



# **Solapur University, Solapur**

**Faculty of Science**

**B.Sc.Part- I (Biotechnology)  
(ENTIRE)**

**Credit and Grading System  
(June, 2014)**

# Solapur University, Solapur

## B. Sc. I Biotechnology (Entire)

(Credit and Grading System syllabus)  
(June, 2014)

**1) Title of the Course:** B.Sc.-I Biotechnology (Entire)

**2) Introduction:** This course provides a broad overview of biotechnology and is intended to produce expert hands that would have sufficient knowledge and expertise to solve the urgent problems of the society by using biotechnology. The course structure is technology-centric where students basically learn technology and are taught necessary basic subjects for that purpose.

**3) Objectives of the course:**

The objectives of B.Sc. Biotechnology (Entire) course are

- To provide an intensive and in-depth learning to the students in field of biotechnology.
- Beyond simulating, learning, understanding the techniques, the course also addresses the underlying recurring problems of disciplines in today's scientific and changing business world.
- To develop awareness & knowledge of different organization requirements 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:**

Biotechnology 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 micropropagation of commercially important plants *in vitro*, transgenic plants, vaccine production, clinical pathology, genetic counseling, human karyotyping 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 & abroad

**5) Eligibility of Course:**

**Eligibility:** A Candidate passing 10+2 with biology as one of the subject and passed from state syllabus / CBSE / equivalent with minimum passing percentage of 45% aggregate for open category and 5 % relaxation in the aggregate for all reserved categories candidates as per the government rules and regulations.

**6) Duration:**

- The duration for this program is of 3 years with semester pattern (06 Semesters)

**7) Medium of Instruction: English**

**SOLAPUR UNIVERSITY, SOLAPUR****Syllabus for B.Sc. I Biotechnology**  
(Implemented from June 2014 onwards)**SEMESTER- I (THEORY)**

<b>Paper No.</b>	<b>Title of the paper</b>	<b>Marks</b>
<b>Paper I</b>	English	<b>100</b>
BT 101	Ecology and Microbiology	<b>100</b>
	Section I: Ecology	
	Section II: Microbiology	
BT 102	Introduction to Biosciences	<b>100</b>
	Section I: Plant Science	
	Section II: Animal Science	
BT 103	Fundamentals of Chemistry and Biophysics	<b>100</b>
	Section I: Chemical Science	
	Section II: Biophysics	
BT 104	Cell Biology and Biostatistics	<b>100</b>
	Section I: Cell Biology	
	Section II: Biostatistics	

**SEMESTER- II (THEORY)**

<b>Paper No.</b>	<b>Title of the paper</b>	<b>Marks</b>
<b>Paper I</b>	English	<b>100</b>
BT 105	Environmental Pollution and Microbial Techniques	<b>100</b>
	Section I: Environmental Pollution	
	Section II: Microbial Techniques	
BT 106	Biochemistry and Cell Physiology	<b>100</b>
	Section I: Biochemistry	
	Section II: Cell Physiology	
BT 107	Biometry and Tissue Culture	<b>100</b>
	Section I: Biometry	
	Section II: Introduction to Tissue Culture	
BT 108	Taxonomy and Computer Science	<b>100</b>
	Section I: Taxonomy	
	Section II: Computer Science	

## **B.Sc.I : Biotechnology Practical Course**

<b>Practical</b>	<b>Title of the practical</b>	<b>Marks</b>
<b>BP 101</b>	Practicals in Chemistry, Biochemistry, Cell Biology and Cell Physiology	<b>100</b>
<b>BP 102</b>	Practicals in Biosciences and Taxonomy	<b>100</b>
<b>BP 103</b>	Practicals in Microbiology and Ecology	<b>100</b>
<b>BP 104</b>	Practicals in Physics, Computer, Biostatistics and Biometry	<b>100</b>

**SEMESTER- I (THEORY)**  
**BT 101: Ecology and Microbiology**  
**Section I: Ecology**

**45L= 3C**

**Unit I**

**[07L=0.5C]**

**Basic Concepts**

**Our environment** – Atmosphere, composition and Structure, Lithosphere, Hydrosphere, Biosphere as a life supporting layer

**Unit II**

**[15L=1C]**

**Ecology** – Concept of Ecosystem, structure, functions, productivity & decomposition, Ecological succession – types & features, energy transfer in ecosystem.

**Types of ecosystem** – Terrestrial-Forest, Grassland, Desert Aquatic-Marine, freshwater, estuarine

**Natural Resources** – Forests, water, soil, minerals; degradation of resources, their Conservation & management.

**Unit. III. Biodiversity & Conservation**

**[15L=1C]**

**Biodiversity** – Importance, uses, types, bio-geographical regions of India, biodiversity in World & India, Hot spots, endangered & threatened species.

**Conservation** Nature conservation – Threats to biodiversity, conservation methods-In situ & Ex situ, genetic conservation, wildlife sanctuaries, national parks, biosphere reserves, sacred grooves, project tiger, wetland conservation.

**Awareness** – Chipko andolan, silent valley, Narmada bachao andolan, save western ghats.

**Unit. IV Biogeochemical cycles –**

**[08L=0.5C]**

Nitrogen, carbon, phosphorus, sulphur, water, oxygen.

**BT 101: Ecology and Microbiology**  
**Section II: MICROBIOLOGY**

**45L=3C**

**Unit I: The Microbial world**

**[08L = 0.5C]**

**Milestones in Microbiology** – introduction, Development of the microscope, discovery of microbial life, Louis Pasteur's contribution, germ theory of disease, development of medical microbiology.

**Introduction to applied branches in microbiology:** air, aquatic, sewage, soil, food, milk, medical, industrial, pollution, agriculture, genetic engineering, geomicrobiology, Gnotobiology.

**Unit II: Cell structure**

**[15L=1C]**

**Types of microorganisms:** bacteria, algae, fungi, protozoa and viruses. Distribution of microorganisms in nature and their beneficial and Harmful activities. Prokaryotic and eukaryotic cell structure and differences.

**Morphology and Cytology of typical bacterial cell** –size and arrangement of bacteria. Structure and functions of – cell wall , cytoplasmic membrane, capsule and slime layer, flagella, pili, nuclear material, cytoplasmic inclusions, reserve food materials, spore and endospore – its formation and germination.

**UNIT – III: Virology, Mycology and Phycology**

**[15L=1C]**

**Virology:-**

Virology – Structure of viruses, Classification based on host & type of nucleic acid and morphological types and as per International Committee on Nomenclature of Viruses. General characteristics of viruses.

**Mycology:-**

General characteristics, classification and cultivation of Fungi.

**Phycology:-**

General characteristics, classification and cultivation of algae

**Unit – IV: General Characteristics of various Microorganisms**

**[07L=0.5C]**

1. Archaeobacteria.
2. Actinomycets.
3. Rickettsia
4. mycoplasma
5. Chlamydia.

**References**

1. Pelczar MJ Jr., Chan ECS and Kreig NR. Microbiology, 5th Edition, Tata McGraw Hill, 1993.
2. Edward Alcamo I ., Fundamentals of Microbiology, 5<sup>th</sup> Edition, Adelson Wesley Longman. Inc. New York, 1997.
3. Crueger and A Crueger, (English Ed., TDW Brock); Biotechnology: A textbook of Industrial Microbiology, Sinaur Associates, 1990.
4. M.T. Madigan and J.M. Martinko, Biology of Microorganisms, 11th Edition, Pearson Prentice Hall, USA, 2006
5. Atlas R. M., Principles of Microbiology, Mosby Year Book, Inc., Missouri.,1995

# BT 102 Introduction to Biosciences

## Section I – Plant Science

45L = 3C

### UNIT I Plant Diversity

[08L=0.5C]

- 1.1 General Classification of Plant Kingdom.
- 1.2 General characters and economic importance of –Algae, Fungi, Lichens, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms.

### UNIT II Plant Taxonomy

[07L=0.5C]

- 2.1 Aims, objectives and functions of taxonomy.
- 2.2 Binomial nomenclature and its significance
- 2.3 Principles of ICBN
- 2.4 Study of outline of Bentham and Hooker's system of classification

### UNIT III Organization of Plant Body

[15L=1C]

- 3.1 Plant Tissues- Simple and complex
- 3.2 Typical Flower – Floral whorls and functions.
- 3.3 Development of male and female gametophyte.
- 3.4 Pollination- types and advantages, fertilization
- 3.5 Fruit- Formation, types:- Simple, aggregate, composite (one example of each), Parthenocarpy
- 3.6 Seed –Formation and structure.

### UNIT IV Internal Organization of Dicot and Monocot & Plant Physiology

[15L=1C]

#### 4.1 Internal Organization of Dicot and Monocot

- 4.1.1 Primary structure, normal secondary growth and annual rings
- 4.1.2 Periderm formation

#### 4.2 Plant Physiology

- 4.2.1 Growth- Phases, growth curve
- 4.2.2 Phytohormones- Role and practical applications.
- 4.2.3 Photoperiodism
- 4.2.4 Vernalization
- 4.2.5 Dormancy, breaking of dormancy, germination, vigour and viability

#### References

1. Devlin R.M. Fundamentals of Plant Physiology (Mac. Millan)
2. Malik C.P. Plant Physiology, Kalyani Publishers
3. Dube H.C. Text of Fungi, Bacteria and Viruses
4. Bold H.C. The Plant Kingdom, Prentice- Hall India
5. Chopra G.L. Class  
Oxford University Press
7. Kumar H.D. Biodiversity and sustainable development (Oxford & IBH)
8. Mukherji H. Plant groups (New central book depot)
9. Parihar N.S. An introduction to embryophyta (Central Book Depot)
10. Vasishtha P.C. Botany for degree students-Gymnosperms
11. Naik V.N. Taxonomy of Angiosperms
12. Lawrence G.H. Taxonomy of flowering plants
13. Chopra G.L. Angiosperms (Systematic and life cycle)
14. Shivarajan V.V. Introduction to principles of Taxonomy
15. Pandey B.P. Text book of Angiosperms
16. Eames A.J. and Mac Daniels L.H. An introduction of Plant Anatomy
17. Esau K. Anatomy of seed plants
18. Esau K. Plant Anatomy

**BT 102 Introduction to Biosciences**  
**Section – II Animal Science**

**45L=3C**

**UNIT I Non-chordates**

**[15L=1C]**

Principles of Classification -Salient features and classification up to classes with the following non chordate phyla with suitable examples

- 1.1 Protozoa
- 1.2 Porifera
- 1.3 Coelenterata
- 1.4 Platyhelminthes
- 1.5 Nematelminthes
- 1.6 Annelida
- 1.7 Arthropoda
- 1.8 Mollusca
- 1.9 Echinodermata

**UNIT II Chordates**

**[15L=1C]**

Classification: General organization and classification of chordates up to the following with suitable examples

- 2.1 Urochordata
- 2.2 Cephalochordata
- 2.3 Agnatha
- 2.4 Fishes
- 2.5 Amphibia
- 2.6 Reptilia
- 2.7 Aves
- 2.8 Mammals

**UNIT III Host parasite relationship**

**[07L=0.5C]**

- 3.1. Global feature of parasite and host interaction
- 3.2. Protozoan parasites
- 3.3. Nematode parasites
- 3.4. Plathelminthes parasites

**UNIT IV Economic zoology**

**[08L=0.5]**

- 4.1 Beneficial and harmful organisms (chordates)
- 4.2 Vermiculture
- 4.3 Aquaculture
- 4.4 Sericulture
- 4.5 Apiculture



**BT 103 Fundamentals of Chemistry and Biophysics**  
**Section I – Chemical Science**

**45L = 3C**

**UNIT I Structure and Bonding**

**[15L=1C]**

- 1.1 Introduction- Definition and formation of ionic and covalent bond with examples, e.g. NaCl, KCl, HCl, CH<sub>4</sub>, Cl<sub>2</sub>, H<sub>2</sub>.
- 1.2 VBT- Postulates.
- 1.3 Concept of Hybridization, sp, sp<sup>2</sup>, sp<sup>3</sup> hybridization with respect to C<sub>2</sub>H<sub>2</sub>, C<sub>2</sub>H<sub>4</sub>, CH<sub>4</sub> (Along with consequences with respect to bond length, bond angle, bond energy and shape of the molecule.
- 1.4 Dipole moment- Definition and significance.
- 1.5 Hydrogen bonding- Definition, intra and intermolecular hydrogen bonding with suitable example (Proteins, alcohols, Hydroxy acids, phenols).
- 1.6 Van der Waal's forces.
- 1.7 Essential and trace elements in biological processes (Mg and Fe).
- 1.8 Ionic solids- Definition and general characteristics, comparison between, ionic and covalent compounds.

**UNIT II Chemical equilibrium and reaction kinetics**

**[15L=1C]**

**2.1 Chemical Equilibrium**

- 2.1.1 Colligative properties- Definition, osmosis, osmotic pressure and reverse osmosis.
- 2.1.2 Common ion effect
- 2.1.3 pH and pOH, buffer capacity.
- 2.1.4 pH of buffers- Henderson equation for acidic and basic buffers with derivation.
- 2.1.5 Numerical problems.

**2.2 Reaction Kinetics**

- 2.2.1 Introduction-Meaning and definitions of- rate constant, order and molecularity of reaction, activation energy.
- 2.2.2 Integrated rate expressions for zero, 1st and 2nd order reactions.
- 2.2.3 Characteristics of 1st order reactions.
- 2.2.4 Catalysis- Definition, types of catalysis with example, characteristics of catalysis.
- 2.2.5 Elementary enzyme catalyzed reactions- Meaning and examples.
- 2.2.6 Numerical problem

**UNIT III Thermodynamics**

**[08L=0.5C]**

- 3.1 Introduction- Reversible and irreversible processes, internal energy.
- 3.2 First Law- Statement and mathematical expression.
- 3.3 Enthalpy, heat of reaction and its types, Measurement of  $\Delta H$ .
- 3.4 Second law- Statement, concept of entropy (Criteria for spontaneous and non-spontaneous processes).
- 3.5 Third law- Absolute entropies and their uses.
- 3.6 Gibbs and Helmholtz free energy functions-Criteria for thermodynamic equilibrium and spontaneity.  $\Delta G$  and work function.
- 3.7 Relation between  $\Delta H$  and  $\Delta G$  (Gibbs-Helmholtz equation).
- 3.8 Numerical problems.

**UNIT IV Electrochemistry (Reduction potentials to be used)**

**[07L=0.5C]**

- 4.1 Oxidation reduction reactions (with relation to biology) Redox reactions.
- 4.2 Galvanic cells, half-cell potentials, e.m.f.- meaning and definition.
- 4.3 Thermodynamics of electrode potentials: - Nernst equation and its derivation, K (equilibrium constant) from cell e.m.f., determination of  $\Delta G$ ,  $\Delta H$  and  $\Delta S$ .
- 4.4 Types of electrodes, construction and working of calomel and glass electrodes.
- 4.5 Numerical Problems.

## Reference Books:

### Chemistry

- 1 University General Chemistry by C.N. R. Rao, Macmillan
- 2 Principles of Physical Chemistry, 4<sup>th</sup> edition by S.H. Marron and C.F. Prutton
- 3 Essentials of Physical Chemistry by B.S. Bahel and G.D. Tuli
- 4 College Chemistry by Linus Pauling
- 5 Concise Inorganic Chemistry by J. D. Lee 5<sup>th</sup> Edition
- 6 Basic Inorganic Chemistry by Cotton and Wilkinson
- 7 Organic Chemistry, 5<sup>th</sup> Edition by Marrison Prentice Hall of India Pvt. Ltd. Boyd, New Delhi
- 8 Guide book to Mechanism in Organic Chemistry by Peper Sykes, 6<sup>th</sup> Edition, Orient Longman
- 9 Organic Chemistry by I.L. Finar, Volume-II, 5<sup>th</sup> Edition
- 10 An introduction to Electrochemistry by Samuel Glasstene
- 11 The elements of Physical Chemistry by P.W. Atkins
- 12 Physical Chemistry for biological sciences by Raymond Chang (University science)
- 13 Physical Chemistry by David Ball

**BT 103 Fundamentals of Chemistry and Biophysics**  
**Section – II Biophysics**

45L = 3C

**UNIT I Elasticity:**

[09L=0.6C]

- 1.1 Introduction, definitions of stress and strain in solids, types of strain and stress.
- 1.2 Hooks law
- 1.3 Definition of Young's modulus (Y), bulk modulus (K) and modulus of rigidity ( $\mu$ )
- 1.4 Relation between Y,  $\mu$  and K (without derivation)
- 1.5 Stress strain curve
- 1.6 Importance of elasticity.

**UNIT II Viscosity:**

[09L=0.6C]

- 2.1 Introduction, streamline and turbulent flows
- 2.2 Concept of viscosity, coefficient of viscosity
- 2.3 Effect of temperature and pressure on viscosity of liquids, concept of pressure energy
- 2.4 Bernoulli's theorem (without proof), Application of Bernoulli's theorem venturimeter, Pitots tube (working only),

**UNIT III Surface Tension:**

[09L=0.6C]

- 3.1 Review of surface tension, surface energy, capillary action, angle of contact, wetability,
- 3.2 Relation between surface tension, excess pressure and curvature (without derivation).
- 3.3 Factors affecting surface tension
- 3.4 Methods of measurement of surface tension- Jaegers method (formula and working only)
- 3.5 Applications of surface tension.

**UNIT IV Sound waves and optics:**

[18L=1.2C]

**4.2 Sound waves:**

- 4.1.1 Introduction, mechanical and electromagnetic waves, transverse and longitudinal waves with characteristics
- 4.1.2 Principle of superposition of waves (Statement only)
- 4.1.3 Phenomenon of beats and expression for frequency of beats, application of beats, audible, ultrasonic and infrasonic waves
- 4.1.4 Properties of ultrasonic waves and their applications
- 4.1.5 Doppler Effect and its applications.

**4.2 Optics:**

- 4.2.1 Properties of light: Reflection, refraction, dispersion, diffraction, Interference and Polarization.
- 4.2.2 Concept of polarization. Polarization by reflection – Brewster's law. Polarization by double refraction – Nicol Prism.
- 4.2.3 Lasers: Stimulated emissions, Optical pumping, Concept of population inversion, Laser action, Working of He-Ne laser.
- 4.2.4 Applications of Laser.

**References**

**Biophysics**

- 1 Physics - David Halliday and Robert Resnick (Vol. I and II) (Willey Eastern Ltd.)
- 2 Fundamentals of mechanics - S.K. Saxena (Himalaya Publication)
- 3 Perspectives of modern physics - Arthur Beiser (Mc Graw Hill)
- 4 Heat and thermodynamics - Zemansky (Mc Graw Hill)
- 5 Fundamentals of optics - Jenkins, White (Mc Graw Hill)
- 6 Optics -Ajoy Ghatak (Tata Mc Graw Hill)
- 7 Solar Energy - Suhas Sukhatme (Tata Mc Graw Hill)
- 8 Digital principles and applications - Malvino and Leach (Tata Mc Graw Hill)
- BOS Biotechnology University of Pune 21.09.07 7
- 9 Elements of spectroscopy - Gupta, Kumar, Sharma (Pragati Prakashan)
- 10 Introduction to atomic spectra - H.E. White (Mc Graw Hill)

**BT 104: Cell Biology and Biostatistics**  
**Section – I: Cell Biology**

**45L=3C**

**Unit I. Cell Structure & Organization**

**[15L=1C]**

Introduction to generalized cell: Animal cell, plant cell.

Cell types: Prokaryotic, eukaryotic, PPLOs,

Cell wall: Ultra structure of prokaryotic and eukaryotic cell wall.

Ultra structure of cell organelles and their functions: Plasma membrane, Ribosomes, Centrioles, Endoplasmic reticulum, Golgi complex, mitochondria, lysosomes, Plastids, nucleus.

Cytoskeleton and cell motility: microtubules, actin filaments, Intermediate filaments.

**Unit II. Cell Biology**

**[15L=1C]**

Cell growth: concept of cell growth and differentiation of division.

Cell cycle and division: Mitosis, meiosis; cell synchrony and its applications; cell senescence, apoptosis.

Chromosomes: Chromosome number, size, types. Chromosomal morphology, topography, fine structure and models; heterochromatin, euchromatin; giant chromosomes.

Genetic code and protein synthesis: Genetic code, wobble hypothesis, components of protein biosynthesis.

**Unit III. Cell membranes and permeability:**

**[07L=0.5C]**

Molecular models of cell membrane, cell permeability; differentiation of cell membrane, intercellular communications and gap junctions; cell coat and cell recognition, cell surface and cancer cells.

**Unit IV. Cell metabolism**

**[08L=0.5C]**

Protein trafficking

Membrane transport.

Cell signalling

Intracellular compartments, mechanism of protein synthesis.

**REFERENCES:**

1. Lodish et al., Molecular cell biology, 4th Edition, W.H.Freeman& Company, 2000.
2. Smith & Wood, Cell Biology, 2<sup>nd</sup> edition, Chapman & Hall, London, 1996.
3. Watson et al., Molecular biology of the gene, 5<sup>th</sup> edition, Pearson Prentice hall, USA, 2003.
4. B. M. Turner, Chromatin & Gene regulation, 1<sup>st</sup> edition, Wiley-Blackwell, 2002.
5. Benjamin Lewin, Gene IX, 9<sup>th</sup> Edition, Jones and Bartlett Publishers, 2007.
6. Alberts, B., Bray Dennis, Lewis Julian, Raff Martin, Roberts. K and Watson, J.D. Molecular Biology of the cell. Garland Publishing Inc. New York, 1994.
7. Cellis, J.E Cell Biology: a Laboratory Handbook Vol.I and II. Academic press, 1998.
8. Malacinski, G.M & Freifelder, D. Essentials of Molecular Biology III Ed. Jones & Bartlett Publishers, 1998.
9. Knudson A.G. 1998, Anti-oncogenes and Human cancer. Proceedings of the national academy of sciences USA 90:10, 10114-10921
10. Bishop J.A. 1982, Retroviruses and cancer genes. advances in cancer research.
11. Brachet J. 1985 Molecular cytology. Academic press New York.
12. Gilbert S.F. Developmental Biology IV Edition. sinauer associates inc. Publishers, Massachusetts, 2000.
13. Kalthoff. K Analysis of biological development. McGraw Hill Inc. New York, 1996.
14. Rao, K.V Developmental biology: A modern Synthesis. Oxford & IBH Publishing Co. Pvt. Ltd, 1993.
15. Subramanian, T. developmental Biology Narosa Publishing House, 2002.
16. Twyman, R.M Instant Notes. Developmental Biology. Bioss Scientific Publishers Ltd, 2001.

## **BT 104: Cell Biology and Biostatistics**

### **Section –II: Biostatistics**

**45L = 3C**

#### **Unit I: Statistics**

**[09L=0.6C]**

Importance and applications, tabulation and classification of data; frequency distribution, graphical distribution of data.

#### **Unit II Measures of central tendencies**

**[09L=0.6C]**

Measures of central tendencies: Mean median and mode, their properties.

#### **Unit III Measures of dispersion**

**[09L=0.6C]**

Measures of dispersion – Range, mean deviation, variance, standard deviation, coefficient of variation; correlation and linear regression.

#### **Unit IV: Probability**

**[18L=1.2C]**

Definition of probability and distributions, concept and problems on probability; binomial, poisson and normal distribution and their applications. Hypothesis testing –parametric and non-parametric tests, t and  $\chi^2$  tests, run tests, significant test, median test, One way analysis of variance.

Concepts and Applications of Biometry in Biotechnology

**BT 105: Environmental Pollution and Microbial Techniques**  
**Section I: Environmental Pollution**

45L=3C

**Unit – I Air pollution**

[15L=1C]

Air pollution – Sources, types of air pollutants & its effects on humans & environment, acid rain, smog, ozone depletion, greenhouse effect, global warming vehicular pollution- sources, impacts on environment. Catalytic converters - uses of catalytic converters in vehicular pollution control, Air pollution Act. Case study – Bhopal gas tragedy.

**Unit – II Water and Soil pollution –**

[07L=0.5]

Types of waste, sources, their composition, effects on humans & environment, marine pollution, thermal pollution, eutrophication, pathogenic diseases, BOD, COD, limits for disposal on land, water bodies. Case study – Minamata episode.

Soil/Land pollution – Soil formation, its contents, sources of pollution, soil salinity, effect of fertilizers & pesticides, impact of excessive irrigation, impact of mining.

**Unit – III Nuclear pollution**

[08L=0.5C]

Nuclear pollution – Radioactivity, isotopes, uses, sources of pollution, measurement of radiation, nuclear fission-electricity, atom bomb; nuclear fusion-hydrogen bomb, treatment of nuclear wastes, effects of nuclear radiation.

Case study – Chernobyl nuclear disaster.

**Problems of pollution** – definition, sources of pollution, local & global impacts of pollution, industrialization, urbanization.

**Unit – IV Energy Studies**

[15L=1C]

Energy requirements of modern society, conventional energy sources, energy crisis. Non conventional energy sources – Solar, wind, hydel, tidal, OTEC, geothermal, hydrogen, solid waste.

Biomass energy – Non biological methods-Wood as fuel, gasification, liquefaction, pyrolysis, Biological-biogas generation, molasses fermentation for alcohol, bioethanol, biodiesel.

Energy plantation, gasohol experiment, new techniques on biological energy production.

**References :**

1. Water Pollution –By Dr.P.K.Goel
2. Atlas R. M., Principles of Microbiology, Mosby Year Book, Inc., Missouri.,1995

**BT 105: Environmental Pollution and Microbial Techniques**  
**Section II: Microbial Techniques**

**45L = 3C**

**Unit I: Microbial growth**

**[15L=1C]**

**Microbial nutrition and culture media:** Nutritional requirements – water, oxygen, hydrogen, carbon, nitrogen, sulphur, phosphorus, inorganic nutrients, growth factors. Common components of media & their functions: Peptone, Meat extract, NaCl, Vitamins, Sugar, Sodium taurocholate, Milk, Starch, Blood, Agar agar. Common indicators & their functions – Andrade's, Neutral Red, Bromothymol Blue. Nutritional classification on the basis of carbon and energy source.

**Growth:** Growth phases in a bacterial culture. Laboratory methods of determination of growth, continuous culture, synchronous growth, diauxic growth.

**Unit II: Pure culture techniques**

**[15L=1C]**

**Media for cultivation of micro-organisms:** natural, synthetic, semi-synthetic, Differential, enriched, enrichment, selective, living media: Embryonated Egg., Animal Tissue Culture, Animals.

**Pure culture technique:** Selective methods: chemical, physical and biological methods of selection. Methods for isolating pure cultures – i) streak method, ii) pour plate, iii) spread plate.

**Anaerobic Culture methods:** i) Rosenthal ii) Gas Pack iii) Use of Reducing agents.

**Maintenance of pure culture** Freezing, Lyophilization, Soil stock, Paraffin method.

**Unit III: Staining Techniques**

**[08L=0.5C]**

Definition of dye and stain. Classification of stains – acidic, basic and neutral. Theories, procedures and mechanisms of – simple staining, differential staining, Gram staining, acid fast staining, negative staining. Special staining methods

- i) Cell wall: - Chances Method
- ii) Capsule: - Manvel's method.
- iii) Volutin Granules: - Albert's Method.

**Unit IV: Sterilization techniques**

**[07L=0.5C]**

Control of micro-organisms Definition of sterilization, disinfectant, antiseptic, germicide, antimicrobial agents. Physical and chemical agents of sterilization.

**References:**

1. Pelczar MJ Jr., Chan ECS and Kreig NR. Microbiology, 5th Edition, Tata McGraw Hill, 1993.
2. Edward Alcamo I., Fundamentals of Microbiology, 5th Edition, Adelson Wesley Longman. Inc. New York, 1997.
3. Crueger and A Crueger, (English Ed., TDW Brock); Biotechnology: A textbook of Industrial Microbiology, Sinauer Associates, 1990.
4. G Reed, Prescott and Dunn's, Industrial Microbiology, 4th Edition, CBS Publishers, 1987
5. M.T. Madigan and J.M. Martinko, Biology of Microorganisms, 11<sup>th</sup> Edition, Pearson Prentice Hall, USA, 2006
6. Atlas R. M., Principles of Microbiology, Mosby Year Book, Inc., Missouri., 1995

**BT 106: Biochemistry and Cell Physiology**  
**Section -I Biochemistry**

**45L=3C**

**Unit I Carbohydrates:**

**[08L=1C]**

Definition, Classification, Functions, Carbohydrates – structure and properties : Monosaccharides, isomerization of monosaccharides, cyclic structure of monosaccharides, different types of monosaccharides, compounds derived from monosaccharides, nomenclature of monosaccharides and chemical properties; Disaccharides, Trisaccharides, Oligosaccharides and Polysaccharides, structure of glycan and its importance.

**Unit II Proteins:**

**[15L=1C]**

Definition, Classification, Functions, Classification of amino acids, aliphatic amino acids, cyclic amino acids; physical and chemical properties; Peptides – classification and nomenclature, biologically important peptides, Glutathione, Peptide hormones, peptides with antibiotic activity. Three dimensional conformation of proteins, bonds stabilizing the proteins, primary, secondary, tertiary and quaternary structure of proteins, important properties of proteins – solubility, molecular weight, amphoteric character; classification of proteins based on molecular shape, solubility, composition, phosphoprotein, glycoproteins, lipoprotein, nucleoproteins, chemoproteins and their types

**Unit III Lipids:**

**[07L=0.5C]**

Definition, Classification, Functions, structure of lipids, fatty acids, saturated and unsaturated fatty acids, branched fatty acids; prostaglandins, leukotrienes and peroxides; Glycolipids, Spinoglycolipids, Cerides, Hydrocarbons, polyisoprenic lipids, polyisoprenic hydrocarbons, Sterol and carotenoids, Isoprenic chain quinone, properties and functions.

**Unit IV Nucleic acid & Vitamins**

**[15L=1C]**

**Nucleic acids:** Definition, Classification, Functions, Nucleic acids: Structure of nucleic acids, pentoses, nitrogen bases, nucleotides, nucleosides – monophosphates, di- and triphosphates, primary structure of nucleic acids, secondary structure of DNA and RNA, Watson and Crick model, other forms of DNA; DNA: Chargaff rule, Physicochemical properties and biological functions of nucleic acids.

**Vitamins:** structure of vitamins, coenzyme form, biochemical function and physiological role, deficiency disorders of water soluble and fat soluble vitamins.

**References**

1. Textbook of Medical Physiology by A.C. Guyton.
2. Textbook of Physiology (Volume I and II) by Dr. A.K. Jain.
3. Understanding Physiology by Dr. R.L. Bijlani.
4. Manual of Practical Physiology for MBBS by Dr. A.K. Jain.
5. Hutchinson's Clinical Methods.



**BT 106: Biochemistry and Cell Physiology**  
**Section -II Cell Physiology**

45L = 3C

**Unit I**

[07L=0.5C]

**Transport in Plants:** Means of Transport, Plant-Water Relations, Long Distance Transport of Water, Transpiration, Uptake and Transport of Mineral Nutrients, Phloem Transport: Flow from Source to Sink. **Mineral Nutrition:** Methods to Study the Mineral Requirements of Plants, Essential Mineral Elements, Mechanism of Absorption of Elements, Translocation of Solutes, Fixation of Nitrogen.

**Unit II**

[15L=1C]

**Photosynthesis in Higher Plants:** Early Experiments, Where does Photosynthesis take place? How many Pigments are involved in Photosynthesis? What is Light Reaction? The Electron Transport, Where are the ATP and NADPH Used? The C4 Pathway, Photorespiration, Factors affecting Photosynthesis. **Plant Growth and Development:** Growth, Differentiation, Dedifferentiation and Redifferentiation, Development, Plant Growth Regulators, Photoperiodism, Vernalisation.

**Unit III**

[08L=0.5C]

**Human Physiology: - Digestion and Absorption:** Digestive System, Digestion of Food, and Absorption of Digested Products. **Breathing and Exchange of Gases:** Respiratory Organs, Mechanism of Breathing, Exchange of Gases, Transport of Gases, Regulation of Respiration. **Body Fluids and Circulation:** Blood, lymph (Tissue Fluid), Circulatory Pathways, Double Circulation, Regulation of Cardiac Activity.

**Unit IV**

[15L=1C]

**Excretory Products and their Elimination:** Human Excretory System, Urine Formation, Function of the Tubules, Mechanism of Concentration of the Filtrate, Regulation of Kidney Function, Micturition, Role of other Organs in Excretion. **Locomotion and Movement:** Types of Movement, Muscle Skeletal System, Joints. **Neural Control and Coordination:** Neural System Human Neural System, Neuron as Structural and Functional Unit of Neural System, Central Neural System, Reflex Action, and Reflex Arc, Sensory Reception and Processing. **Chemical Coordination and Integration:** Endocrine Glands and Hormones, Human Endocrine System, Hormones of Heart, Kidney and Gastrointestinal Tract, Mechanism of Hormone Action.

**References**

1. Review of Medical Physiology by W.F. Ganong.
2. Samson Wright's Applied Physiology.
3. Experimental Physiology by D.T. Harris.
4. Clinical Haematology by Dacie.
5. Wintrobe's - Clinical haematology
6. Bidwell .R.G.S. 1974. Plant Physiology. Macmillan. Publication Co. Newyork.
7. Ting. I.P. 1982 Plant Physiology. Addison Wesley Publication Co. Philippines.
8. Hopkins WG (1998 or 2004 ed). Introduction to Plant Physiology.
9. Stern KR (1997) Introductory Plant Biology. 7th Ed. Wm C Brown Publishers

**107: Biometry and Tissue Culture**  
**Section I – Biometry**

45 L = 3C

**Unit I: Introduction to basic mathematical concepts**

[10L=0.66C]

1. Number system, classification and measurements, variables, discrete and continuous variables, rounding of data, scientific notation; relative numbers, inequalities, mean values, percentages, Algebraic law.
2. Complex numbers: - addition, subtraction, multiplication, division, De-Moivre's theorem, finding roots of polynomial equation.

**Unit II: Set theory.**

[10L=0.67C]

1. Sets and its properties,
2. Functions and relations – linear, periodic and power functions; Quadratic and polynomial equations, exponential, inverse and logarithmic functions;
3. Limits and continuity function.

**Unit III: Mathematics**

[15L = 1C]

Derivate: Implicit and explicit derivative, Logarithmic function derivative, Second order derivate, Application of derivative  
Integration: Definite and Indefinite integration, Application of integration  
Partial Differentiation:-  
Maxima and minima (up to 2 variables)  
Rules of partial differentiation  
Higher order partial derivatives  
Differential equations: - Homogeneous and non-homogeneous differential equations, exact d.e. (including integrating factor).  
Linear differential equation. Applications to growth and decay,  
Law of cooling

**Unit IV: Matrices:**

[10L=0.67C]

Matrices: Intoduction, properties.  
System of linear equations, row echelon form,  
Rank of a matrix, homogeneous and non-homogeneous systems  
 $AX = B$ , consistency, gaussian elimination method.

**References:**

1. Malick, S.C. and Arora Mathematical Analysis
2. Jenny Olive – Maths :- a self study Guide – Cambridge Low prices edition
3. R.G. Bartle and D.R. Sherbert (2nd edition)-1992, John Wiley, New York
4. E.D. Rainville and P.E. Bedient (1989), Elementary Differential equations – McMillan, New York

**BT 107: Biometry and Tissue culture**  
**Section -II Introduction to Tissue Culture**

45L = 3C

**Unit I. Basics of plant tissue culture** **[11L=0.75C]**

- Introduction to Plant tissue culture Lab organization and tissue culture.
- Tissue culture media: Types, Composition and Preparation
- Introduction to Totipotency, tissue culture technique to produce novel plants and hybrids
- Initiation and maintenance of callus and suspension culture, Cytodifferentiation
- Organogenesis: Principles, Concept and Applications of Somatic embryogenesis.

**Unit II. Introduction to cell culture** **[11L=0.75C]**

- Shoot tip culture, rapid clonal propagation.
- Protoplast culture: Importance, Isolation of protoplasts, method of protoplast culture, culture media, Growth and division of protoplast, regeneration of plants
- Anther, Pollen and Ovary culture for production of haploid plants and homozygous lines

**Unit III. Basics of Animal tissue culture** **[10L=0.70C]**

- Introduction to animal tissue culture Lab organization and tissue culture
- Historical perspectives, development, scope; requirements for animal cell and tissue, organ culture.
- Introduction to Instruments used in lab : Inverted microscope, CO<sub>2</sub> Incubator, LAF, Micropipettes .

**Unit IV. Introduction to Animal tissue culture** **[13L=0.80C]**

- Animal Tissue culture media: Types – (Artificial) synthetic media And Natural media, Composition and Preparation, Importance of growth factors of the serum.
- Initiation and maintenance of Primary cell line, secondary cell line and continuous cell line, Organ culture, Trypsinization.
- Anchorage dependence of growth. Non-anchorage dependent cells, Viability – measurement of viability and cytotoxicity

**Reference Books :**

1. Animal Tissue culture : J. Paul
2. Introduction to Plant Tissue culture : M.K. Razdan
3. Plant Tissue Culture : Theory & Practice : S.S. Bhojwani & M.K. Razdan
4. Micropropagation : Debergh & Zimmermann
5. Plant tissue culture : Kalyankumar Dey

**BT 108: Taxonomy and Computer Science**  
**Section -I: Taxonomy**

**45L = 3C**

**Unit I Systems of Classification**

**[11L=0.75C]**

History, Two-, Three- and Five Kingdom system, Concepts of Domains, Units of Classification (Taxa), Binomial Nomenclature (Roles and Importance), Aims and Principles of Taxonomy, Introduction to Identification.

**Unit II Animal Taxonomy**

**[11L=0.75C]**

General characters and Outline classification up to class (Protozoa, Arthropoda, Mollusca, Echinodermata, Hemichordata, Urochordata, Cephalochordata, Agnatha, Fishes, Amphibia,), General and Distinguishing characters of class (Reptillia, Aves, Mammalia)

**Unit III Plant Taxonomy**

**[10L=0.70C]**

General characters and Economical importance of Algae, Bryophytes, Pteridophytes, Gymnosperms, Angiosperms. Introduction to the classification by G. M. Smith for (Algae, Bryophytes, Pteridophytes), Sporne 1965 for (Gymnosperms) and Bentham and Hooker's for (Angiosperms), Salient features of ICBN.

**Unit IV Microbial Taxonomy**

**[13L=0.80C]**

General and Important characters of Archaeobacteria, Actinomycetes, Rickettsia, Mycoplasma, Clamydia. Criteria for classification (Morphological, Cultural, Biochemical), Introduction to Phenetic, Phylogenetic, Conventional and Numerical Taxonomy. General characters, Economic Importance and outline classification (Ainsworth 1973) of Fungi.

**Reference Books**

1. Smith, G.M. 1972. Cryptogamic botany Vol. - II Mc Graw Hill, New Delhi.
2. Sporne, K.R. 1976. Morphology of Petridophytes, BI Publications. Pvt. Ltd.,
3. Pandey B.P. 1977. A Text book of Botany Bryophyta, Peridophyta and Gymnosperms
4. Sporne K.R. 1965. Morphology of gymnosperms. B.I. Publications Pvt. Ltd.
5. Rashid, A 1976. An Introduction to Pteridophyta
6. Bhatnagar S.P. and A. Moitra 1996. Gymnosperms,
7. Margulis. L. and K.V. Schwatz (2 nd ed.) 1988. Five Kingdoms: Anm illustrated Guide to phyla of life on Earth W.H. Freeman & Co. New York.
8. M. Koto-The. Biology of biodiversity-Springer
9. E.O. Wilson-Biodiversity-Academic Press Washington.
10. G.G.-Simpson-Principle of animal taxonomy Oxford IBH Publication company.
11. Snecdor, G.W. and W.G. Cochran Statisical Methods of affiliated-East- West Press, New Delhi.

**BT 108: Taxonomy and Computer Science**  
**Section II: Computer Science**

**45L = 3C**

**Unit I**

**[15L=1C]**

**Introduction to Computers:** History of Computers, Data, Information and Program, Hardware and Software, Types of Computers, **Number Systems:** Introduction, Bits and Bytes, Decimal Number System, Binary Number System, Hexadecimal Number System, Decimal to Binary Conversion, Conversion of fractional decimal to binary, Conversion of Decimal to Hexadecimal, Octal Representation, Representation of signed numbers, Binary Arithmetic, Boolean Algebra. **Algorithms and Flowcharts:** Definition, properties and principles, converting algorithms to flowcharts, comparison between program and algorithm, use basic programming in biology, Databases, Creation and need of Databases.

**Unit II**

**[08L=0.5C]**

**Computer Organization:** Basic Components of a Digital Computer, Central Processing Unit, Arithmetic and Logic Unit – ALU, Memory Unit, Input and Output Devices. **Operating Systems:** Introduction, Major Features of the Operating System, Most Desirable Characters of the Operating System (OS, DOS, Windows, Linux).

**Unit III**

**[07L=0.5C]**

**MS-Office** (Word, Excel, PowerPoint)- Word Features, Font, Font Style, Formatting, Copying and Pasting, Format Painter, Columns, Page Formatting, **Excel**- Cell, Cell Address, Formula, Working with Excel, Creating charts, Working with **PowerPoint**- Preparing presentations (using Clip arts, shapes, moves etc).

**Unit IV**

**[15L=1C]**

**Computer Communications:** Introduction, Network, Some Important Reasons for Networking, Applications of Network, Benefits of Network, Types of Network, Network Topology, Basics of Networking, Common Network Services, Co-Ordinating Data Communication, Forms of Data Transmission, Modem, Data Transfer Rate, Transmission Mode, Internet, Communication Protocol, Who Governs the Internet ? Future of Internet, Uses of Internet, Getting Connected to Internet, Popular Uses of the Web, Intranet and Extranet.

**Reference Books**

1. Fundamentals of Computer by V Rajaraman; Prentice Hall of India Pvt. Ltd., New Delhi
2. Computers Today by SK Basandara, Galgotia publication Pvt ltd. Daryaganj, New Delhi
3. MS-Office 2000 for Everyone by Sanjay Saxena; Vikas Publishing House Pvt. Ltd., New Delhi
4. Internet for Every One by Alexis Leon and Mathews Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
5. A First Course in Computer 2003 Edition with CD by Sanjay Saxena; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
6. Mastering Windows 95, BPB Publication, New Delhi
7. Computer Fundamentals by PK Sinha; BPB Publication, New Delhi
8. Fundamentals of Information Technology by Leon and Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi

## **B.Sc.I Biotechnology: Practical Course**

### **BP 101**

#### **Practicals in Chemistry, Biochemistry, Cell Biology and Cell Physiology**

**4 Credits**

1. Study of chromosomes in onion (root/bud),
2. Cell counting – haemocytometer, Neubauer chamber.
3. Isolation and characterization of subcellular components – nuclei from rat liver.
4. Isolation of mitochondria.
5. Preparation of Molarity, normality and percentage solutions.
6. Determination of conductivity of solution.
7. Determination of an order of reaction.
8. Preparation of buffers (Phosphate buffer, acetate buffer)
9. Study of osmotic pressure on Human RBCs.
10. Study of relative rates of transpiration of different plants.
11. Separation of pigments by paper chromatography.
12. Study the rate of photosynthesis under different light intensities.
13. Determination of bleeding time (BT) and clotting time (CT).
14. Estimation of Proteins by Biuret method.
15. Estimation of Carbohydrate (reducing sugar).
16. Qualitative analysis of Carbohydrates / Amino acids / Lipids (3 practicals).

### **BP 102**

#### **Practicals in Biosciences and Taxonomy**

**4 Credits**

1. Study of Morphological characters of algae.
2. Study of Morphological characters of Fungi.
3. Study of Morphological characters of bryophytes.
4. Study of Morphological characters of pteridophytes .
5. Study of Morphological characters of gymnosperms.
6. Study of Morphological characters of angiosperms.
7. Study of Morphological characters of dicotyledones.
8. Study of Morphological characters of monocotyledones.
9. Study of different parts of plants –Qualitative histochemistry of root, stem and leaf of monocotyledon and dicotyledon. 2P
10. Study of the shoot apex, and dissection of shoot apical meristem.
11. Study of plant cell types using squash techniques and maceration.
12. Study of paramecium, Hydra. 1P
13. Study of collection, preservation & presentation of insects.
14. Study of different types of eggs, larvae & pupae of insects.
15. Study of Morphological characters of Chordate.
16. Study of Morphological characters of Plant Family.
17. Isolation and study of morphological and Biochemical characters of Bacteria from Soil.

**BP 103**  
**Practicals in Microbiology and Ecology**

**4 Credits**

- 1) Precaution to work in microbiology laboratory.
- 2) Use & care of Compound microscope.
- 3) Demonstration of –
  - a) Cleaning of Glasswares
  - b) Sterilization of glasswares (Hot air oven)
- 4) Techniques for pure culture of microbes – streak plate, pour plate, spread plate and serial dilution agar plate.
- 5) Observation of living microbes – wet mount preparation, hanging drop technique for motility.
- 6) Staining techniques – monochrome, Gram's staining, Giemsa's staining. Special staining:- Cell Wall (Chance's), Capsule (Maneval's), Volutin granules (Albert's).
- 7) Study of microbial growth curve.
- 8) Isolation of coliphages from sewage.
- 9) Determination of TS, TDS, TSS.
- 10) Determination of Dissolved oxygen.
- 11) Estimation of Nitrates.
- 12) Estimation of biomass from terrestrial ecosystem.
- 13) Determination of soil pH.
- 14) Estimation of Calcium & Magnesium from water.
- 15) Estimation of Oil & Grease.
- 16) Determination of Salinity of soil.
- 17) Estimation of sulphates.
- 18) Study of air microflora.

**BP104**  
**Practicals in Physics, Computer, Biostatistics, Biometry and Tissue culture**

**4 Credits**

1. Viscosity measurement using Ostwalds viscometer.
2. Surface – tension measurement: Using Jaeger's method, soap bubble Method.
3. Temperature measurement: using thermocouple, RTD.
4. Study of Lambert's & Beer's law.
5. Absorption spectrum of protein by spectrophotometer.
6. Tabulation and Graphical representation of data:
  - a) Line bar diagram
  - b) Simple bar diagram
  - c) Histogram
  - d) Ogive Curve
  - e) Pie chart
7. Measures of central Tendency: To calculate mean, mode and median
8. Measures of dispersion. : To calculate mean deviation, standard deviation, variance.
9. Sterilization and preparation of plant and animal culture media.
10. Micropropagation by proliferation of axillary bud.
11. Subculture of callus and organogenesis of explants
12. Isolation of Bovine serum albumin.
13. Maintenance and establishment of callus culture and suspension culture.
14. Isolation of protoplast.
15. Preparing letter for purchase order on college letter head and take print out.
16. Preparing presentation with PowerPoint- on bio-technology subject.

**Solapur University, Solapur**  
Nature of Question Paper for Credit-Grading Semester Pattern  
• Faculty of Science( Biotechnology)  
(w.e.f. June 2014)  
Time: - 3 hrs. Total Marks- 70

**Section - I**

**Q. No.1) Multiple choice questions** (5)

- 1) -----  
a)        b)        c)        d)
- 2)  
3)  
4)  
5)

**Q.No.2) Answer any five of the following** (10)

- i)  
ii)  
iii)  
iv)  
v)  
vi)  
vii)

**Q.No.3) Write short notes on any Two of the following** (10)

- i)  
ii)  
iii)

**Q.No.4) Answer any one of the following** (10)

- i)  
ii)

**Section - II**

**Q. No.1) Multiple choice questions.** (5)

- 1) -----  
a)        b)        c)        d)
- 2)  
3)  
4)  
5)

**Q.No.2) Answer any five of the following** (10)

- i)  
ii)  
iii)  
iv)  
v)  
vi)  
vii)

**Q.No.3) Write short notes on any Two of the following** (10)

- i)  
ii)  
iii)

**Q.No.4) Answer any one of the following** (10)

- i)  
ii)



**Nature of Question Paper for Practical examination  
B.Sc. Part I biotechnology Semester I and Semester II**

**Subject: BP 101 (Practicals in Chemistry, Biochemistry, Cell Biology and Cell  
Physiology)**

**Time: 10.30 am to 05.30 pm**

**Total Marks: 70**

**Duration: Two days**

<b>Q.1.</b> Isolation of cell organelles practical based on Cell Biology	<b>15</b>
<b>Q. 2.</b> Colourimetric estimation practical based on Biochemistry	<b>15</b>
<b>Q.3</b> Major practical based on Chemistry	<b>10</b>
<b>Q.4.</b> Practical based on Cell Physiology	<b>10</b>
<b>Q.5</b> Practical based on qualitative analysis in biochemistry	<b>05</b>
	<b>05</b>
<b>Q.6</b> Write answers asked on spot A,B,C,D and E	<b>0 5</b>
<b>Q. 7</b> Certified Journal	<b>05</b>
<b>Q.8</b> viva- Voce	

**Nature of Question Paper for Practical examination  
B.Sc. Part I Biotechnology Semester I and Semester II**

**Subject: BP 102 ( Practicals in Biosciences and Taxonomy)**

**Time: 10.30 am to 05.30 pm**

**Total Marks: 70**

**Duration: Two days**

- |  |           |
|--|-----------|
| <b>Q.1.</b> Major practical based on study of morphological characters of given plant specimen   | <b>15</b> |
| <b>Q. 2.</b> Major practical based on study of morphological characters of given animal specimen | <b>15</b> |
| <b>Q.3</b> Isolation and characterization of bacteria from given sample                          | <b>10</b> |
| <b>Q.4.</b> Minor practical based on microscopic observations                                    | <b>10</b> |
| <b>Q.5</b> Minor practical based on Biosciences /Taxonomy  | <b>05</b> |
| <b>Q.6</b> Write answers asked on spot A,B,C,D and E   | <b>05</b> |
| <b>Q. 7</b> Certified Journal  | <b>05</b> |
| <b>Q.8</b> viva- Voce  | <b>05</b> |

**Nature of Question Paper for Practical Examination  
B.Sc. Part I biotechnology Semester I and Semester II**

**Subject: BP 103 (Practicals in Microbiology and Ecology)**

**Time: 10.30 am to 05.30 pm**

**Total Marks: 70**

**Duration: Two days**

Q.1. Practical on growth curve/ isolation of coliphages/pure culture techniques.	15
Q. 2. Determination of chemical parameters of given water sample.	15
.Q.3 Practical based on staining techniques	10
Q.4. . Determination of physical parameters of given water sample.	10
Q.5 Practicals based on working in microbiology laboratory	05
Q.6 Write answers asked on spot A,B,C,Dand E	05
Q. 7 Certified Journal	05
Q.8 Viva- voce	05

