હેમચંદ્રાચાર્ય ઉત્તર ગુજરાત યુનિવર્સિટી

NAAC A (3.02) State University

પો.બો.નં.–૨૧, યુનિવર્સિટી રોડ, પાટણ (ઉ.ગુ.) ૩૮૪૨૬૫

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પરિપત્ર ક્રમાંક – ૪૪/ ૨૦૧૯

વિષયઃ વિજ્ઞાન વિદ્યાશાખાના અનુસ્નાતક કક્ષાના સેમેસ્ટર–૧ થી સેમેસ્ટર–૪ સુધીના નવા અભ્યાસક્રમોનું માળખું તેમજ નવા અભ્યાસક્રમ અંગે...

આ યુનિવર્સિટીના વિજ્ઞાન વિદ્યાશાખા અંતર્ગત વિષયોના અનુસ્નાતક વિભાગો તથા સંલગ્ન વિજ્ઞાન વિદ્યાશાખાની તમામ કોલેજોના આચાર્યશ્રીઓને જણાવવાનું કે, એકેડેમીક કાઉન્સિલ ની તા. ૫/૬/૨૦૧૮ ની સભા ના નિર્દિષ્ટ ઠરાવો અન્વયે UGC ની Model curriculum અંગેની Guideline સંદર્ભે વિજ્ઞાન વિદ્યાશાખા હેઠળના નીચેના વિષયોના અનુસ્નાતક કક્ષાના સામેલ પરિશિષ્ટ પ્રમાણેના નવા અભ્યાસક્રમનું માળખું તેમજ અભ્યાસક્રમો **શૈક્ષણિક વર્ષઃ ૨૦૧૯–૨૦ થી ક્રમશઃ અમલ માં આવે તે રીતે** મંજૂર કરેલ છે. જેનો અમલ કરવા સારૂ સબંધિતોને આ સાથે મોકલવામાં આવે છે.

ક્રમ નં.	અભ્યાસક્રમ	એકેડેમીક કાઉન્સિલની તારીખઃ૦૫/૦૬/૨૦૧૮ના ઠરાવ ક્રમાંક	સેમેસ્ટર
૧	અભ્યાસક્રમો નું માળખું	૦૭	તમામ સેમેસ્ટર
૨	રસાયણશાસ્ત્ર	૪૪	સેમ.–૧ થી સેમ.–૨
૩	પ્રાણીશાસ્ત્ર	૪૫	સેમ.– ૧થી સેમ.–૪
૪	બાયોટેકનોલોજી	૪૬	સેમ.– ૧ થી સેમ.–૪
૫	ગણિતશાસ્ત્ર	૪૭	સેમ.–૧ થી સેમ.–૪
૬	એમ.એસ.સી. ઈલેકટ્રોનિકસ	૪૯	સેમ.–૧ થી સેમ.–૪
૭	ભૌતિકશાસ્ત્ર	૫૦	સેમ.–૧ થી સેમ.–૪

આ બાબતની સબંધિત અધ્યાપકો તથા વિધાર્થીઓને આપના સ્તરેથી જાણ કરવા વિનંતી છે.

નોંધ :– (૧) વિદ્યાર્થીઓની જરૂરીયાત માટે પરિપત્રની એક નકલ કોલેજના ગ્રંથાલયમાં મૂકવાની રહેશે.
(૨) આ અભ્યાસક્રમ / સ્કીમ યુનિવર્સિટીની વેબ સાઈટ www.ngu.ac.in પર પણ ઉપલબ્ધ કરાવવામાં આવનાર છે.

સહી/–
કુલસચિવવતી

બિડાણ : ઉપર મુજબ

નં.–એ કે / અ× સ / ૧૦૧૬૩ / ૨૦૧૯
તારીખ : ૧૪ / ૦૩ / ૨૦૧૯

પ્રતિ,
૧. અધ્યક્ષશ્રી/ કો.ઓર્ડીનેટરશ્રી–વિજ્ઞાન વિદ્યાશાખા અંતર્ગત વિષયોના અનુસ્નાતક વિભાગો, હેમ. ઉ.ગુ. યુનિવર્સિટી, પાટણ.
૨. સંલગ્ન સાયન્સ કોલેજોના આચાર્યશ્રીઓ
૩. ડૉ. એમ. બી. પ્રજાપતિ (ડીનશ્રી),ગણિતશાસ્ત્ર ભવન, હેમ. ઉ.ગુ. યુનિવર્સિટી, પાટણ.
૪. પરીક્ષા નિયામકશ્રી, હેમચંદ્રાચાર્ય ઉત્તર ગુજરાત યુનિવર્સિટી, **પાટણ.** (પાંચ નકલ)
૫. ગ્રંથપાલશ્રી, હેમ.ઉત્તર ગુજરાત યુનિવર્સિટી, **પાટણ.** (વિદ્યાર્થીઓના ઉપયોગ સારૂ રેકર્ડ ફાઈલ માટે)
૬. સિસ્ટમ એનાલીસ્ટશ્રી, કોમ્પ્યુટર (રીઝલ્ટ) સેન્ટર, હેમ.ઉ.ગુ.યુનિવર્સિટી, **પાટણ.** તરફ પરિણામ માટે તથા વેબસાઈટ પર મૂકવા સારૂ.
૭. માન.કુલપતિશ્રી/ કુલસચિવશ્રીનું કાર્યાલય, હેમ.ઉત્તર ગુજરાત યુનિવર્સિટી, **પાટણ.**
૮. અનુસ્નાતક પ્રશાખા (એકેડેમીક શાખા) હેમચંદ્રાચાર્ય ઉત્તર ગુજરાત યુનિવર્સિટી, પાટણ.
૯. મુખ્ય હિસાબી અધિકારીશ્રી (મહેકમ), હેમચંદ્રાચાર્ય ઉત્તર ગુજરાત યુનિવર્સિટી, પાટણ તરફ → પરિપત્રની ફાઈલ અર્થે
૧૦. સિલેકટ ફાઈલે. (૨ નકલ)

Hemchandracharya North Gujarat University

Accredited by NAAC with "A" Grade (CGPA 3.02)

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The Proposed New Structure for M.Sc. Course is based on choice Based Credit System (CBCS) which is in force from June – 2018

CBCS Course Pattern

1. This programme is divided into four Semesters (Two Years) . The duration of an academic year consists of two semesters, each of 15 weeks for teaching. The academic session in each semester will provide 90 teaching days. 24 credit each year X 4 semester= 96 credits master level.
2. There will be three categories of courses / papers in this programme :
   - A. Four Compulsory – Core theory courses with 4 credits each in each semester.
   - B. One Choice Based Elective Course (disciplinary / interdisciplinary) with 2 credits in each semester.
   - C. Two Practical's each of Three credits in each semesters .
   - D. In the IV Semester as above a,b,c or instead of above A,B, C ; a student can undertake Three core theory courses (12 - credits) and project / field work (12 - credits), OR Major Dissertation (24 - credits) OR as per decided by BOS.
3. Detailed Course Pattern for each Semester is given bellow.

M.Sc. : Semester – I

Course	Name of the Course	Exam. Duration (Hours)	Ext. Marks	Int. Marks	Total Marks	Teach, Hours Per week	Credit point
Paper - I	Core-I	2 : 30	70	30	100	4	4
Paper – II	Core-II	2 : 30	70	30	100	4	4
Paper – III	Core-III	2 : 30	70	30	100	4	4
Paper – IV	Core-IV	2 : 30	70	30	100	4	4
Practical : Paper – I	Pract-I	3/4	75	--	75	6	3
Practical : Paper – II	Pract-II	3/4	75	--	75	6	3
Elective Course (Any One) Disciplinary / Interdisciplinary		2 : 00	50	--	50	2	2
TOTAL			480	120	600	30	24

M.Sc. : Semester – II

Course	Name of the Course	Exam. Duration (Hours)	Ext. Marks	Int. Marks	Total Marks	Teach, Hours Per week	Credit point
Paper – V	Core-V	2 : 30	70	30	100	4	4
Paper – VI	Core-VI	2 : 30	70	30	100	4	4
Paper – VII	Core-VII	2 : 30	70	30	100	4	4
Paper – VIII	Core-VIII	2 : 30	70	30	100	4	4
Practical : Paper – III	Pract-III	3/4	75	--	75	6	3
Practical : Paper – IV	Pract-IV	3/4	75	--	75	6	3
Elective Course (Any One) Disciplinary / Interdisciplinary		2 : 00	50	--	50	2	2
TOTAL			480	120	600	30	24

M.Sc. : Semester – III

Course	Name of the Course	Exam. Duration (Hours)	Ext. Marks	Int. Marks	Total Marks	Teach, Hours Per week	Credit point
Paper – IX	Core-IX	2 : 30	70	30	100	4	4
Paper – X	Core-X	2 : 30	70	30	100	4	4
Paper – XI	Core-XI	2 : 30	70	30	100	4	4
Paper – XII	Core-XII	2 : 30	70	30	100	4	4
Practical : Paper – V	Pract-V	3/4	75	--	75	6	3
Practical : Paper – VI	Pract-VI	3/4	75	--	75	6	3
Elective Course (Any One) Disciplinary / Interdisciplinary		2 : 00	50	--	50	2	2
TOTAL			480	120	600	30	24

M.Sc. : Semester – IV

Course	Name of the Course	Exam. Duration (Hours)	Ext. Marks	Int. Marks	Total Marks	Teach, Hours Per week	Credit point
Paper – XIII	Core-XIII	2 : 30	70	30	100	4	4
Paper – XIV	Core-XIV	2 : 30	70	30	100	4	4
Paper – XV	Core-XV	2 : 30	70	30	100	4	4
Paper – XVI	Core -XVI	2 : 30	70	30	100	4	4
Practical : Paper – VII	Pract-VII	3/4	75	--	75	6	3
Practical : Paper – VIII	Pract-VIII	3/4	75	--	75	6	3
Elective Course (Any One) Disciplinary / Interdisciplinary		2 : 00	50	--	50	2	2
TOTAL			480	120	600	30	24

OR

Course	Name of the Course	Exam. Duration (Hours)	Ext. Marks	Int. Marks	Total Marks	Teach, Hours Per week	Credit point
Paper – XIII	Core-XIII	2 : 30	70	30	100	4	4
Paper – XIV	Core-XIV	2 : 30	70	30	100	4	4
Paper – XV	Core-XV	2 : 30	70	30	100	4	4
Major Dissertation			210	90	300	18	12
TOTAL			420	180	600	30	24

NOTE :

1. For 4 credit course: Each syllabus is of 4 Units having equal weightage.
2. For 2 credit course: Each syllabus is of 2 Units having equal weightage.
3. There is no section in semester end examinations i.e. questions Paper is without sections.
4. For question paper of 70 marks: Each Question paper contains 4 questions: Q-1 from unit-I of 18 marks, Q-2 from unit-II of 17 marks, Q-3 from unit-III of 18 marks and last Q-4 from unit-Iv of 17 marks from entire course.
5. For question paper of 50 marks: Each Question paper contains 3 questions: Q-1 from unit-I of 20 marks, Q-2 from unit-II of 20 marks, and last Q-3 is of objective types having 10 marks from entire course.

[BOS may add some specifications with reference to above structure.]

Hemchnadracharya North Gujarat University, Patan.

NAME OF THE DEGREE

Master of Science in Biotechnology
M.Sc. (Biotechnology)

AIMS OF THE PROGRAM

The M.Sc. (Biotechnology) program in Biotechnology aims at training students in the areas of modern Biotechnology. This program offer specialized curriculum in various modules of Biotechnology such as Bioprocess Technology, Molecular Biotechnology, Food and Industrial Microbiology and Plant and Animal Biotechnology. The graduates are expected to carry out both basic and applied research in the areas of Biotechnology having academic and/or industrial relevance. The students would also be trained to assist industry in developing and/or solving problems of Biotechnology. In addition, the program also aims at generating manpower capable of teaching Biotechnology at postgraduate and undergraduate level.

SEMESTERWISE DISTRIBUTION OF MARKS: * 70 Theory + 30 Internal

SEMESTER-I:

4 Papers (100 Marks each*) :	400
2 Combined Practical :	150
Subject Elective :	50
	600 Marks

SEMESTER-II:

4 Papers (100 Marks each*) :	400
2 Combined Practical :	150
Subject Elective :	50
	600 Marks

SEMESTER-III:

4 Papers (100 Marks each*) :	400
2 Combined Practical :	150
Subject Elective :	50
	600 Marks

SEMESTER-VI:

4 Papers (100 Marks each*) :	400
2 Combined Practical :	150
Subject Elective :	50
	600 Marks

OR

SEMESTER-VI:

3 Papers (100 Marks each*) :	300
Major Dissertation	300
	600 Marks

Preamble:

Biotechnology has grown, extensively in last couple of decades. This advanced 'interdisciplinary' life science branch has a tremendous networking potential with modern cutting edge technology. This has given it a separate status in fundamental research as well as in modern industrial enterprise. Global and local focus has slowly shifted to not only current "Century of Knowledge" but also on to technology development and application in life sciences. In the milieu of research and industrialization for economic development and social change, biotechnology is an ideal platform to work. The interdisciplinary nature of biotechnology flags involves many fundamental research fields from cell biology to molecular biology, from biochemistry to biophysics, from genetic engineering to stem cell research, from bioinformatics to genomics-proteomics, from environmental biology and to biodiversity, from microbiology to bioprocess engineering, from bioremediation to In silco drug discovery and so on. The proposed credit-based curriculum and grading system will even add much more to the existing interdisciplinary nature of biotechnology and will also offer many courses to the other branches of life science. The generative power of biological data is effectively harnessed by biotechnology like no other field. The relevance and application of these studies on living organisms and their bioprocesses is extensively covered in this field with the help of technology. Economic and social renaissance is staged on biotechnology especially, since it's biomedical and cutting edge technological applications are tremendously powerful in shaping this century and exciting biofuture. Life science, IT industries and research institutes are always on a lookout for trained Biotechnologists as an efficient work force in fundamental research and industries. Education and research sectors require such interdisciplinary trained workforce to develop future generations of science leaders.

Introduction: Master's in Biotechnology course syllabus is revised to cater to the needs of credit based semester and grading system. The changing scenario of higher education in India and abroad is taken into consideration to make this syllabus more oriented towards current need of modern research and industrial sectors. The syllabus encompasses the fundamental academics at one end and latest technologies in life science at the other. Theory courses will help students develop their knowledge sets on various topics of biotechnology, to which, they are introduced at the undergraduate level. Extensive practical courses are designed to supplement the theory courses with hands on experimentation in wet-lab and on fields.

Empowerment of students to face research and industrial outlets is at the centre of this syllabus. Students having to select their own courses will develop the depth in specialization and also make them ready to face the cutting edge of life science establishment in the world without any further training. The colleges are encouraged to develop their own departmental courses based on available expertise, both, personnel and infrastructural. We have prepared M.Sc. syllabus by keeping in vision the undergraduate curriculum. At the undergraduate level, students were introduced to many fundamental topics in life sciences such as molecular biology, developmental

biology, fermentation technology, biodiversity, bioinformatics and tissue culture etc. At the post graduate level they will be exposed to the advanced principles of biochemistry, genetics, molecular and cell biology, environmental biology, microbiology, bioinformatics etc. along with technological advances and applications of basic principles to successfully carry out research and industrial developments. A research project/ industrial training modules are incorporated to provide a buffer zone for budding biotechnologists eager to enter the life science sector.

Objectives to be achieved:

• To help the students to build interdisciplinary approach

• To empower students to excel in various research fields of Life Sciences

• To inculcate sense of scientific responsibilities and social and environment awareness

• To help students build-up a progressive and successful career

Eligibility: As per HNGU rules

OR

Students with B.Sc in Biotechnology or Microbiology or Biochemistry with subsidiary Botany or Zoology.

1) The syllabus is divided into four semesters. In all the semesters there are four theory papers. The first three semesters carry two practical each and Seminar. A project work is required to be completed in the fourth semester. Apart from the project, the student will also have to complete a practical and a seminar in the fourth semester. Each theory paper is divided into four units and all the units carry equal weightage. All papers and practical are compulsory. Each theory paper carries 100 marks. Each practical carries 75 marks. Subject elective paper has 50 marks.

2) Number of theory and practical periods: The syllabus is based on 18 theory periods and 12 practical periods per week. Candidates are required to pass separately in theory and practical examination.

3) Study tour: Students of M. Sc. Biotechnology are encouraged to visit some research institutes of national and international repute during the two-year course.

4) Seminars: In all the semesters every student has to give at least one seminar per semester.

5) If dissertation opt by students than students must decide topic in third semester and make Research articles review /Book review before Fourth Semester so it will help to write in thesis and encourage the research attitude .

5) Distribution of theory/practical/seminar/project marks according to syllabus only

(a) ***Dissertation / Project* Course** commences in III Semester but evaluated and Grade Points are to be added in 4th Semester.

(b) ***Educational Tours / Field Works*** Course may be carried out in any Semester or all Semesters, but evaluated and Grade Points are to be added in the 4th Semester only.

(c) ***Seminar / Tutorial Course*** may be carried out in first two Semesters but will be evaluated and Grade Points are to be added in the 3rd Semester only.

DISSERTATION (Elective): Any one subject is to be chosen from the following (Subjects offered may change from time to time depending on the availability of expertise)

Course Structure for M.Sc. Biotechnology Programme Semester 1 to 4

SEMESTER 1 to 3	Paper	Hours/ week	Credits	External Exam hours	Internal marks	External marks	Total marks
1	Core Compulsory	4h/ week/per paper	16	2.5	Max.:30 Min: 12	Max.:70 Min: 24	400
2	Practical 1 and 2 in each semester	3+3	6	More than 4 hours		75+ 75	150
3	BT-SE Any one in each semester	2	2	2	----	Max: 50 Min: 17	50
4	Total semester		24				600
Semester 4							
1	Core Compulsory	4h/ week/per paper	16	2.5	Max.:30 Min: 12	Max.:70 Min: 24	400
2	Practical 1 and 2 in each semester	3+3	6	More than 4 hours		75+ 75	150
3	BT-SE Any one in each semester	2	2	2	----	Max: 50 Min: 17	50
4	Total semester		24				600
OR							
1	Core Compulsory	4h/ week/per paper (Three paper)	12	2.5	Max.:30 Min: 12	Max.:70 Min: 24	300
2	Dissertation		12		MAX:90 Min: 30	Max:210 Min:70	300
3	Total		24				600

M. Sc. Biotechnology Semester I

Theory	Paper Name	Credits
BT - CC – 101	Biochemistry	4 units/4 credit
BT- CC – 102	Microbial physiology	4 units/4credits
BT - CC – 103	Cell Biology and Physiology	4 units/4 credits
BT - CC – 104	Biostatistics and Bioinformatics Techniques	4 units/4 credits
Practical		
BT - PC – 105	Practical of BT-CC-101 and 102	6 credit
BT-PC- 106	Practical of BT-CC-103 and 104	6 credit
Subject Elective (any One)		
BT – SE – 107 or 108	107:Basic Chemistry in Biotechnology 108: Cancer Biology	2 units/2credits

M. Sc. Biotechnology Semester II

Theory	Paper Name	Credits
BT - CC – 201	Classical and Molecular Genetics	4 units/4 credit
BT- CC – 202	Immunology and Related Techniques	4 units/4credits
BT - CC – 203	Biophysics and Analytical Technique in Biotechnology	4 units/4 credits
BT - CC – 204	Environmental Biotechnology	4 units/4 credits
Practical		
BT - PC – 205	Practical of BT-CC-201 and 202	6 credit
BT-PC- 206	Practical of BT-CC-203 and 204	6 credit
Subject Elective (any One)		
BT – SE – 207 or 208	207: Nanotechnology 208: Bio-safety issues	2 units/2credits

M. Sc. Biotechnology Semester III

Theory	Paper Name	Credits
BT - CC – 301	r-DNA Technology & Genetic Engineering	4 units/4 credit
BT- CC – 302	Bioprocess and Bioengineering	4 units/4credits
BT - CC – 303	Applied Techniques in plant Cell and Tissue Culture (Plant biotechnology)	4 units/4 credits

BT - CC – 304	**Applied Techniques in Animal Cell and Tissue Culture (Animal biotechnology)**	**4 units/4 credits**
Practical		
BT - PC – 305	**Practical of BT-CC-301 and 302**	**3 credit**
BT-PC- 306	**Practical of BT-CC-303 and 304**	**3 credit**
Subject Elective (any One)		
BT – SE – 307 **BT – SE -308**	**307: Vaccinology** **308: Research Methodology & Professional practices in Biotechnology**	**2 units/2credits**

M. Sc. Biotechnology Semester IV

Theory	**Paper Name**	**Credits**
BT - CC – 401	**Food Biotechnology**	**4 units/4 credit**
BT- CC – 402	**Industrial Practice and Use of Biotechnology**	**4 units/4credits**
BT - CC – 403	**Medical Biotechnology**	**4 units/4 credits**
BT - CC – 404	**Socio-Economic Aspects & IPR**	**4 units/4 credits**
Practical		
BT - PC – 405	**Practical 401 and 402**	**6 credit**
BT-PC- 406	**Practical 403 and 404**	**6 credit**
Subject Elective (any One)		
BT – SE – 407 **BT – SE – 408**	**BT – SE – 407** **Bioentrepreneurship** **BT – SE – 408** **Proteomics and Genomics**	**2 units/2credits**

OR

M. Sc. Biotechnology Semester IV

Theory	Paper Name	Credits
BT - CC – 401	Industrial Practice and Use of Biotechnology	4 units/4 credit
BT- CC – 402	Socio-Economic Aspects & IPR	4 units/4credits
BT - CC – 403	Medical Biotechnology	4 units/4 credits
Major Dissertation: BT-PC-409	Dissertation	12 credits

SEMESTER-I

BT - CC – 101

Biochemistry

Unit	Details Content	No. of Lect.
Unit-I	**Carbohydrates**: Introduction, Classification and Properties Glycolysis, citric acid cycles its function in energy generation and biosynthesis of energy rich bonds.	12
Unit-II	**Amino acids / Proteins**: Introduction, classification and properties. Biosynthesis and degradation of amino acid. Regulation of amino acid metabolism. Urea & Cori cycles	12
Unit-III	**Nucleic acid**: Biosynthesis of purines and pyrimidines. Regulation of purines and pyrimidines biosynthesis.**Lipids**: Fatty acid biosynthesis, Acetyl CoA carboxylase, Fatty acid synthase, desaturase and elongase. Fatty acid oxidation.	12
Unit-IV	**Enzyme:** Classification & nomenclature of Enzymes. **General mechanism of enzyme regulation**; Feedback inhibition and feed forward stimulation; Enzyme repression, induction and degradation	12

Texts/References

1. V.Voet and J.G.Voet, Biochemistry, 3rd edition, John Wiley, New York, 2004.
2. A.L. Lehninger, Principles of Biochemistry, 4th edition, W.H Freeman and Company, 2004.
3. L. Stryer, Biochemistry, 5th edition, W.H. Freeman and Company, 2002.

BT - CC – 102

Microbial Physiology

Unit	Details Content	No. of Lect.
Unit-I	**Microorganism**- General properties, Structure, and Reproduction: Domain Bacteria: Proteobacteria (Alpha, Beta, Gamma, Delta and Epsilon Proteobacteria), Cyanobacteria, Chlorobium, Firmicutes, Actinobacteria, Domain Archea: Crenarchaeota, Euryarchaeota. Classification of Fungi and Algae.Application of Microbes	12
Unit-II	**Viruses,** Virioids and Prions (Acellular entities) General characters, Structure, Criteria for classification of Viruses, Viruses that affect humans, animals and plants, Isolation, cultivation and identification of Viruses (Growing in Bacteria, Living Animals, embryonated eggs, Cell Cultures). Viral Multiplication (Lytic and lysogenic life cycle), Virioids and Prions - General properties and diseases caused by virioids and prions.	12
Unit-III	**Microbial Growth and Control Physical parameters** (Temperature, pH, Osmotic Pressure), Chemical parameters (Carbon, Nitrogen, Phosphorous, Sulphur, Trace elements, oxygen), Growth factors, Culture Media, Phases of Growth, Growth Measurements, Microbial growth control -Physical methods (Heat, Pasteurization, Filtration, Radiation, Dessication, Low Temperature, High Pressure, Osmotic Pressure) and Chemical Methods (Phenols, Halogens, Alcohols, quaternary ammonium compounds).	12
Unit-IV	**Microbiological methods**: Isolation and cultivation of microorganisms from Water, Soil, Air, Rhizoshere, Phyllosphere and Mycorrhiza, Biogeochemical cycle.	12

References:

1. Microbiology by MJ Pelczar Jr, ECS Chan, NR Krieg 5th Edition, Pub: Tata Mcgra-Hill Publishing Co Ltd. 2. Introductory Microbiology by Heritage Pub Heritage
3. General Microbiology by Stainer Pub; Ingraham and Wheeler (McMillan)
4. Alexander M (1977) Introduction to soil microbiology, John Wiley and Sons Inc.N.Y.
5. Atlas R.M. (1998) Microbiology, Fundamentals and applications 2nd Edition, Milan Publishing Co.
6. Brock T.D. and Madigan M.T (1992) Biology of Microorganisms 6th Edn. Prentice Hall, Eagle wood cliffs N.j.

7. Holt J.S. Kreig N.R., Sneath P.H.A and Williams S.T (1994) Bergey‟s Manual of Systemic Bacteriology 9th Edn. William and Wilkins, Baltimore.
8. Prescott L.M, Harley T.P and Klein D.A. (1996) Microbiology WMC. Brown publishers

BT - CC – 103

Cell Biology and Physiology

Unit	Details Content	No. of Lect.
Unit-I	**Basic Characteristics of the Cell**: Structure, organization and composition of prokaryotic and eukaryotic cell. Plasma membranestructure and functions, membrane models. Components of Blood & their functions (Plasma, RBC, WBC, Platelets). Extracellular matrix (collagen, proteoglycans, fibronectin, lamins).	12
Unit-II	**Biomembranes**: Microscopic Techniques, Eukaryotic Membrane Structure, Molecular Composition, Organization and Synthesis, Membrane Transport and Transporters.	12
Unit-III	**Nucleus**: Structure and function of nuclear envelope, lamina and nucleolus; Macromolecular trafficking; Chromatin organization and packaging. Mitochondria & Chloroplast– Structure-function	12
Unit-IV	**Cytoskeleton**: Nature of cytoskeleton, Actin filaments, actin binding proteins, Intermediate filaments, Microtubules, MAPs, Structure and functions of cilia and flagella.. **Cell Cycle**: Molecular events of cell division and cell cycle, regulation of cell cycle events-Cyclins, Cyclin dependent kinases, inhibitors. Apoptosis, necrosis.	12

Texts/References

1. Lodish et al., Molecular cell Biology, 4th Edition, W.H. Freeman & Company, 2000.
2. Smith & Wood, Cell Biology, 2nd Edition, Chapman & Hall, London, 1996.
3. Watson et al., Molecular Biology of the gene, 5th Edition, Pearson Prentice Hall. USA, 2003.
4. B. M. Turner, Chromatin & Gene regulation, 1st Edition, Wiley-Blackwell, 2002.
5. Benjamin Lewin, Gene IX, 9th Edition, Jones and Barlett Publishers, 2007.

BT - CC – 104

Biostatistics and Bioinformatics Techniques

Unit	Details Content	No. of Lect.
Unit-I	**Biostatistics**: Sampling Techniques and data collection, classification and tabulation of data. Graphical and diagrammatic representation, histogram, frequency polygon, frequency curve. **Measures of central tendency** – Mean (arithmetic, harmonic and geometric), Median and Mode. Measures of dispersion – Standard deviation and standard errors	12
Unit-II	**Probability distributions** – binominal and Poisson distribution, Measures of Asymmetry. Statistical hypotheses, types of errors, level of significance, Student's test , chi-square, goodness of fit and F tests. Graphical explanation of any research module	12
Unit-III	Bioinformatics: Introduction to bioinformatics. Use of nucleic acid and protein data banks – NCBI, EMBL, DDBJ,SWISSPORT. Pairwise sequence alignment, Multiple sequence alignment. Gene prediction. Genome analysis and phylogenetic prediction	12
Unit-IV	**Bioinformatics**: Application of Bioinformatics tools in research , Drug designing, Annotation , Application and mechanism of Latest software in biological system.	12

Texts/References

Wayne W. Daniel, Biostatistics : A foundation for Analysis in the Health Sciences, 8th Edition, Wiley, 2004.
Prem S. Mann, Introductory Statistics, 6th Edition, Wiley, 2006.
John A. Rice, Mathematical Statistics and Data Analysis, 3rd Edition, John A. Rice, Duxbury Press, 2006.
Campbell and Heyer, Discovering Genomics, Proteomics, & Bioinformatics, 2nd Edition, Benjamin Cummings, 2002.
Cynthia Gibas and Per Jambeck, Developing Bioinformatics Computer Skill, 1st Edition, O'Reilly Publication, 2001.

BT – SE – 105

Practical:- 1

1. Determination of pI of amino acid by titration method

2. Estimation of glucose by Hagerdon and Jensen method

3. Estimation of total sugar by Anthrone method

4. Estimation of amino acid by Ninhydrin method

5. Estimation of protein by Lowry‟s method

6. Estimation of inorganic phosphate by Fiske-Subbarow method

7. Determination of (a) Iodine number and (b) Acetyl number of a lipid

8. Separation of amino acids by paper chromatography and TLC

9. Microbes culture in broth and solid media, Colony characteristics and Counting of colony (serial dilution method)

10. Bacterial growth assessment by turbidometry

11. Staining techniques (a) Simple staining (b) Gram staining (c) Endospore staining (d) Capsule staining (e) AFB staining (f) negative staining

12. Biochemical tests (a) Indole test (b) Methyl red test (c) Voges Proskaeur test (d) Citrate utilization test (e) Triple sugar vion agar test (f) Starch hydrolysis test (g) Gelatin hydrolysis test (h) Catalase test (i) Oxidase test

13. Soil Microbiology Isolation microflora of (a) rhizosphere (b) phylloplane (c) actinomycetes (d) Rhizobium from legume of root nodules (e) Sporocarp by sieve method (f) identification of Rhizobium and agrobacterium

14. Air Microbiology Isolation of air microflora (a) exposure plate method (b) rotorod sampler method.

15. Water Microbiology: Testing of quality of water (coliform test), H2S strip method.

16. Estimation of lactate/ Citrate from bacterial culture media

BT – SE – 106

Practical:- 2

1. Mounting of polytene chromosomes
2. Mounting of Barr bodies

3. Study of Karyotyping in onion, humans (normal and abnormal)
4. Study of mutation in E.coli by UV light
5. Demonstration of multiple allele by blood group in humans
6. Use of Micrometer and calibration, measurement of onion epidermal cells and yeast.
7. Cell division Mitotic and meiotic studs in grasshopper testes. Onion root tips and flower
8. Chromosomes: Mounting of polygene chromosomes
9. To calculate the averages for the given conditions for the data (Mean ,mode & Median).
10. To perform paired t- test.
11. Pairwise alignment
12. Multiple sequence alignment
13. Searching DNA databases with FASTA and BLAST
14. Searching protein sequence databases with FASTA and BLAST
15. Protein structure visualization
16. Secondary structure prediction online
17. In silico Drug designing
18. Docking and annotation of Genomic or protein sequence

BT – SE – 107

Basic Chemistry in Biotechnology

Unit	Details Content	No. of Lect.
Unit-I	Stoichiometry Chemical Equations , Types of Reactions , The Mole, Empirical Formulas, Limiting Reactants Molarity: Concentration of Solutions ,Titrations	12
Unit-II	Basic concepts of chemical bonding : Lewis structures ,Ionic bonding ,Covalent bonding , Electronegativity and bond polarity	12

BT – SE – 108

Cancer Biology

Unit	Details Content	No. of Lect.
Unit-I	Cancer Defined History of Cancer Research Oncogenes, Tumor suppressors and tumor viruses, Cancer metabolism	12
Unit-II	Cancer microenvironment and angiogenesis ,Invasion and metastasis ,Tumor immunology and immunotherapy, Cancer stem cells , Therapeutic resistance , Future of cancer research	12