



# C. U. SHAH UNIVERSITY

FACULTY OF SCIENCES

BACHELOR OF SCIENCE (MICROBIOLOGY)

DEPARTMENT OF ARTS & HUMANITIES

SEMESTER: IV

CODE: 4SC04PCS1

NAME: Professional Communication Skills (PCS)

### Teaching & Evaluation Scheme:-

Subject Code	Subject Name	Teaching Hours/week				Evaluation scheme/Semester							
		Th	Tu	Pr	Total	Theory				Practical			Total marks
						Sessional Exam		University Exam		Internal		Univ	
						Marks	Hrs	Marks	Hrs	Pr	TW	Pr	
4SC04PCS1	Professional Communication Skills	2	2	0	4	30	1	70	3	----	20	30	150

### Objectives:

- To give a global competitive edge to the students by way of honing their Professional Communication Skills.
- To make them aware of the societal setting of the professional life.
- To train them in basic fundamentals skills of Communication – LSRW

### Prerequisites:

- Students should have basic knowledge of English Language and grammar.
- Students should have ability to speak and write correct sentences in their day to day language.
- Students should be familiar with correct usage of language.

### Course outline:

Sr. No.	Course Content (Title of the Unit)	Minimum Number of Hours
0	Prerequisites	02
1	Behavioural Communication	08
2	Mastering LSRW Skills	05
3	Presentation Skills	05
4	Reading Skill	03
5	Writing Skill	10
6	Learning Phonetics for Effective Speaking	06
7	Revision of Grammar	06



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8	Vocabulary Building	03
	<b>PART-B Prose and Poetry</b>	12
9	One Act Play	
10	Poems	
	Total Hours	60

## Detail Course Content:

Unit No.	Content In Details Including Its Sub Topics
	<b>PART – A Professional Communication</b>
1	<b>Behavioural Communication</b> <ul style="list-style-type: none"> <li>• Basics of Behavioral Communication</li> <li>• Importance of Behavioral Communication in Professional World</li> <li>• Types of Behavioral Communication</li> <li>• Verbal Communication v/s Non Verbal Communication</li> <li>• Grooming and Etiquettes</li> </ul>
2	<b>Mastering LSRW Skills</b> <ul style="list-style-type: none"> <li>• Story Making and Telling</li> <li>• Movie Review (Writing and Speaking)</li> <li>• Book Review (Writing and Speaking)</li> </ul>
3	<b>Presentation Skills</b> <ul style="list-style-type: none"> <li>- What is presentation?</li> <li>- Purpose of Presentation</li> <li>- Preparatory Steps of Presentation</li> <li>- Nuances of Delivery</li> <li>- Importance of Audio-Visual Aids in Presentation</li> </ul>
4	<b>Business &amp; Technical Letter Writing</b> <ul style="list-style-type: none"> <li>• Introduction to Letter Writing</li> <li>• Personal Letter Vs Business Letter</li> <li>• Style of writing Business Letter</li> <li>• Principles of writing Business Letter</li> <li>• Layout of Business Letter</li> </ul> Types of Letter – Inquiry, Order, Quotation, Claim & Adjustment, Sales Letter  <b>Report Writing:</b> <ul style="list-style-type: none"> <li>• What is Report?</li> <li>• Characteristics of Report</li> <li>• Types of Informal Reports</li> </ul>
6	<b>Learning Phonetics for Effective Speaking</b> <ul style="list-style-type: none"> <li>• Speech Mechanism</li> <li>• Sounds, Vowels &amp; Consonants</li> </ul>



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	<ul style="list-style-type: none"><li>• Accents, Tone, Syllable, Intonation Patent &amp; Phonetics Transcription</li></ul>
7	<b>Revision of Grammar</b> Some of the grammatical topics should be revised to strengthen LSRW SKILLS of the students
8	<b>Vocabulary Developing</b> <ul style="list-style-type: none"><li>• Homophones</li><li>• Homonyms</li><li>• One word Substitute</li></ul>
9	<b>PART – B Literature</b>
	<b>Prose (One Act Play)</b> <ul style="list-style-type: none"><li>• “A Marriage Proposal” by Anton Chekhov</li></ul> <b>Poetry</b> <ul style="list-style-type: none"><li>• “The Night of Scorpion ” by NissimEzekeil</li><li>• “The Lamb” by William Black</li><li>• “The Pulley ” by George Herbert</li></ul>

### **Resources:**

- Green Andy, Effective Personal Communication Skills For Public Relations, Kogan Page, Limited, 2006
- Technical Communication, by D.K.Chakradev, Tech-max publication
- Basic Business Communication, by Flatly and Lesicar
- Basic Communication Skills for Technology, by Andrea J. Rutherford, by Pearson Education
- From sentence to paragraph, by William J. Kelly and Deborah L. Lawton, by Longman
- Technical Communication : Principles and Practice, by Meenaxi Raman andSangeeta Sharma, Oxford University Press
- An Intermediate English Grammar, Raymond Murphy, Cambridge University Press
- A High School English Grammar, Wren & Martin, S. Chand Publication
- A Course in Phonetics for Spoken English, Sethi&Dhamija
- Masks: One Act Plays(Ed) D. S. Maini. Macmillan.
- Wing word: A Collection of Poetries.



# C. U. SHAH UNIVERSITY

FACULTY OF SCIENCES

BACHELOR OF SCIENCE (MICROBIOLOGY)

DEPARTMENT OF MICROBIOLOGY

SEMESTER: IV

CODE: 4SC04BIB1

NAME: Bioinformatics and Biostatistics

### Teaching & Evaluation Scheme:-

Subject Code	Subject Name	Teaching Hours/week				Evaluation scheme/Semester							
		Th	Tu	Pr	Total	Theory				Practical			Total marks
						Sessional Exam		University Exam		Internal		Univ	
						Marks	Hrs	Marks	Hrs	Pr	TW	Pr	
4SC04BIB1	Bioinformatics and Biostatistics	3	0	4	7	30	1	70	3	30	--	70	200

### Objectives: -

To provide basic knowledge of Bioinformatics & Biostatistics.

### Prerequisites:-

Basic knowledge of Computational skills is required.

### Course content:

Sr. No.	Course contents	Teaching Hours
1	Introduction to bioinformatics, pattern recognition and prediction, biological databases, primary and secondary sequence databases, composite protein sequence databases, pair wise alignment technique; database searching NCBI, EMB, FASTA, BLAST BITS etc. algorithms and programmes, comparison of two sequences, global and local alignment – multiple sequence alignment.	10
2	Phylogenetic analysis: Sequence based taxonomy, Neighbor joining method, Parsimony tree, Computer Tools for phylogenetic analysis-eg-PHYLIP	10
3	Protein prediction - physical properties, secondary structure, alpha & beta structure, motifs, tertiary structures, specialized structure and function. Molecular visualization - protein conformation and visualization tool (RASMOL).	10
4	Biostatistics - definition - statistical methods - basic principles. Variables - measurements, functions, limitations and uses of statistics. Measures of central tendency - mean, median, mode, geometric mean - merits & demerits. Measures of dispersion - range, standard deviation,	15



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mean deviation, quartile deviation - merits and demerits; Co-efficient of variations. Statistical inference - hypothesis - simple hypothesis - student 't' test - chi square test.	
<b>Total Hours</b>	<b>45</b>

### **Learning Outcomes:-**

At the end of the course the student would have sufficient knowledge of bioinformatics & biostatistics.

### **Teaching & Learning Methodology:-**

- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

### **Books Recommended:**

1. **AH wood, T.K. Parry smith DJ**, Introduction to bioinformatics, 2001. Pearson education Asia.
2. **T.K. Altwood, D.J. Parry-Smith and S. Phukan**, Introduction to Bioinformatics.
3. **David. W. Mount**, Bioinformatics: Sequence and Genome Analysis.
4. **C.A. Orengo, D.T. Jones and J.M. Thornton**, Bioinformatics: Genes, Proteins, and Computers.
5. **Danniel, W.W.**, Biostatistic, 1987. New York, John Wiley Sons.
6. **Sundar Rao, P.S.S and Richards, J.**, An introduction to Biostatistics, 3rd edition, Christian Medical College, Vellore

### **E-Resources:**

1. <http://ocw.metu.edu.tr/course/view.php?id=37>
2. [http://lectures.molgen.mpg.de/online\\_lectures.html](http://lectures.molgen.mpg.de/online_lectures.html)
3. <http://staff.aub.edu.lb/~webbic/nemer/index.html>
4. <http://mleg.cse.sc.edu/edu/csce555/index.php?n=Main.LectureNotes>



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DEPARTMENT OF MICROBIOLOGY

SEMESTER: IV

CODE: 4SC04BIB1

NAME: Bioinformatics and Biostatistics (PRACTICALS)

<b>S.No</b>	<b>Experiment</b>
1	Study of Nucleic acid sequence databanks – GenBank, EMBL nucleotide sequence databank, DDBJ, UniGene.
2	Study of protein data banks - PIR, Swiss-PROT, UniPROT.
3	Study of Protein Structure and Classification databases – PDB, SCOP, CATH, FSSP, PDBSUM.
4	Study of Domain / Motif databases – BLOCKS, PRINTS, SBASE and PFAM.
5	Gene structure and function prediction (using GenScan, GeneMark)
6	Sequence similarity searching (NCBI BLAST)
7	Protein sequence analysis (ExPASy proteomics tools)
8	Multiple alignment - CLUSTALW
9	Building structure for a given sequence using Homology modeling
10	Evaluation of protein structure by Swiss PDB viewer and by other molecular visualization tools.



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FACULTY OF SCIENCES

BACHELOR OF SCIENCE (MICROBIOLOGY)

DEPARTMENT OF MICROBIOLOGY

SEMESTER: IV

CODE: 4SC04IMA1

NAME: Instrumental methods of analysis II

**Teaching & Evaluation Scheme:-**

Subject Code	Subject Name	Teaching Hours/week				Evaluation scheme/Semester							
						Theory				Practical			
		Th	Tu	Pr	Total	Sessional Exam		University Exam		Internal		Univ	
						Marks	Hrs	Marks	Hrs	Pr	TW		Pr
4SC04IMA1	Instrumental methods of analysis II	2	0	0	2	30	1	70	3	----	----	----	100

**Course content:**

Sr. No.	Course contents	Teaching Hours
1	Principle, Procedure & applications of <b>Partition Chromatography:</b> Paper chromatography, Thin Layer Chromatography, Ascending and descending chromatography. Applications of partition chromatography <b>Adsorption Chromatography:-</b> Principle, classification of column chromatography, column efficiency, preparation of column	10
2	<b>H.P.L.C &amp; HPTLC:-</b> Principle, instrumentation, advantages of HPLC & HPTLC, Applications of HPLC and HPTLC. <b>GC:</b> Principle, Instrumentation & Applications	10
3	<b>Electrophoresis</b> Principle, Procedure & applications	10
<b>Total Hours</b>		<b>30</b>

**Learning Outcomes:-**

The student would have sufficient knowledge of chromatographic techniques.

**Teaching & Learning Methodology:-**

- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.



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### **Books Recommended:**

1. **Willard, Hobert H.** *et. al: Instrumental Methods of Analysis*, 7th Ed. Wardsworth Publishing Company, Belmont, California, USA, 1988.
2. **Skoog, D.A. Holler F.J. and Nieman, T.A.** *Principles of Instrumental Analysis*, Thomson Asia Pvt. Ltd. Singapore.

### **E-Resources:**

1. <http://chemistry.syr.edu/totah/che276/support/5a.experiments.html>
2. [http://www.colorado.edu/chemistry/chem5181/Lectures/C4\\_HPLC.pdf](http://www.colorado.edu/chemistry/chem5181/Lectures/C4_HPLC.pdf)
3. <http://www.bhsu.edu/Portals/91/AnalyticalChemistry/StudyHelp/LectureNotes/Chapter21.pdf>
4. <http://www2.fiu.edu/~almirall/Lecture22.pdf>
5. <http://courses.chem.psu.edu/chem35/LecSp06/Lec11Sp06.pdf>
6. [http://www.hopkinsmedicine.org/mams/mams/middleframe\\_files/teaching\\_files/me330.884/2005/ms2005-lecture-4-chromatography.pdf](http://www.hopkinsmedicine.org/mams/mams/middleframe_files/teaching_files/me330.884/2005/ms2005-lecture-4-chromatography.pdf)



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FACULTY OF SCIENCES

BACHELOR OF SCIENCE (MICROBIOLOGY)

DEPARTMENT OF MICROBIOLOGY

SEMESTER: IV

CODE: 4SC04PRM1

NAME: Prokaryotic metabolism

### Teaching & Evaluation Scheme:-

Subject Code	Subject Name	Teaching Hours/week				Evaluation scheme/Semester							
						Theory				Practical			
		Th	Tu	Pr	Total	Sessional Exam		University Exam		Internal		Univ	
						Marks	Hrs	Marks	Hrs	Pr	TW		Pr
4SC04PRM1	Prokaryotic metabolism	6	0	6	12	30	1	70	3	30	--	70	200

### Objectives: -

To give the student a brief idea of microbial metabolism.

### Prerequisites:-

Basic of microbiology is essential.

### Course content:

Sr. No.	Course contents	Teaching Hours
1	<b>Carbohydrate metabolism:</b> Aerobic & Anaerobic glycolysis, sequence of reactions in glycolysis, regulation in glycolysis, citric acid cycle, glycogenesis, glycogenolysis (sequence of reactions & regulation), Pentose-phosphate pathway (sequence of reactions & regulation), extraction of energy from food sources.	15
2	<b>Anaerobic Respiration:</b> Concept of anaerobic respiration, oxidized sulfur compounds, and nitrate as electron acceptor with respect to electron transport chain and energy generation, Biochemistry of methanogens.	15
3	<b>Aerobic Respiration:</b> Mitochondrial electron transport chain, structure and function of ATPase (bacterial and mitochondrial), generation and maintenance of proton motive force, oxidative phosphorylation, inhibitors and un-couplers of electron transport chain and oxidative phosphorylation, Atkinson's energy charge, phosphorylation potential and its significance, Energy generation in all groups of chemolithotrophs.	15
4	<b>Phototrophic metabolism</b> Historical account of photosynthesis, diversity of phototrophic bacteria,	15



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	anoxygenic and oxygenic photosynthesis, photosynthetic pigments: action and absorption spectrum, type, structure and location, physiology of bacterial photosynthesis: light reactions, cyclic and non-cyclic photophosphorylation. Calvin cycle and reductive TCA cycle.	
5	<b>Lipid Metabolism:</b> Lipids as energy reserves, Fatty acid oxidation- alpha, beta and omega oxidations. Energy yields from fatty acid oxidation. Oxidation of unsaturated fatty acids and fatty acids with odd numbered carbon atoms, Ketogenesis. Biosynthesis of fatty acid and triacylglycerols.	15
6	Biosynthesis and catabolism of amino acids, Synthesis of major amino acids.	15
<b>Total Hours</b>		<b>90</b>

### **Learning Outcomes:-**

The student would have gained sufficient knowledge of microbial metabolism at the end of the course.

### **Teaching & Learning Methodology:-**

- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

### **Books Recommended:**

1. **Gottschalk, G.** (1986). Bacterial Metabolism, Springer-Verlag, New-York.
2. **Caldwell, D.R.** (1995). Microbial Physiology and Metabolism, W.C. Brown Publications, Iowa, USA.
3. **Moat, A.G. and Foster, J.W.** (1995). Microbial Physiology, John-Wiley, New York.
4. **White, D.** (1995). The Physiology and Biochemistry of Prokaryotes, Oxford University Press, New York.
5. **Reddy, S.M. and Reddy, S.R.** (2005). A Text Book of Microbiology Vol-II. Microbial Metabolism and Molecular Biology. Himalaya Publishing House, Mumbai.
6. **Lehninger, A.L., Nelson, D.L. and Cox, M.M.** (1993). Principles of Biochemistry, 2<sup>nd</sup> Edition, CBS Publishers and Distributors, New Delhi.

### **E-Resources:**

1. <http://home.cc.umanitoba.ca/~eworobe/122lecture3.pdf>
2. <http://webbuild.knu.ac.kr/~app-mic/resources/lecture/introduction%20to%20microbiology/chap8-metabolism.pdf>
3. [http://www.chris-anthony.co.uk/pdf\\_files/presentations/IntroductionWeb.pdf](http://www.chris-anthony.co.uk/pdf_files/presentations/IntroductionWeb.pdf)
4. <http://www.slideshare.net/valentinanuzzi/ch-7-microbial-metabolism>
5. <https://facultystaff.richmond.edu/~lrunyenjb/bio384/lecturenotes/ch10.pdf>



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DEPARTMENT OF MICROBIOLOGY

SEMESTER: IV

CODE: 4SC04PRM1

NAME: Prokaryotic metabolism (PRACTICALS)

S.No	Experiment
1	Qualitative & Quantitative estimation of Amylase
2	Qualitative & Quantitative estimation of Caseinase
3	Qualitative & Quantitative estimation of Gelatinase
4	Qualitative & Quantitative estimation of Lipase
5	MRVP test
6	IMViC test
7	Aminoacid deaminase test
8	Aminoacid decarboxylase test
9	Urease test
10	Nitrate reduction test
11	Arginine hydrolase test
12	Oxidase test
13	Catalase test



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DEPARTMENT OF MICROBIOLOGY

SEMESTER: IV

CODE: 4SC04BPT1

NAME: Bioprocess Technology

### Teaching & Evaluation Scheme:-

Subject Code	Subject Name	Teaching Hours/week				Evaluation scheme/Semester							
						Theory				Practical			
		Th	Tu	Pr	Total	Sessional Exam		University Exam		Internal		Univ	
						Marks	Hrs	Marks	Hrs	Pr	TW		Pr
4SC04BPT1	Bioprocess technology	3	0	4	7	30	1	70	3	30	--	70	200

### Objectives: -

This subject aims to empower the students with various bioprocess technologies used.

### Prerequisites:-

Basic knowledge of microbiology is essential.

### Course content:

Sr. No.	Course contents	Teaching Hours
1	<b>UPSTREAM PROCESSING:</b> Media Preparation and strain improvement <b>Industrial Strains</b> Strain improvement Different DNA mutating agents like UV, NTG, Nitrous acid, intercalating agents. <b>Fermentation Media Design</b> Buffers, precursors, steering agents, inducers, inhibitors, antifoam agents, trace elements. <b>Asepsis and Sterilization</b> Sterilization & maintenance of aseptic conditions - vessels, medium, additives, air	10
2	<b>UPSTREAM PROCESSING:</b> Fermentation equipment and process monitoring <b>Fermentation Equipments</b> Mode of operation (Batch, fed-batch, semi-continuous, continuous, SSF) Power Input for mixing (mechanical, hydrodynamic and pneumatic) Types of fermentors - typical constructional features and their importance in the specific processes. i. Mechanical - Waldhof fermenter, trickling generator	15



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	ii. Hydrodynamic- deep-jet fermenter iii. Pneumatic - air-lift fermenter, bubble-cap fermenter, acetator, cavitator. iv. Photo-bioreactor, tower and packed tower fermenters, <b>Process parameter monitoring and control</b> Temperature, flow, pressure, dissolved oxygen, foam, inlet and exit gases, pH	
3	<b>Fermentation process operation:</b> Inoculum preparation, scale-up of fermentations. Chemostat and turbidostat. <b>Downstream processing:</b> Separation of cells by froth floatation, sedimentation, flocculation, Filtration and centrifugation. Cell disruption for intracellular products. Membrane filtrations, including reverse osmosis.	15
4	<b>Typical fermentation processes:</b> Antibiotics (Penicillins), organic acids (acetic acid), Microbial enzymes (Amylases and proteases) ethanol. Single cell proteins (SCP), Vitamins (Vit B 12).	5
<b>Total Hours</b>		<b>45</b>

### **Learning Outcomes:-**

The various aspects of fermentation & its uses would be clear at the end of the course.

### **Teaching & Learning Methodology:-**

- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

### **Books Recommended:**

1. **Stanbury PF and Whitaker A**, Principles of Fermentation technology, Pergamon Press, Oxford
2. **Prescott and Dunn's**, "Industrial Microbiology", 4th Edition, McMillan Publishers 1982.
3. **Peppler, H. J. and Perlman, D.** "Microbial Technology". Vol 1 & 2, Academic Press, 1979.
4. **U. Satyanarayana**, "Biotechnology". Books and Allied (P) Ltd, 2005.
5. **Agrawal A. K. and P. Parihar**, "Industrial Microbiology"- Fundamentals and Application AGRIBIOS (India), 2005.
6. **H. A. Modi**, "Fermentation Technology" Vols 1 & 2, Pointer Publications, India, 2009.

### **E-Resources:**

1. <http://lecturenotesfree.blogspot.in/2013/03/fermentation.html>
2. <https://www.msu.edu/course/mmg/301/lec19.pdf>
3. <http://rhoyle.cusd.claremont.edu/mm/Course%20Assets/Biology/Lecture%20Notes/pdf%20Ch.%209%20lecture%20notes.pdf>
4. <http://fbisson.ucdavis.edu/PDF/VEN124%20Section%203.pdf>



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DEPARTMENT OF MICROBIOLOGY

SEMESTER: IV

CODE: 4SC04BPT1

NAME: Bioprocess Technology (PRACTICALS)

<b>S. No</b>	<b>Experiment</b>
1	Isolation of antibiotic producing microbes from soil by crowded plate technique.
2	Fermentation of grape juice and estimation of alcohol by dichromate method.
3	Enzyme immobilization using sodium alginate.
4	Production microbial enzyme (amylase), hydrolysis of starch & its estimation
5	Anaerobic fermentations: Production of methane from Glucose.
6	Ethanol production from Jaggery
7	Chemical estimation of sugar (Reducing & Non reducing)
8	Chemical and Bioassay of Penicillin
9	Coles method
10	DNSA method