

PROGRAMME GUIDE

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

*Scheme of Examination (CBCS/ELECTIVE)

*Detailed Structure of Syllabus




DR. C.V.RAMAN UNIVERSITY

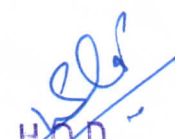
KARGI ROAD, KOTA, BILASPUR, (C.G.)

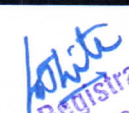
PHONE: 07753-253737, Fax: 07753-253728

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DEAN
Faculty of Science,
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(C.G.), India

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

COURSE STRUCTURE OF B.SC. MICROBIOLOGY 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
3SBBO103	Core Course	Botany – I (Diversity of Microbes and Cryptogams)	100	50	17	20	08	30	12	4	-	-	4
3SBCH 104	Core Course	Chemistry –I (Physical Inorganic & Organic Chemistry)	100	50	17	20	08	30	12	4	-	-	4
3SBMB105	Core Course	Microbiology- I (General Microbiology and Biotechnology)	100	50	17	20	08	30	12	4	-	-	4
Practical Group				Term End Practical Exam		Lab Performance		Sessional					
3SBBO103	Practical	Botany – I (Diversity of Microbes and Cryptogams)	50	25	08	25	08	-	-	-	-	2	2
3SBCH 104	Practical	Chemistry –I (Physical Inorganic & Organic Chemistry)	50	25	08	25	08	-	-	-	-	2	2
3SBMB105	Practical	Microbiology- I (General Microbiology and Biotechnology)	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 Assignment 50%



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COURSE STRUCTURE OF B.SC. MICROBIOLOGY 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
3SBB0203	Core Course	Botany – II (Cell Biology and Genetics)	100	50	17	20	08	30	12	4	-	-	4
3SBCH 204	Core Course	Chemistry –II (Physical Inorganic & Organic Chemistry)	100	50	17	20	08	30	12	4	-	-	4
3SBMB205	Core Course	Microbiology- II (Biotechnology and Immunology)	100	50	17	20	08	30	12	4	-	-	4
Practical Group				Term End Practical Exam		Lab Performance		Sessional					
3SBB0203	Practical	Botany – II (Cell Biology and Genetics)	50	25	08	25	08	-	-	-	-	2	2
3SBCH 204	Practical	Chemistry –II (Physical Inorganic & Organic Chemistry)	50	25	08	25	08	-	-	-	-	2	2
3SBMB205	Practical	Microbiology- II (Biotechnology and Immunology)	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 Graded

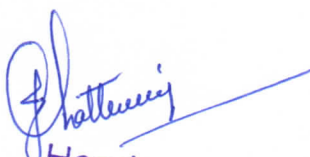
L- Lectures T- Tutorials P- Practical

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. MICROBIOLOGY 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
3SBBO303	Core Course	Botany – III (Biodiversity & Systematic of seed plant)	100	50	17	20	08	30	12	4	-	-	4
3SBCH 304	Core Course	Chemistry –III (Physical, Inorganic & Organic Chemistry)	100	50	17	20	08	30	12	4	-	-	4
3SBMB305	Core Course	Microbiology-III (Principle of Bioinstrumentation and Techniques)	100	50	17	20	08	30	12	4	-	-	4
Practical Group				Term End Practical Exam		Lab Performance		Sessional					
3SBBO303	Practical	Botany – III (Biodiversity & Systematic of seed plant)	50	25	08	25	08	-	-	-	-	2	2
3SBCH 304	Practical	Chemistry –III (Physical, Inorganic & Organic Chemistry)	50	25	08	25	08	-	-	-	-	2	2
3SBMB305	Practical	Microbiology-III (Principle of Bioinstrumentation and Techniques)	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

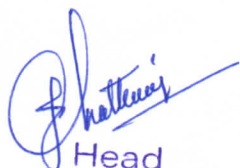
L- Lectures T- Tutorials P- Practical

Major- Term End Theory / Practical Exam

Minor- Pre University Test

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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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COURSE STRUCTURE OF B.SC. MICROBIOLOGY SEMESTER IVth

COURSE STRUCTURE OF B.S.C. MICROBIOLOGY 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
3SBBO403	Core Course	Botany – IV (Structure, Development & Reproduction in flowering plant)	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
3SBMB405	Core Course	Microbiology- IV (Environmental and Medical Microbiology)	100	50	17	20	08	30	12	4	-	-	4
Practical Group				Term End Practical Exam		Lab Performance		Sessional					
3SBBO403	Practical	Botany – IV (Structure, Development & Reproduction in flowering plant)	50	25	08	25	08	-	-	-	-	2	2
3SBCH404	Practical	Chemistry –IV (Physical Inorganic & Organic Chemistry)	50	25	08	25	08	-	-	-	-	2	2
3SBMB405	Practical	Microbiology- IV (Environmental and Medical Microbiology)	50	25	08	25	08	-	-	-	-	2	2
Grand Total			550							16		6	22

Minimum Passing Marks are equivalent to Grade D

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Major- Term End Theory / Practical Exam

Minor- Pre University Test

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COURSE STRUCTURE OF B.SC. MICROBIOLOGY 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	Botany - 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	Microbiology -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	Botany - V	50	25	08	25	08	-	-	-	-	2	2
****	Practical	Chemistry -V	50	25	08	25	08	-	-	-	-	2	2
****	Practical	Microbiology -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

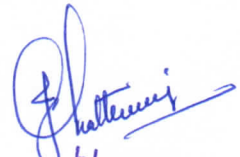
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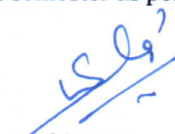
L- Lectures T- Tutorials P-Practical


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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COURSE STRUCTURE OF B.SC. MICROBIOLOGY 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	Botany - 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	Microbiology -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	Botany - VI	50	25	08	25	08	-	-	-	-	2	2
****	Practical	Chemistry -VI	50	25	08	25	08	-	-	-	-	2	2
****	Practical	Microbiology -VI	50	25	08	25	08	-	-	-	-	2	2
	Research Component	Project/ Desertions/ Internship / Viva Voice	100	50	17	-	-	50	20	-	-	4	4
	Grand Total		550							12	-	10	22

Minimum Passing Marks are equivalent to Grade D

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Major- Term End Theory / Practical Exam

Minor- Pre University Test

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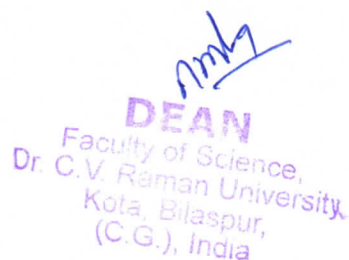
Compulsory Project/Dissertation/Internship with choice in any Disciplinary specific elective. Compulsory one paper presentation certificate in related discipline.



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W.E.F. JULY 2020

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. Microbiology**.

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		
3SBBO503	Discipline Specific Elective-I	Botany-V (Plant physiology and biochemistry)	3SBBO603	Discipline Specific Elective-I	Botany-VI (Plant Ecology, Biodiversity and Phytogeography)
3SBBO504	Discipline Specific Elective-II	Botany-V (Plant Pathology)	3SBBO604	Discipline Specific Elective-II	Botany-VI (Ethno botany)
3SBBO505	Discipline Specific Elective-III	Botany-V (Plant Reproduction)	3SBBO605	Discipline Specific Elective-III	Botany-VI (Evolutionary And Economic Botany)
GROUP ELECTIVE -II			GROUP ELECTIVE -V		
3SBCH503	Discipline Specific Elective-I	Chemistry –V (Physical Inorganic and Organic Chemistry)	3SBCH603	Discipline Specific Elective-I	Chemistry-VI (Physical Inorganic and Organic Chemistry)
3SBCH504	Discipline Specific Elective-II	Chemistry-V (Industrial Chemistry)	3SBCH604	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		
3SBMB503	Discipline Specific Elective-I	Microbiology V (Industrial and Agriculture Microbiology)	3SBMB603	Discipline Specific Elective-I	Microbiology VI (Molecular Biology and Genetic Engineering)
3SBMB504	Discipline Specific Elective-II	Microbiology V (Microbial Genetics)	3SBMB604	Discipline Specific Elective-II	Microbiology V (Analytical Microbiology)
3SBMB505	Discipline Specific Elective-III	Microbiology V (Microbial Physiology)	3SBMB605	Discipline Specific Elective-III	Microbiology VI (Immunology and Clinical Microbiology)


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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. Microbiology****SUBJECT: BASIC COMPUTER & INFORMATION TECHNOLOGY-I****Subject Code: 3BCA201****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	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. 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।	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	INTRODUCTION TO COMPUTER ORGANIZATION –II basic components of a computer system Control Unit, ALU. Input/Output function and Characteristics, memory RAM, ROM, EPROM, PROM. कम्प्यूटर ऑर्गनाइजेशन का परिचय कम्प्यूटर सिस्टम के आधार उपकरण, कंट्रोल युनिट, ए.एल.यू. इनपुट/आउटपुट फंक्शन और विशेषताएं, मेमोरी रेम, रोम, इपी रोम, पी रोम, और अन्य प्रकार की मेमोरी।	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	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. इनपुट तथा आउटपुट डिवाइसेस इनपुट डिवाइस: कीबोर्ड, माउस, ट्रेकबॉल, 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।	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 प्रिमेरी विरुद्ध भिन्न स्टोरेज डिवाइजेस मेग्नेटिक 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>	<p>ICT based class room teaching, Case Analysis, Individual Presentation</p>
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 कमांड्स DIR, MD, CD, RD, Copy, DEL, REN, VOL, DATE, TIME, CLS, PATH, TYPE आदि।</p> <p>•बाह्य कमांड्स CHKDSK, SCOPE, PRINT, DISKCOPY, DOSKEY, TREE, MOVE, LABEL, APPEND, FORMAT, SORT, FDISK, BACKUP, MODE, ATTRIB HELP, SYS आदि।</p>	<p>ICT based class room teaching, Case Analysis, Group Presentation</p>

PRACTICALS:-

DOS:

- DOS commands: Internal & External Commands.
- Special batch file: Autoexec, Bar Hard disk setup. Windows 98:
- Destop 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. Microbiology

Subject Code: 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. डायरी, 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 पहुँच ही गया - (आत्मकथांश) महात्मा गांधी अफसर (व्यंग्य) . शरद जोशी तीर्थयात्रा (कहानी) . डॉ. मिथलेश कुमार मिश्र मकड़ी का जाला (व्यंग्य) . डॉ. रामप्रकाश सक्सेना 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 मैसूर के महाराजा को (पत्र-लेखन) . स्वामी वववेकानंद बूढ़ी रानी कहेंगी किताबें सुनीता रानी घोष.डॉ - (आलेख)	सत्रीय कार्य

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	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 सत्याथी 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 :

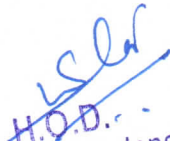
- ☐ विद्यार्थी भारत भूमि से प्रेम व स्नेह के भावों को बढ़ा सकेंगे।
- ☐ विद्यार्थियों की हिन्दी की शब्द संपदा में वृद्धि होगी।
- ☐ पत्र-लेखन, सार लेखन, भाव पल्लवन साक्षात्कार के कौशल का विकास होगा।
- ☐ डायरी एवं संस्मरण लेखन विद्या का परिमार्जन होगा।
- ☐ हिन्दी के समृद्ध साहित्य कोश से लाभान्वित होंगे।


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 रुचि


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SEMESTER- 1st**Course: B. Sc. Microbiology****SUBJECT: BOTANY-1****(DIVERSITY OF MICROBES AND CRYPTOGRAMS)****Subject Code: 3SBB0103****Theory Max. Marks: 50****Theory Min. Marks: 17****COURSE OBJECTIVE:**

- To make the student know the outline of origin and evolution of life. Understand the structure of Bacteria & viruses and plant diseases caused by Bacteria & viruses and their control
- To make students learn the general characters and economic importance of Algae & Fungi.
- To make the students understand the vegetative and reproductive features of different algae and fungi through the study of representative types of various classes.
- To help the students identify and understand plant diseases caused by fungi and their Control measures.
- To make the students know the formation of lichens and their economic and ecological importance.
- To help the students know the systematic position of the two Cryptogamic groups (Bryophyta & Pteridophyta) and their classification.
- To make the students understand the life histories of Bryophyta & Pteridophyta through the study of representative types.
- To enable the students to assess the phylogenetic aspects of the above two groups.
- To help the students to get an insight into the geological past, extinct plants and their preservation.

Units	Unit Wise Course Content	Methodology Adopted
Unit-I	Viruses, Mycoplasma and Bacteria: characteristics of viruses and mycoplasma, general account of TMV and T4 bacteriophage. Bacterial structure, nutrition, reproduction and economic importance; general account of Cyanobacteria.	ICT & Green Board based Class Room Teaching, individual presentation and through Microscope
Unit-II	Algae: General characters, classification and economic importance; important features and life history of Chlorophyceae- volvox, oedogonium, Charophyceae-chara, Xanthophyceae - vaucheria, Phaeophyceae-ectocarpus, sargassum, Rhodophyceae - polysiphonia.	ICT & Green Board based Class Room Teaching, individual presentation and through Microscope
Unit-III	Fungi: general characters, classification and economic importance, important features and life history of Mastigomycotina- Phytophthora, Zygomycotina-Mucor. Ascomycotina: Aspergillus, Peziza, Basidiomycotina - puccinia, Deuteromycotina- Cercospora, Colletotrichum, general account of lichens.	ICT & Green Board based Class Room Teaching, individual presentation and through Microscope
Unit-IV	Bryophyta: classification, study of morphology, anatomy, reproduction of Hepaticopsida Riccia, Marchantia, Anthocerotopsida Anthoceros, Bryopsida- Polytrichum.	ICT & Green Board based Class Room Teaching, individual presentation and through Microscope

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Unit-V	Pteridophyta: Important characters and classification. Stellar organization. Morphology and anatomy of Rhynia. Structure, anatomy and reproduction in Lycopodium, Selaginella, Equisetum and Marsilea.	ICT & Green Board based Class Room Teaching, individual presentation and through Microscope
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COURSE OUTCOMES:

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

- Study of Pteridophytes and Gymnosperms will help the students understand the connecting link between the lower and higher organisms in the plant kingdom.
- The anatomy imparts a thorough knowledge about the internal structure and relationship between tissues and evolution.
- Most of the techniques in biotechnology uses bacteria, viruses and fungi. This course will make the students adept in the structure and functions of these microbes which in turn will give them confidence to work using these organisms.

PRACTICAL

- Study of volvox by preparing temporary slide.
- Study of oedogonium by preparing temporary slide.
- Study of chara by preparing temporary slide.
- Study of vaucheria by preparing temporary slide.
- Study of external morphology of sargassum.
- Study of polysiphonia by preparing temporary slide.
- Study of phytophthora by preparing temporary slide.
- Study of mucor by preparing temporary slide.
- Study of Aspergillus by preparing temporary slide.
- Study of peziza by preparing temporary slide.
- Study of puccinia by preparing temporary slide.
- Study of cercospora by preparing temporary slide.
- Study of colletotricum by preparing temporary slide.
- Study of external morphology and internal structure of lichen thallus.
- To study external morphology of ricciathallus.
- To study thallus anatomy by preparing temporary slide.
- To study external morphology of Marchantiathallus.
- To study internal structure and thallus anatomy by preparing temporary slide.
- Study of morphology and anatomy of Rhynia.
- Study of external morphology and anatomy of seleginella. Study of external morphology and anatomy of Lycopodium.
- Plant disease.
 - (a) Tobacco mosaic disease.
 - (b) Leaf curl disease of papaya.
 - (c) Late blight disease of potato.
 - (d) Tikka disease of ground nut.
 - (e) Red rot of sugarcane

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Job opportunity	Employability skill	Local/National/UNDP Goal Achieved	Enterprenurship Opportunity
Microbiologists, Academician	Identification of Microorganisms	Goal 04(quality Education) Goal 14(Life below water) Goal 15(Life on Land)	Academician, Microbiologist

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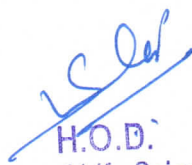
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		Goal 03(Good health &well being)	
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SEMESTER- 1st
Course: B. Sc. Microbiology

Subject Code: 3SBCH 104
Theory Max. Marks: 50
Min. Marks : 17

SUBJECT: CHEMISTRY-I (PHYSICAL, INORGANIC & ORGANIC CHEMISTRY Theory)

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>

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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, 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>	Usage of ICT (PowerPoint, PDF and video lectures) and black board (traditional) as 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

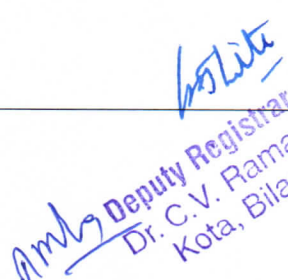
- Inorganic Chemistry (Part-I, Part-II), R.L. Dutta, NBS Publication.
- Unified Chemistry, Dr.M.M.Tandon, ShivalAgrawal& Comp.
- Synthetic Organic Chemistry, O.P.Agrawal, Krishna Prakashan Media Ltd.
- Physical Chemistry, K.L.Kapoor, Macmillan Pub. India, Ltd

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 academicians etc.

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SEMESTER- 1st

Course: B. Sc. Microbiology

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. Microbiology
SUBJECT: MICROBIOLOGY- I
(GENERAL MICROBIOLOGY AND BIOTECHNOLOGY)

Subject Code: 3SMB105

Theory Max. Marks: 50

Theory Min. Marks 17

COURSE OBJECTIVE:

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

Unit	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 based class room teaching, Group Discussion, Case Analysis, Individual Presentations
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 based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
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 based class room teaching, Case Analysis, Group Presentation
Unit – IV	Nucleic Acid: DNA: Structure, types and replication, RNA: Structure, and types and Function, Structure of gene old and new concept.	ICT based class room teaching, Case Analysis, Individual Presentation
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 based class room teaching, Case Analysis, Group Presentation

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.

PRACTICALS

- 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 Bacteria test

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



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Semester- II

Course: B. Sc. Microbiology

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 Madhya Pradesh Hindi Granth Academy, Bhopal.
2. English Grammar and Composition Wren & Martin S.CHAND & COMPANY LTD. New Delhi

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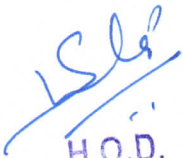
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Reference Books:

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. Microbiology
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, SahityaBhawan Publications
- Agrawal and Mishra (2017) Fundamental Of Entrepreneurship, SahityaBhawan 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

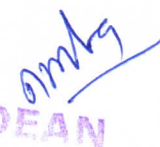
Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Manager, Purchase Officer, Project Auditor,	<ul style="list-style-type: none"> Self-confidence, Leadership, Creativity, Time Management 	No poverty, No Hunger, Quality Education, Decent work and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


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SEMESTER- 2nd

Course: B. Sc. Microbiology

SUBJECT: BOTANY-II (CELL BIOLOGY AND GENETICS)

Subject Code: 3SBB0203

Theory Max. Marks: 50

Theory Min. Marks: 17

COURSE OBJECTIVE:

- Outline the structure of the biomolecules found in all living organisms.
- Describe the function and structure of cells including the metabolic reactions that occur in cells.
- Explain the process of inheritance.
- Describe how RNA, DNA and proteins are synthesized.
- Explain the process of cell division in both somatic and germ cells.
- Explain the processes by which animals acquire nutrients, water and oxygen, eliminate wastes, protect against foreign substances, acquire information about their environment and reproduce.
- Generate a hypothesis from a set of observations and then design experiments to test the hypothesis.

Unit	Course Content	Methodology Adopted
Unit – I	The cell envelops; plasma membrane, bilayer lipid structure, function of the cell wall. Structure and function of cell organelles: Golgibodies, ER, Peroxisome, Vacuole, Chloroplast and Mitochondrion.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Ultrastructure and function of nucleus: Nuclear membrane, Nucleolus, Extranuclear genome, Presence and functions of mitochondrial and plastid-DNA, Plasmids. chromosomal organization; morphology, centromere and telomere, special types of chromosome, Mitosis and Meiosis	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Variations in chromosomes structure: Deletions, duplications translocations. inversions; variation in chromosome number, aneuploidy, polyploidy, DNA the genetic material, DNA structure and replication, the nucleosome model, satellite and repetitive DNA.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Structure of gene, genetic code, transfer of genetic information; trascription, translation, protein synthesis, tRNA, and ribosomes. Regulation of gene expression in prokaryotes and eukaryotes.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Genetic inheritance; Mendelism; laws of segregation and independent assortment; linkage analysis; interactions of genes. Genetic variations; mutations, spontaneous and induced; transposable elements; DNA damage and repair.	ICT based class room teaching, Case Analysis, Group Presentation

COURSE OUTCOME:-

- The course aims to develop students understanding of three areas of widely used and advanced scientific methods – spectroscopic tools, molecular imaging and bioinformatics. This is achieved via lectures,
- classes, seminars and a bioinformatics problem based learning exercise.
- To help students develop successful strategies for learning how to learn and communicate complex information in cell biology, we developed a quarter-long cell biology class based on team projects.

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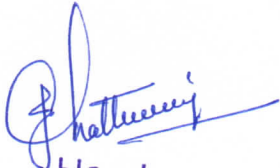
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- Each team researches a particular human disease and presents information about the cellular structure or process affected by the disease, the cellular and molecular biology of the disease, and recent research focused on understanding the cellular mechanisms of the disease process.


PRACTICAL

- To prepare the temporary slide of onion membrane and to study the plant cell.
- To study the cell structure of onion hydrilla and spirogyra.
- To study the cyclosis in tradescantia stem cell.
- To study the plastid distribution in plants.
- To examine the electron micrograph of an eukaryotic cell.
- To examine the electron micrograph of an chloroplast.
- To examine the electron micrograph of an endoplasmic reticulum.
- To examine the electron micrograph of an Golgi body.
- To examine the electron micrograph of an Ribosome.
- To examine the electron micrograph of an Nucleus.
- To make a temporary acetocarmine stained slides of root tip of onion and to study various stages of mitosis.
- To make a temporary acetocarmine stained slides of Floral bud of onion and to study various stages of meiosis.
- Cytological examination of lampbrush chromosome.
- Cytological examination of Polytene chromosome.
- Cytological examination of Barr body.
- To demonstrate the phenomenon of segregation by yellow and green colour pea seeds.
- To demonstrate the independent assortment by various type of pea seeds.

Job opportunity	Employability skill	Local/National/UNDP Goal Achieved	Enterprenurship Opportunity
Cell biologist, Geneticist	Genetics	Goal 04(quality Education) Goal 14(Life below water) Goal 15(Life on Land) Goal 03(Good health & well being)	Academician, Genetic engineer


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SEMESTER- 2nd**Course: B. Sc. Microbiology****Chemistry –II (Physical, Inorganic & Organic Chemistry)****Course Objective:**

Study of Chemical bonding, Noble gases, s-block and p-block elements. 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 structure. MO picture. Aromaticity the Huckel rule, aromatic ions. Aromatic</p>	Usage of ICT (Powrpoint, PDF and video lectures) and black board

	<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

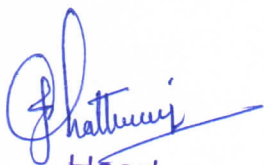
Viva: 6 marks

Records: 8 marks

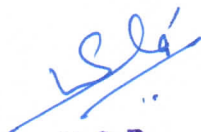
COURSE OUTCOME:-

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. Microbiology****SUBJECT: MICROBIOLOGY- II****(BIOTECHNOLOGY AND IMMUNOLOGY)****COURSE OBJECTIVE:****Subject Code: 3SMB205****Theory Max. Marks: 50****Theory Min. Marks: 17**

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 fattyacids.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Cconcept of immunity, innate and acquired immunity. Brief account of cells and organs of immune system. Antigen and Antigenecity. Antibody structure and function. Antigen- Antibodyreaction.	ICT based class room teaching, Case Analysis, Group Presentation

PRACTICALS

- 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
- Identification of human blood groups.
- To perform Total Leukocyte Count of the given blood sample.
- To perform DOT ELISA.
- To perform immunoelectrophoresis.

COURSE OUTCOMES

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

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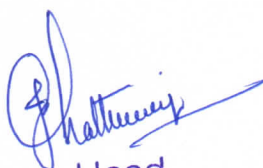
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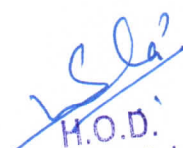
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before they are available.

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


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SEMESTER- IIIrd

Course: B. Sc. Microbiology

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. Microbiology

SUBJECT: BASIC COMPUTER & INFORMATION TECHNOLOGY-II

Subject Code: 3CBCA502

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	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. Slide sorter, slide transition effect and animation effects.	ICT based class room teaching, Case Analysis, Individual Presentation

	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 Browers.	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.

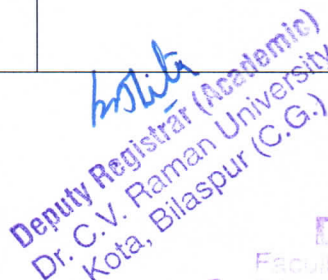
Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Computer Operator, Office Assistant, Training and Support in Institutions/universities, Research and Academics, System Analyst in State and Central Research organization, Consultant in Software 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. Microbiology

SUBJECT: BOTANY-III

(BIODIVERSITY & SYSTEMATIC OF SEED PLANT)

Subject Code: 3SBB0303

Theory Max. Marks: 50

Theory Min. Marks: 17

COURSE OBJECTIVE:

- Discuss the type of seeds produced by gymnosperms, as well as other characteristics of gymnosperms
- State which period saw the first appearance of gymnosperms and explain when they were the dominant plant life
- List the four groups of modern-day gymnosperms and provide examples of each
- To appreciate the fantastic commonness existing among organisms.
- The student will be able to appreciate the uniqueness of different groups and the way they are classified
- To develop curiosity in observing and identifying different types of gymnosperms.
- To observe and differentiate the variations existing in the internal structure of plants.
- To create interest in plant anatomy and to appreciate the function of a particular tissue or organ correlated with its structure.
- To enable the student understand the anatomical features within the system instead of merely memorizing the technical terms and the text book figures.

Unit	Course Content	Methodology Adopted
Unit – I	Characteristics and Classification of Gymnosperms, Heterospory and Origin of Seed Habit, Evolution and Diversity of Gymnosperms, Geological Time Scale, and Fossilization. Fossil Gymnosperms: Lyginopteris and Lagenostoma.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Morphology, Anatomy Reproduction and life cycle of Cycas, Pinus and Ephedra.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Origin and Evolution of Angiosperms, Fundamental components of 6, 7, 8 taxonomy, Plant Identification, Principles and rules of Botanical Nomenclature, Herbarium and Botanical gardens; Classification of Angiosperms: Bentham and Hooker, and Hutchinson, Modern trends in Taxonomy.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Diagnostic characteristics and Economic Importance of Families – Ranunculaceae, Brassicaceae, Malvaceae, Rutaceae, Fabaceae, and Apiaceae.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Diagnostic characteristics & Economic Importance of Families – Asteraceae, Asclepiadaceae, Solanaceae, Lamiaceae, Euphorbiaceae, Liliaceae and Poaceae.	ICT based class room teaching, Case Analysis, Group Presentation

COURSE OUTCOMES

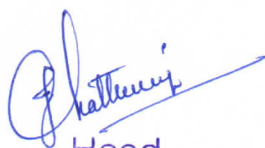
- An understanding of major patterns in the evolution of seed plants
- Study of Gymnosperms will help the students understand the connecting link between the lower and higher organisms in the plant kingdom. The anatomy imparts a thorough knowledge about the internal structure and relationship between tissues and evolution.
- An appreciation of seed plant diversity.
- A basic understanding of the principles of phylogenetic systematic.
- An overview of the diagnostic characters of the main lineages of seed plants.

- An understanding of the methods and principles of classification and nomenclature

PRACTICALS

- Study of microscope.
- Study of prepared slide of T.S. of young root Cycas.
- Study of prepared slide of T.S. of stem Cycas.
- Study of prepared slide of V.S of leaflets cycas.
- Study of prepared slides of T.S of young root pinus.
- Study of prepared slide of T.S. of young stem pinus.
- Study of prepared slide of T.S of dwarf shoot of pinus.
- Study of prepared slide of T.S. of root Ephedra.
- Study of prepared slide of T.S of stem Ephedra.
- Study of prepared slide of V.S of leaf Ephedra.
- Study of permanent slides of cycas, pinus and Ephedra.
- Study of different types of inflorescence and flowers. Method of Describing a flowering plant in botanical language Floral for mula of plants and economic importance.
- Study of Bracaceae family (Brassica Campestris) up to family level.
- Study of Malvaceae family (Hibiscus rosasinensis) up to family.
- Study of Papilionaceae family (Pisum sativum) up to family.
- Study of family Asclepiadaceae (Calotropis procera) up to family level .
- Study of family solanaceae (Solanum nigrum) up to family level.
- Study of family Lamiaceae (Ocimum Sanctum) up to family level.
- Study of family Asteraceae (Helianthus annuus) up to family level.

Job opportunity	Employability skill	Local/National/UNDP Goal Achieved	Enterprenurship Opportunity
Seed biologist, Taxonomist	Plant identification, Seed expert	Goal 04(quality Education) Goal 14(Life below water) Goal 15(Life on Land) Goal 03(Good health & well being)	Academician, Genetic engineer



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SEMESTER- 3rd
Course: B. Sc. Microbiology

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-1 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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KARGI ROAD, KOTA, BILASPUR (C.G.)

SEMESTER- 3rd
Course: B. Sc. Microbiology

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.

- (a) Determination of acetic acid in commercial vinegar using NaOH.
- (b) Determination of alkali content- antacid tablet using HCl.
- (c) Estimation of calcium content in chalk as calcium oxalate by permagnometry.
- (d) 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.

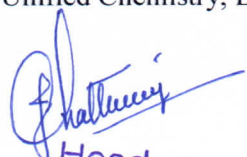
- (a) Separation of green leaf pigments (spinach leaves may be used).
- (b) Preparation and separation of 2,4-dinitrophenylhydrazones of acetone, 2-butanone, hexane-2 and 3-one using toluene and light petroleum (40:6).
- (c) Separation of a mixture of dyes using cyclohexane and ethylacetate (8:5:1.5).

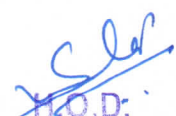
B. Paper chromatography:
Ascending and Circular Determination of R_f values and identification of organic compounds


- (a) Separation of a mixture of phenylalanine and glycine, alanine and aspartic acid, leucine and glutamic acid. Spray reagent ninhydrin.
- (b) Separation of a mixture of DL-alanine, glycine and L-leucine using nbutanol: acetic acid: water (4:1:5). Spray reagent ninhydrin.
- (c) 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. Microbiology

Subject Code: 3SMB305
Theory Max. Marks: 50
Theory Min. Marks: 17

SUBJECT: MICROBIOLOGY –III
(PRINCIPLE OF BIOINSTRUMENTATION AND TECHNIQUES)

COURSE OBJECTIVE:

Learn the qualitative functions of the four primary system components and technical vocabulary associated with instrumentation, design and basic signal analysis and static analysis .

SYLLABUS

Unit	Course Content	Methodology Adopted
Unit – I	Colorimetry and spectrophotometry. Spectrofluorimetry, turbidometry, nephelometry. luminometry. pHmetry.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Chromatography; adsorption partition, column, gas, ion-exchange, gel Filtration and affinity Chromatography, HPLC, FPLC.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Centrifugation and ultracentrifugation: Microscopy- light, phase-contrast, fluorescence, dark field, electron microscopy. Laser, confocal, microscopy and digital image analysis.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Tissue culture techniques; Principal and requirements of animal tissue culture Decontamination, sterilization and disinfection.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Electrophoresis techniques types and their application; Electrophoresis of proteins and nucleic acids. Enzyme purification and assay techniques	ICT based class room teaching, Case Analysis, Group Presentation

COURSE OUTCOMES:-

provide the reader with a tool to help select the most appropriate instrument for use in an observational study.

PRACTICAL:-

- 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.
- Testing of Beer's law
- Exercise on Tissue culture techniques

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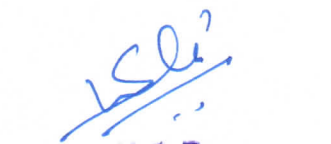
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Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Cell biologist ,Academician	Pathology lab technician	Goal 04(Quality education) Goal 13(climate action)	Pathology lab




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Semester- IV

Course: B. Sc. Microbiology

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

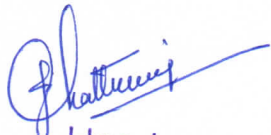
Theory Max. Marks: 25


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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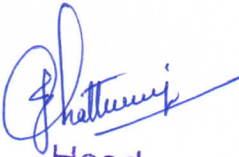
Text Book

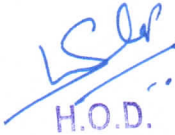
1. English language and Scientific Temper- Dr. Padam Kumar Jain, Chawdhry Madhya Pradesh Hindi Granth Academy, Bhopal.
2. English Grammar and Composition Wren & Martin. S.Chand & Company Ltd New Delhi.
3. Descriptive English (For Competitive Examinations) S.J.Thakur, S.K. Rout. B.K Publication Private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

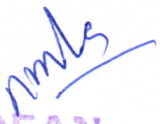
Reference Books:

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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DR. C.V.RAMAN UNIVERSITY
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SEMESTER- IV

COURSE: B. SC. MICROBIOLOGY

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 New Delhi

ferences

- A foundation course in Human Values Delhi and Professional Ethics Gaur R.R, Sangal R, Bagaria G P, Excel books, New Delhi
- *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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SEMESTER- 4th

Course: B. Sc. Microbiology

SUBJECT: BOTANY-IV

(STRUCTURE, DEVELOPMENT & REPRODUCTION IN FLOWERING PLANT)

Subject Code: 3SBB0403

Theory Max. Marks: 50

Theory Min. Marks: 17

COURSE OBJECTIVE:

- The anatomy of a flower
- The life cycle of flowering seed plants
- The anatomy of a seed
- The role of pollination and seed dispersal in the angiosperm life cycle
- Identify the characteristics of flowering plants
- Describe the structure of a flower and the difference between perfect and imperfect flowers
- Summarize the life cycle of a flowering plant, identifying the sporophyte, the gametophytes, and when mitosis/meiosis/fertilization occur
- Diagram the process of double fertilization
- Explain the importance of pollen and the different types of pollination seen in this group
- Describe the role of the seed, its relationship to fruit, the different types of seeds, and seed dispersal mechanisms

Unit	Course Content	Methodology Adopted
Unit – I	The Root system: Root apical meristems, Differentiation of primary and secondary tissues and their roles, Anatomy of Monocot and Dicot roots, Morphological modification of root for storage, respiration, reproduction and interaction with microbes.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	The Shoot system: Shoot apical meristem and histological organization, Anatomy of primary stem in Monocotyledons and Dicotyledons, Secondary growth in stem and root – Vascular cambium and its functions, Characteristics of growth rings, Sapwood and Heart wood, Secondary Phloem, Cork Cambium and Periderm.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	The Leaf system: Origin, Development, Diversity in size, shape and arrangement, Internal structure of Dicot and Monocot leaf in relation to photosynthesis and water loss, Adaptations to water stress, senescence and abscission.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	The Flower system: Concept of flower as a modified shoot, Structure of Anther, Microsporogenesis and Male Gametophyte, Structure of Pistil, Ovules, Megasporogenesis and Development of Female Gametophyte (Embryo Sac) and its types, Pollination – Mechanism and Agencies of Pollination, Pollen Pistil interactions and Self incompatibility.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Double Fertilization, Development and types of Endosperm and its morphological nature, Development of Embryo in Monocots and Dicots, Fruit development and maturation. Seed structure and dispersal, Vegetative Propagation.	ICT based class room teaching, Case Analysis, Group Presentation

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COURSE OUTCOMES

1. Sexual Reproduction in Flowering Plants

1. Recognize that flowering plants exhibit an alternation of generations even though they produce two types of spores and two types of gametophytes.
2. Identify the reproductive parts of a flower and describe the function of each part.
3. Diagram and describe the development of male and female gametophytes and the development of the sporophyte of flowering plants.

2. Growth and Development

1. Recognize the developmental steps of a eudicot embryo and compare the function of its cotyledons to that of a cotyledon in monocots.
2. Identify different types of fruits.
3. Label seed structure and describe germination and dispersal.

3. Asexual Reproduction and Genetic Engineering in Plants

1. Recognize how asexual reproduction in plants differs from sexual reproduction.
2. Describe how plants are propagated in tissue culture.
3. Explain how genetic engineering can be used to alter plant traits.


4. Control of Growth and Responses


1. Explain the importance of plant hormones.
2. Identify the various types of plant hormones and their function.
3. Recognize how plants respond to stimuli.

PRACTICALS

- Study of anatomy of t.s. of dicot root *Helianthus annuus*. Study of anatomy of t.s. of dicot root *Cicer* and *Ranunculus*.
- Study of anatomy of t.s. of monocot roots *Asparagus*. Study of anatomy of t.s. of monocot roots *Zeamays* and *Orchid*.
- Study of anatomy of t.s. of dicot stem *Cucurbita* and *Xanthium*.
- Study of anatomy of t.s. of monocot stem *Triticum aestivum* and *Asparagus*.
- Study of v.s. of isobilateral monocot leaf *Zeamays* and *Bambusa*.
- Study of prepared slide of l.s. of shoot apex.
- Study of prepared slide of l.s. of root apex
- Study of different types of ovules.
- Study of pneumatophore or respiratory root

Job opportunity	Employability skill	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Horticulturist, Taxonomist	Plant identification, Plant anatomy	Goal 04 (quality Education) Goal 14 (Life below water) Goal 15 (Life on Land) Goal 03 (Good health & well being)	Academician, Horticulture


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SEMESTER- 4th

Course: B. Sc. Microbiology

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. 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, 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	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 academician etc.

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SEMESTER- 4th

Course: B. Sc. Microbiology

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 thio sulphate.

Viva 5 Marks

Sessional 5 Marks

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SEMESTER- 4th
Course: B. Sc. Microbiology

Subject Code: 3SMB405
Theory Max. Marks: 50
Theory Min. Marks:17

SUBJECT: MICROBIOLOGY –VI
(ENVIRONMENTAL AND MEDICAL MICROBIOLOGY)

COURSE OBJECTIVE:

The study of the composition and physiology of microbial communities in the environment. It also includes the study of microorganisms that exist in artificial environments such as bioreactors. The taxonomic, ecological, and genetic relationships among microorganisms, and the biotechnological application of microorganisms to solve environmental problems.

Unit	Course Content	Methodology Adopted
Unit – I	Aerobiology; definition, droplet nuclei, aerosol assessment of air quality, some important air borne diseases caused by bacteria (Diphtheria, Pneumonia, Meningitis), virus Influenza, Chicken pox, Measles) and Fungi (mycosis); their symptoms and preventive measures.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Soil microbiology: physical and chemical characteristics and micro flora of various soil types, rhizosphere, phyllosphere. Brief account of microbial interactions: symbiosis, mutualism, commensalism, competition, amensalism, synergism, parasitism and predation. Biofertilizers - biological nitrogen fixation, nitrogenase enzyme, nif genes, symbiotic nitrogen fixation, and non-symbiotic nitrogen fixation, <i>Azotobacter</i> , <i>Azospirillum</i>), VAM-ecto-endo-ectendomycorrhizae.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Aquatic microbiology; ecosystem, fresh water (ponds, lakes, stream) and marine, Water zonation: upwelling, eutrophication. Potability of water - microbial assessment of water quality. Brief account of water borne diseases (Typhoid, Dysentery, Cholera, Hepatitis) and preventive measures.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Food spoilage and Food borne infections. A brief mention about biodegradation, xenobiotics, bioaccumulation, biopesticides and deterioration. General concept of industrial microbiology and their applications.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Waste Treatment: types of wastes, characterization of solid and liquid waste, waste treatment solid saccharification, gasification, composting. Liquid waste treatment- aerobic, anaerobic primary secondary and tertiary methods.	ICT based class room teaching, Case Analysis, Group Presentation

COURSE OUTCOME:-

An awareness of the need for a good understanding of how microorganisms react in the environment, and this has been heightened from time to time as detrimental microbial activities become evident under certain conditions. study of the relationships of microorganisms with each other and with their environments.

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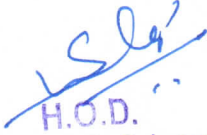
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PRACTICAL:-

- Isolation of microorganisms from air soil and water
- Isolation of pathogenic microorganisms
- Study of rhizospheric and phyllospheric microbes from economically important Plants
- Biodegradation of some organic molecules
- Microbial assessment of potable water
- Analysis of sewage waste, solid waste (garbage)
- Isolation of aquatic fungi (zoospore) by baiting technique
- Isolation of keratinophilic fungi from soil by baiting technique
- Demonstration of bacterial antagonism
- Microscopic observation of root colonization by VAM fungi


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


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SEMESTER- 5th

Course: B. Sc. Microbiology

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. Microbiology

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 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.Kharpar
- Environmental Pollution Engineering and Control, C.S.Rao

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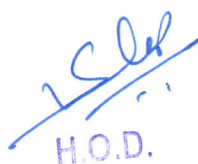
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- Environmental Chemistry, B.K. Sharma &H.Kaur.

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
ching, 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. Microbiology

SUBJECT: DISCIPLINE SPECIFIC ELECTIVE-I

BOTANY-V (PLANT PHYSIOLOGY AND BIOCHEMISTRY)

Subject Code: 3SBB0503

Theory Max. Marks: 50

Theory Min. Marks: 17

COURSE OBJECTIVE:

- Understand the basic principles related to various physiological functions in plant life.
- Familiarize with the basic skills and techniques related to plant physiology.
- Understand the role, structure and importance of the bio molecules associated with plant life.
- Familiarize with the recent trends in the field of plant physiology.
- Familiarize with applied aspects of plant physiology in other fields like agriculture.
- To get an idea of environmental issues and its conservation
- To have an understanding of Environmental legislation and laws

Unit	Course Content	Methodology Adopted
Unit – I	Plant Water Relations: Properties of water, Importance of water in plant life, Diffusion, Osmosis & Osmotic relation to plant cell, Water Absorption, Ascent of Sap, Essential macro & micronutrients and their role. Transpiration: Structure & Physiology of Stomata, Mechanism of Transpiration, Factors affecting the rate of transpiration.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Photosynthesis: Chloroplast, Photosynthetic pigments, Red drop, Emerson's effect, Concept of two Photosystems, Light reaction, Dark reaction - Calvin cycle, Hatch-Slack cycle, CAM cycle, Factors affecting rate of photosynthesis & Photorespiration.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Respiration: Mitochondria, aerobic and anaerobic respiration, Respiratory coefficient, mechanism of respiration - Glycolysis, Kreb's cycle, Pentose phosphate pathway, Electron transport system, Factors affecting rate of respiration, Redox potential and theories of ATP synthesis.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Definition, classification and chemical structure: monosaccharide, disaccharide, oligosaccharide and polysaccharides; Amino acids, essential and non essential amino acids; Lipids, saturated and non saturated fatty acids. Classification, nomenclature and characteristics of Enzymes, Concept of holoenzyme, apoenzyme, co-enzyme and co-factors, mode & mechanism of enzyme action, Factors affecting enzyme activity. Plant Hormones, mode of action of Auxins, Gibberellins, Cytokinin and Abscissic acid.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Genetic Engineering: Tools and techniques of recombinant DNA technology; cloning vectors; genomic and cDNA library; transposable elements; gene mapping and chromosome walking. Biotechnology: Functional definition; basic aspects of plant tissue culture; cellular totipotency, differentiation and morphogenesis biology of Agrobacterium; vectors for gene delivery and marker genes. Salient achievements in crop biotechnology.	ICT based class room teaching, Case Analysis, Group Presentation

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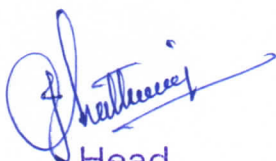
COURSE OUTCOMES

- The study of functions of plant cell incorporates knowledge at molecular level.
- This gives an idea of the cell functions and by alteration of the functioning of enzymes and biomolecules,
- The student can find out more ideas of improving productivity.
- The physiological knowledge help to develop newer ideas in developing newer techniques in agriculture.
- Environmental awareness makes the students respect mother earth by protecting and conserving the plants and animals and keep up the balance on the earth.

PRACTICALS

- Study of instruments.
- Experiment to demonstrate transpiration in plants by bell jar method.
- To demonstrate that there is loss in weight of plant due to transpiration. Demonstrate that oxygen (O₂) gas is released during photosynthesis.
- Experiment to show that carbon dioxide (CO₂) is necessary for photosynthesis.
- General test for carbohydrates in plant tissue.
- To test the presence of monosaccharide in plant tissue.
- To perform starch test in leaves. To test the presence of lipids in plant tissues Demonstration of micro propagation (seed culture, stem culture).
- Demonstration of micro propagation (seed culture, stem culture).
- Perform starch test in leaves.
- Demonstration of micro propagation.

Job opportunity	Employability skill	Local/National/UNDP Goal Achieved	Enterprenurship Opportunity
Plant physiologist, Biochemist	Plant physiology, Biochemistry	Goal 04(quality Education) Goal 14(Life below water) Goal 15(Life on Land) Goal 03(Good health &well being)	Academician, genetic engineer



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SEMESTER- 5th

Course: B. Sc. Microbiology

**SUBJECT: DISCIPLINE SPECIFIC ELECTIVE-II
BOTANY-V (PLANT PATHOLOGY)**

Subject Code: 3SBBO504

Theory Max. Marks: 50

Theory Min. Marks: 17

COURSE OBJECTIVE:

To introduce concepts and principles of plant pathology. Study of interaction between plant and pathogen in relation to the overall environment and mechanism of disease development by pathogens.

Unit	Course Content	Methodology Adopted
Unit – I	Plant Diseases Definition of plant disease, Nature and Concept of diseases in plant, importance of plant diseases and their effect on human affairs, classification of plant diseases, definition and terms in plant pathology history and development of plant pathology, methods of studying plant diseases (Air born, soil born and Water born diseases), Koch's Postulates.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Plant Disease Epidemiology Detail study of symptoms, Fungi, etiology, epidemiology and control of fungal disease of plants: Late blight of potato, Damping off vegetables, Taphrina leaf spot of turmeric, Black rust of wheat, Red rot of sugarcane, Tikka disease of groundnut, Powdery mildew of apple, Rust of linseed, Rust of coffee, Smut disease of grasses.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Seed Pathology Principles of plant disease control, plant quarantine, seed treatment, methods of studying seed born disease, collection, preservation, isolation of pathogens and biological control of plant diseases.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Host – Pathogen Interaction Distribution on plant pathogens, mode of infection, entry of pathogen in to host, roles of enzymes, toxins, phytoalexins in plant pathogenesis, physiological changes in diseased plants.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Plants Bacteriology And Virology Nomenclature and Classification of plant viruses, detail study of symptoms, symptoms caused by plant pathogenic bacteria and viruses, control of bacterial and viral disease : Bacterial leaf blight of rice, Citrus canker, Little leaf of brinjal, Tobacco mosaic disease, Potato scab, Crown gall of apple and grapes, Leaf curl of papaya, Bud blight disease.	ICT based class room teaching, Case Analysis, Group Presentation

COURSE OUTCOMES

Students will know about concept of diseases, knowledge and awareness of diseases, causal agents of plant diseases, identification methods and management of crop diseases.

PRACTICALS

1. To study different sterilization technique.
2. To study preparations of culture media.(MS)
3. To study sterilization of seeds.
4. Enplant preparations.
5. Study of different techniques in plant hybridization.
6. Preparation of synthetic seeds.

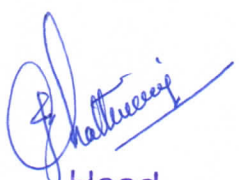
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Job opportunity	Employability skill	Local/National/UNDP Goal Achieved	Enterprenurship Opportunity
Plant Pathologist, Microbiologist	Plant pathology, Mycologist	Goal 04(quality Education) Goal 14(Life below water) Goal 15(Life on Land) Goal 03(Good health &well being)	Academician, Horticulture


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SEMESTER- 5th**Course: B. Sc. Microbiology****SUBJECT: DISCIPLINE SPECIFIC ELECTIVE-III****BOTANY-V (PLANT REPRODUCTION)****Subject Code: 3SBBO505****Theory Max. Marks: 50****Theory Min. Marks: 17****COURSE OBJECTIVE:**

To enable the students:

- To understand the various aspects of plant floral parts, development and reproduction
- To understand the various aspects of embryology and apomixes

Unit	Course Content	Methodology Adopted
Unit – I	Flower Calyx, corolla, Androecium, Gynoecium; Microsporangium: Anther Wall, Endothecium Middle layers, Tapetum, Nuclear behaviour in tapetal cells, Sporogenous tissue; Male Gametophyte: Formation of vegetative and generative cells, Formation of Sperms, Pollen wall, Abnormal features. Megasporangium: Types of ovule, Integuments, Nucellus, Megasporogenesis, Special features. Female Gametophyte: Types of female gametophytes, Mature Embryo sac, Haustorial behaviour of embryo sac, Nutrition of Embryo sac.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Pollination Anther dehiscence, pollen transfer, self pollination, cross pollination, artificial pollination, pollen storage; Fertilization: Pollen germination and pollen tube growth. Path of pollen tube, pollen tube discharge, Double fertilization, Syngamy. Endosperm: Types of endosperm, ruminant endosperm, cytology of endosperm, functions of endosperm.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Embryo Zygote, proembryo, Embryogeny in dicotyledons, Embryogeny in monocotyledons, suspensor, under developed and reduced embryos, Nutrition of embryo. Polyembryony: Causes of polyembryony, experimental induction of polyembryony, classification of polyembryony practical value of polyembryony.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Embryology in relation to Taxonomy Importance of Embryological characters in taxonomic considerations, families with special embryological features, examples of the value of embryology in taxonomy,	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Apomixis Vegetative reproduction, apospory, causes of apomixis, significance of apomixis.: Experimental Embryology: Palynology in relation to Taxonomy. Effects of young seeds on fruit growth, Parthenocarpy, parasexual hybridization.	ICT based class room teaching, Case Analysis, Group Presentation

Outcome

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


- Discuss the structural elements of plants floral parts and reproduction.
- Discuss the Pollination, embryology and apomixes.

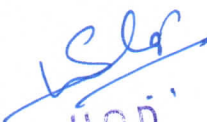
PRACTICALS

- To study the parts of flower.
- To cut the T.S. of anther, pollen and ovule.

- To cut the T.S. of Dicot and monocot embryo.
- To study the modes of reproduction in plant.
- To study of endosperm.
- To study of different types of ovule.

Job opportunity	Employability skill	Local/National/UNDP Goal Achieved	Enterprenurship Opportunity
Embryologist, Flowering expert	Pollination, Embryology	Goal 04(quality Education) Goal 14(Life below water) Goal 15(Life on Land) Goal 03(Good health &well being)	Academician, Horticulture


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SEMESTER- 5th

Course: B. Sc. Microbiology

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, antiarthrits 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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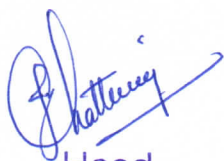
	structure of D(+) glucose, mechanism of mutarotation. Structures of ribose and deoxyribose. Carbohydrates - II An introduction to glycosidic linkages in di- and poly-saccharides. Reducing and non reducing sugars. Structure determination of maltose, sucrose, starch and cellulose.	
Unit-V	Fat and oil -Elementary 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, Shivrati 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. Microbiology

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. Delmon Elsevier Science publisher.
2. Stoichiometry, B.T. Bhatt and S.N. Vora—Tata McGraw Hill Publishing Co. Ltd., New Delhi.

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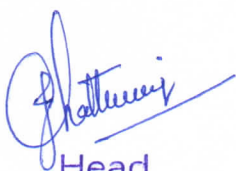
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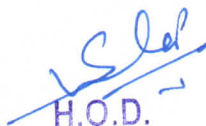
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- 3. Chemical Process Principles—Part-I, D.A. Hougen, K.M. Watson, R.A. Regatz Asia publishing House, Bombay.
- 4. Introduction to Chemical Engineering, W.L. Budger and I.T. Banchemo, McGraw Hill Book Co. of U.S.A.
- 5. Industrial chemistry: B. K. 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. Microbiology

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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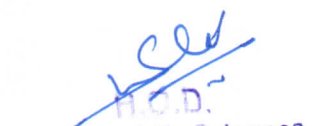
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- Green Chemistry: Introductory Text, M.Lancaster
- Principles and practice of heterogeneous catalysis, Thomas J.M., Thomas M.J., John Wiley
- Green Chemistry: Environmental friendly alternatives R S Sanghli and M.M Srivastava,
- Environmental Chemistry: 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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SEMESTER- 5th
Course: B. Sc. Microbiology
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. Microbiology

SUBJECT: DISCIPLINE SPECIFIC ELECTIVE-I

MICROBIOLOGY-V (INDUSTRIAL AND AGRICULTURE MICROBIOLOGY)

Subject Code: 3SBMB503

Theory Max. Marks: 50

Theory Min. Marks:17

COURSE OBJECTIVE:

Industrial microorganisms are used to produce many things, including food, cosmetics, pharmaceuticals and construction materials. Microorganisms can be genetically modified or engineered to aid in large-scale production.

SYLLABUS

Unit	Course Content	Methodology Adopted
Unit – I	Fermentation equipments and production process. Principles types of fermenters- the batch fermenters, continuous stirred tank fermenters, Tubular fermenter, The fluidized bed fermenter, Solid State fermenters. Computer control of fermentation process. Strain improvement process.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Industrial production of organic acids- Lactic and Enzymes - amylase, protease and aminoacids.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Production of alcohol, wine, beer and acetic acid. Production of antibiotics - Penicillin and Streptomycin. Soil fertility and management of agricultural soils, influence of available nitrogen on soil fertility. Importance of crop-rotation. Soil management. Management practices: Pesticides and their impact and effect on soil fertility	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Microbial diseases of crop plants. Control of plant diseases. Chemical control of plant diseases. Biological Control- its mechanism and importance, biopesticides.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Importance of microorganisms in dairy industries. Production of cheese, Butter milk and in bakery industries - leavening of bread, Indian fermented foods. Fungi and bacteria as a source of single cell proteins (SCP) and proteins.	ICT based class room teaching, Case Analysis, Group Presentation

COURSE OUTCOMES:-

Industrial microbiology includes the use of microorganisms to manufacture food or industrial products in large quantities. Numerous microorganisms are used within industrial and agriculture microbiology;

PRACTICALS:-

- Measurement of production of citric acid by *Aspergillus niger*.
- Measurement and production of alcohol by yeast.
- Demonstration of Transformation of steroids.
- Demonstration of IAA production by microbes.
- Demonstration of enzyme production by microorganisms.
- Demonstration of mushroom cultivation.
- Study of microbial diseases of crop plants.

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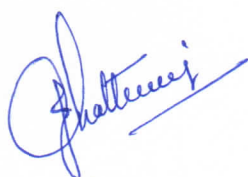
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- Study of effect of fungicides and insecticides on microorganisms.
- Study of antagonistic activities among microorganisms.
- Study of fungal contaminants from stored agricultural product.

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



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SEMESTER- 5th

Course: B. Sc. Microbiology

**SUBJECT: DISCIPLINE SPECIFIC ELECTIVE-II
MICROBIOLOGY-V (MICROBIAL GENETICS)**

Subject Code: 3SBMB504

Theory Max. Marks: 50

Theory Min. Marks: 17

COURSE OBJECTIVE:

- Students will learn the basic principles of inheritance at the molecular, cellular and organismal levels.
- Students will understand causal relationships between molecule/cell level phenomena ("modern" genetics) and organism-level patterns of heredity ("classical" genetics)
- Students will test and deepen their mastery of genetics by applying this knowledge in a variety of problem-solving situations.
- Recombinant DNA methods and their basis in bacterial genetics.
- Applications of DNA technology: pharmaceuticals, agriculture..

SYLLABUS

Unit	Course Content	Methodology Adopted
Unit – I	Fundamentals of Genetics <ul style="list-style-type: none"> • DNA as genetic material. • Structure and types of DNA and RNA. • Genetic code. • Protein synthesis - Transcription and translation. 	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	DNA Replication and Gene Structure <ul style="list-style-type: none"> • DNA replication. • Cis-trans complementation test. • Fine structure analysis of r II region of T4 by Benzer. 	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Mutation <ul style="list-style-type: none"> • Evidence for spontaneous nature of mutation. • Molecular basis of mutation- Types of mutation. • Types of bacterial mutants and their isolation. • Mutagenic agents- Physical and chemical. • Mutation rate and Ames test. 	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Genetic Recombination-I <ul style="list-style-type: none"> • Gene transfer in bacteria. • Transformation- Competence, DNA uptake, artificially induced competence, electroporation. • Transposable elements. • Plasmid- Structure, properties and types of plasmids. 	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Genetic Recombination-II <ul style="list-style-type: none"> • Transduction- U tube experiment, Generalized and specialized transduction, Abortive transduction. • Conjugation- F factor, characters of donor and recipient. • Steps in conjugation, sexduction, formation of Hfr and F⁺ prime cells. 	ICT based class room teaching, Case Analysis, Group Presentation

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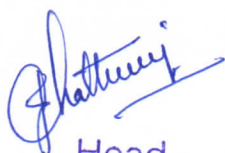
COURSE OUTCOME:-

- The student will demonstrate knowledge of gene manipulation and analysis by:
- Describing the processes and applications of Recombinant DNA Technology.
- Explaining the role of restriction end nucleases in genemanipulation.
- Determining the applicability of different kinds of cloning vectors.
- Illustrating the use of genomic libraries in gene detection and characterization.
- Examining the process of restriction mapping.
- Describing the process of Southern Blot analysis.
- Summarizing methods used for DNA sequencing.
- Describing the principles of the Polymerase Chain Reaction (PCR) and their applications.

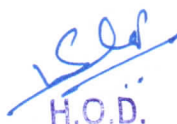
PRACTICALS:-

- Isolation of bacterial genomic DNA.
- Isolation of Plasmid DNA.
- Electrophoretic analysis of DNA.
- UV as a mutagenic agent.
- Replica plating technique.
- Isolation of antibiotic resistant mutants by gradient plate technique.
- Quantitative estimation of DNA by DP method.
- Quantitative estimation of RNA by original method

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



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KARGI ROAD, KOTA, BILASPUR (C.G.)

SEMESTER- 5th

Course: B. Sc. Microbiology

**SUBJECT: DISCIPLINE SPECIFIC ELECTIVE-III
MICROBIOLOGY-V (MICROBIAL PHYSIOLOGY)**

Subject Code: 3SBMB505

Theory Max. Marks: 50

Theory Min. Marks:17

COURSE OBJECTIVE:

- Microbial physiology is a broad subject area and this course will attempt to provide a balance between the breadth of subjects addressed and the depth at which the subjects are discussed. The course has three overarching topics:
 - Central metabolism and energy conservation,
 - Macromolecular biogenesis and function
 - Integration of metabolic events.
- The introductory lectures will address metabolic functions that are common to most organisms. The lectures will then progress to address metabolic functions that are the "exception to rule" to highlight the diversity of the microbial world.
- Students will learn about current events in the subject of microbial physiology and modern techniques used to examine metabolism. They will also learn about how the metabolic potential of micro-organisms has been harnessed to address problems facing society.

SYLLABUS

Unit	Course Content	Methodology Adopted
Unit – I	Cultivation and Pure Culture Techniques <ul style="list-style-type: none"> Nutrition and nutritional types of bacteria. Bacteriological media (types and uses), cultivation of aerobic and anaerobic microbes. Isolation of microorganisms, pure culture and cultural characteristics. 	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Microbial Growth <ul style="list-style-type: none"> Mathematical expression of bacterial growth, generation time and growth rate. Growth curve and phases of growth cycle. Batch, continuous and synchronous cultures; diauxic growth. Factors affecting microbial growth. 	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Measurement and Preservation Methods <ul style="list-style-type: none"> Quantitative measurement of bacterial growth by cell mass, cell number and cell activity. Maintenance and preservation of cultures. 	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Control of Microorganisms-I <ul style="list-style-type: none"> Microbial death curve under adverse condition. Concept of sterilization, disinfection, asepsis and sanitation. Physical methods of control- Temperature, radiation, desiccation, osmotic pressure, filtration. 	ICT based class room teaching, Case Analysis, Individual Presentation

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Unit – V	Control of Microorganisms-II <ul style="list-style-type: none"> Chemical methods of control- Phenol, alcohol, halogens, heavy metals, dyes, detergents, quaternary ammonium compounds, aldehydes and gaseous chemosterilizers. Evaluation of antimicrobial potency of disinfectants and antiseptics- Tube dilution, Agar diffusion. Phenol coefficient. 	ICT based class room teaching, Case Analysis, Group Presentation
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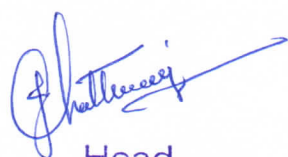
COURSE OUTCOME:-

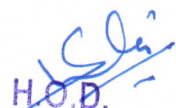
- Demonstrate theory and practical skills in microscopy and their handling techniques and staining procedures
- Understand the basic microbial structure and function and study the comparative characteristics of prokaryotes and eukaryotes and also Understand the structural similarities and differences among various physiological groups of bacteria/archaea
- Know various Culture media and their applications and also understand various physical and chemical means of sterilization
- Know General bacteriology and microbial techniques for isolation of pure cultures of bacteria, fungi and algae
- Master aseptic techniques and be able to perform routine culture handling tasks safely and effectively
- Comprehend the various methods for identification of unknown microorganisms
- Understand the microbial transport systems and the modes and mechanisms of energy conservation in microbial metabolism – Autotrophy and heterotrophy
- Know the various Physical and Chemical growth requirements of bacteria and get equipped with various methods of bacterial growth measurement.

PRACTICALS:-

- Principles and working knowledge of instruments like autoclave, pH meter, incubator, hot air oven, centrifuge, microscope and colony counter.
- Preparation of solid and liquid culture media and their sterilization.
- Growth of bacteria on agar slant, agar stab, Petri plate and in broth.
- Staining techniques- Simple staining, Gram staining, Negative staining, Endospore staining, Metachromatic granule staining, Spirochete staining.
- Isolation of microorganisms by streak plate method.
- Isolation of microorganisms by pour plate method.
- Motility by hanging drop method.
- Preparation of McFarland scale.
- Use of counting chamber for bacterial count.
- Effect of temperature on bacterial growth.
- Effect of pH on bacterial growth.
- Effect of osmotic pressure (salt and sugar concentration) on bacterial growth.
- The oligodynamic action of heavy metals on bacterial growth.
- One step growth of bacteriophage.

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


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SEMESTER- 6th

Course: B. Sc. Microbiology

SUBJECT: DISCIPLINE SPECIFIC ELECTIVE-I

BOTANY-VI (PLANT ECOLOGY, BIODIVERSITY AND PHYTOGEOGRAPHY)

Subject Code: 3SBB0603

Theory Max. Marks: 50

Theory Min. Marks: 17

COURSE OBJECTIVE:

- To examine the role that biotic and abiotic factors play in ecological biogeography
- To gain an appreciation of Earth's geological history and understand the role of historical biogeography in interpreting plant distributions
- To investigate the relationship between systematics and biogeography
- To investigate the relationship between systematics and biogeography (phylogeography)
- To review major features of contemporary plant distributions with emphasis on hot-spots, endemics, and islands
- To understand the role that glaciation has played in plant distributions
- To examine pattern and process in bent hic marine algal distributions with a focus on kelp

SYLLABUS

Unit	Course Content	Methodology Adopted
Unit – I	Ecosystems: Structure and types, Biotic and Abiotic components, Trophic levels, Food chains, Food webs, Ecological pyramids, Energy flow; Biogeochemical cycles: Concept, Gaseous and Sedimentary cycles, Carbon, Nitrogen, Phosphorus and Sulfur cycle.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Ecological adaptations: Morphological, Anatomical and Physiological responses, Water adaptation (Hydrophytes, Xerophytes and Mesophytes), Temperature adaptation (Thermoperiodism and Vernalization), Light adaptation (Heliophytes and Sciophytes), Plant Succession: Causes, trends and processes, types of succession - Lithosere, Hydrosere and Xerosere.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Population Ecology: Distribution patterns, Density, Natalty, Mortality, Growth curves, Ecotypes and Ecads; Community Ecology: Characteristics, Classification, Life forms. Biodiversity: Basic concept, definition, Importance, Biodiversity of India, Hotspots, In situ and ex situ conservation, Endangered and threatened species, Red data book.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Soil: Physico-chemical properties, Soil formation, Development of Soil Profile, Soil classification, Soil composition, Soil factors; Pollution: Definition, Types & Causes; Global Phytogeography: Phytogeographical regions of India, Vegetation types of Madhya warming, Climate change and Ozone holes.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Pradesh, Biosphere reserves, Sancturries and National parks of Madhya Pradesh, Natural resources – definition and classification of natural resources, Conservation and management of natural resources, Land resources management, Water resources management, Wet land resource management.	ICT based class room teaching, Case Analysis, Group Presentation

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OUTCOMES

Students will be able to:

- Distinguish between ecological versus historical biogeography
- Recognize patterns and hypothesize underlying process
- Summarize the five areas that have resulted in a Renaissance in Biogeography
- Describe the 3 major biogeographic patterns and illustrate them with significant plant genera
- Compare long-distance dispersal vs vicariance as mechanisms for disjunct distributions
- Define endemic and illustrate with significant plant genera (from BC and elsewhere)

PRACTICALS

- To determine the minimum size of the quadrat by species area curve. To determine the frequency of various species occurring in a given area.
- Determination of percentage frequency of plant species by quadrat method.
- Determination of density of plant species by quadrat methods.
- Study the soil texture of field soil.
- To study the composition of field soil. To study out the water holding capacity of the soil.
- To find out pH of the soil.
- To test the presence of nitrate in the soil. To study the. Morphological adaptation in hydrophytes.
- To classify hydrophytes, xerophytes plant.
- To study the morphological adaptation in hydrophytes.
- To study the hydrophytic adaptation in the t.s. of hydrilla stems.
- To study the morphological and anatomical adaptation in xerophytes.
- To study the xerophytic adaptation in v.s. of nerium leaf. To study the mesophytic plant.

Job opportunity	Employability skill	Local/National/UNDP Goal Achieved	Enterprenurship Opportunity
Ecologist, Environmentalist	Pollution Expert Ecology, soil profiling	Goal 04(quality Education) Goal 14(Life below water) Goal 15(Life on Land) Goal 03(Good health &well being)	Academician, Environmentalist



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SEMESTER- 6th**Course: B. Sc. Microbiology****SUBJECT: DISCIPLINE SPECIFIC ELECTIVE-II****BOTANY-VI (ETHNO BOTANY)****Subject Code: 3SBB0604****Theory Max. Marks: 50****Theory Min. Marks: 17****COURSE OBJECTIVE:**

To enable the students:

- To proper documentation and presentation of traditional knowledge about plants.
- To use important plants by the tribal communities for various purposes.
- Conservation natural growing plants and socioeconomic impacts.
- Ethnobotany solve human problem of nutrition health care and life support system.

Unit	Course Content	Methodology Adopted
Unit – I	Ethno-Medicine Introduction, concept, scope and objective; Aboriginal uses and management of ethno-botanical species in India. Carefully analyzed, verified and proper preparation of medicines by local healers. Exploration of some ethno-medicinal plants used by tribals. Medico-Ethno-botanical sources in India. Ailments for cure diseases.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Ethno-botany (concept and studies) Introduction, definition, Classification, method of study ethno-botany, phytosociological studies, Significance and ethno-botanical practices, role of ethnic groups, Traditional systems of medicine, Conservation and protection of ethno-biodiversity, ethno- botany as tool to protract ethnic groups. Role of ethno-botany in modern, high tech science.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Ethno-botany and Legal aspect Ethnobotany as an interdisciplinary science. Paleo-ethnobotany. Aims and object of legal aspect. Biopiracy, Intellectual property rights, endangered species Vulnerable and extinct ethno-species . Application of natural habitat and propagation of ethno-botanical species. Propagation through cutting, layering, grafting, and budding. Enforcement of existing Acts. Policy framework.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Herbal Medicines and Folk medicines History ,Scope, Definition, Aims and Objects about folk and herbal medicines. Selection of herbal planting material for Cultivation, Harvesting, Storage and Marketing of herbal medicines. Systematic position of herbal medicinal plants. Nursery, Forming, use of green houses for nursery. Development of agro- technology and promotion of rural bio-technology.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Pharmacognosy and Economic ethno-botany Active principals and method of screening, testing of secondary metabolites-Alkaloids, Flavonoids, Steroids, Tannins, Terpenoids, Phenolic compounds. Anti-microbial, Anti-oxidant, Anti-inflammatory, Drug adulteration- types, methods of drug evaluation. Biological testing of herbal medicines. Future aspect of pharmacognosy. Tribal economic realization through different sources for their livelihood. Ethnic policy for commercialization.	ICT based class room teaching, Case Analysis, Group Presentation

COURSE OUTCOMES

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

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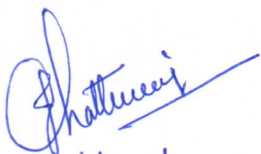
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1. To express the historical development of ethnobotany. Recognize and identify important plant species.
2. Explain ethnobotanically uses of plants. Detail their native habitats and cultivated lands.

PRACTICALS

- Study of Ethnomedicinal plant.
- Study of archaeoethnobotany
- Study of Plants used in various systems of medicines.
- Study of plant used in Ayurvedic, Unani and Homoeopathic system .
- Study of plant in Allopathic systems.
- Plants used by villagers and tribal people.

Job opportunity	Employability skill	Local/National/UNDP Goal Achieved	Enterprenurship Opportunity
Medicinal plant expert, Environmentalism	Ethnomedicine, herbal medicine	Goal 04(quality Education) Goal 14(Life below water) Goal 15(Life on Land) Goal 03(Good health &well being)	Medicinal plant cultivation



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SEMESTER- 6th

Course: B. Sc. Microbiology

SUBJECT: DISCIPLINE SPECIFIC ELECTIVE-III

BOTANY-VI (EVOLUTIONARY AND ECONOMIC BOTANY)

Subject Code: 3SBB0605

Theory Max. Marks: 50

Theory Min. Marks: 17

COURSE OBJECTIVE:

- Describe the theory of natural selection.
- Explain how new species arise.
- Construct a phylogenetic tree.
- Explain the mechanisms which underlie evolution at the molecular level.
- To identify the following crops: Sorghum, Maize, Rice, and Wheat
- To know the origin, distribution, spread and taxonomy of the above listed crops
- To be able to describe morphological feature
- To know the economic importance of the listed crops.

SYLLABUS

Unit	Course Content	Methodology Adopted
Unit – I	Evolutionary Biology: Origin of life (including aspects of prebiotic environment and molecular evolution); Concept of evolution; Theories of organic evolution; Mechanisms of speciation. Hardy-Weinberg genetic equilibrium, genetic polymorphism and selection; origin and evolution of economically important microbes and plants.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Origin of agriculture: World centers of primary diversity of domesticated plants; Plant introduction; Secondary centers of origin. Plant as a source of renewable energy; Innovations for meeting world food demands.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Botany, cultivation and uses of – a. Food, forage and fodder crops (cereals, pulses, vegetables and fruits) b. Fiber yielding plants c. Botany, cultivation and uses of Medicinal plants d. Aromatic plants e. Oil yielding plants	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Important fire-wood, timber-yielding plants and Non-wood forest products (NWFPs) such as- Bamboos, rattans, raw materials for paper-making, gums, tannins, dyes and resins. Plants used as avenue trees for shade, pollution control and aesthetics.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Farming of medicinal plant, cryopreservation, seed bank, methods of crop rotation.	ICT based class room teaching, Case Analysis, Group Presentation

COURSE OUTCOMES

- Acknowledge the economic uses of plants in modern society.
- Acquire an increased awareness and appreciation of plants & plant products encountered in everyday life.

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- Develop scientific insights into the development of many plant products that have shaped our society.
- Appreciate the diversity of plants and the plant products in human use;
- Understand the biological reasons why certain plant resources are important;
- Explain the geographical, historical, and cultural contributions of economically important plants on the development of human culture.
- Understand the conditions & consequences of natural selection; & describe different modes of speciation
- Search the library for literature review; & choosing a valuable research topic.

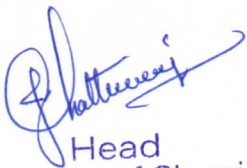
PRACTICAL:-

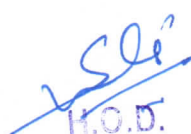
- Study of timber –Yielding plants
- Study of aromatic plant
- Study of cultivation and uses of medicinal plants
- Study of oil yielding plants
- Study of fiber yielding plants
- Study of Food, forage and fodder crops (cereals, pulses vegetables and fruits)


PRACTICAL –IV

- Study of timber –Yielding plants
- Study of aromatic plant
- Study of cultivation and uses of medicinal plants
- Study of oil yielding plants
- Study of fiber yielding plants
- Study of Food, forage and fodder crops (cereals, pulses vegetables and fruits)

Job opportunity	Employability skill	Local/National/UNDP Goal Achieved	Enterprenurship Opportunity
Economic botany expert, Environmental	Food and fiber yielding plant, Agriculture	Goal 04(quality Education) Goal 14(Life below water) Goal 15(Life on Land) Goal 03(Good health &well being)	Fiber, food and timber plant cultivator


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SEMESTER- 6th
Course: B. Sc. Microbiology
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-	(a) Organometallic compounds: Organomagnesium compounds, The Grignard reagents-formation, structure and synthetic applications,	Usage of ICT (Powrpoint, PDF and video lectures) and black

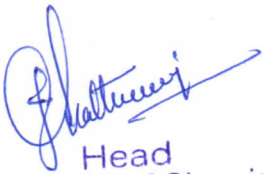
V	<p>organozinc compounds, formation and chemical reactions, Organolithium compounds-formation and chemical reactions.</p> <p>(b) Organic synthesis via enolates Organic synthesis via enolates, acidity of α-hydrogens, alkylation of diethylmalonate and ethylacetoacetate. Synthesis of ethylacetoacetate, 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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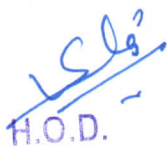
Course Outcomes – After completion of the course student will able to understand the physical photochemistry, application of inorganic polymers and organometallic compounds.

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. Microbiology

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: D. Satyanarayana

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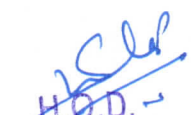
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W.E.F. JULY 2020

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

SEMESTER- 6th

Course: B. Sc. Microbiology

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

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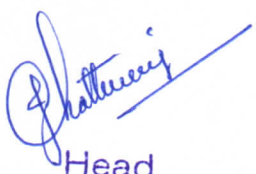
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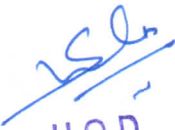
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2. Nanotechnology: Importance and Application by M.H. Fulekar, IK International, 2010.
3. Nanotechnologies, Hazards and Resource efficiency by M. Steinfeldt, Avon Gleich, U. Petschow, R. Haum. Springer, 2007.


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. Microbiology
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. Microbiology

SUBJECT: DISCIPLINE SPECIFIC ELECTIVE-I

MICROBIOLOGY – VI (MOLECULAR BIOLOGY AND GENETIC ENGINEERING)

Subject Code: 3SBMB603

Theory Max. Marks: 50

Theory Min. Marks:17

COURSE OBJECTIVE:

Knowledge about national or international research laboratories, biomedical or biotechnology institutions, pharmaceutical companies, biotechnology and genetic engineering application and research centers, genetic diagnosis centers, or fertility centers.

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	<i>Mutations: spontaneous and induced, base pair change, frame shift, deletion, inversion, random duplication, insertion, useful phenotypes (auxotrophs, conditional lethal, resistance). Reversion vs. suppression, Ames' test.</i>	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:-

Advancements in Genetic Engineering, in the field of biotechnology, agriculture and medicine.

PRACTICAL:-

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

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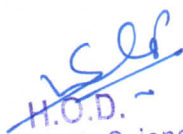
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- Demonstration of mammalian sexchromatin.
- Preparations of temporary mount and study the different stages of Mitosis (Onion root tip).
- Demonstration of Southern BlotTechnique.
- Perform electrophoresis of restrictedDNA.
- Demonstration DNA amplification byPCR.
- Study of semi conservative replication of DNA through micrographs/schematic representations.
- Hybridization and detection of gene ofinterest)
 1. Demonstration of NorthernBlotting.
 2. Demonstration of WesternBlotting.

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


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SEMESTER- 6th

Course: B. Sc. Microbiology

SUBJECT: DISCIPLINE SPECIFIC ELECTIVE-II

MICROBIOLOGY -VI (ANALYTICAL MICROBIOLOGY)

Subject Code: 3SBMB604

Theory Max. Marks: 50

Theory Min. Marks:17

COURSE OBJECTIVE:

- Analytical Microbiology focuses on the processes, methodologies, developments, and approaches involved in analytical microbiology, including microbiological, antibiotic, and amino acid assays and dilution methods.
- The selection first offers information on the theory of antibiotic inhibition zones, microbiological assay using large plate methods, and dilution methods of antibiotic assays.
- Discussions focus on serial dilution assay, requirements for accurate assay, microbiological assay of riboflavin, laws of adsorption and partition, mechanisms of antibiotic action, and biological considerations affecting the use of statistical methods.

Unit	Course Content	Methodology Adopted
Unit – I	Bioassays <ul style="list-style-type: none">• Bioassay of growth supporting substances- Amino acids and Vitamins.• Bioassay of growth inhibiting substances-Antibiotics.• Automation of bioassay.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Quality Control <ul style="list-style-type: none">• Quality control tests- Sterility testing, Microbial Limit Test (MLT).• Pyrogen testing (LAL test), Minimum Inhibitory Concentration (MIC).• FDA and Good Manufacturing Practices.• Quantitative and qualitative analysis of food, milk, water and sewage.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Colorimetry and Spectrophotometry <ul style="list-style-type: none">• Lambert – Beer's Law.• Ultraviolet, Visible, Infra red and Fluorescence spectroscopy.• Atomic absorption, Raman spectrum, X-ray Crystallography and NMR.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Separation Techniques-I <ul style="list-style-type: none">• Chromatography-Principle.• Types of chromatography- Paper, Thin layer, Column, Ion exchange and Gas chromatography.• Sedimentation and filtration.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Separation Techniques-II <ul style="list-style-type: none">• Electrophoresis- Principle and working.• Agarose gel, native PAGE and SDS-PAGE.• Principle, working and applications of centrifuge.	ICT based class room teaching, Case Analysis, Group Presentation

COURSE OUTCOME:

- Demonstrate within multiple microbiology disciplines the core theories and practices;

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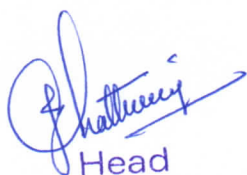
- describe/explain the processes used by microorganisms for their replication, survival, and interaction with their environment, hosts, and host populations;
- explain the theoretical basis of the tools, technologies and methods common to microbiology; and
- demonstrate practical skills in the use of tools, technologies and methods common to microbiology, and apply the scientific method and hypothesis testing in the design and execution of experiments.
- In addition, in upper level courses, students will be able to:
- evaluate and respond to a complex question or challenge, using perspectives and scholarship drawn from microbiology and from cognate and non-cognate fields;

COURSE CODE: 3SBMB604

PRACTICALS:-

- Isolation of antibiotic producer from soil sample.
- Isolation of amylase producer from soil sample.
- Estimation of soil microflora.
- Qualitative and quantitative examination of Food.
- Qualitative and quantitative examination of Milk.
- Qualitative and quantitative examination of Water.
- Qualitative and quantitative examination of Sewage.
- Bioassay of penicillin.
- Bioassay of vitamin.
- Sugar estimation by Cole's Method.
- Estimation of MIC.
- Sterility testing of pharmaceutical products- injectibles, eye and eardrops.
- Microbial Limit Test- Tablets and syrups.
- Determination of Phenol coefficient.
- Separation of amino acids by TLC. 16. Separation of sugars by Paper chromatography.

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



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SEMESTER- 6th

Course: B. Sc. Microbiology

SUBJECT: DISCIPLINE SPECIFIC ELECTIVE-III

MICROBIOLOGY – VI (IMMUNOLOGY AND CLINICAL MICROBIOLOGY)

Subject Code: 3SBMB605

Theory Max. Marks: 50

Theory Min. Marks:17

COURSE OBJECTIVE:

- The student will be able to identify common infectious agents and the diseases that they cause.
- The student will be able to evaluate methods used to identify infectious agents in the clinical microbiology lab.
- The student will be able to recall microbial physiology including metabolism, regulation and replication.
- The student will be able to explain general and specific mechanisms by which an infectious agent causes disease.
- The student will be able to recognize and diagnose common infectious diseases from the clinical presentation and associated microbiology.
- The student will be able to describe the epidemiology of infectious agents including how infectious diseases are transmitted.
- The student will be able to assess treatment strategies including the appropriate use of antimicrobial agents and common mechanisms of antimicrobial action and resistance.

Unit	Course Content	Methodology Adopted
Unit – I	Infection and Immunity Normal flora of human body. Infection and its type. Mechanism of pathogenesis. Immunity – Natural and acquired. Defense mechanisms – First line, second line and third line of host defense. Vaccines – Preparation and types, vaccination schedule for children in India.	ICT based class room teaching, Group Discussion, Case Analysis, Individual Presentations
Unit – II	Epidemiology of infectious diseases Transmission of diseases. Types of diseases – Epidemic, Pandemic, Sporadic. Nosocomial Infections. Epidemiological Methods – Descriptive, Analytical and Experimental Epidemiology. Antibiotics – Mode of action and development of resistance. Transmission of drug resistance. Antiviral and Antifungal drugs.	ICT based class room teaching, Case Analysis, Individual Presentation, Visit to Venture Capitalists
Unit – III	Components of Immune System Organs and cells involved in immune response. Antigen – Properties and types, Adjuvants. Immunoglobulin – Separation, structure and types. Primary and secondary responses. Complement – Components and Biological activities.	ICT based class room teaching, Case Analysis, Group Presentation
Unit – IV	Antigen – Antibody Reactions Antigen and antibody reactions – agglutination, precipitation. Toxin neutralization test. Immunofluorescence, ELISA, RIA. Allergic skin tests – Tuberculin test and Lepormin test. Hypersensitivity – Immediate and delayed type. Autoimmune Diseases.	ICT based class room teaching, Case Analysis, Individual Presentation
Unit – V	Microorganisms and Diseases Gram positive cocci – Staphylococcus aureus . Gram negative bacilli – Salmonella typhi . Acid fast bacteria – Mycobacterium tuberculosis. Anaerobic, Gram positive bacilli – Clostridium tetani. Spirochaete – Treponema pallidum. Virus – Hepatitis and HIV.	ICT based class room teaching, Case Analysis, Group Presentation

COURSE OUTCOME:

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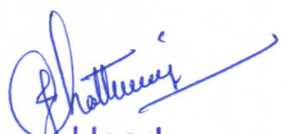
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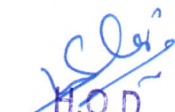
- Students will be able to communicate scientific information effectively, especially relating to microbiological organisms, and the roles of microbial organisms in ecosystem function and health-related issues
- Students will be able to collect, analyze and interpret scientific data, including developing a familiarity with microbiology laboratory techniques and safety procedures
- Students will develop proficiency in the quantitative skills necessary to analyze biological problems (e.g., arithmetic, algebra, dimensional analysis, and statistical analysis as applied to biology), with a knowledge of specialized techniques used in microbiology.
- Students will be able to apply the scientific method as a demonstration that they understand its application furthering our knowledge of the microbial world
- Students will be able to describe fundamental principles of biology e.g., central dogma, diversity of life, inheritance and how these principles relate to microorganisms
- Students will be able to describe unique microbial genetic systems (i.e., prokaryotic and viral genomes, lateral gene transfer, plasmid structure and function, etc.)
- Students will appreciate the biological diversity of microbial forms, and appreciate that this diversity results from evolutionary processes
- Students will be able to access and interrogate the primary scientific literature and be aware of leading journals in the field of microbiology
- Students will be able to synthesize material from lower division courses across a biological sub-discipline and apply this to advanced course material (i.e., a Capstone experience); specifically, students will draw from their learning experiences in the fields of microbial ecology & evolution, microbial physiology, bioremediation, immunology, etc., as related to the topic of their capstone course
- Students will gain familiarity with the unique role of microbes play in genetic modification technologies (i.e., creation of GMOs, industrial applications, gene therapy, etc.)
- Students will gain familiarity with the role of microbes in human disease, the role of microbes in issues of international health, and the human immune response to microbial infection
- Students will gain familiarity with the role of microbes in the context of ecosystem function (e.g., microbial ecology, micro biome, etc.)

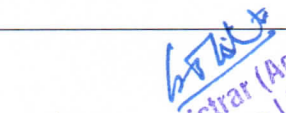
PRACTICALS:-

- Determination of Blood Groups.
- Estimation of hemoglobin by Sahli's method.
- Estimation of hemoglobin by Cyanmethaemoglobin method.
- Total count of W.B.C.
- Total count of R.B.C.
- Differential W.B.C. count.
- Flocculation reaction- VDRL.
- Agglutination reaction- Widal test.
- Examination of urine- chemical, physical, microscopic and bacteriological.
- Isolation and identification of gram positive bacteria: Staphylococcus aureus.
- Isolation and identification of gram negative bacteria: E. coli, Proteus sp. and Salmonella

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Cell biologist Academician	Pathology lab technician 	Goal 04(Quality education) Goal 13(climate action)	Pathology lab


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