

PROGRAMME GUIDE

BACHELOR OF SCIENCE (BIOTECHNOLOGY) (B.Sc. BIOTECHNOLOGY)

- *Scheme of Examination (CBCS/ELECTIVE)
- *Detailed Structure of Syllabus



DR. C.V.RAMAN UNIVERSITY

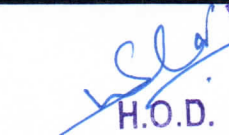
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Dr. C.V. Raman University,
Kota, Bilaspur,
(C.G.), India

BACHELOR OF SCIENCE
Duration: 36 Months (3 Years)
Eligibility: 12th Pass from Science

COURSE STRUCTURE OF B.SC. BIOTECHNOLOGY SEMESTER Ist

COURSE STRUCTURE OF B.SC. BIOTECHNOLOGY SEMESTER Ist													
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional ***		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
3CBCA201	Ability Enhancement	Basic Information Computer Technology - I	50	25	08	10	04	15	06	2	-	-	2
3HBHL101	Ability Enhancement	हिन्दी भाषा और संरचना	50	25	08	10	04	15	06	2	-	-	2
3SBBT103	Core Course	Biotechnology- I (General Microbiology & Biotechnology)	100	50	17	20	08	30	12	4	-	-	4
3SBCH104	Core Course	Chemistry –I (Physical Inorganic & Organic Chemistry)	100	50	17	20	08	30	12	4	-	-	4
3SBZO105	Core Course	Zoology – I (Invertebrates & Cell Biology)	100	50	17	20	08	30	12	4	-	-	4
Practical Group				Term End Practical Exam		Lab Performance		Sessional					
3SBBT103	Practical	Biotechnology- I (General Microbiology & Biotechnology)	50	25	08	25	08	-	-	-	-	2	2
3SBCH104	Practical	Chemistry –I (Physical Inorganic & Organic Chemistry)	50	25	08	25	08	-	-	-	-	2	2
3SBZO105	Practical	Zoology – I (Invertebrates & Cell Biology)	50	25	08	25	08	-	-	-	-	2	2
Grand Total			550							16	-	6	22

Minimum Passing Marks are equivalent to Grade D

L- Lectures T- Tutorials P- Practical

Major- Term End Theory / Practical Exam

Minor- Pre University Test

Sessional weightage – Attendance 50%, Three Class Tests/Lab Performance Assignment 50%

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COURSE STRUCTURE OF B.SC. BIOTECHNOLOGY SEMESTER IIInd													
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional ***		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
3HBEL201	Ability Enhancement	English Language and Indian Culture	50	25	08	10	04	15	06	2	-	-	2
3MBFE101	Ability Enhancement	Fundamental of Entrepreneurship	50	25	08	10	04	15	06	2	-	-	2
3SBBT203	Core Course	Biotechnology- II (Biotechnology and Immunology)	100	50	17	20	08	30	12	4	-	-	4
3SBCH204	Core Course	Chemistry -II (Physical Inorganic & Organic Chemistry)	100	50	17	20	08	30	12	4	-	-	4
3SBZO205	Core Course	Zoology – II (Vertebrates & Developmental Biology)	100	50	17	20	08	30	12	4	-	-	4
Practical Group				Term End Practical Exam		Lab Performance		Sessional					
3SBBT203	Practical	Biotechnology- II (Biotechnology and Immunology)	50	25	08	25	08	-	-	-	-	2	2
3SBCH204	Practical	Chemistry -II (Physical Inorganic & Organic Chemistry)	50	25	08	25	08	-	-	-	-	2	2
3SBZO205	Practical	Zoology – II (Vertebrates & Developmental Biology)	50	25	08	25	08	-	-	-	-	2	2
Skill Courses								Sessional					
	Skill Enhancement	Skill Enhancement Elective Course-I	50	-	-	-	-	50	20	1	-	1	2
	Grand Total		600							17	-	7	24

Minimum Passing Marks are equivalent to Grade D

L- Lectures T- Tutorials P- Practical

Major- Term End Theory / Practical Exam

Minor- Pre University Test

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Skill Elective I – Any other course being offered in this semester as per the list given at the end of course structure.

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COURSE STRUCTURE OF B.SC. BIOTECHNOLOGY SEMESTER IIIrd													
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional ***		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
3HBHL302	Ability Enhancement	हिन्दी भाषा संवेदना एवं संचार साधन	50	25	08	10	04	15	06	2	-	-	2
3CBCA502	Ability Enhancement	Basic Information Computer Technology – II	50	25	08	10	04	15	06	2	-	-	2
3SBBT303	Core Course	Biotechnology- III (Molecular Biology)	100	50	17	20	08	30	12	4	-	-	4
3SBCH304	Core Course	Chemistry -III (Physical, Inorganic & Organic Chemistry)	100	50	17	20	08	30	12	4	-	-	4
3SBZO305	Core Course	Zoology – III (Genetic)	100	50	17	20	08	30	12	4	-	-	4
Practical Group				Term End Practical Exam		Lab Performance		Sessional					
3SBBT303	Practical	Biotechnology- III (Molecular Biology)	50	25	08	25	08	-	-	-	-	2	2
3SBCH304	Practical	Chemistry -III (Physical, Inorganic & Organic Chemistry)	50	25	08	25	08	-	-	-	-	2	2
3SBZO305	Practical	Zoology – III (Genetic)	50	25	08	25	08	-	-	-	-	2	2
Skill Courses								Sessional					
	Skill Enhancement	Skill Enhancement Elective Course-II	50	-	-	-	-	50	20	1	-	1	2
	Grand Total		600							17	-	7	24

Minimum Passing Marks are equivalent to Grade D

L- Lectures T- Tutorials P- Practical

Major- Term End Theory / Practical Exam

Minor- Pre University Test

Sessional weightage - Attendance 50%, Three Class Tests/ Lab Performance Assignment 50%

Skill Elective II- Any other course being offered in this semester as per the list given at the end of course structure.

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BACHELOR OF SCIENCE
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Eligibility: 12th Pass from Science

COURSE STRUCTURE OF B.SC. BIOTECHNOLOGY SEMESTER IVth													
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional ***		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
3HBEL402	Ability Enhancement	English Language and Scientific Temper	50	25	08	10	04	15	06	2	-	-	2
3HBHP401	Ability Enhancement	Human Values & Ethics	50	25	08	10	04	15	06	2	-	-	2
3SBBT403	Core Course	Biotechnology- IV (Industrial Biotechnology)	100	50	17	20	08	30	12	4	-	-	4
3SBCH404	Core Course	Chemistry -IV (Physical Inorganic & Organic Chemistry)	100	50	17	20	08	30	12	4	-	-	4
3SBZO405	Core Course	Zoology – IV (Animal Physiology)	100	50	17	20	08	30	12	4	-	-	4
Practical Group				Term End Practical Exam		Lab Performance		Sessional					
3SBBT403	Practical	Biotechnology– IV (Industrial Biotechnology)	50	25	08	25	08	-	-	-	-	2	2
3SBCH404	Practical	Chemistry –IV (Physical Inorganic & Organic Chemistry)	50	25	08	25	08	-		-	-	2	2
3SBZO405	Practical	Zoology – IV (Animal Physiology)	50	25	08	25	08	-	-	-	-	2	2
Grand Total			550							16		6	22


Minimum Passing Marks are equivalent to Grade D


L- Lectures T- Tutorials P- Practical

Major- Term End Theory / Practical Exam


Minor- Pre University Test

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COURSE STRUCTURE OF B.S.C. BIOTECHNOLOGY SEMESTER Vth													
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional ***		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
3SBES501	Ability Enhancement	Environmental Studies	50	25	08	10	04	15	06	2	-	-	2
3HBEL501	Ability Enhancement	Introduction to soft skill & Team Building	50	25	08	10	04	15	06	2	-	-	2
****	Discipline Specific Elective	Biotechnology - V (Select any one from below given Elective-I)	100	50	17	20	08	30	12	4	-	-	4
****	Discipline Specific Elective	Chemistry - V (Select any one from below given Elective-II)	100	50	17	20	08	30	12	4	-	-	4
****	Discipline Specific Elective	Zoology - V (Select any one from below given Elective-III)	100	50	17	20	08	30	12	4	-	-	4
Practical Group				Term End Practical Exam		Lab Performance		Sessional					
****	Practical	Biotechnology -V	50	25	08	25	08	-	-	-	-	2	2
****	Practical	Chemistry -V	50	25	08	25	08	-	-	-	-	2	2
****	Practical	Zoology -V	50	25	08	25	08	-	-	-	-	2	2
Skill Courses								Sessional					
	Skill Enhancement	Skill Enhancement Elective Course-III	50	-	-	-	-	50	20	1	-	1	2
	Grand Total		600							17	-	7	24

Minimum Passing Marks are equivalent to Graded

L- Lectures T- Tutorials P- Practical

Major- Term End Theory / Practical Exam

Minor- Pre University Test

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Skill Elective III- Any other course being offered in this semester as per the list given at the end of course structure.

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Eligibility: 12th Pass from Science

COURSE STRUCTURE OF B.SC. BIOTECHNOLOGY SEMESTER VIth													
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional ***		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
****	Discipline Specific Elective	Biotechnology - VI (Select any one from below given Elective-IV)	100	50	17	20	08	30	12	4	-	-	4
****	Discipline Specific Elective	Chemistry - VI (Select any one from below given Elective-V)	100	50	17	20	08	30	12	4	-	-	4
****	Discipline Specific Elective	Zoology - VI (Select any one from below given Elective-VI)	100	50	17	20	08	30	12	4	-	-	4
Practical Group				Term End Practical Exam		Lab Performance		Sessional					
****	Practical	Biotechnology - VI	50	25	08	25	08	-	-	-	-	2	2
****	Practical	Chemistry -VI	50	25	08	25	08	-	-	-	-	2	2
****	Practical	Zoology -VI	50	25	08	25	08	-	-	-	-	2	2
	Research Component	Project/Dissertations/Internship	100	50	17	-	-	50	20	-	-	4	4
	Grand Total		550							12	-	10	22

Minimum Passing Marks are equivalent to Grade D

L- Lectures T- Tutorials P- Practical

Major- Term End Theory / Practical Exam

Minor- Pre University Test

Sessional weightage – Attendance 50%, Three Class Tests/ Lab Performance Assignment 50%

Compulsory Project/Dissertation/Internship with choice in any Disciplinary specific elective. Compulsory one paper presentation certificate in related discipline.

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SPECILIZATION WITH ELECTIVE

****Note** - Students need to select any one paper from below mentioned three papers from Each Group Elective's for Fifth and Sixth semester of **B.Sc. Biotechnology**.

ELECTIVES FOR SEMESTER 5 TH			ELECTIVES FOR SEMESTER 6 TH		
Course Code	Course Type	List of Electives	Course Code	Course Type	List of Electives
GROUP ELECTIVE -I			GROUP ELECTIVE -IV		
3SBBT503	Discipline Specific Elective-I	Instrumentation Biotechnology and Complex	3SBBT 603	Discipline Specific Elective-I	Applied Biotechnology
3SBBT504	Discipline Specific Elective-II	Environmental Biotechnology- V	3SBBT 604	Discipline Specific Elective-II	Recombinant DNA Technology
3SBBT505	Discipline Specific Elective-III	Genetics & Genetic Engineering	3SBBT 605	Discipline Specific Elective-III	Plant and Animal tissue culture Techniques and its Application Biotechnology
GROUP ELECTIVE -II			GROUP ELECTIVE -V		
3SBCH503	Discipline Specific Elective-I	Chemistry –V (Physical Inorganic and Organic Chemistry)	3SBCH 603	Discipline Specific Elective-I	Chemistry-VI (Physical Inorganic and Organic Chemistry)
3SBCH504	Discipline Specific Elective-II	Chemistry-V (Industrial Chemistry)	3SBCH 604	Discipline Specific Elective-II	Chemistry-VI (Nano-Chemistry)
3SBCH505	Specific Elective-III	Chemistry –V (Green Chemistry)	3SBCH605	Discipline Specific Elective-III	Chemistry-VI (Bio-Chemistry)
GROUP ELECTIVE-III			GROUP ELECTIVE -VI		
3SBZO503	Discipline Specific Elective-I	Zoology -V (Applied Zoology)	3SBZO603	Discipline Specific Elective-I	Zoology-VI (Environmental Biology & Evolution)
3SBZO504	Discipline Specific Elective-II	Zoology- V (Wild Life Conservation)	3SBZO604	Discipline Specific Elective-II	Zoology-VI (Aquaculture)
3SBZO505	Discipline Specific Elective-III	Zoology-V (Industrial Biology)	3SBZO605	Discipline Specific Elective-III	Zoology- VI(Economic) Zoology

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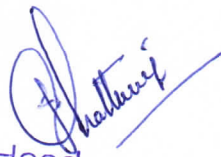
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SKILL ENHANCEMENT ELECTIVE COURSES

Non-Technical			
Elective No.	Department/ Faculty Name		
	Faculty of Information Technology		
I	SCIT 201	Data Entry Operation	2(1+0+1)
II	SCIT 301	Multimedia	2(1+0+1)
III	SCIT 501	Web Designing with HTML	2(1+0+1)
IV	SCMIT 201	Web Development	2(1+0+1)
V	SCMIT 301	LINUX	2(1+0+1)
	Faculty of Management		
I	SMGT 201	Briefing and Presentation Skills	2(1+0+1)
II	SMGT 301	Resolving Conflicts and Negotiation Skills	2(1+0+1)
III	SMGT 802	Entrepreneurship Development	2(1+0+1)
	Faculty of Commerce		
I	SCOM 201	Tally ERP 9	2(1+0+1)
II	SCOM 302	Multimedia	2(1+0+1)
III	SCOM 803	Data Analyst	2(1+0+1)
	Faculty of Humanities		
I	SHBA 301	Pursuing Happiness	2(1+0+1)
II	SHBA302	Communication Skill and Personality Development	2(1+0+1)
III	SHMA301	Tourism in M.P	2(1+0+1)
	Faculty of Science		
I	SSBI 301	Mushroom Cultivation	2(1+0+1)
II	SSPH 301	House Hold Wiring	2(1+0+1)
III	SSPH 301	Basic Instrumentation	2(1+0+1)
IV	SSPH 301	DTP Operator	2(1+0+1)
V	SSCH 301	Graphic Designing	2(1+0+1)
	Faculty of Education		
I	SCBE 403	Understanding of ICTC (Information Communication Technology)	2(1+0+1)
II	SCPE 201	Yoga Education	2(1+0+1)


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SEMESTER- 1st

Course: B. Sc. Biotechnology

SUBJECT: BASIC COMPUTER & INFORMATION TECHNOLOGY-I

Subject Code: 3CBCA201

Theory Max. Marks: 25

Theory Min. Marks: 08

COURSE OBJECTIVE:

To educate students to analyze, design, integrate & manage information systems using information technology.

Unit	Course Content	Methodology Adopted
Unit – I	<p>INTRODUCTION TO COMPUTER ORGANIZATION –I History of development of Computer system concepts. Characteristics, Capability and limitations. Generation of computer. Types of PC's Desktop. Laptop, Notebook. Workstation & their Characteristics.</p> <p>कम्प्यूटर ऑर्गनाइजेशन का परिचय कम्प्यूटर का इतिहास, कम्प्यूटर सिस्टम विचारधारा, विशेषताएं, योग्यताएं व सीमाएं, कम्प्यूटर की पीढ़ियां, पी.सी. के प्रकार, डेस्कटॉप के प्रकार, लेपटॉप के प्रकार, नोटबुक, वर्क स्टेशन आदि की विशेषताएं।</p>	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	<p>INTRODUCTION TO COMPUTER ORGANIZATION –II basic components of a computer system Control Unit, ALU. Input/Output function and Characteristics, memory RAM, ROM, EPROM, PROM.</p> <p>कम्प्यूटर ऑर्गनाइजेशन का परिचय कम्प्यूटर सिस्टम के आधार उपकरण, कंट्रोल यूनिट, ए.एल.यू. इनपुट/आउटपुट फंक्शन और विशेषताएं, मेमोरी रेम, रोम, इपी रोम, पी रोम, और अन्य प्रकार की मेमोरी।</p>	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	<p>INPUT & OUTPUT DEVICES Input Devices : Keyboard, Mouse, Trackball. Joystick, Digitizing tablet, Scanners, Digital Camera, MICR, OCR, OMR, Bar-code Reader, Voice Recognition, Light pen, Touch Screen. Output Devices: Monitors Characteristics and types of monitor, Video Standard VGA, SVGA, XGA, LCD Screen etc. Printer, Daisy wheel, Dot Matrix, Inkjet, Laser, Line Printer. Plotter, Sound Card and Speakers.</p> <p>इनपुट तथा आउटपुट डिवाइसेस इनपुट डिवाइस: कीबोर्ड, माउस, ट्रैकबॉल, जॉयस्टिक, डिजिटाइजिंग टेबलेट, स्कैनर्स, डिजिटल केमरा, एमआईसीआर, ओसीआर, ओएमआर, बार कोड रीडर, आवाज को पहचानने वाला, लाइटपेन, टचस्क्रीन। इनपुट डिवाइस मॉनीटर की विशेषताएं एवं मॉनीटर के प्रकार, वीडियो स्टैंडर्ड VGA, SVGA, XGA, LCD स्क्रीन आदि, प्रिंटर, डेजी व्हील, डॉट मैट्रिक्स, इंकजेट, लेजर, लाइन प्रिंटर, प्लॉटर, साउंड कार्ड्स एवं स्पीकर्स।</p>	ICT based class room teaching, Case Analysis, Group Presentation

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Unit – IV	<p>STORAGE DEVICES : Storage fundamental primary Vs Secondary. Various Storage Devices magnetic Tape. Cartridge Tape, Data Drives. Hard Drives, Floppy Disks, CD, VCD, CD-R, CD-RW, Zip Drive, DVD, DVD-RW.</p> <p>स्टोरेज डिवाइसेस स्टोरेज फंडामेंटल्स प्रथमरी विरुद्ध भिन्न स्टोरेज डिवाइसेस मैग्नेटिक टेप, कार्ट्रिज टेप, डाटा ड्राइव्स, हार्ड डिस्क ड्राइव्स फ्लोपी डिस्कस, सी.डी., वी.सी.डी., सी.डी. –आर.सी.डी– आर. डब्ल्यू, जीप ड्राइव, डी.वी.डी., डी.वी.डी., – आर. डब्ल्यू।</p>	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	<p>INTRODUCTION TO OPERATING SYSTEM : Introduction to operating systems, its functioning and types. basic commands of dos & Windows operating System.</p> <p>Disk Operating System (DOS) - Introduction, History and Versions of DOS.</p> <p>DOS Basics - Physical Structure of disk, Drive name, FAT, file & directory structure and naming rules, booting process, DOS system files.</p> <p>DOS Commands - Internal - DIR, MD, CD, RD, Copy, DEL, REN, VOL, DATE, TIME, CLS, PATH, TYPE etc. External CHKDSK, SCOPE, PRINT DISKCOPY, DOSKEY, TREE, MOVE, LABEL, APPEND, FORMAT, SORT, FDISK, BACKUP, MODE, ATTRIB HELP, SYS etc.</p> <p>ऑपरेटिंग सिस्टम का परिचय ऑपरेटिंग सिस्टम का परिचय, उसके लक्षण एवं प्रकार, डॉस एवं विन्डोज का मूल कमांड। डॉस बेसिक्स—</p> <p>फिजीकल स्ट्रक्चर ऑफ डिस्क, ड्राइव नेम, फेट, फाईल एवं डायरेक्ट्री स्ट्रक्चर एवं नेमिंग नियम, बूटिंग प्रक्रिया, डॉस सिस्टम फाईल्स।</p> <p>डॉस कमांडस—</p> <p>•आंतरिक कमांडस DIR, MD, CD, RD, Copy, DEL, REN, VOL, DATE, TIME, CLS, PATH, TYPE आदि।</p> <p>•बाह्य कमांडस CHKDSK, SCOPE, PRINT, DISKCOPY, DOSKEY, TREE, MOVE, LABEL, APPEND, FORMAT, SORT, FDISK, BACKUP, MODE, ATTRIB HELP, SYS आदि।</p>	ICT based class room teaching, Case Analysis, Group Presentation

PRACTICALS:-**DOS:**

- DOS commands: Internal & External Commands.
- Special batch file: Autoexec, Bar Hard disk setup. Windows 98:
- Desktop setting: New folder, rename bin operation, briefcase, and function. Control panel utility.
- Display properties: Screen saver, background settings.

MS Word:

- Creating file; save, save as HTML, Save as Text, Template, RTF Format.
- Page setup utility: Margin settings, paper size setting, paper source, layout.
- Editing: Cut, past special, undo, redo, find, replace, go to etc.
- View file: page layout, Normal Outline, master document, ruler header, footer, footline, full screen.
- Insert: break, page number, symbol, date & time, auto text, caption file, object, hyperlink, picture etc.
- Format: font, paragraph, bullets & numbering, border & shading, change case, columns.
- Table: Draw label, insert table, cell handling, table auto format, sort formula.

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COURSE OUTCOME:-

Student will be able to use computer system easily and they will get knowledge about how to use different type of operating system.

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Computer Operator, Office Assistant, Training and Support in Institutions/universities, Research and Academics, System Analyst in State and Central Research organization, Consultant in Software firms, Quality Assurance and Testing in Public and Private sectors, Application Customization and Development, Start own venture	Learn basic's of Computer, Computations, Network, Internet and Programming Languages, Time, Management, Speaking, Cooperating, Presenting	No Poverty, Quality Education, Industry Innovation and Infrastructure.	Can start own Computer Assistance services.

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SEMESTER- 1st
Course: B. Sc. Biotechnology

SubjectCode: 3HBHL-101
Theory Max. Marks: 25

SUBJECT: हिन्दी भाषा और संरचना

Theory Min. Marks: 08

पाठ्यक्रम के उद्देश्य:

1. विद्यार्थियों में राष्ट्र प्रेम की भावना का विकास करना।
2. हिन्दी के समृद्ध साहित्य को नयी पीढ़ी तक पहुँचाना।
3. पत्र-लेखन, सार लेखन, भाव पल्लवन एवं साक्षात्कार के कौशल का विकास करना।
4. जायरी, संस्मरण, लेखन, पारिभाषिक, शब्दावली, तत्सम, तद्भव, देशज, विदेशी शब्दों इत्यादि के ज्ञान का परिमार्जन करना।

Unit	Unit wise course contents	Methodology Adopted
इकाई-1	भारत वंदना - (काव्य) त्रिपाठी निराला जाग तुझको दूर जाना - सुश्री महादवी वर्मा स्वतंत्रता पुकारती जयशंकर प्रसाद - (काव्य) हम अनिकेतन - (काव्य) बालकृष्ण शर्मा नवीन भाषा की महत्ता और उसके विविध रूप भाषा-कौशल	व्याख्यान एवं काव्य मंच
इकाई-2	करुणा निबंध- (आचार्य रामचन्द्र शुक्ल समन्वय की प्रक्रिया (निबंध) - रामधारी सिंह दिनकर बिच्छी बुआ लक्ष्मण.डॉ - (कहानी) बिष्ट 'बटरोही' अनुवाद - परिभाषा प्रकार, महत्व, विशेषताएँ हिन्दी की शब्दसंपदा- पारिभाषिक शब्दावली	ग्रीन बोर्ड
इकाई-3	विलायत पहुंच ही गया - (आत्मकथांश) महात्मा गांधी अफसर (व्यंग्य) . शरद जोशी तीर्थयात्रा (कहानी) . डॉ. मिथलेश कुमार मिश्र मकड़ी का जाला (व्यंग्य) . डॉ. रामप्रकाश सकसेना वाक्य - संरचना : तत्सम, तद्भव देशज विदेशी	व्याख्यान, यू-ट्यूब लिंक से
इकाई-4	अप्प दीपो भव) वक्तृत्व कलास्वामी श्रद्धानंद - () भारत का सामाजिक व्यक्तित्व (प्रस्तावना) - जवाहरलाल नेहरू पत्र-लेखन के महाराजा को (पत्र-लेखन) . स्वामी वववेकानंद बुनी रहेंगी किताबें सुनीता रानी घोष.डॉ - (आलेख)	सत्रीय कार्य

	पत्र-लेखन महत्व और उसके विविध रूप सड़क पर दौड़ते ईहा मृग)निबंधश्यामसुन्दर.डॉ - (दुबे	
इकाई-5	योग की शक्ति (डायरी) डॉ. हरिवंश राय बच्चन कोश के अखाड़े में कोई पहलवान नहीं उतरता(साक्षात्कार) – भाषाविद डॉ. हरिदेव बाहरी से प्रो. त्रिभुवननाथ शुक्ल नीग्रो सैनिक से भेंट (यात्रा -संस्मरण) - डॉ. देवेन्द्र सत्याधी यदि बा न होती तो शायद गांधी को यह ऊँचाई न मिलती (साक्षात्कार) कथाकार - गिरिराज किशोर से सत्येन्द्र शर्मा सार लेखन भाव-पल्लवन साक्षात्कार और कौशल	प्रश्न मंच

अपेक्षित परिणाम :

- ☐ विद्यार्थी भारत भूमि से प्रेम व स्नेह के भावों को बढ़ा सकेंगे।
- ☐ विद्यार्थियों की हिन्दी की शब्द संपदा में वृद्धि होगी।
- ☐ पत्र-लेखन, सार लेखन, भाव पल्लवन साक्षात्कार के कौशल का विकास होगा।
- ☐ डायरी एवं संस्मरण लेखन विद्या का परिमार्जन होगा।
- ☐ हिन्दी के समृद्ध साहित्य कोश से लाभान्वित होंगे।

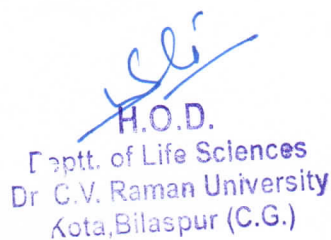
पाठ्य पुस्तक – हिन्दी भाषा और संरचना त्रिभुवन नाथ शुक्ल हिन्दी ग्रन्थ अकादमी भोपाल म.प्र।

संदर्भ ग्रंथ – हिन्दी भाषा और संरचना त्रिभुवन नाथ शुक्ल हिन्दी ग्रन्थ अकादमी भोपाल म.प्र।

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
शिक्षक, उद्घोषक	प्रातियोगी परीक्षा में लाभकारी	उच्च गुणवत्ता	साहित्य के क्षेत्र में रूचि




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SEMESTER- 1st

Course: B. Sc. Biotechnology

BIOTECHNOLOGY- I

(GENERAL MICROBIOLOGY & BIOTECHNOLOGY)

COURSE OBJECTIVE:

This course focuses on the general principles of microbiology and bacterial and virus cell structure and function.

Subject Code: 3SBBT103

Theory Max. Marks: 50

Theory Min. Marks: 17

Units	Unit Wise Course Content	Methodology Adopted
Unit-I	Unity of microbial world, scope of microbiology, Microbiology and human health, beneficial and harmful microbes. development of microbiology (contributions and pioneers).	ICT & Green Board based Class Room Teaching, individual presentation and though Microscope
Unit-II	Diversity of microbial world: principle of classification, classification of viruses, Bacteria (including Cyanobacteria) Fungi. Structure, Functional organization and economic importance of bacteria (Gram + ^{ve} and Gram - ^{ve}) and viruses (Plants and Animals).	ICT & Green Board based Class Room Teaching, individual presentation and though Microscope
Unit-III	Methods of studying microorganism: Origin of microbes, microscopy, pure culture techniques, Sterilization, Aseptic techniques, isolation of pure culture, conditions and media for growth of microorganisms in the laboratory.	ICT & Green Board based Class Room Teaching, individual presentation and though Microscope
Unit-IV	Nucleic Acid: DNA: Structure, types and replication, RNA: Structure, and types and Function, Structure of gene old and new concept.	ICT & Green Board based Class Room Teaching, individual presentation and though Microscope
Unit-V	Structure of gene, genetic code, transfer of genetic information; transcription, translation, protein synthesis, ribosomes. Regulation of gene expression in prokaryotes and eukaryotes	ICT & Green Board based Class Room Teaching, individual presentation and though Microscope

Course Outcomes:

Describe diversity of microorganisms, bacterial cell structure and function, microbial growth and metabolism, and the ways to control their growth by physical and chemical means.

PRACTICAL

- Preparation of solid/ liquid culture media
- Sterilization techniques.
- Isolation of single colonies on solid media
- Enumeration of Bacterial numbers by serial dilution and plating.
- Simple and differential staining.
- Measurement of microorganism (micrometry) and Camera Lucida drawings of isolated organism.
- Gram -^{ve} and Gram +^{ve} Bacteriatest.

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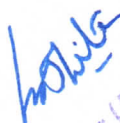
Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Cell biologist, biotechnologist	Pathology lab technician	Goal 04(Quality education) Goal 13(climate action) and Goal 15(Life and land)	Pathology lab



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SEMESTER- 1st

Course: B. Sc. Biotechnology

Subject Code: 3SBCH 104

Theory Max. Marks: 50

Theory Marks : 17

SUBJECT: CHEMISTRY-I (PHYSICAL, INORGANIC & ORGANIC Min. CHEMISTRY

Course Objective:

- To develop an understanding on the basics of mathematical concept, gaseous, liquid and colloidal states.
- To understand chemical kinetics, structure bonding and stereochemistry.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	<p>A. Mathematical Concepts : Logarithmic relations, curves stretching, linear graphs and calculation of slopes, Differentiation of functions like Kx, ex, xn, $\sin x$, $\log x$; maxima and minima, partial differentiation and reciprocity relations. Integration of some useful/relevant functions; permutations and combinations. Factorials, Probability.</p> <p>B. Gaseous States : Deviation from ideal behavior, van der Waals equation of state. Critical phenomenon : PV isotherms of ideal gases, continuity of states, the isotherms of van der Waals equations, relationship between critical constants and vander Waals constants, the law of corresponding states, reduced equation of states.</p>	<p>Usage of ICT techniques (PowerPoint, PDF and video lectures), Google classroom and black board (traditional) as per requirement of the topic.</p> <p>Use of Mathematical Models</p>
Unit-II	<p>A. Liquid State : Intermolecular forces, structure of liquids (a qualitative description) Liquid crystals: Difference between liquid crystal, solid and liquid. Classification, structure of nematic and cholestric phases. Thermography and seven segment cell.</p> <p>B. Colloidal State : Definition of colloids, classification of colloids. Solids in liquids (sols): properties- kinetic, optical and electrical; stability of colloids, protective action, Hardy-Schulze law, gold number. Liquids in liquids (emulsions) : types of emulsions, preparation. Emulsifier. Liquids in solids (gels): classification, preparation and properties, inhibition, general applications of colloids.</p>	<p>Usage of ICT enabled techniques (Power Point, PDF and video lectures), Google classroom and black board (traditional) as per requirement of the topic.</p> <p>Usage of Chemical modeling methods.</p>
Unit-III	<p>Chemical Kinetics : Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction concentration, temperature, pressure, solvent, light and catalyst. Concentration dependence of rates, mathematical characteristics of simple chemical reactions- zero order, first order, second order, pseudo order, half life and mean life. Determination of the order of reaction - differential method, method of integration, method of half life period and isolation method.</p>	<p>Usage of ICT (Power Point, PDF and video lectures) and black board (traditional) as per requirement of the topic.</p>
Unit-IV	<p>A. Structure and Bonding : Hybridizations, Bond lengths and bond angles, bond energy : Localized and delocalized chemical bond, van-der Waals interactions, inclusion compounds, clathrates, charge transfer complexes.</p>	<p>Usage of ICT (PowerPoint, PDF and video lectures) and black board (traditional) as</p>

	<p>resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.</p> <p>B. Mechanism of Organic reactions : Curved arrow notations, drawing electron movements with arrows, half-headed and double headed arrows, homolytic and heterolytic bond breaking.</p> <p>C. Types of Reagents : Electrophiles and nucleophiles. Types of organic reactions. Energy consideration. Reactive intermediates- carbocations, carbanions, free radicals and carbenes. Methods of determination of reaction mechanism.</p>	per requirement of the topic. NPTEL lecture video. E-UG Pathshala
Unit-V	<p>Stereochemistry : Concept of isomerism, types of isomerism, optical isomerism, elements of symmetry, molecular chirality, enantiomers, stereogenic centres, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, mesocompounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configurations, sequence rule, D & L, R & S systems of nomenclature. E and Z system of Nomenclature geometrical isomerism in alicyclic compounds. Conformation, conformational analysis of ethane and n-butane. Conformations of cyclohexanes, axial and equatorial bonds, Newman projection and Sawhorse formulae, Fischer and Flying wedge formulae.</p>	Usage of ICT (Power Point, PDF and video lectures) and black board (traditional) as per requirement of the topic. NPTEL video lecture

Course Outcomes: The knowledge gained on mathematical concepts, liquid state, chemical kinetics, structure & bonding and stereochemistry will provide a strong platform to understand the concepts on these subjects for further learning

Text And Reference Book

- Inorganic Chemistry (Part-I, Part-II), R.L. Dutta, NBS Publication.
- Unified Chemistry, Dr.M.M.Tandon, ShivalAgrawal& Comp.
- Synthetic Organic Chemistry, O.P.Agrawal, Krishna Prakashan Media Ltd.
- Physical Chemistry, K.L.Kapoor, Macmillan Pub. India, Ltd

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Chemist, Scientist, Analyst, Academic, food industries	Able to prepare chemical and understanding on the basics of mathematical concept	Goal04(quality education) Goal13 (climate action), Goal 15(Life on land), Goal03 (Good health & well being)	Food, cosmetic & water purification expert, good academician etc.

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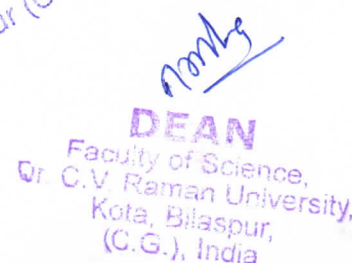
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SEMESTER- 1st

Course: B. Sc. Biotechnology

SUBJECT: CHEMISTRY-I

(PHYSICAL, INORGANIC & ORGANIC CHEMISTRY) PRACTICAL

Subject Code: 3SBCH104

Theory Max. Marks: 25

Theory Min. Marks : 08

Physical Chemistry

A. (Any one experiment will be asked in examination form the following carrying 06 Marks)

1. Calibration of thermometer
2. Determination of melting point
3. Determination of boiling point
4. Determination of mixed melting point
5. Preparation of solutions of various concentrations, NaOH, HCl, H₂SO₄.

Inorganic chemistry

B. (Any one experiment will be asked in examination form the following carrying 05 Marks)

1. To determine the velocity constant (specific reaction rate) of hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
2. To study the effect of acid strength on the hydrolysis of an ester.
3. To compare the strength of HCl and H₂SO₄ by studying the kinetics of hydrolysis of ester.
4. To study kinetically the reaction rate of decomposition of iodide by H₂O₂.
5. Determination of surface tension / percentage composition of given organic mixture using surface tension method.
6. Determination of viscosity / percentage composition of given organic mixture using viscosity method.

Organic chemistry

C. (Any one experiment will be asked in examination form the following carrying 04 Marks)

1. Distillation
2. Crystallization
3. Decolourisation and crystallization using charcoal
4. Sublimation

Viva: 5 marks

Records: 5 marks

Text And Reference Book

- Unified Practical Chemistry, Dr. M.M.Tandon, Shivalal Agrawal & Com.
- Unified Chemistry, Tandon, Rathore, Agrawal, Shivalal Agrawal & Com.

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SEMESTER- 1st

Course: B. Sc. Biotechnology

SUBJECT: ZOOLOGY-I (INVERTEBRATES & CELL BIOLOGY)

Subject Code: 3SBZO105

Theory Max. Marks: 50

Theory Min. Marks :17

COURSE OBJECTIVE:

This paper is aimed to introducing the students for the salient features of all Invertebrates, cell organization and celldivision.

Unit	Course Content	Methodology Adopted
Unit – I	Classification of Non Chordates upto classes according to Parker sand Heswell. (7th Edition) 1. Classification of lower Invertebrates. 2. Classification of higher invertebrates. 3. Protozoa – Type study of Plasmodium. 4. Porifera – Type study of Sycon.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	1. Coelenterata – Type study of Obelia. 2. Helminthes – Type study of Liver Fluke. 3. Annelida – Type study of Earthworm, Metamerism, Trochophore Larva.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	1. Arthropoda – Type study of Prawn. 2 Mollusca – Type study of Pila. 3. Echinodermata – External Features of Star Fish and Echinoderm Larvae.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	1. The cell – History of Cell Biology, Cell theory, Prokaryotic and Eukaryotic cell. 2. Microscopy : Compound and Electron Microscopy.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	1. Nuclear Organization of cell. 2. Extra nuclear organization of cell. 3. Cell reproduction – Amitosis, mitosis, meiosis.	ICT based class room teaching, Case Analysis, Group Presentation

COURSE OUTCOMES

The student have a knowledge of Classification and life cycle of invertebrates and cell division.

PRACTICALS

The Practical's work will be based on theory syllabus and the candidates will be required to show knowledge of the following –

1. Study of Museum Specimens, slides relevant to the type study in theory
2. Mounting (Temporary)
 - a. Mouth parts of insects
 - b. Statocyst of Prawn
 - c. Ctenidium and Osphradium of Pila
 - d. Scales of Teleost fish
 - e. Mounting Material
3. Major Dissection
 - a. Earthworm: Digestive system, nervous system and reproductive system.
 - b. Cockroach : Digestive system, Nervous system.

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- c. Prawn : Nervous System, Appendages.
- 4 Minor Dissection
- Hastate plate and appendages of Prawn.
 - Salivary glands of Cockroach.
 - Radula of Pila.
5. Cell Biology
- Study of Prokaryotic and eukaryotic cell.
 - Study of DNA and RNA models.
 - Squash preparation of chromosomes from onion root tip.
 - study of meiosis in grasshopper testis.

Practical

- Major Dissection
- Minor Dissection
- Mounting
- Spotting (Representative of Each phylum)
- Cytological exercise (any two)
- Viva
- Record & Collection

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity

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Semester- II

Course: B. Sc. Biotechnology

Subject: Foundation Course

Paper I: English Language and Indian Culture

Course Objective:

1. To Study the basic concept and Language Skills of English Language.
2. Comprehensive study of different kinds of vocabulary in English Language.
3. To Study the different era in every story and moods in poems.

Subject Code: 3HBEL201

Theory Max. Marks: 25

Theory Min. Marks: 08

	Course content	Methodology Adopted
Unit – I	1. Amalkanti: Nirendranath Chakrabarti 2. Sita: Toru Dutt 3. Tryst with Destiny: Jawaharlala Nehru 4. Delhi in 1857: Mirza Ghalib 5. Preface to the Mahabharata: C. Rajagopalachari 6. Where the Mind is Without Fear: Rabindranath Tagore 7. A Song of Kabir: Translated by Tagore 8. Satyagraha: M.K. Gandhi 9. Toasted English: R.K. Narayan 10. The Portrait of a Lady: Khushwant Singh 11. Discovering Babasaheb: Ashok Mahadevan	Reading , Usage of ICT(Power point, PDF, and video lectures) and black board (traditional) as per requirement of the topic
Unit – II	Comprehension	Reading aloud with expression
Unit – III	Composition and Paragraph Writing (Based on expansion of an idea).	Lectures , Usage of ICT(Power point, PDF, and video lectures) and black board (traditional) as per requirement of the topic
Unit – IV	Basic Language Skills: Vocabulary – Synonyms, Antonyms, Word Formation, Prefixes and Suffixes, Words likely to be confused and Misused, Words similar in Meaning or Form, Distinction between Similar Expressions, Speech Skill.	Discussion method, Usage of ICT(Power point, PDF, and video lectures) and black board (traditional) as per requirement of the topic
Unit – V	Basic Language Skills: Grammar and usage – The Tense Forms, Propositions, Determiners and Countable/Uncountable Nouns, Verb, Articles, Adverbs.	

Course Outcome:

1. Students will be able to understand the basic concept and Language Skills of English Language.
2. Students will be able to understand the different use of vocabulary in their sentences.
3. Students will be able to understand the varieties of stories on different issues and on different format.

Text Books:

1. English Language and Indian culture Dr. Neeraj Agnihatri, Dr. Sameera Nayeer Publisher Madhaya Pradesh Hindi Granth Academy, Bhopal.
2. English Grammar and Composition Wren & Martin S.CHAND & COMPANY LTD. New Delhi

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Reference Books:

1. Junior English Grammar Lucent Sharma R.K. Publication Patna.
2. A Senior English Grammar and composition Aggarwala N.K. Goyal Prakashan New Delhi.
3. A comprehensive Approach to English Grammar Shrivastava Avinash Pratap Indra Publishing House BPL.
4. Essentials of English Grammar Raymond Murphy Cambridge University press.
5. Learner's English Grammar and Composition N. D. V. Prasada Rao S. Chand & Company Ltd. New Delhi.

Job Opportunities	Employability Skill developed	UNDP Goal Achieved	Entrepreneurship Opportunity
Writer Asst. Professor Lecturer	Command on language Develop LSRW skills Research skill	Quality education Goal achieved	Research Guide Critic Publisher Novelist, Socialist

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SEMESTER-2nd

Course: B. Sc. Biotechnology

SUBJECT: FUNDAMENTALS OF ENTREPRENEURSHIP

Subject Code: 3MBFE101

Theory Max. Marks: 25

Theory Min. Marks: 08

COURSE OBJECTIVE:

Understanding basic concepts of entrepreneurship and key steps in the elaboration of business ideas, Developing personal creativity and entrepreneurial initiative.

Unit	Unit wise course contents	Methodology Adopted
Unit – I	Entrepreneurship-Definition, Characteristics and importance, Types and functions of an entrepreneur, merits of a good entrepreneur motivational factors of entrepreneurship.	Usage of ICT like PPT, Video Lectures, Black board.
Unit – II	Motivation to achieve targets and establishment of ideas. Setting targets and facing challenges. Resolving problems and creativity. Sequenced planning and guiding capacity, Development of self confidence. Communication skills, Capacity to influence, leadership.	Usage of ICT like PPT, Video Lectures, Black board.
Unit – III	Project Report- Evaluation of selected process. Detailed project report - Preparation of main part of project report pointing out necessary and viability. Selecting the form of Organization: Meaning and characteristics of sole Proprietorship, Partnership and cooperative committees, elements affecting selection of a form of an organization. Economic management -Role of banks and financial institutions banking, financial plans, working capital-evaluation and management, Cost and Price determination, Calculation of Profits, keeping of accounts.	Usage of ICT like PPT, Video Lectures, Black board.
Unit – IV	Production management - Methods of purchase. Management of movable assets/goods. Quality management. Employee management. Packing. Marketing management Sales and the art of selling. Understanding the market and market policy. Consumer management. Time management.	Usage of ICT like PPT, Video Lectures, Black board.
Unit - V	Role of regulatory institutions - district industry centre, pollution control board, food and drug administration, special study of electricity development and municipal corporation. Role of development organizations, khadi & village Commission/ Board, State Finance Corporation, scheduled banks, MP Women's Economics Development Corporation. self-employment-oriented. Understanding basic concepts of entrepreneurship and key steps in the elaboration of business ideas, Developing personal creativity and	Usage of ICT like PPT, Video Lectures, Black board.

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- Udhyaamita Vikas : U.C Gupta (Kailash Prakashan)
- Udhmita Vikas (H) : Entrepreneurship Development / by Tribhuvannath Shukl Bhopal: Madhya Pradesh Hindi Granth Academy,
- Varshney, G.K. (2010). Fundamental Of Entrepreneurship, Sahitya Bhawan Publications
- Agrawal and Mishra (2017) Fundamental Of Entrepreneurship, Sahitya Bhawan Publications.
- Fundamentals of Entrepreneurship by G.K. Varshney Agra Sahitya Bhawan
- Fundamentals of Entrepreneurship (H) by Avnish Kumar Mishra Agra Sahitya Bhawan
- Fundamentals of Entrepreneurship by H. Nandan New Delhi PHI Learning
- Fundamentals of Entrepreneurship and Small Business Management by Vasant Desai Mumbai Himalaya Publishing House
- Fundamentals of Entrepreneurship : Principles, Policies and Programmes by K.K. Patra
- Mumbai Himalaya Publishing House
- Fundamentals of Entrepreneurship by Sangram Keshari Mohanty New Delhi PHI Learning

Reference Books:

- Entrepreneurial Development : Dr. S.S. Khanka (S. Chand)
- Entrepreneurship Development : D. Acharya (Himalya Publication House)
- Entrepreneurship : New Venture Creation by David H. Holt New Delhi PHI Learning

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Manager, Purchase Officer, Project Auditor,	<ul style="list-style-type: none"> Self-confidence, Leadership, Creativity, Time Management 	No poverty, No Hunger, Quality Education, Decent work and Economic Growth, Sustainable Cities and Communities, Responsible Consumption and production	Entrepreneur, Project report developer


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SEMESTER- 2nd

Course: B. Sc. Biotechnology

SUBJECT: BIOTECHNOLOGY- II

(BIOTECHNOLOGY AND IMMUNOLOGY)

Subject Code: 3SBBT203

Theory Max. Marks: 50

Theory Min. Marks:17

COURSE OBJECTIVE:

Biochemistry is the study to understand the molecular basis of life and its role in the disease process. Immunology is the study of body defends itself against disease and helps us understand how the immune system is tricked into attacking its own tissue.

Unit	Course Content	Methodology Adopted
Unit – I	Structure and properties of mono and disaccharides, amino acids and peptides, bases; purines and pyrimidens, sugars; ribose, deoxyribose and nucleoside and nucleotide; general account of lipids.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Concept of macromolecules; Structural and functional organization of polysaccharides (starch, glycogen, cellulose, mucopolysaccharides), proteins.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Enzymes; historical account, classification, Co-enzymes and their role. Enzyme action, Enzyme kinetic. Km, Vm and Enzyme inhibition. Allosteric Enzymes and isoenzymes. Extracellular enzymes and their role.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Metabolism; General concept of metabolisms (anabolism, catabolism and amphibolism). Glycolysis TCA Cycle and HMP Shunt. Anaerobic catabolism of glucose; alpha, beta and gamma oxidation of fatty acids.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Concept of immunity, innate and acquired immunity. Brief account of cells and organs of immune system. Antigen and Antigenicity. Antibody structure and function. Antigen- Antibody reaction.	ICT based class room teaching, Case Analysis, Group Presentation

OUTCOME

Biochemistry is a specialised application of chemistry to biological samples. Immunology is the study of a patient's immune system.. Immunology testing is less automated than Biochemistry and results usually take about a week before they are available.

PRACTICAL

- General and specific qualitative test for carbohydrates
- General and specific qualitative test for amino acids
- General and specific qualitative test for lipids
- Estimation of Protein
- Estimation of blood glucose
- Assay of the activity of amylases
- Identification and Enumeration of White Blood Cells

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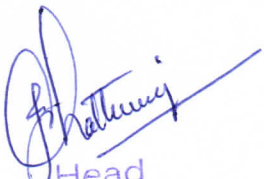
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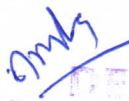
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- Identification of human bloodgroups.
- To perform Total Leukocyte Count of the given bloodsample.
- To perform DOT ELISA.
- To perform immunoelectrophoresis.

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Cell biologist, biotechnologist	Pathology lab technician	Goal 04(Quality education) Goal 13(climate action) and Goal 15(Life and land)	Pathology lab


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SEMESTER- 2nd

Course: B. Sc. Biotechnology

Chemistry –II (Physical, Inorganic & Organic Chemistry)

Course Objective:

Study of Chemical bonding , Noble gases ,S-block and P-block element .Brief discussion of Arenes and Aromaticity, cycloalkenes, dienes and alkynes.

Subject Code: 3SBCH 204

Theory Max. Marks: 50

Theory Min. Marks :17

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	<p>A. Atomic Structure : Idea of de Broglie's matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrödinger wave equation, significance of n and l, quantum numbers, radial and angular wave functions and probability distribution curves, effective nuclear charge.</p> <p>B. Periodic Properties : Atomic and ionic radii, ionization energy, electron affinity and electronegativity : definition, method of determination, trends in periodic table and applications.</p> <p>C. Chemical Bonding : Covalent bond- valence bond theory and its limitations, directional characteristic of covalent bond. Hybridization and shapes of simple molecules and ions. Valence Shell Electron Pair Repulsion (VSEPR) theory to NH_3, SF_4, ClF_3, ICl_2^- and H_2O. Molecular Orbital theory for homonuclear and heteronuclear (CO and NO) diatomic molecules</p>	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-II	<p>A. Solid State : Definition of space lattice, Unit cell, Laws of crystallography - (i) Law of constancy of interfacial angles (ii) Law of rationality of indices (iii) Laws of symmetry, Symmetry elements in crystals. Diffraction : X-ray diffraction by crystals, Derivation of Bragg's equation. Determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method).</p> <p>B. Ionic Solids : Ionic structures , radius ratio effect and coordination number, limitation of radius ratio rule, Lattice defects, semiconductors, lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarizability of ions. Fajan's rule, Metallic bond, free electron, Valence bond and Band theories.</p>	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-III	<p>A. s-Block Elements : Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems, an introduction to alkyls and aryls.</p> <p>B. p-Block Elements : Comparative study (including diagonal relationship) of groups 13-17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13-16. Hydrides of boron-diborane and higher boranes. Borazine, borohydrides. Fullerenes, carbides, fluorocarbons, silicates (structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens.</p>	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-IV	<p>A. Arenes and Aromaticity : Nomenclature of benzene derivatives. The aryl group, Aromatic nucleus and side chain structure of benzene, molecular formula and Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance and MO picture. Aromaticity the Huckel rule, aromatic ions. Aromatic and black board</p>	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.

	<p>electrophilic substitution, Mechanism of nitration, halogenation, sulphonation, and Friedel-Crafts reaction. Energy profile diagrams. Activating and deactivating substituents. orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Birch reduction. Methods of formation and chemical reactions of alkylbenzenes and biphenyl.</p> <p>B. Alkenes : Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regio-selectivity in alcohol dehydration. The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes, mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration-oxidation, oxymercuration-reduction, Epoxidation, ozonolysis.</p>	(traditional) as per requirement of the topic. Nptel lecture video
Unit-V	<p>A. Cycloalkenes, Dienes and alkynes : Methods of formation, conformation and chemical reactions of cycloalkenes, nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions - 1,2 and 1,4 additions, Diels-Alder reaction. Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration oxidation and polymerization.</p> <p>B. Alkyl and Aryl Halides : Nomenclature and classes of alkyl halides, methods of formation, chemical reactions; mechanisms of nucleophilic substitution reaction of alkyl halides, SN2 and SN1 reactions with energy profile diagrams.</p>	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic. NPTEL video lecture

Course Outcome Upon successful completion of this course, students will understand theories of chemical bonding and determine the molecular geometry of molecules using VSEPR theory. Understand the general and physical properties of matter.

Text And Reference Book

- Inorganic Chemistry (Part-I, Part-II), R.L. Dutta, NBS Publication.
- Unified Chemistry, Dr.M.M.Tandon, ShivalAgrawal& Comp.
- Synthetic Organic Chemistry, O.P.Agrawal, Krishna Prakashan Media Ltd.
- Physical Chemistry, K.L.Kapoor, Macmillan Pub. India, Ltd

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Chemist, Quantum mechanics, Scientist, Academic ,food industries	Analysis and Production of organic chemicals	Goal04(quality education) Goal13 (climate action), Goal 15(Life on land),Goal03 (Good health & well being)	Food, cosmetic & water purification expert, good academician etc.

PRACTICAL

Max. Marks 50

Duration of practicals during the entire semester: 90 hours

Duration of practical during the semester examination: 4 hours

Inorganic chemistry

Inorganic mixture analysis 12 Marks

Macro/Semi-micro Analysis- Cation analysis, separation and identification of ions from group I-VI, anion analysis

Separation of cations by paper chromatography. 4 marks

Preparation of ferrous alum. 8 marks

Organic Chemistry: (12 marks)

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1. Detection of elements (N, S and halogens) 2 elements, 4 marks
2. Functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and aniline) in simple organic compounds.

2 functional groups: 8 marks

Viva: 6 marks

Records: 8 marks

COURSE OUTCOME:-

Upon successful completion of this course, students will understand theories of chemical bonding and determine the molecular geometry of molecules using VSEPR theory. Understand the general and physical properties of matter.

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity

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SEMESTER- 2nd

Course: B. Sc. Biotechnology

SUBJECT: ZOOLOGY-II

(VERTEBRATES & DEVELOPMENTAL BIOLOGY)

Subject Code: 3SBZO205

Theory Max. Marks: 50

Theory Min. Marks:17

COURSE OBJECTIVE:

This paper is aimed to introducing the students for the salient features of all Vertebrates, and developmental biology

Unit	Course Content	Methodology Adopted
Unit – I	1. Origin of Chordates. Classification of phylum Chordata upto orders according to Parker and Haswell (Latest edition). 2. Hemichordata – External features and affinities of Balanoglossus.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	1. Urochordata – Type study of Herdmania (excluding Development). Cephalochordata – Type study of Amphioxus. Affinities of Amphioxus.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	1. Comparison between Petromyzon and Myxine. 2. Comparative account of limb bones and girdles of vertebrates (Amphibia, Reptiles, Birds and Mammals).	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	1. Parthenogenesis. 2. Gametogenesis. 3. Fertilization, Patterns of cleavage	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	1. Frog and chick embryology upto the formation of three germinal layers. 2. Fate map construction in frog & chick Gastrulation in frog and chick upto the formation of germinal layers. 3. Concept of competence, determination and differentiation. 4. Extra embryonic membranes in chick. 5. Concept of regeneration	ICT based class room teaching, Case Analysis, Group Presentation

PRACTICALS

The practical work will be based on theory syllabus and the candidates will be required to show knowledge of the following:

- Study of museum specimens and slides relevant to theory paper.
- Osteology
 - Girdles and limb bones of : Frog, Varanus, Fowl and Rabbit
- Cell Biologya.
 - Study of DNA and RNA Models.
 - Preparations of polytene chromosome in chironomous larva
 - Squash preparation of chromosome from Onion root tip.
 - Study of Meiosis in Grasshopper testis.
- Embryology : Study of different developmental stages of frog and chick – whole mounts and sections.

COURSE OUTCOME:-

The student have a knowledge of Classification and life cycle of Vertebrates, gametogenes is and formation of three germinal layers

Job opportunity	Employability skill Head developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
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SEMESTER- IIIrd

Course: B. Sc. Biotechnology

SUBJECT: हिन्दी भाषा संवेदना एवं संचार साधन

Subject Code: 3HBHL-302

Theory Max. Marks: 25

Theory Min. Marks: 08

पाठ्यक्रम के उद्देश्य:

1. विद्यार्थियों को भारतीय संवेदना, संस्कृति, वैश्विक चेतना से परिचित कराना।
2. धर्म, दर्शन, न्याय, नीति, साहित्य की प्राचीन व नवीन मान्यताओं से परिचित करवाना।
3. संचार संसाधनों से परिचित करवाना।
4. सिनेमा, रंगमंच, संगीत, चित्रकला इत्यादि से परिचित करवाना।

Unit	Unit wise course contents	Methodology Adopted
इकाई-1	1. भारतीय संस्कृति 2. भारतीय समाज व्यवस्था 3. सभ्यता एवं संस्कार 4. वैश्विक चेतना 5. समन्वयीकरण भारतीय अंतर्राष्ट्रीय संदर्भ में	व्याख्यान एवं नाट्य मंचन
इकाई-2	1. धर्म 2. न्याय 3. दर्शन 4. वैश्विक चेतना 5. साहित्य	ग्रीन बोर्ड
इकाई-3	1. संचार संसाधन : संपर्क के नए क्षितिज 2. समाचार पत्र 3. भारतीय प्रेस परिषद् 4. रेडियो 5. दूरदर्शन	व्याख्यान
इकाई-4	1. सिनेमा 2. रंगमंच 3. संगीत 4. चित्र, मूर्ति, स्थापत्य कला 5. शिल्प कला	सत्रीय कार्य
इकाई-5	1. कम्प्यूटर 2. दूरभाष सौगात विज्ञान की 3. मंत्र (कहानी) प्रेमचंद 4. मातृ भूमिगुप्त मैथिलीशरण : (कविता) 5. साहित्यकपाम का दायित्व डॉ. भारती प्रेम	प्रश्न मंच

अपेक्षित परिणाम : 1. विद्यार्थी आधुनिक संचार संसाधनों के प्रयोग में कुशल हो सकेंगे।

2. भारत की धर्म, दर्शन, नीति, संस्कृति, सभ्यता, संस्कारों इत्यादि के प्रति ज्ञान प्राप्त कर कुशल एवं संवेदनशील नागरिक बन सकेंगे।

पाठ्य पुस्तक - हिन्दी भाषा और संरचना त्रिभुवन नाथ शुक्ल हिन्दी ग्रन्थ अकादमी भोपाल म.प्र।

संदर्भ ग्रंथ - हिन्दी भाषा और संरचना त्रिभुवन नाथ शुक्ल हिन्दी ग्रन्थ अकादमी भोपाल म.प्र।

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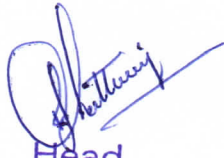
Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
शिक्षक, उद्घोषक	प्रातियोगी परीक्षा में लाभकारी	उच्च गुणवत्ता	साहित्य के क्षेत्र में रुचि




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SEMESTER- 3rd
Course: B. Sc. Biotechnology

Subject Code: 3BCA502
Theory Max. Marks: 25
Theory Min. Marks:08

SUBJECT: BASIC COMPUTER & INFORMATION TECHNOLOGY-II

COURSE OBJECTIVE:-

To educate students to analyze , design , integrate & manage information systems using information technology.

Unit	Course Content	Methodology Adopted
Unit – I	Word Processing: Word Introduction to word Processing. MS Word: features, Creating, Saving and Operating Multi document windows, Editing Text selecting, Inserting, deleting moving text. Previewing documents, Printing document to file page. Reduce the number of pages by one. Formatting Documents: paragraph formats, aligning Text and Paragraph, Borders and shading, Headers and Footers, Multiple Columns.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Introduction to Excel Excel & Worksheet : Worksheet basic. Creating worksheet, entering data into worksheet, heading information, data text, dates, alphanumeric, values, saving & quitting worksheet. Opening and moving around in an existing worksheet. Toolbars and Menus, keyboard shortcuts. Working with single and multiple workbook coping, renaming, moving, adding and deleting. coping entries and moving between workbooks. Working with formulas & cell referencing. Autosum. Coping formulas Absolute & Relative addressing.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	INTRODUCTION TO POWER POINT Features and various versions. Creating presentation using Slide master and template in various colour scheme. Working with slides make new slide move, copy, delete, duplicate, lay outing of slide, zoom in or out of a slide. Editing and formatting text: Alignment, editing, inserting, deleting, selecting, formatting of text, find and replace text.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	POWER POINT – II Bullets, footer, paragraph formatting, spell checking. Printing presentation Print slides, notes, handouts and outlines. Inserting objects Drawing and Inserting objects using Clip Arts picture and charts.	ICT based class room teaching, Case Analysis, Individual Presentation

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	Slide sorter, slide transition effect and animation effects. Presenting the show making stand alone presentation, Pack and go wizards.	
Unit – V	INTRODUCTION OF INTERNET Evolution, Protocol, concept, Internet, Dial-up connectivity, leased line, VSAT, Broad band, URLs, Domain names, Portals. E-mail, Pop & web based Email. Basic of sending and receiving Emails, Email & Internet Ethics, Computer virus, Antivirus software wage, Web Browsers.	ICT based class room teaching, Case Analysis, Group Presentation

PRACTICALS:-**MS- Power Point:**

Creating new slide, formatting slide layout, slide show & sorter, Inserting new slide, slide no., date, time, chart, formatting slide, tool operation.

List of suggested practical work:

- Under standing of a dial up connection through modern.
- Configuring a computer for an e-mail and using outlook Express or Netscape Messenger.
- Registration an e-mail address.
- Understanding of e-mail drafting.
- Understanding of address book maintenance for e-mail.
- Understanding of different mail program tools.
- Send and receive functions of e-mail.


Note- Minimum laboratory timing of six hours in a week.

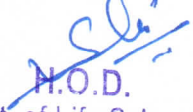
COURSE OUTCOME:-

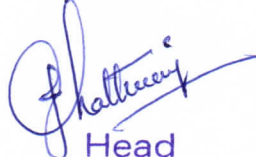
Student will be able to use computer system easily and they will get knowledge about how to use different type of operating system.

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Computer Operator, Office Assistant, Training and Support in Institutions/universities, Research and Academics, System Analyst in State and Central Research organization, Consultant in Software firms, Quality Assurance and Testing in Public and Private sectors, Application Customization and Development, Start own venture	Learn basic's of MS-word improve their skills with advanced features	No Poverty, Quality Education, Industry Innovation and Infrastructure.	Can start own Computer Assistance services.


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SEMESTER- 3rd

Course: B. Sc. Biotechnology

SUBJECT: BIOTECHNOLOGY-III – (MOLECULAR BIOLOGY)

Subject Code: 3SBBT303

Theory Max. Marks:50

Theory Min. Marks:17

COURSE OBJECTIVE:

- The field overlaps with other areas of biology and chemistry, particularly genetics and biochemistry.
- Molecular biology chiefly concerns itself with understanding the interactions between the various systems of a cell, including the interrelationship of DNA, RNA and protein synthesis and learning how these interactions are regulated.

Unit	Course Content	Methodology Adopted
Unit – I	History of molecular biology, model systems, concepts of molecular biology, early history of genetic engineering, genetic engineering concepts, ethical issue.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Mutations: spontaneous and induced, base pair change, frame shift, deletion, inversion, random duplication, insertion, useful phenotypes (auxotroph, conditional lethal, resistance). Reversion vs. suppression, Ames' test.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	DNA as genetic material; basic mechanism of replication, enzymes involved in replication, Enzymes involved in transcription translation, regulation of gene expression-transcription, translation and control of gene expression in microbes.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Genetic recombination; requirements, molecular basic, genetic analysis of recombination in bacteria, Biology of plasmids. Bacteriophage, lytic vs lysogenic phages, single stranded DNA phages.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Plasmid and phage vectors, restriction and ligation of vector and passenger DNA, transformation of host cells. selection vs screening of recombinant colonies, analysis recombinant clones, DNA sequencing.	ICT based class room teaching, Case Analysis, Group Presentation

COURSE OUTCOME:-

Molecular Biology gives depth knowledge of biological and/or medicinal processes through the investigation of the underlying molecular mechanisms.

PRACTICALS

- Exercise on paper and gelelectrophoresis
- Characterization of genetic markers of known bacterial strain
- Isolation of DNA from bacteria
- Isolation of Plasmid DNA
- Simple cloning using plasmid DNA as vector and transformation of competent *E.coli*
- Electrophoresis of Protein/DNA
- Estimation of DNA from Plant cells
- Preparation of Polytene chromosome from *Chironomus* larva/*Drosophila* larva
- Demonstration of mammalian sex chromatin.

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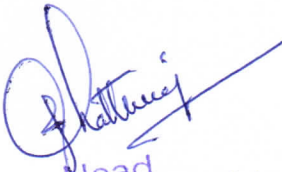
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- Preparations of temporary mount and study the different stages of Mitosis (Onion roottip).
- Demonstration of Southern Blot Technique.
- Perform electrophoresis of restricted DNA.
- Demonstration DNA amplification by PCR.
- Study of semi conservative replication of DNA through micrographs/schematic representations.
- Hybridization and detection of gene of interest)
- Demonstration of Northern Blotting.
- **Demonstration of Western Blotting.**

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Cell biologist, biotechnologist	Pathology lab technician	Goal 04(Quality education) Goal 13(climate action) and Goal 15(Life and land)	Pathology lab


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SEMESTER- 3rd
Course: B. Sc. Biotechnology

Subject Code: 3SBCH404
Theory Max. Marks: 50
Theory Min. Marks :17

SUBJECT: CHEMISTRY –III (PHYSICAL, INORGANIC & ORGANIC CHEMISTRY)

Course Objective: Study of efficiency and terms as well as thermodynamic process, spectrum, transition elements and coordination compounds

Unit	Course Content	Methodology Adopted
Unit – I	Thermodynamics-I Definition of thermodynamic terms: System, surrounding, Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work. First Law of Thermodynamics: Statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's Law: Joule Thomson coefficient and inversion temperature. Calculation of w , q , dU and dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process. Thermochemistry: Standard state, standard enthalpy of formation: Hess's Law of heat summation and its application. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermochemical data, temperature dependence of enthalpy, Kirchhoff's equation. Second Law of Thermodynamics- Need for the law, different statements of the law, Carnot cycle and its efficiency. Carnot theorem. Thermodynamic scale of temperature.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Thermodynamics-II (a) Concept of entropy: Entropy as a state function, entropy as a function of P&T, entropy change in physical change, Clausius inequality, entropy as criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases. Third Law of Thermodynamics: Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data, Gibbs and Helmholtz functions, Gibbs function (G) and Helmholtz function(A) as a thermodynamic quantities, A and G as a criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G and A with P, V and T.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Chemistry of elements of I transition series: Characteristic properties of d-block elements. Properties of the elements of the first transition series, their binary compounds such as carbides, oxides and sulphides. Complexes illustrating relative stability of their oxidation states, coordination number and geometry chemistry of elements of II and III transition series: General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry	ICT based class room teaching, Case Analysis, Group Presentation

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Unit – IV	<p>(a) Coordination Compounds: Werner's coordination theory and its experimental verification, EAN Concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, VBT of transition metal complexes.</p> <p>(b) Oxidation and Reduction: Use of redox potential data, analysis of redox cycle, redox stability in H₂O: Frost, Latimer and Pourbaix diagram. Principles involved in the extraction of elements.</p>	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	<p>(a) Alcohols: Classification and nomenclature. Monohydric alcohols: nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding, acidic nature, reactions of alcohols. Dihydric alcohols: nomenclature, methods of formation, chemical reactions of vicinal glycols, pinacole-pinacolone rearrangement. Trihydric alcohols-nomenclature and methods of formation, chemical reactions of glycerol.</p> <p>(b) Phenols: Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols: resonance stabilization of phenoxide ion. Reactions of phenols: electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis and Reimer-Tiemann reaction</p> <p>(c) Ethers and Epoxides Nomenclature of ethers and methods of their formation, physical properties. Chemical reactions: cleavage and auto oxidation. Ziesel's method. Synthesis of epoxides. Acid and base-catalysed ring opening of epoxides, orientation of epoxide ring opening, reaction of Grignard and organolithium reagents with epoxides.</p>	ICT based class room teaching, Case Analysis, Group Presentation

Course Outcomes

- Upon successful completion of this course, students will understand kinetics, equilibrium, LeChatelier's principle, acid and base reactions, pH, buffers, colligative properties, and electrochemical applications in an undergraduate laboratory.
- Understand the first law of thermodynamics and the role of energy and enthalpy in chemical reactions and perform thermochemical calculations.

Text And Reference Book

- Inorganic Chemistry (Part-I, Inorganic Chemistry (Part-I, Part-II), R.L. Dutta, NBS Publication.
 - Unified Chemistry, Dr.M.M.Tandon, ShivalAgrawal& Comp.
 - Synthetic Organic Chemistry, O.P.Agrawal, Krishna Prakashan Media Ltd.
 - Physical Chemistry, K.L.Kapoor, Macmillan Pub. India, Ltd
- The knowledge gained on mathematics concept, liquid state, chemical kinetics, structure & bonding and stereochemistry will provide a strong platform to understand the concepts on these subjects for further learning

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Chemist, Quantum mechanics, Scientist, Academic ,food industries	Knowledge of valuable chemical and thermochemistry	Goal04(quality education) Goal13 (climate action), Goal 15(Life on land),Goal03 (Good health & well being)	Food, cosmetic & water purification expert , good academician etc.

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SEMESTER- 3rd
Course: B. Sc. Biotechnology

Subject Code: 3SBCH404
Theory Max. Marks: 25
Theory Min. Marks : 08

SUBJECT: CHEMISTRY-III (INORGANIC & ORGANIC CHEMISTRY) PRAC.

PRACTICAL

Time: 6 hours

Inorganic Chemistry 7 marks

Calibration of the fractional weights, pipettes and burettes. Preparation of Standard Solutions. Dilution of 0.1 M to 0.001 M solutions.

Quantitative analysis -Volumetric analysis.

- Determination of acetic acid in commercial vinegar using NaOH.
- Determination of alkali content- antacid tablet using HCl.
- Estimation of calcium content in chalk as calcium oxalate by permagnometry.
- Estimation of hardness of water by EDTA

Gravimetric analysis:

Barium as barium sulphate

Organic Chemistry Laboratory Techniques 7 marks

A. Thin layer chromatography

Determination of R_f values and identification of organic compounds.

- Separation of green leaf pigments (spinach leaves may be used).
- Preparation and separation of 2,4-dinitrophenylhydrazones of acetone, 2-butanone, hexane-2 and 3-one using toluene and light petroleum (40:6).
- Separation of a mixture of dyes using cyclohexane and ethylacetate (8:5:1.5).

B. Paper chromatography:
Ascending and Circular Determination of R_f values and identification of organic compounds

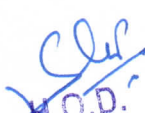
- Separation of a mixture of phenylalanine and glycine, alanine and aspartic acid, leucine and glutamic acid. Spray reagent ninhydrin.
- Separation of a mixture of DL-alanine, glycine and L-leucine using nbutanol: acetic acid: water (4:1:5). Spray reagent ninhydrin.
- Separation of monosaccharides- a mixture of D-galactose and Dfructose using n-butanol: acetone: water (4:1:5). Spray reagent-aniline hydrogen phthalate.

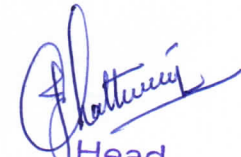
Text and Reference Book

- Experiments & calculations in chemistry, Dr.S.S.Dara, S.Chand & Company Lmt.
- Unified Chemistry, Dr. M.M.N. Tandon, Shivalal Agrawal & Com.


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SEMESTER- 3rd

Course: B. Sc. Biotechnology

SUBJECT: ZOOLOGY-III (GENETICS)

Subject Code: 3SBZO305

Theory Max. Marks: 50

Theory Min. Marks:17

COURSE OBJECTIVE:

This paper is aimed to introducing the students for Genetics and applied Genetics.

Unit	Course Content	Methodology Adopted
Unit – I	Heredity & Variation, Gene and Genetic Material <ol style="list-style-type: none">1. Chromosome: The Physical basis of heredity and transmitters of heredity.2. Types of chromosomes: Lampbrush, salivary gland and Beta Chromosomes.3. Nucleocytoplasmic interactions : Ultra structure of nucleus, nucleolus, Role of nucleus and nucleolus in nucleocytoplasmic interactions including Synthesis & Export of RNA, transport of Proteins4. Heredity and Variation : Sources of variation, Genotype, phenotype and environmental variations (elementary idea)<ul style="list-style-type: none">-Mendel's laws of heredity-Kinds of variations-Genetic basis of variation.5. Chemistry of Gene;<ul style="list-style-type: none">(a) Nucleic Acids and their structure.(b) Concept of DNA replication.(c) Nucleosome (Solenoid model).(d) Split genes, overlapping genes and Pseudo genes.(e) Genetic Code.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Cytoplasmic Inheritance, Gene Expression and Regulation <ol style="list-style-type: none">1. Cytoplasmic inheritance: Maternal effect on limnea (Shell Coiling), Kappa particles in Paramecium.2. Transcription in Prokaryotes and Eukaryotes3. Translation in Eukaryotes4. Gene Expression: Regulation of protein synthesis, transcription in Prokaryotes and Eukaryotes.5. Gene Expression: Operon model	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Linkage and Chromosomal Aberrations <ol style="list-style-type: none">1. Gene Linkage: Kinds and Theories of linkage, significance of linkage.2. Gene linkage, Mechanism of genetic recombination.3. Sex Chromosomes System: Sex differentiation, chromosome theory of sex determination.4. Sex linked inheritance (Haemophilia, Colour blindness)5. Structural changes in chromosomes.6. Numerical changes in chromosomes.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Mutation and Applied Genetics <ol style="list-style-type: none">1. Types of Mutation.2. Causes of mutation.3. Mutagens- classification, Types & effects.4. Gene therapy.5. DNA finger printing.	ICT based class room teaching, Case Analysis, Individual Presentation

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Unit – V	Human Genetics & Genetic Engineering <ol style="list-style-type: none"> Human chromosomes, Elementary idea of Human Genome Project Common genetic diseases in man (Autosomal syndromes, sex chromosome syndromes, diseases due to mutation-Sickle cell anaemia, Albinism & Alkaptonuria. Multiple factors and blood groups. Twins- physical traits, mental traits. Techniques used in recombinant DNA technology. Construction of Chimeric DNA, Elementary idea of plasmids & vectors. Gene cloning and Polymerase Chain Reaction (PCR) ,Gel Electrophoresis, Northern & Southern Blotting. 	ICT based class room teaching, Case Analysis, Group Presentation
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PRACTICAL

- Identification of spots related to theory.
- Squash preparation of onion root tip / Chironomous larva salivary gland/grass hopper testis.
- Study of instruments techniques related to applied genetics – PCR, Gel electrophoresis, DNA fingerprinting etc.
- Problems based on genetics.

COURSE OUTCOMES

The student have a knowledge of Gene, genetic code ,diseases and treatment.

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity



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Semester- IV

Course: B. Sc. Biotechnology

Subject: English Language and Scientific Temper

Course Objective:

1. To Study the basic language skills (speaking, listening, reading, and writing) and grammar
2. Comprehensive study of different kinds of letters and applications.
3. To study the different kinds of prose and poetry

Subject Code: 3HBEL402

Theory Max. Marks: 25

Theory Min. Marks: 08

	Course content	Methodology Adopted
Unit – I	1. Tina Morris : Tree 2. Nissim Ezekiel : Night of the Scorpion 3. C.P. Snow : Ramanujan 4. Roger Rosenblatt : The Power of WE 5. George Orwell: What is Science? 6. C.Rajagopalachari : Three Questions 7. Desmond Morris : A short extract from the Naked Ape 8. A.G. Gardiner : On the rule of the road	Reading , Usage of ICT(Power point, PDF, and video lectures) and black board (traditional) as per requirement of the topic
Unit – II	Comprehension of an unseen passage.	Reading aloud with expression
Unit – III	I Letter Writing: Formal Letters, Informal letters, Applications.	Lectures , Usage of ICT(Power point, PDF, and video lectures) and black board (traditional) as per requirement of the topic
Unit – IV	Report Writing.	Discussion method, Usage of ICT(Power point, PDF, and video lectures) and black board (traditional) as per requirement of the topic
Unit – V	Language Skills Correction of common errors in sentence structure : usage of pronouns, subject/ verb agreement word order, gender; compound nouns, collective nouns, possessives, articles and prepositions. (advanced)	

Course Outcome:

1. Student will be able to understand correct use of grammar and language skills.
2. Student will be familiar with different prose and poetry.
3. Student should be able to write analytically in a variety of formats, including essays, report writing and application.

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Text Book

1. English language and Scientific Temper- Dr. Padam Kumar Jain, Chawdhry Madhya Pradesh Hindi Granth Academy, Bhopal.
2. English Grammar and Composition Wren & Martin. S.Chand & Company Ltd New Delhi.
3. Descriptive English (For Competitive Examinations) S.J.Thakur, S.K. Rout. B.K Publication Private Limited

Reference Books:

1. A Senior English Grammar and composition Aggarwala N.K Goyal Prakashan New Delhi.
2. A comprehensive Approach to English Grammar Shrivastava Avinash Pratap Indra Publishing House- Bhopal.
3. General English Thakur A.k- Lucent Publication- Patna.
4. Essentials of English Grammar Raymond Murphy Cambridge University press.
5. Learner's English Grammar and Composition N.D.V.Prasada Rao (S. Chand & Company Ltd.) New Delhi.
6. Strengthen your Writing V.R Narayana Swami (Orient Longman) New Delhi.

Job Opportunities	Employability Skill developed	UNDP Goal Achieved	Entrepreneurship Opportunity
Writer Asst. Professor Lecturer	Command on language Develop LSRW skills Research skill	Quality education Goal achieved	Research Guide Critic Publisher Novelist, Socialist

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SEMESTER- IV

COURSE: B. SC. BIOTECHNOLOGY

SUBJECT:- HUMAN VALUES AND ETHICS

Subject Code: 3HBHP401

THEORY MAX. MARKS: 25

Theory Min. Marks: 08

COURSE OBJECTIVES:

- To help students understand the basic guidelines, content and process of Human value and value crisis in contemporary Indian Society
- To help students understand the meaning of happiness and prosperity for a human being.
- To help students reflect critically on gender violence .
- To facilitate the students to understand harmony at all the levels of human living, and live accordingly

	Unit wise course content	Methodology Adopted
UNIT-I	<p><i>Concept of value and value crisis in contemporary Indian Society.</i></p> <ol style="list-style-type: none"> 1. Concept of value 2. Value crisis at- individual level 3. Value crisis at- Cultural level 4. Value crisis at- Societal level 5. The Indian concept of value. 6. Modern Approach to the study of Values. 	<p>Usage of ICT (PowerPoint, Pdf and video lectures) and black board (traditional) as per requirement of the topic</p>
UNIT-II	<p><i>Moral and Ethical Human values.</i></p> <ol style="list-style-type: none"> 1. Bases for Moral Judgment 2. Some Canons of Ethics 3. Ethics of Duty 4. Ethics of Responsibility 5. Factors to be considered in making Ethical Judgments. Continuous Happiness and Prosperity- A look at basic Human Aspirations 	<p>Usage of ICT (PowerPoint, Pdf and video lectures) and black board (traditional) as per requirement of the topic</p>
UNIT-III	<p><i>Moral Values in Profession.</i></p> <ol style="list-style-type: none"> 1. What is Profession? 2. Professional Ethos 3. Code of Professional Ethics 4. Corporate social Responsibility 	<p>Usage of ICT (PowerPoint, Pdf and video lectures) and black board (traditional) as per requirement of the topic</p>
UNIT-IV	<p>Gender sensitization.</p> <ol style="list-style-type: none"> 1. Socialization of Women 2. Demographic consequences 3. Domestic Violence 4. Women's work, its politics and economics , fact and fiction <p>,Unrecognized and unaccounted work</p>	<p>Usage of ICT (PowerPoint, Pdf and video lectures) and black board (traditional) as per requirement of the topic</p>

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UNIT-V	Co- Curricular Activities and value Education. <ol style="list-style-type: none"> 1. Games and sports 2. Literary and cultural Activities 3. NSS, NCC activates 4. A New Approach to Human Value Freedom, Creativity Love & Wisdom 	requirement of the topic
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JRSE OUTCOMES:

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

Understand the significance of value inputs in a classroom and start applying them in their life and profession.

Understand the value of harmonious relationship based on trust and respect in their life and profession.

Students will develop a sense of appreciation of women in all walks of life .

Understand the role of a human being in ensuring harmony in society

ext Books-

- *Human Values,* Tripathy International Publishers
- *मूल्य, पर्यावरण और मानव अधिकार की शिक्षा* A.N. New Age
- *Human Values in Education* N.L. Gupta Concept Publishing
- *company* New Delhi

ferences

- A foundation course in Human Values Delhi and Professional Ethics Gaur R.R, Sangal R, Bagaria G P, Excel books, New
- *Indian Ethos and Modern Management* Bajpai B L, New Royal BoLucknow
- Human values Mishra Dr. RajanLaxmi PublicatiPVT Delhi
- Professional Ethics and Human values S. Dinesh Babu Laxmi Publications PVT.LTD
- Business Ethics and Communication Rathore , P.S., S. Chand Publishing Co. New Delhi

Jeevan Vidya ek Parichay Nagraj, A, Divya Path Sansthan, Amarkantak

MMENDED BOOKS -

Job Opportunities	Employability Skill Developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
	Action planning human value skills gender sensitization	Goal 04 (Quality Education Decent work economic growth achieved	Consultant for human values

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**DR. C.V.RAMAN UNIVERSITY**

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SEMESTER- 4th**Course: B. Sc. Biotechnology****SUBJECT: BIOTECHNOLOGY– IV
(INDUSTRIAL BIOTECHNOLOGY)****Subject Code: 3SBBT403****Theory Max. Marks: 50****Theory Min. Marks:17****COURSE OBJECTIVE:**

The objective is to develop biotechnology approaches that will yield 'green' industrial processes that are cost effective and sustainable.

Unit	Course Content	Methodology Adopted
Unit – I	Industrially important microbes and their products, screening, strain development strategies.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Fermented foods cheese production, use of enzymes in food industry, processing of milk and dairy products (Pasteurized milk, sterilized milk, cream and butter), enzymes in fruit juice and brewing industries (Fruit Juice and Wines, Beer), single cell protein.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Structure and types. Fermentation media, media sterilization, Types of fermentation (Batch and Continuous) and downstream processing.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Alcohol And Acid Production Industrial production of alcoholic beverages vinegar, Ethanol, organic acids, Amino acids and Antibiotics	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Tannery technology – Tanning – types of tanning – chrome tanning and vegetable tanning. Tanning Process (pre tanning, tanning, post tanning and finishing). Treatment of tannery effluents by microbes.	ICT based class room teaching, Case Analysis, Group Presentation

COURSE OUTCOMES:-

Industrial biotechnology is one of the most promising new approaches to pollution prevention, resource conservation, and cost reduction. It is often referred to as the third wave in biotechnology. If developed to its full potential, industrial biotechnology may have a larger impact on the world than health care and agricultural biotechnology.

PRACTICAL:-

- Demonstration for production of Penicillin
- Cultivation of edible mushrooms
- Production and estimation of alkaline protease.
- Study Isolation of industrially important microorganisms.
- Production of Citric acid, Lactic acid, alcohol.
- Production of bread and yoghurt
- Study of Bioreactor and its essential parts
- Microscopic observation of industrially important microorganisms using Light microscopy.
- Culturing and Characterization of microorganisms used in Dairy industry
- Study of microbial fermentations for the production and estimation (qualitative and quantitative) of:
 - (a) Enzyme: Amylase
 - (b) Amino acid: Glutamic acid
 - (c) Organic acid: Citric acid

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(d) Alcohol: Ethanol

(e) Antibiotic: Penicillin

- A visit to any educational institute/industry to see an industrial fermenter, and other downstream processing operations.

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Cell biologist, biotechnologist	Pathology lab technician	Goal 04(Quality education) Goal 13(climate action) and Goal 15(Life and land)	Pathology lab


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SEMESTER- 4th

Course: B. Sc. Biotechnology

SUBJECT: CHEMISTRY-IV (Physical, Inorganic & Organic chemistry)

Subject Code: 3SBCH404

Theory Max. Marks: 50

Theory Min. Marks : 17

Unit	Course Content	Methodology Adopted
Unit – I	<p>Phase equilibrium Statement and the meaning of the terms: phase component and the degree of freedom, derivation of the Gibbs phase rule. Phase equilibria of one component system: water, CO₂ and S system. Phase equilibria of two component system: solid liquid equilibria, simple eutectic: Bi-Cd, Pb-Ag system, desilverisation of lead.</p> <p>Solid solutions: compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (NaCl-H₂O) (FeCl₃-H₂O) and (CuSO₄-H₂O) system. Freezing mixtures, acetone-dry ice.</p> <p>Liquid-liquid mixtures: Ideal liquid mixtures, Raoult's and Henry's law. Non-ideal system azeotropes: HCl-H₂O and ethanol water systems.</p>	ICT based class-room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	<p>Electrochemistry Electrical transport- conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of specific conductance and equivalent conductance with dilution. Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Transport number: Application of conductivity measurements: determination of degree of dissociation, determination of K_a of acids, determination of solubility product of sparingly soluble salt, conductometric titrations.</p> <p>Definition of pH and pK, determination of pH using hydrogen, quinhydrone and glass electrodes by potentiometric methods.</p>	ICT based class room teaching, Case Analysis, Individual Presentation, Use of chemical modeling.
Unit – III	<p>(a) Chemistry of Lanthanides Elements: electronic structure, oxidation states, ionic radii and lanthanide contraction, complex formation, occurrence and isolation of lanthanide compounds.</p> <p>(b) Chemistry of Actinides: General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, Similarities between the later actinides and later lanthanides.</p> <p>(c) Acids and Bases: Arrhenius, Brønsted-Lowry, Lux-Flood, Solvent system and Lewis concepts of acids and bases.</p> <p>(d) Non-aqueous Solvents: Types of solvents and their general characteristics, reaction in non-aqueous solvents with reference to liquid NH₃ and liquid SO₂.</p>	ICT based class room teaching, Case Analysis, Group Presentation

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Unit – IV	<p>(a) Aldehydes and ketones: Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes and ketones. Physical properties. Mechanism of nucleophilic additions to carbonyl group aldol perkin and knovenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction, Mannich reaction. Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction. Clemmensen, Wolf-Kishner, LiAlH_4 and NaBH_4 reductions.</p> <p>(b) Carboxylic Acids: Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids, reactions of carboxylic acids. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation. Methods of formation and chemical reactions of unsaturated monocarboxylic acids.</p>	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	<p>Organic Compounds of Nitrogen Preparation of nitroalkanes and nitroarenes. Chemical reaction of nitroalkanes. Mechanism of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media, Picric acid.</p> <p>Halonitroarenes: reactivity, structure and nomenclature. Structure and nomenclature of amines, physical properties and stereochemistry of amines. Separation of mixture of primary, secondary and tertiary amines. Structural features affecting basicity of amines. Amine salt as phase transfer catalysts. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aldehydic and ketonic compounds. Gabriel-Phthalamide reaction, Hoffmann bromamide reaction, Reactions of amines, electrophilic aromatic substitution in aryl amines, reaction of amines with nitrous acid. Synthetic transformation of aryl diazonium salts, azo coupling.</p>	ICT based class room teaching, Case Analysis, Group Presentation

Course Outcomes

Upon successful completion of this course students will describe the bonding and properties of transition and inter transition element coordination compounds

Text And Reference Book

- Inorganic Chemistry (Part-I, Part-II), R.L. Dutta, NBS Publication.
- Unified Chemistry, Dr.M.M.Tandon, ShivrulAgrawal & Comp.
- Synthetic Organic Chemistry, O.P.Agrawal, Krishna Prakashan Media Ltd.
- Physical Chemistry, K.L.Kapoor, Macmillan Pub. India, Ltd

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Steel industries, pharmaceutical industries, food industries	Applied knowledge , Catalysis in industry	Goal04(quality education) Goal13 (climate action), Goal 15(Life on land),Goal03 (Good health & well being)	Food, cosmetic & water purification expert, subject course expert, Self-Coaching class expert & as a good academican etc.

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SEMESTER- 4th
Course: B. Sc. Biotechnology
SUBJECT: CHEMISTRY-III
(INORGANIC & ORGANIC CHEMISTRY) PRACTICAL

Subject Code: 3SBCH104
Theory Max. Marks: 25
Theory Min. Marks : 08

PRACTICAL

Time: 6 hours

Organic Chemistry 5 marks

Qualitative analysis

Identification of an organic compound through the functional group analysis, determination of melting point and preparation of suitable derivatives.

Physical Chemistry 5 marks

Transition temperature

1. Determination of transition temperature of given substance by thermometric, dilatometric method (e.g.) ($\text{MnCl}_2 \times 4\text{H}_2\text{O} / \text{SrBr}_2 \times 2\text{H}_2\text{O}$).

Phase equilibrium

1. To study the effect of solute (e.g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquid (e.g., phenol water system) and to determine the concentration of that soluble in phenol water system.

2. To construct the phase diagram of two component (e.g., diphenyl amine/benzophenone) by cooling curve method.

Thermochemistry

1. To determine the enthalpy of neutralization of weak acid/weak base versus strong acid/ strong base and determine the enthalpy of ionization of the weak acid/ base.

Inorganic chemistry-

Quantitative Volumetric Analysis

1. Estimation of ferrous and ferric by dichromate method.

2. Estimation of copper using thiosulphate.

Viva 5 Marks

Sessional 5 Marks

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SEMESTER- 4th

Course: B. Sc. Biotechnology

SUBJECT: ZOOLOGY-IV (ANIMAL PHYSIOLOGY)

Subject Code: 3SBZO405

Theory Max. Marks:50

Theory Min. Marks:17

COURSE OBJECTIVE:

This paper is aimed to introducing the students for animal physiology viz digestion ,respiration ,excretion, nervous and endocrine function

Unit	Course Content	Methodology Adopted
Unit – I	Nutrition, Metabolism 1. Physiology of digestion in mammals 2. Protein Metabolism-Deamination, decarboxylation.Transamination of amino acids, and Ornithine cycle. 3. Carbohydrate metabolism- Glycogenesis, Glycogenolysis, glycolysis, The Citric acid cycle, Gluconeogenesis. 4. Lipid Metabolism-Beta oxidation of fatty acids.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Respiration 1. Organs of respiration in mammals 2. Mechanism of respiration in mammals. 3. Physiology of respiration (transport of gases, chloride shift). 4. Properties and function of respiratory pigments.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Regulatory Mechanisms and Enzymes 1. Osmoregulation. 2. Physiology of Excretion- urea and urine formation in mammals. 3. Thermoregulation. 4. Definition and nomenclature of enzymes, classification of enzymes. 5. Mechanism of enzyme action.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Neuromuscular Co- ordination 1. Structure and properties of nervous tissue. 2. Physiology of nerve impulse conduction. 3. Types of muscles and their properties. 4. Theory of muscle contraction and its biochemistry	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Endocrine system 1. Structure and functions of Pituitary Gland. 2. Structure and functions of Thyroid Gland. 3. Structure and functions of Adrenal Gland. 4. Structure and functions of Parathyroid, Thymus and Islets of langerhan's.	ICT based class room teaching, Case Analysis, Group Presentation

PRACTICAL

- Detection of protein, carbohydrate and lipid.
- Study of Human salivary enzyme activity in relation to pH.
- Detection of nitrogenous waste products – Ammonia & Urea

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- Use of Kymograph
- Exercise on Haematology – Counting of RBC /WBC and Blood grouping in blood samples.
- Estimation of Haemoglobin in blood samples.
- Histological study of various endocrine glands –T. S. of Thyroid, T. S. of Pituitary gland , T. S. of Adrenal gland , T. S. of Testis, T. S. of Ovary.
- Histological study of Alimentary canal & various digestive organs – T.S of Stomach , T.S of Intestine , T.S of Pancreas, and T. S. of liver.
- Histological study of Visceral organs - T.S of Lungs, L.S. of Kidney
- Histological study of Muscles – Striated, Unstriated & Cardiac muscle.


COURSE OUTCOMES


The student have a knowledge of physiological diseases and treatment

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity




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SEMESTER- 5th

Course: B. Sc. Biotechnology

SUBJECT: ENVIRONMENTAL STUDIES

Subject Code: 3SBES501

Theory Max. Marks: 25

Theory Min. Marks 08

COURSE OBJECTIVE:

Student will be able to become proficient in the natural and physical sciences, as well as to be aware of social and cultural influences upon environmental problems facing society today.

Unit	Course Content	Methodology Adopted
Unit – I	Scope and importance of environmental studies. Natural resources: Renewable and non-renewable resources, Natural resources and associated problems. Forest, Water, Food, energy and land resources.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Ecosystems: Definition, concept, structure and functions. Producers, consumers and decomposers of an ecosystem. Energy flow in the ecosystem. Types of ecosystems. Bio-diversity: Definition, classification, threats to biodiversity and its conservation.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Environmental pollution: Causes, effects and control of air, water, soil, thermal, noise and marine pollution. Causes, effects and management of soil nuclear hazards. Solid waste management : Causes, effects and Control measures of urban industrial waste.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	The Environment Protection Act, The Air Act, The water Act, The Wildlife Protection. Act and Forest Conservation Act. Woman and child welfare, HIV/AIDS and Role of information technology on environment and human health.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Social issues and the environment, unsustainable to sustainable development. Urban problem related to energy, water conservation, rain water harvesting, watershed management Disaster types and Disaster management, Floods, earthquakes, cyclones and land slides.	ICT based class room teaching, Case Analysis, Group Presentation

Course Outcome:-

- The Environmental Studies minor supplements other majors to facilitate students' understanding of complex environmental issues from a problem-oriented, interdisciplinary perspective.
- Enable the student to acquire basic ideas about environment and emerging issues about environment problems.
- Aware about the need and importance of Natural Resources.
- Develop knowledge and understanding of the environment and enable the students to contribute towards maintaining and improving the quality of the environment.

Textbook and Reference Book

- Environmental Pollution Control in Process Industries, S.P.Mahajan
- Introduction to Air Pollution P.K.Trivedi
- Environmental Pollution Analysis, S.M.Kharpkar
- Environmental Pollution Engineering and Control, C.S.Rao

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- Environmental Chemistry, B.K. Sharma & H.Kaur.

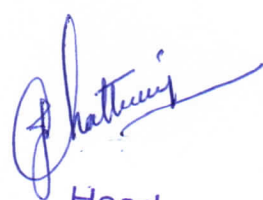
Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
aching, ironmental- cer/Chemist, ntist, Environmental ntist.	Able to solve Problem related Enzyme Peptide, Air and Water. Able to Understand Radiation Pollution	Goal 3: (UNDP) Good health and well-being Goal 6: (UNDP) Clean water and Sanitation Goal 15: Life on Land	Health & Environment Protection Service, Environmental Analyst/specialist with Eco-friendly approach & environmental initiatives



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SEMESTER- 5th

Course: B. Sc. Biotechnology

SUBJECT: INTRODUCTION TO SOFT SKILL & TEAM BUILDING

Subject Code: 3HBEL501

Theory Max. Marks: 25

Theory Min. Marks: 8

COURSE OBJECTIVE:

By the end of the soft skills training program, the students should be able to:

- Develop effective communication skills (spoken and written).
- Develop effective presentation skills.
- Conduct effective business correspondence and prepare business reports which produce results.
- Become self-confident individuals by mastering inter-personal skills, team management skills, and leadership skills.
- Develop all-round personalities with a mature outlook to function effectively in different circumstances.
- Develop broad career plans, evaluate the employment market, identify the organizations to get good placement, match the job requirements and skill sets.
- Take part effectively in various selection procedures adopted by the recruiters.

Unit	Unit wise course contents	Methodology Adopted
nit - I	General Introduction of self by students, Importance of the Training sessions, Importance of Presentation Skills, Public Speaking, Basic English Grammar Vocabulary, Kinds of Sentences, Verb, Adverb, Tenses, Preposition, Conjunction, Formation of Sentences, Sentence Making, Translation, Communication Skills Communication meaning, Function, Process, Types of communication, Barriers of communication, Guidelines for effective communication, Purpose of Good communication, Importance of right Pronunciation	Usage of ICT like PPT, Video Lectures, Black board.
nit - II	Listening and Writing Skills Importance of effective listening, Importance of effective writing skills, Conversation Practice, Guidelines for Effective writing, Body Language Gestures, Voice Modulation, Eye Contact, Facial Expression, Posture, Dressing Sense, Attire, Hand, movements, General Etiquette, Mannerism, Smiling Gestures, Confidence building, Exit walk, Behavioral skills Team Management, Time Management, Stress Management, Decision Making, Positive Thinking Attitude, self actualization, Working style	Usage of ICT like PPT, Video Lectures, Black board.
nit - III	Email Skills Email Etiquette, Email Drafting, Creating a Resume/ Resume writing tips Format and Content Resume, Fresher's Resume, Helpful Tips For Resume Writing, Things to avoid in Resume, Group Discussion Introduction "what is GD", Ability to Influence, Importance of Active Listening, Key Steps to succeed in GD Do's and Don'ts of GD.	Usage of ICT like PPT, Video Lectures, Black board.
nit - IV	Interview Skills/ Tips Groundwork before the Interview, Greeting Etiquettes, Self Introduction, Tips to answer "questions" Do's and Don'ts of Interview, Preparing a day before the interview, Things to remember during the Interview. Telephonic Interview and Video Conferencing Interview Tips Treat the Interview like a face to face Interview, Telephone Etiquette, Flow of Conversation.	Usage of ICT like PPT, Video Lectures, Black board.
nit - V	Corporate Etiquette Professional Attitude at work, Punctuality, Meeting etiquettes, Professional Dressing sense, Cordial Relation with Fellow workers	Usage of ICT like PPT, Video Lectures, Black board.

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COURSE OUTCOME:-

- The teaching methods in the soft skills training include lectures, projects, role plays, quizzes, and various other participatory sessions. The emphasis will be on learning by doing.
- Since the method of training is experiential and highly interactive, the students imbibe the skills and attributes in a gradual and subtle way over the duration of the program. The students will not only learn the skills and attributes but also internalize them over a period of time.
- Internalization ensures that the skills and attributes become part of the students' nature. Subtle changes are bound to occur in their behavior and outlook, and these will make them more self-assured and confident. Moreover, the behavior changes will be gradual and natural and will not appear artificial or put on. Thus, the changes in them will be genuine and positive.
- The Soft Skills training program is a credit course and the evaluation of the students takes place on a continuous basis. Active participation in activities, interest displayed by the students in acquiring the necessary attributes and skills and the commitment shown by them to improve in terms of attitudes are the main criteria for evaluation.

Text Books:

- Business Communication, Universal Pub. Agra – Dr. Ramesh Mangal

Reference Books:

- English Grammar- Wren & Martin
- Putting your best foot forward- Lt. Co. (Dr.) Pramod Deogirikar

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Soft Skill Trainer, HR Executive	<ul style="list-style-type: none"> • Writing skills, Communication skills, Soft skills, Stress management, Team working 	No Poverty, Zero hunger, Quality Education and Decent work and Economic Growth	Soft Skill Trainer

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SEMESTER- 5th

Course: B. Sc. Biotechnology

SUBJECT: DISCIPLINE SPECIFIC ELECTIVE-I

BIOTECHNOLOGY-V (INSTRUMENTATION BIOTECHNOLOGY AND COMPLEX)

Subject Code:3SBBT503

Theory Max. Marks:50

Theory Min. Marks:17

COURSE OBJECTIVE:

To ensure quality control in bioinformatics research through a scientific user committee, documentation, data traceability and reliability, CECILL licences, indicator measurement.

Unit	Course Content	Methodology Adopted
Unit – I	Chromatography; adsorption partition, column, gas, ion-exchange, gel Filtration and affinity Chromatography, HPLC, FPLC.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Electrophoresis techniques types and their application; Electrophoresis of proteins and nucleic acids.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Centrifugation and ultracentrifugation, Colorimetry, Microscopy-light, phase-contrast, fluorescence, dark field, electron microscopy.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Introduction to Bioinformatics. Genomics - information flow in biology, DNA sequence data. Nature of Biological data. Major Bioinformatics Resources: NCBI, EBI and ExPASy.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Introduction to computer fundamental, Organization. Evolution, Generation of computers (I, II, III, IV, V). Classification of computers (mainframes, minicomputers, microcomputers, special purpose). M Office.	ICT based class room teaching, Case Analysis, Group Presentation

COURSE OUTCOME:-

Knowledge and awareness of the basic principles and concepts of biology, computer science and mathematics existing software effectively to extract information from large databases and to use this information in computer modeling

PRACTICALS

- Exercise on colorimeter/spectrophotometer/pHmeter.
- Exercise on paper, thin layer, column chromatography
- Exercise on paper and gelelectrophoresis
- Exercise on tissue culture techniques.
- Absorbance curve for dyes.

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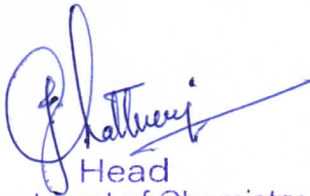
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- Exercise on lab instruments
- Testing of Beer's law
- Slide preparation
- To perform spreadsheet application
- Cell separation by Centrifugation
- Defined projects will be done by the students and evaluated by the instructor.
- Document Preparation
- Presentation Software
- Familiarizing with the Operating System, Control Panel, Networking Configuration, Firewall setting
- Spreadsheet Handling, Working with worksheets, Creating a spreadsheet, entering and formatting information, basic functions and formulas, creating charts, tables and graphs.

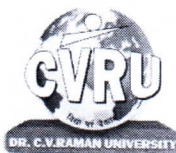
Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Cell biologist, biotechnologist	Pathology lab technician	Goal 04(Quality education) Goal 13(climate action) and Goal 15(Life and land)	Pathology lab


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SEMESTER- 5th

Course: B. Sc. Biotechnology

SUBJECT: DISCIPLINE SPECIFIC ELECTIVE-II

BIOTECHNOLOGY-V (ENVIRONMENTAL BIOTECHNOLOGY)

Subject Code:3SBBT504

Theory Max. Marks:50

Theory Min. Marks:17

COURSE OBJECTIVE:

One of the main objectives of environmental biotechnology is the conservation of resources via the recycling of waste materials.

Unit	Course Content	Methodology Adopted
Unit – I	1. Environment: Basic concepts and issues. 2. Environmental pollution: Type of pollution, 3. Air pollution and its control through Biotechnology.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	1. Water pollution and its control: waste water treatment – physical, chemical, biological processes. 2. Microbiology of waste water treatments, aerobic process; Activated sludge, oxidation ditches, trickling filter, rotating discs, rotating drums, oxidation ponds. 3. Anaerobic process: Anaerobic digestion, anaerobic filters,	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	1. Treatment schemes for waste water of dairy, distillery, tannery, sugar, antibiotic industries. Bioremediation. 2. Xenobiotics in Environment- Ecological considerations, oil pollution, surfactants, pesticides.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	1. Global Environment problems: Ozone depletion, UV-B, green house-effect and rain, their impact and biotechnological approaches for management. 2. IPR.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	1. Biodegradation of cellulose lignins and hydrocarbons (superbug). 2. Composting, treatment of solid wastes. 3. Bioaccumulation of metals and detoxification Outcome- Environmental biotechnology is a system of scientific and engineering knowledge related to the use of microorganisms and their products in the prevention of environmental pollution through biotreatment of solid, liquid, and gaseous wastes, bioremediation of polluted environments and biomonitoring of environment and treatment processes.	ICT based class room teaching, Case Analysis, Group Presentation

PRACTICALS

- To determine the Total dissolved solids of water (TDS).
- Determination of Dissolved oxygen (DO) of water.

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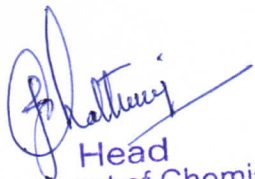
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- Determination of chemical oxygen demand (COD) of water.
- Determination of Biological oxygen demand (COD) of water.
- To Screen the antagonism between *Trichoderma* sp. And *Curvularia* sp.
- Determination of effect of fungicide on the growth of fungi (*Trichoderma* sp.).
- Effect of fungicide on the antagonism between *Trichoderma* sp. And *Curvularia* sp.
- To determine the Most Probable Number (MPN) of a given water sample

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Cell biologist, biotechnologist	Pathology lab technician	Goal 04(Quality education) Goal 13(climate action) and Goal 15(Life and land)	Pathology lab


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SEMESTER- 5th

Course: B. Sc. Biotechnology

SUBJECT: DISCIPLINE SPECIFIC ELECTIVE-III

BIOTECHNOLOGY-V (GENETICS & GENETIC ENGINEERING)

COURSE OBJECTIVE:

To impart basic knowledge and genetics techniques of various aspects of biotechnology. Biotechnology is the research oriented subject.

Subject Code: 3SBBT505

Theory Max. Marks: 50

Theory Min. Marks:17

Unit	Course Content	Methodology Adopted
Unit – I	Origin of life: Classical experiments and current concepts. Evolution of biological macromolecules, Evolution of early forms, Mendelian genetics: Model's Law, Chromosomal basis of heredity, Chromosomal analysis, allelic variation, dominance, linkage and crossing over.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Microbial genetics: genetics: genetics cross and analysis with special reference to E. Coil (conjugation, general and specialized transduction), Bacteriophage lamoda (lytic/lysogenic). Genetic mapping in eukaryotes: Drosophila; maize and Human examples. Sex determination, genetic disorder and chromosomal abnormalities.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Cloning, History of cloning, Isolation and Quantification of DNA vehicles, Plasmids, Bacteriophage, Phagemid & Cosmids. Selectio and Screening of Recombinants, Vectors of plants and animals, Expression Vectors, Gene Cloning and expression of foreign gene in bacteria.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Construction of genomic and DNA libraries. Production of transgenic microbes, Animals & plants and their application in Biotechnology. Gene Cloning in medicine, Production of protein from cloned genes.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Over expression conditions, production of inclusion bodies, solubilization, insoluble proteins, purification protocol, Determination of purity and activity of over expressproteins.	ICT based class room teaching, Case Analysis, Group Presentation

PRACTICALS

- Study of plant chromosome (Roottip).
- Study of animal chromosome (Chironomous larvae)
- Study of human chromosome (Slide)
- Estimation of DNA by the diphenylamine reaction.
- Estimation of RNA by the mean of orcinol reaction.
- Isolation and DNA from microbial, plant/animal.
- Isolation of RNA from Yeast.
- Isolation of chromosome DNA from bacteria.
- Isolation of plasmid DNA from bacteria.
- Isolation of nucleic acid (DNA/RNA) from biological material by perchloric acid method.
- Extraction in saline, buffer and solvent.
- Effect of UV radiation on microbial cell
- Demonstration of repair mechanism in microbes.
- Bacteriophage and determination of latent period of infection
- Isolation of total RNA from Plant tissue by SDS phenol method.

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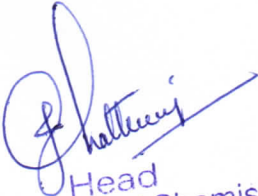
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COURSE OUTCOMES:-

- Origin of life: Classical experiments and current concepts. Microbial genetics:. Gene Cloning and expression of foreign gene in bacteria.
- Production of transgenic microbes, Animals & plants and their application in Biotechnology. Gene Cloning in medicine, Production of protein from cloned genes.

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Cell biologist, biotechnologist	Pathology lab technician	Goal 04(Quality education) Goal 13(climate action) and Goal 15(Life and land)	Pathology lab


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SEMESTER- 5th

Course: B. Sc. Biotechnology

SUBJECT: Chemistry-V (Physical Inorganic & Organic Chemistry)

Subject Code: 3SBCH503

Max. Marks: 50

Min. Marks:17

Course Objective: To Study the concepts of UV and IR spectroscopy and Bio-Organic & Bioinorganic Chemistry

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	<p>Spectroscopy – I (a) Electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom.</p> <p>(b) Rotational spectrum of diatomic molecules. Raman spectrum, application of Raman spectrum.</p> <p>Spectroscopy - II</p> <p>(a) UV Spectroscopy : Electronic excitation, elementary idea of instrument used, Applications to structure determination of organic molecules. Woodward-Fieser rule for determining max of , -unsaturated carbonyl compounds.</p> <p>(b) Infrared Spectrum : Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.</p>	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic, E-UG Pathshala, Google Classroom,
Unit-II	<p>Bioinorganic Chemistry - I Essential and trace elements in biological processes, metalloporphyrins with special reference to haemoglobin and myoglobin, Biological role of alkali and alkaline earth metal ions with special reference to Ca^{2+}. Nitrogen fixation.</p> <p>Bioinorganic Chemistry - II Role of metal ions in biological process, Na/K pump, metal complexes as therapeutic agents anticancer agents, antiarthirits drugs and chelation therapy</p>	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-III	<p><u>Inorganic Chemistry</u></p> <p>Hard and Soft Acids and Bases (HSAB) Classification of acids and bases as hard and soft, Pearson's HSAB concept, acid-base strength and hardness and softness, Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.</p> <p>Gravimetric Analysis Principles of gravimetric estimation, supersaturation, co-precipitation, post-precipitation and Ash treatment with respect to the estimation of Ba, Zn and Cu.</p> <p>Water Analysis Hardness, types of hardness-Temporary, permanent and total hardness, acidity and alkalinity, BOD, COD and DO.</p>	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-IV	<p>Carbohydrates - I Classification and nomenclature, monosaccharide, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharide, erythro and threo diastereoisomers. Conversion of glucose into mannose. Formation of glycosides, ethers and esters, determination of ring size of monosaccharide, cyclic</p>	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic. Nptel lecture video E-UG Pathshala

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	structure of D(+) glucose, mechanism of mutarotation. Structures of ribose and deoxyribose. Carbohydrates - II An introduction to glycosidic linkages in di- and poly-saccharides. Reducing and non reducing sugars. Structure determination of maltose, sucrose, starch and cellulose.	
Unit-V	Fat and oil -Elementary Idea of Fats, Oils and Detergents Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Soapnification value, iodine value, acid value. Soaps and Detergents : Soaps, synthetic detergents, alkyl and aryl sulphonates Synthetic Dyes: Colour and constitution (electronic concept). Classification of dyes. Chemistry and synthesis of methyl orange, Congo red, Malachite green, Crystal violet, Phenolphthalein, Fluorescein, Alizarin and Indigo	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.NPTEL video lecture

Course Outcomes – After completion of the course student will able to Understand the Spectroscopy ,acid/base reactions, their products, and how buffer systems work

Text And Reference Book

- Inorganic Chemistry (Part-I, Part-II), R.L. Dutta, NBS Publication.
- Unified Chemistry, Dr.M.M.Tandon, ShivrAm Agrawal & Comp.
- Synthetic Organic Chemistry, O.P.Agrawal, Krishna Prakashan Media Ltd.
- Physical Chemistry, K.L.Kapoor, Macmillan Pub. India, Ltd

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Steel industries, pharmaceutical industries, food industries, Rubber industry, Thermal insulation	Chemical analysis. Applied chemistry knowledge chemical production	Goal04(quality education) Goal13 (climate action), Goal 15(Life on land),Goal03 (Good health & well being)	Food, cosmetic & water purification expert good academician etc.

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SEMESTER- 5th

Course: B. Sc. Biotechnology

SUBJECT: Chemistry-V (Elective –I) Industrial Chemistry

Subject Code: 3SBCH504

Max. Marks: 50

Min. Marks: 17

Course Objective: Study of basic concept of distillation, evaporation, absorption, filtration and drying catalysis Microwave and Ultrasound assisted green synthesis, Green catalysis and its application. .

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	1. Distillation: Introduction, batch and continuous distillation, separation of azeotropes, plate columns and packed columns. 2. Absorption: Introduction, equipments, packed columns, spray columns, bubble columns, mechanically agitated contactors.	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-II	1. Energy Balance: Heat capacity of pure gases and gaseous mixtures at constant pressures, sensible heat changes in liquids, Enthalpy changes. 2. Drying: Introduction, free moisture, bound moisture, drying curve, equipments– traydryer, rotary dryer, flash dryer, fluid bed dryer, drum dryer, spray dryer.	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-III	1. Energy Balance: Heat capacity of pure gases and gaseous mixtures at constant pressures, sensible heat changes in liquids, Enthalpy changes. 2. Drying: Introduction, free moisture, bound moisture, drying curve, equipments– traydryer, rotary dryer, flash dryer, fluid bed dryer, drum dryer, spray dryer.	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-IV	Catalysis: Introduction, Types, Basic principles, mechanisms, factors affecting the performance, introduction to phase transfer catalysis, Enzymes catalyzed reactions- rate model, industrially important reactions. 2. Renewable Natural resources: Cellulose, Starch: - properties, modification, important industrial chemicals derived from them. Alcohols, oxalic acid and Furfura.	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic. Nptel lecture video
Unit-V	Utilities in Industry: Fuel: Types of fuels – advantages and disadvantages. Boilers: Types of boilers and their functioning. Water: Specifications for Industrial use, various water treatments. Steam: Generation and use. Fluid Flow: Fans, Blowers, Compressors, vacuum pumps, Ejectors. Pumps: Reciprocating pumps, Gear pumps, Centrifugal pumps. Heat Transfer: Heat exchangers- shell and tube type, finned tube heat exchangers, plate heat exchangers, refrigeration cycles.	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic. NPTEL video lecture

Course Outcomes - Knowledge of industrial chemistry and its application.

Reference books:

- 1. Catalysis, Heterogeneous and Homogeneous. DeMon Elsevier Science publisher.
- 2. Stoichiometry, B.T. Bhatt and S.N. Voras, Tata McGraw Hill Publishing Co. Ltd, New Delhi.

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- 3. Chemical Process Principles—Part-I, D.A. Hougen, K.M. Watson, R.A. Regatz Asia publishing House, Bombay.
- 4. Introduction to Chemical Engineering, W.L. Budger and I.T. Banchero, McGraw Hill Book Co. of U.S.A.
- 5. Industrial chemistry: B. K. Sharma
- 6. Riegel's Handbook of Industrial Chemistry: J. A. Kent CBS Publishers, New Delhi.
- 7. A Textbook of Engineering Chemistry, S. S. Dara: S. Chand & Company Ltd. New Delhi.
- 8. Environmental Chemistry: A. K. De, New Age International Pvt, Ltd, New Delh

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Steel industries, pharmaceutical industries, food industries. Power plant	Application and Production of chemical	Goal04(quality education) Goal13 (climate action), Goal 15(Life on land),Goal03 (Good health & well being)	Food, cosmetic & water purification expert good academician, chemical business etc.

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SEMESTER- 5th

Course: B. Sc. Biotechnology

SUBJECT: Chemistry-V (Elective –I) Green Chemistry

Subject Code: 3SBCH505

Max. Marks: 50

Min. Marks: 17

Course Objective: To Study the basic concepts of Green Chemistry, Green Reactions, Microwave and Ultrasound assisted Green synthesis, Green Catalysis and its application.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	Green Chemistry: Introduction- Definition of green Chemistry, need 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 examples of sonochemical reactions (Heck, Hunsdiecker and Wittig reactions).	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-II	Selection of solvent: i) Aqueous phase reactions ii) Reactions in ionic liquids, Heckreaction, Suzuki reactions, epoxidation. iii) Solid supported synthesis Super critical CO ₂ : Preparation, properties and applications, (decaffeination, dry cleaning)	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-III	Microwave and Ultrasound assisted green synthesis: Apparatus required, examples of MAOS (synthesis of fused anthro quinones, Leukart reductive amination of ketones) - Advantages and disadvantages of MAOS. Aldol condensation-Cannizzaro reaction, Diels-Alder reactions-Strecker's synthesis	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-IV	Green Catalysis: Heterogeneous catalysis, use of zeolites, silica, alumina, supported catalysis- biocatalysis: Enzymes, microbes Phase transfer catalysis (micellar/surfactant)	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.Nptel lecture video
Unit-V	Examples of green synthesis / reactions and some real world cases: 1. Green synthesis of the following compounds: adipic acid , catechol , disodium imino di 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)	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.NPTEL video lecture

Course Outcomes: After completion of the course the learners will be able to know about the reaction of Green catalysis, Microwave and Ultrasound assisted green synthesis and its modern application in Green Chemistry.

Reference books:

- Green Chemistry Theory and Practice. P.T.Anatas and J.C. Warner
- Green Chemistry V.K. Ahluwalia Narosa, New Delhi.
- Real world cases in Green Chemistry M.C. Cann and M.E. Connelly
- Green Chemistry: Introductory Text M.Lancaster, Royal Society of Chemistry (London)

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Deptt. of Life Sciences
Dr. C.V. Raman University
Kota Bilaspur (C.G.)

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- Green Chemistry: Introductory Text, M.Lancaster
- Principles and practice of heterogeneous catalysis, Thomas J.M., Thomas M.J., John Wiley
- Green Chemistry: Environmental friendly alternatives R S Sanghli and M.M Srivastava,
- Environmental Chemistry: A. K. De, New Age International Pvt, Ltd, New Delhi

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Pharmaceutical industries, food industries. Power plant, pollution controlling device	Green chemistry and catalysis information	Goal04(quality education) Goal13 (climate action), Goal 15(Life on land),Goal03 (Good health & well being)	Food, cosmetic & water purification expert good academician, chemical business etc.

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Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 5th

Course: B. Sc. Biotechnology

SUBJECT: Chemistry Practical - V

Subject Code: 3SBCH503

Practical Max. Marks: 25

Practical Min. Marks: 08

Time: 6 hour

Inorganic Chemistry 05 Marks

Analysis of inorganic mixture containing five radicals with at least one interfering radical (phosphate, borate, oxalate or fluoride).

Organic Chemistry 05 Marks

Preparation:

(i) Acetylation

(ii) Benzoylation

(iii) meta-Dinitrobenzene

(iv) Picric acid

Physical Chemistry 05 Marks

(i) Effluent Analysis

Identification of cations and anions in different water samples.

(ii) Water analysis

To determine the amount of dissolved oxygen in water samples in ppm units.

Viva 05 Marks

Sessional 05 Marks

Books:

- Unified Chemistry, Dr. M.M.N.Tandon, Shival Agrawal & Company.
- Experiment & Calculations in Engineering Chemistry, Dr. S.S. Dara, S.Chand & Com. Ltd.

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SEMESTER- 5th

Course: B. Sc. Biotechnology

**SUBJECT: DISCIPLINE SPECIFIC ELECTIVE-I
ZOOLOGY –V (APPLIED ZOOLOGY)**

Subject Code: 3SBZO503

Theory Max. Marks: 50

Theory Min. Marks:17

COURSE OBJECTIVE:

This paper is aimed to introducing the students for Aquaculture, Economic Entomology, toxicology and lab techniques.

Unit	Course Content	Methodology Adopted
Unit – I	Aquaculture <ul style="list-style-type: none">• Definition and scope of aquaculture.• Prawn culture –(Culture of fresh water prawn, Methods of prawn fishing, preservation and processing of prawns)• Pearl culture and Pearl Industry.• By products of fishing industry.• Frog culture, Breeding and selection.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Pisciculture <ul style="list-style-type: none">• General account of Edible fresh water fishes.• Carp culture: Management of ponds, Preservation and processing of fishes.• Maintenance of Aquarium• Plankton and their role in Fisheries.• Elementary knowledge of polyculture.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Economic Entomology <ul style="list-style-type: none">• Sericulture: Species of silkworm, life history of Bombyx mori, Sericulture Industry in India.• Apiculture –life cycle and species Methods of bee keeping, Products of bees, enemies of bees.• Lac culture: Lifecycle, Host Plant cultivation.• Common Pest: Stored Grains Sitophilus oryzae and Tribolium Castaneum, Vegetable pest Piers brassicae and Dacus cucurbitae..• Biological control of insect pests.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Toxicology <ul style="list-style-type: none">• Toxicology: Basic concepts,• Heavy metal toxicity- Pb, Cd, Hg.• Toxicity testing, LC 50, LD 50, acute and chronic toxicity.• Pesticide and their toxicological effect.• Occupational health hazards and their control	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Lab Techniques <ul style="list-style-type: none">• pH- Definition, Study of pH- meter, determination of pH.• Chromatography: Principles & Types of chromatography (Paper Chromatography).• Types of microtome and their uses.• General ideas of some common fixatives, stains and reagents.• Museum keeping, preservation and skeleton preparation, taxidermy(Bird)	ICT based class room teaching, Case Analysis, Group Presentation

PRACTICAL

1. Study of museum specimen of fresh water edible fishes.
2. Study of pH of Water and soil.

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3. Study of Chromatography (Paper Chromatography).
4. Study of working instrument : Microtome.
5. Study of different techniques for Museum Keeping..
6. Maintenance of aquarium.
7. Study of pests-
Stored grain pests- Sitophilus Oryzae & Tribolium castanaeum.
Vegetable pests- Pieris brassicae & Dacus cucurbitae
8. Study of Plankton – Euglena, Paramecium, Cyclops, Mysis, Daphnia

PRACTICAL MARKS DISTRIBUTION

1. Exercise based on pH determination
2. Exercise based on simple chromatography
3. Comments on instruments based on theory paper(any one) Exercise based on museum keeping techniques
4. Spotting
5. Viva
6. Practical record/collection

COURSE OUTCOMES

The student have a knowledge of different culture Skill to develop own Business, lab Techniques and self employment.

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity



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SEMESTER- 5th

Course: B. Sc. Biotechnology

**SUBJECT: DISCIPLINE SPECIFIC ELECTIVE-II
ZOOLOGY-V (WILDLIFE CONSERVATION)**

Subject Code: 3SBZO504

Theory Max. Marks: 50

Theory Min. Marks:17

COURSE OBJECTIVE:

This paper is aimed to introduce wildlife conservation ,endangered species ,santuries biosphere reserve Project Tiger and. Gir Lion.

Unit	Course Content	Methodology Adopted
Unit – I	1. Wild Life of India. 2. Types of Wild Life. 3. Value of Wild Life. 4. Positive negative of Wild Life.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	1. Wild Life protection act. 2. Conservation of wild Life in India. 3. Endangered species in India.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	1. Wild Life conservation. 2. National park in India. 3. Santuries in C.G & M.P.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	1. Project Tiger. 2. National animal and their conservation. 3. Project Gir Lion.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	1. Wild Life in M.P & C.G with references to mammals. 2. Biosphere reserves. 3. Bird santuries in India.	ICT based class room teaching, Case Analysis, Group Presentation

PRACTICAL

1. Wild life : Endangered and threatened species.
2. National animal and their conservation
3. Achanakmar Project Tiger.
4. Zoo Visit Kannan Pendari
5. Crocodile Project, National park in India.
6. Bird santuries in India.
7. Butterfly identification, Santuries ,Biospher Reserve

Course Outcomes

The student have a knowledge of different biosphere reserve, santuries ,wildlife conservation Skill to develop employment in Zoo.

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity

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SEMESTER- 5th

Course: B. Sc. Biotechnology

**SUBJECT: DISCIPLINE SPECIFIC ELECTIVE-III
ZOOLOGY-V (INDUSTRIAL BIOLOGY)**

Subject Code: 3SBZO505

Theory Max. Marks: 50

Theory Min. Marks:17

COURSE OBJECTIVE:

This paper is aimed to introduce micro-organism used in Fermentation. Vitamin, Enzyme Antibiotics, Alcohol, dairy products and other pathogenic treatment.

Unit	Course Content	Methodology Adopted
Unit – I	1. Vitamin.- Commercial production of vitamin. 2. Fermentation techniques 3. Microorganism used in alcohol.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	1. Antibiotics their importance 2. Antibiotics and their Producing companies. 3. Chemical nature of Penicillin.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	1. Biofertilizers 2. Vermi composting 3. Enzymes and their properties. 4. Industrial uses of enzymes.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	1. Microbiology of domestic water and sewage. 2. Microbiology of milk and milk products. 3. Industrial microbiology.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	1. Brief introduction to pathogenic Nemetodes. 2. Brief account, Life history and Pathogenicity of <i>Entamoeba, Trypanozoma, Giardia</i> . 3. Vector insects	ICT based class room teaching, Case Analysis, Group Presentation

PRACTICAL

1. Study of Micro-organism from soil.
2. Study of *Entamoeba, Trypanozoma, Giardia*.
3. Study of Microorganism used in alcohol.
4. Study of Microbiology of domestic water and sewage.
5. Study of Biofertilizers, Vermi composting
6. Study of Vector insect

COURSE OUTCOMES

The student have a knowledge of different micro-organism used for drug, alcohol vitamin, antibiotics, enzyme, dairy production Skill to develop own Business, marketing and self employment.

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity

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SEMESTER- 6th

Course: B. Sc. Biotechnology

**SUBJECT: DISCIPLINE SPECIFIC ELECTIVE-I
BIOTECHNOLOGY (APPLIED BIOTECHNOLOGY)**

Subject Code: 3SBBT603

Theory Max. Marks: 50

Theory Min. Marks:17

COURSE OBJECTIVE:

- To trained the students for industrial need and pursue further education.
- To include entrepreneurship among the student so as to start their own ventures in the field of biotechnology.

Unit	Course Content	Methodology Adopted
Unit – I	Introduction to plant tissue culture, Nutritional requirements, In vitro culture, Single cell culture, Somaclonal variations, Anther culture, Ovule culture. somatic . embryogenesis, Organogenesis	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Somatic hybridization, Genetic manipulation of plants using <i>Agrobacterium-tumefaciens</i> . The engineering of recombinant plasmids in higher plants. Isolated Microspore. Embryogenesis incereals.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Energy transfer in ecosystem, Renewable and non-renewable resources, Role of biotechnology in pollution, Type and management of pollution, Waste water treatment, xenobiotics, Bioremediation, green house effect, Ozone depletion, Bioleaching, biofertilizers, Biopesticides, Modern fuels, Biogas, Microbial H ₂ production.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Production of some important bioproducts, Antibiotic and beverages. Microbial role in food processes, operation and production, new protein post harvest technology and process of food preservation milk procession operations.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Medical application of rDNA technology, Human disorders associated with defects in protein/enzyme biosynthesis, DNA probes and their application in diagnosis of genetic and other disorders. Plant DNA finger printing.	ICT based class room teaching, Case Analysis, Group Presentation

COURSE OUTCOMES

Students will be able to:

To introduced the plant tissue culture ,Nutritional requirements, In vitro culture, Single cell culture, Somaclonal variations, Anther culture, Ovule culture somatic embryogenesis, Organogenesis.To the study of DNA probes and their application in diagnosis of genetic and other disorders. Plant DNA finger printing

PRACTICALS

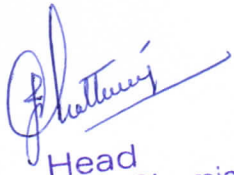
- Growth of plant tissue into undifferentiated mass of callus.
- Preparation of animal cell culture media.
- Separation and culture of lymphocyte from blood.
- Demonstration of fermentor.
- Preparation of wine.
- Effects of toxicants on microbes.
- Effects of toxicants on animal cell.

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- Extraction of citric acid from *Aspergillus*.
- Production of ethanol by yeast.
- Demonstration of PCR.
- Immobilization of yeast cells.
- Immobilization of enzyme.
- Extraction and preparation of lactic acid.
- Extraction and preparation of citric acid.
 - a. Demonstration of Radial immunodiffusion analysis.
 - b. Isolation of microorganism from polluted site/ industrial waste.

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Cell biologist, biotechnologist	Pathology lab technician	Goal 04(Quality education) Goal 13(climate action) and Goal 15(Life and land)	Pathology lab


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SEMESTER- 6th

Course: B. Sc. Biotechnology

SUBJECT: DISCIPLINE SPECIFIC ELECTIVE-II

Subject Code: 3SBBT604

Theory Max. Marks: 50

Theory Min. Marks: 17

BIOTECHNOLOGY (RECOMBINANT DNA TECHNOLOGY)

COURSE OBJECTIVE:

To familiarize the student with emerging field of biotechnology i.e. Recombinant DNA Technology as well as to create understanding and expertise in wet lab techniques in genetic engineering.

Unit	Course Content	Methodology Adopted
Unit – I	Scope and aim of the Biotechnology, Recombinant DNA Technology: General concept and Application Strategies of recombinant DNA technology in Prokaryotes. Restriction Enzymes: endonuclease (type, Nomenclature, Restriction, Sequence and Cleavage Pattern)- a. Modification of cutends b. Steps in genecloning c. Isolation of the desired gene d. DNA Library, Genomic Library	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	1. Vectors (Animal and Plant vectors) 2. Bacteriophage Vectors 3. Introduction of vectors into appropriate host	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	1. PCR- Procedure (denaturation Annealing extension) 2. Types of PCR 3. Applications advantages and Limitation of PCR.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Monoclonal Antibodies: Structure, Production, Application Genome map and Genome Project, Apoptosis.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	1. Stem cell technology 2. Targeted Gene Transfer 3. DNA Fingerprinting 4. Transgenic animals and Plants	ICT based class room teaching, Case Analysis, Group Presentation

Outcomes

At the end of the course, the students will have sufficient scientific understanding of the subject and have good knowledge of application of Recombinant DNA techniques in Life Sciences Research.

PRACTICALS

- Demonstration for isolation of DNA from:
 - Bacteria (genomic)
 - Bacteria (Plasmid)
 - Plants
- Demonstration for Isolation of RNA.
- Demonstration of DNA from Plant Cells.

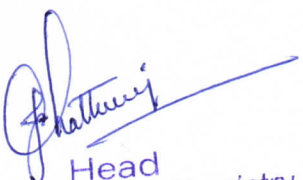
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- Separation of animal genomic DNA by Agarose gelelectrophoresis
- Separation of Bacterial proteins by vertical SDS-PAGEelectrophoresis
- Transformation
- Digestion of DNA using restriction enzymes and analysis by agarose gel electrophoresis.
- Ligation of DNAfragments.
- Demonstration ofPCR.
- Interpretation of sequencing gelelectropherograms.

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Cell biologist, biotechnologist	Pathology lab technician	Goal 04(Quality education) Goal 13(climate action) and Goal 15(Life and land)	Pathology lab


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SEMESTER- 6th

Course: B. Sc. Biotechnology

SUBJECT: DISCIPLINE SPECIFIC ELECTIVE-III

BIOTECHNOLOGY (PLANT AND ANIMAL TISSUE CULTURE
TECHNIQUES AND ITS APPLICATION BIOTECHNOLOGY)

Subject Code: 3SBBT605

Theory Max. Marks: 50

Theory Min. Marks:17

COURSE OBJECTIVE:

This course focuses on the Laboratory organization & Plant and Animal Tissue Culture Techniques and its application.

Unit	Course Content	Methodology Adopted
Unit – I	Introduction to Techniques - Introductory history, Laboratory organization, Media, Aseptic manipulation. Basic concepts in cell culture - cell culture, Cellular Totipotency, Somatic Embryogenesis.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	In vitro culture : approaches & methodologies - preparation steps for tissue culture, surface sterilization of plant tissue material, basic procedure for aseptic tissue transfer, incubation of culture.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Tissue nutrition : Growth Hormones - Plant cells (Composition of culture media, Growth hormones, Vitamins, Unidentified supplements, selection of media); Animal cells (substrate on which cells grow, Feeder layer on substrate, gas phase for tissue culture, media and supplements).	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Tissue culture methodologies - Plant cells (Callus Culture, Cell Suspension Culture, Organ Micro-culture, plant micro-propagation, Somatic Embryogenesis); Animal cells (Source of tissue, primary culture, differentiation of cells, growth kinetics, animal cell lines and their origin and characterization).	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Cloning & Selection of specific cell types – cloning, somatic cell fusion and HAT selection, Medium suspension fusion, selection of Hybrid clone, production of monoclonal antibodies. Organ Culture - Culture of embryonic organs, whole embryo culture, culture of adult organs.	ICT based class room teaching, Case Analysis, Group Presentation

COURSE OUTCOME:-

Student able to, Plant And Animal tissue culture Laboratory organization & Cloning.

PRACTICAL:

1. Antigen-Antibody reactions – Agglutination (Blood grouping testing).
2. Antibody titration (Ouchterlony Double Diffusion).
3. Antigen-Antibody reactions – Immuno-electrophoresis, Rocket immuno-electrophoresis.
4. Antigen-Antibody reactions – Coombs' test
5. Antigen-Antibody reactions – ELISA.
6. In vitro Culture - Washing & Sterilization, Preparatory steps for tissue culture, surface sterilization of plant material, basic procedures for Aseptic tissue transfer, incubation of culture
7. Preparation of Culture media & Reagents - Media composition, Nutrition, Hormones.
8. Tissue Culture – Callus culture, Cell suspension
9. Organ Micro-culture - Shoot tip, excised root, Leaf culture.
10. Plant micro-propagation – micro-culture of plants.

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Cell biologist, biotechnologist	Pathology lab technician	Goal 04 (Quality education) Goal 13 (Climate action) and Goal 15 (Life and land)	Pathology lab

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SEMESTER- 6th

Course: B. Sc. Biotechnology

SUBJECT: Chemistry-VI

(Physical Inorganic & Organic Chemistry)

Subject Code: 3SBCH 603

Max. Marks: 50

Min. Marks-17

Course Objective: To Study the basic concepts of photochemistry, solution, Inorganic polymer, preparation and properties of organometallic compounds.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	(a) Photochemistry Interaction of radiation with matter, difference between thermal and photochemical process. Law of photochemistry-Grotthus-Draper law, Stark-Einstein law, Beer-Lambert's law. Determination of rate constant of unimolecular reactions. Electronic transitions, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions-energy transfer processes	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic .E-UG Pathshala
Unit-II	(a) Solutions, dilute solutions and colligative properties-I Ideal and non ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient. Dilute solutions- colligative properties. Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis, law of osmotic pressure and its measurements, determination of molecular weight from osmotic pressure. (b) Solutions, dilute solutions and colligative properties-II Elevation of boiling point and depression of freezing point. Thermodynamic derivation of relation between molecular weight and elevation of boiling point and depression in freezing point. Experimental methods of determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solute.	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-III	Inorganic polymers: Introduction and scope of inorganic polymers, special characteristics, classification, homo and hetero atomic polymers and their applications. Silicones and phosphazenes as examples of inorganic polymers, nature of bonding in triphosphazenes.	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-IV	Organometallic chemistry (a) Definition, nomenclature and classification of organometallic compounds. Preparation, properties, bonding and applications of alkyls and aryls of Li, Al, Hg, Sn and Ti. (b) A brief account of metal-ethylenic complexes and homogeneous hydrogenation; mononuclear carbonyls and the nature of bonding in metal carbonyls. Transition metal organometallic compounds with bonds to hydrogen and boron. (c) Metal nitrosyls: modes of coordination, nature of bonding and probable applications.	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic. Nptel lecture video E ug Pathshala
Unit-V	(a) Organometallic compounds: Organomagnesium compounds, The Grignard reagents-formation, structure and synthetic applications,	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.

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V	<p>organozinc compounds, formation and chemical reactions, Organolithium compounds-formation and chemical reactions.</p> <p>(b) Organic synthesis via enolates Organic synthesis via enolates, acidity of α-hydrogens, alkylation of diethylmalonate and ethylacetoacetate. Synthesis of ethylacetoacetate, the Claisen condensation, keto-enol tautomerism of ethylacetoacetate. Alkylation of 1, 3-dithianes, alkylation and acylation of enamines.</p> <p>(c) Organosulphur compounds Nomenclature, structural features.</p> <p>(d) Amino acids Classification, structure, stereochemistry of amino acids, acid base behaviour, isoelectric point, general methods of preparation and properties of α-amino acids</p>	board (traditional) as per requirement of the topic, NPTEL video lectures, Use of chemical models with structural elucidation, Google Classroom, other digital tools along with Chem-draw Softwares.
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Course Outcomes – After completion of the course student will be able to understand the physical photochemistry, application of inorganic polymers and organometallic compounds.

Text And Reference Book

- Inorganic Chemistry (Part-I, Part-II), R.L. Dutta, NBS Publication.
- Unified Chemistry, Dr.M.M.Tandon, ShivalAgrawal& Comp.
- Synthetic Organic Chemistry, O.P.Agrawal, Krishna Prakashan Media Ltd.
- Physical Chemistry, K.L.Kapoor, Macmillan Pub. India, Ltd

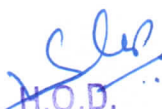
Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Steel industries, pharmaceutical industries, food industries, Rubber industry, Thermal insulation officer	Analysis and problem-solving. time management and organization. Applied knowledge chemical production	Goal04(quality education) Goal13 (climate action), Goal 15(Life on land),Goal03 (Good health & well being)	Food, cosmetic & water purification expert good academician etc.



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SEMESTER- 6th

Course: B. Sc. Biotechnology

SUBJECT: Discipline Specific Elective-II (Bio-Chemistry)

Subject Code: 3SBCH 604

Theory Max. Marks: 50

Theory Min. Marks: 17

Course Objective: To Study & know about the basic concepts of biochemistry, Cellular mechanisms, cell biology, chemical entities supporting life, Vitamins, Carbohydrates, lipids, proteins, enzymes, DNA, RNA, and their Structure and classification as well as their physical, chemical and optical properties.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	Introduction: The foundations of biochemistry and Vitamins Cellular and chemical foundations of life . Structure and active forms of water soluble and fat soluble vitamins, deficiency diseases and symptoms, hypervitaminosis.	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-II	Unique properties, weak interactions in aqueous systems, ionization of water, buffers, water as a reactant and fitness of the aqueous environment.	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-III	Carbohydrates and glycobiology Monosaccharides - structure of aldoses and ketoses, ring structure of sugars, conformations of sugars, mutarotation, anomers, epimers and enantiomers, structure of biologically important sugar derivatives, oxidation of sugars. Formation of disaccharides, reducing and non-reducing disaccharides. Polysaccharides – homo- and heteropolysaccharides, structural and storage polysaccharides. Structure and role of proteoglycans, glycoproteins and glycolipids (gangliosides and lipopolysaccharides). Carbohydrates as informational molecules, working with carbohydrates	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-IV	Building blocks of lipids - fatty acids, glycerol, ceramide. Storage lipids -triacyl glycerol and waxes. Structural lipids in membranes – glycerophospholipids, galactolipids and sulpholipids, sphingolipids and sterols, structure, distribution and role of membrane lipids. Plant steroids. Lipids as signals, cofactors and pigments	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic. Nptel lecture video
Unit-V	Structure and classification, physical, chemical and optical properties of amino acids Nucleic acids Nucleotides - structure and properties. Nucleic acid structure – Watson-Crick model of DNA. Structure of major species of RNA - mRNA, tRNA and rRNA. Nucleic acid chemistry - UV absorption, effect of acid and alkali on DNA. Other functions of nucleotides - source of energy, component of coenzymes, second messengers	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic. NPTEL video lecture

Course outcome- The Students will able to understand the biochemistry of organisms, the building blocks of life & all the relevant biochemical processes including the properties and synthesis.

Reference books:

- 1. Fundamentals of Biochemistry: A. C. Deb
- 2. Biochemistry : U. Satyanarayana

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- 3. Biochemistry : Lubest Stryer
- 4. Textbook of Biochemistry : Jain & Jain

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Steel industries ,pharmaceutical industries, food industries,Narmada coldrink plant	Analysis and problem-solving. time management Biochemical Knowledge	Goal04(quality education) Goal13 (climate action), Goal 15(Life on land),Goal03 (Good health & well being)	Food, cosmetic & water purification expert good academician, chemical business etc.



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SEMESTER- 6th

Course: B. Sc. Biotechnology

SUBJECT: Discipline Specific Elective-II (NanoChemistry)

Subject Code: 3SBCH 605

Theory Max. Marks: 50

Theory Min. Marks: 17

Course outcome- To understand preparation of nanoparticle, organic nanoparticle and about the role of nanoparticle in environmental protection.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	Introduction: Nanoscale Science and Technology-Applications for Physics, Chemistry, Biology and Engineering; Classifications of nanostructured materials, nano particles; 3 quantum dots, nanowires, ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties:	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-II	Preparation methods: Bottom-up Synthesis-Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy.	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-III	Nanoporous materials: Zeolites, mesoporous materials, nanomembranes - Carbon nanotubes and graphene - Core shell and hybrid nanocomposites..	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-IV	Organic Nanoparticles: Introduction, definition, structure, types of NP, analytical methods (Extraction and isolation, Separation, Characterization and Imaging), general method of preparation, properties, detection, and characterization of organic nanoparticles: hydrophobic drugs, protein, peptide, lipid, cyclodextrine, polysaccharides. Nanocochleates, Prospects and Future Challenges.	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic. Nptel lecture video
Unit-V	Nanomaterials for Environmental Protection: Nano technology processes – Nano Engineering materials for Pollution Prevention, Green Chemistry, Energy efficient resources and materials, Nano technology products- Nanomaterials (nanostructures) Nanodevices and nanosystems.	Usage of ICT (Powrpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.NPTEL video lecture

Course Outcome- After the completion of course learner is able to understand about:

- Nanochemistry of Nanomaterials and its types
- Preparation methods of Nanomaterials/Nanoparticles & nanosynthesis
- Nanoscience affecting environment
- Organic nanoparticles & their characterization techniques.
- Nanomaterials for Environmental Protection

References:

1. Enviroanotechnology by Mao Hong fan, Chin-pao Huang, Alan E Bland, Z Honglin Wang, Rachid Sliman, Ian Wright. Elsevier, 2010.

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2. Nanotechnology: Importance and Application by M.H. Fulekar, IK International, 2010.
3. Nanotechnologies, Hazards and Resource efficiency by M. Steinfeldt, Avon Gleich, U. Petschow, R. Haum. Springer, 2007.

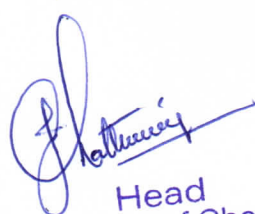
Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Steel industries ,pharmaceutical industries, food industries nanoindustry	Environmental Problem determination and its solution	Goal04(quality education) Goal13 (climate action), Goal 15(Life on land),Goal03 (Good health & well being)	Food, cosmetic & water purification expert good academician, chemical business etc.




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SEMESTER- 6th

Course: B. Sc. Biotechnology

SUBJECT: Chemistry Practical - VI

Subject Code: 3SBCH 603

Practical Max. Marks: 25

Practical Min. Marks: 08

Time: 6 hour M.M: 30

Inorganic Chemistry 05 Marks

Complex Compound Preparation:

1. Diaquabis(methyl acetoacetato)nickel(II)
2. Diaquabis(ethyl acetoacetato)cobalt(II)
3. Bis(methyl acetoacetato)copper(II) monohydrate
4. Potassium chlorochromate(IV)
5. Tetraamminecopper(II) sulphate monohydrate
6. Mercury(II) tetrathiocyanatocobaltate(II)
7. Hexaamminenickel(II) chloride

Organic Chemistry 05 Marks

Binary mixture analysis containing two solids: Separation, identification and preparation of derivatives.

Physical Chemistry Instrumentation 05 Marks

(iii) Job's method

(iv) Mole-ratio method.

Viva 05 Marks

Sessional 05 Marks

Books:

- Experiments & Calculations in engineering chemistry, Dr. S.S. Dara, S.Chand & Company Ltd.
- Practical Chemistry, Dr. M.M.N.Tandon, Shival Agrawal & Company

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SEMESTER- 6th

Course: B. Sc. Biotechnology

SUBJECT: DISCIPLINE SPECIFIC ELECTIVE-I

ZOOLOGY – VI (ENVIRONMENTAL BIOLOGY & EVOLUTION)

Subject Code: 3SBZO603

Theory Max. Marks: 50

Theory Min. Marks:17

COURSE OBJECTIVE:

This paper is aimed to introduce Ecology ,Origin of life and evolution, Palaeontology and distribution

Unit	Course Content	Methodology Adopted
Unit – I	Concept of Ecology <ul style="list-style-type: none">• Abiotic and Biotic Factors• Energy flow in ecosystem• Food chain and Food web• Biogeochemical cycle: CO₂, N and P• Population Concept- Characteristics of population. Factors affecting population growth.• Community Concept-Succession, Periodicity ,Indicators	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Habitat Ecology <ul style="list-style-type: none">• Fresh water habitat – Factors and classification.• Marine habitat- Factors and classification• Terrestrial habitat – Factors and classification.• Ecological divisions of India.• Natural resources and their Conservation with special reference to forests	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Man and Environment <ul style="list-style-type: none">• Wild life conservation (Laws, National Parks and Sanctuaries of MP)• Environmental degradation and pollution.• Thermal and Noise pollution• Radiation Ecology ,Global Warming and Green House Effect• Urbanisation and effect of human population on environment.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Origin of life and evolution <ul style="list-style-type: none">• Origin of life- modern concept only• Lamarckism, Darwinism.• Modern Synthetic theory :Variations Mutations, Isolation & Speciation• Adaptations and Mimicry• Micro, macro Evolution and Mega evolution.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Palaeontology and distribution <ul style="list-style-type: none">• Fossils, Methods of fossilisation, Determination of age of Fossils.• Study of Extinct forms: Dinosaurs and Archaeopteryx• Zoogeographical distribution of animals• Evolution of man.	ICT based class room teaching, Case Analysis, Group Presentation

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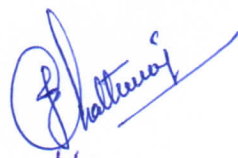
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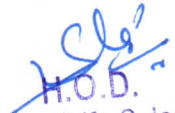
1. Study of Fresh water, Marine and Terrestrial Fauna .
 2. Water analysis – Oxygen, Chloride.
 3. Pond ecosystem.
 4. Wild life : Endangered and threatened species.
 5. Study of specimen related with Micro , Mega evolution ,Commensalisms
Symbiosis , Mimicry , Parasitism and colouration .
- Study of various fossils: Living fossil, Limulus, Latimera, dinosaurs, Archaeopteryx,.

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity




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SEMESTER- 6th

Course: B. Sc. Biotechnology

SUBJECT: DISCIPLINE SPECIFIC ELECTIVE-II

ZOOLOGY – VI (ENVIRONMENTAL BIOLOGY & EVOLUTION)

Subject Code: 3SBZO604

Theory Max. Marks: 50

Theory Min. Marks:17

COURSE OBJECTIVE:

This paper is aimed to introduce fresh water Prawn, Fish and Pearl Culture.

Unit	Course Content	Methodology Adopted
Unit – I	Aquaculture: history, definition, scope & importance. Abiotic & biotic factors of water necessary for fish life. Ecological characteristics of pond.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Fish culture :- Mono, Poly, Fish culture. Fresh water prawn culture, pearl culture. Sewage fed fish culture.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Fish breeding in natural conditions. Transport of live fish & seed. Different types of crafts & gears used for fish catching, induced breeding.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Fresh water fish farm: different types of fish ponds, preservation and processing byproducts of fish Industry & their utility.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Water pollution and its effects on fisheries and their control. Common fish diseases & their control. Biochemical composition and nutritional value of fish. Cultivable species of fishes in India.	ICT based class room teaching, Case Analysis, Group Presentation

COURSE OUTCOME:-

The student have a knowledge of different culture Skill to develop own Business, marketing and self employment.

PRACTICAL:-

1. Study of Fresh water, Marine and Terrestrial Fauna.
2. Water analysis – Oxygen, Chloride.
3. Pond ecosystem.
4. Study of specimen of fresh water fishes.
5. Study of slide preparation from fish scale.

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity

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Course: B. Sc. Biotechnology

SUBJECT: DISCIPLINE SPECIFIC ELECTIVE-III
ZOOLOGY-VI (ECONOMIC ZOOLOGY)

Subject Code: 3SBZO605

Theory Max. Marks: 50

Theory Min. Marks:17

COURSE OBJECTIVE:

This paper is aimed to introduce Pearl Culture, Lac –Culture , Sericulture and Poultry keeping. Protozoa, rats, mites, insect diseases and control.

Unit	Course Content	Methodology Adopted
Unit – I	1. Protozoa and human diseases 2. House hold insect. 3. Mites and their control.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	1. Toxicology: Basic concepts, 2. Heavy metal toxicity- Pb, Cd, Hg. 3. Toxicity testing, LC 50, LD 50, acute and chronic toxicity. 4. Pesticide and their toxicological effect. 5. Pest of Pulse crops, Vegetables and Paddy	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	1. Chemical control of pest. 2. Natural control of pest. 3. Physical control of pest. 4. Biological control of insect pests.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	1. Economic importance of mammals. 2. Poultry keeping. 3. Rats and their control.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	1. Pearl culture: 2. Sericulture 3. Lac culture. 4. Apiculture 5. Snake venom.	ICT based class room teaching, Case Analysis, Group Presentation

COURSE OUTCOME:-

The student have a knowledge of different culture Skill and diseases and their control to develop own Business, marketing and self employment.

PRACTICAL:-

- Study of Life cycle of Silk worm
- Study of Bee culture
- 3.Study of pests-Stored grain pests- Sitophilus Oryzae & Triboliumcastanaeum.
- 4.Study of Vegetable pests- Pierisbrassicae & Dacuscucurbitae
- Study of Plankton – Euglena, Paramoecium, Cyclops, Mysis, Daphnia
- Study of Protozoa and diseases.

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Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
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