SOLAPUR UNIVERSITY
SOLAPUR

M.Sc. Part I Semester I & Semester II

Microbiology

CBCS Syllabus
(With effect from June 2016)

M. SC. MICROBIOLOGY REVISED SYLLABUS

(NEW CBCS PATTERN) (w. e. f. June, 2016)

1. Title of the Course: **M. Sc**. **DEGREE COURSE FOR MICROBIOLOGY**

2. Introduction: This course provides a broad overview of microbiology and to produces expert hands that would have sufficient knowledge and expertise to solve the urgent problems of the region by using microbiology. The course structure is biological centric where students basically learn microbiology and are taught necessary basic subjects for that purpose.

In addition to disciplines like Virology, Immunology, Genetics, Molecular Biology, Enzymology, Biostatistics, Bioinformatics, Scientific Writing, Computer Science, Industrial Microbiology and waste management etc., topics introduced in the course of two year are in the field of microbiology.

3) Objectives of the course: A prime objective to maintain updated curriculum and providing therein inputs to take care of fast paced developments in the knowledge of Microbiology in relation to international context, a two year program is formulated for M.Sc. Microbiology to develop competent microbiologist to achieve desirable placements in the country and abroad. The program obliges students to read original publications and envisages significant inputs in the laboratory work, communication skills, creativity, planning, execution and critical evaluation of the studies undertaken.

• Beyond simulating, learning, understanding the techniques, the course also addresses the underlying recurring problems of disciplines in today scientific and changing business world.

• To develop awareness & knowledge of different organization requirement and subject knowledge through varied subjects and training methodology in students.

• To train the students to take up wide variety of roles like researchers, scientists, consultants, entrepreneurs, academicians, industry leaders and policy.

• To provide an intensive and in-depth learning to the students in field of microbiology.

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• To develop awareness & knowledge of different organization requirement and subject knowledge through varied subjects and training methodology in students.

• To train the students to take up wide variety of roles like researchers, scientists, consultants, entrepreneurs, academicians, industry leaders and policy.

4) Advantages of the Course: •Microbiology has tremendous job potential. The successful students will be able to establish trading, industrial and consultancy organizations in pharmaceuticals, paper, fermentation, food processing & preservation, agriculture, environment

protection and also their own industry for micro propagation of commercially important plants in vitro, transgenic plants, vaccine production, clinical pathology, genetic counseling, human karyo typing etc.

• Multinational companies dealing with production of tissue cultured and genetically modified plants, food products, leather, dairy, beverages, pharmaceutical, chemical Industries, agribusiness, Environment protection.

• Medical & Scientific Research Organizations.

• Universities in India & aboard.

5) Eligibility of Course:

Eligibility: A Candidate possessing Bachelor Degree with Microbiology /. Or life sciences as a principal subject (Microbiology), and who have passed the entrance examination conducted by the Solapur University shall be held eligible for admission to M. Sc. Course in Microbiology. Students from other University with B.Sc. General Degree in life sciences and who have passed the entrance examination conducted by the University are also eligible.

• Admission: Merit list based on average of B.Sc. aggregate and entrance exam conducted by University. For other university student merit list only on basis of entrance examination conducted by University.

6) Duration: • The duration for this program is of 2 years with semester pattern (04 Semesters)

7) Medium of Instruction: English

8) Structure of the Course:

• Structure of M.Sc. course in faculty of Science has total of 4 semesters for 2 years.

• M. Sc. I comprise of total two semesters and M. Sc. II comprises of total two semesters.

• Semester I includes four theory papers (3 Hard Core and 1 Soft Core) and practical course as per theory papers.

• Semester II & III includes four theory papers (2 Hard Core, 1 Soft Core and 1 Open Elective) and practical course as per theory papers.

• Semester IV includes four theory papers (3 Hard Core and 1 Soft Core) and a Major project substituting the practical course

• Each theory paper comprising of 5 units which are distributed in total 60 lecture hours having weightage of 4 credits.

• Practical papers are to be conducted at the end of their respective semester.

• Final year Major project work should begin in III semester and the completed thesis should be submitted at the end of the IV semester.

• Student would have to present his/her project work during the project report submission which would be evaluated by the internal as well as the external examiners.

• As per the credit system, the assessment of Theory paper of 100 marks weightage will be as: 70 marks theory assessment by University examination (UA) and 30 marks internal assessment by the college (CA). For internal assessment of candidate, periodical tests/seminars/ viva/oral / quiz etc. may be suitably adopted.

• As per the credit system, the assessment of practical paper of 100 marks weightage will be as: 70 marks practical assessment by University examination (UA) and 30 marks internal assessment by the college (CA).

• In each semester students has to give compulsorily 16 tutorials (4 tutorials per theory paper) with weightage of 25 marks (1 credit)

The overall structure of the course to be implemented from the academic year 2016 onwards fis as follows:

M.Sc.		**MICROBIOLOGY.C B C S w.e.f.2016-17(REVISED)**							
Sem	Code	Title of the Paper	Semester Exam.			L	T	P	Credits
I		**Hard Core**	Thr	IA	Total				
MSc	HCT1.1	Cytology and Taxonomy of Microorganisms	70	30	100	4			4
	HCT1.2	Microbial Chemistry and Enzymology.	70	30	100	4			4
	HCT1.3	Recent trends in Virology	70	30	100	4			4
Soft Core(Any one)									
	SCT1.1	**Microbiological Techniques and Scientific Writing**	70	30	100	4			4
	SCTI1.2	**Biophysics and Bioinstrumentaion**	7 0	30	100	4			
		Tutorial			25		1		1
Practical									
	HCP1.1	Practical Course HCP1.1	35	15	50			2	6
	HCP1.2	Practical Course HCP1.2)	35	15	50			2	
	HCP1.3	Practical Course HCP1.3	35	15	50			2	
Soft Core (Any one)									
	SCP1.1	**Practical Course SCP1.1**	35	15	50			2	2
	SCP1.2	**Practical Course SCP1.2**	35	15	50			2	
Total for First Semester			420	180	625				25
Semister II									
	Code	**Title of the Paper**	**Semister Exam.**			**L**	**T**	**P**	**Credits**
MS		**Hard Core**	Thr	IA	Tota				
	HCT2.1	Microbial Genetics	70	30	100	4			4
	HCT2.2	Microbial Ecology and Diversity	70	30	100	4			4
Soft Core(Any one)									
	SCT2.1	**Microbial Physiology and Metabolism**	70	30	100	4			4
	SCT2.2	**Medical Microbiology**	70	30	100	4			4
Open Elective(Anyone)									
	OET2.1	**Bioinformatics &Biostastastics**	7 0	30	100	4			4
	OET2.2	**Microbial Nanotechnology**	7 0	30	100	4			
		Tutorial			25		1		1
Practical									
	HCP2.1	Practical Course HCP2.1	35	15	50			2	4
	HCP2.2	Practical Course HCP2.2)	35	15	50			2	
Soft Core(Any one)									
	SCP2.1	Practical Course SCP2.1	35	15	50			2	
	SCP2.2	Practical Course SCP2.2	35	15	50			2	2
Open Elective(Anyone)									
	OEP2.1	Practical Course OEP2.1	35	15	50			2	2
	OEP2.2	Practical Course OPEP2.2	35	15	50			2	
Total for Second Semester			420	180	625				25

HCT. 101: Cytology and Taxonomy of microorganisms. **No. of lectures.**

UNIT: I Bacterial cytology **10**

1. Surface properties of bacteria and its significance

2. Cell division, Cell cycle and differentiation of *Bacillus, Azotobacter, Candida,Aureobasidium*

3. General characteristics and molecular architecture of Cyanobacteria

4. General characteristics and molecular architecture of Mycoplasmas.

5. General characteristics and molecular architecture of Rickettsias and Chlamydia.

UNIT: II Microbial cytology **10**

1. General characteristics and structure of algae, and micro algae

2. General characteristics and structure of fungi. fungal cell- hyphae and nonmotile unicells.

3. General characteristics and molecular architecture of Actinomycetes.

4. General characteristics of Lichens and Mycorrhizae.

UNIT: III Microbial Taxonomy **10**

1.Outline classification of fungi.

2. Outline classification of algae, micro algae.

3. Outline classification of Cyanobacteria

4. Outline classification of Rickettsias and Chlamydia.

5. Outline classification of Actinomycetes.

UNIT: IV Bacterial nomenclature **10**

Bacterial nomenclature and classification:

Principles of bacterial nomenclature.

Outline classification of prokaryotic organisms.

UNIT: V Bacterial Taxonomy 10

A.Introduction to Bergey's manual of Determinative Bacteriology and Bergey' Manual of Systemic Bacteriology

B) Numerical taxonomy, chemotaxonomy, phylogenetic and serological Methods used in classification.

References:HCT. 101: Cytology and Taxonomy of microorganisms.

1.Bacterial cell structure by Rogers, ASM publications.

2.General Microbiology by stanier etal, 5th Edn.

3.Microbial Ultra structure by Fuller R.

4.Chemical Microbiology by Rose.

5.Microbial and Plant Protoplasts by Peberdy Etal.

6.Biology of Mycoplasma by Smith P. I.

7.Introduction to Fungi by Alexopolus.

8. Bergy's manual of systemic bacteriology Vol. 1, 2,3, 4 Williams, Wilkins & Baltimore, Academic Press.

9.Bergey's manual of Determinative Bacteriology Williams, Wilkins & Baltimore, Academic Press.

10. A Manual of Soil Fungi – Gilman J. C. (1967) Oxford & JBH Publications.

HCT. 102: Microbial Chemistry and Enzymology

Unit-I **10**

Microbial chemistry

1. Protein Chemistry: a)Amino acids- Classification, structural features and Chemical reactions.

b) Reverse turns, Ramchandran plot, helix coil transition.

2. Carbohydrates Chemistry- Nomenclature, types and structures.

3 Lipid Chemistry: a) Fatty acids- types and nomenclature's) Types of lipids and structural aspects.c)Steroids, Terpenes and Prostaglandins.

4. Vitamins:a) Water and fat soluble. b)Structures and functions of vitamins.

5. Chemistry of Porphyrins, Chlorophylls, Cytochromes, Haemoglobin, leg haemoglobin and Bacteriorhodopsin.

Unit-II **10**

Enzymology: Basic Concepts

1.Nomenclature and Classification of Enzymes

2. Basic concepts, types of specificities-Substrate and product, bonds, group relative of absolute.c)Factors responsible for specificity

3. a) Structure of enzymes- Physical Structure of enzymes, monomeric and oligomeric enzymes.b)Concept of active site- Ogston's experiment, lock and key and induced fit hypotheses.

Unit-III **10**

Kinetics of Enzyme activity: a)Introduction of Chemical kinetics.b)Kinetics of Single substrate enzyme catalyzed reactions-Wilhelmy's and Brown's work, Henri and Michaelis and menten derivations, Briggs and Halden modification.c)Significanceof the M-M equation and

Km. d)Modification of M-M equation- Lineweaver- Burk, Eadie- Hofstee, Hanes and Eisenthal andCornish-Bowden.e)Kinetics of multi substrate reactions.f)Inhibition- Basic concepts, kinetics, examples and significance of reversible and irreversible inhibition.

Unit-IV **10**

Catalytic power of enzymes:

1.Basic concept of catalysis-activation energy barrier and the transition state theory

2.Catalytic mechanism in chemistry and in enzymes- acid –base, covalent and electrochemical reactions.

3.Factors enhancing the catalytic efficiency of enzymes proximity and orientation, orbital steering, distortion and strain.

4.Functional groups involved in the catalytic mechanism-a)Amino acidsb)Co factors- Prosthetic groups, coenzymes, co substrates.c)Metal ions in enzyme function.- hteir role, metal activated andmetallo enzymes, ternary complexes.

5.Methods used to identify functional groups in the active site.

6.Some examples of enzyme function- Chymotrypsin, Lysozyme, Triose phosphate, Isomerase.

Unit-V **10**

Regulation of Enzyme function:

1.Control of enzyme activity by-a)Changes in covalent structure- irreversible and reversible

b)Ligand induced conformational changes-Allosteric enzymes- Basic concepts Cooperativity, model proposed to explain the mechanism of functioning (MWC and KNF) structural aspects of aspartate carbomyl transferase, role of allosteric enzymes in metabolic regulation (feed back inhibition).

2.Enzymes in organized systems and their role in control function

a)Multienzyme system- Basic concepts, significance and types with examples, structural aspects of pyruvate dehydrogenase and fatty acid synthesis.

b)Isoenzymes- basic concepts, types with examples and their significance to the cells and to the medical fields.

References :HCT. 102: Microbial Chemistry and Enzymology

1.Biological Chemistry by Melhar H.R. and E.H. Cord 1968 Harper and Row Publisher inc New York

2.Biochemistry by Stryer, L. 1981 2nd edition, W.H. Freeman and company, Sanfrancisco.

3.Biochemistry by Stryer, L. 1988 3rd edition, W.H. Freeman and company, Sanfrancisco
4.Enzyme nomenclature- International Union of Biochemists (IUB) Academic press.
5.Understanding enzymes- Trevor Palmer Ellis Harwood Publications.
6.Fundamentals of Enzymology- N.C. Price and L.Stevenson, Oxford University Press.
7.Enzymes P.Boyer, Academic Press.
8.The Enzymes M. Dixon and E.C. Webb.
9.Advances in Enzymology- Series edited by N.O. Kaplan, Academic Press.
10.Enzyme structure and Mechanism- A. Fershit, Freeman, USA.
11.Biochemistry by Lehninger A.L. Kalyni Publisher, New Delhi
12.Principals of Biochemistry by Lehninger A.L.1984 1st Indian edition, LBS Publisher and Distributor Pvt. Ltd, New Delhi.
13.Basic Biochemistry 2nd Edition – Lehninger, A. L. (1984) Kalyani Publications, Ludhiyan, New Delhi.
14.Textbook of Biochemistry, 4th Edition – West E.S.W.R. Tood, H.S. Mason, J.T.V. Burgen (1966) Macmillan Company, New York.
15.Principles of Biochemistry 5th Edition – White A. P. Handler, Pand E. L. Smith 1973) McGrow Hill Koga Kusha Ltd., Tokyo.
16.Biochemistry – by Zubay

HCT1.3 Recent trends in Virology

Unit: I: Classification and Morphology of Viruses. **10**

Brief outline of discovery of viruses. Classification and nomenclature of animal and plant viruses. Cataloging the viruses through virus classification schemes of ICTV /ICNV. Morphology and ultra-structure of viruses, viroids and prions.

Unit: II:Cultivation and assay of viruses **10**

Cultivation of viruses using embryonated eggs, experimental animals and cell cultures(Cell-lines, cell strains and transgenic systems). Purification of viruses by adsorption, precipitation, enzymatic and serological methods – haemagglutination and ELSA.Assay of viruses – Physical and Chemical methods (Electron Microscopy and Protein and Nucleic acids studies). Infectivity Assays (Plaque and end-point)Infectivity of plant viruses. Genetic analysis of viruses by classical genetic methods.

Unit: III: Viral Multiplication **10**

Bacteriophages – Lytic and lysogenic interactions

Animal viruses – Mechanism of virus adsorption and entry into the host cell, DNA and RNAviruses-Mechanism of genome replication, Transcription, post transcriptional changes, translation, assembly, exit and maturation of progeny virions.

Unit: IV: Pathogenesis of Viruses **10**

Host and virus factors involved in pathogenesis, patterns of infection, pathogenesis of animal viruses: Adeno virus, Herpes virus, Picorna virus, Poxvirus and Orthomyxovirus, pathogenesis of plant [TMV], Satellite viruses and their role in plant virus replication. Insect viruses [NPV], Viruses pathogenic to algae and fungi.

Host cell transformation by viruses, oncogenesis by DNA and RNA viruses.

Unit: V: Control of Viruses and Emerging Viral infections **10**

Control of viral infections with vaccines and chemotherapeutic agents.

Virus neutralization by antibody and interferon.

Structure, genomic organization, pathogenesis and control of AIDS caused by (HIV) Human Immunodeficiency virus.

Emerging viral infections:SARS.EBOLA(EVD) ETC

References: HCT1.3: Recent trends in Virology

1. Bacterial & Bacteriophage Genetics by Edward A. Birge.
2. Principles of Bacteriology, Virology & Immunity 8th edition (Vol. 4) by Topley & Wilson's.
3. General Virology – Luria.
4. Introduction to Plant Virology – Bos I. (1983) Longman, London & New York..
5. Animal Virology – Fenner, F & White, D. O. (1976) Academic Press Inc., New York.
6. Chemistry of Viruses (2nd edition) – Knight C. A. (1975) Springer Verlag Inc. New York.
7. Virology – Dulbecco R. and Ginsberg H. S. (1980), Harper and Ravi Publishers Inc. New York.

Soft Core (SCT) (Any one)

SCT1.1 Microbiological Techniques and Scientific Writing. No. of lectures.

UNIT: I **10**

MICROBIOLOGICAL TECHNIQUES:

1) Principles and methods of enrichment and isolation of bacteria, fungi, algae, protozoa and viruses.

2 microscopy – basic principles and applications of transmission and scanning electron microscopy, methods of sectioning and staining of specimens for microscopy .

UNIT: II **10**

REGULATORY REQUIREMENTS FOR MICROBIOLOGY LABOROTORY

1) Installation qualification (IQ), operational qualification (OQ) and performance qualification (PQ) for laboratory equipments.

2) Methods of validitation and calibration of equipments.

3) Documentation – importance and significance.

4) Current Good Manufacturing Practices (CGMP) and Current Good Laboratory Practices (CGLP).

UNIT: III **10**

BIOCHEMICAL TECHNIQUES:

1) Chromatography – principles, materials and applications of

i.) Column chromatography:- Adsorption – hydroxylapatite, ion exchange, affinity chromatography.Partition – normal phase, reverse phase, ion pair reverse phase,chiral , counter Current, molecular exclusion chromatography, High Performance Liquid chromatography(HPLC) Gas Liquid chromatography(GLC)

ii.) Planar chromatography- paper, thin layer chromatography.

2) Electrophoresis – General principles, Moving boundary and zonal electrophoresis, Electroendoosmosis.

i.)Protein electrophoresis- SDS-PAGE, native gels, gradient gels, IEF,2-D PAGE, Cellulose acetate, continuous flow.

ii.)Nucleic acid electrophoresis- DNA sequencing gels, pulsed field gel electrophoresis (PFGE), RNA electrophoresis.

iii.) Electrophoresis of other molecules – polysaccharide and glycoprotein, lipoproteins etc.

3)CENTRIFUGATION

1)Basic principles and types of centrifuges and rotors, Principles and methods of differential, density gradient centrifugation, centrifugal elutriation, analytical centrifugation.

2) Microfilm ultrafilteration – principles, materials used and applications.

Nanofilteration, reverse osmosis.

UNIT: IV: 10

Basic concept of Scientific Writing

1. History and basic concept of scientific writing:

Basic grammar: Tenses, Voices, Propositions and conjunctions, Conditional sentences, count and non-count nouns; concord, Punctuations.

Effective written presentations: Order of sentences in paragraph; sentence connection, cohesion and coherence; Contradiction, tautology, semantic anomaly, circumlocution.

Using dictionary and the thesaurus Spell check, grammar check, logical sequence, connectivity and relevance in scientific writing.

UNIT: V 10

Scientific methods and documentation.

1**.**Scientific methods: concept, hypothesis, theory, law, Design of experiment; Inductive and deductive reasoning

2. Different types of scientific documents, review paper, book reviews, research paper, thesis, project reports and conference report.

3.Components of research paper, IMRAD system, title, authors and addresses, abstract, acknowledgements, references, tables and illustrations,

4.Preparation for publications-Submission of manuscript, ordering reprints

5.. Presentation of research: Oral and poster presentation, presentation in conferences and symposia. Preparation and submission of proposals to the funding agencies

References: SCT1.1 Microbiological Techniques and Scientific Writing

1.A Biologist's guide to principles techniques of Practical biochemistry by K. Wilson and K. H. Goulding, Edwward Arnold publications.

2.Chromatographic methods by Brathwaite & White.

3.Analytical Chemistry by Robert B. Dilts, Van Nostrand Publications,

4.Introduction to practical biochemistry by D. Plummer, J. Wiley & Sons.

5.Laboratory methods in biochemistry by J. Jayaraman.

6.Methods in Microbiology by Norris and Ribbons, Academic press.

7.Principles and techniques at practical Biochemistry – K. Wilson and J. Walker, Cambridge University Press
8.Day D.A., Sakaduski N, Day N. (2011) Scientific English: A guide for scientists and other professionals. ABC-CLIO Publications.
9.Day R.A. & Gastel B 6th Edition (2006) How to write and publish a scientific paper, Cambridge University Press.
10.Alley M (1996). The craft of scientific writing. Springer Publication.
11..Day R.A. (1988) How to write & publish a Scientific paper, Cambridge University Press.

SCT: 1.2 Biophysics and Bioinstrumentation

Unit-I **10**

Biophysical Techniques

i)X-ray diffraction analysis and crystallography.

ii)Circular dichroism and optical rotary dispersion spectroscopy.

iii)Infra red and Raman spectroscopy.

iIv) Electron spin and nuclear magnetic resonance spectroscopy.

Unit-II **10**

Analytical techniques

a) Immunochemical techniques – general principles and applications of immunodiffusion, immunoelectrophoresis, radioimmunoassay, enzyme linked immunosorbent assay, fluorescence immunoassay, immunoblotting, immunohistochemistry.

b)Radio isotopic techniques- nature of radioactivity, methods of detection and measurement, methods of application – tracer, autoradiography.

Unit-III **10**

Spectroscopy

c)Spectroscopy – general principles of electromagnetic radiation spectroscopy.

d)Principles, instrumentation and applications UV – visible spectrophotometry, turbidimetry andnephelometry, fluorimetry, luminometry, atomic absorption and mass spectroscopy.

Unit-IV **10**

Electrochemical Techniques

e) Electrochemical techniques – electrochemical cells, potentiometry and voltametry .

f) Principles and applications of ion selective and gas sensing electrodes, pH, oxygen electrodes and redox couples.

g) Principles, apparatus, functioning and applications of nanometry.

Unit-V **10**

Molecular Biophysics

1.Physical and chemical properties of amino acids and polypeptides, theoretical and experimental methods for determination of sizes of proteins, physical nature of non- covalent interactions, conformational properties of proteins, Ramchandran plot, secondary, super secondary, tertiary and quaternary structure of proteins.

2. Protein structure determination by X-ray diffraction.

3.Application of NMR spectroscopy for protein and DNA structure determination. Electron spray mass spectroscopy analysis of biomolecules.

References : SCT1.2 Biophysics and Bioinstrumentation

1.Principles of Physical Biochemistry – Van Holde, et al., Prentice Hall.

2.Crystallography made crystal clear – G. Rhodes, Academic Press.

3.Introduction to Protein Structure – Branden and Tooze, Garland Publishing Co.

4.Methods in Modern Biophysics -Bengt Nölting, 2nd Edition Springer 2006

5.Biophysics - Vasantha Pattabhi N. Gautham Narosa Publishing House

6.Principles of Protein X-Ray Crystallography - Jan Drenth Third Edition

Practical Courses SEMESTER –I

HCP1.1: on (HCT1.1 Cytology and Taxonomy of Microorganisms)

1.) Demonstration of: Bacterial and yeast DNA

2) Preparation of yeast protoplasts.

3.) Isolation and purification of lysozyme from egg white and preparation of bacterial protoplasts.

4.) Isolation of bacterial cell wall and study of cell wall polysaccharide by chromatographic technique.

5.) Single cell and single spore isolation techniques.

6.) Study of magnetic and electric field on behavior of microorganisms.

7.) Isolation and identification of reserved food material from *Bacillus megaterium* . Isolation and morphological studies of –

i.)Algae –spirulina, scenedesmus spp.

ii.)Fungi- Aspergillus, Penicillium, Rhizopus, Fusarium, Trichoderma and saccharomyces.

iii.)Protozoa – Euglena, Paramoecium and Plasmodium.

iv.)Mycorrhiza – VAM fungi – demonstration. v.) Lichen- demonstration.

8.) Induction of ascospore in yeasts of *Saccharomyces cerevesiae*.

HCP1.2: Practical Course on (Microbial Chemistry and Enzymology)

1. Estimation of total carbohydrates, proteins, lipids, RNA and DNA of bacteria

2. Preparation of Buffers- Phosphate, Acetate, Citrate etc.

3. Studies on enzyme Amylase-

a)Precipitation of enzyme by solvent & salt and partial purification by dialysis.

b) Quantitative estimation of the enzyme and enzyme activity.

4. Effect of following factors on amylase activity

i) Substrate concentration (S0)- determination of Vmax and Km.

ii) Determination of optimum pH for amylase activity

iii) Determination of optimum temperature for amylase activity.

iv) Metal ions for activity.

5.Immobilization of amylase in Na- alginate .

6.Studies on

a) Stability- thermal storage - wet and dry

b) effect of S0 temperature, pH on immobilized amylase.

7.Study and detection of levels of lactate dehydrogenase, alkaline phosphatase in serum.

8.Assay of Cellulase and Pectinase..

HCP1.3:Practical Course on (Recent trends in Virology)

1. Isolation, titration and high titer stock preparation of *E.coli* phages from sewage.

2. Phage typing of *E.coli* and *Salmonella* strains.

3. Infectivity Assays (Plaque and end-point)

4. Infectivity Assays of plant viruses

5. Study of one step growth curve of phage T4

6. Study of Egg inoculation techniques.

7. Cultivation of animal viruses in embrocated eggs.

8. Purification of viruses by serological methods – haemagglutination and ELSA.

SCP1.1: Practical Course on (Microbiological Techniques and Scientific Writing)

1) Enrichment and Isolation of anoxygenic phototrophic bacteria and bioluminescent bacteria.

2.Different cultivation techniques for Actinomycetes

3) Writing suitable title (Analysis) of research papers.

4) Search of authors instructions from website of a scientific journal and its analysis/ comparison

5) Assignment on analysis of data/ Results/ Conclusion.

7) Assignment on Google search for scientific purpose.

8) Writing abstract for research paper

OR

SCP1.2: Practical Course on (Biophysics and Bioinstrumentation)

1.Chromatographic Separation of amino acids, sugars, dyes, and plant materials using paper by paper Chromatographic techniques

2. Chromatographic Separation of amino acids, sugars, dyes, and plant materials using thin layer Chromatographic techniques.

3. Chromatographic Separation of amino acids, sugars, dyes, and plant materials using column Chromatographic techniques

4. Electrophoretic separation of proteins and nucleic acids by agarose gel electrophoresis .

5. Electrophoretic separation of proteins and nucleic acids by polyacrylamide gel electrophoresis.

6. Electrophoresis of polysaccharide and glycoprotein, lipoproteins etc.

7. Studies on the principles of light spectroscopy – Beer and Lambert`s laws, extinction coefficient and molar extinction coefficient.

8. UV – visible spectrophotometry & atomic absorption spectroscopy.

9. Immunochemical techniques: Immunodiffusion, immunoelectrophoresis, radioimmunoassay, enzyme linked immunosorbent assay , immunoblotting, immunohistochemistr

References for practical courses:

1.Practical Microbiology by R.C.Dubeyand D.K.Maheshwari. S.Chand&Co.

2.Experimental Microbiology by R.J.Patel.AdityaPublishers,Ahmedabad

3 .Identification Methods for Microbiologists by B.M.Gibbs and F.A.Skinner.AcademicPress

4.Laboratory Microbiology by L.Jack Bradshaw. W.B.Saunders &Co.

5.Benson's Microbiological Applications Laboratory Manualin General Microbiology by Alfred E.Brown

6.Methods in Microbiology(Vol.5BandVol.3A) by Norris and Ribbons.AcademicPress

7.Bergey'sManualof Systematic Bacteriology

8.Microbiological Methods by Michael Collins

9.Handbookof Microbiological Media by R.M.Atlas.CRCPublications

10.Laboratory Exercisesin Microbiology by Robert A.Pollockand others

Semester: II

HCT2.1 Microbial Genetics **No. of lectures.**

Unit-I **10**

Classical genetics:

1. Origin of life, Organic evolution Darwinism and Mendelism
2. Genetic Material:
   a) Evidences of Nucleic acid as genetic material
   b) Watson and Cricks model of DNA structure,Alternative forms of DNA
3 Split genes and Overlapping genes
4. Evolution of One cistron one polypeptide theory, genetic complementation,Cis- Trans test of genetic function.

Unit-II **10**

Duplication of Chromosomes and DNA

a) DNA replication in *E. coli* – rules and enzymes involved, Mechanism of DNA replication, theta and rolling circle model

b) Chromosome duplication- Taylor's experiment, Dupra,s folded fiber and alternative folded fiber model of metaphase chromosome.

Unit-III

Transposons and Plasmids **10**

1. Mobile elements in Prokaryotes and Eukaryotes- Insertion sequences, transposons, transposable elements and their properties, detection and significance, retrosposons, J. Shapire's model of replicative transposition.
2. Plasmids- Nomenclature, classification, general properties and types. Detection and purification, amplification and rearrangements, replication and transfer process, plasmids in Yeasts.

Unit-IV **10**

Molecular aspects of gene regulation and expression:

a) Genetic code- Deciphering of genetic code and important properties of genetic code

b)Transcription in Prokaryotes and Eukaryotes- Structure of r RNA, t RNA and mRNA, antisense RNA and its significance, post transcriptional process**.**

c) Translation in Prokaryotes and Eukaryotes- Operon models Lactose, tryptophan and arabinose, Britten and Davidson's model, post translational process.

Unit-V

Techniques in genetics **10**

Terratogenesis and DNA damage and Repair

1.Techniques- PCR, LCR, RFLP, DNA foot printing and finger printing,Chromosome walking, blotting techniques, gene sequencing and mapping,DNA melting, gene targeting, Cloning (animal,Human Genome project)

2.Terratogenesis- Genetic disorders and differential gene activity, Genetic counseling

3.DNA damage and repair- types of damages, damaging agents,Repair mechanisms Photoreactivation, dark repair, post replication recombination repair,SOSrepair, role of conservation of genetic integrity, relationship to lifespan and Ageing process,mechanism of ageing.

References: HCT2.1: Microbial Genetics

1. Molecular Biology of gene – J. D. Watson (2004)
2. Gene expression by Lewin Vol. 5, 6, 7 & 8 John Willey & Sons.
3. Microbial Genetics – Freifelder.
4. Principles of Genetics – Gardner, E. J. (1991) John Willey & Sons Publication, New York.
5. A DNA replication – Kornberg A., Freeman Publications, San Fransisco.
6. Genetics – P.K.Gupta

HCT2.2: Microbial Ecology and Diversity

No. of lectures.

Unit-I **10**

Microbial Ecology

Basic ecological principles, Ecosystems, habitats, ecological niches, gen burst of population and population explosion, community, energy transfer and ecosystem management ,microbe-microbe,microbe-plant and microbe-animal interactions. Endolithic microorganisms of Antarctica. Concept of autotrophy – an example of extreme synthesis

Unit-II **10**

Microbial Diversity:

1) Microbial World: General characteristics and outline classification of Bacteria, Yeasts, Molds, Viruses, Protozoa, Lichens, Mycorrhiza Viroids and Prions and their role in the biosphere

2)Differentiation : In Bacillus ,Azotobacter, Candida, Mycoplasma and Aureobasidium spp.

Unit-III **10**

Anoxygenic and Oxygenic photosynthesis:

1)Anoxygenic photosynthetic microbes-General characteristic of purple and green sulphur bacteria

2)Oxygenic photosynthetic microbes- General characteristics of Cyanobacteria and Prochlorales

3)Methanogenic Archeobacteria—General characteristics

Unit-IV **10**

Bioluminescence nitrogen fixation Microbial fossils and uncultured organisms:

1) Bioluminescent and nitrogen fixing bacteria- A high energy spending bacteria

2) Magnetotactic bacteria

3) Microorganisms in prospecting of oils

4)Microbial fossils

5) Identification of uncultured organisms

Unit-V **10**

Extremophiles:

1)Acidophilic, alkalophilic, psychrophilic, thermophilic, barophilic, osmophilic and halophilic microorganisms

2)Microbes in toxic environments like acid mine drainage, coal desulphurisation ,wastes containing cyanides, xenobiotics, pesticides and chemicals, heavy metals, hydrocarbons and radio isotopic materials

3)Biodeterioration-concept, biodeterioration of wood, stonework, pharmaceutical products, rubber, plastic, paints, lubricants, cosmetics, & control of biodefenoration

References: HCT2.2: Microbial Ecology and Diversity

1.Extremophiles-(2000) By B.N.Johari Springer Verlag,New York.

2.Microbial diversity (1999) by D.Colwd Academic press.

3.Bergy's Manual of Systematic Bacteriology (1984).Vols.I and III .Williams and Wilkins, Baltimore Academic press

4.Microbial life in extreme environments (1978) by D.s.Kushner Academic press Inc.New York

5.Microbial ecology (1979) by J.M.Lynch and N.J.Poole .Blackwell Scientic Publications,Oxford.

6.Brock biology of microorganisms (2000).9th eds.by M.T. Madigan,J.M.Martinko and Jack parker.

7.Biochemistry, Bioengineering and biotechnology Hand book (1991).by B.Atkinson et al.Macmil

SCT2.1Microbial Physiology and Metabolism **No. of lectures.**

Unit-I **10**

Transport in Bacteria

1.Transport mechanism of Nutrients across the cell membrane- Simple diffusion, facilitated diffusion, group translocation and Active transport and Passive transport.

2.Permeation – different permeation systems in ***E.coli*** amino acid permeases transport of inorganic ions physiological consequences and significance of permease mechanism.

Unit-II

Electron transport chain and TCA Cycle **10**

1.ETC: Concept, components involved electron transport and oxidative phosphorylation, theories of ATP formation.

2. Bacterial Electron Transport Chain- photosynthetic and non photosynthetic, aerobic and anaerobic bacterial ETC.

3. Mitochondrial ETC: structure of mitochondria, mitochondrial ETC, shuttle systeme across membrane, Atkinson`s energy change.

4) Citric acid cycle: steps involved, amphibolic nature, anapleurotic reaction.

Unit-III **10**

Biosynthesis

a.) Purines and pyrimidines by de novo synthesis.

b.)Saturated fatty acids.

c) Amino acid synthesis pathways

Unit-IV **10**

Oxidation of hydrocarbons and Drug metabolism:

a.)Alkanes and alkenes – alpha, beta, and omega oxidation.

b.) Aromatic hydrocarbons – beta keto adipate pathway, valerate pathway, gentisate pathway.

c) Drug metabolism and detoxification.

Unit-V **10**

Osmosis, Oxygen toxicity and Microbial hormones

1.Osmosis – definition, microbial response to osmotic stress, avoidance of osmotic stresses,responses of microbial – plasma – membrane –to- osmotic – stresses. Reverse osmosis.

2.Oxygen toxicity – catalase, peroxidase, super oxide dismutase, mechanism of O_2 toxicity

3. Microbial hormones and their significance.

References: SCT2.1Microbial Physiology and Metabolism

1.Bacterial Physiology and Metabolism by R. J. Sokath.

2.Metabolism by Doelle, Academic Press, London.

4.Biochemistry of Microbial growth – by Mandelstam.

5.Methods in Microbiology Vol. 3 A, Norris & Ribbons (eds) Academic Press.

6.Microbial Physiology – Dawes I. W., and Sutherland J. W, (1976) Halsted press
7.Metabolic Pathways 3rd edition – Greenberg D. M, (1976) Springer Verlag, New York.
8.Microbial Physiology - Albert G. Moat, John W. Foster John John Wiley & Sons

SCT2.2: Medical Microbiology

No. of lectures.

Unit-I **10**

Virulence &Epidemiology

1. Virulence: Entry, establishment, spread of microorganism in body, tissue damage and antiphagocytic factors, mechanism of bacterial adhesion; colonization and invasion of mucous membranes of respiratory; enteric and urinogental tracts; measurement of virulence, bacterial resistance to humoral defense; coagulase reacting factor; lysozyme; lactoferrin; transferrin, microbial toxins – characteristics and mode of action of Diptheria, cholera, Vibrio parahaemolyticus, endotoxins of gram negative bacteria, plasmid mediated factors associated with bacterial virulence, Antigenic variation and bacterial virulence.

2. Epidemiology: Infectious disease cycle, Characteristics of infectious disease in population, epidemiological methods – descriptive, analytical and experimental epidemiology, measurement of infection rate.

Unit-II **10**

Microbial diseases

1.Microbial diseases: morphological, cultural, biochemical, antigenic characters, pathogenesis, transmission, laboratory diagnosis, prevention and control of – Helicobacter pylori, Leptospiraicterohaemorrhagiae, Balantidium coli, Wucheriabancroftii, Taeniasaginata, Ascarislumbricoides, Enterobicusvermicularis, Trichonella spiralis, Herpes virus, Hepatitis B,Japanese encephalitis, Dengue fever, Rubella and Rubiola virus.

2.Anaerobic bacterial infections in Human beings and therapy.

3. Dental Caries and periodontal diseases and their infectious nature.

4. AIDS and prevalence of Tuberculosis, Mycoplasma and cryptococcal infections.

Unit-III **10**

Medical Mycology

Medical Mycology: Pathogenic fungi, structural dimorphism and pathogenesis of fungi, role of extracellular products in fungal infections

Unit-IV **10**

Clinical microbiology

1.Clinical microbiology - Collection, transportation and preliminary processing of clinical specimen, Rapid methods of identification of pathogenic microorganisms – API, ELISA, FAT, RIA and Western Blot.

2. Enzymes in medical diagnosis and therapy

Unit-V **10**

Chemotherapy and animal Tissue Culture

1. Chemotherapy – different chemotherapeutic agents for Bacteria, fungi,viruses and protozoa,

2.Mechanism of action of different chemotherapeutic agents.

3. Animal Tissue Culture – types, formulations of media, methodology and applications.

References: SCT2.2: Medical Microbiology

1.Medical Microbiology,13th EditionbyE.Jawetz,J.L.Melnick,E.A.Adelberg

2.Medical Microbiology,6thEditionbyS.Gupte,JaypeeBrothersPublications

3.Medical Microbiology,byW.Irving,T.Boswelland D.Aladeen.

4.Medical Microbiology,byR.Cruickshank,J.P.Duguid,B.P.Marmion,R.H.A.Swain.

5.TheTextbook of Microbiology, by R.C.Dubeyand D.K.Maheshwari.

6.Textbook of Microbiology by R.Vasanthkumari.

7.Medical Microbiology by S.RajanMJPPublishers.

8. Unsworth K. E. and David W. Holden, (2000), *Identification and analysis of bacterial virulence genes in vivo,* Phil. Trans. R. Soc. London B. **355,** 613-622

9. Woods D. E., (2002), *The use of animal infection models to study the pathogenesis ofmelioidosis and glanders*, Trends Microbiol, **10(11)**:483-5

10. Eduardo A. G.roisman and Howard Ochman, (1994), *How to become a pathogen*, Trends in Microbiology, **2(8):**289-294

11. Carpenter Philip L., (1975), *Saunders International Edition - Immunology and Serology*, W. B. Saunders and Co., London

12. Schlessinger David, Editor, *Mechanism of Microbial Virulence*, in Microbiology – 1979, American Society for Microbiology, Washington D. C., 79-230

13. Schlessinger David, Editor, *Biochemical Genetics of Pathogenecity*, in Microbiology – 1979, American Society for Microbiology, Washington D. C., 79-230
14. Mark J. Pallen1 & Brendan W. Wren, (2007), *Bacterial pathogenomics*, Nature Rev. **449|18**: 835-842
15. Hughes Eric A. and Jorge E. Galan, (2002), *Immune Response to Salmonella: Location, Location, Location?*, Immunity, **16:** 325–328
16. Bhavsar Amit P., Julian A. Guttman and B. Brett Finlay, (2007), *Manipulation of host-cell pathways by bacterial pathogens*, Nature Rev **449/18:**827-834
17. David N. Fredricks and David A. Relman, (1996), *Sequence-Based Identification of Microbial Pathogens: a Reconsideration of Koch's Postulates*, Clinical Microbiology Reviews, 18–33

OET2.1: Bioinformatics & Biostatistics — No. of lectures.

UNIT I: Introduction to Bioinformatics — 10

1. Introduction to Bioinformatics: Use of bioinformatics in major research areas.Major Bioinformatics Resources: (National Centre for Biotechnology Information (NCBI), European Bioinformatics Institute (EBI), Expert Protein Analysis System (ExPASy). The knowledge of various databases and bioinformatics tools available at these resources, the major content of the databases, purpose and utility in life sciences.

2.Open access bibliographic resources and literature databases: Basic concept of open access bibliographic resources related to Life Sciences,
the significance and need for such resources, the major content of the databases, how to search and use these resources/databases with special reference to PubMed, PubMed Central, Public Library of Sciences etc.

UNIT II: Taxonomy and phylogeny — 10

1. Taxonomy and phylogeny: Phylogenetic analysis algorithms such as Maximum Parsimony, UPGMA, Transformed Distance, Neighbors- Relation, Neighbor-Joining; Probabilistic models and associated algorithms such as Probabilistic models of evolution and Maximum likelihood algorithm.

2. Chemoinformatics, Pharmacogenomics – Application of Bioinformatics in drug discovery,

UNIT III: Sequence and Structure Databases — 10

1. Sequence and Structure Databases: Knowledge of the following databases with respect to: organization of data, contents and formats of database entries, retrieval of data using text-based search tools, sources of data (e.g. sequencing projects, individual scientists, patent offices etc.), method for deposition of data to databases.

2. Nucleic acid sequence databases: GenBank, EMBL, DDBJ Protein sequence databases: SWISS-PROT, TrEMBL.Genome Databases at NCBI, EBI, TIGR, SANGER Viral Genomes Archeal and Bacterial Genomes

3. Genomics and Proteomics. Large scale genome sequencing strategies. Gene networks/basic concepts, computational model such as Lambda receptor and Lac-operon.

4. Functional genomics: application of sequence based and structure- based approaches to assignment of gene functions - e.g. sequence comparison, structure analysis (especially active sites, binding sites) and comparison, pattern identification, etc. Use of various derived databases.

5. DNA microarray: understanding of microarray data and correlation of gene expression data to biological processes and computational analysis tools (especially clustering approaches).

6. Protein arrays: bioinformatics-based tools for analysis of proteomics data (Tools available at ExPASy Proteomics server);

databases (such as InterPro) and analysis tools.Prediction of 3D structure of proteins

Unit – IV – Biostatistics **10**

1. Biostatistics - Basic concepts, definitions, statistics and biostatistics, sampling methods, merits and demerits of Random, deliberate or nonrandom, stratified, and cluster sampling. scales and variables, data organization, tabulation, graphical representation,

2. Collection and presentation of data: primary and secondary data, collection of data – enumeration and measurement, significant digits, rounding of data, accuracy and precision, recording of data. Tabular and diagrammatic presentation – arrays, frequency distribution, bar diagrams, histograms and frequency polygons.

3. Descriptive statistics: measures of central tendency, dispersion, skewness and kurtosis, Normal, Binomial and Poisson distribution and their applications, test for goodness of fit. Standard error, Confidence interval

UNIT – V- Probability **10**

1. Probability - definition, elementary properties, types, rules, applications to biological problems, chi-square ($\chi 2$) distribution and test.

2. Hypothesis testing: definition of hypothesis, hypotheses - null and alternate hypotheses, general procedure, decision about H0 – one-tailed and two- tailed tests, type I and type II errors

3. Analysis of Variance (ANOVA): basic concepts, experimental designs – CRD, RBD, factorial experiment, repeated measures, other designs, general method, F – test, multiple comparison tests.

4**. Correlation and Regression**

References: OET2.1: Bioinformatics & Biostatistics

Bioinformatics

1. Bergeron, B. (2003) Bioinformatics Computing, Prentice-Hall of India Private Limited, New Delhi – 110 001
2. Baxevanis, A. D. and Ouellette, B. F. F. (2001) Bioinformatics: A practical guide to the analysis of genes and proteins. Second Edition. John Wiley & Sons, New York.
3. Jean-Michel Claverie and C. Notredame (2003) Bioinformatics: A Beginner's Guide, Wiley Dreamtech India (P) Ltd., New Delhi
4. Khan,I. A.(2005) Elementary Bioinformatics, Pharma Book Syndicate, Hyderabad 500 095
5. Lacroix, Z. and Critchlow, T. (Eds.) 2003. Bioinformatics. Managing Scientific Data. Morgan Kaufmann Publishers.
6. Mount, D. W. (2001) Bioinformatics: sequence and genome analysis. Cold Spring Harbor Laboratory Press, New York.
7. Narayanan, P. (2005) Bioinformatics a Primer, New Age International (P) Limited, Publishers, New Delhi – 110 002
8. Westhead, D. R., J. H. Parish and R. M. Twyman (2003) Bioinformatics (Instant Notes Series), Viva Books Private Limited, New Delhi, Mumbai, Chennai, Kolkata
9. Zoe L. and Terence C. (2004) Bioinformatics: Managing ScientificData, Morgan Kaufmann Publishers, New Delhi

Biostatistics

1. Daniel, Wayne (2007) Biostatistics A foundation for Analysis in the healthsciences, Edition 7, Wiley- India edition.
2. Davis, Charles S.(2002): Statistical Methods for the Analysis of Repeated Measurements
3. Finney, D.J. (1971): Statistical Method in Biological Assays.
4. Fleiss, Joseph L., Levin Bruce & Paik Myunghee Cho (2003): Statistical Methods fo Rates and Proportions

5. Irfan Ali Khan and Atiya Khanum, Fundamentals of Biostatistics. 2nd Ed. Ukaaz Publications, Hyderabad.
6. Montgomery D.C. – Design and analysis of experiments, John Wiley & Sons.
7. Murthy M.N. – Sampling methods, Indian Statistical Institute, Kolkata.

OET2.2 Microbial Nanotechnology

Unit – I **10**

History – bionanotechnology – concept and future prospects – application in Life Sciences. Terminologies – nanotechnology, bionanotechnology, nanomedicine, nanowires, quantum Dots, nanocomposite, nanoparticles.

Unit – II **10**

Molecular nanotechnology – nanomachines – collagen. Uses of nanoparticles – cancer therapy – manipulation of cell and biomolecules. Cytoskeleton and cell organelles. Types of nanoparticles production – physical, chemical and biological. Microbial synthesis of nanoparticles

Unit – III **10**

Nanoparticles – types, functions – Silver, Gold and Titanium. Physical and chemical properties of nanoparticles. Characterization of nanoparticles – UVVis spectroscopy, Electron Microscopy – HRTEM, SEM, AFM, EDS, XRD.

Unit – IV **10**

Uses of nanopartcles in biology : Drug delivery – protein mediated and nanoparticle mediated. Uses of nanoparticles in MRI, DNA and Protein Microarrays. Nanotechnology in health sectors. Toxicology in nanoparticles – Dosimetry.

Unit – V **10**

Advantages of nanoparticles – drug targeting, protein detection, MRI, development of green chemistry – commercial viability of nanoparticles. Disadvantages – health risk associated with nanoparticles, inadequate knowledge on nanoparticles research.

References: OET2.2; Microbial Nanotechnology

Introduction to Nanotechnology, Isha Publication. Elisabeth Papazoglou and Aravind Parthasarathy, B.K. (2007)

Bionanotechnology. Morgan & Claypool Publishers. Bernd Rehm (2006).

Microbial Bionanotechnology: Biological Self-assembly Systems and Biopolymer-based Nanostructures. Horizon Scientific Press. David E. Reisner, Joseph D. Bronzino (2008). **Bionanotechnology:** Global Prospects. CRC Press. Ehud Gazit (2006). Plenty of Room for Biology at the Bottom: An Introduction to Bionanotechnology. Imperial College Press.

Semester: II;Practical Course

HCP 2.1Practical Course : Microbial Genetics

1) Isolation of DNA from bacteria and yeasts.

2) Fluctuation test.

3) Isolation of RNA from yeasts.

4) Isolation of bacterial and yeast plasmids (amplification, curing and purification).

5) Study of transformation, transfection, conjugation, transduction, protoplast fusion in bacteria

6) Isolation of restriction endonucleases from bacteria.

7) Isolation of thiamine requiring mutants of *E.coli* using replica plate technique

8) Testing of chemicals for mutagenicity by Ames, lambda-muta test and Induct-test

9) Study of UV absorption spectra of Macromolecules (Protein, Nucleic Acid and Bacterial Pigments

HCP 2.2Practical Course Microbial Ecology and Diversity

1. Enrichment and Isolation of anoxygenic phototrophic bacteria

2. Study of Bioluminescent bacteria.

3. Isolation microorganisms producing plant growth promoting substances Indol Acetic Acid & Gibberellins.

5 Isolation of of bacteria and other microorganisms producing catalase, peroxidases, dismutase.,

6..Isolation of of bacteria and other microorganisms producing alkaline lipase and proteases.

7. Isolation of chemolithotrophic bacteria like Nitrosomons and Nitrobacter spp.

8. Different cultivation techniques for Actinomycetes

9Isolation of Methane bacteria from Biogas slurry

10. Studies on Magnetotactic Bacteria

11. Isolation of Cyanobacteria from water sample

SCP.2.1: Practical Course: Microbial Physiology and Metabolism

1. Study of galaxies transport in yeasts

2. Determination of specific growth rate and generation time of E. coli

5. Determination of protein content of bacteria

4. Determination of carbohydrate content of bacteria

5. Determination of nucleic acid (DNA, RNA) content of bacteria

6. Determination of phenol coefficient of test disinfectant

7. Effect of hypotonic and hypertonic solutions on cells

SCP2.2: Practical Course: Medical Microbiology

1. Antibiotic sensitivity tests by Kirby-Bauer method.

2. Antibiotic sensitivity tests by Stocks comparative diffusion method

3. Determination of MIC (Minimal inhibitory concentration) by tube, disc and plate method.

4. Detection of MIC 50 and MBC of an antibiotic.

5. Isolation of drug resistant microorganisms.

6. Isolation and Identification of pathogen belonging to Enterobacteriaceae at species level.

7. Demonstration on animal inoculation by various routes.

8.Preparation of glasswares,plasticwares,media and finechemicalsforanimal cell cultures.

9..Culturing,maintenance and pass aging of stock of animal cell cultures

OET2.1: Bioinformatics & Biostatistics

1. Assignment on Google for scientific information search by using Pub Med/Medline/Pub Med Central for biological information

2. Retrieving protein and nucleic acid sequences from databases

3. Assignment on Single and multiple Sequence alignment using BLAST, Clustal and Clustal W

5. Assignment on Gen Bank. and study of Nucleic acid and protein sequence data.

6. Studying protein 3D structure using RASMOL

7. Measures of central tendency – Mean, median and mode,

8. Measures of dispersion – variance and standard deviation

9. Estimation of confidence interval for a normal distribution

10. ANOVA – CRD, RBD

11. Student's t-test and chi-square test on sample data

12. Finding correlation and regression of the data using MS-EXCEL

13. Entering biological data in MS-EXCEL and its use for statistical analysis.

OEP2.2:Practical Course:Microbial Nanotechnology

1.Preparation of nanoparticles using microorganismsand microbiological templates,

2.Preparation of various metalnanoparticles for the study of their biologicalactivity

3.Estimation of antibacterial activity of metal nanoparticles

5.Synthesis of goldnanoparticles and its assembly/Conjugation with biomolecules i.e. BSA

6. SDS PAGE gel shift assay for study of nanoparticle-biomolecule assembly.

7. Preparation of PGLA-tetracycline functional nanoparticles using emulsion diffusion method/nano-precipitation/dialysis method

8. Conjugation between PGLA and tetracycline

9. Sunlight induced rapid and efficient biogenicsynthesis of silvernanoparticles using aqueous leaf extract of *Ocimumsanctum*

References for practical courses:

1. LaboratoryTechniquesinMicrobiologyand

2.Handbook of Techniques in Microbiology by A.S.Karwa, M.K.Raiand H.B.Singh. Scientific Publishers, Jodhpur

3.Laboratory Exercises in Microbiologyby J.P.HarleyandL.M.Prescott5thEd

4.Laboratory Manua lin Biochemistryby J.Jayaraman. New Age International Publishers

5.Experimental Microbiology by R.J.Patel. AdityaPublishers,Ahmedabad

6.Molecular Cloning –ALaboratoryManual, Vol.1,2,3by J.Sambrook,E.F.FritschandT.Maniatis

7.Advanced Techniques in mDiagnostic Microbiology by Yi-Wie-Tang and CharlesW.Stratton,Springer

8 .MolecularBiology Laboratory Manual by DennyR.Randall

9.Identification Methods for Microbiologists by B.M.Gibbs and F.A.Skinner.AcademicPress

10.Laboratory Microbiology by L.Jack Bradshaw. W.B.Saunders &Co.

11.Benson's Microbiological Applications Laboratory Manual in General Microbiology by Alfred E.Brown