International Non-proprietary Names for drugs.

UNIT V Pharmacovigilance methods 12 HOURS

Passive surveillance – Spontaneous reports and case series Stimulated reporting. Active surveillance – Sentinel sites, drug event monitoring and registries Comparative observational studies – Cross sectional study, case control study and cohort study. Targeted clinical investigations.

Total: 60 HOURS

TEXT BOOKS

1. SK Gupta, (2018). *Textbook of Pharmacovigilance: Ensuring the Safe Use of Medicines*. Sushma Srivastava Jaypee Brothers Medical Publishers,

REFERENCE BOOKS

1. Varun and Deepak Pragi. (2020). *Current trends in pharmacovigilance*.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	-	2	-	-	-	-	-	-	-	-	-	-	2	3
CO2	3	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	3
CO3	2	-	2	1	3	-	-	-	-	-	-	-	-	-	-	-	3
CO4	2	-	-	-	-	-	-	3	-	2	-	-	-	-	-	-	3
CO5	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	3
Average	**3**	**-**	**2**	**1**	**2.33**	**-**	**-**	**3**	**-**	**2**	**-**	**-**	**3**	**-**	**-**	**2**	**3**

1- Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VIII

24MBU811 BIOPROCESS ENGINEERING - PRACTICAL 5H-2C

Instruction Hours/week: L:0 T:0 P: 5 **Marks:** Internal**:40** External**:60 T**otal**:100**

End Semester Exam: 9 Hours

PREREQUISITE:

- Bioprocess Engineering (24MBU801)

COURSE OBJECTIVES (CO):

- To teach the use of microorganisms in the manufacture of food or industrial products.
- To impart knowledge on microbial fermentation of enzymes and antibiotics
- To acquire knowledge and practice Microbial fermentation of amino acids and organic acids

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	**Course Outcomes**	**Blooms Level**
CO1	Practice production and estimation of various enzymes	Apply
CO2	Apply techniques in production of amino acids	Apply
CO3	Exercise microbial fermentation for the production of organic acids	Apply
CO4	Apply fermentation techniques in the production of antibiotics	Apply
CO5	Utilize techniques for the production of Alcoholic beverages	Apply

EXPERIMENTS **60 HOURS**

1. Microbial fermentation – Production and estimation (qualitative and quantitative) of enzyme-Amylase, Protease, lipase and asparaginase.
2. Microbial fermentation –Production and estimation (qualitative and quantitative) of Amino acid – Glutamic acid.
3. Microbial fermentation – Production and estimation (qualitative and quantitative) of Organic acid-Citric acid and DHA.
4. Microbial fermentation – Production and estimation (qualitative and quantitative) of Antibiotics - Penicillin, Bacitracin.
5. Microbial fermentation – Production and estimation (qualitative and quantitative) of Alcohol - Ethanol

TEXT BOOKS **Total** : **60 HOURS**

1. Crueger W and Crueger A. (2017). *Biotechnology: A textbook of Industrial Microbiology*. 3rd edition. Panima Publishing Co. New Delhi.
2. Geoffrey M Gadd, Sima Sariaslani (2015). *Advances in Applied Microbiology*, CRC Press.
3. Nduka Okafor, Benedict C. Okeke (2017). *Modern Industrial Microbiology and Biotechnology*, 2nd Edition, CRC Press.

REFERENCE BOOKS

1. Stanbury PF, Whitaker A and Hall SJ. (2006). *Principles of Fermentation Technology*. 2nd edition, Elsevier Science Ltd.
2. E. MTEl-Mansi, Jens Nielsen, David Mousdale (2009) *Fermentation Microbiology and Biotechnology*, Fourth Edition, CRC Press.

3. Karp G. (2010) *Cell and Molecular Biology: Concepts and Experiments*.6th edition. John Wiley & S ons. Inc
4. Nigam A and Ayyagari A. (2007). *Lab Manual in Biochemistry, Immunology and Biotechnology*. Tata McGraw Hill.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	POS2
CO1	3	-	-	2	-	-	-	2	-	-	2	-	-	-	-	-	3
CO2	-	-	-	2	-	-	-	3	-	-	2	-	-	-	-	-	3
CO3	-	-	-	2	-	-	-	3	-	-	2	-	-	-	-	-	3
CO4	-	-	-	2	-	-	-	3	-	-	2	-	-	-	-	-	3
CO5	-	-	-	2	-	-	-	3	-	-	2	-	-	-	-	-	3
Average	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**3**

1- Low, 2 - Medium, 3 - High, '-' - No Correlation

Semester VIII

24MBU891	**RESEARCH PROJECT**	**16H-12C**

Instruction Hours/week: L:0 T:0 P:16 **Marks:** Internal**:120** External**:180 T**otal**:300**

End Semester Exam: -