UG Program (4 Years Honors)
CBCS-2020-21

B.Sc.,
B.Sc., Microbiology, Bio-Chemistry, Chemistry (MBC)

SYLLABUS

PRINCIPAL
Aditya Degree College
KAKINADA

UG Program (4 years Honors) Structure (CBCS)

2020-21 A. Y., onwards

BACHLOR OF SCIENCE

(3rd and 4th year detailed design will be followed as per APSCHE GUIDELINES)

Subjects/ Semesters		I		II		III		IV		V		VI			
		H/W	C	H/W	C	H/W	C	H/W	C	H/W	C	H/W	C		
Languages												THIRD PHASE of APPRENTICESHIP Entire 5th / 6th Semester		FIRST and SECOND PHASES (2 spells) of APPRENTICESHIP between 1st and 2nd year and between 2nd and 3rd year (two summer vacations).	
English		4	3	4	3	4	3								
Language (H/T/S)		4	3	4	3	4	3								
Life Skill Courses		2	2	2	2	2+2	2+2								
Skill Development Courses		2	2	2+2	2+2	2	2								
Core Papers															
M-1	C1 to C5	4+2	4+1	4+2	4+1	4+2	4+1	4+2 4+2	4+1 4+1						
M-2	C1 to C5	4+2	4+1	4+2	4+1	4+2	4+1	4+2 4+2	4+1 4+1						
M-3	C1 to C5	4+2	4+1	4+2	4+1	4+2	4+1	4+2 4+2	4+1 4+1						
M-1	SEC (C6,C7)									4+2 4+2	4+1 4+1				
M-2	SEC (C6,C7)									4+2 4+2	4+1 4+1				
M-3	SEC (C6,C7)									4+2 4+2	4+1 4+1				
Hrs/ W (Academic Credits)		30	25	32	27	32	27	36	30	36	30	0	12	4	4
Project Work															
Extension Activities (Non Academic Credits)															
NCC/NSS/Sports/Extra Curricular									2						
Yoga							1		1						
Extra Credits															
Hrs/W (Total Credits)		30	25	32	27	32	28	36	33	36	30	0	12	4	4

M= Major; C= Core; SEC: Skill Enhancement Courses

PRINCIPAL
Aditya Degree College
KAKINADA

2.DETAILS OF COURSE TITLES & CREDITS

Marks & Credits distribution: UG-Sciences

Sl. No	Course type	No. of courses	Each course teaching Hrs/wk	Credit for each course	Total credits	Each course evaluation			Total marks
						Conti-Assess	Univ-exam	Total	
1	English	3	4	3	9	25	75	100	300
2	S.Lang	3	4	3	9	25	75	100	300
3	LS	4	2	2	8	0	50	50	200
4	SD	4	2	2	8	0	50	50	200
5	Core/SE -I	5+2	4+2	4+1	35	25	75+50	150	1050
	Core/SE -II	5+2	4+2	4+1	35	25	75+50	150	1050
	Core/SE -III	5+2	4+2	4+1	35	25	75+50	150	1050
6	Summer-Intern	2		4	8		100	200	200
7	Internship/ Apprentice/ on the job training	1		12	12		200	200 25	200
		38			**159**				**4550**
8	**Extension Activities (Non Academic Credits)**							25	
	NCC/NSS/Sports/ Extra Curricular			2	2				
	Yoga	2		1	2				
	Extra Credits							25	
	Total	**40**			**142**				

PRINCIPAL
Aditya Degree College
KAKINADA

1. LIFE SKILL AND SKILL DEVELOPMENT COURSES

Life /Skill development courses: 4 courses of LSC and 4 courses of SDC with options

Each course of 2 hrs/ week containing 3 units of syllabi for 30 hrs teaching with 2 credits based on 50 marks evaluation. No internal assessment. University sem-end exam:50 marks (2 Hrs)

Question paper would be in two sections (Section A and Section B) for 50 marks

Section A consisting of 8 questions covering two questions from each unit and the remaining to be from any unit. Student has to write 4 questions and each question carries 5 marks (i.e., 5 X 4 = 20 marks). Each question to be answered with 5-7 points/10-15 lines of answer with necessary diagram/equations/ figure/flow charts, if necessary.

Section B consisting of 6 questions covering all units (i.e., from each unit two questions to be given with either or choice). Student has to write 3 questions and Each question carries 10 marks. (i.e., 10 X 3 = 30 marks). Each question to be answered with 10 to 15 points or 20 to 35 lines along with diagrams/equations/ figure/flow charts, if necessary.

List of Life Skill courses

Sem	No. of Courses	Course name	Preferred teaching department
I	1	Human Values and Professional Ethics (HVPE)	English/Telugu/Any Dept
		Entrepreneurship Development (ED)	Commerce
II	1	Information and Communication Technology (ICT)	Computers
		Indian Culture and Science (ICS)	History/Telugu
III	Compulsory	Environmental Education (EE)	Botany/Zoology/Environmental Science/ Any dept.
	1	Personality Development and Leadership (PDL)	English/Any Dept
		Analytical Skills (AS)	Maths/Statistics

List of Skill Development Courses along with their Semester-wise allotment with choices.

SEM	No. of courses	Names of courses		Preferred teaching department
I	One	1. Tourism Guidance (or)		History/Any dept
		2. Plant Nursery (or)		Botany
		3. Electrical Appliances (or)		Physics
		4. Insurance Promotion		Commerce
II	Two (1 from A group and 1 from B Group)	'A' Group	1. Survey & Reporting (or)	Economics/History
			2. Business communication (or)	English
			3. Solar Energy (or)	Physics
			4. Agricultural Marketing	Commerce/Economics
		'B' Group	1. Social Work Methods (or)	Political science/social work
			2. Advertising (or)	Commerce
			3. Dairy Technology (or)	Zoology
			4. Performing Arts	Telugu
III	one	1. Disaster Management (or)		English/Telugu/Any dept
		2. Online Business (or)		Commerce
		3. Poultry Farming (or)		Zoology
		4. Financial Markets		Economics/Commerce

PRINCIPAL
Aditya Degree College
KAKINADA

DETAILS OF COURSE TITLES & CREDITS

Sem	Course No	Course Name	Course Type (L/T/P)	Hrs/Week	Credits	Max. Marks	Max. Marks
				Sciences:4+2	Sciences: 4+1	Internal/ Conti./ Mid Assessment	Sem- End Exam
I	1	Introduction To Microbiology and Microbial Diversity	T	4	4	25	75
	2	Introduction To Microbiology and Microbial Diversity Lab	L	2	1	-	50
II	3	Microbial Physiology and Biochemistry	T	4	4	25	75
	4	Microbial Physiology And Biochemistry Lab	L	2	1	-	50
III	5	Molecular Biology and Microbial	T	4	4	25	75
	6	Molecular Biology and Microbial Lab	L	2	1	-	50
IV	7	Immunology And Medical Microbiology	T	4	4	25	75
	8	Immunology and Medical Microbiology Lab	L	2	1	-	50
	9	Microbial Ecology and Industrial Microbiology	T	4	4	25	75
	10	Microbial Ecology and Industrial Microbiology Lab	L	2	1	-	50

Note: *Course type code: T: Theory, L: Lab, P: Problem-solving

PRINCIPAL
Aditya Degree College
KAKINADA

a. Proposed combination subjects

BSc CBMB(Chemistry, Botany &Microbiology) BSc (Chemistry, Biochemistry &Microbiology)
BSc (Nutrition, Biochemistry & Microbiology)
BSc (Computer Science, Biochemistry & Microbiology) BSc (Chemistry, Zoology &Microbiology)
BSc (Food Chemistry, Zoology & Microbiology)

b. Student eligibility for joining in the course:

Eligibility Criteria for BSc - MICROBIOLOGY

1. BiPC – Intermediate with Botany, physics, chemistry
2. MBPC (CBSE) - Mathematics, Biology, Physics, Chemistry
3. MPC- Mathematics, Physics, Chemistry
4. MLT vocational course - Medical lab technology
5. MPHW (F)- Multipurpose Health Worker
6. SERI VOCATIONAL
7. CP&M-Crop Production & Management
8. DAIRY- Dairying livestock & management
9. FISH- Fisheries vocational
10. OT-Ophthalmic technician
11. PT-physiotherapy vocational

REFERENCE: https://oamdc.ap.gov.in/courseEligibilityReport.do

c. Faculty eligibility for teaching the course: MSc Microbiology with NET/SLET/Ph.D

d. List of Proposed Skill enhancement courses with syllabus, if any Not Yet finalized by APSCHE

e. Any newly proposed Skill development/Life skill courses with draft syllabus and required resources, **Visit AKNU Website**

PRINCIPAL
Aditya Degree College

Skill Enhancement Courses (SECs) for Semester -V,

From 2022-23(Syllabus-Curriculum)

Structure of SECs for Semester–V

(To choose One pair from the Four alternate pairs of SECs)

Courses 6&7	Name of Course	Th. Hrs/ Week	IE Marks	EE Marks	Credits	Prac. Hrs/wk	Marks	Credits
6A	Food and Dairy Microbiology	3	25	75	3	3	50	2
7A	Environmental and Agriculture Microbiology	3	25	75	3	3	50	2

OR

Courses 6&7	Name of Course	Th. Hrs/ Week	IE Marks	EE Marks	Credits	Prac. Hrs/wk	Marks	Credits
6B	Clinical and Diagnostic Microbiology	3	25	75	3	3	50	2
7B	Molecular Biotechnology, Biostatistics and Bioinformatics	3	25	75	3	3	50	2

OR

Courses 6&7	Name of Course	Th. Hrs/ Week	IE Marks	EE Marks	Credits	Prac. Hrs/wk	Marks	Credits
6C	Pharmaceutical Microbiology	3	25	75	3	3	50	2
7C	Biosafety and IPR	3	25	75	3	3	50	2

Note: Course type code: T: Theory, L: Lab, P: Problem solving

Note: FIRST and SECOND PHASES (2 spells) of APPRENTICESHIP between 1st and 2nd year and between 2nd and 3rd year (two summer vacations)

Note: THIRD PHASE of APPRENTICESHIP Entire 5th / 6th Semester

Note-1: For Semester-V, for the domain subject Microbiology, any one of the three pairs of SECs shall be chosen as courses 6 & 7 i.e.,6A &7A or 6B & 7B or 6C&7C. The pair shall not be broken (ABC allotment is random, not on any priority basis).

Note-2: One of the main objectives of skill enhancement courses (SEC) is to inculcate skills related to the domain subject in students. The syllabus of SEC will be partially skill oriented. Hence, teachers shall also impart practical training to students on the skills embedded in syllabus citing related real field situations.

Note-3: Syllabi of theory, practical's and skill oriented Field training and others inclusion of unit tests together shall be completed in 90 hours (Hours:90 hrs- Teaching: 50 hrs., Labs: 30 hrs., Field training: 05, others incl. unit tests: 05hrs.)

PRINCIPAL
Aditya Degree College
KAKINADA

2. DETAILS OF COURSE TITLES & CREDITS

Sem	Course No	Course Name	Course Type (T/P/L)	Hrs/Week	Credits	Max. Marks	Max. Marks
				Science: 4+2	Science: 4+2	Count/Internal/ Mid Assessment	Sem- End Exam
I	BCH-1	Biomolecules	T	4	4	25	75
		Biomolecules Lab	L	2	1	-	50
II	BCH-II	Analytical Techniques	T	4	4	25	75
		Analytical Techniques Lab	L	2	1	-	50
III	BCH-III	Enzymology, Bioenergetics and Intermediary Metabolism	T	4	4	25	75
		Enzymology, Bioenergetics and Intermediary Metabolism Lab	L	2	1	-	50
IV	BCH-IV	Physiology, Nutritional and Clinical Biochemistry	T	4	4	25	75
		Physiology Nutritional and Clinical Biochemistry Lab	L	2	1	-	50
	BCH-V	Microbiology, Immunology and Molecular Biology	T	4	4	25	75
		Microbiology, Immunology and Molecular Biology Lab	L	2	1	-	50

Note: *Course type code: T: Theory, L: Lab, P: Problem solving

a. Proposed combination subjects: Biochemistry, Biotechnology, Microbiology
Biochemistry, Biotechnology, Chemistry
Biochemistry, Biotechnology, Zoology

b. Student eligibility for joining in the course: + 2/ Intermediate with Bi.P.C. and M.Bi.P.C.

PRINCIPAL
Aditya Degree College
KAKINADA

c. Faculty eligibility for teaching the course: M.Sc. (Minimum Qualification)
M.Phil. and Ph.D. are desirable

d. List of Proposed Skill enhancement courses with syllabus, if any
Industrial Biochemistry
Environmental Biochemistry
Pharmaceutical Biochemistry

e. Any newly proposed Skill development/Life skill courses with draft syllabus and required resources

PRINCIPAL
Aditya Degree College
KAKINADA

Skill Enhancement Courses (SECs) for Semester -V,

From 2022-23(Syllabus-Curriculum)

Structure of SECs for Semester–V

(To choose One pair from the Four alternate pairs of SECs)

Univ. Code	Course 6&7	Name of the Course	Th. Hrs. / Week	IE Marks	EE Marks	Credits	Prac. Hrs./ Wk	Marks	Credits
	6A	Clinical Biochemistry	3	25	75	3	3	50	2
	7A	Haematological and Immunological Techniques	3	25	75	3	3	50	2

OR

Univ. Code	Course 6&7	Name of the Course	Th. Hrs. / Week	IE Marks	EE Marks	Credits	Prac. Hrs./ Wk	Marks	Credits
	6B	Food Technology	3	25	75	3	3	50	2
	7B	Food Microbiology	3	25	75	3	3	50	2

OR

Univ. Code	Course 6&7	Name of the Course	Th. Hrs. / Week	IE Marks	EE Marks	Credits	Prac. Hrs./ Wk	Marks	Credits
	6C	Genetic Engineering	3	25	75	3	3	50	2
	7C	Bioinformatics	3	25	75	3	3	50	2

Note: *Course type code: T: Theory, L: Lab, P: Problem solving

***Note**: FIRST and SECOND PHASES (2 spells) of APPRENTICESHIP between 1st and 2nd year and between 2nd and 3rd year (two summer vacations)

***Note**: THIRD PHASE of APPRENTICESHIP Entire 5th / 6th Semester

Note-1: *For Semester–V, for the domain subject Biochemistry, any one of the three pairs of SECs shall be chosen as courses 6 and 7, i.e., 6A & 7A or 6B & 7B or 6C & 7C. The pair shall not be broken (ABC allotment is random, not on any priority basis).*

Note-2: *One of the main objectives of Skill Enhancement Courses (SEC) is to inculcate field skills related to the domain subject in students. The syllabus of SEC will be partially skill oriented.*

Hence, teachers shall also impart practical training to students on the field skills embedded in the syllabus citing related real field situations

PRINCIPAL
Aditya Degree College
KAKINADA

STRUCTURE OF CHEMISTRY CORE SYLLABUS

Sem	Course No	Course Name	Course Type (T/P/L)	Hrs/Week	Credits	Max. Marks	Max. Marks
				Science: 4+2	Science: 4+1	Count/Internal/ Mid Assessment	Sem- End Exam
I	1	Inorganic and Physical Chemistry	T	4	4	25	75
	2	Practical – I Analysis of SALT MIXTURE	L	2	1	-	50
II	3	Organic and General Chemistry	T	4	4	25	75
	4	Practical – II Volumetric Analysis	L	2	1	-	50
III	5	Organic Chemistry and Spectroscopy	T	4	4	25	75
	6	Practical – III Organic preparations and IR Spectral Analysis	L	2	1	-	50
IV	7	Inorganic, Organic and Physical Chemistry	T	4	4	25	75
	8	Practical – IV Organic Qualitative analysis	L	2	1	-	50
	9	Inorganic and Physical Chemistry	T	4	4	25	75
	10	Practical-V Course Conductometric and Potentiometric Titrimetry	L	2	1	-	50

PRINCIPAL
Aditya Degree College
KAKINADA

ADIKAVI NANNAYA UNIVERISITY:: RAJAHMENDRAVARAM
B.Sc Chemistry Syllabus (w.e.f: 2020-21 A.Y)

Skill Enhancement Courses (SECs) for Semester -V,

From 2020-21(Syllabus-Curriculum)

Structure of SECs for Semester–V

(To choose One pair from the Five alternate pairs of SECs)

Univ. Code	Course NO. 6&7	Name of Course	Th.Hrs./ Week	IE Mar-ks	EE Mar-ks	Credits	Prac. Hrs./ Wk	Mar-ks	Credits
	6A	Synthetic Organic Chemistry	3	25	75	3	3	50	2
	7A	Analysis of Organic Compounds	3	25	75	3	3	50	2
		OR							
	6B	Analytical Methods in Chemistry-1	3	25	75	3	3	50	2
	7B	Analytical Methods in Chemistry-1	3	25	75	3	3	50	2
		OR							
	6C	Industrial Chemistry-1	3	25	75	3	3	50	2
	7C	Industrial Chemistry-2	3	25	75	3	3	50	2
		OR							
	6D	Environmental Chemistry	3	25	75	3	3	50	2
	7D	Green Chemistry and Nanotechnology	3	25	75	3	3	50	2
		OR							
	6E	Analytical Methods in Chemistry	3	25	75	3	3	50	2
	7E	Cosmetics and Pharmaceutical Chemistry	3	25	75	3	3	50	2

Note: *Course type code: T: Theory, L: Lab, P: Problem solving

***Note**: FIRST and SECOND PHASES (2 spells) of APPRENTICESHIP between 1st and 2nd year and between 2nd and 3rd year (two summer vacations)

***Note**: THIRD PHASE of APPRENTICESHIP Entire 5th / 6th Semester

Note-1: For Semester–V, for the domain subject Chemistry, any one of the five pairs of SECs shall be chosen as courses 6 and 7, i.e., 6A&7A or 6B&7B or 6C&7C or 6D&7D or 6E&7E. The pair shall not be broken (ABC allotment is random, not on any priority basis).

***Note-2:** One of the main objectives of Skill Enhancement Courses (SEC) is to inculcate skills related to the domain subject in students. The syllabus of SEC will be partially skill oriented. Hence, teachers shall also impart practical training to students on the skills embedded in syllabus citing related real field situations.*

PRINCIPAL
Aditya Degree College
KAKINADA

UG(English)	Semester - I	Credits: 03
Course - 1	A Course In Communication And Soft Skills	Hrs/Week: 04

Learning Outcomes:

By the end of the course the learner will be able to :

- Use grammar effectively in writing and speaking.
- Demonstrate the use of good vocabulary
- Demonstrate an understating of writing skills
- Acquire ability to use Soft Skills in professional and daily life.
- Confidently use the tools of communication skills

UNIT I: Listening Skills

i. Importance of Listening
ii. Types of Listening
iii. Barriers to Listening
iv. Effective Listening

UNIT II: Speaking Skills

a. Sounds of English: Vowels and Consonants
b. Word Accent
c. Intonation

UNIT III: Grammar

a) Concord
b) Modals
c) Tenses (Present/Past/Future)
d) Articles
e) Prepositions
f) Question Tags
g) Sentence Transformation (Voice, Reported Speech & Degrees of Comparison)
h) Error Correction

UNIT IV: Writing

v. Punctuation
vi. Spelling
vii. Paragraph Writing

UNIT V: Soft Skills

a. SWOC
b. Attitude
c. Emotional Intelligence
d. Telephone Etiquette
e. Interpersonal Skills

పాఠ్య ప్రణాళిక

యూనిట్-I

రాజనీతి - నన్నయ

మహాభారతం-సభాపర్వం-ప్రథమాశ్వాసం-(26-57 పద్యాలు)

యూనిట్-II

దక్షయజ్ఞం - నన్నెచోడుడు

కుమారసంభవం-ద్వితీయాశ్వాసం-(49-86 పద్యాలు)

యూనిట్-III

ధౌమ్య ధర్మోపదేశము - తిక్కన

మహాభారతం-విరాటపర్వం-ప్రథమాశ్వాసం-(116-146) పద్యాలు

యూనిట్-IV

పలనాటి బెబ్బులి - శ్రీనాథుడు (పలనాటి వీరచరిత్ర-ద్విపద కావ్యం పుట 108-112
'బాలచంద్రుడు భీమంబగు సంగ్రామం బొనర్చుట.. (108)..
..... వెఱగంది కుంది' (112) సం. అక్కిరాజు ఉమాకాంతం
ముద్రణ.వి.కె.స్వామి, బెజవాడ 1911.

యూనిట్-V

సీతారావణ సంవాదం - మొల్ల

రామాయణము-సుందరకాండము-(40-87 పద్యాలు)

✦వ్యాకరణం

సంధులు: ఉత్వ, త్రిక, ద్రుతప్రకృతిక, నుగాగమ,ద్విరుక్తటకారాదేశ, యణాదేశ, వృద్ధి, శ్చుత్వ, జశ్త్వ, అనునాసిక సంధులు.

సమాసాలు: అవ్యయీభావ, తత్పురుష, కర్మధారయ, ద్వంద్వ, ద్విగు, బహువ్రీహి.

అలంకారాలుః

అర్థాలంకారాలు ః ఉపమ, ఉత్ప్రేక్ష, రూపక, స్వభావోక్తి, అర్థాంతరవ్యాస, అతిశయోక్తి.

శబ్దాలంకారాలు ః అనుప్రాస (వృత్యనుప్రాస, ఛేకామప్రాస లాటానుప్రాస, అంత్యానుప్రాస)

ఛందస్సు

వృత్తాలు: ఉత్పలమాల, చంపకమాల, శార్దూలము, మత్తేభము;

జాతులు : కందం, ద్విపద; ఉపజాతులు : ఆటవెలది, తేటగీతి, సీసం మరియు ముత్యాలసరాలు

UG Courses	Semester - I	Credits:03
Course: 1	Poetry, Prose & Grammar	Hrs/Weeks:04

UNIT – I OLD POETRY: 1. **"Arya Padukabhishekaha"**,

Valmiki Ramayanam- Ayodhya Kanda, Sarga-100 Geetha Press, Gorakhpur.

2. " **YakshaPrasnaha**", Mahabharatam of Vedavyasa, Vanaparva, Adhyaya -313, Geeta Press, Gorakhpoor.

UNIT – II MODERN POETRY: 1." **Mevada Rajyastapanam"** 4th Canto, Srimat Pratapa Ranayanam, Mahakavyam, Pt.Ogeti Parikshit sarma, Published by, Pt.Ogeti Parikshitsarma, 10/11, Sakal nagar, Pune, 1989.

2.**"VivekanandaSuktayaha"**, Vivekanandasuktisudha by Dr.SamudralaLakshmanaiah, Published by Author, 18-1-84, Yasoda Nagar, Tirupati. Selected Slokas 25.

UNIT – III PROSE: 1. **"Atyutkataihi papapunyairihaiva phalamasnute"**, Hitopadesaha-Mitralabha 2 & 3 stories, Pages 61-84.

2. " **Sudraka -Veeravarakatha''**, Hitopadesaha-Vigraham, 8th story, Pages 63-70,Chowkhamba krishadas academy,Varanasi, 2006.

UNIT - IV GRAMMAR: 1.**DECLENSIONS** Nouns ending in vowels
Deva, Kavi, Bhanu, Dhatru, Pitru, Go, Ramaa, Mati.

2.CONJUGATIONS

1st Conjugation - Bhoo, Gam, Shtha, Drusir, Labh, Mud.

2nd Conjugation - As. 10th Conjugation – Bhaash.

UNIT – V GRAMMAR: 1. **SANDHI - Swara Sandhi** : Savarnadeergha, ayavayava, Guna,Vruddhi, yaanadesa.
-**Halsandhi**:Schutva, Stutva, Anunasika.2.**SAMASA**
Dwandwa, Tatpurusha, Karmadharaya,, Dwigu.

UG(General HINDI)	Semester - I	Credits:03
Course :1	Prose, Short Stories, Grammar and Letter Writing	Hrs/Weeks:04

UNIT 1

गद्य संदेश (Prose)(सं. डा .वी. एल. नरसिंहम शिवकोटि)

1. साहित्य की महत्ता

2. मित्रता

3.पुथ्वीराज की ऑखें

UNIT 2

कथा लोक (Short Stories)(सं. डा. घनश्याम)

1.मुक्तिधन

2.गूदडसाई

3.उसने कहा था

UNIT 3

व्याकरण (Grammar)(सरल हिन्दी व्याकरण.. दक्षिण भारत हिन्दी प्रचार सभा..मद्रास)

लिंग, वचन, काल, वाच्य।

UNIT 4

कार्यालयीन शब्दावली : अंग्रेजी से हिंदी और हिंदी से अंग्रजी

(Changing Administrative Terminology Hindi to English and English to Hindi)

UNIT 5

पत्र लेखन : वैयक्तिक पत्र(छुट्टी पत्र, पिता, मित्र के नाम पत्र, पुस्तक विक्रेता के नाम पत्र

**** **** ****

UG- LIFE SKILL COURSE

HUMAN VALUES AND PROFESSIONAL ETHICS (HVPE)

(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (LS)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 hrs)
I	Life skill course	Human values and professional ethics (HVPE)	30	2	2	50 Marks

Objective: Learning Outcome: On completion of this course, the UG students will be able to

- Understand the significance of value inputs in a classroom and start applying them in their life and profession
- Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
- Understand the value of harmonious relationship based on trust and respect in their life and profession
- Understand the role of a human being in ensuring harmony in society and nature.
- Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

UNIT: 1 - Introduction – Definition, Importance, Process & Classifications of Value Education: Understanding the need, basic guidelines, content and process for Value Education Understanding the thought provoking issues; need for Values in our daily life Choices making – Choosing, Cherishing & Acting, Classification of Value Education: understanding Personal Values, Social Values, Moral Values & Spiritual Values.

UNIT: 2 - Harmony in the Family – Understanding Values in Human Relationships:
Understanding harmony in the Family- the basic unit of human interaction, Understanding the set of proposals to verify the Harmony in the Family; Trust (*Vishwas*) and Respect (*Samman*) as the foundational values of relationship, Present Scenario: Differentiation (Disrespect) in relationships on the basis of body, physical facilities, or beliefs.
Understanding the Problems faced due to differentiation in Relationships. Understanding the harmony in the society (society being an extension of family): *Samadhan*, *Samridhi*, *Abhay*, *Sah-astitva* as comprehensive Human Goals Visualizing a universal harmonious order in society- Undivided Society (*AkhandSamaj*), Universal Order (*SarvabhaumVyawastha*)- from family to world family.

UNIT: 3 - Professional Ethics in Education: Understanding about Professional Integrity, Respect & Equality, Privacy, Building Trusting Relationships.Understanding the concepts; Positive co-operation, Respecting the competence of other professions. Understanding about Taking initiative and Promoting the culture of openness. Depicting Loyalty towards Goals and objectives.

Text Books:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.
2. Bhatia, R. & Bhatia, A (2015) Role of Ethical Values in Indian Higher Education.

References books:

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5. A Nagraj, 1998, JeevanVidyaEkParichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.

Co-curricular Activities:

1. Visit to an Old Age Home and spending with the inmates for a day.
2. Conduct of Group Discussions on the topics related to the syllabus.
3. Participation in community service activities.
4. Working with a NGO like Rotary Club or Lions International, etc.

UG- LIFE SKILL COURSE
ENTREPRENEURSHIP DEVELOPMENT (ED)
(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (LS)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 hrs)
I	Life skill course	Entrepreneurship Development	30	2	2	50 Marks

Course Objective: A Generic Course that is intended to inculcate an integrated personal Life Skill to the student.

Learning Outcomes:

After successful completion of the course the student will be able to;

- Understand the concept of Entrepreneurship, its applications and scope.
- Know various types of financial institutions that help the business at Central, State and Local Level
- Understand Central and State Government policies, Aware of various tax incentives, concessions
- Applies the knowledge for generating a broad idea for a starting an enterprise/start up
- Understand the content for preparing a Project Report for a start up and differentiate between financial, technical analysis and business feasibility.

Unit-I: Entrepreneurship: Definition and Concept of entrepreneurship - Entrepreneur Characteristics – Classification of Entrepreneurs –Role of Entrepreneurship in Economic Development –Start-ups.

Unit-II: Idea Generation and Project Formulation: Ideas in Entrepreneurships – Sources of New Ideas – Techniques for Generating Ideas – Preparation of Project Report –Contents; Guidelines for Report preparation – Project Appraisal Techniques –Economic Analysis-Financial Analysis-Market Analysis.

Unit-III: Institutions Supporting and Taxation Benefits: Central level Institutions: NABARD; SIDBI,– State Level Institutions –DICs – SFC - Government Policy for MSMEs - Tax Incentives and Concessions.

Reference Books:

1. Arya Kumar, Entrepreneurship, Pearson, Delhi
2. Poornima MCH, Entrepreneurship Development –Small Business Enterprises, Pearson, Delhi
3. Sangeetha Sharma, Entrepreneurship Development, PHI Learning
4. KanishkaBedi, Management and Entrepreneurship, Oxford University Press, Delhi
5. Anil Kumar, S., ET.al., Entrepreneurship Development, New Age International Publishers, New Delhi
6. Khanka, SS, Entrepreneurship Development, S. Chand, New Delhi
7. Peter F. Drucker, Innovation and Entrepreneurship
8. A.Sahay, M. S. Chhikara, New Vistas of Entrepreneurship: Challenges &Opportunities
9. Dr B E V L Naidu, Entrepreneurship. Seven Hills Publishers

Suggested Co-Curricular Activities (As far as possible)

1. Group Discussion
2. Debate
3. Seminar
4. Visit to an SSI and preparing of an outline Report
5. Invited Lecture by a Bank Employee on the Bank Support to a Start Up.
6. Chart showing tax concessions to SSI, MSME both direct and indirect.

UG- SKILL DEVELOPMENT COURSE
TOURISM GUIDANCE
(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
I	Skill Development Course	Tourism Guidance	30	2	2	50 Marks

Learning Outcomes:
By successful completion of the course, students will be able to:

- Understand the basic tourism aspects .
- Comprehend the requirements, role and responsibilities of profession of a Tourist Guide
- Apply the knowledge acquired in managing different groups and guiding in a tour
- Explain basic values related to tourism and heritage

Unit I: (06 hrs)
Tourism – What is Tourism - Characteristics of Tourist Places – Guidance in Tourism - Meaning of Guidance – Types of Tour Guidance - Government/Department Regulations

Unit II: (10 hrs)
Types of Guides – Characteristics of a Guide - Duties and Responsibilities of a Guide - The Guiding Techniques –Guide's personality- Training Institutions – Licence.
Leadership and Social Skills - Presentation and Communication Skills - Working with different age and linguistic groups - Working under difficult circumstances – Precautions at the site -Relationship with Fellow Guides and Officials.

Unit III: (10 hrs)
Guest Relationship Management- Personal and Official - Arrangements to Tourists – Coordinating transport - VISA/Passport -Accident/Death -Handling Guests with Special Needs/ Different Abilities – Additional skills required for Special/Adventure Tours - Knowledge of Local Security and Route Chart – Personal Hygiene and Grooming - Checklist - Code of Conduct

Co-curricular Activities Suggested: (04 hrs)

1. Assignments, Group discussion, Quiz etc.
2. Invited lecture/training by local tourism operators/expert/guides
3. Visit to local Tourism Department office and a tourist service office
4. Organisation of college level short-duration tours to local tourist sites.

Reference Books:

1. Jagmohan Negi (2006); Travel Agency and Tour Operations, Kanishka Publishers, New Delhi
2. Mohinder Chand (2009); Travel Agency and Tour Operations: An Introductory Text, Anmol Publications Pvt. Limited, New
3. Pat Yale(1995); Business of Tour Operations, Longman Scientific & Technical, New Delhi
4. Websites on Tourism guidance.

UG- SKILL DEVELOPMENT COURSE
PLANT NURSERY
(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
I	Skill Development Course	Plant Nursery	30	2	2	50 Marks

Learning Outcomes: On successful completion of this course students will be able to;

- Understand the importance of a plant nursery and basic infrastructure toestablish it.
- Explain the basic material, tools and techniques required for nursery.
- Demonstrate expertise related to various practices in a nursery.
- Comprehend knowledge and skills to get an employment or to become an entrepreneur in plant nursery sector.

Unit-1: Introduction to plant nursery: **(06 Hrs)**

1. Plant nursery: Definition, importance.
2. Different types of nurseries –on the basis of duration, plants produced, structure used.
3. Basic facilities for a nursery; layout and components of a good nursery.
4. Plant propagation structures in brief.
5. Bureau of Indian Standards (BIS-2008) related to nursery.

Unit- 2: Necessities for nursery: **(09 Hrs)**

1. Nursery beds – types and precautions to be taken during preparation.
2. Growing media, nursery tools and implements, and containers for plant nursery, in brief.
3. Seeds and other vegetative material used to raise nursery in brief.
4. Outlines of vegetative propagation techniques to produce planting material.
5. Sowing methods of seeds and planting material.

Unit-3: Management of nursery: **(09 Hrs)**

1. Seasonal activities and routine operations in a nursery.
2. Nursery management – watering, weeding and nutrients; pests and diseases.
3. Common possible errors in nursery activities.
4. Economics of nursery development, pricing and record maintenance.
5. Online nursery information and sales systems.

Suggested Co-curricular activities: **(6 Hrs)**

1. Assignments/Group discussion/Quiz/Model Exam.
2. Demonstration of nursery bed making.
3. Demonstration of preparation of media for nursery.
4. Hands on training on vegetative propagation techniques.
5. Hands on training on sowing methods of seeds and other material.
6. Invited lecture cum demonstration by local expert.
7. Watching videos on routine practices in plant nurseries.
8. Visit to an agriculture/horticulture /forest nursery.
9. Case study on establishment and success of a plant nursery.

Reference books:

1. Ratha Krishnan, M., et.al. (2014) *Plant nursery management: Principles and practices,* Central Arid Zone Research Institute (ICAR), Jodhpur, Rjasthan
2. Kumar, N., (1997) *Introduction to Horticulture*, Rajalakshmi Publications, Nagercoil.
3. Kumar Mishra, K., N.K. Mishra and Satish Chand (1994) *Plant Propagation*, John Wiley & Sons, New Jersey.

UG- SKILL DEVELOPMENT COURSE
ELECTRICAL APPLIANCES
(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
I	Skill Development Course	Electrical Appliances	30	2	2	50 Marks

Learning Outcomes: By successful completion of the course, students will be able to:

- Acquire necessary skills/hand on experience/ working knowledge on multimeters, galvanometers, ammeters, voltmeters, ac/dc generators, motors, transformers, single phase and three phase connections, basics of electrical wiring with electrical protection devices.
- Understand the working principles of different household domestic appliances.
- Check the electrical connections at house-hold but will also learn the skill to repair the electrical appliances for the general troubleshoots and wiring faults.

UNIT-I : **(6 hrs)**

Voltage, Current, Resistance, Capacitance, Inductance, Electrical conductors and Insulators, Ohm's law, Series and parallel combinations of resistors, Galvanometer, Ammeter, Voltmeter, Multimeter, Transformers, Electrical energy, Power, Kilowatt hour (kWh), consumption of electrical power

UNIT-II : **(10 hrs)**

Direct current and alternating current, RMS and peak values, Power factor, Single phase and three phase connections, Basics of House wiring, Star and delta connection, Electric shock, First aid for electric shock, Overloading, Earthing and its necessity, Short circuiting, Fuses, MCB, ELCB, Insulation, Inverter, UPS

UNIT-III: **(10 hrs)**

Principles of working, parts and servicing of Electric fan, Electric Iron box, Water heater; Induction heater, Microwave oven; Refrigerator, Concept of illumination, Electric bulbs, CFL, LED lights, Energy efficiency in electrical appliances, IS codes & IE codes.

Co-curricular Activities (Hands on Exercises): **(04 hrs)**

[Any four of the following may be taken up]

1. Studying the electrical performance and power consumption of a given number of bulbs connected in series and parallel circuits.
2. Measuring parameters in combinational DC circuits by applying Ohm's Law for different resistor values and voltage sources
3. Awareness of electrical safety tools and rescue of person in contact with live wire.
4. Checking the specific gravity of lead acid batteries in home UPS and topping-up with distilled water.
5. Identifying Phase, Neutral and Earth on power sockets.
6. Identifying primary and secondary windings and measuring primary and secondary voltages in various types of transformers.
7. Observing the working of transformer under no-load and full load conditions.
8. Observing the response of inductor and capacitor with DC and AC sources.
9. Observing the connections of elements and identify current flow and voltage drops.
10. Studying electrical circuit protection using MCBs, ELCBs
11. Assignments, Model exam etc.

Reference Books:

1. A Text book on Electrical Technology, B.L.Theraja, S.Chand& Co.,
2. A Text book on Electrical Technology, A.K.Theraja.
3. Performance and design of AC machines, M.G.Say, ELBSEdn.,
4. Handbook of Repair & Maintenance of domestic electronics appliances; BPB Publications
5. Consumer Electronics, S.P.Bali, Pearson
6. Domestic Appliances Servicing, K.P.Anwer, Scholar Institute Publications

UG- SKILL DEVELOPMENT COURSE
INSURANCE PROMOTION
(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
I	Skill Development Course	Insurance Promotion	30	2	2	50 Marks

Learning Outcomes:
By successful completion of the course, students will be able to;

- Understand the field level structure and functioning of insurance sector and it's role in protecting the risks.
- Comprehend pertaining skills and their application for promoting insurance coverage
- Prepare better for the Insurance Agent examination conducted by IRDA
- Plan 'promoting insurance coverage practice' as one of the career options.

UNIT I:
Section I: **(06 Hrs)**
Introduction of Insurance - Types of insurances. Growth of Insurance sector in India - Regulatory mechanism (IRDA) - Its functions

UNIT II:
Section II: **(10 Hrs)**
Life Insurance plans. Health insurance plans. Products and features. Contents of documents– Sales Promotion methods - Finding prospective customers –Counselling – Helping customers in filing - Extending post-insurance service to customers.

UNIT III:
Section III: **(10 Hrs)**
General Insurance - It's products (Motor, Marine, Machinery, Fire, Travel and Transportation) and features. Contents of documents. Dealing with customers – Explaining Products to Customers - Promoting Customer loyalty. Maintenance of Records.

Co-curricular Activities Suggested: **(4 hrs)**

1. Collection of pamphlets of various insurance forms and procedures
2. Invited Lectures by Development Officers concerned
3. Mock practice of selling of insurance products
4. Preparation of working documents
5. Assignments, Group discussion, Quiz etc.

Reference books:

1. Principles of Insurance, Himalaya publishing House
2. Principles and Practice of Insurance, "
3. Fundamentals of insurance, "
4. Life and General Insurance Management, "
5. Financial services, Tata McGraw hill
6. Insurance Principles and Practices, Sultan Chand &Sons
7. Websites on insurance promotion

B Sc	Semester: I	Credits: 4
Course: 1	Introduction to Microbiology and MicrobialDiversity	Hrs/Wk: 4

Aim and objectives of Course:
To understand History & Development of Microbiology, Microscopy, staining and sterilization techniques, Ultra-structure of cell, Different methods of microbial characterization To study nature of viruses, viral classification, cultivation of viruses and Type study of TMV & HIV

Learning outcomes of Course
Up on completion of the course students able to

1. Explain relationship and apply appropriate terminology relating to the structure, Genetics, metabolism and ecology of prokaryotic microorganisms, Algae, viruses and Fungi.
2. Students will get basics and importance of Microbiology.
3. Demonstrate appropriate laboratory skill and techniques related to isolation, staining, identification and control of microorganisms.

UNIT I:
History of Microbiology & Place of Microorganisms in the living world: History of Microbiology in the context of contributions of Anton von Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Ivanowsky,Martinus Beijerinck and Sergei Winogradsky. Importance and applications of microbiology, Place of Microorganisms in the Living World Haeckel's three Kingdom concept, Whittaker's five kingdom concept, three domain concept of Carl Woese

UNIT II:
Prokaryotic microorganisms and Viruses: Ultra-structure of Prokaryotic cell- Cell Wall, Cell Membrane, Cytoplasm, Nucleoid, Plasmid, Inclusion Bodies, Flagella Pili, Capsule, Endospore General characteristics of Bacteria (Size, shape, arrangement, reproduction) General characteristics of Rickettsia, Mycoplasmas, Cyanobacteria, Archaea General characteristics of viruses, Cultivation of Viruses (in brief) Morphology, Structure and replication of TMV and Lambda Bacteriophage.

UNIT III:
Eukaryotic microorganisms: Fungi - Habitat, nutrition, vegetative structure and modes of reproduction; outline classification, Algae - Habitat, thallus organization, photosynthetic pigments, storage forms of food, reproduction.. Protozoa – Habitat, cell structure, nutrition, locomotion, excretion, reproduction, encystment, outline classification.

UNIT IV:
Isolation and Culture of Bacteria and Fungi: Growth media- Natural, synthetic and semi synthetic media. Selective, Enrichment, and Differential media Pure culture techniques - dilution-plating, Streak-plate, Spread-plate, Pour-Plate and micromanipulator. Preservation of microbial cultures - sub culturing, overlaying cultures with mineral oils, lyophilization, sand cultures, storage at low temperature.

UNIT V:
Principles of Microscopy, Sterilization and Disinfection: Principles of microscopy - Bright field and Electron microscopy (SEM and TEM). Staining Techniques - Simple and Differential staining techniques (Gram staining, Sporestaining). Sterilization and disinfection techniques – Physical methods - autoclave, hot- air oven, pressure cooker, laminar air flow, filter sterilization, Radiation methods - UV rays, Gamma rays. Chemical methods - alcohols, aldehydes, fumigants, phenols, halogens and hypochlorite's.

RECOMMENDED TEXT BOOKS:

1. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (1993). Microbiology. 5th Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi.
2. Dube, R.C. and Maheswari, D.K. (2000) General Microbiology. S Chand, New Delhi. Edition), Himalaya Publishing House, Mumbai.
3. Power, C.B. and Daginawala, H.F. (1986). General Microbiology Vol I & II
4. Prescott, M.J., Harley, J.P. and Klein, D.A. (2012). Microbiology. 5th Edition, WCB McGrawHill, New York.
5. Reddy, S.M. and Reddy, S.R. (1998). Microbiology Practical Manual, 3 rd Edition, Sri Padmavathi Publications, Hyderabad.

REFERENCE BOOKS:

1. Singh, R.P. (2007). General Microbiology. Kalyani Publishers, New Delhi.
2. Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). General Microbiology, 5th Ed., Prentice Hall of India Pvt. Ltd., New Delhi.
3. Microbiology Edited by Prescott
4. Jaya Babu (2006). Practical Manual on Microbial Metabolisms and General Microbiology. Kalyani Publishers, New Delhi.
5. Gopal Reddy *et al.,* Laboratory Experiments in Microbiology

B Sc	Semester: I	Credits: 1
Course: 1(L)	Introduction to Microbiology and MicrobialDiversity Lab	Hrs/Wk: 2

List of the Practical's:

1. Microbiology Good Laboratory Practices and Biosafety.
2. Preparation of culture media for cultivation of bacteria- Nutrient broth & Nutrient agar
3. Preparation of culture media for cultivation of fungi – Sabourauds agar
4. Sterilization of medium using Autoclave
5. Sterilization of glassware using Hot Air Oven
6. Light compound microscope and its handling
7. Microscopic observation of bacteria (Gram +ve bacilli and cocci, Gram -ve bacilli), Algae and Fungi.
8. Simple staining
9. Gram's staining
10. Hanging-drop method& temporary wet mount (TWM) for observation of living microrganisms.
11. Isolation of pure cultures of bacteria by serial dilution and Streak/Spread/Pour Plate Method.
12. Preservation of bacterial cultures by Serial subculturing & Slant Preparation with mineral oil overlay.
13. Observation of electron micrographs of bacterial cells

RECOMMENDED TEXT BOOKS:

1. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (1993). Microbiology. 5th Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi.
2. Dube, R.C. and Maheswari, D.K. (2000) General Microbiology. S Chand, New Delhi. Edition), Himalaya Publishing House, Mumbai.
3. Power, C.B. and Daginawala, H.F. (1986). General Microbiology Vol I & II
4. Prescott, M.J., Harley, J.P. and Klein, D.A. (2012). Microbiology. 5th Edition, WCB McGrawHill, New York.
5. Reddy, S.M. and Reddy, S.R. (1998). Microbiology Practical Manual, 3 rd Edition, Sri Padmavathi Publications, Hyderabad.
6. Singh, R.P. (2007). General Microbiology. Kalyani Publishers, New Delhi.
7. Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). General Microbiology, 5th Ed., Prentice Hall of India Pvt. Ltd., New Delhi.
8. Microbiology Edited by Prescott
9. Jaya Babu (2006). Practical Manual on Microbial Metabolisms and General Microbiology. Kalyani Publishers, New Delhi.
10. Gopal Reddy *et al.*, Laboratory Experiments in Microbiology

DETAILS OF COURSE WISE SYLLABUS

4. Details of course-wise Syllabus

B.Sc.	Semester - I	Credits: 4
Course: 1	BIOMOLECULES	Hrs/Wk: 4

Aim and objectives of Course (Biomolecules):
The student gains knowledge in the chemistry of biomolecules such as water, carbohydrates, lipids, proteins and nucleic acids which make up all the living organisms including humans.

Learning outcomes of Course
This course will enable the student to understand the importance of biomolecules in living organisms and effects of their alterations in diseases occurring in plants, animals and humans.
The practical will give the expertise to the student for analysis of any biological or non-biological sample for identification of its chemical composition.

3·Detailed Syllabus: (Five units with each unit having 12 hours of class work)

UNIT I: 12 hours
Carbohydrates: Carbohydrates: Classification, monosaccharides, D and L designation, open chain and cyclic structures, epimers and anomers, mutarotation, reactions of carbohydrates (due to functional groups - hydroxyl, aldehyde and ketone. Amino sugars, Glycosides. Structure and biological importance of disaccharides (sucrose, lactose, maltose, isomaltose, trehalose), tri-saccharides (raffinose, melezitose), structural polysaccharides (cellulose, chitin, pectin) and storage polysaccharides (starch, inulin, glycogen). Glycosaminoglycans, Bacterial cell wall polysaccharides. Outlines of glycoproteins, glycolipids and blood group substances.

UNIT II: 12 hours
Lipids: Classification, saturated and unsaturated fatty acids, structure and properties of fats and oils (acid, saponification and iodine values, rancidity). General properties and structures of phospholipids. Prostaglandins- structure, types and biological role. Lipoproteins- types and functions, Bio-membranes-formation of micelles, bilayers, vesicles, liposomes. Membrane composition and organization - Fluid mosaic model.

UNIT III: 12 hours
Amino Acids: Amino Acids: Classification, structure, stereochemistry, chemical reactions of amino acids due to carbonyl and amino groups. Titration curve of glycine and px values. Essential and non-essential amino acids, non-protein amino acids. Peptide bond -Nature and conformation. Naturally occurring peptides - glutathione, enkephalin.

UNIT IV: 12 hours
Proteins: Proteins Classification based on solubility, shape and function. Determination of amino acid composition of proteins. General properties of proteins, denaturation and renaturation of proteins. Structural organization of proteins- primary, secondary, tertiary and quaternary structures (Eg. Hemoglobin and Myoglobin).

UNIT V: 12 hours
Nucleic acids and porphyries: Types of RNA and DNA. Structure of purines and pyrimidines, nucleosides, nucleotides. Stability and formation of phosphodiester linkages. Effect of acids, alkali and nucleases on DNA and RNA. Structure of Nucleic acids- Watson-Crick DNA double helix structure, denaturation and renaturation kinetics of nucleic acids-, Tm-values and their significance, cot curves and their significance.Structure of porphyrins: Identification of Porphyrins, Protoporphyrin, porphobilinogen properties, Structure of metallo-porphyrins–Heme, cytochromes and chlorophylls.

RECOMMENDED BOOKS:

1. The biochemistry of Nucleic acids; Adams et al., Chapman and Hall, 1986.
2. Proteins: A guide to study by physical & chemical methods, Haschemeyer and Haschemeyer,
3. Proteins: Structure, function and evolution. Dickerson & Geis, 2nd Edn, Benjamin/Cummings.
4. Biochemistry - Zubay C, Addison – Wesley, 1986.
5. Biochemistry, A problem Approach, 2nd Edn. Wood, W.B. Addison Wesley 1981.
6. Biochemistry, Lehninger A.H.
7. Textbook of Biochemistry West, E.S., Todd, Mason & Vanbruggen, Macmillian&Co.
8. Principles of Biochemistry White-A, Handler, Pand Smith E.L. Mc Grew Hill.
9. Organic chemistry, I.L. Finar, ELBS. (1985).
10. Organic Chemistry by Morrison and Boyd (2000) Prentice Hall.
11. Fundamentals of Biochemistry by Donald Voet (1999).

4· Details of Lab/Practical/Experiments/Tutorials syllabus:

B.Sc.	Semester - I	Credits: 1
Course: 1(L)	BIOMOLECULES LAB	Hrs/Wk: 2

List of practical Experiments:

1. Qualitative identification of carbohydrates- glucose, fructose, ribose/xylose, maltose, sucrose, lactose, starch/glycogen.
2. Qualitative identification of amino acids-histidine, tyrosine, tryptophan, cysteine, arginine.
3. Qualitative identification of lipids- solubility, saponification, acrolein test, Salkowski test, Lieberman-Burchard test.
4. Preparation of Osazones and their identification.
5. Absorption maxima of colored substances-p-Nitrophenol, Methyl orange.

12. Recommended Co-curricular activities:(Co-curricular Activities should not promote copying from text book or from others' work and shall encourage self/independent and group learning)

A. Measurable:

1. Assignments on: Amino Acids
2. Student seminars (Individual presentation of Courses) on topics relating to: Syllabus
3. Quiz Programmes on: Nucleic acids and porphyrins
4. Individual Field Studies/projects: relating to Syllabus
5. Group discussion on: Carbohydrates

B. **Group/Team Projects**: qualitative and quantitative Analysis of Biomolecules General

1. Collection of news reports and maintaining a record of Course-cuttings relating to topics covered in syllabus.
2. Group Discussions on: new scientific approaches and Discoveries
3. Watching TV discussions and preparing summary points recording personal observations etc., under guidance from the Lecturers
4. Any similar activities with imaginative thinking.
   Organizing exhibitions
   Preparation of charts and models
   Science fairs
   Science clubs
   Essay writing

13. Recommended Continuous Assessment methods:
    - Slip test
    - Oral test
    - Assignments
    - Seminars

B.Sc.	Semester - I	Credits: 4
Course: 1	Inorganic and Physical Chemistry	Hrs/Wk: 4

Course outcomes:

At the end of the course, the student will be able to;

- Understand the basic concepts of p-block elements
- Explain the difference between solid, liquid and gases in terms of intermolecular interactions.
- Apply the concepts of gas equations, pH and electrolytes while studying other chemistry courses.

UNIT I:

INORGANIC CHEMISTRY :Chemistry of p-block elements

Group 13: Preparation & structure of Diborane, Borazine

Group 14: Preparation, classification and uses of silicones

Group 15: Preparation & structures of Phosphonitrilic halides $\{(PNCl_2)_n$ where n=3, 4

Group 16: Oxides and Oxoacids of Sulphur (structures only)

Group 17: Pseudohalogens, Structures of Interhalogen compounds.

UNIT II:

1. Chemistry of d-block elements:

Characteristics of d-block elements with special reference to electronic configuration, variable valence, magnetic properties, catalytic properties and ability to form complexes. Stability of various oxidation states.

2. Chemistry of f-block elements:

Chemistry of lanthanides - electronic structure, oxidation states, lanthanide contraction, consequences of lanthanide contraction, magnetic properties. Chemistry of actinides - electronic configuration, oxidation states, actinide contraction, comparison of lanthanides and actinides.

3. Theories of bonding in metals:

Valence bond theory and Free electron theory, explanation of thermal and electrical conductivity of metals based on these theories, Band theory- formation of bands, explanation of conductors, semiconductors and insulators.

UNIT III: PHYSICAL CHEMISTRY

Solid state

Symmetry in crystals. Law of constancy of interfacial angles. The law of rationality of indices. The law of symmetry. Miller indices, Definition of lattice point, space lattice, unit cell. Bravais lattices and crystal systems. X-ray diffraction and crystal structure. Bragg's law. Powder method. Defects in crystals. Stoichiometric and non-stoichiometric defects.

UNIT IV:

1. Gaseous state

van der Waal's equation of state. Andrew's isotherms of carbon dioxide, continuity of state. Critical phenomena. Relationship between critical constants and vander Waal's constants. Lawof corresponding states. Joule- Thomson effect. Inversion temperature.

2.Liquid state

Liquid crystals, mesomorphic state. Differences between liquid crystal and solid/liquid. Classification of liquid crystals into Smectic and Nematic. Application of liquid crystals as LCD devices.

UNIT V:SOLUTIONS, IONIC EQUILIBRIUM & DILUTE SOLUTIONS

1. Solutions

Azeotropes- HCl-H_2O system and ethanol-water system. Partially miscible liquids-phenol- water system. Critical solution temperature (CST), Effect of impurity on consulate temperature. Immiscible liquids and steam distillation. Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law.

2. Ionic equilibrium

Ionic product, common ion effect, solubility and solubility product. Calculations based on solubility product.

3. Dilute solutions

Colligative properties- RLVP, Osmotic pressure, Elevation in boing point and depression in freezing point. Experimental methods for the determination of molar mass of a non-volatile solute using osmotic pressure, Elevation in boiling point and depression in freezing point. Abnormal colligative properties. Van't Hoff factor.

Co-curricular activities and Assessment Methods

1. Continuous Evaluation: Monitoring the progress of student's learning
2. Class Tests, Worksheets and Quizzes
3. Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality
4. Semester- end Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the semester.

REFERENCE BOOKS

1. Principles of physical chemistry by Prutton and Marron
2. Solid State Chemistry and its applications by Anthony R. West
3. Text book of physical chemistry by K L Kapoor
4. Text book of physical chemistry by S Glasstone
5. Advanced physical chemistry by Bahl and Tuli
6. Inorganic Chemistry by J. E. Huheey
7. Basic Inorganic Chemistry by Cotton and Wilkinson
8. A textbook of qualitative inorganic analysis by A.I. Voge
9. Atkins, P.W.&Paula,J.deAtkin'sPhysicalChemistryEd.,OxfordUniversityPress 10thEd(2014).
10. Castellan, G.W.Physical Chemistry4th Ed. Narosa (2004).
11. Mortimer, R. G.Physical Chemistry3rdEd. Elsevier: NOIDA, UP(2009)
12. Barrow, G.M. PhysicalChemistry

B.Sc.	Semester - I	Credits: 1
Course: 1(L)	Analysis of SALT MIXTURE LAB	Hrs/Wk: 2

LABORATORY COURSE -I **30**hrs (2 h / w)

Qualitative inorganic analysis (Minimum of Six mixtures should be analyzed) 50 M

Course outcomes:

At the end of the course, the student will be able to;

- Understand the basic concepts of qualitative analysis of inorganic mixture
- Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
- Apply the concepts of common ion effect, solubility product and concepts related to qualitative analysis

Analysis of SALT MIXTURE **50 M**

Analysis of mixture salt containing two anions and two cations (From two different groups) from the following:

Anions: Carbonate, Sulphate, Chloride, Bromide, Acetate, Nitrate, Borate, Phosphate.

Cations: Lead, Copper, Iron, Aluminium, Zinc, Nickel, Manganese, Calcium, Strontium, Barium, Potassium and Ammonium.

UG(English)	Semester -II	Credits: 03
Course - 2	A Course In Reading & Writing Skills	Hrs/Week: 04

Learning Outcomes:
By the end of the course the learner will be able to :

- Use reading skills effectively
- Comprehend different texts
- Interpret different types of texts
- Analyse what is being read
- Build up a repository of active vocabulary
- Use good writing strategies
- Write well for any purpose
- Improve writing skills independently for future needs

UNIT I:

Prose : 1. How to Avoid Foolish Opinions Bertrand Russell
Skills : 2. Vocabulary: Conversion of Words
: 3. One Word Substitutes
: 4. Collocations

UNIT II:

Prose : 1. The Doll's House Katherine Mansfield
Poetry : 2. Ode to the West Wind P B Shelley
Non-Detailed Text : 3. Florence Nightingale Abrar Mohsin
Skills : 4. Skimming and Scanning

UNIT III:

Prose : 1. The Night Train at Deoli Ruskin Bond**Poetry** : 2. Upagupta Rabindranath Tagore
Skills : 3. Reading Comprehension
: 4. Note Making/Taking

UNIT IV

Poetry : 1. Coromandel Fishers Sarojini Naidu
Skills : 2. Expansion of Ideas
: 3. Notices, Agendas and Minutes

UNIT V:

Non-Detailed Text : 1. An Astrologer's Day R K Narayan
Skills : 2. Curriculum Vitae and Resume
: 3. Letters
: 4. E-Correspondence

పాఠ్య ప్రణాళిక

యూనిట్-I : ఆధునిక కవిత్వం

1. ఆధునిక కవిత్వం- పరిచయం
2. కొండవీడు - దువ్వూరి రామిరెడ్డి
   ('కవికోకిల' గ్రంథావళి-ఖండకావ్యాలు-నక్షత్రమాల సంపుటి నుండి)
3. మాతృసంగీతం - అనిసెట్టి సుబ్బారావు ('అగ్నివీణ' కవితాసంపుటి నుండి)
4. 'తాతకో నూలుపోగు' - బండారు ప్రసాదమూర్తి ('కలనేత' కవితాసంపుటి నుండి)

యూనిట్-II : కథానిక

5. తెలుగు కథానిక - పరిచయం
6. భయం (కథ) - కాళీపట్నం రామారావు
7. స్వేదం ఖరీదు....? - (కథ) - రెంటాల నాగేశ్వరరావు

యూనిట్-III : నవల

8. తెలుగు 'నవల' - పరిచయం
9. రథచక్రాలు (నవల) - మహీధర రామ్మోహన రావు (సంక్షిప్త ఇతివృత్తం మాత్రం)
10. రథచక్రాలు (సమీక్షా వ్యాసం) - డా॥ యల్లాప్రగడ మల్లికార్జునరావు

యూనిట్-IV: నాటకం

11. తెలుగు 'నాటకం' - పరిచయం
12. యక్షగానము (నాటిక) - ఎం.వి.ఎస్. హరనాథరావు.
13. "అపురూప కళారూపాల విధ్వంసదృశ్యం 'యక్షగానము' (సమీక్షా వ్యాసం)"
    -డా॥కందిమళ్ళసాంబశివరావు

యూనిట్-V: విమర్శ

14. తెలుగు సాహిత్య విమర్శ - పరిచయం
15. విమర్శ-స్వరూప స్వభావాలు; ఉత్తమ విమర్శకుడు-లక్షణాలు

UG(General HINDI)	Semester - II	Credits:03
Course : 2	Prose, Short Stories, Grammar and Letter Writing	Hrs/Weeks:04

Unit 1

गद्य संदेश (Prose) (सं. डा.वी.एलण्नरसिंहम शिवकोटि)

1. बिंदा

2. भारत एक है

3.एच.आई.वी / एड्स

Unit 2

कथा लोक (Short Stories) (सं. डा. घनश्याम)

1.भूख हडताल

2.परमात्मा का कुत्ता

3.और वह पढ गई...

Unit 3

व्याकरण (Grammar) (सरल हिन्दी व्याकरण.. दक्षिण भारत हिन्दी प्रचार सभा..मद्रास)

संधि विच्छेद, वाक्यों की शुद्धि

Unit 4

कार्यालयीन हिंदी : पदनाम ... हिंदी से अंग्रेजी और अंग्रेजी से हिंदी

(Changing Administrative Terminology Hindi to English and English to Hindi)

Unit 5

पत्र लेखन : (Letter Writing)

नौकरी केलिए आवेदन पत्र

**** **** ****

UG Courses	Semester - II	Credits:03
Course: 2	Poetry, Prose & Grammar	Hrs/Weeks:04

UNIT – I OLD POETRY:

1."**Indumateeswayamvaram**", Raghuvamsam of kalidasa, 6th canto, Chowkhamba krishadas academy, Varanasi-2012.

2. "**Deekshaapradanam**", Buddacharitam of Aswagosha, 16th canto. Selected verses.

UNIT – II MODERN POETRY:

1. "**Gangavataranam**", Bhojas Champu Ramayanam, Balakanda.
2. "**Mohapanodaha**", 4th cant. Dharma Souhrudam by P.Pattabhi Ramarao, , Published by Author, Ramanth Nagar.
3. "**VandeKasmeerabharatam**", by Doolypala Ramakrishna from Samskrita pratibha, sahitya academy , New Delhi -2018.

UNIT – III PROSE:

1. "**Avantisundarikatha**", 5th Chapter. Dasakumara Charitam, Purva peetika.
2. "**Charudattacharitam**", Bhasakathasaraha by Y.Mahalingasastry.

UNIT - IV GRAMMAR:

1. **DECLENSIONS** :Nouns ending in vowels
   Nadee, Janu, vadhoo, Matru, Phala, Vaari & Madhu.
2. **CONJUGATIONS**
   III Conjugation- Yudh, IV Conjugation- Ish, VIII Conjugation- Likh, Kru, IX Conjugation-Kreen X, Conjugation-Kath, Ram, Vand.

UNIT – V GRAMMAR:

1. **SANDHI** - Halsandhi : Latva, Jastva
   -Visarga sandhi: Utva, Visargalopa, Rephadesa, Ooshma.

2.**SAMASA**
Avyayeebhava, Bahruvrihi.

UG- LIFE SKILL COURSE
INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)

(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (LS)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 hrs)
II	Life skill course	Information and Communication Technology (ICT)	30	2	2	50 Marks

Objectives: This course aims at acquainting the students with basic ICT tools which help them in their day to day and life as well as in office and research.

Course outcomes: After completion of the course, student will be able to;

- Understand the literature of social networks and their properties.
- Explain which network is suitable for whom.
- Develop skills to use various social networking sites like twitter, flickr, etc.
- Learn few GOI digital initiatives in higher education.
- Apply skills to use online forums, docs, spreadsheets, etc for communication, collaboration and research.
- Get acquainted with internet threats and security mechanisms.

UNIT-I:Fundamentals of Internet: What is Internet?, Internet applications, Internet Addressing – Entering a Web Site Address, URL–Components of URL, Searching the Internet, Browser–Types of Browsers, Introduction to Social Networking: Twitter, Tumblr, LinkedIn, Facebook, flickr, Skype, yahoo, YouTube, WhatsApp.

UNIT-II: E-mail: Definition of E-mail -Advantages and Disadvantages –User Ids, Passwords, Email Addresses, Domain Names, Mailers, Message Components, Message Composition, Mail Management. G-Suite: Google drive, Google documents, Google spread sheets, Google Slides and Google forms.

UNIT-III: Overview of Internet security, E-mail threats and secure E-mail, Viruses and antivirus software, Firewalls, Cryptography, Digital signatures, Copyright issues. What are GOI digital initiatives in higher education? (SWAYAM, Swayam Prabha, National Academic Depository, National Digital Library of India, E-Sodh-Sindhu, Virtual labs, e-acharya, e-Yantra and NPTEL).

RECOMMENDED CO-CURRICULAR ACTIVITIES: Co-curricular activities shall not promote copying from textbook or from others work and shall encourage self/ independent and group learning.

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
2. Student seminars (on topics of the syllabus and related aspects (individual activity))
3. Quiz and Group Discussion
4. Slip Test
5. Try to solve MCQ's available online.
6. Suggested student hands on activities:

a. Create your accounts for the above social networking sites and explore them, establish a video conference using Skype.
b. Create an Email account for yourself- Send an email with two attachments to another friend. Group the email addresses use address folder.
c. Register for one online course through any of the online learning platforms like NPTEL, SWAYAM, Alison, Codecademy, Coursera. Create a registration form for your college campus placement through Google forms.

Reference Books:

1. In-line/On-line: Fundamentals of the Internet and the World Wide Web, 2/e –By Raymond Green law and Ellen Hepp, Publishers: TMH
2. Internet technology and Web design, ISRD group, TMH.
3. Information Technology – The breaking wave, Dennis P.Curtin, Kim Foley, Kunai Sen and Cathleen Morin, TMH.

UG- LIFE SKILL COURSE
INDIAN CULTURE AND SCIENCE(ICS)
(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (LS)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam(2 Hrs)
II	Life skill course	Indian culture and science(ICS)	30	2	2	50 Marks

Learning Outcomes: By successful completion of the course, students will be able to:

- Understand the evolution of India's culture
- Analyze the process of modernization of Indian society and culture from past to future
- Comprehend objective education and evaluate scientific development of India in various spheres
- Inculcate nationalist and moral fervour and scientific temper

Unit – I: Unity in Diversity in India: **(09 hrs)**

Coexistence of various religions since ancient times - Hinduism, Buddhism, Jainism and Atheism, and later Sikhism, Islam and Christianity The Bhakti (Vishnavite and Saivaite) and Sufi Movements. The concepts of seela, karuna, kshama, maitri, vinaya, santhi and ahimsa Achievements in Literature, Music, Dance, Sculpture and Painting - Craftsmanship in cloth, wood, clay, metal and ornaments Cultural diversity, Monogamy, Family system, Important seasonal festivals

Unit – II: Social Reforms and Modern Society: **(09 hrs)**

Reforms by Basaveswara - Raja Rama Mohan Roy – Dayananda Saraswathi –Swamy Vivekananda –Mahatma Gandhi - B. R. Ambedkar - Reforms in Andhra by Vemana,Veerabrahmam, Gurajada, Veeresalingam and Gurram Jashua (only reforms in brief, biographies not needed). Modern Society: Family unity, Community service, Social Harmony, Civic Sense, Gender Sensitivity, Equality, National Fervor

Unit – III: Science and Technology: **(11 hrs)**

Objectivity and Scientific Temper – Education on Scientific lines (Bloom's Taxonomy) - Online Education. Developments in Industry, Agriculture, Medicine, Space, Alternate Energy, Communications, Media through ages

Co-curricular Activities Suggested: Assignments, Group discussions, Quiz etc

1. Invited Lecture by a local expert
2. Visit to a scientific institutions, local heritage sites, museums, industries etc.

Reference Books:

1. History of India and Culture (Upto 1526 A.D), Telugu Academy
2. History of India and Culture (1526 A.D to 1964), Telugu Academy
3. Basham, A.L (ed), A Cultural History of India
4. Hana S. Noor Al-Deen&J.A.Hendricks, Social Media : Usage and Impact
5. Bipan Chandra, Aditya Mukherjee, Mridula Mukherjee, India After Independence
6. S.K.Thakur, ISRO: History and Achievements
7. V. Ramakrishna, Social Reform Movement Andhra, Vikas Publications

UG- SKILL DEVELOPMENT COURSE

SURVEY & REPORTING

(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Group 'A'	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
II	Skill Development Course		Survey & Reporting	30	2	2	50 Marks

Learning Outcomes:

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

- Understand the basics of survey and reporting needs and methods
- Comprehend designing of a questionnaire
- Conduct a simple and valid survey and Collect data
- Organize and interpret data and Prepare and submit report.

Unit I: (08Hrs)

Survey: Meaning and Definition –Identifying need for survey - Identifying Sample –Characteristics of Sample - Types of Survey – Survey Methods – Advantages and Disadvantages of Survey – Essential Steps in Survey – Online Survey.

Unit II: (09Hrs)

Preparing Questionnaire: Types and Parts of Questionnaire – Qualities of good Questionnaire – Precautions in Preparing Questionnaire. Administering/Piloting Questionnaire –Collection of data - Dealing with People – Maintaining objectivity/neutrality.

Unit III: (10 Hrs): Methods of Organizing data – Forms of data presentation - Tables and Figures – Basic Statistical Methods of Analysis of data –Percentages - Mean, Mode and Median –Simple Ways of showing Results– Tables/Graphs/Diagrams

Report Writing: Forms of Reporting - Parts of a Report - Title page to Acknowledgements - Characteristics of a Good Report – Style of language to be used - Explaining Data in the Report – Writing fact-based Conclusions – making Recommendations – Annexing required material.

Recommended Co-curricular Activities (3 hrs):

1. Invited Lecture/Training by a Local Expert
2. Collection and study of questionnaires
3. Preparation of sample questionnaire and conduct a live sample survey
4. Preparation of a sample Report
5. Assisting a real time field survey and report writing
6. Assignments, Group discussion, Quiz etc.

Reference books:

1. Denscombe M., The Good Research Guide: For Small-Scale Social Research Projects, Open Uni. Press, 1998
2. Sudman S &Bradburn N.M., Asking Questions, 1973

UG- SKILL DEVELOPMENT COURSE
BUSINESS COMMUNICATION
(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Group 'A'	Course Title	Hrs/ Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
II	Skill Development Course		Business Communication	30	2	2	50 Marks

Learning Outcomes:
After successful completion of this course, students will be able to;

- Understand the types of business communication and correspondence
- Comprehend the processes like receiving, filing and replying
- Acquire knowledge in preparing good business communications
- Acquaint with organizational communication requirements and presentations.

UNIT I: **(06hrs)**
Introduction and Importance of communication an overview - meaning and process of communication - organizational communication and its barriers.

UNIT II: **(10hrs)**
Types of Business Communications –Categories, methods and formats - Business vocabulary - Business idioms and collocations – Organisational Hierarchy - Various levels of communication in an organization – Top-down, Bottom-up and Horizontal-Business reports, presentations– Online communications.

UNIT III: **(10hrs)**
Receiving business communications -Filing and processing -Sending replies. Routine cycle of communications – Writing Communications - Characteristics of a good business communication - Preparation of business meeting agenda – agenda notes - minutes –circulation of minutes – Presentations of communication using various methods.

Recommended Co-curricular Activities **(04hrs)**:
1. Collection of various model business letters
2. Invited lecture/field level training by a local expert
3. Reading of various business reports and minutes and its analysis
4. Presentations of reports, charts etc.
5. Assignments, Group discussion, field visit etc.

Reference books:

1. Chaturvedi. P.D.Chaturvedi.M - Business Communication concepts, Cases and applications - Pearsons Education.
2. Kaul Asha - Effective Business Communication - PHI Learning pvt Ltd .
3. www.swayam.gov.in
4. Websites on business communication

UG- SKILL DEVELOPMENT COURSE
SOCIAL WORK METHODS
(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Group	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
II	Skill Development Course	'B'	Social work Methods	30	2	2	50 Marks

Learning Outcomes: By successful completion of the course, students will be able to:
- Understand the basic concepts relating to social work practice, values, principles of social work and social problems in India
- List out different approaches of providing help to the people in need.
- Acquaint the process of primary methods of social work
- Get to know the skills of working with individuals, groups and communities.

Unit-I: (07Hrs)- Introduction to social work and concepts related to social work : Introduction to Social Work- Definition- Scope- objectives - Functions- social service, social welfare services, social reform, major social problems in India; Social work philosophy, values, objectives, principles, methods and fields of social work.

Unit-II: (09Hrs) Methods of Working with Individuals and Groups
Social case work –Definition-scope and importance of social case work, principles and process of social case work -Tools and techniques in social case work- Counselling skills.
Social Group Work-Definition-scope- the need for social group work –Group work process - Principles of Group Work -Stages of Group Work-Facilitation skills and techniques.

Unit-III: (09Hrs) Working with Communities and Field Work in social work
Community – definition - characteristics- types- community organisation as a method of social work-definition-objectives-principles- phases of community organization - 3 concepts of community development, community participation and community empowerment.
Field work in social work – Nature, objectives and types of field work - Importance of field work supervision.

Suggested Co-curricular Activities: (05 hours)
1. Divide the students into groups, each group containing not exceeding 10 students depending upon the total number of students in a class or section. Each group can search in internet about any one of the institutions which work for the welfare of children or women or elderly or scheduled caste and scheduled tribe children or differently abled persons or Juvenile homes or Correctional homes or hospitals or Mahila Pragathi pranganam or Swadhar project or any social welfare project or non governmental organizations (NGOs) to have an idea about welfare agencies working for the needy.
2. Ask each group to exchange and discuss the information with other groups in the classroom with the information they collected on Internet.
3. Group Discussion with the students- what type of community problems they observe in their villages/towns/cities? Ask them to tell what are the line departments which will help to solve the problems of their communities and suggest them what type strategies help the communities to empower.
4. Invited lectures/Training by local experts
5. Visit to a community
6. Assignments, Quiz etc.

Reference books:

1. Chowdhary, Paul. D. (1992). Introduction to Social Work. New Delhi: Atma Ram and Sons.
2. Friedlander W.A. (1955). Introduction to social welfare, New York, Prentice Hall.
3. Government of India, (1987). Encyclopedia of Social Work in India (Set of 4 Volumes). New Delhi, Publications Division, Ministry of Information and Broadcasting.
4. Lal Das, D.K. (2017). Practice of Social Research – Social Work Perspective, Jaipur, Rawat Publications.
5. Madan, G.R. (2009). Indian Social Problems (Volume 1 & 2). New Delhi: Allied publishers Private Limited.
6. Siddiqui, H.Y. (2007). Social Group Work. Jaipur: Rawat Publications
7. Pasty McCarthy &Carolin Hatcher, (2002). Presentation skills. The Essential Guide for Students. New Delhi, Sage Publications.
8. Websites on Social work methods.

UG- SKILL DEVELOPMENT COURSE

SOLAR ENERGY

(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Group 'A'	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
II	Skill Development Course		Solar Energy	30	2	2	50 Marks

Learning Outcomes: After successful completion of the course, students will be able to:

- Acquire knowledge on solar radiation principles with respect to solar energy estimation.
- Get familiarized with various collecting techniques of solar energy and its storage
- Learn the solar photovoltaic technology principles and different types of solar cells for energy conversion and different photovoltaic applications.
- Understand the working principles of several solar appliances like Solar cookers, Solar hot water systems, Solar dryers, Solar Distillation, Solar greenhouses

UNIT-I – Solar Radiation: **(6 hrs)**

Sun as a source of energy, Solar radiation, Solar radiation at the Earth's surface, Measurement of Solar radiation-Pyroheliometer, Pyranometer, Sunshine recorder, Prediction of available solar radiation, Solar energy-Importance, Storage of solar energy, Solar pond

UNIT-II – Solar Thermal Systems: **(10 hrs)**

Principle of conversion of solar radiation into heat, Collectors used for solar thermal conversion: Flat plate collectors and Concentrating collectors, Solar Thermal Power Plant, Solar cookers, Solar hot water systems, Solar dryers, Solar Distillation, Solar greenhouses.

UNIT-III – Solar Photovoltaic Systems: **(10 hrs)**

Conversion of Solar energy into Electricity - Photovoltaic Effect, Solar photovoltaic cell and its working principle, Different types of Solar cells, Series and parallel connections, Photovoltaic applications: Battery chargers, domestic lighting, street lighting and water pumping

Co-curricular Activities (Hands on Exercises): **(04 hrs)**

[Any four of the following may be taken up]

1. Plot sun chart and locate the sun at your location for a given time of the day.
2. Analyse shadow effect on incident solar radiation and find out contributors.
3. Connect solar panels in series & parallel and measure voltage and current.
4. Measure intensity of solar radiation using Pyranometer and radiometers.
5. Construct a solar lantern using Solar PV panel (15W)
6. Assemble solar cooker
7. Desigining and constructing photovoltaic system for a domestic house requiring 5kVA power
8. Assignments/Model Exam.

Reference Books:

1. Solar Energy Utilization, G. D. Rai, Khanna Publishers
2. Solar Energy- Fundamentals, design, modeling& applications, G.N. Tiwari, Narosa Pub., 2005.
3. Solar Energy-Principles of thermal energy collection & storage, S.P. Sukhatme, Tata Mc-Graw Hill Publishers,1999.
4. Solar Photovoltaics- Fundamentals, technologies and applications, Chetan Singh Solanki, PHI Learning Pvt. Ltd.,
5. Science and Technology of Photovoltaics, P. Jayarama Reddy, BS Publications, 2004.

AGRICULTURAL MARKETING

(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Group	Course Title	Hrs/ Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
II	Skill Development Course	'A'	Agricultural Marketing	30	2	2	50 Marks

Learning Outcomes:

By the successful completion of this course, the student will be able to;

- Know the kinds of agricultural products and their movement
- Understand the types, structure and functioning of agricultural marketing system
- Comprehend related skills and apply them in sample situations
- Extend this knowledge and skills to their production/consumption environment

Unit- I: **(06hrs)**

Introduction of Agriculture and agricultural products (including agriculture, horticulture, sericulture, floriculture, aquaculture- genetic culture and dairy product) - Agricultural Marketing - Role of marketing - Concepts - Goods and services - Movement of product from farm to consumer –Middlemen – Moneylenders - Types of agricultural markets (basic classification).

Unit- II: **(09hrs)**

Basic structure and facilities of an agricultural market – Primary, secondary and tertiary markets– Functioning of Market Yards–Market information – Rythu Bharosa Kendras (RBK) – Govt market policies and regulations- Contract farming -Govt Apps for marketing of agri products.

Unit- III: **(10hrs)**

Planning production – assembling – grading - transportation– storage facilities. Price fixation. Dissemination of market information –and role of ICT. Marketing - Mix- Product element- Place element- Price element- Promotion element. Selection of target market. Government programs in support of Agricultural marketing in India.

Suggested Co-curricular Activities: **(05hrs)**

1. Study visit to agricultural markets and Rythu Bharosa Kendras (RBK)
2. Invited lecture by field expert
3. Survey of various involved activities e.gassembling, grading, storage, transportation and distribution
4. Identify the demand for food processing units
5. Application of Govt Apps as one Nation and one Market
6. Assignments, Group discussion, Quiz etc.

Reference books:

1. S.S.Acharya & N.L.Agarwala, Agricultural Marketing in India - Oxford and IBH Publications
2. K.S.Habeeb - Ur - Rahman Rural Marketing in India - Himalaya publishing
3. S.S.Chinna Agricultural Marketing in India - KALYANI publishers
4. Publications of National Institute of Agricultural Marketing, Odisha
5. Wikiepedia and other websites on Agricultural Marketing.

UG- SKILL DEVELOPMENT COURSE
ADVERTISING
(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Group	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
II	Skill Development Course	'B'	Advertising	30	2	2	50 Marks

Learning Outcomes:
After Successful completion of this course, the students are able to;

- Understand the field of Advertising
- Comprehend opportunities and challenges in Advertising sector
- Prepare a primary advertising model
- Understand applying of related skills
- Examine the scope for making advertising a future career

UNIT I: **(06hrs)**
Introduction of advertising concepts- functions - Types of advertising - Creative advertising messages - Factors determining opportunities of a product/service/Idea

UNIT II: **(10 hrs)**
Role of advertising agencies and their responsibilities - scope of their work and functions - - Ethical issues - Identifying target groups -Laws in advertising. Advertising Statutory Bodies in India - Role of AAAI (Advertising Agencies Association of India), ASCI (Advertising Standard Council of India)

UNIT III: **(10hrs)**
Types of advertising – Basic characteristics of a typical advertisement –Reaching target groups - Local advertising – Feedback on impact of advertisement - Business promotion.

Recommended Co-curricular Activities: **(04 hrs)**

1. Collection and segmentation of advertisements
2. Invited Lectures/skills training on local advertising basics and skills
3. Visit to local advertising agency
4. Model creation of advertisements in compliance with legal rules
5. Assignments, Group discussion, Quiz etc.

Reference books:

1. Bhatia. K.Tej - Advertising and Marketing in Rural India - Mc Millan India
2. Ghosal Subhash - Making of Advertising - Mc Millan India
3. JethWaneyJaishri& Jain Shruti - Advertising Management - Oxford university Press Publications of Indian Institute of Mass Communications
4. Websites on Advertising

UG- SKILL DEVELOPMENT COURSE
DAIRY TECHNOLOGY
(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Group 'B'	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
II	Skill Development Course		Dairy Technology	30	2	2	50 Marks

Learning Outcomes:
After successful completion of the course, students will be able to;

- Understand the pre-requisites for starting a Dairy farm
- Recognize different breeds of Cows & buffaloes following safety precautions.
- Prepare and give recommended feed and water for livestock
- Maintain health of livestock along with productivity
- Vaccination of cattle, nutrients requirements
- Entrepreneurship i.e., Effectively market dairy products
- Ensure safe and clean dairy farm and Standard safety measures to be taken Efficiently start and manage to establish or develop a Dairy Industry

Unit- I (Introduction and Establishment of a Dairy Farm): **(05 Hrs)**

1.1 Dairy development in India – Dairy Cooperatives (NDRI, NDDB, TCMPF) (1hr)
1.2 Constraints of Present Dairy Farming and Future Scope of Dairy Farmer. (1 hr)
1.3 Selection of site for dairy farm; Systems of housing – Loose housing system, Conventional Dairy Farm; Records to be maintained in a dairy farm. (2 hrs)

Unit - II (Livestock Identification and Management): **(13 Hrs)**

2.1 Breeds of Dairy Cattle and Buffaloes – Identification of Indian cattle and buffalo breeds and Exotic breeds; Methods of selection of Dairy animals. (5 hrs)
2.2 Systems of inbreeding and crossbreeding. (2 hrs)
2.3 Weaning of calf, Castration, Dehorning, Deworming and Vaccination programme (3 hrs)
2.4 Care and management of calf, heifer, milk animal, dry and pregnant animal, bulls and bullocks.(3 hrs)

Unit- III (Feed Management, Dairy Management, Cleaning and Sanitation): **(8 Hrs)**

3.1 Basic Principles of Feed, Important Feed Ingredients, Feed formulation and Feed Mixing (2 hrs)
3.2 Operation Flood –Definition of Milk and Nutritive value of milk and ICMR recommendation of nutrients –Per Capita Milk production and availability in India and Andhra Pradesh – Methods of Collection and Storage of Milk–Labelling and Storage of milk products (4 hrs)
3.3 Cleaning and sanitation of dairy farm – Safety precautions to prevent accidents in an industry. (2 hrs)

Co-curricular Activities Suggested: (4 hrs)

1. Group discussion & SWOT analysis
2. Visit to a Dairy Farm
3. Visit to Milk Cooperative Societies
4. Visit to Feed Milling Plants
5. Market Study and Identification of Government Schemes, Insurance and Bank Loans in relation

Reference books:

1. Dairy Science: Petersen (W.E.) Publisher – Lippincott & Company
2. Principles and practices of Dairy Farm –Jagdish Prasad
3. Text book of Animal Husbandry - G C Benarjee
4. Hand book of Animal Husbandry - ICAR Edition
5. Outlines of Dairy Technology – Sukumar (De) – Oxford University press
6. Indian Dairy Products – Rangappa (K.S.) & Acharya (KT) – Asia Publishing House.
7. The technology of milk Processing – Ananthakrishnan, C.P., Khan, A.Q. and Padmanabhan, P.N. – Shri Lakshmi Publications.
8. Dairy India 2007, Sixth edition
9. Economics of Milk Production – Bharati Pratima Acharya Publishers.
10. http://www.asci-india.com/BooksPDF/Dairy%20Farmer%20or%20Entrepreneur.pdf
11. https://labour.gov.in/industrial-safety-health

UG- SKILL DEVELOPMENT COURSE

PERFORMING ARTS

(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Group 'B'	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
II	Skill Development Course		Performing Arts	30	2	2	50 Marks

Learning Outcomes:

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

- Acquire the basic knowledge in performing arts
- Understand the modern stage and performance on the stage
- Comprehend and improve the skills related to performing arts on the stage
- Understand various Telugu folk arts and their significance
- Know the modes of presentation and skills pertaining to folk arts.

Unit-I: Introduction to performing Arts (06 Hrs)

Arts – and its definition; Fine Arts; Arts - Learning &Imitation – Rasaas, Bhaavas and Rasa Sutra. Dasaroopakaas; Nrittha, Nrithya,Natya; Action – Kinds of Actions; Ancient Costume style

Unit-II: Performing Arts – Stage Arts (10 Hrs)

Origin of Drama (Theatre); Features of Stage; Varieties of Modern Telugu Drama; Famous Telugu Dramas. Stage performance; Dramatic Actor and its definition; Actor–characteristics, Functions and Responsibilities. Traits of an Actor – Diction, Articulation, Dialogue modulation, Time sense, Observation, Mime, Improvisation, Commentary, Dress code, Make-up, lighting &Stage Direction.

Unit-III: Performing Arts – Forms (10 Hrs)

Folk Arts, their nature and significance – Brief introduction to Pagativeshaalu, Bommalaatalu, Veedhinaatakaalu, Yakshagaanaalu, Harikathalu, Burrakathalu, Oggukathalu, Chindu,Yakshagaanam, KolaatamandPulivesham.

Co-curricular Activities Suggested: (4 hrs)

1. Collection of information on modern stage plays, natakasamajams and audio visual material.
2. Providing training classes/inviting lectures with the help of local artists
3. Visit to a real time performing folk arts, if possible.
4. Mock experience classes of Stage plays and Folk arts.
5. Assignments, Group discussion, Quiz etc.

Reference books:

1. Andhra Naataka Ranga Charithra –Mikkilineni Radha Krishna Murthy
2. Telugu SahithyaSameeksha (Vol-II) – Dr. G. Nagaiah
3. Telugu NaatakaVilaasam – Dr.P.S.RAppa Rao
4. Telugu JaanapadaVignanam – Prof. Tangirala Venkata Subba Rao
5. JaanapadaVignandhyayanam – Prof. G.S. Mohan
6. NaatyaSasthramu (VisleshanathmakaAdhyayanam) – Dr.P.S.RAppa Rao
7. SahithyaSilpaSameeksha – Prof. PingaliLakshmikantham
8. Nurella Telugu NatakaRangam – Prof. ModaliNagabhushanaSarma
9. Websites on Performing Arts.

B Sc	Semester: II	Credits: 4
Course: 2	Microbial Physiology and Biochemistry	Hrs/Wk: 4

Aim and objectives of Course:

To understand DNA, RNA, Protein structure and synthesis. DNA damage, mutations and repair. Gene transfer methods.

Learning outcomes of Course:

1. This Course provides Understanding of biomolecular synthesis and control will help in further study.
2. Develop knowledge on microbial genetics and molecular biology

UNIT I:

Biomolecules: General characters and outline classification of Carbohydrates (Monosaccharides- Glucose, Fructose, Ribose, Disaccharides- Sucrose, Lactose, Polysaccharides- Starch, glycogen, Cellulose) General characters and outline classification of fatty acids (Saturated & Unsaturated Fatty Acids) Lipids (Simple & complex lipids) General characteristics of Amino Acids and Proteins. Structure of Nucleic acids.

UNIT II:

Enzymes: Properties and classification of Enzymes. Biocatalysis- induced fit and lock and key models. Coenzymes and Cofactors. Inhibition of enzyme activity- competitive, noncompetitive, uncompetitive and allosteric. Factors effecting enzyme activity

UNIT III:

Analytical Techniques: Principle and applications of - Colorimetry Chromatography (paper, thin-layer, and column), Spectrophotometry (UV & visible), Centrifugation and Gel Electrophoresis (Agarose and SDS).

UNIT IV:

Microbial Nutrition and growth: Nutritional requirements of Microorganisms Nutritional groups of microorganisms- autotrophs, heterotrophs, lithotrophs, organotrophs, phototrophs, chemotrophs Microbial Growth- different phases of growth in batch cultures; Synchronous, continuous, biphasic growth. Factors influencing microbial growth Methods for measuring microbial growth - Direct microscopy, viable count estimates, turbidometry and biomass.

UNIT V :

Microbial metabolism: Aerobic respiration - Glycolysis, TCA cycle, ED Pathway, Electron transport Oxidative and substrate level phosphorylations. Anaerobic respiration (Nitrate and sulphate respiration) Fermentation- lacticacid and ethanol fermentations Outlines of oxygenic and anoxygenic photosynthesis in bacteria.

RECOMMENDED TEXT BOOKS:

1. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company Caldwell, D.R. (1995). Microbial Physiology and Metabolism, W.C. Brown Publications,Iowa, USA.
2. Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). Principles of Biochemistry, 2nd Edition, CBS Publishers and Distributors, New Delhi.
3. Sashidhara Rao, B. and Deshpande, V. (2007). Experimental Biochemistry: A student Companion. I.K. International Pvt. Ltd.
4. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed.,
5. W.H.Freeman
6. Voet,D. and Voet J.G (2004) Biochemistry 3rd edition, John Wiley and Sons
7. White, D. (1995). The Physiology and Biochemistry of Prokaryotes, Oxford UniversityPress, New York.

B Sc	Semester: II	Credits: 1
Course: 2(L)	Microbial Physiology and Biochemistry Lab	Hrs/Wk: 2

List of Experiments:

1. Qualitative Analysis of Carbohydrates.
2. Qualitative Analysis of Aminoacids.
3. Colorimetric estimation of proteins by Biuret / Lowry method.
4. Separation of components of a given mixture using a laboratory scale centrifuge.
5. Separation of mixtures by paper / thin layer chromatography.
6. Demonstration of column packing in any form of column chromatography.
7. Effectoftemperature/pH / Salt concentration on bacterial growth
8. Demonstration of electrophoretic technique
9. Study and plot the growth curve of E. coli by turbidometric and Standard Plate Count methods

RECOMMENDED TEXT BOOKS &REFERENCE BOOKS:

1. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company Caldwell, D.R. (1995). Microbial Physiology and Metabolism, W.C. Brown Publications,Iowa, USA.
2. Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). Principles of Biochemistry, 2nd Edition, CBS Publishers and Distributors, New Delhi.
3. Sashidhara Rao, B. and Deshpande, V. (2007). Experimental Biochemistry: A student Companion. I.K. International Pvt. Ltd.
4. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed.,
5. W.H.Freeman
6. Voet,D. and Voet J.G (2004) Biochemistry 3rd edition, John Wiley and Sons
7. White, D. (1995). The Physiology and Biochemistry of Prokaryotes, Oxford UniversityPress, New York.

B.Sc.	Semester - II	Credits: 4
Course-2	ANALYTICAL TECHNIQUES	Hrs/Wk: 4

Aim and objectives of Course: Analytical Techniques

The knowledge in the analytical techniques will enable the student for isolation, purification and chemical characterization of compounds from plants and microbes which will have medical or commercial importance.

Learning outcomes of Course

1. The student will learn the various analytical techniques and their applications in separation and isolation of cells and tissues for studying their functional abnormalities
2. The practicals will provide the expertise to the student for quantification of electrolytes and other metal ions, hormones and identification of bacteria.
3. The expertise gained by the student in this course can be useful in food industries, pharma industries, clinical and microbiological labs.

UNIT I: 12 hours

Biophysical Concepts & Cell disruption methods: Water as biological solvent, Buffers, measurement of pH, electrodes, Biological relevance of pH, pKa value, Electrical conductivity, analysis of drinking water and pond water, Total dissolved salts (TDS), BOD, COD, soil analysis (texture, organic matter, elements), Methods of tissue homogenization: (Potter-Elvejham, mechanical blender, sonicator and enzymatic).

UNIT II: 12 hours

Microscopy and Centrifugation: Basic principles of light microscopy, phase contrast, electron microscope and fluorescent microscope and their applications. Centrifugation techniques, principles and applications- differential, density gradient. Ultra-centrifugation- preparative and analytical.

UNIT III: 12 hours

Chromatographic techniques: Chromatography - Principle and applications, Types of chromatographic techniques - Course chromatography- solvents, Rf value, applications; Thin layer chromatography- principle, choice of adsorbent and solvent, Rf value, applications; Gel filtration, Ion- exchange- principle, resins, action of resins, experimental techniques, applications, separation of metal ions; Affinity chromatography.

UNIT IV: 12 hours

Spectroscopy and tracer techniques: Electromagnetic radiation, Beer-Lambert's law. Colorimetry and Spectrophotometry, spectrofluorimetry, flame photometry. Tracer techniques: Radio isotopes, units of radio activity, half-life, β and γ- emitters, use of radioactive isotopes in biology, ELISA.

UNIT V: 12 hours

Electrophoresis: Electrophoresis- principles and applications of Course, polyacrylamide (native and SDS) and agarose gel electrophoresis, isoelectric focusing, immune-electrophoresis-types and applications.

RECOMMENDED TEXT BOOKS:

1. Principles and Techniques of practical Biochemistry. Eds. Williams and Wilson.
2. Techniques in Molecular biology Ed. Walker & Gastra, Croom Helm, 1983.
3. Principles of instrumental analysis, 2nd Ed, Holt-Sanders, 1980.
4. An introduction to spectroscopy for Biochemistry. Ed. Brown S.N., Academic press
5. Analytical Biochemistry, Holmes and Hazel peck, Longman, 1983.
6. An introduction to practical biochemistry. David T. Plummer, Tata Mac Grew-Hill
7. Biophysical chemistry, Edshall & Wyman, Academic press Vol. II & I.
8. A textbook of quantitative inorganic analysis including elementary instrumental analysis, Vogel ELBS.
9. Biochemical calculations Seigel, IH, 2nd Edit, John Wiley & sons Inc., 1983.
10. Analytical Biochemistry by Friefelder David.

B.Sc.	Semester - II	Credits: 1
Course-2(L)	ANALYTICAL TECHNIQUES LAB	Hrs/Wk: 2

Details of Lab/Practical/Experiments/Tutorials syllabus:

List of practical Experiments:

1. Preparation of Buffers
2. Sub cellular fraction using Centrifuge
3. Isolation of RNA and DNA from tissue/culture.
4. Qualitative Identification of DNA, RNA and Nitrogen Bases
5. Isolation of egg albumin from egg white.
6. Isolation of cholesterol from egg yolk.
7. Isolation of starch from potatoes.
8. Isolation of casein from milk.
9. Separation of amino acids by Course chromatography.
10. Determination of exchange capacity of resin by titrimetry.
11. Separation of serum proteins by Course electrophoresis.

1. Recommended Co-curricular activities: (Co-curricular Activities should not promote copying from text book or from others' work and shall encourage self/independent and group learning)

A. Measurable:

1. Assignments on: Microscopy and Centrifugation
2. Student seminars (Individual presentation of Courses) on topics relating to: Tracer techniques
3. Quiz Programmes on: Spectroscopy
4. Individual Field Studies/projects: Chromatographic techniques
5. Group discussion on: Spectroscopy and tracer techniques
6. Group/Team Projects on: Isolation and characterization of compounds from different sources using above techniques.

B. General

1. Collection of news reports and maintaining a record of Course-cuttings relating to topics covered in syllabus
2. Group Discussions on: new scientific approaches and Discoveries
3. Watching TV discussions and preparing summary points recording personal observations etc., under guidance from the Lecturers
4. Any similar activities with imaginative thinking.
   Organizing exhibitions
   Preparation of charts and models
   Science fairs
   Science clubs
   Essay writing

2. Recommended Continuous Assessment methods:
   - Slip test
   - Oral test
   - Assignments
   - Seminars

B.Sc.	Semester - II	Credits: 4
Course: 2	Organic & General Chemistry	Hrs/Wk: 4

Course outcomes:

At the end of the course, the student will be able to;

- Understand and explain the differential behavior of organic compounds based on fundamental concepts learnt.
- Formulate the mechanism of organic reactions by recalling and correlating the fundamental properties of the reactants involved
- Learn and identify many organic reaction mechanism including Free Radical Substitution, Electrophonic Addition and Electrophonic Aromatic Substitution.
- Correlateanddescribethestereochemicalpropertiesoforganiccompoundsand reactions.

UNIT I: ORGANIC CHEMISTRY

Recapitulation of Basics of Organic Chemistry

Carbon-Carbon sigma bonds (Alkanes and Cycloalkanes)

General methods of preparation of alkanes- Wurtz and Wurtz-Fittig reaction, Corey House synthesis, physical and chemical properties of alkanes, Isomerism and its effect on properties, Free radical substitutions; Halogenations, concept of relative reactivity v/s selectivity. Conformational analysis of alkanes (Conformations, relative stability and energy diagrams of Ethane, Propane and butane) General molecular formulae of cycloalkanes and relative stability, Baeyer strain theory, Cyclohexane conformations with energy diagram, Conformations of monosubstituted cyclohexane.

UNIT II: Carbon-Carbon pi Bonds(Alkenes and Alkynes)

General methods of preparation, physical and chemical properties. Mechanism of E1, E2, E1 cb reactions, Saytzeff and Hofmann eliminations, Electrophilic Additions ,mechanism (Markovnikov/Anti Markovnikov addition) with suitable examples,, *syn and anti-addition*; additionofH_2,X_2, HX. Oxymercuration, demercuration, hydroboration-oxidation, ozonolysis, hydroxylation, Diels Alderreaction,1,2- and1,4-addition reactions in conjugated dienes. Reactions of alkynes; acidity, electrophilic and nucleophilic additions, hydration to form carbonyl compounds, Alkylation of terminal alkynes.

UNIT III: Benzene and its reactivity

Concept of aromaticity, Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non - Benzenoid compounds (cyclopropenyl cation, cyclopentadienyl anion and tropylium cation) Reactions - General mechanism of electrophilic aromatic substitution, mechanism of nitration, Friedel- Craft's alkylation and acylation. Orientation of aromatic substitution - ortho, para and meta directing groups. Ring activating and deactivating groups with examples (Electronic interpretation of various groups like NO_2 and Phenolic).

Orientation of

i. Amino, methoxy and methyl groups
ii. Carboxy, nitro, nitrile, carbonyl and sulfonic acid groups
iii. Halogens (Explanation by taking minimum of one example from each type)

UNIT IV: GENERAL CHEMISTRY

1. Surface chemistry and chemical bonding Surface chemistry

Colloids- Coagulation of colloids- Hardy-Schulze rule. Stability of colloids, Protection of Colloids, Gold number.

Adsorption-Physical and chemical adsorption, Langmuir adsorption isotherm, applications of adsorption.

2. Chemical Bonding

Valence bond theory, hybridization, VB theory as applied to ClF3,Ni(CO)**4,** Molecular orbital theory -LCAO method, construction of M.O. diagrams for homo-nuclear and hetero-nuclear diatomic molecules(N2,O2,CO and NO).

3. HSAB

Pearson's concept, HSAB principle & its importance, bonding in Hard-Hard and Soft-Soft combinations.

UNIT V:

Stereochemistry of carbon compounds

Molecular representations- Wedge, Fischer, Newman and Saw-Horse formulae. **Optical isomerism**: Optical activity- wave nature of light, plane polarised light, optical rotation and specific rotation. Chiral molecules- definition and criteria (Symmetry elements)- Definition of enantiomers and diastereomers – Explanation of optical isomerism with examples- Glyceraldehyde, Lactic acid, Alanine, Tartaric acid, 2,3-dibromopentane. D,L, R,S and E,Z- configuration with examples. Definition of Racemic mixture – Resolution of racemic mixtures (any 3 techniques)

Co-curricular activities and Assessment Methods Continuous Evaluation: Monitoring the progress of student's learning Class Tests, Worksheets and Quizzes Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality

Semester-end Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the semester.

REFERENCE BOOKS:

1. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds; Wiley: London, 1994. Kalsi, P. S. Stereochemistry Conformation and Mechanism; New Age International, 2005.

Practical:

1. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).
2. Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000).
3. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012)

Additional Resources:

1. Solomons, T. W. G.; Fryhle, C. B. &Snyder, S. A. Organic Chemistry, 12th Edition, Wiley. Bruice, P. Y. Organic Chemistry, Eighth Edition, Pearson.
2. Clayden, J.; Greeves, N.&Warren, S. Organic Chemistry, Oxford. Nasipuri, D. Stereochemistry of Organic Compounds: Principles and Applications, Third Edition, NewAge International.
3. Gunstone, F. D. Guidebook to Stereochemistry, Prentice Hall Press, 1975.

B.Sc.	Semester - II	Credits: 1
Course: 2(L)	Volumetric Analysis Lab	Hrs/Wk: 2

Course outcomes:

At the end of the course, the student will be able to;

- Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
- Understand and explain the volumetric analysis based on fundamental concepts learnt in ionic equilibria
- Learn and identify the concepts of a standard solutions, primary and secondary standards
- Facilitate the learner to make solutions of various molar concentrations.
- This may include: The concept of the mole; Converting moles to grams; Converting grams to moles; Defining concentration; Dilution of Solutions; Making different molar concentrations.

Volumetric analysis **50 M**

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Determination of Fe (II) using $KMnO_4$ with oxalic acid as primary standard.
3. Determination of Cu (II) using $Na_2S_2O_3$ with $K_2Cr_2O_7$ as primary standard.
4. Estimation of water of crystallization in Mohr's salt by titrating with $KMnO_4$

UG(English)	Semester -III	Credits: 03
Course - 3	A Course In Conversational Skills	Hrs/Week: 04

Learning Outcomes

By the end of the course the learner will be able to :

- Speak fluently in English
- Participate confidently in any social interaction
- Face any professional discourse
- Demonstrate critical thinking
- Enhance conversational skills by observing the professional interviews

UNIT I:

Speech : 1. Tryst with Destiny Jawaharlal Nehru
Skills : 2. Greetings
: 3. Introductions

UNIT II:

Speech : 1. Yes, We Can Barack Obama
Interview : 2. A Leader Should Know How to Manage Failure Dr.A.P.J.Abdul Kalam/ India Knowledge at Wharton
Skills : 3. Requests

UNIT III:

Interview : 1. Nelson Mandela's Interview With Larry King
Skills : 2. Asking and Giving Information
: 3. Agreeing and Disagreeing

UNIT IV:

Interview : 1. JRD Tata's Interview With T.N.Ninan
Skills : 2. Dialogue Building
: 3. Giving Instructions/Directions

UNIT V:

1. **Speech** : 1. You've Got to Find What You Love Steve Jobs
Skills : 2. Debates
: 3. Descriptions
: 4. Role Play

పాఠ్య ప్రణాళిక

యూనిట్-I: వ్యక్తీకరణ నైపుణ్యాలు

1. భాష-ప్రాథమికాంశాలు: భాష-నిర్వచనం, లక్షణాలు, ఆవశ్యకత, ప్రయోజనాలు
2. వర్ణం-పదం-వాక్యం', వాక్య లక్షణాలు, సామాన్య-సంయుక్త-సంశ్లిష్టవాక్యాలు
3. భాషా నిర్మాణంలో 'వర్ణం-పదం-వాక్యం' ప్రాధాన్యత

యూనిట్-II సృజనాత్మక రచన

4. కవితా రచన : ఉత్తమ కవిత - లక్షణాలు
5. కథారచన : ఉత్తమ కథ - లక్షణాలు
6. వ్యాస రచన : ఉత్తమ వ్యాసం-లక్షణాలు

యూనిట్-III: అనువాద రచన

7. అనువాదం-నిర్వచనం, అనువాద పద్ధతులు,
8. అనువాద సమస్యలు-భౌగోళిక,భాషా,సాంస్కృతిక సమస్యలు, పరిష్కారాలు
9. అభ్యాసము : ఆంగ్లం నుండి తెలుగుకు,తెలుగు నుండి ఆంగ్లానికి ఒక పేరానుఅనువదించడం

యూనిట్ IV మాధ్యమాలకు రచన-1 (ముద్రణామాధ్యమం/ప్రింట్ మీడియా)

10. ముద్రణామాధ్యమం (అచ్చుమాధ్యమం) : పరిచయం, పరిధి, వికాసం
11. వివిధ రకాల పత్రికలు-పరిశీలన, పత్రికాభాష, శైలి, వైవిధ్యం
12. పత్రికా రచన : వార్తా రచన, సంపాదకీయాలు, సమీక్షలు-అవగాహన

యూనిట్ V మాధ్యమాలకు రచన-2 (ప్రసార మాధ్యమం/ఎలక్ట్రానిక్ మీడియా)

13. ప్రసారమాధ్యమాలు : నిర్వచనం, రకాలు, విస్తృతి, ప్రయోజనాలు
14. శ్రవణ మాధ్యమాలు - రచన: రేడియో రచన, ప్రసంగాలు, నాటికలు, ప్రసార సమాచారం
15. దృశ్యమాధ్యమాలు - రచన: వ్యాఖ్యానం (యాంకరింగ్), టెలివిజన్ రచన

UG(General HINDI)	Semester III	Credits:03
Course : 3	Old and Modern Poetry, History of Hindi Literature ,Essays (Translation and Functional Hindi)	Hrs/Weeks:04

Unit 1

1. काव्यदीप (Ancient and Modern Poetry) (सं.बी.राधाकृष्णमूर्ति)

साखी...1..10 दोहे

सूरदास...बाल वर्णन

मातृभूमि...मैथिलीशरण गुप्त

तोडती पत्थर...सूर्यकांत त्रिपाठी निराला

भारतमाता...सुमित्रानंदन पंत

Unit 2

2. हिंदी साहित्य का इतिहास (History of Hindi Literature) (डा. बाबू गुलाबराय)

हिंदी साहित्य का काल विभाजन (डा. रामचन्द्र शुक्ल)

भक्तिकाल की विशेषताएँ

ज्ञानाश्रयी शाखा ... कबीर

प्रेमाश्रयी शाखा ... जायसी

Unit 3

3. निबंध (General Essays)

1.समाचार पत्र 2.बेकारी समस्या

3.पर्यावरण और प्रदूषण 4. साहित्य और समाज

Unit 4

4. अनुवाद (Translation) अंग्रेजी से हिंदी (Five Simple Sentences)

Unit 5

5. प्रयोजनमूलक हिंदी (Functional Hindi)

राष्ट्रभाषा, राजभाषा, संपर्क भाषा

*** **** ***

UG Courses	Semester - III	Credits:03
Course: 3	Drama, Upanishad, Alankara and History of Literature.	Hrs/Weeks:04

UNIT – I : OLD DRAMA

1."**Madhyamavyayogaha**". Bhasa Natakachakram.
krishadas academy, Varanasi 1998.

UNIT – II :MODERN DRAMA

"Sankalpabalam" by Prof.G.S.R.Krishna Murthy,
Published by Semushi, R.S.Vidyapeetam, Tirupati-2019.

UNIT – III :UPANISHAD

1."**Sishyanusasanam**" – Sikshavalli of Taittireeyopanishad.

2. **"Sraddatrayavibhagayoga"**,

17th Chapter, Bhagavadgita, Geetapress, Gorakhpoor.

UNIT - IV : 1. ALANKARAS:

1. Upama 2. Ananvaya 3. Utpreksha 4. Deepakam

5. Aprastutaprasamsa 6.Drushtanta 7. Prateepa.

2.HISTORY OF SANSKRIT LITERATURE

1.Panini 2.Kautilya 3.Bharatamuni 4. Bharavi 5.Magha

6.Bhavabhuti 7. Sankaracharya, 8.Jagannatha. 9. Dandi.

UNIT – V : HALANTA SABDAS

1.Jalamuch 2.Vaach 3.Marut 4.Bhagavat 5.Bhavat

6.Pachats 7. Naman 8.Rajan 9.Gunin 10.Vidwas 11. Manas.

UG- LIFE SKILL COURSE

ENVIRONMENTAL EDUCATION (EE) (Mandatory)

(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (LS)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
III	Life skill course	Environmental Education(EE)	30	2	2	50 Marks

Course objective: A Generic Course intended to create awareness that the life of human beings is an integral part of environment and to inculcate the skills required to protect environment from all sides.
Learning outcomes: On completion of this course the students will be able to .....

- Understand the nature, components of an ecosystem and that humans are an integral part of nature.
- Realize the importance of environment, the goods and services of a healthy biodiversity, dependence of humans on environment.
- Evaluate the ways and ill effects of destruction of environment, population explosion on ecosystems and global problems consequent to anthropogenic activities.
- Discuss the laws/ acts made by government to prevent pollution, to protect biodiversity and environment as a whole.
- Acquaint with international agreements and national movements, and realize citizen's role in protecting environment and nature.

Unit 1: Environment and Natural Resources: **(06hrs)**

1. Multidisciplinary nature of environmental education; scope and importance.
2. Man as an integral product and part of the Nature.
3. A brief account of land, forest and water resources in India and their importance.
4. Biodiversity: Definition; importance of Biodiversity - ecological, consumptive, productive, social, ethical and moral, aesthetic, and option value.
5. Levels of Biodiversity: genetic, species and ecosystem diversity.

Unit-2: Environmental degradation and impacts: **(10hrs)**

1. Human population growth and its impacts on environment; land use change, land degradation, soil erosion and desertification.
2. Use and over-exploitation of surface and ground water, construction of dams, floods, conflicts over water (within India).
3. Deforestation: Causes and effects due to expansion of agriculture, firewood, mining, forest fires and building of new habitats.
4. Non-renewable energy resources, their utilization and influences.
5. A brief account of air, water, soil and noise pollutions; Biological, industrial and solid wastes in urban areas. Human health and economic risks.
6. Green house effect - global warming; ocean acidification, ozone layer depletion, acid rains and impacts on human communities and agriculture.
7. Threats to biodiversity: Natural calamities, habitat destruction and fragmentation, over exploitation, hunting and poaching, introduction of exotic species, pollution, predator and pest control.

Unit 3: Conservation of Environment: **(10hrs)**

Concept of sustainability and sustainable development with judicious use of land, water and forest resources; a forestation.

1. Control measures for various types of pollution; use of renewable and alternate sources of energy.
2. Solid waste management: Control measures of urban and industrial waste.
3. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.
4. Environment Laws: Environment Protection Act; Act; Wildlife Protection Act; Forest Conservation Act.
5. International agreements: Montreal and Kyoto protocols; Environmental movements: Bishnois of Rajasthan, Chipko, Silent valley.

Suggested activities to learner: (4 hours)

1. Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc
2. Visit to a local polluted site-Urban/Rural/Industrial/Agricultural site.
3. Study of common plants, insects, birds and basic principles of identification.
4. Study of simple ecosystems-forest, tank, pond, lake, mangroves etc.
5. Case study of a Forest ecosystem or a pond ecosystem.

Suggested text book:

1. Erach Barucha (2004) *Text book of Environmental Studies for Undergraduate courses* (Prepared for University Grants Commission) Universities Press.
2. Purnima Smarath (2018) *Environmental studies* Kalyani Publishers, Ludhiana

Reference books:

1. Odum, E.P., Odum, H.T. & Andrews, J. (1971) *Fundamentals of Ecology*. Philadelphia: Saunders.
2. Pepper, I.L., Gerba, C.P. &Brusseau, M.L. (2011). *Environmental and Pollution Science*. Academic Press.
3. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. (2012) *Environment. 8th edition*. John Wiley & Sons.
4. Singh, J.S., Singh, S.P. and Gupta, S.R. (2014) *Ecology, Environmental Science and Conservation.* S. Chand Publishing, New Delhi.
5. Sengupta, R. (2003) Ecology and economics: An approach to sustainable development. OUP.
6. Wilson, E. O. (2006) *The Creation: An appeal to save life on earth.* New York: Norton.
7. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll (2006) *Principles of Conservation Biology.* Sunderland: Sinauer Associates.

UG- LIFE SKILL COURSE
PERSONALITY ENHANCEMENT AND LEADERSHIP (PDL)
(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (LS)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam(2 Hrs)
III	Life skill course	Personality enhancement and leadership(PDL)	30	2	2	50 Marks

Learning Outcomes:

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

- Develop comprehensive understanding of personality
- Know how to assess and enhance one's own personality
- Comprehend leadership qualities and their importance
- Understand how to develop leadership qualities

Unit – I: (7 hrs)

Meaning of Personality – Explanations of Human Personality – Psychodynamic Explanations – Social Cognitive Explanation – Big Five traits of Personality

Unit – II: (8 hrs)

Assessment of Personality - Projective& Self Report Techniques - Building Self-Confidence – Enhancing Personality Skills

Unit – III: (10 hrs)

Leadership Characteristics – Types of Leaders – Importance of Leadership – Leadership Skills – Building and Leading Efficient Teams – Leadership Qualities of Abraham Lincoln, mahatma Gandhi, Prakasam Pantulu, Dr. B. R. Ambedkar & J.R.D.Tata

Co-curricular Activities Suggested: (05 hrs)

- Assignments, Group discussions, Quiz etc
- Invited Lecture by a local expert
- Case Studies (ex., on students behavior, local leaders etc.)

Reference Books:

1. Girish Batra, Experiments in Leadership, Chennai: Notion Press, 2018
2. Mitesh Khatri, Awaken the Leader in You, Mumbai: Jaico Publishing House, 2013
3. Carnegie Dale, Become an Effective Leader, New Delhi: Amaryllis, 2012
4. Hall, C.S., Lindzey. G. & Campbell, J.B Theories of Personality. John Wiley & Sons,1998

UG- LIFE SKILL COURSE

ANALYTICAL SKILLS(AS)

(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (LS)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
III	Life skill course	Analytical skills(AS)	30	2	2	50 Marks

Course Objective: Intended to inculcate quantitative analytical skills and reasoning as an inherent ability in students.

Course Outcomes:

After successful completion of this course, the student will be able to;

- Understand the basic concepts of arithmetic ability, quantitative ability, logical reasoning, business computations and data interpretation and obtain the associated skills.
- Acquire competency in the use of verbal reasoning.
- Apply the skills and competencies acquired in the related areas
- Solve problems pertaining to quantitative ability, logical reasoning and verbal ability inside and outside the campus.

UNIT – 1: (10 Hrs)

Arithmetic ability: Algebraic operations BODMAS, Fractions, Divisibility rules, LCM & GCD(HCF).

Verbal Reasoning: Number Series, Coding & Decoding, Blood relationship, Clocks, Calendars.

UNIT – 2: (10 Hrs)

Quantitative aptitude: Averages, Ratio and proportion, Problems on ages, Time-distance–speed.

Business computations: Percentages, Profit & loss, Partnership, simple compound interest.

UNIT – 3: (07 Hrs)

Data Interpretation: Tabulation, Bar Graphs, Pie Charts, line Graphs. Venn diagrams.

Recommended Co-Curricular Activities (03 Hrs)

Surprise tests / Viva-Voice / Problem solving/Group discussion.

Text Book:

Quantitative Aptitude for Competitive Examination by R.S. Agrawal, S.Chand Publications.

Reference Books:

1. Analytical skills by Showick Thorpe, published by S Chand And Company Limited, Ramnagar, New Delhi-110055.
2. Quantitative Aptitude and Reasoning by R V Praveen, PHI publishers.
3. Quantitative Aptitude for Competitive Examination by Abhijit Guha, Tata Mc Graw Hill Publications.

UG- SKILL DEVELOPMENT COURSE
DISASTER MANAGEMENT
(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
III	Skill Development Course	Disaster Management	30	2	2	50 Marks

Learning Outcomes:
After successful completion of the course, the students are able to;

- Understand the nature, cause and effects of disasters
- Comprehend the importance of Disaster Management and the need of awareness
- Acquire knowledge on disaster preparedness, recovery remedial measures and personal precautions
- Volunteer in pre and post disaster management service activities

UNIT-I: **(06 hrs)**
Introduction of Disaster - Different types of disasters- Natural- (flood, cyclone, earthquake, famine and pandemic) - Accidental- (Fire, Blasting, Chemical leakage, Rail, Aviation, Road boat tragedies and nuclear pollution) - Disaster Management Act 2005

UNIT-II: **(09hrs)**
Causes and immediate effects of Disasters - Preparedness of disasters –Precautions – Dissemination of information - Nature and concepts - Role of National Disaster Management Authority and Role of Government and non governmental organizations in protecting human livestock and natural resources.- Use of technology -Role of Citizens and Youth in the prevention.

UNIT-III: **(09 hrs)**
Post disaster effects - short term - Procedures for Rehabilitation and Recovery - Role of volunteers and Safety Precautions - Long term remedial and preventive measures – Collection, filing and storage of information - Case studies

Suggested co curriculum Activities: **(06 hrs)**

1. Invite lectures by local experts
2. Training on preparedness, post disaster services
3. Analysis of Case studies
4. Visit to a disaster management office and facility
5. Assignments, Group discussion, quiz etc.

Reference books:

1. Jagbirsingh - Disaster Management Future challenges and opportunities- - K.W.Publishers
2. GOI - UNDP Disaster Management Guidelines
3. J.P.Singhal - Disaster Management - Laxmi Publications
4. www. ndma. gov.in
5. Wikipedia and other websites on Disaster management.

UG- SKILL DEVELOPMENT COURSE

ONLINE BUSINESS

(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
III	Skill Development Course	Online Business	30	2	2	50 Marks

Learning Outcomes:

After successful completion of the course, students will be able to;

- Understand the online business and its advantages and disadvantages
- Recognize new channels of marketing, their scope and steps involved
- Analyze the procurement, payment process, security and shipping in online business
- Create new marketing tools for online business
- Define search engine, payment gateways and SEO techniques.

Unit-I: **(06 Hrs)**

Introduction to Online-business-Definition-Characteristics-Advantages of Online Business-Challenges-Differences between off-line business, e-commerce and Online Business.

Unit-II: **(10 Hrs)**

Online-business Strategies-Strategic Planning Process- Procurement -Logistics & Supply Chain Management- Customer Relationship management.

Unit-III: **(10 Hrs)**

Designing Online Business Website – Policies - Security & Legal Issues - Online Advertisements - Payment Gateways - Case Study

Co-curricular Activities Suggested: **(4 hrs)**

1. Assignments, Group discussion, Quiz etc.
2. Short practical training in computer lab
3. Identifying online business firms through internet
4. Invited Lectures by e-commerce operators
5. Working with Google and HTML advertisements.
6. Visit to a local online business firm.

Reference books:

1. David Whiteley, "E-Commerce", Tata McGraw Hill, 2000.
2. E Business by Jonathan Reynolds from Oxford University Press.
3. Soka, From EDI to Electronic Commerce, McGraw Hill.
4. Websites on Online business.

UG- SKILL DEVELOPMENT COURSE

POULTRY FARMING

(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
III	Skill Development Course	Poultry Farming	30	2	2	50 Marks

Learning Outcomes: By successful completion of the course, students will be able to;

- Understand the field level structure and functioning of insurance sector and it's role in protecting the risks
- Comprehend pertaining skills and their application for promoting insurance coverage
- Prepare better for the Insurance Agent examination conducted by IRDA
- Plan 'promoting insurance coverage practice' as one of the career options.

Unit I (Introduction to Poultry Farming): **(10Hrs)**

1.1 General introduction to poultry farming -Definition of Poultry; Past and present scenario of poultry industry in India.

1.2 Principles of poultry housing. Poultry houses. Systems of poultry farming.

1.3 Management of chicks, growers and layers. Management of Broilers.

1.4 Preparation of project report for banking and insurance

Unit II (Feed and Livestock Health Management): **(10 Hrs):**

2.1 Poultry feed management – Principles of feeding, Nutrient requirements for different stages of layers and broilers. Feed formulation and Methods of feeding.

2.2 Poultry diseases – viral, bacterial, fungal and parasitic(two each); symptoms, control and management; Vaccination programme.

Unit III (Harvesting of Eggs and Sanitation): **(10 Hrs)**

3.1 Selection, care and handling of hatching eggs. Egg testing. Methods of hatching.

3.2 Brooding and rearing. Sexing of chicks.

3.3 Farm and Water Hygiene, Recycling of poultry waste.

Co-curricular Activities Suggested: **(4 hrs)**

1. Group discussion& SWOT analysis
2. Visit to a poultry farm
3. Invited Lectures by Concerned officers of government or private farms
4. Cheap and Healthy Feed preparation by students based on government standards
5. Market study and Survey (Monitoring of daily price hike in poultry market and analysis)
6. Online Swayam Moocs course on poultry farming (see reference 9 below)

Reference books:

1. Sreenivasaiah., P. V., 2015. Textbook of Poultry Science. 1st Edition. Write & Print Publications, New Delhi
2. 2. Jull A. Morley, 2007. Successful Poultry Management. 2nd Edition. Biotech Books, New Delhi"
3. Hurd M. Louis, 2003. Modern Poultry Farming. 1st Edition. International Book Distributing Company, Lucknow.
4. Life and General Insurance Management
5. Financial services, Tata McGraw hill
6. http://www.asci-india.com/BooksPDF/Small%20Poultry%20Farmer.pdf
7. https://nsdcindia.org/sites/default/files/MC_AGR-Q4306_Small-poultry-farmer-.pdf
8. http://ecoursesonline.iasri.res.in/course/view.php?id=335
9. https://swayam.gov.in/nd2_nou19_ag09/preview

UG- SKILL DEVELOPMENT COURSE

FINANCIAL MARKETS

(w.e.f. 2020-2021 A.Y.)

Semester	Course Code (SD)	Course Title	Hrs/Sem	Hrs/wk	Credits	Sem End Exam (2 Hrs)
III	Skill Development Course	Financial Markets	30	2	2	50 Marks

Learning Outcomes:

After successful completion of this course, the students will be able to;

- Acquire knowledge of financial terms
- Know the concepts relating to and markets and different avenues of investment
- Understand the career skills related to Stock Exchanges
- Comprehend the personal financial planning and money market skills

UNIT-I: **(06hrs)**

Indian Financial System- its components - Financial markets and institutions

UNIT-II: **(10hrs)**

Capital Market - its function - organizations - elements - (shares, debentures, bonds, mutual funds) debt market - Equity market (SEBI) and secondary market (NSE)

UNIT-III: **(10hrs)**

Money market - Organized - Unorganized - Sub market (call money, commercial bills, Treasury bill, Certificate of Deposit, Commercial papers)

Co-curricular activities: **(04 hrs)**

1. Collection and study of pamphlets, application forms etc.
2. Invited lectures on the field topics by local experts
3. Introducing Online classes from NSE
4. Field visit to mutual fund offices/share brokers
5. Observation, study and analysis of selected companies share prices
6. Assignments, Group discussion, quiz etc.

Reference books:

1.T.R. Jain R.L.Sarma - Indian Financial System- VK Global publisher
2. Jithendra Gala - Guide to Indian Stock markets Buzzing Stock publishing house
3. Saha Siddhartha- Indian financial System- and Markets - McGraw hill
4. Websites on Indian Financial markets.

B Sc	Semester: III	Credits: 4
Course: 3	Molecular Biology and Microbial Genetics	Hrs/Wk: 4

Aim and objectives of Course:
To understand different biomolecules, analytical techniques, bacterial nutrition, growth and metabolism
Learning outcomes of Course: Up on completion of this course students should able to:

1. Explain working principle and applications of Colorimetry, Chromatography, Spectrophotometry, Centrifugation and Gel Electrophoresis.
2. Knowledge on Microbial nutrition, bacterial growth, metabolism and Respiration.
3. The student will get first-hand experience on separation methods

UNIT I:
Nucleic acids: DNA and RNA - Role in heredity-The central dogma Watson and Crick model of DNA, Types of RNA, structure, and functions, Organization of DNA in prokaryotes

UNIT II :
Genetic material and replication: Experiments which established DNA as genetic material RNA as genetic material, Mechanism of DNA Replication in Prokaryotes, Proof of semi conservative mechanism of replication (Meselson - Stahl Experiment)

UNIT III:
Gene expression and regulation: Concept of gene - Muton, recon and cistron. Genetic code
Protein synthesis - Transcription and translation in Prokaryotes Regulation of gene expression in bacteria -*lac* operon

UNIT IV:
Mutations, damage and repair: Outlines of DNA damage and repair mechanism Mutations - spontaneous and induced Chromosomal aberrations - deletions, inversions, tandem duplications, insertions Point mutations- base pair changes, frame shifts Mutagens - Physical and Chemical mutagens Bacterial recombination-Transformation, Conjugation, Transduction (Generalized and specialized transductions)

UNIT V:
Genetic engineering: Basic principles of genetic engineering. Restriction endonucleases, DNA ligases. Vectors – plasmids (pBR322), Cosmids, Phagemids, lambda phage vector, M 13 vectors.
Outlines of gene cloning methods. Polymerase chain reaction. Genomic and cDNA libraries. General account on application of genetic engineering in industry, agriculture, and medicine.

RECOMMENDED TEXT BOOKS:

1. Freifelder, D. (1990). Microbial Genetics. Narosa Publishing House, New Delhi. Freifelder, D. (1997). Essentials of Molecular Biology. Narosa Publishing House, New Delhi.
2. Glick, B.P. and Pasternack, J. (1998). Molecular Biotechnology, ASM Press,Washington D.C., USA.
3. Lewin, B. (2000). Genes VIII. Oxford University Press, England.
4. Maloy, S.R., Cronan, J.E. and Freifelder, D. (1994). Microbial Genetics, Jones and Bartlett Publishers, London.
5. Ram Reddy, S., Venkateshwarlu, K. and Krishna Reddy, V. (2007) A text Book of Molecular Biotechnology. Himalaya Publishers, Hyderabad.
6. Sinnot E.W., L.C. Dunn and T. Dobzhansky. (1958). Principles of Genetics. 5 th Edition. McGraw Hill, New York.
7. Smith, J.E. (1996). Biotechnology, Cambridge University Press.
8. Snyder, L. and Champness, W. (1997). Molecular Genetics of Bacteria. ASM press,
9. Strickberger, M.W. (1967). Genetics. Oxford & IBH, New Delhi. Verma, P.S. and Agarwal, V.K. (2004). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Co. Ltd., New Delhi

B Sc	Semester: III	Credits: 1
Course: 3(L)	Molecular Biology and Microbial Genetics Lab	Hrs/Wk: 2

List of the Experiments:

1. Study of different types of DNA and RNA using micrographs and model / schematic representations.
2. Study of semi-conservative replication of DNA through micrographs / schematic representations
3. Isolation of genomic DNA from *E. coli*
4. Estimation of DNA using UV spectrophotometer.
5. Resolution and visualization of DNA by Agarose Gel Electrophoresis.
6. Resolution and visualization of proteins by Polyacrylamide Gel Electrophoresis (SDS - PAGE).
7. Problems related to DNA and RNA characteristics, Transcription and Translation.
8. Induction of mutations in bacteria by UV light.
9. Instrumentation in molecular biology - Ultra centrifuge, Transilluminator, PCR

REFERENCE BOOKS:

1. Smith, J.E. (1996). Biotechnology, Cambridge University Press.
2. Snyder, L. and Champness, W. (1997). Molecular Genetics of Bacteria. ASM press,
3. Strickberger, M.W. (1967). Genetics. Oxford & IBH, New Delhi.
4. Verma, P.S. and Agarwal, V.K. (2004). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Co. Ltd., New Delhi.

B.Sc.	Semester - III	Credits: 4
Course: 3	ENZYMOLOGY, BIOENERGETICS AND INTERMEDIARY METABOLISM	Hrs/Wk: 4

Aim and objectives of Course (Enzymology, Bioenergetics and Intermediary Metabolism):
The student will get knowledge in enzymes, their physiological importance and other applications. They also understand the metabolism of biomolecules like carbohydrate, lipid and aminoacids.

Learning outcomes of Course

a) The student will know how the biomolecules such as carbohydrates, lipids and proteins get metabolized for the purpose of energy and other physiological functions in the body.
b) The course will enable the student to understand the pathophysiology of metabolic diseases such as diabetes, atherosclerosis etc. which occur due to alterations in metabolism.
c) The practicals will provide the expertise for quantification of enzymes' activities, glucose, proteins and lipid levels in blood which will have clinical applications

UNIT I: 12 hours

Enzymology: Introduction to Biocatalysis, differences between chemical and biological catalysis. Nomenclature and classification of enzymes. Definition of holo-enzyme, apo-enzyme, coenzyme, cofactor. Active site, Enzyme specificity. Principles of energy of activation, transition state. Interaction between enzyme and substrate-lock and key, induced fit models. Fundamentals of enzyme assay, enzyme units. Outlines of mechanism of enzyme action, factors affecting enzyme activity. Commercial application of enzymes.

UNIT II: 12 hours

Bioenergetics and Biological oxidation: Bioenergetics: Thermodynamic principles – Chemical equilibria; free energy, enthalpy (H), entropy (S). Free energy change in biological transformations in living systems; High energy compounds. Energy, change, oxidation-reduction reactions.Organization of electron carriers and enzymes in mitochondria. Classes of electron-transferring enzymes, inhibiters of electron transport. Oxidative phosphorylation. Uncouplers and inhibitors of oxidative phosphorylation. Mechanism of oxidative phosphorylation.

UNIT III: 12 hours

Carbohydrate Metabolism: Concept of anabolism and catabolism. Glycolytic pathway, energy yield. Fate of pyruvate-formation of lactate and ethanol, Citric acid cycle, regulation, energy yield, amphipathic role. Anaplerotic reactions. Glycogenolysis and glycogenesis. Pentose phosphate pathway. Gluconeogenesis. Photosynthesis- Light and Dark reactions, Calvin cycle, C4 Pathway. Disorders of carbohydrate metabolism- Diabetes Mellitus.

UNIT IV: 12 hours

Lipid Metabolism: Catabolism of fatty acids (β- oxidation) with even and odd number of carbon atoms, Ketogenesis, de novo synthesis of fatty acids, elongation of fatty acids in mitochondria and microsomes, Biosynthesis and degradation of triacylglycerol and lecithin. Biosynthesis of cholesterol. Disorders of lipid metabolism.

UNIT V: **12 hours**

Metabolism of Amino acids: General reactions of amino acid metabolism- transamination, decarboxylation and deamination, Urea cycle and regulation, Catabolism of carbon skeleton of amino acids- glycogenic and ketogenic amino acids. Metabolism of glycine, serine, aspartic acid, methionine, phenylalanine and leucine. Biosynthesis of creatine. Inborn errors of aromatic and branched chain amino acid metabolism.

RECOMMENDED BOOKS:

1. Understanding enzymes: Palmer T., Ellis Harwood ltd., 2001.
2. Enzyme structure and mechanism. Alan Fersht, Freeman & Co. 1997
3. Principles of enzymology for food sciences: Whitaker Marc Dekker 1972.
4. Principles of Biochemistry, White. A, Handler, P and Smith.
5. Biochemistry, Lehninger A.L.
6. Biochemistry, Lubert Stryer.
7. Review of physiological chemistry, Harold A. Harper.
8. Text of Biochemistry, West and Todd.
9. Metabolic pathways – Greenberg.
10. Mitochondria, Munn.
11. Biochemistry, 2nd Edition, G. Zubay.

B.Sc.	Semester - III	Credits: 1
Course: 3(L)	ENZYMOLOGY, BIOENERGETICS AND INTERMEDIARY METABOLISM LAB	Hrs/Wk: 2

1. Details of Lab/Practical/Experiments/Tutorials syllabus:

List of practical Experiments:

1. Assay of amylase.
2. Assay of urease.
3. Assay of catalase
4. Effect of pH, temperature and substrate concentration on enzyme activity.
5. Estimation of glucose by DNS method.
6. Estimation of glucose by Benedict's titrimetric method.
7. Estimation of total carbohydrates by Anthrone method.
8. Tests for lipids- Salkowski test, Lieberman-Burchard test.
9. Estimation of amino acid by Ninhydrin method.
10. Estimation of protein by Biuret method.

2. Recommended Co-curricular activities: (Co-curricular Activities should not promote copying from text book or from others' work and shall encourage self/independent and group learning)

C. Measurable:

1. Assignments on: Enzymology.
2. Student seminars (Individual presentation of Courses) on topics relating to: Metabolic pathways.
3. Quiz Programmes on: Bioenergetics and Biological oxidation.
4. Individual Field Studies/projects: metabolism of biomolecules in healthy and diseased condition.
5. Group discussion on: Lipid Metabolism
6. Group/Team Projects on: Bioenergetics and Biological oxidation

7. General .

1. Collection of news reports and maintaining a record of Course-cuttings relating to topics covered in syllabus.
2. Group Discussions on: new scientific approaches and Discoveries
3. Watching TV discussions and preparing summary points recording personal observations etc., under guidance from the Lecturers.
4. Any similar activities with imaginative thinking.

Organizing exhibitions
Preparation of charts and models
Science fairs
Science clubs
Essay writing

8. Recommended Continuous Assessment methods:

Slip test
Oral test
Assignments
Seminars

B.Sc.	Semester - III	Credits: 4
Course: 3	Organic chemistry & Spectroscopy	Hrs/Wk: 4

Course outcomes:

At the end of the course, the student will be able to;

- Understand preparation, properties and reactions of haloalkanes, haloarenes and oxygen containing functional groups.
- Use the synthetic chemistry learnt in this course to do functional group transformations.
- To propose plausible mechanisms for any relevant reaction

UNIT I: ORGANIC CHEMISTRY

Chemistry of Halogenated Hydrocarbons: Alkyl Halides: Methods of preparation and properties, nucleophilic substitution reactions– SN1, SN2 and SNi mechanisms with stereo chemical aspects and effect of solvent etc.; nucleophilic substitution vs. elimination, Williamson's synthesis. Aryl Halides: Preparation (including preparation from diazonium salts) and properties, nucleophilic aromatic substitution; SN Ar, Benzyne mechanism. Relative reactivity of alkyl, allyl, benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.

1. Alcohols & Phenols

Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Bouvet Blanc Reduction; Oxidation Of Diols By Periodic Acid Andlead Tetraacetate,Pinacol- Pinacolone Rearrangement;

Phenols: Preparation And Properties; Acidity And Factors Affecting It, Ring substitution reactions, Reimer–Tiemann and Kolbe's–Schmidt Reactions, Fries and Claisen Rearrangement with mechanism;

UNIT II:

Carbonyl Compounds: Structure, reactivity, preparation and properties; Nucleophilic Addition, Nucleophilic Addition-elimination reactions with ammonia derivatives Mechanisms of Aldol and Benzoin Condensation, Claisan-Schmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann Haloform Reaction And Baeyer Villiger oxidation, α- substitution reactions, oxidations and reductions (Clemmensen, wolf –kishner, with $LiAlH_4$ &$NaBH_4$). Addition Reactions Of α, β-unsaturated carbonyl compounds: Michael Addition. Active Methylene Compounds: Keto-enol tautomerism. Preparation And Synthetic Applications Diethyl malonate and ethyl acetoacetate.

UNIT III:

Carboxylic Acids and their Derivatives : General methods of preparation, physical properties and reactions of monocarboxylic acids, effect ofsubstituent acidic strength. Typical reactions of icarboxylic acids, hydroxy acids and unsaturated acids. Preparation And Reactions Of Acid Chlorides, anhydrides, esters and amides; Comparative study of nucleophilic substitution at acyl group-Mechanism of acidic and alkaline hydrolysis of esters, Claisen Condensation, Reformatsky reactions and Curtius Rearrangement Reactions involving H, OH and COOH groups- salt formation, anhydride formation, acid chloride formation, amide formation and esterification (mechanism). Degradation of carboxylic acids by Huns-Diecker reaction, decarboxylation by Schimdt reaction, Arndt- Eistert synthesis, halogenation by Hell- Volhard- Zelinsky reaction.

UNIT IV: SPECTROSCOPY

Molecular Spectroscopy:Interactionofelectromagneticradiationwithmoleculesandvarioustypesof spectra;

Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.

Vibrational Spectroscopy: Classical Equation Of Vibration, computation of force constant, Harmonic and anharmonic oscillator, Morse Potential curve, vibrational degrees of freedom for polyatomic molecules, modes of vibration. Selection rules for vibrational transitions, Fundamental Frequencies, overtones and hot bands.

Electronic spectroscopy: Energy levels of molecular orbitals (σ, π, n). Selection rules for electronic spectra. Types of electronic transitions in molecules, effect of conjugation. Concept of chromophore. bathochromic and hypsochromic shifts. Beer-Lambert's law and its limitations.

Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of nuclear magnetic resonance, equivalent and non-equivalent protons, position of signals. Chemical shift, NMR splitting of signals - spin-spin coupling, coupling constants. Applications of NMR with suitable examples - ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromo ethane, ethyl acetate, toluene and acetophenone.

UNIT V: Application of Spectroscopy to Simple Organic Molecules

Application of visible, ultraviolet and Infrared spectroscopy in organic molecules. Application of electronic spectroscopy and Woodward rules for calculating λ_{max} of conjugated dienes and α,β – unsaturated compounds.

Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions).

Co-curricular activities and Assessment Methods Continuous Evaluation: Monitoring The Progress Of student's learning Class Tests, Worksheets and Quizzes, Presentations, Projects and Assignments Group Discussions: Enhances Critical Thinking Skills And personality

Semester-end Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the semester.

REFERENCE BOOKS:

1. A TextBook of Organic Chemistry by Bahl and Arunbahl
2. A Textbook of Organic chemistry by I L FinarVol I
3. Organic chemistry by Bruice
4. Organic chemistry by Clayden
5. Spectroscopy by William Kemp
6. Spectroscopy by Pavia
7. Organic Spectroscopy by J. R. Dyer
8. Elementary organic spectroscopy by Y.R. Sharma
9. Spectroscopy by P.S.Kalsi
10. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
11. Spectrometric Identification of Organic Compounds by Robert M Silverstein, Francis X Webster
12. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. Practical Organic Chemistry,5th Ed. Pearson (2012)
13. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry:Preparation and Quantitative Analysis, University Press (2000)

B.Sc.	Semester - III	Credits: 1
Course: 3(L)	Organic preparations and IR Spectral Analysis Lab	Hrs/Wk: 2

Course outcomes:

On the completion of the course,the student will be able to do the following:

1. how to use glassware, equipment and chemicals and follow experimental procedures in the laboratory
2. how to calculate limiting reagent, theoretical yield, and percent yield
3. how to engage in safe laboratory practices by handling laboratory glassware, equipment, and chemical reagents appropriately
4. how to dispose of chemicals in a safe and responsible manner
5. how to perform common laboratory techniques including reflux, distillation, recrystallization, vacuum filtration.
6. how to create and carry out work up and separation procedures
7. how to critically evaluate data collected to determine the identity, purity, and percent yield of products and to summarize findings in writing in a clear and concise manner

Organic preparations: **40M**

i. Acetylation of one of the following compounds:

amines (aniline, o-, m-, p- toluidine and o-, m-, p-anisidine) and phenols (β-naphthol, vanillin, salicylic acid) by any one method:

a. Using conventional method.

b. Using green approach

ii. Benzoylation of one of the following amines

(aniline, o-, m-, p- toluidine and o-, m-, p-anisidine)

a. Nitration of any one of the following:Acetanilide/nitrobenzene by conventional method

b. Salicylic acid by green approach (using ceric ammonium nitrate).

IR Spectral Analysis **10M**

IR Spectral Analysis of the following functional groups with examples

a) Hydroxyl groups

b) Carbonyl groups

c) Amino groups

d) Aromatic groups

B Sc	Semester: IV	Credits: 4
Course: 4	Immunology and Medical Microbiology	Hrs/Wk: 4

Aim and objectives of Course:

- To study types of immunity, immune organs, cells, antibodies and antigenantibody interactions.
- To learn diagnostic and pathogenesis of various diseases. Antimicrobial defense and different toxins and vaccines.

Learning outcomes of Course: Up on completion of the course students able to

1. Explain No-specific body defence and the immune response
2. Develop knowledge on disease transmission and control
3. Demonstrate on collection and handling of laboratory specimens
4. Develop an information making personal health decision in regard to infectious diseases.
5. Student can safeguard himself & society and can work diagnostics and hospitals.

UNIT I:

Immune System: Concept of Innate and Adaptive immunity Primary and secondary organs of immune system - thymus, bursa fabricus, bone marrow, spleen, lymph nodes. Cells of immune system- Identification and function of B and T lymphocytes, null cells, monocytes, macrophages, neutrophils, basophils and eosinophils Complement system (in brief)

UNIT II :

Immune response: Characteristics of antigen (Foreignness, Molecular size, Heterogeneity and solubility) Haptens. Antibodies - basic structure and types and functions (Immune complex formation and elimination - Agglutination, Precipitation, Neutralization, Complement fixation, Phagocytosis) Generation of Humoral Immune Response (Plasma and Memory cells) Generation of Cell Mediated Immune Response MHC- Functions of MHC I & II molecules Hypersensitivity-definition and types (in brief) Autoimmunity (in brief)

UNIT III:

Microbes in Health and Disease: Normal flora of human body. Definitions - Infection, Invasion, Pathogen, Pathogenicity, Virulence, Toxigenicity, Opportunistic infections, Nosocomial infections. General account on microbial diseases – causal organism, pathogenesis, epidemiology, diagnosis, prevention, and control of the following Bacterial diseases - Tuberculosis, Typhoid. Fungal diseases - Candidiasis. Protozoal diseases - Malaria. Viral Diseases –Corona virus and AIDS

UNIT IV:

Principles of Diagnosis: General principles of diagnostic microbiology- Collection, transport of clinical samples, Identification by Culturing&Biochemical characteristics (IMViC),Identification by molecular assays (PCR, RT-PCR, DNA probes), Identification by serological tests (ELISA, Immunofluorescence, Agglutination based tests, Complement fixation)

UNIT V:

Prevention and Treatment: Vaccines Monoclonal antibodies- Production and application Antimicrobial agents- General modes of action of antibacterial (Penicillin), antifungal (Amphotericin), antiviral (Amantadine)agents Interferons Tests for antimicrobial susceptibility (Disc diffusion) Antibiotic resistance in bacteria.

RECOMMENDED TEXT BOOKS:

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication.
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. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology.11th edition Wiley-Blackwell Scientific Publication, Oxford.
4. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.

REFERENCE BOOKS:

1. Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
2. Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Microbiology. 4th edition. Elsevier Publication.
3. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education.

B Sc	Semester: IV	Credits: 1
Course: 4(L)	Immunology and Medical Microbiology Lab	Hrs/Wk: 2

List of the Experiments:

1. Identification of human blood groups.
2. Separate serum from the blood sample (demonstration).
3. Immunodiffusion by Ouchterlony method.
4. Identification of any of the bacteria (*E. coli, Pseudomonas, Staphylococcus*, *Bacillus*) using laboratory strains on the basis of cultural, morphological and biochemical characteristics: IMViC, urease production and catalase tests
5. Study of composition and use of important differential media for identification of bacteria: EMB Agar, McConkey agar, Mannitol salt agar
6. Antibacterial sensitivity by Kirby-Bauer method
7. Determination of Minimal Inhibitory Concentration (MIC) of an antibiotic
8. Study symptoms of the diseases with the help of photographs: Anthrax,Polio, Herpes, chicken pox, HPV warts, Dermatomycoses (ring worms)
9. Study of various stages of malarial parasite in RBCs using permanent mounts.
10. Phenol coefficient test
11. Isolation of Normal flora of human body (Hands, Feet, Nostrils, Teeth Surface) by swab method.
12. Evaluation of Hand Sanitizer Effectiveness by Filter Paper Disc Method & thumb impression method.

RECOMMENDED TEXT BOOKS & REFERENCE BOOKS:

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication.
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. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology.11th edition Wiley-Blackwell Scientific Publication, Oxford.
4. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
4. Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
5. Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Microbiology. 4th edition. Elsevier Publication.
6. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education.

B Sc	Semester: IV	Credits: 4
Course: 5		Hrs/Wk: 4

Aim and objectives of Course:

- To study role of microorganisms in nutrient cycling, microorganism in waste treatment and degradation of xenobiotics
- To determine the potability of drinking water
- To study concepts of screening and strain improvement, media, Fermentation, assays with examples of industrially important processes

Learning outcomes of Course: Up on completion of the course students able to

- Understand fundamental concept in soil microbial diversity, basic concept of biogeochemical cycles and plant growth promotion and plant diseases
- Understands the role of microorganisms in treatment of solid and liquid waste.
- Acquire knowledge on application of microorganisms in agro – environmental fields.
- Get basic information design of fermenter, fermentation processes and Single cell proteins.
- Self-reliance in the industrial application of Microbiology in life and industry.
- Entrepreneurship can be established with the gained knowledge.

UNIT I:

Microbial Ecology: Role of microorganisms in Biogeochemical cycles (Carbon, nitrogen, phosphorus) Microbe-microbe interactions - Synergism, mutualism, commensalism, antagonism, competition, parasitism, predation Plant- Microbe interactions - Plant growth promoting Microorganisms, Plant pathogens

UNIT II:.

Microorganisms in Environment: Microbes in waste management- solid and liquid waste (aerobic and anaerobic) Microbes in degradation of Xenobiotics Microbes in drinking water-detection of potability by (a) standard qualitative procedure: presumptive test/MPN test, confirmed and completed tests for faecal coliforms (b) Membrane filter technique Microbes in food - intrinsic and extrinsic parameters that affect microbial growth in food.

UNIT III:

Industrial Microbiology: Industrial important Microorganisms- Yeasts & Moulds , Bacteria , Actinomycetes . Screening techniques. Strain improvement techniques.

UNIT IV:

Fermentation processes: Design of fermented (for control of pH, temperature, dissolved oxygen, foaming and aeration) Types of fermentation processes - solid state, liquid state, batch, fed-batch, continuous. Fermentation media (Carbon source, nitrogen source, minerals, vitamins & growth factors, Buffers, Precursors, Antifoam agents, water, oxygen)Examples of Crude media; molasses, corn- steep liquor, sulphite waste liquor, whey. Downstream processing - filtration, centrifugation, cell disruption, solvent extraction.

UNIT V:

Microbial Productions: Microbial production of Industrial products: Citric acid, Ethanol, Penicillin, Glutamic acid, vitamin B12, Amylase, Yogurt Microbial cells as food- SCP

RECOMMENDED TEXT BOOKS:

- Atlas RM and Bartha R. (2000). **Microbial Ecology: Fundamentals & Applications.** 4th edition. Benjamin/Cummings Science Publishing, USA
- Barton LL & Northup DE (2011). **Microbial Ecology**. 1st edition, Wiley Blackwell, USA
- Campbell RE. (1983). **Microbial Ecology**. Blackwell Scientific Publication, Oxford, England
- Coyne MS. (2001). **Soil Microbiology: An Exploratory Approach.** Delmar Thomson Learning
- Lynch JM &Hobbie JE. (1988). **Microorganisms in Action: Concepts & Application in Microbial Ecology.** Blackwell Scientific Publication, U.K
- Madigan MT, Martinko JM and Parker J. (2014). **Brock Biology of Microorganisms.** 14th edition. Pearson/ Benjamin Cummings
- Maier RM, Pepper IL and Gerba CP. (2009). **Environmental Microbiology**. 2nd edition, Academic Press

B Sc	Semester: IV	Credits: 1
Course: 5(L)	Microbial Ecology and Industrial Microbiology Lab	Hrs/Wk: 2

List of the Experiments:

1. Microbial fermentation for the production and estimation of ethanol
2. Isolation of amylase producing microorganisms from soil
3. Isolation of food spoilage microorganisms from spoiled food sample.
4. MPN test
5. Demonstration of fermenter
6. Production of wine from grapes
7. Growth curve and kinetics of any two industrially important microorganisms.
8. Microbial fermentation for the production and estimation of citric acid
9. Preparation of yoghurt.
10. Crowded plate technique
11. Isolation of microorganism from soil
12. Isolation of microorganism from different water samples

REFERENCE BOOKS:

1. Martin A. (1977). **An Introduction to Soil Microbiology**. 2nd edition. John Wiley & Sons Inc. New York & London. Adams MR and Moss MO. (1995). **Food Microbiology**. 4th edition, New Age International (P) Limited Publishers, New Delhi, India.
2. Banwart JM. (1987). **Basic Food Microbiology**. 1st edition. CBS Publishers and Distributors, Delhi, India.
3. Casida LE. (1991). **Industrial Microbiology**. 1st edition. Wiley Eastern Limited.
4. Crueger W and Crueger A. (2000). **Biotechnology: A textbook of Industrial Microbiology**. 2nd Edition. Panima Publishing Company, New Delhi
5. Frazier WC and Westhoff DC. (1992). **Food Microbiology**. 3rd edition. Tata McGraw- Hill Publishing Company Ltd, New Delhi, India.
6. Jay JM, Loessner MJ and Golden DA. (2005). **Modern Food Microbiology**. 7th edition, CBS Publishers and Distributors, Delhi, India

B.Sc.	Semester - IV	Credits: 4
Course:4	PHYSIOLOGY, NUTRITIONAL AND CLINICAL BIOCHEMISTRY	Hrs/Wk: 4

Aim and objectives of Course (Physiology, Nutritional and Clinical Biochemistry):

The student will get knowledge on different physiological systems and their functions in the human body. By studying blood, its composition and its functions the student will understand the importance of blood.

Learning outcomes of Course:

a) This course will also provide knowledge on hormones, their functions and the diseases occurring due to alterations in the levels of hormones.
b) By studying this course the student will know the nutritional importance of proteins, carbohydrates, lipids, vitamins and minerals.
c) Clinical biochemistry unit along with practicals will enable the student to do diagnostic tests for liver diseases, Gastro intestinal diseases, renal diseases and nutritional deficiencies.

UNIT I: 12hours

Digestion and Blood:Digestion and absorption of carbohydrates, lipids and proteins. Role of enzymes and gastrointestinal hormones in digestion. Composition of blood, Blood groups, coagulation of blood and disorders of blood coagulation (haemophilia). Hemoglobin and transport of gases in blood (oxygen and CO_2). Types of anemias, haemoglobinopathies-sickle cell anemia.

UNIT II: 12hours

Nervous system and excretory system: Introduction to nervous system, general organization of nervous system, Neurons-structure, types, properties and functions; Neurotransmitters, Cerebrospinal fluid-composition and functions, Reflex-types and properties. Introduction to excretory system. Organization of kidney, Structure and functions of nephron, Urine formation, Role of kidneys in maintaining acid-base and electrolyte balance in the body.

Unit III: 12 hours

Endocrinology: Endocrinology- organization of endocrine system. Classification of hormones. Outlines of chemistry, physiological role and disorders of hormones of thyroid, parathyroid, pituitary and hypothalamus. Introduction of gastrointestinal hormones. Mechanism of hormonal action- signal transduction pathways for glucocorticoids and insulin. Adrenalin, estrogen and progesterone.

UNIT IV: 12hours

Nutritional Biochemistry: Balanced diet. Calorific values of foods and their determination by bomb calorimeter. BMR and factors affecting it. Specific dynamic action of foods. Energy requirements and recommended dietary allowance (RDA) for children, adults, pregnant and lactating women. Sources of complete and incomplete proteins. Biological value of proteins. Malnutrition-Kwashiorkor, Marasmus and PEM. Vitamins- sources, structure, biochemical roles, deficiency disorders of water and fat soluble vitamins. Introduction to nutraceutical and functional foods. Bulk and trace elements-Ca, Mg, Fe, I, Cu, Mo, Zn, Se and F.

UNIT V: 12hours

Clinical Biochemistry: Plasma proteins in health and disease. Liver diseases-jaundice. Liver function tests- conjugated and total bilirubin in serum, albumin: globulin ratio, Serum enzymes in liver diseases-SGOT, SGPT, GGT, CPK, Acid and alkaline phosphatases. Serum lipids and lipoproteins. Normal and abnormal constituents of urine. Renal function tests-Blood urea, creatinine, GFR, creatinine clearance. GTT and gastric and pancreatic function tests.

RECOMMENDED BOOKS:

1. Essentials of Food and Nutrition, Vol. I & II, M.S. Swaminathan.
2. Text Book of Biochemistry with clinical correlations. Thomas M. Devlin (John Wily)
3. Harper's Review of Biochemistry, Murray et al (Longman).
4. Biochemical aspects of human disease – R.S. Elkeles and A.S. Tavil. (Blackwell Scientific Publications).
5. Clinical chemistry in diagnosis and treatment–Joan F.Zilva and P.R.Pannall (Lloyd-Luke Medical Books, 1988).
6. Varley's Practical clinical Biochemistry – Ed. Alan W. Gowenlock (Heinemann Medical Books, London, 1988).

B.Sc.	Semester - IV	Credits: 1
Course:4(L)	PHYSIOLOGY NUTRITIONAL AND CLINICAL BIOCHEMISTRY LAB	Hrs/Wk: 2

Details of Lab/Practical/Experiments/Tutorials syllabus:

List of practical Experiments:

1.Estimation of calcium by titrimetry
2.Estimation of iron by Wong's method.
3.Estimation of vitamin C by 2, 6 -dichlorophenol indophenol method.
4.Determination of iodine value of an oil.
5.Estimation of hemoglobin in blood.
6.Total count - RBC and WBC. Differential count.
7.Determination of blood group and Rh typing.
8.Visualization of antigen antibody reactions (Ouchterlony technique).
9.Urine analysis for albumin, sugars and ketone bodies.
10.Estimation of urinary creatinine.
11.Estimation of blood Glucose.
12.Estimation of serum total cholesterol.

7. Recommended Co-curricular activities: (Co-curricular Activities should not promote copying from text book or from others' work and shall encourage self/independent and group learning)

A. Measurable:
1. Assignments on: Endocrinology
2. Student seminars (Individual presentation of Courses) on topics relating to: syllabus

B. Quiz Programmes on: Digestion and Blood
1. Individual Field Studies/projects: Clinical Biochemistry
2. Group discussion on: Nutritional Biochemistry
3. Group/Team Projects on: Clinical Biochemistry

C. General
1. Collection of news reports and maintaining a record of Course-cuttings relating to topics covered in syllabus
2. Group Discussions on: new scientific approaches and Discoveries
3. Watching TV discussions and preparing summary points recording personal observations etc., under guidance from the Lecturers
4.Any similar activities with imaginative thinking.
Organizing exhibitions
Preparation of charts and models
Science fairs
Science clubs
Essay writing

23. Recommended Continuous Assessment methods:
Slip test
Oral test
Assignments
Seminars

B.Sc.	Semester - IV	Credits: 4
Course:5	MICROBIOLOGY, IMMUNOLOGY AND MOLECULAR BIOLOGY	Hrs/Wk: 4

Aim and objectives of Course (Microbiology, Immunology and Molecular biology):

a) This course will enable the student to know various microbes such as bacteria, fungi and viruses, their structures and other properties and diseases caused by them.
b) The student will also get knowledge in their commercial applications by making use of their beneficial effects such as fermentation in alcohol production, nitrogen fixation in agriculture etc.

Learning outcome of Course:

a) The student will get knowledge in immune system, vaccines and also understand the pathogenesis of auto immune diseases and immune deficiency diseases.
b) This course will provide knowledge and expertise in molecular biology such as genes, their structure and importance. This will also enable the student to know the applications of PCR in cloning and diagnosis of genetic and viral diseases.
c) The practicals will provide the expertise to the student to work in microbiology laboratory, food and pharma industries, and biotech companies for production of vaccines and other life-saving drugs.

UNIT I: 12hours

Microbiology: Introduction to microbiology and microbial diversity. Classification of microorganisms- prokaryotic and eukaryotic microorganisms. Bacterial structure, growth curve and kinetics of growth. Introduction to viruses-plant and animal viruses, structure, life cycle, Food and dairy microbiology. Nitrogen Fixation Nitrogen cycle, Non-biological and biological nitrogen fixation, photosynthetic and non-photosynthetic systems, Nitrogenase system. Utilization of nitrate ion, Ammonia incorporation into organic compounds

UNIT II: 12 hours

Microbial techniques: Preparation of different growth media, isolation and culturing and preservation of microbes, Gram's staining- Gram positive and Gram-negative bacteria, motility and sporulation, Sterilization techniques -Physical methods, chemical methods, radiation methods, ultrasonic and antibiotic resistance.

UNIT III: 12 hours

Applied Biochemistry : Fermentation Technology: Batch, continuous culture techniques, principle, types of fermentors. Pasteur Effect. Industrial production of chemicals- alcohol, acids (citric acid), solvents (acetone), antibiotics (penicillin), Enzyme Technology: Immobilization of enzymes and cells, industrial applications, enzymes in Bioremediation.

UNIT IV: 12hours

Immunology: Organs and cells of immune system. Innate and acquired immunity, Cell mediated and humoral immunity (T-cells and B-cells). Classification of immunoglobulins, structure of IgG. Epitopes / antigenic determinants. Concept of haptens. Adjuvants. Monoclonal antibodies. Antigen-antibody reactions- agglutination, immunoprecipitation, immunodiffusion. Blood group antigens. Immunodiagnostics- ELISA, RIA. Vaccines and their classification. Traditional vaccines-live and attenuated. Modern vaccines- recombinant and peptide vaccines. Outlines of hypersensitivity reactions.

UNIT V: 12 hours

Molecular biology: Types of RNA and DNA, DNA replication-leading and lagging strands, Okazaki fragments, inhibitors of DNA replication. Genetic code, Protein synthesis-transcription, translation, inhibitors of protein synthesis. Outlines of cloning technology, vectors, restriction enzymes, PCR, applications of cloning in agriculture, industry and medical fields.

RECOMMENDED BOOKS:

1. Willey MJ, Sherwood, LM &Woolverton C J (2013) Prescott, Harley and Klein's Microbiology by. 9th Ed., McGraw Hill.
2. Atlas RM. (1997). Principles of Microbiology. 2nd edition. W. M. T. Brown Publishers.
3. Pelczar MJ, Chan ECS and Krieg NR. (1993). Microbiology. 5th edition. McGraw Hill Book Company.
4. Fermentation Technology (2nd ed.) Standury (Pergman press)
5. Biotechnology: Textbook of Industrial microbiology 2nd Edit. by Crueger and Crueger (2000).
6. Principles of Biochemistry, White. A; Handler P and Smith.
7. Ivan M. Roitt; Essential Immunology (Latest Edition). Blackwell Scientific Publication
8. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition
9. W.H. Freeman and Company, New York.
10. Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.
11. Watson JD, Baker TA, Bell SP, Gann A, Levine M and Losick R (2008) Molecular Biology of the Gene, 6th edition, Cold Spring Harbour Lab. Press, Pearson Publication
12. Molecular biology by David Freifelder.

B.Sc.	Semester - IV	Credits: 1
Course:5(L)	MICROBIOLOGY, IMMUNOLOGY AND MOLECULAR BIOLOGY LAB	Hrs/Wk: 2

Details of Lab/Practical/Experiments/Tutorials syllabus:

List of Practical Experiments

1. Biosafety and good laboratory practices (GLP) of Microbiology.
2. Sterilization of microbial media by autoclave.
3. Isolation of pure cultures: (i) Streak plate method. (ii) Serial dilution method.
4. Demonstration of alcohol fermentation.
5. Antibiotic sensitivity by Course disc method.
6. Effect of nitrogen sources on growth of E. coli
7. Immunodiffusion by Ouchterlony method.
8. Blood group analysis.
9. Isolation of DNA from plant tissues.
10. Spotters.

1. Recommended Co-curricular activities:(Co-curricular Activities should not promote copying from text book or from others' work and shall encourage self/independent and group learning)

A .Measurable:. Assignments on: Immunology

1. Student seminars (Individual presentation of Courses) on topics relating to: Microbiology & Molecular Biology.
2. Quiz Programmes on: Molecular biology
3. Individual Field Studies/projects: Microbiology
4. Group discussion on: Applied Biochemistry
5. Group/Team Projects on: Microbial techniques

B. **General**

1. Collection of news reports and maintaining a record of Course-cuttings relating to topics covered in syllabus
2. Group Discussions on: new scientific approaches and Discoveries
3. Watching TV discussions and preparing summary points recording personal observations etc., under guidance from the Lecturers

5. Any similar activities with imaginative thinking.

Organizing exhibitions
Preparation of charts and models
Science fairs
Science clubs
Essay writing

6. Recommended Continuous Assessment methods:

Slip test
Oral test
Assignments
Seminars

B.Sc.	Semester - IV	Credits: 4
Course: 4	Inorganic, Organic and Physical Chemistry	Hrs/Wk: 4

Course outcomes:

At the end of the course, the student will be able to;

- To learn about the laws of absorption of light energy by molecules and subsequent photochemical reactions.
- To understand the concept of quantum efficiency and mechanisms of photochemical reactions.

UNIT I:

Organ metallic Compounds: Definition and classification of organometallic compounds on the basis of bond type, Concept of hapticity of organic ligands. Metal Carbonyls:18electronrule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation of mono and binuclear carbonyls of 3d series. P-acceptor behaviour of carbon monoxide. Synergic effects (VB approach) - (MO diagram of CO can be referred to for synergic effect to IR frequencies).

UNIT II:

Carbohydrates: Occurrence, classification and their biological importance, Monosaccharides: Constitution and absolute configuration glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth Projection And Conformational Structures ;Interconversions of aldoses and ketoses; Kiliani-Fischer synthesis and Ruff degradation; Disaccharides– Elementary Treatment Of Maltose, lactose and sucrose. Polysaccharides–Elementary Treatment Of starch.

UNIT III:

Amino acids and proteins: Introduction: Definition of Amino acids, classification of Amino acids into alpha, beta, and gamma amino acids. Natural and essential amino acids - definition and examples, classification of alpha amino acids into acidic, basic and neutral amino acids with examples. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples - Glycine, Alanine, valine and leucine) by following methods: a) from halogenated carboxylic acid b) Gabriel Phthalimide synthesis c) strecker's synthesis.

Physical properties: Zwitter ion structure - salt like character - solubility, melting points, amphoteric character, definition of isoelectric point.

Chemical properties: General reactions due to amino and carboxyl groups - lactams from gamma and delta amino acids by heating- peptide bond (amide linkage). Structure and nomenclature of peptides and proteins.

Heterocyclic Compounds: Introduction and definition: Simple five membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole - Aromatic character – Preparation from 1, 4, - dicarbonyl compounds, Paul-Knorr synthesis. Properties: Acidic character of pyrrole - electrophilic substitution at 2 or 5 position, Halogenation, Nitration and Sulphonation under mild conditions - Diels Alder reaction in furan. Pyridine – Structure - Basicity - Aromaticity- Comparison with pyrrole- one method of preparation and properties - Reactivity towards Nucleophilic substitution reaction.

UNIT IV:

Nitrogen Containing Functional Groups: Preparation, properties and important reactions of nitro compounds, amines and diazonium salts.

1. Nitro hydrocarbons

Nomenclature and classification-nitro hydrocarbons, structure -Tautomerism of nitroalkanes leading to aci and keto form, Preparation of Nitroalkanes, reactivity -halogenation, reaction with HONO (Nitrous acid), Nef reaction and Mannich reaction leading to Micheal addition and reduction.

2.Amines:

Introduction, classification, chirality in amines (pyramidal inversion), importance and general methods of preparation.

Properties : Physical properties, Basicity of amines: Effect of substituent, solvent and steric effects. Distinction between Primary, secondary and tertiary amines using Hinsberg's Method And Nitrous Acid. Discussion of the following reactions with emphasis on the mechanistic pathway: Gabriel Phthalimide synthesis, Hoffmann- Bromamide Reaction,Carbylamine Reaction, Mannich reaction, Hoffmann's exhaustive methylation, Hofmann-elimination reaction and Cope elimination.

Diazonium Salts: Preparation and synthetic applications of diazonium salts including preparation of arenes, haloarenes, phenols, amino and nitro compounds. Coupling Reactions Of Diazonium Salts (preparation of azo dyes).

UNIT V:

Photochemistry: Difference between thermal and photochemical processes, Laws of photochemistry- Grothus- Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield- Photochemical reaction mechanism- hydrogen- chlorine and hydrogen- bromine reaction. Qualitative description of fluorescence, phosphorescence, Jablonski diagram, Photosensitized reactions- energy transfer processes (simple example).

Thermodynamics: The first law of thermodynamics-statement, definition of internal energy and enthalpy, Heat capacities and their relationship, Joule-Thomson effect- coefficient, Calculation of work for the expansion of perfect gas under isothermal and adiabatic conditions for reversible processes, State function. Temperature dependence of enthalpy of formation- Kirchoff s equation, Second law of thermodynamics Different Statements of the law, Carnot cycle and its efficiency, Carnot theorem, Concept of entropy, entropy as a state function, entropy changes in reversible and irreversible processes. Entropy changes in spontaneous and equilibrium processes. Third law of thermodynamics, Nernst heat theorem, Spontaneous and non- spontaneous processes, Helmholtz and Gibbs energies-Criteria for spontaneity.

Co-curricular activities and Assessment Methods

Continuous Evaluation: Monitoring the progress of student's learning Class Tests, Worksheets and Quizzes Presentations, Projects and Assignments Group Discussions: Enhances Critical Thinking Skills And personality

Semester-end Examination: critical indicator of student's teachers throughout the semester.

REFERENCE BOOKS:

1. Concise coordination chemistry by Gopalan and Ramalingam
2. Coordination Chemistry by Basalo and Johnson
3. Organic Chemistry by G.Mareloudan, Purdue Univ
4. Text book of physical chemistry by S Glasstone
6. Concise Inorganic Chemistry by J.D.Lee
7. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan
8. A Text Book of Organic Chemistry by Bahl and Arunbahl
9. A Text Book of Organic chemistry by I L FinarVol I
10. A Text Book of Organic chemistry by I L FinarVol II
11. Advanced physical chemistry by Gurudeep Raj

B.Sc.	Semester - IV	Credits: 1
Course: 4(L)	Organic Qualitative analysis Lab	Hrs/Wk: 2

Course outcomes:

At the end of the course, the student will be able to;

- Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
- Determine melting and boiling points of organic compounds
- Understand Application of concepts of different organic reactions studied in theory part of organic chemistry

Organic Qualitative analysis **50 M**

Analysis of an organic compound through systematic qualitative procedure for functional group identification including the determination of melting point and boiling point with suitable derivatives.

Alcohols, Phenols, Aldehydes, Ketones, Carboxylic acids, Aromatic primary amines, amides and simple sugars

B.Sc.	Semester - IV	Credits: 4
Course: 5	Inorganic & Physical Chemistry	Hrs/Wk: 4

Course outcomes:

At the end of the course, the student will be able to;

- Understand concepts of boundary conditions and quantization, probability distribution, most probable values, uncertainty and expectation values
- Application Of Quantization To Spectroscopy.
- Various types of spectra and their use in structure determination.

UNIT I: INFORMATION CHEMISTRY

Coordinator Chemistry: IUPAC nomenclature of coordination compounds, Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Valence Bond Theory (VBT): Inner and outer orbital complexes. Limitations of VBT, Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry, Factors affecting the magnitude of crystal field splitting energy, Spectrochemical series, Comparison of CFSE for Octahedral and Tetrahedral complexes, Tetragonal distortion of octahedral geometry, Jahn-Teller distortion, square planar coordination.

UNIT II:

1. Inorganic Reaction Mechanism:

Introduction to inorganic reaction mechanisms. Concept of reaction pathways, transition state, intermediate and activated complex. Labile and inert complexes, ligand substitution reactions -SN^1 and SN^2, Substitution reactions in square planar complexes, Trans-effect, theories of trans effect and its applications

2. Stability of metal complexes:

Thermodynamic stability and kinetic stability, factors affecting the stability of metal complexes, chelate effect, determination of composition of complex by Job's method and mole ratio method.

Bioinorganic Chemistry:

Metal ions present in biological systems, classification of elements according to their action in biological system. Geochemical effect on the distribution of metals, Sodium / K - pump, carbonic anhydrase and carboxypeptidase. Excess and deficiency of some trace metals. Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity, Use of chelating agents in medicine, Cis-platin as an anti-cancer drug. Iron and its application in bio-systems, Haemoglobin, Myoglobin. Storage and transfer of iron.

UNIT-III: PHYSICAL CHEMISTRY

1 .Phase rule: Concept of phase, components, degrees of freedom. Thermodynamic derivation of Gibbs phase rule. Phase diagram of one component system - water system, Study of Phase diagrams of Simple eutectic systems i) Pb-Ag system, desilverisation of lead ii) NaCl-Water system, Congruent and incongruent melting point- Definition and examples for systems having congruent and incongruent melting point , freezing mixtures.

UNIT IV:

Electrochemistry: Specific conductance, equivalent conductance and molar conductance- Definition and effect of dilution. Cell constant. Strong and weak electrolytes, Kohlrausch's law and its applications, Definition of transport number, determination of transport number by Hittorf's method. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only), Application of conductivity measurements- conduct metric titrations.Electrochemical Cells- Single electrode

potential, Types of electrodes with examples: Metal- metal ion, Gas electrode, Inert electrode, Redox electrode, Metal-metal insoluble salt- salt anion. Determination of EMF of a cell, Nernst equation, Applications of EMF measurements - Potentiometric titrations. Fuel cells- Basic concepts, examples and applications

UNIT V:

Chemical Kinetics :

The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction, Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).Enzyme catalysis- Specificity,factors affecting enzyme catalysis, Inhibitors and Lock & key model. Michaels- Menten equation- derivation, significance of Michaelis-Menten constant.

Co-curricular activities and Assessment Methods Continuous Evaluation: Monitoring the progress of student's learning Class Tests, Worksheets and Quizzes Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality

Semester-end Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the semester.

REFERENCE BOOKS:

1. Text book of physical chemistry by S Glasstone
2. Concise Inorganic Chemistry by J.D.Lee
3. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan
4. Advanced physical chemistry by Gurudeep Raj
5. Principles of physical chemistry by Prutton and Marron
6. Advanced physical chemistry by Bahl and Tuli
7. Inorganic Chemistry by J.E.Huheey
8. Basic Inorganic Chemistry by Cotton and Wilkinson
9. A textbook of qualitative inorganic analysis by A.I. Vogel
10. Atkins, P.W. & Paula, J.de Atkin's Physical Chemistry Ed., Oxford UniversityPress 10thEd(2014)
11. Castellan,G.W.PhysicalChemistry4thEd.Narosa(2004)
12. Mortimer,R. G.PhysicalChemistry3rdEd. Elsevier:NOIDA,UP(2009).
13. Barrow, G.M.Physical Chemistry

B.Sc.	Semester - IV	Credits: 1
Course: 5(L)	Conductometric and Potentiometric Titrimetry Lab	Hrs/Wk: 2

Course outcomes:

At the end of the course, the student will be able to;

- Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
- Apply concepts of electrochemistry in experiments
- Be familiar with electroanalytical methods and techniques in analytical chemistry which study an analyte by measuring the potential (volts) and/or current (amperes) in an electrochemical cell containing the analyte

Conductometric and Potentiometric Titrimetry **50 M**

1. **Conductometric titration-** Determination of concentration of HCl solution using standard NaOH solution.
2. **Conductometric titration-** Determination of concentration of CH_3COOH Solution using standard NaOH solution.
3. **Conductometric titration-** Determination of concentration of CH_3COOH and HCl in a mixture using standard NaOH solution.
4. **Potentiometric titration-** Determination of Fe (II) using standard $K_2Cr_2O_7$ solution.
5. Determination of rate constant for acid catalyzed ester hydrolysis.

B.Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 6A	Food and Dairy Microbiology	Hrs/Wk:4

I THEORY

A. Learning outcomes

LO1: Understanding the key concepts in food and dairy microbiology
LO2: Emphasizing the role of intrinsic and extrinsic factors on growth and survival of microorganisms in food and dairy industries
LO3: Enumerating the various methods of isolation, detection and identification of microorganisms employed in food and dairy industries
LO4: Identifying the types and nature of food spoilage caused by microorganisms
LO5: Developing principles and methods for the microbiological examination and preservation of foods
LO6: Perception of food safety regulations and the rationale use of standard methods and procedures for the microbial analysis of food and dairy products.

B. SYLLABUS

UNIT – 1 **No. of Hours:10**

Microbiology of foods: Foods as a substrate for microorganisms, Intrinsic and extrinsic parameters that affect the microbial growth in food. Survival of microbes in foods. natural flora and source of contamination of foods in general. Identification of specific groups – Bacteria, Viruses, Fungi and Protozoa. Food sanitation and control.

UNIT – II **No. of Hours:10**

Microbial spoilage of food: Spoilage of canned foods, cereals, fruits, vegetables, bread, eggs, meat and fish. Food intoxication -Staphylococcal poisoning, botulism, Food infection – Salmonellosis, Shigellosis, Mycotoxins produced by fungi - Aflatoxins in stored food and grains.

UNIT – III **No. of Hours:10**

Principles of food preservation -Methods of food preservation- Physical methods-high temperature, canning, freezing, dehydration, and radiation. chemical methods- salt, sugar, organic acids, SO_2, nitrite and nitrates, ethylene oxide, antibiotics and bacteriocins Organic acids, nitrates and cresols. Food processing- Thermal processing, Chemical processing (Sugar, Salt, Smoke, acid and chemicals). Packaging materials

UNIT - IV **No. of Hours:10**

Fermented Foods: Dairy starter cultures, fermented dairy products: yogurt and cheese (Types and Production), other fermented foods: acidophilus milk, kumiss, kefir, dahi, dosa, sauerkraut, soy sauce and tampeh. Microorganisms as food – single cell protein, yeast, algae and fungal organisms. Mushrooms: Types and cultivation. Probiotics: Health benefits, types of microorganisms used, probiotic foods available in market.

UNIT – V **No. of Hours: 10**

Dairy Microbiology (Skill-based unit): Physical and chemical properties of milk, Microorganisms in milk, Sources of microbial contamination of milk - milch animal, utensils and equipment, water, milking environment. Methods of preservation of milk and milk products: Pasteurization, sterilization, dehydration, Fermentation in milk: Souring, lactic acid fermentation and proteolysis.

C. REFERENCE

1. Beety C. Hobbs, Food Microbiology, Arnold-Heinemann Publishing Private Limited, New Delhi
2. Hammer B.W and Babal, Dairy Bacteriology, Prentice Hall Incorporated, London.
3. Jay J.M., Modern Food Microbiology, CBS Publishers and Distributors, New York
4. Pelczar M.J., Chan E.C.S and Krieg N.R., Microbiology, McGraw Hill Book Company, New York
5. Salle A.J., Fundamental Principles of Bacteriology, Tata McGraw-Hill Publishing Company Limited, New Delhi.
6. Varnam A.H. and Evans M.G., Foodborne Pathogens, Wolfe Publishing House, London
7. M.P. Dayle et al, 2001, Food Microbiology: Fundamentals & Frontiers, 2nd edition, ASM press.
8. Adams, M.R. and Moss M.O. 1995, Food Microbiology, Royal Society of Chemistry ==Publication, Cambridge.
9. Frazier W.C. and West haff D.C,1988, Food Microbiology, Tata Mc.Graw Hill Publishing Company Limited, New Delhi.
10. Stantury, P.F., Whitekar, A. and Hall, S.J., 1995, Principles of Fermentation Technology.
11. Banwart, GJ, 1989, Basic Food Microbiology, CBS Publishers and Distributors, Delhi
12. Hobbs BC and Roberts.D, 1993, Food Poisoning and Food Hygiene, Edward Arnold (A division at Hodder and Strong ton) London.

B.Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:1
Course: 6A	Food and Dairy Microbiology Lab	Hrs/Wk:2

A. LEARNING OUTCOMES

LO1: Developing skilled training in microbiological examination of foods
LO2: Technical expertise in quality testing of milk and milk products
LO3: Gaining hands on experience on concepts of acid fermentations
LO4: Understanding the principles involving various methods of food preservation
LO5: Emphasizing the nutritional value of Fermented foods
LO6: Identifying the methods to control spoilage of foods adopting safety regulations

B. SYLLABUS

1. Isolation and identification of microbes from infected fruits and vegetables
2. Isolation and identification of microbes from idly batter and pickles
3. Isolation and identification of microbes from home-made and commercial curd
4. Preparation of yogurt
5. Determination of microbiological quality of milk sample by MBRT
6. Estimation of fat content of milk by Gerber's method
7. Estimation of Lactose in milk
8. Estimation of Lactic acid in milk

C. REFERENCES

1.Srivastava, Handbook of Milk Microbiology.
2. Harrigan W.F., Laboratory methods in Food Microbiology.
3. Aneja, 2001, Experiments in Microbiology, Plant Pathology, Tissue Culture & Mushroom production Technology, 3rdEdition, New age international
4. Atlas R.M., Microbiology – fundamentals and applications, Macmillan Publishing Company, New York.
5. Cappuccino &Sherman, Microbiology: A laboratory manual, Benjamin cummings Science publishing, 5th edition.
6. Gopal Reddy, M.N. Reddy, D.V.R. Sai Gopal and K.V. Mallaiah, Laboratory Experiments in Microbiology, Himalaya Publishing House.

CO-CURRICULAR ACTIVITIES

A. MANDATORY: (Lab/field training of students by teacher)

1.For Teacher:

- Visit to any food processing centres
- Organising industrial tours to any dairy farms

2.For Student:

- Preparation of charts or models on Fermented foods, SCP, production flow charts etc.,
- Microorganisms and food – any event or curricular activity

B. SUGGESTED CO-CURRICULAR ACTIVITIES

1. Internships in dairy farms /food industries / research organizations, universities etc.
2.Seminars, Group discussions, Quiz, Debates etc.
3.Preparation of videos related to food processing techniques and protocols
4. Invited lectures and presentations on related topics by experts in the specified area.

B.Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 7A	Environmental and Agriculture Microbiology	Hrs/Wk:4

LEARNING OUTCOMES

LO1: Providing basic understanding of microbial diversity in the environment
LO2: Perception of Energy transfer efficiencies between tropic levels
LO3: Enumerating the role of microbes in waste management and bioremediation.
LO4: Emphasizing the role of microbes in maintaining soil profile and fertility
LO5: Insights into the role of microorganisms as biofertilizers and biopesticides
LO6: Enumerating the various classes of microbes affecting agricultural yields.

SYLLABUS

UNIT – 1 **No. of Hours:10**

Ecology- Basic concepts of Ecology and Environment, Ecosystem – Concept, components, food chains, food webs and trophic levels. Energy transfer efficiencies between trophic levels. Microflora of fresh water and marine habitats. Aero microflora and dispersal of microbes. Host-Microbe interactions: Mutualism, synergism, commensalism, competition, amensalism, parasitism, predation. Microbes and biogeochemical cycles - nitrogen, sulphur, carbon and phosphorus.

UNIT – II **No. of Hours:10**

Outlines of Waste management: Sources and types of solid waste, Methods of solid waste disposal (composting and sanitary landfill). Liquid waste management: Composition and strength of sewage (BOD and COD), Primary, secondary and tertiary sewage treatment. Microorganisms and pollution: methyl mercury, acid rain water, carbon monoxide. Microbial Bioremediation of common pesticides, organic (hydrocarbons, oil spills) and inorganic (metals) matter. Biofouling.

UNIT – III **No. of Hours:10**

Soil Microbiology- Microorganisms, soil structure, soil profile, Physio-chemical conditions, Microbial composition, sampling techniques, Role of Microorganisms in organic matter decomposition (cellulose, Hemicellulose, Lignin's). Rhizosphere and Phyllosphere microflora. Management of soil biota for maintaining soil fertility. Conversion of waste lands into fertile lands. Management of soil nutrients. Microbes in composting.

UNIT – IV **No. of Hours:10**

Microorganisms in Agriculture: Biofertilizers - definition, types (bacterial - Rhizobium, Azotobacter; phosphate solubilizers (PSB) - examples of Bacterial sps., BGA, Azolla; kind of association, mode of application, merits and demerits. Biopesticides - introduction, types (Bacterial - Bacillus thuringiensis, viral - NPV, fungal - Trichoderma), mode of action, factors influencing, genes involved and target pests. Mycorrhiza-Importance of mycorrhizal inoculums, types of mycorrhizae associated plants, Production and field applications of Ectomycorrhizae and VAM.

UNIT – V **No. of Hours: 10**

Contributions of G. Rangaswamy, Beijerinck, Winogradsky and Winogradsky's coloumn. Study of microbes as plant pathogens: Fungi - *Puccinia graminis, Plasmopara viticola, Cercospora arachidicola* Bacteria - *Xanthomonas oryzae, Xanthomonas campestris* Mycoplasma - sandal spike, grassy shoot Viruses - TMV (Tobacco Mosaic Virus), tomato leaf curl. Advantages, social and environmental aspects of transgenic plants (Bt crops, golden rice).

C. REFERENCE

1. Atlas RM and Bartha R. (2000). Microbial Ecology: Fundamentals & Applications. 4th edition, Benjamin/Cummings Science Publishing, USA
2. Barton LL & Northup DE (2011). Microbial Ecology. 1st edition, Wiley Blackwell, USA
3. Campbell RE. (1983). Microbial Ecology. Blackwell Scientific Publication, Oxford, England.
4. Coyne MS. (2001). Soil Microbiology: An Exploratory Approach. Delmar Thomson Learning.
5. Lynch JM & Hobbie JE. (1988). Microorganisms in Action: Concepts & Application in Microbial Ecology. Blackwell Scientific Publication, U.K.
6. Maier RM, Pepper IL and Gerba CP. (2009). Environmental Microbiology. 2nd edition, Academic Press.
7. Martin A. (1977). An Introduction to Soil Microbiology. 2nd edition. John Wiley & Sons Inc. New York & London.
8. Okafor, N (2011). Environmental Microbiology of Aquatic & Waste systems. 1st edition, Springer, New York.
9. Singh A, Kuhad, RC & Ward OP (2009). Advances in Applied Bioremediation. Volume 17, Springer-Verlag, Berlin Hedeilberg
10. Subba Rao NS. (1999). Soil Microbiology. 4th edition. Oxford & IBH Publishing Co. New Delhi.

B.Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:1
Course: 7A	Environmental and Agriculture Microbiology Lab	Hrs/Wk:2

A. LEARNING OUTCOMES

LO1: Gaining skilled expertise in identification and isolation of Microorganisms
LO2: Estimating BOD of water samples
LO3: Checking water potability with suitable procedures
LO4: Acquiring skilled training in soil analysis
LO5: Understanding the microbe borne diseases affecting agricultural crops
LO6: Estimating, characterizing and identification of air flora and soil flora

B. SYLLABUS

1. Enumeration of bacteria, fungi and actinomycetes from soil
2. Enumeration and identification of rhizosphere micro flora
3. Isolation of rhizobium from root nodules.
4. Isolation of Azotobacter from soil.
5. Observation& description of any three bacterial and fungal plant diseases
6. Analysis of soil - pH, Moisture content and water holding capacity.
7. Study of air flora by Petri plate exposure method.
8. Analysis of potable water by Standard plate count
9. Determination of coliform count in water by MPN (Presumptive, confirmed and completed test).
10. Determination of Biological Oxygen Demand (BOD) of waste water samples.

C. REFERENCES

1. Aneja K.R., Experiments in Microbiology, Plant Pathology, Tissue culture and Mushroom cultivation, New Age International, New Delhi.

2. Hurst. C.J., Environmental Microbiology, ASM Press, Washington D.C

3. Mehrotra R.S., Plant Pathology, Tata McGraw Hill Publications Limited, New DelhiHurst C.J, Manual of Environmental Microbiology, 2nd Edition.

4. A practical manual of soil microbiology laboratory methods, Land and Water Division

5. Microbiology Laboratory Manual, Naveena Varghese, P.P. Joy, Kerala Agricultural UniversityPractical Manual for Undergraduates Microbiology by Mukesh Kumar (Author)

6. Environmental Microbiology A Laboratory Manual 2nd Edition - December 13, 2004, Authors: Ian Pepper, Charles Gerba, Jeffrey Brendecke, eBook ISBN: 9780080470511

CO-CURRICULAR ACTIVITIES

A. MANDATORY: (Lab/field training of students by teacher)

1. For Teacher:

- Visit to any agriculture field
- Organising awareness programmes on environmental pollution

2. For Student:

- Preparation of charts or models on biodegradable and eco-friendly mechanisms etc.,
- Encouraging pollution free practices, any event or curricular activity

B. SUGGESTED CO-CURRICULAR ACTIVITIES

1. Organizing Eco club activities to promote eco-friendly green belts
2. Promoting awareness to create a clean and pollution free environments
3.Seminars, Group discussions, Quiz, Debates etc.
4. Invited lectures and presentations on related topics by experts in the specified area
5. Visiting Agriculture farms/biodiversity parks/Forest nurseries, research institutes, universities etc.

B.Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 6B	Clinical and Diagnostic Microbiology	Hrs/Wk:4

LEARNING OUTCOMES

LO1: Deep understanding of the disease cyclesand their out breaks
LO2: Gaining theoretical knowledge of most common disease-causing organisms
LO3: Enumerating the methods and vehicles of disease transmission
LO4: Understanding the basics of Clinical laboratory protocols
LO5: Systematic knowledge on the pathogenesis and laboratory diagnosis of diseases
LO6: Developing insights into clinical practices and serological techniques

SYLLABUS

UNIT – 1 **No. of Hours:10**

Diseases- sources and types of diseases. Epidemiology of Infectious diseases, Diseases in population- Epidemic, Pandemic, Endemic diseases, Sporadic, outbreaks, Portals of Entry and Exit, Herd Immunity, Control of Disease transmission. Methods of transmission and role of biological vectors- (1) House fly (2) Mosquitoes (3) sand fly in disease transmission.

UNIT – II **No. of Hours:10**

Types of Infections –Description of pathogenesis, etiology and laboratory diagnosis of bacteraemia, blood stream infections, Respiratory tract infections (Pneumonia, Flu) Central Nervous System infections (meningitis, encephalitis) Urinary tract infections and Gastrointestinal tract infections (*E. coli and Klebsiella*). Sexually transmitted diseases: *Treponema, Neisseria.*

UNIT – III **No. of Hours:10**

Identification of organisms - microscopic examination of specimen for Bacterial pathogens – simple, differential staining, Giemsa, Leishman, Wright stains and motility. Biochemical reaction – Sugar fermentation test, antibiotic Susceptibility testing – MIC, Kirby Bauer, dilution methods. Cultural tests- IMVIC tests. Isolation and identification of viruses.

UNIT - IV **No. of Hours:10**

Clinical lab technology- Methods of collection of urine, blood, sputum, stool etc. The techniques of preservation of samples. Separation of blood plasma and serum. Blood smear preparations, E.S.R, P.C.V, Blood indices - Platelet count: BT, CT. Examination of urine: Sample collection, microscopic examination- crystals, casts, sediments, pregnancy tests. Examination of Stool - Indication, Collection, Microscopic examination and its significance

UNIT – V **No. of Hours: 10**

Serology – Antigen - antibody reactions – Agglutinations (blood grouping, WIDAL) Hemagglutination, Precipitation (VDRL), Complementation fixation test, Immunodiffusion, Immunoelectrophoretic (rocket, counter current). ELISA, RIA. Quantitative study of Antigen - Antibody precipitin reactions, Western blot analysis for HIV.

C. REFERENCE

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication
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. Virology, Sawant, K.C., 2005, First edition, Dominant Publishers and distributors, Delhi.
4. Subash O. Panija Textbook of Medical Parasitology, 1996. First edition. All India Publishers and Distributors Regd. 920 Poonamallee High Road, Chennai.
5. Rajesh Karyakarte and Ajith Damle (2005) Medical Parasitology, books and Allied (P)Ltd. Kolkata.
6. Jaya Ram Paniker, Textbook of Medical Parasitology, Published by 'Jaypee Brothers', 4th Edition.
7. Coloratlas, Textbook of Diagnostic Microbiology (5th Edition), edited by Eimer.W. Koneman, published by Lippinett.
8. Mosby, Diagnostic Microbiology by Bailey and Swotts, 10th Edition, published.
9. David Greenwood, Richard C.B.Slack, John.F.Peutherer, Medical Microbiology, 16th Edition.
10. SharmaJ.B., Medical Microbiology – A Clinical perspective, paras publishing.
11. Patrick R.Murray, Ken.S.Rosenthal, George.S.Kobayashi, Michael A. Ptaller, Medical Microbiology, 3rd Edition.
12. Jawetz, Melnick and Adelberg's, Medical Microbiology (2004) 23rd Edition, Mc Graw Hill.

B.Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:1
Course: 6B	Clinical and Diagnostic Microbiology Lab	Hrs/Wk:2

LEARNING OUTCOMES

LO1: Demonstrating culture dependent studies of microbes and their diseases
LO2: Acquiring technical expertise in handling microbe under aseptic conditions
LO3: Providing hands-on experience to basic serological techniques
LO4: Performing microbial isolation and biochemical characterization of test samples
LO5: Imparting knowledge in serological testing
LO6: Handling serological kits with ease

SYLLABUS

1. Preparation of different media used in diagnostic Microbiology (culture media/observation): Blood Agar, Mannitol salt agar, MacConkey agar,
2. Collection of throat swabs – culturing the specimen. And laboratory examination for *streptococcus pyogenes*
3. Examination of urine for pathogenic microorganisms –collection of urine, microscopic examination of urine, Enterobacteriaceae – *Escherichia coli, Klebsiella pneumonia*
4. Mycology – Direct microscopy – cultures using Sabouraud's Dextrose agar medium, Wet mount preparations using Lactophenol cotton blue/KOH mount
5. Blood grouping and Rh typing
6. Hemoglobin estimation
7. RBC and WBC count
8. Bleeding time and Clotting time,
9. Medical Parasitology – *E. histolytica, G. lamblia, Trypanosomas, Leishmania and Plasmodium* (Permanent Slide Observation)
10. Laboratory diagnosis of common helminthes infections (permanent slide observations of Helminths' Round worm, Hook worm and Pin worm)

C. REFERENCES

1. J.G.Cappucinno and H.Sherman, Microbiology: A laboratory manual, 4th Edition.
2. K.R.Aneja, Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom cultivation, 3rd Edition.
3. Bailey and Scott, Diagnostic Microbiology.
4. Sastry A.S,Bhat .S,Essentials Of Medical Microbiology
5. Murray, Rosenthal, Medical Microbiology
6. J. G Collee, A.G. Fraser, B.P Marmion,A. Simmons, Mackie & Mccartney Practical Medical Microbiology
7. Manual of Clinical Microbiology, Lenetle, E., Balows, H.A., Hausler, W.J and Shadomy J., 1985. Bethesda American Society of Microbiology.
8. Seiverd, Charles E. Hematology for Medical Technologies. 4th Ed. Lea & Febiger,U.S.,
9. CullingC.F.A. Handbook of Histopathological and Histochemical Technique – Third Edition. Butterworths. London.
10. Abdul Khader, 2003, Medical laboratory techniques, First edition. Frontline Publications, Hyderabad.
11. Godkar P.B., Text Book of Medical Laboratory Technology, 2nd Edn.2003. Bhalani Publication.

12. Subish.C.Panija, Textbook of Medical Parasitology, published by 'All India Publishers and distributors'.

CO-CURRICULAR ACTIVITIES

A. MANDATORY: (Lab/field training of students by teacher:

1. For Teacher:

- Visit to any hospital facilities/diagnostic centres
- Creating practical awareness on diseases-spread, prevention and control

2. For Student:

- Preparation of charts or models on notifiable diseases, epidemiological studies etc.,
- Diagnostic infrastructure or forensic case studies – any event or curricular activity

B. SUGGESTED CO-CURRICULAR ACTIVITIES

1. Internships in MLT labs/ hospital facilities/ research organizations, universities etc.
2. Seminars, Group discussions, Quiz, Debates etc.
3. Preparation of videos related to recent diagnostic techniques and forensic protocols
4. Invited lectures and presentations on related topics by experts in the specified area.

B.Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 7B	Molecular Biotechnology, Biostatistics and Bioinformatics	Hrs/Wk:4

LEARNING OUTCOMES

LO1: Developing sound knowledge on procedural repertoire and strategies in gene cloning
LO2: Enumerating the versatile tools and techniques employed in Molecular biotechnology
LO3: Enlisting the applications of genetic engineering and their impact on society
LO4: Emphasizing the structural and functional analysis of rDNA recombinants
LO5: Imparting basic knowledge of biostatistical tools employed for quantitative analysis
LO6: understanding an overview on searching and alignment of biological databases in-silico

SYLLABUS

UNIT – 1 No. of Hours:10

r-DNA technology- Introduction, DNA sequencing- Maxam-Gilbert and Di-deoxy methods. Blotting techniques - Southern, Northern and western blotting. DNA finger printing. PCR-principle, types, applications. DNA Microarray technique. Restriction endonucleases and other enzymes involved in rDNA technology. Ligases- DNA ligases, ligation of fragments with cohesive ends & blunt ends; homopolymer tailing.

UNIT – II No. of Hours:10

Cloning strategies- Transformation, microinjection, Ballistic Gun Method, Electroporation, Liposome and Ti- plasmid mediated Gene Transfer. Cloning vectors- Plasmids, Cosmids and bacteriophages, Phagemids, YACs and BACs. Construction of genomic and cDNA libraries. Selection of transformed cells. Screening methods (Genetic marker and blue white screening).

UNIT – III No. of Hours:10

Applications of rDNA technology-In medicine (recombinant insulin), industry (production of amylase) and agriculture (Biopesticides, Biofertilizers). Role of microorganisms in creation of transgenic animals and plants. Genetically engineered microbes for industrial applications- Biogas, Biosensors, Bioplastics, Recombinant vaccines, Golden rice. Introduction to GM crops and challenges-Bt cotton, brinjal, ELSI (Ethical, legal and social issues) of Biotechnological inventions.

UNIT - IV No. of Hours:10

Biostatistics: Measures of Central tendency and distribution – mean, median, mode, range, standard deviation, variance. Basic principles of Probability theory, Bayes theorem, Normal distribution, Statistical inference. Comparison of variance (F-test), t-test for comparison of means, Chi square test. Analysis of variance (ANOVA) One way and two way. Correlation and Linear regression analysis

UNIT – V **No. of Hours: 10**

Bioinformatics-Introduction to Bioinformatics and internet, Scope of Bioinformatics. Biological databases: NCBI, EMBL. Concept of World Wide Web: HTML, HTPP. Searching sequence databases using BLAST and FASTA. Genomics- Sequencing, Assembly, annotation, comparative genomics. Proteomics- Peptide finger printing. Gene prediction – Statistical based approaches and Similarity based approaches, Molecular phylogenetics.

C. REFERENCE

1. Primrose, Modern Biotechnology, Black well scientific publication Oxford.
2. Old & Primrose, Principles of Gene Manipulation: An introduction to genetic engineering.
3. J.D. Watson et al., Recombinant DNA, Wiley scientific 7. J.M. Walker, Molecular Biology &Biotechnology, Roya society of chemistry.
4. H. Krenzer, Recombinant DNA & Biotechnology. 9. M.Schena, DNA micro arrays.
5. David Freifelder, 2008, Molecular Biology, 2nd Edition, Narosa Publishing House.
6.Daniel, 2006 , Biostatistics, Eighth Edition. John Wisely and sons.
7. Durbin, Eddy, Krogh, Mathison, Biological sequence analysis.
8. T.A. Attwood and D.J. parry – smith, 2001, Introduction of Bioinformatics.
9. David W, 2005, Bio-informatics; sequence and Genome Analysis, 2nd Edition by Mount CBS publishers

B.Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:1
Course: 7B	Molecular Biotechnology, Biostatistics and Bioinformatics Lab	Hrs/Wk:2

LEARNING OUTCOMES

LO1: Developing practical experience in extraction of DNA
LO2: Hands on experience in restriction digestion, gel electrophoresis
LO3: Gaining skilled knowledge in performing Transformation using molecular kit
LO4: Understanding the principle and working of PCR
LO5: Demonstrating the Insilco analysis for genome annotation and gene prediction
LO6: Working on problems related to measures of t-test and chi square test

SYLLABUS

1. Isolation of DNA from E. coli/coconut.
2. Transformation in Bacteria using plasmid.
3. Agarose gel electrophoresis
4. Restriction digestion of DNA and Ligation of DNA molecules
5. Activity of DNase and RNase on DNA and RNA.
6. Isolation of Plasmid DNA.
7. Demonstration of PCR
8. Use of Internet/software for sequence analysis of nucleotides and proteins: Studies of public domain databases for nucleic acid and protein sequences.
9. Genome sequence analysis
10. Problems related to measures of central tendency, dispersion, t-test and chi square test.

REFERENCES

1. Sambrook and Russell, Molecular Cloning – A Laboratory Manual, 3rd Edition, Volumes I to III, CSHL Press.
2. Ausbel et al., 2000, Current Protocols in molecular biology.
3. R.Twyman, Advanced Molecular Biology: A concise reference, Springer.
4. Genome analysis, 2000, 4 volumes, ESHL Press.
5. Baxevanis, Bioinformatics-A Practical Guide to the Analysis of Genes and Proteins. 2 nd Edition.
6. Higgis, Bioinformatics: Seqence, structure and Data Bank: A Practical Approach.
7. A.D. Baxevaris, 1998, Bioinformatics: A practical guide to the analysis of genes and proteins, (Edited) B.F .Publication.
8.Daniel, 2006, Biostatistics, Eighth Edition. John Wisely and sons

CO-CURRICULAR ACTIVITIES

A. Mandatory: (Lab/field training of students by teacher)

1. For Teacher:

- Visit to any forensic labs /molecular diagnostic centres and research institutes
- Creating awareness biostatistical and bioinformatic online free tools– any event or curricular activity

2. For Student:

- Preparation of charts or models or flow charts of gene cloning strategies and applications etc.,
- Computational programming of gene and protein sequencing through NCBI websites

B. Suggested Co-Curricular Activities

1. Internships in genomic and transcriptional programmes/ research institutes/ universities
2. Seminars, Group discussions, Quiz, Debates etc.
3. Preparation of videos related rDNA technology, genomics and protein structure predictions
4. Invited lectures and presentations on related topics by experts in the specified area.

B.Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 6C	Pharmaceutical Microbiology	Hrs/Wk:4

LEARNING OUTCOMES

LO1: Developing insights into the hierarchy of quality control and quality in Pharma industry
LO2: Enumerating the various sterility tests practised in manufacture of medicines
LO3: Emphasizing the types of microbial spoilage and their preventive measures
LO4: Perception of rules and regulations pertaining to GMP/GLP
LO5: Understanding the basic concepts of drug discovery and designing
LO6: Enlisting the various types and production of vaccines

SYLLABUS

UNIT – 1 **No. of Hours:10**

Microbiological Laboratory and Safe Practices -Quality assurance, quality control definition, history and introduction. Standard Methods involved in assessment of microbial quality control. Laboratory facility design for quality control: Sterilization, disinfection and decontamination. Personnel training: Hygiene and handling techniques. Good Manufacturing practices and good laboratory practices.

UNIT – II **No. of Hours:10**

Microbial Spoilage - Types of microbial spoilage factors affecting spoilage. Design of specialized media for identification of pathogens- raw material, water, pH. Uses of media. sample preparation from Aqueous, soluble, insoluble, medical and pasteurized materials. Selective and indicator media used in pharmaceutical and food industries. Control of microbial risk in medicines -Sterility tests, Microbial limit tests and endotoxin tests/LAL test.

UNIT – III **No. of Hours:10**

Techniques for enumeration of microorganisms: Counting methods: pour plate, spread plate, membrane filtration. Most Probable Number (MPN) and MIC. Turbidimetric methods. Staining techniques for identification bacteria and Fungi. Biochemical, molecular and immunological methods. Instruments associated in QC and QA: Principle involved, working conditions, uses and precautions of Laminar Air Flow (LAF), Autoclave, Incubator, pH meter, Colony counter, Hot air oven, Centrifuges and storage devices.

UNIT - IV **No. of Hours:10**

Introduction- History of drug design, Current approaches and philosophies in drug design, Molecular mechanisms of diseases and drug action with examples. Pharmaceutical products of microbial origin (antibiotics) animal origin (sex hormones), plant origin (Alkaloids & Morphine). Sources of Drugs- Microbial drugs, Plants as a source of drugs, *E. coli* as a source of recombinant therapeutic proteins.

UNIT – V **No. of Hours: 10**

Expression of recombinant proteins in yeasts, animal cell culture systems. Rational drug design and Combinatorial approaches to drug discovery. Drug development process- Impact of genomics and related technologies upon drug discovery: Gene chips, Proteomics, Structural genomics and Pharmacogenetics. Drug manufacturing process- Guides to good manufacturing practice. Vaccines-Traditional vaccine preparations, Attenuated and inactivated viral and bacterial vaccines, Toxoids. Peptide vaccines.

REFERENCE

1. W.B.Hugo & A.D. Russell, Pharmaceutical Microbiology edited, 6thEdition, BlackWell science.
2. Shanson D.C., Microbiology in clinical practice, 2nd edition, London; Wright.
3. T Sammes Ellis Horwood, topics in Antibiotic chemistry VolI to V.
4. Wulf Crueger, Biotechnology – A text book of Industrial Microbiology, 2nd Edition,Panima publishers
5. A.H .Patel,1984, Industrial Microbiology, Macmilan India Limited.
6. Coulson C.J., London; Taylor and Francis, Molecular mechanisms of drug action.
7. Denyes S.P.& Baird R.M. Chichester, Ellis Horwood, Guide to microbiologicalControl in Pharmaceuticals.
8. Murray S.Cooper, Quality control in the Pharmaceutical Industry-Edt., Vol-II,Academic press, NewYork.
9. Sydney H. Willin, Murray M. Tuckerman, William S. Hitchings IV, GoodManufacturing practices of pharmaceuticals, second Edt., Mercel Dekker NC, New york.
10. Rajesh Bhatia, Rattan lal punjani, Quality assurance in Microbiology, CBSPublisher &Distributors, New Delhi.

B.Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:1
Course: 6C	Pharmaceutical Microbiology Lab	Hrs/Wk:2

A. Learning outcomes

LO1: Developing practical knowledge on microbiological quality testing
LO2: Acquiring skilled expertise in performing assays of antibiotics
LO3: Technical expertise on isolation and characterization of contaminated microbes
LO4: Gaining procedural acumens into antibiotic sensitivities towards test pathogens
LO5: Developing practical insights for good laboratory practices
LO6: Microbiological analysis of air and water

B. Syllabus:

1. Isolation and enumeration of bacteria from spoiled food / pharmaceutical source.
2. Quality Assurance of water by MPN method.
3. Preparation of any two selective and indicator media commonly used Q.A & Q.C
4. Microbial quality of in and around laboratory conditions.
5. Isolation and Identification of fungi by using selective media and staining procedures.
6. Identification of MIC of any one antibiotic (Penicillin/streptomycin) by tube dilution method
7. Antibiotic sensitivity by Well diffusion method-antibacterial and antifungal
8. Isolation of Actinomycetes from soil.
9. Identification of antibacterial activity of actinomycetes
10. Assay of any one antibiotic (Penicillin).

C. References

1. General Practice A Practical Manual With Cd 5Ed by Vaidya G.
2. Microbial Contamination Control In Pharmaceutical Industry by Luis Jimenez, Taylor & Francis
3. Clinical Microbiology Quality In Laboratory Diagnosis (Pb) by Stratton, Demos Medical Publishing
4. Hand book of Microbial Quality control by Rosamund. M, Baird Norman. A, Hodges and Stephen. P, Denyer. CRC press.
5. Hand book on microbiological quality control in pharmaceuticals and medical devices by Baird norman
5. Aneja, 2001, Experiments in Microbiology, Plant Pathology, Tissue Culture & Mushroom production Technology, 3rdEdition, New age international

Co-curricular Activities:

A. Mandatory: (Lab/field training of students by teacher:

1.For Teacher:

- Visit to any R and D research laboratories/universities/ Drug developing institutes
- Organising industrial tours to any pharma industries

2.For Student:

- Preparation of charts or models on SOPs, Documentation, production flow charts etc.,
- Laboratory safety guidelines, – any event or curricular activity

B. Suggested Co-Curricular Activities:

1. Internships in pharmaceutical industry/ research organizations, universities etc.
2.Seminars, Group discussions, Quiz, Debates etc.
3.Preparation of videos related to drug design and production techniques and protocols
4. Invited lectures and presentations on related topics by experts in the specified area.

B.Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 7C	Biosafety and Intellectual Property Rights	Hrs/Wk:4

LEARNING OUTCOMES

LO1: Enlisting a wide range of safety protocols in maintenance of biological safety cabinets
LO2: Developing insights into the Role of Institutional Biosafety Committees (IBSC)
LO3: Enumerating the Biosafety rules and regulations at National and International level
LO4: Perception of the properties and limitations of patents, trade secrets and copy rights
LO5: Emphasizing the steps involved in filing of patent application filing
LO6: Understanding the international conventions in maintaining IPRs.

B. SYLLABUS

UNIT – 1 **No. of Hours:10**

Biosafety: Introduction; biosafety issues in biotechnology; Biological Safety Cabinets & their types; Primary Containment for Biohazards; Biosafety Levels of Specific Microorganisms. Biosafety Guidelines: Biosafety guidelines and regulations (National and International)

UNIT – II **No. of Hours:10**

GMOs- 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. RES guidelines for using radioisotopes in laboratories and precautions.

UNIT – III **No. of Hours:10**

Introduction to Intellectual Property: Types of IPR, Trade secrets, Trademarks, patents, Copyright & Related Rights, Industrial Design and Rights, Geographical Indications-importance of IPR, Management of IPR, Advantages and Disadvantages. International co-operation of IPRs, legal protection of biotechnological inventions – World Intellectual Property Rights Organization (WIPO).

UNIT - IV **No. of Hours:10**

Grant of Patent and Patenting Authorities: Types of patents, properties of patents, patentability, patenting life forms and biotechnological inventions. Patent Filing Procedures; Patent licensing and agreement; Patent infringement- meaning, scope, litigation, case studies, Rights and Duties of patent owner.

UNIT – V **No. of Hours: 10**

Agreements and Treaties: International conventions, GATT, TRIPS Agreements; Role of Madrid Agreement; Hague Agreement; WIPO Treaties; Budapest Treaty on international recognition of the deposit of microorganisms; UPOV & Berne conventions; Paris Convention

Treaty (PCT); Indian Patent Act 1970 & recent amendments. Intellectual properties Appellate board (IPAB).

C. REFERENCE

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, Tax mann, Allied Services (p) Ltd.
4. Singh K K (2015). Biotechnology and Intellectual Property Rights: Legal and Social Implications, Springer India.
5. Goel D & Prashar S (2013). IPR, Biosafety and Bioethics. Pearson
6.Sydney H. Willin, Murray M. Tuckerman, William S. Hitchings IV, Good Manufacturing practices for pharmaceuticals, second Edt., Mercel Dekker NC New york
7. Senthil Kumar Sadhasivam and Mohammed Jaabir, M. S. 2008. IPR, Biosafety and biotechnology Management. Jasen Publications, Tiruchirappalli, India.
8. Singh B.D.,1998, Biotechnology, Kalyani publishers, Rajinder Nagar, Ludhiana

B.Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:1
Course: 7C	Biosafety and Intellectual Property Rights Lab	Hrs/Wk:2

LEARNING OUTCOMES

LO1: Developing awareness of biological safety cabinets
LO2: Technical expertise in filing of patents
LO3: Understanding the guidelines of safety measures
LO4: Acquiring knowledge on QA and QC in pharma
LO5: Perception of legalities in IPR maintenance
LO6: Deep insights of case studies of IPRs and their disputes

SYLLABUS

1. Study of components and design of a BSL – III laboratory (models)
2. Filing applications for approval from bio safety committee (models)
3. Study of bio safety measures in pharmaceutical industry.
4. Study on QA & QC parameters followed in R&D laboratory.
5. Filing primary applications for patents
6. Study of steps of patenting process
7. A case study of patents application-Gene technology/ processes
8. A case study of Patent disputes-AMUL/kwality
9. A case study on patents of biotechnological inventions
10. A case study of copy rights-Delhi university case

REFERENCES

1. Hand book of Microbial Quality control by Rosamund. M, Baird Norman. A, Hodges and Stephen. P, Denyer. CRC press.
2. Guide to Microbiological Control in Pharmaceuticals and Medical Devices, Second Edition, Stephen P. Denyer, Rosamund M. Baird, CRC Press.
3. Denyes S.P. & Baird R.M. Chichester, Ellis Horwood, Guide to microbiological control in Pharmaceuticals.
4. Murray S. Cooper, Quality control in in the Pharmaceutical Industry- Edt., Vol- II, Academic press, New York.
5. Sydney H. Willin, Murray M. Tuckerman, William S. Hitchings IV, Good Manufacturing practices for pharmaceuticals, second Edt., Mercel Dekker NC Nework

CO-CURRICULAR ACTIVITIES

A. MANDATORY: (Lab/field training of students by teacher:

1. For Teacher:

- Working on patents & other IPRs case studies for legalities and disputes
- Organising industrial tours to any production or quality control units

2. For Student:

- Preparation of charts or models on safety measures, flow charts etc.,
- Web search for new patents and copy rights - any event or curricular activity

B. SUGGESTED CO-CURRICULAR ACTIVITIES

1. Internships in R and D wings of pharma/ research organizations, universities etc.
2. Seminars, Group discussions, Quiz, Debates etc.
3. Preparation of videos related to biological safety cabinets techniques and protocols
4. Invited lectures and presentations on related topics by experts in the specified area.

B.Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 6A	Clinical Biochemistry	Hrs/Wk:4

UNIT – I

Introduction:

Organization of Clinical laboratory. Introduction to instrumentation and automation in Clinical biochemistry laboratories, safety regulations and first aid. General comments on specimen collection, Type of specimen for biochemical analyses. Precision, accuracy, quality control, precautions and limitations.

UNIT – II

Basics of Hepatic and Renal physiology:

Evaluations of biochemical changes in liver and kidney diseases, Liver function tests (LFTs), Renal function tests (RFTs), GFR. Diagnostic biochemical profile.

UNIT – III

Glucose metabolism

Digestion, absorption and assimilation of carbohydrates. Enzymes and hormones (Insulin, Glucagon) in regulation of blood glucose levels. Clinical significance of variations in blood glucose levels, disorders - Diabetes mellitus, Insulin resistance

UNIT – IV

Lipid profile: Lipids, fats, Triglycerides, cholesterol, fatty acids, PUFAS. Digestion and absorption of lipids. Composition and functions of lipoproteins. Clinical significance of elevated lipoproteins.

Exercises

Estimation of triglycerides, cholesterol, LDL, VLDL and HDL cholesterol.

UNIT – V

Cardiovascular diseases: Basic cardiovascular physiology, biochemical symptoms associated with cardiovascular diseases and their evaluation. Involvement of enzymes in diagnosis of heart diseases including Aspartate transaminase, Isoenzymes of creatine kinase and lactate dehydrogenase and troponin.

B.Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:1
Course: 6A	Clinical Biochemistry Lab	Hrs/Wk:2

1. Collection of blood, separation of plasma, serum and their storage
2. Estimation of bilirubin (direct and indirect method)
3. Estimation of serum transaminases (AST, ALT) and serum alkaline phosphatises (ALP)
4. Quantitative determination of serum urea and creatine
5. Use of urine strips / dip strip method for urine analysis
6. Estimation of blood glucose by glucose oxidase - peroxidase method
7. GTT (Glucose Tolerance Test)
8. Estimation of cholesterol
9. Estimation of creatine kinase (CK)
10. Estimation of LD

Suggested readings

1. Medical laboratory technology a procedure manual for routine diagnostic tests. Volume 1, Mukhergee, K.L, Tata Mc Graw hill publishing Company Limited, (New Delhi). ISBN 9780070076594/ISBN-978007007663

2. Medical laboratory technology a procedure manual for routine diagnostic tests.Volume 2, Mukhergee, K.L, Tata Mc Graw hill publishing Company Limited,(New Delhi). ISBN 9780070076648

3. Medical Biochemistry 2005, 2 nd Edition, Bayner, J.W, and Dominiazak, M.H,Elsevier, Mosby Ltd (Philadelphia). ISBN-0/7234/3341/0

4. Experimental Biochemistry, A student companion (2005), Rao, B.S, and Deshpande, V., IK international Pvt.Ltd(NewDelhi) ISBN-8188237/41

5. Clinical diagnosis and management by Lab methods (John Bernard Henry, W.B. Salunders Company, 1984).

6. Clinical Biochemistry – S. Ramakrishnan and Rajiswami.

7. Clinical chemistry in diagnosis and treatment–Joan F.Zilva and P.R.Pannall (Lloyd-Luke Medical Books,

B.Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 7A	Haematological and Immunological Techniques	Hrs/Wk:4

UNIT - I

Introduction

Organization of Clinical Immunology laboratory. Introduction and maintenance of clinical Immunology laboratory; hazards in clinical laboratory; units; 'normal range', reference values. Factors affecting reference values quality control in laboratory – use of external and internal standards; use of WHO standards.

UNIT - II

Composition of blood and Lymph

Plasma and cells-RBC, WBC, platelets, blood clotting, plasma proteins, separation and applications, plasma therapy. Lymph.

UNIT - III

Advanced diagnostic methods

Identification of viral, bacterial and other diseases - ELISA, Western blot, RT-PCR, Tissue Histopathology, fixing, staining (H&E) and microtome sections

UNIT - IV

Auto immunity

Introduction, Auto recognition, classes of auto immuno diseases. (Hashimoto disease, thyrotoxicosis, Systemic lupus erythematosus, Autoimmune haemolytic anaemia, Rheumatoid arthritis).

UNIT – V

Immunoglobulins (Igs)

Types of Igs, nature and structure of Igs –Light chain, heavy chain and functions. Adjuvants, Antibody production, enzymatic cleavage of Igs, Haptens.

B.Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:1
Course: 7A	Haematological and Immunological Techniques Lab	Hrs/Wk:2

1. Determination of human blood groups
2. Differential Leucocyte count in human peripheral blood by Leishmans staining
3. Separation of mononuclear cells from human peripheral blood
4. Determination of Erythrocyte Sedimentation Rate (ESR)
5. Determination of Packed Cell Volume (PCV)
6. Estimation of Haemoglobin (Hb) by Sahlis acid hematin method
7. Detection of HCG by latex agglutination inhibition test
8. Widal test
9. Ouchterlony double immuno diffusion
10. Single Radial Immunodiffusion

REFERENCE BOOKS

1. Essential Immunology - By I. Roitt, Publ: Blackwell

2. Immunology - By G. Reever & I. Todd, Publ: Blackwell

3. Abbas AK, Lichtman AH, Pillai S. Cellular and Molecular Immunology. Saunders Publication, Philadelphia

4. Golds by RA, Kindt TJ, Osborne BA. Kuby's Immunology. W.H. Freeman and Company, New York

5. Ronald Hoffman, Edward J. Benz Jr., Leslie E. Silberstein, Helen Heslop, Jeffrey Weitz, John Anastasi - Hematology: Basic Principles and Practice, Elsevier Health Sciences, 2012

6. Betty Ciesla, Hematology in Practice, F.A. Davis, 2011.

B.Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 6B	Food Technology	Hrs/Wk:4

UNIT-I

Food Regulations and Standards

Sampling methods - Sample preparation for analysis; Statistical evaluation of analytical data - Official Methods of Food Analysis. Moisture in foods - determination by different methods - ash content of foods, wet, dry ashing, microwave ashing methods; Significance of Sulphated Ash, water soluble ash and acid insoluble ash in foods determination of dietary fibre and crude fibre.

UNIT-II

Analysis of major food components

Determination of total fats in foods by different methods; Analysis of oils and fats for physical and chemical parameters, Quality standards, and adulterants; different methods of determination of protein and amino acids in foods; determination of total carbohydrates, starch, disaccharides and simple sugars in foods.

UNIT-III

Processing and preservation of foods

Blanching, pasteurization, sterilization, microwave heating. Low Temperature-refrigeration, freezing, dehydro-freezing. Food irradiation. Processing and preservation by drying, concentration and evaporation. Non-thermal methods like High pressure, pulsed electric field, hurdle technology. Use and application of enzymes and microorganisms in processing and preservation of foods.

UNIT-IV

Environmental contaminants and drug residues in food:

Fungicide and pesticide residues in foods; heavy metal and their health impacts; use of veterinary drugs (e.g. Malachite green in fish and β-agonists in pork); other contaminants in food, radioactive contamination of food, Food adulteration and potential toxicity of food adulterants. Endocrine disrupters in food.

UNIT-V

Fermentative food Products

Foods: Processes for preparing fermented products including Yogurt (curd) and other Traditional Indian Products like idli, dosa, dhokla, shrikhand, Soya based products like soya sauce, natto, Cheese.; Alcoholic Beverages based on fruit juices (wines), cereals (whisky, beer, vodka,), sugar cane (rum) Process description, quality of raw materials, fermentation process controls.

B.Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:1
Course: 6B	Food Technology Lab	Hrs/Wk:2

1. Titratable Acidity in foods.
2. Determination of proteins, fats and carbohydrates
3. Methods for Processing and preservation of foods
4. Determination of Glucose content by enzymatic method (amylase, invertase)
5. Qualitative detection of adulterants in foods
6. Wine preparation from fruit juices and molasses
7. identification of microbial strains in yogurt
8. MBRT of milk

Reference Books

1. A first course in food analysis By A. Y. Sathe.

2. Hand book of analysis and quality control for fruit & vegetable products By S. Ranganathan.

3. Handling and storage of food grains by S. V. Pingale.

4. Food science chemistry & experimental food By Dr. M. Swaminathan.

5. Food chemistry by William Hogland Meyer.

6. Food adulteration By Thankamma Jacob.

7. Food Microbiology by William C. Frazier.

8. Preservation of Fruits and Vegetables by Giridharilal.

B.Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 7B	Food Microbiology	Hrs/Wk:4

UNIT I

History and development of Microbiology-Importance and significance of microorganisms in food science. Bacterial growth curves, Factors affecting the growth of microorganisms in food – Intrinsic and Extrinsic parameters

UNIT II

Determination of microorganisms and their products in food: Sampling, sample collection, transport and storage, sample preparation for analysis. Microscopic and culture dependent methods- Direct microscopic observation, culture, enumeration and isolation methods; Chemical and Physical Methods-Chemical, immunological and nucleic acid-based methods;

UNIT III

Protection and preservation of Foods:

Chemical, Modified atmosphere, Radiation in foods from the microbiological angle. Indicators of water and food safety and quality: Microbiological criteria of foods and their Significance.

UNIT IV

Food spoilage: characteristic features, dynamics and significance of spoilage of different groups of foods - Cereal and cereal products, vegetables and fruits, meat poultry and sea foods, milk and milk products, packed and canned foods.

UNIT V

Food borne diseases: *Bacterial borne diseases* (Staphylococcal intoxification, Botulism, Salmonellosis, Shigellosis, Enteropathogenic *Escherichia Coli Diarrhoea*, Clostridium Perfringens gastroenteritis, *Bacillus cereus Gastroenteritis). Mycotoxins:* Aflatoxicosis, Deoxyni valenol Mycotoxicosis, Ergotism. Drug resistance - phenomena and mechanism.

B.Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:1
Course: 7B	Food Microbiology Lab	Hrs/Wk:2

1. Preparation of common laboratory media and special media.
2. Bacterial count by standard plate method (SPC)
3. Isolation and Identification of bacteria
4. Gram's staining
5. acid-fast staining
6. Microbiological analysis of typical processed foods
7. Coli form test
8. Microbiological analysis of food born bacterial pathogens

Text books and reference materials

1. Prescott LM Harley JP and Klein DA (2006). Microbiology (7th edition) McGraw Hill, Newyork.

2. Frazier, W.C. (1988) Food Microbiology, Mc Graw Hill Inc. 4th Edition.

3. Vijaya Ramesh,K. (2007) Food Microbiology. MJP publishers, 2007

4. Yasmine Motarjemi and Martin Adams. (2006) Emerging Food borne pathogen- Wood Head Publishing England.

5. Arun, K Bhunia. (2008) Food borne microbial pathogens: Mechanisms and pathogenesis. Springer.

6. Thomas J. Montville, Karl R. Matthews, Kalmia E. Kniel (2012). Food Microbiology: An Introduction, American Society for Microbiology.

7. Dubey, R.C. and Maheswari, D.K. (2008) Text book of Microbiology. S Chand Publishing.

B.Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 6C	Genetic Engineering	Hrs/Wk:4

UNIT -I

Basics of Genetic engineering

Introduction, historical perspective, basics of cloning, Vectors, Restriction enzymes, plasmids PBR 322, PUC vector, Cosmids, YACs, cDNA libraries.

UNIT -II

Genetic Engineering in Animals

Gene transfer methods in Animals. Transfection. Microinjection, Embryonic-stem cells Gene transfer and Retro-virus Gene transfer methods to create transgenic animals. Applications of transgenic animals in agriculture, medicine and pharmaceuticals.

UNIT -III

Genetic engineering in Plants

Manipulation of Plant Genes-Electroporation, Shotgun method, *Agrobacterium* mediated gene transfer. Applications in Crop improvement, disease and pest resistance, tolerance to environmental stress. Genetically engineered foods.

UNIT- IV

Genetic engineering in Microorganisms

Gene transfer methods in microorganisms - transformation, transduction and conjugation. Transposons.

UNIT- V

Genetic engineering-Environment

Bioremediation Biodegradation, Biofuels and Bioplastics from genetically engineered rape oil seed and other crops as substitutes for fossil fuels, Biosensors.

B.Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:1
Course: 6C	Genetic Engineering Lab	Hrs/Wk:2

1. PCR
2. Restriction mapping
3. CaCl2 mediated transfection
4. Restriction Fragment Length Polymorphism (RFLP)
5. Random Amplified Polymorphic DNA (RAPD)
6. Plasmid isolation from E. coli

Suggested books

1. Genes and Probes, A Practical Approach Series (1995) by Hames and SJ Higgins; Oxford
2. Gel Electrophoresis of Nucleic Acids, A practical Approach (1990) by D Rickwood and BD Hames. Oxford Univ. Press.
3. Genetics by Gardinar
4. Biotechnology by U.Satyanarayana

B.Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 7C	Bioinformatics	Hrs/Wk:4

UNIT- I

Scope of Bioinformatics No. of Hours:6

Genomics, structural and functional genomics, genome annotations, gene production approaches and tools. DNA microarray and computational analysis tools. Computer aided drug design and systems biology.

UNIT- II

Biological data bases No. of Hours:6

Introduction to biological databases. Primary, secondary and composite databases, NCBI, EBI, Nucleic acid databases (Gene Bank), EMBL, DDBJ, NDB) protein database, (PIR, Swissport, TrEMDL, PDB) Metabolic databases (KEGG, EcoCyc).

UNIT -III

Sequence Alignments:

Similarity, identities and homology. Concept of alignment pairwise sequence alignment, gaps, gap-penalties, scoring matrices, PAM 250, BLOSUM62, Local and Global Sequence alignment, multiple sequence alignment, progressive alignment, Logarithm alignment. Application of multiple sequence alignment- CLUSTAL W, BLAST-blastn, blastp and blastx

UNIT- IV

Genome projects

General introduction to genome projects (rice and *Mycobacterium tuberculosis* genome project). Special emphasis on Human Genome Project (HGP). Science behind HGP, benefits of HGP, genetic testing standard, quality and commercialization.

UNIT- V

Proteomics

Introduction, principle, technique of swiss- 2D PAGE data base. Gel analysis, post gel analysis, MALDITOF. Significance and applications of proteomics in modern biology.

B.Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:1
Course: 7C	**Bioinformatics Lab**	Hrs/Wk:2

1. Searching data from Biological data bases
2. Demonstration on Nucleic acid and protein databases
3. Simple and multiple Sequence alignment
4. Searching structural data from PDB
5. Database search using BLAST
6. SDS-PAGE
7. IEF (2-D gel analysis)
8. Demonstration of MALDI -TOF

Suggested books

1. Genome Mapping: A practical approach. Dear P (Editor). 1st Ed. 2000. Oxford University.
2. Developing Bioinformatics Skills. Alfonso Valencia and Blaschke. L (2005) Oreilles
3. Bioinformatics sequence, structure and data banks ed. By Des Higgins Willie Taylor (2006).
4. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins" (Andreas D. Baxevanis, B. F. Ouellette), Paperback, 2nd ed., 470 pp., ISBN: 0471383910, Publisher: Wiley, John & Sons, Inc.Pub.
5. David W. Mount, Bioinformatics: Sequence and Genome Analysis, 2nd edition, Cold Spring Harbor Laboratory, 2004.
6. Introduction to Bioinformatics by T.K. Altwood and D.J Parry-Smith (Pearson Education Asia1999).

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 6A	Synthetic Organic Chemistry	Hrs/Wk:4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Identify the importance of reagents used in the synthesis of organic compounds.
2. Acquire knowledge on basic concepts indifferent types of pericyclic reactions.
4. Understand the importance of retro synthesis in organic chemistry.
5. Comprehend the applications of different reactions in synthetic organic chemistry.

Syllabus :*(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit-1: Pericyclic reactions — 12 hours

3. A brief introduction to synthetic organic chemistry
4. Features and classification of pericyclic reactions: Phases, nodes and symmetry properties of molecular orbitals in ethylene, 1, 3-butadiene, 1, 3, 5-hexatriene, alkylation and ally radical. Thermal and photochemical reactions.
5. Electro cyclic reactions: Definition and examples, definitions of con and dis rotation, Woodward- Hoffmann selection rules.(Correlation diagrams are not required)
6. Cyclo addition reactions: Definition and examples, definitions of supra facial and antar facial addition, Woodward- Hoffmann selection rules. (Correlation diagrams are not required)

Unit-2: Organic photochemistry — 8hours

1. Jablonski diagram-singlet and triplet states
2. Photochemistry of Carbonyl compounds-□−□ and □−□* transitions, Norrish type-1and type-2 reactions
3. Paterno – Buchi reaction.

Unit-3: Retro synthesis — 12 hours

1. Important terms in Retro synthesis with examples-Disconnection, Target molecule, FGI, Synthon, Retro synthetic analysis, chemo selectivity, region selectivity
2. Importance of Order of events in organic synthesis
3. Retro synthetic analysis of the compounds: a. cyclohexene, b. 4-Nitro toluene, c. Paracetamol.

Unit-4: Synthetic Reactions — 8hours

Shapiro reaction, Stork - enamine reaction (only alkylation), Wittig reaction, Robinson annulation, Bailys-Hillman reaction, Heck reaction, Suzuki coupling. Synthesis of aldehydes and ketones using1, 3-Dithiane.

Unit-5: Reagents in Organic Chemistry — 10 hours

Oxidizing agents: PCC, PDC, SeO_2 (Riley oxidation), NBS.

Reducing agents: $LiAlH_4$ (with mechanism), LTBA, Metal-solvent reduction (Birch reduction), Catalytic reduction.

References

1. Pericyclic reactions by Ian Fleming, Second edition, Oxford University press.
2. Pericyclic Reactions-A Text book: Reactions, Applications and Theory by S. Sankararaman, WILEY-VCH.
3. Reaction Mechanism in Organic Chemistry by S.M. Mukherji and S.P. Singh, Revised edition, Trinity Press.
4. Pericyclic reactions-A Mechanistic study by S.M. Mukherji, Macmillan India.
5. Organic synthesis: The disconnection approach by Stuart Warren, John Wiley & Sons.
6. Organic chemistry by Jonathan Clayden, Nick Greeves and Stuart Warren, Second edition, Oxford university press.
7. Reactions, Reagents and Rearrangements by S.N. Sanyal, Bharati Bhawan Publishers & Distributors.

ADIKAVI NANNAYA UNIVERISITY:: RAJAHMENDRAVARAM
B.Sc Chemistry Syllabus (w.e.f: 2020-21 A.Y)

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 1
Course: 6A	Synthetic Organic Chemistry Lab	Hrs/Wk:2

Learning Outcomes:

On successful completion of this practical course, student shall be able to:

1. Perform the organic qualitative analysis for the detection of N, S and halogens using the green procedure.
2. Learn the procedure for the separation of mixture famine acids using paper Chromatography.
3. Prepare the TLC plates for TLC chromatography.
4. Acquire skills in conducting column chromatography for the separation of dyes in the given mixture.

Practical (Laboratory) Syllabus :(30hrs) (Max.50 Marks)

1. Green procedure for organic qualitative analysis: Detection of N, S and halogens
2. Separation of given mixture of amino acids (glycine and phenyl alanine) using ascending paper chromatography.
3. Separation of a given dye mixture (methyl orange and methylene blue) using TLC (using alumina as adsorbent).
4. Separation of mixture of methyl range and methyl enable by column chromatography
5. Separation of food dyes using Column Chromatography
6. Separation of triglycerides using TLC

Lab References:

1. Vogel A. I. Practical Organic Chemistry, Longman Group Ltd.
2. Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley-Eastern.
3. Ahluwalia V. K. and Aggarwal R. Comprehensive Practical Organic Chemistry, University press.
4. Mann F. G and Saunders B.C, Practical Organic Chemistry, Pearson Education.

Co-Curricular Activities

a) Mandatory:*(Lab/field training of students by teacher:(lab: 10+field:05)*:

1. **For Teacher**: Training of students by the teacher in laboratory and field for not less than15 hours on the field techniques/skills of detection of N, Sand halogens using the green procedure, preparation of TLC plates, detection of organic compounds using R_f values in TLC/ paper chromatography, loading of column, selection of solvent system for column chromatography, separation of amino acids and dye mixture using chromatographic techniques.
2. **For Students**: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observes the synthetic reactions. Write their observations and submit a hand written fieldwork/project work report notexceeding10 pages in the given format to the teacher.
3. Max marks for Fieldwork/project work Report: 05.
4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*
4. Unit tests (IE).

b) Suggested Co-Curricular Activities

1. Training of students by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics), collection of relevant videos and material.
3. Visits of abilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 7A	Analysis of Organic Compounds	Hrs/Wk:4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Identify the importance of mass spectrometry in the structural elucidation of organic compounds.
2. Acquire the knowledge eon structural elucidation of organic compounds.
3. Understand various chromatography methods in the separation and identification of organic compounds.
4. Demonstrate the knowledge gained in solvent extraction for the separate the organic compounds.

Syllabus :*(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit-1: Mass Spectrometry **10 hours**

A brief introduction to analysis of organic compounds

Basic principles, Instrumentation - Mass spectrometer, electron Ionization (Electron Impact ionization, EI), Molecular ions, metastable ions, Isotope abundance. Basic fragmentation types. Fragmentation patterns in Toluene, 2-Butanol, Butaldehyde, Propionic acid.

Unit-2: Structural elucidation of organic compounds using IR, NMR, mass spectral data- **8hours**

2, 2, 3, 3-Tetra methyl butane, Butane-2, 3-dione, Prop ionic acid and methyl propionate.

Unit-3: Structural elucidation of organic compounds using IR, NMR, Mass spectral data- **8 hours**

Phenyl acetylene, ace to phenomenon amici acid and p-nitro aniline.

Unit-4: Separation techniques-1 **12 hours**

1. Solvent extraction-Principle and theory, Batch extraction technique, application of batch extraction in the separation of organic compounds from mixture- acid & neutral, base &neutral.
2. Chromatography- Principle and theory, classification, types of adsorbents, eluents, $R_f$values and factors affecting $R_f$values.
3. Thin layer chromatography-principle, experimental procedure, advantages and applications.

Unit-5: Separation techniques-2 **12 hours**

1. Paper chromatography- Principle, experimental procedure, ascending, descending, radial and two dimensional, applications.
2. Column chromatography-Principle, classification, experimental procedure, applications.
3. HPLC-Principle, Instrumentation-block diagram and applications.

References

1. Organic Spectroscopy by William Kemp, Third Edition, Palgrave USA.
2. Introduction to Spectroscopy by Pavia, Lamp man, Kriz and Vyvyan, Fifth edition, Cen gage.
3. Organic Spectroscopy: Principles and Applications by Jag Mohan, Second edition, Alpha Science.
4. Spector's copy of Organic Compounds by P.S. Kalsi, Seventh edition, New Age International.
5. Spectroscopic Methods in Organic Chemistry by Ian Fleming and Dudley Williams, Seventh edition, Springer.
6. Fundamentals of Analytical Chemistry by F. James Holler, Stanley R Crouch, Donald M. West and Douglas A. Skoog, Ninth edition, Cen gage.
7. Analytical Chemistry by Gary D.Christian, Purnendu K.Dasgupta and Kevin A.Schug, Seventh edition, Wiley.
8. Quantitative analysis by R.A. Day Jr. and A.L. Underwood, Sixth edition, Pearson.
9. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.

ADIKAVI NANNAYA UNIVERISITY:: RAJAHMENDRAVARAM
B.Sc Chemistry Syllabus (w.e.f: 2020-21 A.Y)

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 1
Course: 7A	Analysis of Organic Compounds Lab	Hrs/Wk:2

Learning Outcomes:

On successful completion of this practical course, student shall be able to:

1. Prepare acetanilide using the green synthesis.
2. Demonstrate the preparation of anazodye.
3. Acquire skills in the separation of organic compounds in the given mixture using solvent extraction

Practical (Laboratory) Syllabus :(30hrs) (Max.50 Marks)

1. Identification of various equipment in the laboratory.
2. Acetylating of 1^0 amine by green method: Preparation of acetanilide
3. Rearrangement reaction in green conditions: Benzil - Benzilic acid rearrangement
4. Radical coupling reaction: Preparation of 1,1-bis -2-naphthol
5. Green oxidation reaction: Synthesis of adipic acid
6. Preparation and characterization of biodiesel from vegetable oil/ waste cooking oil
7. Photo reduction of Benzophenone to Benzopinacol in the presence of sunlight.
8. Separation of organic compounds in a mixture (acidic compound + neutral compound) using solvent extraction.
9. Separation of organic compounds in a mixture (basic compound +neutral compound) using solvent extraction.

Lab References:

1. Vogel A. I. Practical Organic Chemistry, Longman Group Ltd.
2. Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley-Eastern.
3. Ahluwalia V. K. and Aggarwal R. Comprehensive Practical Organic Chemistry, Universitypress.
4. Mann F.G and Saunders B.C, Practical Organic Chemistry, Pearson Education.

Co-Curricular Activities:

***a)* Mandatory:** *(Lab/field training of students by teacher:(lab:10+field:05):*

5. **For Teacher**: Training of students by teacher in laboratory and field for not less than15 hours on the field techniques/skills of preparation of acetanilide, preparation of azodye, use of separating funnel for solvent extraction, separation of organic compounds in a mixture.
6. **For Student**: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for the separation of organic compounds. Write their observations and submit a handwritten fieldwork/project work report not exceeding10 pages in the given format to the teacher.
7. Max marks for Fieldwork/project work Report: 05.

4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*

5. Unit tests (IE).

***b)* Suggested Co-Curricular Activities**

1. Training of students' by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics), collection of videos and other material.
3. Visits of facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 6B	Analytical Methods in Chemistry-1	Hrs/Wk:4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Identify the importance of solvent extraction and ion exchange method.
2. Acquire knowledge on the basic principles of volumetric analysis and gravimetric analysis.
3. Demonstrate the usage of common laboratory apparatus used in quantitative analysis.
4. Understand the theories of different types of titrations.
5. Gain knowledge on different types of errors and their minimization methods.

Syllabus:

(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)

Unit-1: Quantitative analysis-1 **8 hours**

1. A brief introduction to analytical methods in chemistry
2. Principles of volumetric analysis, concentration terms- Molarity, Molality, Normality, v/v, w/v, ppm and ppb, preparing solutions- Standard solution, primary standards and secondary standards.
3. Description and use of common laboratory apparatus- volumetric flask, burette, pipette, beakers, measuring cylinders.

Unit-2: Quantitative analysis-2 **12hours**

1. Principles of volumetric analysis: Theories of acid-base (including study of acid-base titration curves), redox, complex metric, iodometric and precipitation titrations-choice of indicators for the saturations.
2. Principles of gravimetric analysis: precipitation, coagulation, peptization, co precipitation, post precipitation, digestion, filtration, and washing of precipitate, drying and ignition.

Unit-3: Treatment of analytical data **8hours**

Types of errors- Relative and absolute, significant figures and its importance, accuracy - methods of expressing accuracy, errors- Determinate and indeterminate and minimization of errors, precision-methods of expressing precision, standard deviation and confidence interval.

Unit-4: separation techniques **12 hours**

1. Solvent Extraction: Introduction, principle, techniques, factors affecting solvent extraction, Batch extraction, continuous extraction and counter current extraction. Synergism. Application-Determination of Iron (III).
2. Ion Exchange method: Introduction, action of ion exchange resins, applications.

UNIT-5: Analysis of water **10hours**

Determination of dissolved solids, total hardness of water, turbidity, alkalinity, Dissolved oxygen, COD, determination of chloride using Mohr's method.

References

1. Fundamentals of Analytical Chemistry by F.James Holler, Stanley R Crouch, Donald M.Westand Douglas A.Skoog, Ninth edition, Cengage.
2. Analytical Chemistry by Gary D.Christian, Purnendu K.Dasgupta and KevinA.Schug,Seventh edition, Wiley.
3. Quantitative analysis by R.A.DayJr. And A.L.Underwood, Sixth edition, Pearson.
4. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.
5. Text book of Environmental Chemistry and Pollution Control by S.S.Dara and D.D.Mishra, Revised edition, S Chand & CoLtd.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 1
Course: 6B	Analytical methods in Chemistry-1 Lab	Hrs/Wk:2

Learning Outcomes:

On successful completion of this practical course, student shall be able to:

1. Estimate Iron(II) using standard Potassium dichromate solution
2. Learn the procedure for the estimation of total hardness of water
3. Demonstrate the determination of chloride using Mohr's method
4. Acquire skills in the operation and calibration of pH meter
5. Perform the strong acid vs strong base titration using pH meter

c) Practical (Laboratory)Syllabus:(30hrs) (Max.50 Marks)

1. Estimation of Iron(II) using standard Potassium dichromate solution (using DPA indicator)
2. Estimation of total hardness of water using EDTA
3. Determination of chloride ion by Mohr's method
4. Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid, sodium acetate and their mixtures.
5. Preparation of buffer solutions of different pH (i) Sodium acetate-acetic acid, (ii) Ammonium chloride-ammonium hydroxide.
6. pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base.
7. Determination of dissociation constant of a weak acid.

d) Lab References:

1. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.

e) Co-Curricular Activities:

***a)* Mandatory:** *(Lab/field training of students by teacher:(lab:10+field:05):*

8. **For Teacher**: Training of students by the teacher in laboratory and field for not less than 15 hours on the field techniques/skills of calibration of pH meter, Strong acid vs strong base titration using pH meter, determination of chloride ion, estimation of water quality parameters and estimation of Iron(II).
9. **For Student**: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe various methods used for the analysis of water. Write their observations and submit a hand written fieldwork/project work report not exceeding10 pages in the given format to the teacher.
10. Max marks for Fieldwork/project work Report: 05.
4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*
5. Unit tests (IE).

***b)* Suggested Co-Curricular Activities**

1. Training of students' by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics).
3. Visits to facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 7B	Analytical Methods in Chemistry-2	Hrs/Wk:4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Identify the importance of chromatography in the separation and identification of compounds in a mixture
2. Acquire a critical knowledge on various chromatographic techniques.
3. Demonstrate skills related to analysis of water using different techniques.
4. Understand the principles of spectro chemistry in the determination of metal ions.
5. Comprehend the applications of atomic spectroscopy.

Syllabus :*(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit-1: Chromatography-Introduction and classification **10 hours**

Principle, Classification of chromatographic methods, Nature of adsorbents, eluents, $R_f$values, factors affecting $R_f$values.

Unit-2: TLC and paper chromatography **12 hours**

1. Thin layer chromatography: Principle, Experimental procedure, preparation of plates, adsorbents and solvents, development of chromatogram, detection of spots, applications and advantages.
2. Paper Chromatography: Principle, Experimental procedure, choice of paper and solvents, various modes of development- ascending, descending, radial and two dimensional, applications.

Unit -3: Column chromatography **12 hours**

1. Column chromatography: Principle, classification, Experimental procedure, stationary and mobile phases, development of the Chromatogram, applications.
2. HPLC: Basic principles, instrumentation –block diagram and applications.

Unit -4: Spectrophotometry **8hours**

Principle, Instrumentation: Single beam and double beam spectrometer, Beer-Lambert's law- Derivation and deviations from Beer-Lambert's law, applications of Beer-Lambert's law-Quantitative determination ofFe^{+2}, $Mn^{+2}$and Pb^{+2}.

Unit -5: Atomic spectroscopy **8hours**

Types, atomizer, atomic absorption and emission and applications.

References

1. Fundamental so Analytical Chemistry by F.James Holler, Stanley R Crouch, Donald M.Westand Douglas A.Skoog, Ninth edition, Cengage.
2. Analytical Chemistry by Gary D.Christian, Purnendu K.Dasgupta and Kevin A.Schug, Seventh edition, Wiley.
3. Quantitative analysis by R.A.Day Jr. and A.L.Underwood, Sixth edition, Pearson.
4. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition/ Pearson.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 1
Course: 7B	Analytical Methods in Chemistry-2 Lab	Hrs/Wk:2

Learning Outcomes:

On successful completion of this practical course, student shall be able to:

1. Perform the separation of a given dye mixture using TLC
2. Learn the preparation of TLC plates
3. Demonstrate the separation of mixture of amino acids using paper chromatography
4. Acquire skills in using column chromatography for the separation of dye mixture

Practical (Laboratory) Syllabus: (30hrs) (Max.50Marks)

1. Separation of a given dye mixture (methyl orange and methylene blue) using TLC (using alumina as adsorbent).
2. Separation of mixture of methyl orange and methylene blue by column chromatography.
3. Separation of given mixture of amino acids (glycine and phenyl alanine) using ascending paper chromatography.
4. Separation of food dyes using Column Chromatography
5. Separation of triglycerides using TLC
6. Verification of Beer lambert's law. (Using potassium permanganate solution) using colorimeter /spectrophotometer.

Lab References:

1. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.
2. Vogel A. I. Practical Organic Chemistry, Longman Group Ltd.
3. Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley- Eastern.
4. Ahluwalia V. K. and Aggarwal R. Comprehensive Practical Organic Chemistry, University press.
5. Mann F.G and Saunders B.C, Practical Organic Chemistry, Pearson Education.

Co-Curricular Activities:

a)* Mandatory:(Lab/field training of students by teacher (lab:10+field:05):*

1. **For Teacher**: Training of students by the teacher in laboratory and field for not lessthan15 hours on the field techniques/skills of determination of hardness of water, using the calorimeter and or Spectrophotometer, preparation of TLC plate, identification of spots in TLC and Paper chromatographic techniques, loading of column, selection of solvent system, separation of amino acids and dyes mixture using chromatographic techniques.
2. **For Student**: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the chromatographic techniques used for the separation of compounds. Write their observations and submit a hand written fieldwork/project work report not exceeding 10 pages in the given format to the teacher.
3. Max marks for Fieldwork/project work Report: 05.
4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*
5. Unit tests (IE).

***b)* Suggested Co-Curricular Activities**

1. Training of students by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics).
3. Visits to facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 6C	Industrial Chemistry-1	Hrs/Wk:4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Identify the importance of different surface coatings.
2. Acquire a critical knowledge on manufacture of ceramics and cement.
3. Understand various steps in the manufacture of cane sugar.
4. Explain the manufacture of pulp and paper.

Syllabus :*(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit-1: Fertilizers **10 hours**

A brief introduction to industrial chemistry

Different types of fertilizers. Manufacture of the following fertilizers: Urea, Ammonium nitrate, Calcium ammonium nitrate, Ammonium phosphates; Polyphosphate, Superphosphate, Compound and mixed fertilizers.

Unit-2: Silicates **10hours**

1. **Ceramics:** Important clays and Felds par. Ceramics-types, uses and manufacture. High technology ceramics and their applications.
2. **Cements:** Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.

Unit-3: Surface Coatings **12 hours**

Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Oil paint, modified oils, Pigments, toners and lake pigments, fillers, thinners, enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Water and Oil paints.

Unit-4: Sugar Chemistry **08hours**

Introduction–Manufacture and recovery of cane sugar from molasses, manufacture of sucrose from beat root, testing and estimation of sucrose.

Unit-5: Paper Industry **10hours**

Pulp and Paper-Introduction, Manufacture of pulp, sulphate or Kraft pulp, soda pulp, sulphite pulp, rag pulp, beating, refining, filling, sizing and colouring of pulp, manufacture of paper.

References:

1. E.Stocchi: *Industrial Chemistry*, Vol-I, Ellis HorwoodLtd.UK
2. J.A.Kent: Riegel's *Hand book of Industrial Chemistry*, CBS Publishers, New Delhi.
3. P.C.Jain, M.Jain: *Engineering Chemistry,* Dhanpat Rai & Sons, Delhi.
4. R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry,* Vikas Publications, NewDelhi.
5. B.K.Sharma: *Engineering Chemistry*, Goel Publishing House, Meerut
6. O. P. Vermani, A. K. Narula: *Industrial Chemistry,* Galgotia Publications Pvt. Ltd., New Delhi.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 1
Course: 6C	Industrial Chemistry - 1 Lab	Hrs/Wk:2

Lab work-Skills Outcomes:

On successful completion of this practical course, student shall be able to:

1. Determine free acidity in ammonium sulphate fertilizer.
2. Learn the procedure for the Estimation of Calcium in Calcium ammonium nitrate fertilizer.
3. Demonstrate skills on Estimation of phosphoric acid in superphosphate fertilizer.
4. Acquire skills in using colorimetry for the estimation of sucrose.

Practical(Laboratory)Syllabus:(30hrs) (Max.50 Marks)

5. Determination of free acidity in ammonium sulphate fertilizer.
6. Estimation of Calcium in Calcium ammonium nitrate fertilizer.
7. Estimation of phosphoric acid in superphosphate fertilizer.
8. Estimation of sucrose by colorimetry.

Lab References

1. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.
2. Text book on Experiments and Calculations in Engineering Chemistry, S.S.Dara, S.Chand.
3. R.Gopalan, D.Venkappayya, S.Nagarajan: Engineering Chemistry, Vikas Publications.
4. B.K.Sharma: Engineering Chemistry, Goel Publishing House, Meerut

Co-Curricular Activities:

***a)* Mandatory:** *(Lab/field training of students by teacher:(lab:10+field:05):*

1. **For Teacher**: Training of students by the teacher in laboratory and field for not less than15 hours on field related skills in determination of free acidity, estimation of calcium and phosphoric acid in a fertilizer, use of colorimeter to estimate sucrose.

2. **For Student**: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the surface coatings of surfaces used to prevent the corrosion. Write their observations and submit a hand written fieldwork/project work report not exceeding10 pages in the given format to the teacher.

3. Max marks for Fieldwork/project work Report: 05.
4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*
5. Unit tests (IE).

***b)* Suggested Co - Curricular Activities**

1. Training of students by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics).
3. Visits to facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 4
Course: 7C	Industrial Chemistry-2	Hrs/Wk:4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Identify the importance of industrial waste management.
2. Acquire a critical knowledge on the preparation and applications of organic polymers.
3. Demonstrate the analysis of water quality parameters.
4. Explain the sources of air pollution.

***II.* Syllabus :** *(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit-1: Organic Polymers-1 **10 hours**

Basic definitions, degree of polymerization, classification of polymers- Natural and Synthetic polymers, Organic and In organic polymers, Thermoplastic and Thermo setting polymers, Plastics, Elastomers, Fibers and Resins, Linear, Branched and Cross-Linked polymers.

Unit-2: Organic Polymers-2 **10 hours**

Addition polymers and Condensation polymers, mechanism of polymerization- Free radical, ionic and Zeigler-Natta polymerization. Industrial manufacturing and applications of following polymers, Polystyrene, Poly acrylonitrile, Poly methacrylate, Poly methyl-methacrylate.

Unit-3: Air Pollution **8 hours**

Sources of air pollution, acid rain, photochemical smog, Greenhouse effect, Formation and depletion of ozone, sources and effects of various gaseous pollutants: NOx, SOx, SPM, CO, hydrocarbons, controlling methods of air pollution.

Unit-4: Analysis of water **10hours**

Determination of total hardness of water, Dissolved oxygen, BOD, COD, total dissolved solids, turbidity, alkalinity, determination of chloride using Mohr's method.

Unit-5: Industrial Waste Management **12hours**

Waste water treatment - primary, secondary & tertiary treatment. (All treatment methods in detail). Characteristics of solid wastes, methods of solid waste treatment and disposal, microbiology involved in solid waste disposal, methods of solid waste disposal-composting, sanitary landfilling- economic, aesthetic and environmental problems.

References:

1. E.Stocchi: *IndustrialChemistry*,Vol-I,EllisHorwoodLtd.UK
2. J.A.Kent: Riegel's *Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
3. P.C.Jain, M.Jain: *Engineering Chemistry,* DhanpatRai & Sons, Delhi.
4. R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry,* Vikas Publications, New Delhi.
5. B.K.Sharma: *Engineering Chemistry*, Goel Publishing House, Meerut
6. O. P. Vermani, A. K. Narula: *Industrial Chemistry,* Galgotia Publications Pvt. Ltd., New Delhi.
7. A.K.De, *Environmental Chemistry*: New Age International Pvt, Ltd, New Delhi.
8. C.k.Varshney: *Water Pollution and Management*, Wiley Eastern Limited, Chennai.
9. S.S. Dara and D.D. Mishra: *Textbook of Environmental Chemistry and Pollution Control*, Revised edition, S.C.Hand &CoLtd.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 1
Course: 7C	Industrial Chemistry-2 Lab	Hrs/Wk:2

Lab work-Skills Outcomes:

On successful completion of this practical course, student shall be able to:

1. Learn the procedures for the determination of BOD and COD.
2. Demonstrate skills in the determination of chloride in the given water sample.
3. Acquire skills in determining the hardness of water.

Practical (Laboratory) Syllabus:(30hrs)

Determination of Hardness of water by EDTA titration.

1. Determination of Chemical Oxygen Demand (COD)
2. Determination of Biological Oxygen Demand (BOD)
3. Determination of chloride using Mohr's method.
4. Determination of pH, turbidity and total solids in water sample.
5. Determination of Ca^{+2} and Mg^{+2} in soil sample by flame photometry.
6. Determination of Ph in soil samples using pH-metry.

Lab References:

1. Textbook of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.
2. Textbook on Experiments and Calculations in Engineering Chemistry, S.S.Dara, S.Chand.

Co-Curricular Activities

***a)* Mandatory:** *(Student training by teacher in field related skills: inlab:15, infield: 05 hours):*

1. **For Teacher**: Training of students by the teacher in laboratory and field for not less than15hours on the field related skills in determination of hardness of water, estimation of COD and BOD in water sample, determination chloride ion in water sample.
2. **For Student**: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the measurement of water quality parameters. Write their observations and submit a hand written fieldwork/project work report not exceeding10 pages in the given format to the teacher.
3. Max marks for Fieldwork/project work Report: 05.
4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*
5. Unit tests (IE).

***b)* Suggested Co-Curricular Activities**

1. Training of students by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics).
3. Visits to facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 4
Course: 6D	Environmental Chemistry	Hrs/Wk:4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Understand the environment functions and how it is affected by human activities.
2. Acquire chemical knowledge to ensure sustainable use of the world's resources and ecosystems services.
4. Engage in simple and advanced analytical tools used to measure the different types of pollution.
5. Explain the energy crisis and different aspects of sustainability.
6. Analyze key ethical challenges concerning biodiversity and understand the moral principles, goals and virtues important for guiding decisions that affect Earth's plant and animal life.

Syllabus : *(Total Hours: 90, including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit-I Introduction **10h**

Environment Definition – Concept of Environmental chemistry- Scope and importance of environment in nowadays – Nomenclature of environmental chemistry – Segments of environment– Effects of human activities on environment – Natural resources–Renewable Resources–Solar and biomass energy and Nonrenewable resources – Thermal power and atomic energy – Reactions of atmospheric oxygen and Hydro logical cycle.

Unit -II

Air Pollution **10h**

Definition – Sources of air pollution – Classification of air pollution – Ambient air quality standards- Climate change – Global warming – Pollution from combustion systems- Acid rain – Photochemical smog – Greenhouse effect – Formation and depletion of ozone – Bhopal gas disaster–Instrumental techniques to monitor pollution – Controlling methods of air pollution.

Unit -III

Water pollution **10h**

Unique physical and chemical properties of water – Water quality standards and parameters – Turbidity- pH Dissolved oxygen – BOD, COD, Suspended solids, total dissolved solids, alkalinity– Hardness of water–Methods to convert temporary hard water in to soft water – Methods to convert permanent hard water into soft water – eutrophication and its effects –Industrial waste water treatment.

Unit -IV

Chemical Toxicology **10h**

Toxic chemicals in the environment – effects of toxic chemicals – cyanide and its toxic effects – pesticides and its biochemical effects – toxicity of lead, mercury, arsenic and cadmium- Solid waste management.

Unit -V

Ecosystem and biodiversity **10h**

Ecosystem

Concepts–structure–Functions and types of ecosystem–Abiotic and biotic components – Energy flow and Energy dynamics of ecosystem– Food chains – Food web– Tropic levels–Biogeochemical cycles (carbon, nitrogen and phosphorus)

Biodiversity

Definition – level and types of biodiversity – concept- significance – magnitude and distribution of biodiversity–trends-bio geographical classification of India–biodiversity at national, global and regional level.

List of Reference books:

1. Fundamentals of ecology by M.C.Dash
2. A Text book of Environmental chemistry by W. Moore and F.A. Moore
3. Environmental Chemistry by Samir k.Banerji
4. Water pollution, Lalude, MC Graw Hill
5. Environmental Chemistry, Anil Kumar De, Wiley Eastern ltd.
6. Environmental analysis, SM Khopkar (IIT Bombay)
7. Environmental Chemistry by BK Sharma & H Kaur, Goel publishing house.
8. Fundamentals of Environmental Chemistry, Manahan, Stanley. E
9. Applications of Environmental Chemistry, Eugene R. Wiener
10. Web related references suggested by teacher.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 1
Course: 6D	Environmental Chemistry Lab	Hrs/Wk:2

Lab work-Skills Outcomes:

On successful completion of this practical course, student shall be able to:

11. List out, identify and handle various equipment in Chemistry lab.
12. Learn the procedures of preparation of standard solutions.
13. Demonstrate skills in operating instruments.
14. Acquire skills in handling spectrophotometer.
15. Analyse water and soil samples.

Practical (Laboratory) Syllabus: **(30hrs)** (Max.50 Marks).

16. Identification of various equipment in the laboratory.
17. Determination of carbonate and bicarbonate in water samples by double titration method.
18. Determination of hardness of water using EDTA
    a) Permanent hardness b) Temporary hardness
19. Determination of Chlorides in water samples by Mohr's method.
20. Determination of pH, turbidity and total solids in water sample.
21. Determination of Ca^{+2} and Mg^{+2} in soil sample by flame photometry.
22. Determination of PH in soil samples using pH metry.

List of Reference books:

23. A Text Book of Quantitative Inorganic Analysis (3rd Edition)–A.I.Vogel
24. Water pollution, Lalude, MC Graw Hill
25. Environmental analysis, SM Khopkar (IIT Bombay)
26. Web related references suggested by teacher.

Co-Curricular Activities:

a) Mandatory: (Training of students by teacher on field related skills: 15hrs)

1. For Teacher: Skills training of students by the teacher in classroom, lab and field for not less than15 hours on field related quantitative techniques for the water quality parameters, soil pollution and air pollution.

2. For Student: Individual visit to any one of the local field agencies/research laboratories in universities/research organizations/private sector culminating writing and submission of a hand-written fieldwork/project work Report not exceeding 10 pages in the given format.

3. Max marks for Fieldwork/project work Report: 05.

4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of places visited, observations, findings and acknowledgements.*

5. Unit tests (IE).

b) Suggested Co-Curricular Activities:

1. Training of students by related industrial experts.
2. Visits to research organizations and laboratories.
3. Invited lectures and presentations on related topics by field / industrial experts.
4. Assignments.
5. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
6. Preparation of videos on tools, techniques and applications of spectrophotometry.

ADIKAVI NANNAYA UNIVERISITY:: RAJAHMENDRAVARAM
B.Sc Chemistry Syllabus (w.e.f: 2020-21 A.Y)

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 4
Course: 7D	Green Chemistry and Nanotechnology	Hrs/Wk:4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Understand the importance of Green chemistry and Green synthesis.
2. Engage in Microwave assisted organic synthesis.
3. Demonstrate skills using the alternative green solvents in synthesis.
4. Demonstrate and explain enzymatic catalysis.
5. Analyse alternative sources of energy and carry out green synthesis.
6. Carry out the chemical method of nanomaterial synthesis.

Syllabus: *Total Hours: 90, including Teaching, Lab, Field Training, Unit tests etc.)*

Unit-I Green Chemistry: Part- I **10 hrs**

Introduction-Definition of green Chemistry, Need for green chemistry, Goals of Green chemistry Basic principles of green chemistry. Green synthesis- Evaluation of the type of the reaction i) Rearrangements (100% atom economic), ii) Addition reaction (100% atom economic). Organic reactions by Sonication method: apparatus required and examples of sonochemical reactions (Heck, Hunds dicker and Wittig reactions).

Unit- II Green Chemistry: Part- II **10 hrs**

A) Selection of solvent:

i) Aqueous phase reactions

ii) Reactions in ionic liquids, Heck reaction, Suzuki reactions, epoxidation.

Iii) Solid supported synthesis

B) Supercritical CO2: Preparation, properties and applications, (decaffeination, drycleaning)

C) Green energy and sustainability.

Unit-III Microwave and Ultrasound assisted green synthesis: **10 hrs**

Apparatus required, examples of MAOS (synthesis of fused anthroquinones, Leukart reductive amination of ketones) - Advantages and disadvantages of MAOS. Aldol condensation –Cannizzaro reaction- Diels-Alder reactions-Strecker's synthesis

Unit-IV Green catalysis and Green synthesis **10 hrs.**

Heterogeneous catalysis, use of zeolites, silica, alumina, supported catalysis - bio catalysis: Enzymes, microbes Phase transfer catalysis (micellar /surfactant)

1. Green synthesis of the following compounds: adipic acid, catechol, disodium menudo acetate (alternative Strecker's synthesis)

2. Microwave assisted reaction in water –Hoffmann elimination – methyl benzoate to benzoic acid – oxidation of toluene and alcohols–microwave assisted reactions in organic solvents. Diels-Alder reactions and decarboxylation reaction.

3. Ultrasound assisted reactions–sonochemical Simmons–Smith reaction (ultrasonic alternative to iodine)

Unit – V Nanotechnology in Green chemistry **10 hrs**

Basic concepts of Nano science and Nanotechnology – Bottom-up approach and Top-down approaches with examples – Synthesis of Nano materials – Classification of Nanomaterial – Properties and Application of Nanomaterial. Chemical and Physical properties of Nanoparticles – Physical synthesis of nanoparticles – Inert gas condensation - aerosol method - Chemical Synthesis of nanoparticles – precipitation and co-precipitation method, sol-gel method.

Lab work - Skills Outcomes:

On successful completion of this practical course, student shall be able to:

1. List out, identify and handle various equipment in the laboratory.
2. Learn the procedures of green synthesis.
3. Demonstrate skills in the preparation of Nanomaterials.
4. Acquire skills in Microwave assisted organic synthesis.
5. Perform some applications of Nanomaterials.

ADIKAVI NANNAYA UNIVERISITY:: RAJAHMENDRAVARAM
B.Sc Chemistry Syllabus (w.e.f: 2020-21 A.Y)

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 1
Course: 7D	Green Chemistry and Nanotechnology Lab	Hrs/Wk:2

Practical (Laboratory) Syllabus: (30 hrs.) (Max.50 Marks).

1. Identification of various equipment in the laboratory.
2. Acetylation of 1^0 amine by green method: Preparation of acetanilide
3. Rearrangement reaction in green conditions: Benzil - Benzilic acid rearrangement
4. Radical coupling reaction: Preparation of 1,1-bis -2-naphthol
5. Green oxidation reaction: Synthesis of adipicacid
6. Preparation and characterization of biodiesel from vegetable oil/ waste cooking oil
7. Preparation and characterization of Nanoparticles of gold using tea leaves.
8. Benzoin condensation using Thiamine Hydrochloride as a catalyst instead of cyanide.
9. Photo reduction of Benzophenone to Benzopinacol in the presence of sunlight.

Reference books:

1. Green Chemistry Theory and Practical. P.T.Anatas and J.C. Warner
2. Green Chemistry V.K. Ahluwalia Narosa, New Delhi.
3. Real world cases in Green Chemistry M.C. Cann and M.E. Connelly
4. Green Chemistry: Introductory Text M.Lancaster: Royal Society of Chemistry (London)
5. Principles and practice of heterogeneous catalysis, Thomas J.M.,Thomas M.J., John Wiley
6. Green Chemistry: Environmental friendly alternatives R S Sanghli and M.M Srivastava, Narosa Publications
7. Nanotechnology: Health and Environmental Risks, Jo Anne Shatkin, CRC Press (2008).
8. Green Processes for Nanotechnology: From Inorganic to Bioinspired Nanomaterials, Vladimir A. Basiuk, Elena V. Basiuk Springer (2015)
9. Web related references suggested by teacher.

Co-Curricular Activities:

a) Mandatory: (*Training of students by teacher on field related skills: 15 hours*)

1.For Teacher: Training of students by the teacher in the classroom or in the laboratory for not less than 15 hours on field related quantitative techniques for Enzymatic catalysis, Microwave assisted organic synthesis, Biodiesel preparation etc.

2.For Student: Individual visit to any one of the local field agencies, research laboratories in universities/research organizations/private sector culminating writing and submission of a hand-written fieldwork/project work Report not exceeding 10 pages in the given format.

3. Max marks for fieldwork/project work Report: 05.

4. Suggested Format for fieldwork/project work: *Title page, student details, index page, details of places visited, observations, findings and acknowledgements.*

5. Unit tests (IE).

b) Suggested Co-Curricular Activities:

1. Training of students by related industrial experts.
2. Visits to research organizations and laboratories.
3. Invited lectures and presentations on related topics by field / industrial experts.
4. Assignments.
5. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
6. Preparation of videos on tools, techniques and applications of Green chemistry and Nano synthesis.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 6E	Analytical Methods in Chemistry	Hrs/Wk:4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Understand the various methods involved in Quantitative analysis.
2. Acquire a critical knowledge on separation techniques.
3. Demonstrate skills related to Chromatographic techniques through hands on experience.
4. Able to engage in safe and accurate laboratory practices by handling laboratory glassware, Equipment and chemical reagents appropriately.
5. Comprehend the applications of Chromatographic techniques in different fields.

Syllabus: *Total Hours: 90, including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit-1: Quantitative analysis **(10hrs)**

Importance in various fields of science, steps involved in chemical analysis. Principles of volumetric analysis: Theories of acid-base, redox, complex metric, iodometric and precipitation titrations Detection of end point in redox titration, choice of indicators for the saturations. Principles of gravimetric analysis: precipitation, coagulation, peptization, co-precipitation, post-precipitation, digestion, filtration and washing of precipitate, drying and ignition.

Unit-2: Treatment of analytical data: **(10hrs)**

Types of errors, significant figures and its importance, accuracy-methods of expressing accuracy, absolute and relative errors, error analysis and minimization of errors.

Precision - methods of expressing precision, standard deviation and confidence limit. The correlation coefficient.

Unit-3: Separation techniques in Chemical analysis: **(10hrs)**

Solvent Extraction: Introduction, principle, techniques, factors affecting solvent extraction, Batch extraction, continuous extraction and counter current extraction. Synergism. Application-Determination of Iron (III).

Ion Exchange: Introduction, action of ionex change resins, separation of inorganic mixtures, applications.

Unit– 4: Chromatography: Part - I **(10hrs)**

Classification of chromatography methods, principles of differential migration adsorption phenomenon, Nature of adsorbents, solvent systems, R_f values, factors effecting R_f values.

Paper Chromatography: Principles, R_f values, experimental procedures, choice of paper and solvent systems, developments of chromatogram-ascending, descending and radial. Two dimensional chromatography, applications.

Unit– 5: Chromatography: Part - II **(10hrs)**

Thin layer Chromatography (TLC): Advantages. Principles, factors effecting R_f values. Experimental procedures. Adsorbents and solvents. Preparation of plates. Development of the chromatogram. Detection of the spots. Applications.

Column Chromatography: Principles, experimental procedures, Stationary and mobile Phases, Separation techniques, Applications. HPLC: Basic principles and applications.

Lab work-Skills Outcomes:

On successful completion of this practical course, student shall be able to:

1. List out, identify and handle various equipment in Analytical Chemistry lab.
2. Learn the procedures of preparation of primary and secondary standard solutions.
3. Demonstrate skills in the preparation of Paper, Thin layer and column Chromatography.
4. Acquire skills in observing the Chromatogram.

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 1
Course: 6E	Analytical Methods in Chemistry Lab	Hrs/Wk:2

5. Perform some separation techniques of Organic compounds.

Practical (Laboratory) Syllabus :(30hrs) (Max.50Marks).

1. Identification and handling of various laboratory equipment.
2. Determination of Zn(II)/ Mg(II) using EDTA
3. Determination of Fe (II) present in an Iron tablet using $KMnO_4$ -Redox titration.
4. Determination of Saponification value of oil and Iodine value of oil.
5. Paper chromatographic separation of $Fe3^+$, Al^{3+}, and Cr^{3+}.
6. Separation and identification of the monosaccharaides present in the given mixture (glucose & fructose) by paper chromatography. Reporting the Rf values.
7. Chromatographic separation of the active ingredients of plants, flowers and juices by TLC.
8. Separation by Column Chromatography – Mixture of Ortho and Para Nitro anilines.

List of Reference Books

1. Analytical Chemistry by Skoog and Miller
2. A text book of qualitative in organic analysis by A.I.Vogel
3. Nano chemistry by Geoffrey Ozin and Andre Arsenault
4. Stereo chemistry by D.Nasipuri
5. Organic Chemistry by Clayden
6. Analytical Chemistry by Gary D. Christian, 6th edition
7. Chemistry experiments for instrumental methods, Donald T Sawyer William
8. Instrumental methods of analysis, Willard, Merit, Dean, 6th edition.
9. Web related references suggested by teacher.

Co-Curricular Activities:

a) Mandatory: (training of students by teacher on field related skills: 15 hrs.)

1. For Teacher: Training of students by the teacher in laboratory and field for not less than 15 hours on field related Quantitative techniques like Separation techniques, preparation by Column, preparation of TLC and determination of the purity of the sample.

2. For Student: Individual visit to any one of the Field agency, research laboratories in universities/research organizations/private sector culminating writing and submission of a hand-written fieldwork/project work Report not exceeding 10 pages in the given format.

3. Max marks for Fieldwork/project work Report: 05.

4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of places visited, observations, findings and acknowledgements.*

5. Unit tests (IE).

b) Suggested Co-Curricular Activities:

1. Training of students by related industrial experts.
2. Visitor research organizations and laboratories.
3. Invited lectures and presentations on related topics by field / industrial experts.
4. Assignments.
5. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
6. Preparation of videos on tools, techniques and applications of chromatography.

MODEL QUESTION PAPER (Sem-end. Exam)

B. Sc DEGREE EXAMINATIONS

ADIKAVI NANNAYA UNIVERISITY:: RAJAHMENDRAVARAM

B.Sc Chemistry Syllabus (w.e.f: 2020-21 A.Y)

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits:4
Course: 7E	Cosmetics and Pharmaceutical Chemistry	Hrs/Wk:4

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Explain the principles of formulation and application of Cosmetics & perfumes.
2. Acquire a critical knowledge on synthetic techniques of drugs.
3. Demonstrate the skills in various aspects of the fermentation technology and apply for production.
4. Comprehend the applications offer mentation.

Syllabus: *Total Hours: 90, including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit- I Chemistry of Cosmetics **(8hrs)**

A general study including preparation and uses of the following: Hair dye, hair spray, shampoo, suntan lotions, face powder, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and shaving creams), antiperspirants and artificial flavours.

Unit- II Chemistry of Perfumes **(8hrs)**

Essential oils and their importance in cosmetic industries with reference to Eugenol, Geranial, sandalwood oil, eucalyptus, rose oil, 2-phenyl ethyl alcohol, Jasmine, Civet one, Mascon.

Unit–III Drugs & Pharmaceuticals – I **(10hrs)**

Drug discovery, design and development; Basic Retrosynthetic approach. Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, anti- inflammatory agents (Aspirin, paracetamol, ibuprofen)

Unit–IV Drugs & Pharmaceuticals - II **(12hrs)**

Synthesis of the representative drugs of the following classes: Antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital, Diazepam), Cardiovascular (Glycerol triturate), antilaprosy (Daps one), HIV-AIDS related drugs (AZT-Zidovudine).

Unit – V Fermentation **(12hrs)**

Aerobic and anaerobic fermentation. Production of (i) Ethyl alcohol and citric acid, (ii) Antibiotics; Penicillin, Cephalosporin, Chloromycetin and Streptomycin, (iii) Lysine, Glutamic acid, Vitamin B_2, Vitamin B_{12} and Vitamin C.

Lab work-Skills Outcomes:

On successful completion of this practical course, student shall be able to:

1. The ability to develop comprehensive product development programs to meet new product criteria and timing.
2. Acquire skills in the preparation of Cosmeceuticals.
3. Demonstrate proficiency in the experimental techniques for fermentation and microbial production of enzymes.
4. Carry out perfume testing with the knowledge of perfumes.
5. Learn the procedure of synthesis of drugs.
6. Critically develop, apply, report, interpret and reflect on strategies for collecting data in the lab and field.

ADIKAVI NANNAYA UNIVERISITY:: RAJAHMENDRAVARAM
B.Sc Chemistry Syllabus (w.e.f: 2020-21 A.Y)

B. Sc	Semester – V (Skill Enhancement Course- Elective)	Credits: 1
Course: 7E	Cosmetics and Pharmaceutical Chemistry Lab	Hrs/Wk:2

Practical (Laboratory) Syllabus :(30hrs)

Identification of various equipment in the laboratory

1. Preparation of talcum powder.
2. Preparation of shampoo.
3. Preparation of hair remover.
4. Preparation of face cream.
5. Preparation of nail polish and nail polish remover.
6. Preparation of Aspirin and it's analysis.
7. Preparation of Magnesium bisilicate (Antacid).
8. Fermentation process.

Reference Books:

1. A handbook of Industrial Organic Chemistry by Samuel P Sadtler, JB Lippincott company.
2. Handbook Industrial Chemistry by Mohammad Farhat Ali Khan, First edition
3. Related online methods available.
4. Industrial Chemistry, E. Stocchi: Vol -I, Ellis Horwood Ltd. UK.
5. Engineering Chemistry P.C. Jain, M. Jain:,Dhanpat Rai & Sons, Delhi.
6. Industrial Chemistry, Sharma, B.K. & Gaur, , Goel Publishing House, Meerut(1996)
7. Introduction to Medicinal Chemistry, G.L. Patrick: Oxford University Press, UK.
8. Medicinal and Pharmaceutical Chemistry, Hakishan, V.K. Kapoor:, Vallabh Prakashan, Pitampura, New Delhi.
9. Principles of Medicinal Chemistry, William O. Foye, Thomas L., Lemke, David A. William: B.I. Waverly Pvt. Ltd. New Delhi.
10. Industrial Microbiology, 3rd Edition, JR Casida L.E. (2015New Age International (P) Limited Publishers, New Delhi, India.
11. Industrial Microbiology: An Introduction. 1st Edition, Waites M.J., Morgan N.L., Rockey J.S. and Higton G. (2001) Blackwell Science, London, UK.
12. Microbiology. 5th Edition, Pelczar M.J., Chan E.C.S. and Krieg N.R. (2003) Tata McGraw-Hill Publishing Company Limited, New Delhi.

Co-Curricular Activities:

a) **Mandatory :***(Training of students by teacher on field related skills: 15hrs)*

1. For Teacher: Training of students by the teacher in laboratory and field fornotlessthan15hoursonfield skills/techniques like purification of the crude, Separation techniques, synthesis of simple drugs etc.

2. For Student: Individual visit to any one of the related local agencies, cosmetic industry, pharmaceutical laboratories in universities / research organizations / private sector culminating writing and submission of a hand-written fieldwork/project work Report not exceeding 10 pages in the given format.

3. Max marks for Fieldwork/project work Report: 05.

4. Suggested Format for Fieldwork/project work**:** *Title page, student details, index page, details of places visited, observations, findings and acknowledgements.*

5. Unit tests (IE).

b) <u>Suggested Co-Curricular Activities</u>

1. Training of students by related industrial experts.
2. Assignments(including technical assignments like identifying tools in plant biotechnology and their handling, operational techniques with safety and security, IPR)
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Preparation of videos on tools and techniques in plant biotechnology.
5. Collection of material/figures/photos related to products of plant tissue culture, writing and organizing them in a systematic way in a file.
6. Visits to plant tissue culture/biotechnology facilities, firms, research organizations etc.
7. Invited lectures and presentations on related topics by field/industrial experts.

PRINCIPAL
Aditya Degree College
KAKINADA