Solapur University, Solapur

Faculty of Science

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

Choice Based Credit System (CBCS) (w.e.f. June, 2016)

Solapur University, Solapur

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(w.e.f. June 2016)

- **Choice Based Credit System:** With the view to ensure worldwide recognition, acceptability, horizontal as well as vertical mobility for students completing undergraduate degree, Solapur University has implemented Choice Based Credit System (CBCS) at Undergraduate level.

  The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations.

- **Outline of Choice Based Credit System:**
  1. ***Core Course:*** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
  2. ***Elective Course:*** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

     Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective.
  3. ***Ability Enhancement Courses (AEC):*** The Ability Enhancement (AE) Courses may be of two kinds: Ability Enhancement Compulsory Courses (AECC) and Skill Enhancement Courses (SEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement; (i) Environmental Science and (ii) English/MIL Communication. These are mandatory for all disciplines. SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

- **Credit:** Credit is a numerical value that indicates students work load (Lectures, Lab work, Seminar, Tutorials, Field work etc.) to complete a course unit. In most of the universities 15 contact hours constitute one credit. The contact hours are transformed into credits.

  Moreover, the grading system of evaluation is introduced for B.Sc. course wherein process of Continuous Internal Evaluation is ensured. The candidate has to appear for Internal Evaluation of 30 marks and University Evaluation for 70 marks. It is 70+30 pattern of evaluation. It is applicable for theory and practical as well. The details regarding this evaluation system are as under.

- **Conversion of marks into Grades:**

  A table for the conversion of the marks obtained by a student in each paper (out of 100) to grade and grade point is as given below:

Sr. No.	Range of Marks	Grade	Grade Point
1	80 – 100	O	10
2	70 – 80	A+	9
3	60 – 69	A	8
4	55 – 59	B+	7
5	50 – 54	B	6
6	45 – 49	C+	5
7	40 – 44	C	4
8	<39	FC	0 (Failed in Term Exam)
9	<39	FR	0 (Failed in Internal Assessment)

1. **Grade Point Average at the end of the Semester (SGPA)**

$$\text{SGPA} = \frac{(G_1 \times C_1) + (G_2 + C_2) + \dots \dots \dots}{\sum C_i}$$

(ΣC_i = The total number of credits offered by the student during a semester)

2. **Cumulative Grade Point Average (CGPA)**

$$\text{CGPA} = \frac{(G_1 \times C_1) + (G_2 + C_2) + \dots \dots \dots}{\sum C_i}$$

(ΣC_i = The total number of credits offered by the student upto and including the semester for which CGPA is calculated.)

3. **Final Grade Point Average (FGPA)**

It will be calculated in the similar manner for the total number of credits offered for the completion of the said course.

Where: C_i = Credits allocated for the i^{th} course.

G_i = Grade point scored in the i^{th} paper (subject)

4. Conversion of average grade points into grades:

SGPA/CGPA/FGPA	Letter Grade
9.5 – 10	O
8.5 – 9.49	A+
7.5 – 8.49	A
6.5 – 7.49	B+
5.5 – 6.49	B
4.5 – 5.49	C+
4.0 – 4.49	C
<3.99	FC / F
	FR

- **Structure of B.Sc. Biotechnology (Entire) Programme as per CBCS pattern**

Class	Semester	Marks-Theory	Credits-Theory	Marks-Practical	Credits-Practical	Total Credits
B.Sc. I	I	900	24	--	--	24
	II	900	24	400	16	40
B.Sc. II	III	600	18	--	--	18
	IV	700	22	600	24	46
B.Sc. III	V	500	16	--	--	16
	VI	500	16	400	20	36
Total		4100	120	1400	60	180

B.Sc. Biotechnology (Entire) Programme :

- **Total Marks :** Theory + Practicals = 4100 +1400 =5500
- **Credits :** Theory + Practicals = 120 + 60 = 180
- Numbers of Papers Theory: Ability Enhancement Course(AECC) : 05

  Theory: Discipline Specific Elective Paper (DSE) : 02

  Theory: Core Course (CC) : 34

  Total : Theory Papers :41

  Practical: Core Course (CC) : 14

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- **Title of the Course:** B.Sc. Part-I

- **Subject:** Biotechnology

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

- **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 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.

- **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 & aboard.

- **Eligibility and Admission:** 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. Admission is based on first come first serve basis.

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

- **Medium of Instruction:** English

- **Syllabus Structure:**
  - The University follows semester system.
  - An academic year shall consist of two semesters.
  - Each B.Sc. course shall consist of three years i.e. six semesters.
  - B.Sc. Part-I Biotechnology shall consist of two semesters: Semester I and Semester II.

    In semester I, there will be four core subjects. Each subject is having two papers of 100 marks for each. Similarly in Semester II there will be four core subjects. Each subject is having two papers of 100 marks for each. English will be as Ability Enhancement Course (AECC) in both semester I and II. English paper carries 100 marks in each semester.

    The scheme of evaluation of performance of candidates shall be based on University assessment as well as College internal assessment as given below. For B.Sc. Part-I Biotechnology sem I & II the internal assessment will be based on Internal tests, Home assignment, Viva, Seminar, Group discussion etc. as given below. Practical course examination of 100 marks for each course shall be conducted at the end of IInd semester. The practical examination of 100 marks shall also consist of 70 marks for University practical assessment and 30 marks for college internal assessment.

    For University practical examination out of two examiners, one examiner will be internal and another examiner will be External. Both examiners will be appointed by the University. The internal practical assessment shall be done as per scheme given below.

- **Scheme of Evaluation**

  As per the norms of the grading system of evaluation, out of 100 marks, the candidate has to appear for college internal assessment of 30 marks and external evaluation (University assessment) of 70 marks. The respective B.O.S. may decide the nature of college internal assessment after referring to scheme given below or may be used as it is.

  Semester – I

  Theory: (100 marks)

  University Examination (70 marks): No. of theory papers: 9

Internal Continuous Assessment: (30 marks)

Scheme of marking: 15 marks – Internal test
15 marks – Home assignment / seminars / viva/ industry visit/ group discussion.

Semester – II

Theory: (100 marks)

University Examination (70 marks): No. of theory papers: 9

Internal Continuous Assessment: (30 marks)

Scheme of marking: 15 marks – Internal test
15 marks – Home assignment / seminars / viva/ industry visit/ group discussion.

Practical Examination: (100 marks)

University Examination (70 marks): No. of practical course: 4

Internal Continuous Assessment: (30 marks)

Scheme of marking: 20 marks – Internal test on any two practicals
10 marks – Lab Journal / Viva, attendance, attitude etc.

- **Passing Standard**

  The student has to secure a minimum of 4.0 grade points (Grade C) in each paper. A student who secure less than 4.0 grade point (39% or less marks, Grade FC/FR) will be declared fail in that paper and shall be required to reappear for respective paper. A student who failed in University Examination (theory) and passed in internal assessment of a same paper shall be given FC Grade. Such student will have to reappear for University Examination only. A student who fails in Internal assessment and passed in University examination (theory) shall be given FR Grade. Such student will have to reappear for both University examination as well as internal assessment. In case of Annual pattern/old semester pattern students/candidates from the mark scheme the candidates shall appear for the same 70 marks of external examination and his performance shall be scaled to 100 marks.

- **ATKT**

  Candidate passed in all papers except 5 (five) papers combined together of semester I and II of B.Sc. Part-I Biotechnology examination shall be permitted to enter upon the course of Semester III of B.Sc. Part-II Biotechnology

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Structure for B. Sc. Part-I Biotechnology (Entire)

Subject/ core course	Name and Type of Paper		No. of papers/ Practical	Hrs/Week			Total Marks Per Paper	UA	CA	Credits
	Type	Name		L	P	T				
Class: →	**B.Sc.-I Semester-I Theory**									
	Ability Enhancement Course (AECC)	English paper I (communication skill)		4.0	--	--	100	70	30	4.0
	Core	**BT 101:** Ecology and Microbiology	Paper I: Ecology	2.5	--	--	100	70	30	2.5
			Paper II: Microbiology	2.5	--	--	100	70	30	2.5
	Core	**BT 102:** Introduction to Biosciences	Paper I: Animal Sciences	2.5	--	--	100	70	30	2.5
			Paper II: Plant Sciences	2.5	--	--	100	70	30	2.5
	Core	**BT 103:** Fundamentals of chemistry and Biophysics	Paper I: Chemical Sciences	2.5	--	--	100	70	30	2.5
			Paper II: Biophysics	2.5	--	--	100	70	30	2.5
	Core	**BT 104:** Cell Biology and Biostatistics	Paper I: Cell Biology	2.5	--	--	100	70	30	2.5
			Paper II: Biostatistics	2.5	--	--	100	70	30	2.5
Total (Theory)				**24**	**--**	**--**	**900**	**630**	**270**	**24**

Subject/ core course	Name and Type of Paper		No. of papers/ Practical	Hrs/Week			Total Marks Per Paper	UA	CA	Credits
	Type	Name		L	P	T				
Class: →	**B.Sc.-I Semester-II Theory**									
	Ability Enhancement Course (AECC)	English paper II (communication skill)		4.0	--	--	100	70	30	4.0
	Core	**BT 105:** Environmental pollution and Environmental pollution Techniques	Paper I: Environmental pollution	2.5	--	--	100	70	30	2.5
			Paper II: Microbial techniques	2.5	--	--	100	70	30	2.5
	Core	**BT 106:** Taxonomy and Tissue Culture	Paper I: Taxonomy	2.5	--	--	100	70	30	2.5
			Paper II: Tissue Culture	2.5	--	--	100	70	30	2.5
	Core	**BT 107:** Biochemistry and Cell Physiology	Paper I: Biochemistry	2.5	--	--	100	70	30	2.5
			Paper II: Cell Physiology	2.5	--	--	100	70	30	2.5
	Core	**BT 108:** Biometry and Computer Science	Paper I: Biometry	2.5	--	--	100	70	30	2.5
			Paper II: Computer Science	2.5	--	--	100	70	30	2.5
Total (Theory)				**24**	**--**	**--**	**900**	**630**	**270**	**24**
Practical Syllabus										
	Core	Laboratory Course I	Based on BT 101 and BT 105	--	4	--	100	70	30	4
	Core	Laboratory Course II	Based on BT 102 and BT 106	--	4	--	100	70	30	4
	Core	Laboratory Course III	Based on BT 103 and BT 107	--	4	--	100	70	30	4
	Core	Laboratory Course IV	Based on BT 104 and BT 108	--	4	--	100	70	30	4
Total (Practical)					**16**	**--**	**400**	**280**	**120**	**16**
Grand Total (Semester I + Semester II)				**48**	**16**	**--**	**2200**	**1540**	**660**	**64**

Abbreviations:

L: Lectures; T: Tutorials; P: Practicals; UA: University Assessment; CA: College Assessment

Semester I
(Theory)

BT 101: Ecology and Microbiology
Paper- I: Ecology

37L = 2.5 Credits

Unit I [07L]

Basic Concepts

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

Unit II [12L]

Ecology – Concept of Ecosystem, structure, functions, productivity and decomposition, Ecological succession – types and 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 and management.

Unit III. Biodiversity & Conservation [12L]

Biodiversity – Importance, uses, types, bio-geographical regions of India, biodiversity in World and India, Hot spots, endangered & threatened species. **Conservation** Nature conservation – Threats to biodiversity, conservation methods – *In situ* and *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 – [06L]

Nitrogen, Carbon, Phosphorus, Sulphur, Water, Oxygen.

Reference:-

1. Ecology & Environment: Sharma P.D.
2. Environmental Science: Santra S.C.
3. Modern Concepts Ecology: Kumar H.D.
4. Environmental Chemistry: De A.K.
5. Environmental Biology: Verma P.S.& Agarwal V.K.
6. Environmental Biotechnology: Rana S.V.S.
7. Environmental Biotechnology: Thakur Indu S.
8. Fundamentals of Ecology: Dash M.C.
9. Environment Problems & Solutions : Asthana D.K. & Asthana Meera.
10. Handbook of Methods in Environmental Studies (Vol 1&2) : Maiti S.K.
11. Fundamentals of Ecotoxicology: Michael C. Newman.

BT 101: Ecology and Microbiology
Paper II: Microbiology

38L = 2.5 Credits

Unit I: History and Scope of Microbiology: [10 L]
History of Microbiology: Introduction, Controversy over abiogenesis / Spontaneous generation conflict. **Important contributions of** Antony Van Leeuwenhoek, Louis Pasture, Edward Jenner, Robert Koch, Alexander Fleming, Robert Hook, John Tyndall, Watson & Crick, Joseph Lister, D.Ivanovsky Winogradsky, Martinus Beijerink. **Introduction to applied branches in microbiology**: air, aquatic, sewage, soil, food, milk, medical, industrial, pollution, agriculture, genetic engineering, geomicrobiology, Gnotobiology.

Unit – II: Introduction to types of various Microorganisms: [10L]
Types of microorganisms: bacteria, algae, fungi, protozoa, viruses, Distribution of microorganisms in nature and their beneficial and Harmful activities. **General characteristics, classification and cultivation of:** Fungi**,** viruses, algae

Unit -III: Cell structure [10L]
Cell structure: 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, Mesosomes, Ribosomes, structure and function of endospore.

Unit –IV: General Characteristics of various Microorganisms: [08L]
Archaebacteria. Actinomycets. Rickettsia Mycoplasma, Chlamydia

References

1. Pelczar MJ Jr., Chan ECS and Kreig NR. Microbiology, 5th Edition, Tata McGraw Hill, 1993.
2. Stanier R.Y., Adelberg E.A. and Ingraham J.L. General Microbiology Fifth edition
3. Salle A.G. Fundamental principles of Microbiology,7th edition
4. Powar C.B. and Daginawala, General Microbiology, Second edition
5. Atlas R. M., Principles of Microbiology, Mosby Year Book, Inc., Missouri.,1995
6. Frobisher, Fundamentals of Microbiology,9th edition

BT 102: Introduction to Biosciences
Paper-I Animal Science

38L = 2.5 Credits

Unit I Animal Tissues and Histology 10L

1.1 Review of following tissues with reference to origin, location and functions i) Epithelial ii) Connective iii) Muscular iv) Nervous

1.2 Histology of following mammalian organs: i) Tooth ii) Salivary gland iii) Oesophagus iv) Stomach v) Ileum vi) Rectum vii) Liver viii) Pancreas ix) Kidney x) Spinal cord xi) Testis xii) Ovary xiii) Uterus xiv) Pituitary gland

Unit II Ethology 06L

a) Mimicry –Butterfly, Camouflage – Chameleon b) Courtship behavior in birds, c) Social behavior in Honey bees: Casts, swarming, absconding, Nauptial flight and communication.

UNIT III Host Parasite Relationship 10L

3.1. Features of parasite and host interaction
3.2. Protozoan parasites: Plasmodium, Entamoeba
3.3. Nematode parasites: Ascaris, Schistosoma
3.4. Platyhelminthes parasites: Taenia, Fasciola

UNIT IV Economic Zoology 12L

4.1 Beneficial and harmful organisms (Chordates)
4.2 Vermiculture: Types of Earthworms, Preparation of Vermicompost bed, Vermiwash, Economic importance
4..3 Aquaculture: Food value of fishes, Fresh water Fish farming- Construction and Maintenance, Maintenance of glass aquarium and ornamental fishes
4.4 Sericulture: Types of Silk moth, Morphology of mulberry silk moth, Life cycle, rearing of silkworm, Economic importance
4.5 Apiculture: Types and caste, Honey comb, Bee keeping, Economic importance

References:

1) Fish Culture – K.H. Alikuhni
2) Fish Culture – Lagler
3) Hand Book of Animal Husbandary and Dairy –Mudlyer
4) Bee keeping in India – Sardar Sing
5) Bee Keeping in India – M.G. Smith
6) Poultry keeping in India – Naidu P.N.M.
7) Poultry Husbandry – M.A. Jule
8) Introduction to sericulture – Ganga and Shetty
9) Histology – Ham A.W.
10) Baileys's T.B. of Histology – Williams and Williams
11) An Atlas of Histology – Heineman Educational Book Ltd.London
12) Microscopic anatomy of vertebrates –Lea and Febigen, Philadelphia
13) Histology of Mammals – Atavale M.V. and Latey A.N.
14) Hyman, L. H. – The invertebrates, Vol. I (McGraw Hill)
15) Hyman L.H. – The invertebrates, Vo. II (McGraw Hill)
16) Barnes R. D. – Invertebrate Zoology (W.B. Saunders Co.)
17) Pearse / Buchschaum – Living invertebrates, Blackwell Scientific Publications, California

18) Parker and Haswell – A Text Book of Zoology – Invertebrates Vol. I Edited by Marshall and Williams, C.B.S. Publishers and Distributors, New Delhi.
19) P. S. Dhami and J.K. Dhami – Invertebrates, S. Chand and Company. New Delhi
20) Textbook of Invertebrates by R. L. Kotpal
21) Textbook of Vertebrates by R. L. Kotpal
22) A Text Book of Invertebrates – N. C. Nair, N. Soundara Pandian, S. Leelavathy, T. Murugan
23) R. L. Kotpal – Modern Text Book of Zoology, Invertebrates

BT 102 Introduction to Biosciences
Paper-II Plant Science

37L = 2.5 Credits

UNIT I Plant Diversity 08L

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: Meristems and Permanent tissues 10L

1.1 Introduction and Classification of Meristems
1.2 Functions of Meristems
1.3 Theories of structural development – a) The Apical cell theory b) Histogen Theory c) Tunica corpus theory
1.4 Structure and functions of Simple tissues.
1.5 Structure and function of Complex tissues
1.6 Types of vascular bundles.

UNIT III Organization of Plant Body 10L

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

UNIT IV Dicot and Monocot, Plants as Food 09L

4.1 Internal Organization of Dicot and Monocot (stem and roots)
4.1.1 Primary structure, normal secondary growth and annual rings
4.1.2 Periderm formation.
4.2 Plant as Food
4.2.1 The range of food crops
4.2.2 Origin of staple crops
4.2.3 Other food crops
4.2.4 Plants for alcohol, flavor

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
6. Kumar H.D. Biodiversity and sustainable development (Oxford & IBH)
7. Mukherji H. Plant groups (New central book depot)
8. Parihar N.S. An introduction to embryophyta (Central Book Depot)
9. Vasishtha P.C. Botany for degree students-Gymnosperms
10. Naik V.N. Taxonomy of Angiosperms
11. Lawrence G.H. Taxonomy of flowering plants
12. Chopra G.L. Angiosperms (Systematic and life cycle)

13. Shivarajan V.V. Introduction to principles of Taxonomy
14. Pandey B.P. Text book of Angiosperms
15. Eames A.J. and Mac Daniels L.H. An introduction of Plant Anatomy
16. Esau K. Anatomy of seed plants
17. Esau K. Plant Anatomy
18. P.C. Vashista. Plant Anatomy. Pradip Publications, Opposite Sitla mandir, Jalandhar-144008.
19. B.P.Pandey ,Plant Anatomy. S.Chand & Company,LTD. Ram Nagar, New Delhi.110055.
20. Plant Biology, The Instant Notes series, B.D. Hames, *School of Biochemistry and Molecular Biology, University of Leeds, Leeds, UK*

BT 103: Fundamentals of Chemistry and Biophysics
Paper I – Chemical Science

37L = 2.5 Credits

UNIT I Structure and Bonding [12L]

1.1 Introduction- Definition and formation of ionic and covalent bond with examples, e.g. NaCl, KCl, HCl, CH_4, Cl_2, H_2.
1.2 VBT- Postulates.
1.3 Concept of Hybridization, sp, sp^2, sp^3 hybridization with respect to C_2H_2, C_2H_4, CH_4 (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 Types of bonds in biomolecule [Covalent (glycoside, peptide, phosphodiester), ionic, hydrogen, Van der Waals, hydrophobic, co-ordinate)] their formation and interaction.
1.6 Ionic solids- Definition and general characteristics, comparison between, ionic and Covalent compounds.

UNIT II Solutions [10L]

2.1 Solutions, types of solutions, solvation energy, solubility & factors affecting solubility
2.2 Mole concept: Definition & introduction to molarity, normality, molality, percentage with examples of solution preparation.
2.3 Equivalent & molecular mass, Expression for concentration of solutions.
2.4 classification of solvents, polarity of solvents
2.5 Dilution factor, serial dilution, Solute–solvent interactions in solutions.

UNIT III Chemical equilibrium and reaction kinetics [08L]

3.1 Chemical Equilibrium
3.2 Colligative properties- Definition, osmosis, osmotic pressure and reverse osmosis.
3.3 Common ion effect
3.4 pH and pOH, buffer capacity.
3.5 Acid base titrations, Indicators in titrations, Titration curves
3.6 pH of buffers- Henderson equation for acidic and basic buffers with derivation.

UNIT IV Reaction Kinetics [07L]

4.1 Introduction-Meaning and definitions of- rate constant, order and molecularity of reaction, activation energy.
4.2 Integrated rate expressions for zero,1st and 2nd order reactions.
4.3 Characteristics of 1st order reactions.
4.4 Catalysis- Definition, types of catalysis with example, characteristics of catalysis.
4.5 Elementary enzyme catalyzed reactions- Meaning and examples.

Reference Books:

1. University General Chemistry by C.N. R. Rao, Macmillan
2. Principles of Physical Chemistry, 4th 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 5th Edition
6. Basic Inorganic Chemistry by Cotton and Wilkinson
7. Organic Chemistry, 5th Edition by Marrison Prentice Hall of India Pvt. Ltd. Boyd, New Delhi

8. Guide book to Mechanism in Organic Chemistry by Peper Sykes, 6th Edition, Orient Longman
9. Organic Chemistry by I.L. Finar, Volume-II, 5th 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
Paper – II Biophysics

38L = 2.5 Credits

UNIT I Elasticity: [08L]

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

UNIT II Viscosity: [07L]

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, Construction & working of Venturimeter & Pitots tube.

UNIT III Surface Tension: [08L]

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: [15L]

4.1 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 Properties of ultrasonic waves and their applications
4.1.4 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: Spontaneous emissions, Stimulated emissions, Optical pumping, Laser action, Working of He-Ne laser.
4.2.4 Applications of Laser.

References

1. Physics - David Hallday 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)
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
Paper - I: Cell Biology

38L = 2.5 Credits

UNIT I: Cell structure and Organization: [12L]

Introduction and History of Cell Biology; Introduction to generalized cell: Ultra structure of Animal cell, plant cell, PPLOs, plant cell wall; Ultra structure of cell organelles and their function: plasma membrane , Ribosomes, Centrioles, Endoplasmic reticulum, Golgi complex, Mitochondria, Lysosomes, Plasmids Nucleus; Cytoskeleton and cell motility: Micro tubules, Microfilament, Intermediate filament.

UNIT II: Cell Biology: [12L]

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: Chromosomes number, Size, Types, Chromosomal morphology, Topography, Fine structure and models, Heterochromatin, Euchromatin, Giant chromosomes; Genetic code properties: Wobble hypothesis.

UNIT III: Cell Membranes and permeability: [07L]

Molecular models of cell membrane, Cell permeability, Differentiation of cell membrane, Intercellular communication and gap junctions, cell coat and cell recognition, cell surface and cancer cells.

UNIT IV: Cell Metabolism: [07L]

Protein trafficking, Membrane transport, Cell signalling.

References:

1. Molecular biology of the cell - Albert & Johnson
2. Molecular Cell Biology – Lodish 5th Ed
3. Cell Biology – C. B. Pawar
4. Biochemistry by Stryer 7th Ed
5. Lehninger Principles Biochemistry 5th Ed
6. Biology - Science for Life: Colleen Belk

BT 104: Cell Biology and Biostatistics
Paper - II: Biostatistics

37 L = 2.5 Credits

UNIT I: Statistics: [07L]
Importance and application, Tabulation and classification of Data, Frequency distribution, Diagrammatic and Graphical representation of data (problems).

UNIT II: Measures of central tendencies: [10L]
Measures of central tendencies (with problems): Mean median and mode, their properties.

UNIT III: Measures of dispersion: [08L]
Measures of dispersion – Range, mean deviation, Variance, Standard deviation, Coefficient of variation, Correlation and linear regression.

UNIT IV : Probability: [12L]
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 z tests , run tests, significant test, median test, One way analysis of variance.

References:

1. Fundamentals of Biostatistics: Khan and Khanum; Ukaaz Publication.
2. Statistical Methods in Biology: Baily, N.T.J; English University Press
3. Statistics in Biology: Bliss C. I; MacGrraw Hill, New York
4. Statistic for Biologists: 2nd Edition; Campbell R.C.; University Press, Cambridge
5. Statistical Methods: Gupta S. P.; Sultan Chand and Sons, New Delhi

Semester II
(Theory)

BT 105: Environmental Pollution and Microbial Techniques
Paper- I: Environmental Pollution

37L = 2.5 Credits

Unit – I Air and Noise pollution: [12L]
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. **Noise Pollution** – Introduction to sound and noise, sources of noise, measurement of noise, adverse effect of noise pollution.

Unit – II Water and Soil pollution: [06L]
Water Pollution – 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: [07L]
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 Resources: [12L]
Energy requirements of modern society, conventional energy sources, energy crisis. Non conventional energy sources – Solar, wind, 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.

Reference:-

1. Ecology & Environment: Sharma P.D.
2. Environmental Science: Santra S.C.
3. Modern Concepts Ecology: Kumar H.D.
4. Environmental Chemistry: De A.K.
5. Environmental Biology: Verma P.S.& Agarwal V.K.
6. Environmental Biotechnology: Rana S.V.S.
7. Environmental Biotechnology: Thakur Indu S.
8. Fundamentals of Ecology: Dash M.C.
9. Environment Problems & Solutions : Asthana D.K. & Asthana Meera.
10. Handbook of Methods in Environmental Studies (Vol 1&2) : Maiti S.K.
11. Fundamentals of Ecotoxicology : Michael C. Newman.

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

38L = 2.5 Credits

Unit I: Microbial growth [13L]

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. 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. Continuous culture, Synchronous growth, Diauxic growth.

Unit II: Pure culture techniques [13L]

Media for cultivation of micro-organisms: natural, synthetic, semi-synthetic, differential enriched, enrichment, selective media with one example each. Living media: Embryonated Egg, Animal Tissue Culture, and Animals. **Pure culture technique**: Methods for isolating pure cultures – i) streak plate method, ii) pour plate method, iii) spread plate method. **Anaerobic Culture methods**: i) Gas Pack, ii) Use of Reducing agents. **Maintenance of pure culture**: Freezing, Lyophilization, Soil stock, Paraffin method.

Unit III: Staining Techniques [06L]

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 [06L]

Definition of Sterilization, Disinfectant, Antiseptic, Germicide, Antimicrobial agents. Methods of Sterilization and Disinfection.

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, Adelison Wesley Longman. Inc. New York, 1997.
3. Crueger and A Crueger, (English Ed., TDW Brock); Biotechnology: A textbook of Industrial Microbiology, Sinaeur 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, 11th Edition, Pearson Prentice Hall, USA, 2006
6. Atlas R. M., Principles of Microbiology, Mos by Year Book, Inc., Missouri.,1995
7. General Microbiology by Powar C. B. and H. F. Daginawala

BT 106: Taxonomy and Tissue culture
Paper I: Taxonomy

37L = 2.5 Credits

Unit I Systems of Classification: [7L]
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: [10L]
Silent features and classification upto classes (with one example): Protozoa, Porifera, Coelenterata, Platyhelminthes, Annelida, Arthrophoda, Mollusca, Echinodermata, Hemichordata, Urochordata, Cephalochordata, Agnatha), General and Distinguishing characters of class (with one example): Pisces, Amphibia, Reptilia, Aves, Mammals

Unit III Plant Taxonomy [10L]
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),

Unit IV Microbial Taxonomy [10L]
Criteria for bacterial classification – Morphological, Cultural and Biochemical Characters, Introduction to Phenetic, Phylogenetic, Conventional and Numerical Taxonomy. General characters, Economic Importance and outline classification (Ainsworth 1973) of Fungi.

Reference Books

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

BT 106: Taxonomy and Tissue culture
Paper – II: Introduction to Tissue Culture

38L = 2.5 Credits

Unit I: Basics of plant tissue culture [10L]

- 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.
- Initiation and maintenance of callus and suspension culture, Cytodifferentiation
- Organogenesis: Principles, Concept and Applications of Somatic embryogenesis.

Unit II: Introduction to cell culture [09L]

- 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 [09L]

- 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 lab0: Inverted microscope,CO_2 Incubator, LAF, Micropipettes .

Unit IV: Introduction to Animal tissue culture [10L]

- 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, Trypsinizaion.
- 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 107: Biochemistry and Cell Physiology
Paper-I Biochemistry

38L = 2.5 Credits

Unit I Carbohydrates: [11L]

Definition, classification, structures & role of -

A) Monosaccharides- aldoses & ketoses
   i) Trioses-glyceraldehyde & dihydroxy acetone;
   ii) Tetroses-erythrose, erythrulose
   iii) Pentoses-ribose, ribulose, xylose, xylulose;
   iv) Hexoses-glucose, mannose, galactose, fructose.
   Reactions of monosaccharides, reducing properties (Fehling test) oxidation, reduction, osazone formation. Isomeric structures, mutarotation.

B) Derived monosaccharides- Deoxy sugars (β D- deoxy ribose), sugar acid (L- ascorbic acid), amino sugars (β D glucosamine, β D galactosamine, N-acetyl glucosamine)

C) Oligosaccharides: glycoside bond, maltose, isomaltose, lactone, sucrose, cellobiose, their hydrolysis.

D) Polysaccharides- starch, glycogen, cellulose, chitin, peptidoglycan.

Unit II Amino acids and Proteins: [11L]

A) Amino acids- meaning, definition, structure & classification of amino acids. Zwitterions, pI, ninhydrin reaction, titration curve of glycine and histidine.

B) Proteins-Formation of peptide bond, definition of proteins.
   a) Simple proteins (albumin & globulin)
   b) Complex proteins
   c) Derived proteins

   Structural levels of proteins-
   a) Primary structure (insulin, oxitocin)
   b) Secondary structure (α helix & β pleated, e.g. Collagen)
   c) Tertiary structure (myoglobin)
   d) Quaternary structure (haemoglobin)

   Forces involved in stabilizing native structure of protein.

Unit III Lipids: [05L]

Definition & classification with two examples of each class. Structure & functions of-
   a) Simple lipids- Fatty acids & triglycerides.
   b) Compound lipids- phospholipids, spingolipids, glycolipids
   c) Derived lipids- steroids (cholesterol), terpenes, carotenes.

Lipid bilayer- Fluid mosaic model of plasma membrane.

Unit IV Nucleic acid & Vitamins [11L]

A) Nucleic acids: Meaning, distinction between DNA & RNA. Components of nucleic acids-nitrogenous bases, sugars, phosphoric acid, nucleosides & nucleotides phosphodiester linkage, representation of primary structure of polynucleotide. Watson-Crick model of DNA. Structure and function of t-RNA, m-RNA and r-RNA.

B) Vitamins: Definition, differences between fat soluble & water soluble vitamins. Source, requirement, biochemical role & deficiency disorders of vitamins- retinol, thiamine, niacin, riboflavin, pyridoxine & pantothenic acid, their coenzyme forms.

References:

1. Outlines of Biochemistry- Cohn & Stumpf
2. Biochemistry – O. P. Agarwal
3. Text Book of Biochemistry & Human Physiology- G.P. Talwar
4. Harper's Review of Biochemistry- H.A. Harper (Ed)
5. Principals of Biochemistry- Lehninger
6. Biochemistry – S. C. Rastogi
7. Text Book of Biochemistry- A.V.S.S. Ramarao
8. Biochemistry – U. Satyanarayan
9. Cell & Molecular Biology- P.K. Gupta
10. Elements of Biochemistry- P.K. Gupta
11. Fundamental of Biochemistry- J.L. Jain
12. Elementary Biochemistry- J.L. Jain

BT 107: Biochemistry and Cell Physiology
Paper-II Cell Physiology

37L = 2.5 Credits

Unit I [07L]

Transport in Plants: 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 [11L]

Plant Hormones: Structure and physiological role of Auxin, Cytokinin, Gibbrellic acid, Abscisic acid, Ethylene, Brassinoids, Jasmonic acids, Peptide hormones.

Plant Growth and Development: Seed dormancy (Types, Phases, Factors causing, Methods of breaking of seed dormancy), Seed viability, Seed germination (Types, conditions necessary). Growth and its characteristics, Photoperiodism (SDP, LDP, DNP, Critical Day length, phytochrome, florigen), Vernalisation.

Unit III [08L]

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. **Locomotion and Movement:** Types of Movement, Muscle Skeletal System, Joints.

Unit IV [11L]

Excretory Products and their Elimination: Human Excretory System, Nephron and its function, Micturition, Role of other Organs in Excretion. **Neural Control and Coordination:** Human Neural System, Neuron, Central Neural System, Reflex Action, and Reflex Arc, Sensory Reception and Processing. **Chemical Coordination and Integration:** Endocrine Glands and Hormones with their physiological role.

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

BT 108: Biometry and Computer Science
Paper I – Biometry

37 L = 2.5 Credits

Unit I: Introduction to basic mathematical concepts [09L]

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-Moiver's theorem, finding roots of polynomial equation.

Unit II: Set theory. [09L]

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 [10L]

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 i.e. (including integrating factor). Linear differential equation. Applications to growth and decay, Law of cooling

Unit IV: Matrices: [09L]

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 108: Biometry and Computer Science
Paper II: Computer Science

38L = 2.5 Credits

Unit I [13L]

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 [06L]

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 [06L]

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 [13L]

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, Coordinating 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

Semester I & II
(Practical)

B.Sc. Part-I Biotechnology (Entire)
(Practical Syllabus)

Laboratory Course – I: (Based on BT 101 and BT 105) **4 Credits**

1) Precaution to work in microbiology laboratory.
2) Use & care of Compound microscope.
3) Demonstration of –
   a) Cleaning of Glassware
   b) Sterilization of Glassware (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), Flagella staining (Loeffler's).
7) Study of microbial growth curve.
8) Study of air micro-flora.
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.

Laboratory Course – II: (Based on BT 102 and BT 106) **4 Credits**

1. Study of Morphological characters of algae, fungi
2. Study of Morphological characters of bryophytes, pteridophytes
3. Study of Morphological characters of gymnosperms, angiosperms
4. Study of Morphological characters of dicotyledones, monocotyledones
5. Study of different parts of plants –Qualitative histochemistry of root, stem and leaf of monocotyledon and dicotyledon.
6. Study of the shoot apex, and dissection of shoot apical meristem.
7. Study of plant cell types using squash techniques and maceration.
8. Study of paramecium, Hydra.
9. Study of collection, preservation & presentation of insects.
10. Study of different types of eggs, larvae & pupae of insects.
11. Study of worker bee, honey combe, honey.

12 Study of silk moth life cycle (model/chart) silk cocoon, Silk product.

13. Study of Morphological characters of Chordate.
14. Isolation and study of morphological and Biochemical characters of Bacteria from Soil.
15. Sterilization and preparation of plant and animal culture media.
16. Micropropagation by proliferation of axillary bud.
17. Subculture of callus and organogenesis of explants
18. Isolation of Bovine serum albumin.
19. Maintenance and establishment of callus culture and suspension culture.
20. Isolation of protoplast.

Laboratory Course – III: (Based on BT 103 and BT 107) **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. Preparation of Molarity, normality and percentage solutions.
7. Determination of conductivity of solution.
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. Determination of bleeding time (BT) and clotting time (CT).
13. Estimation of Proteins by Biuret method.
14. Estimation of Carbohydrate (reducing sugar).
15. Qualitative analysis of Carbohydrates.
16. Qualitative analysis of Amino acids.
17. Qualitative analysis of Lipids.

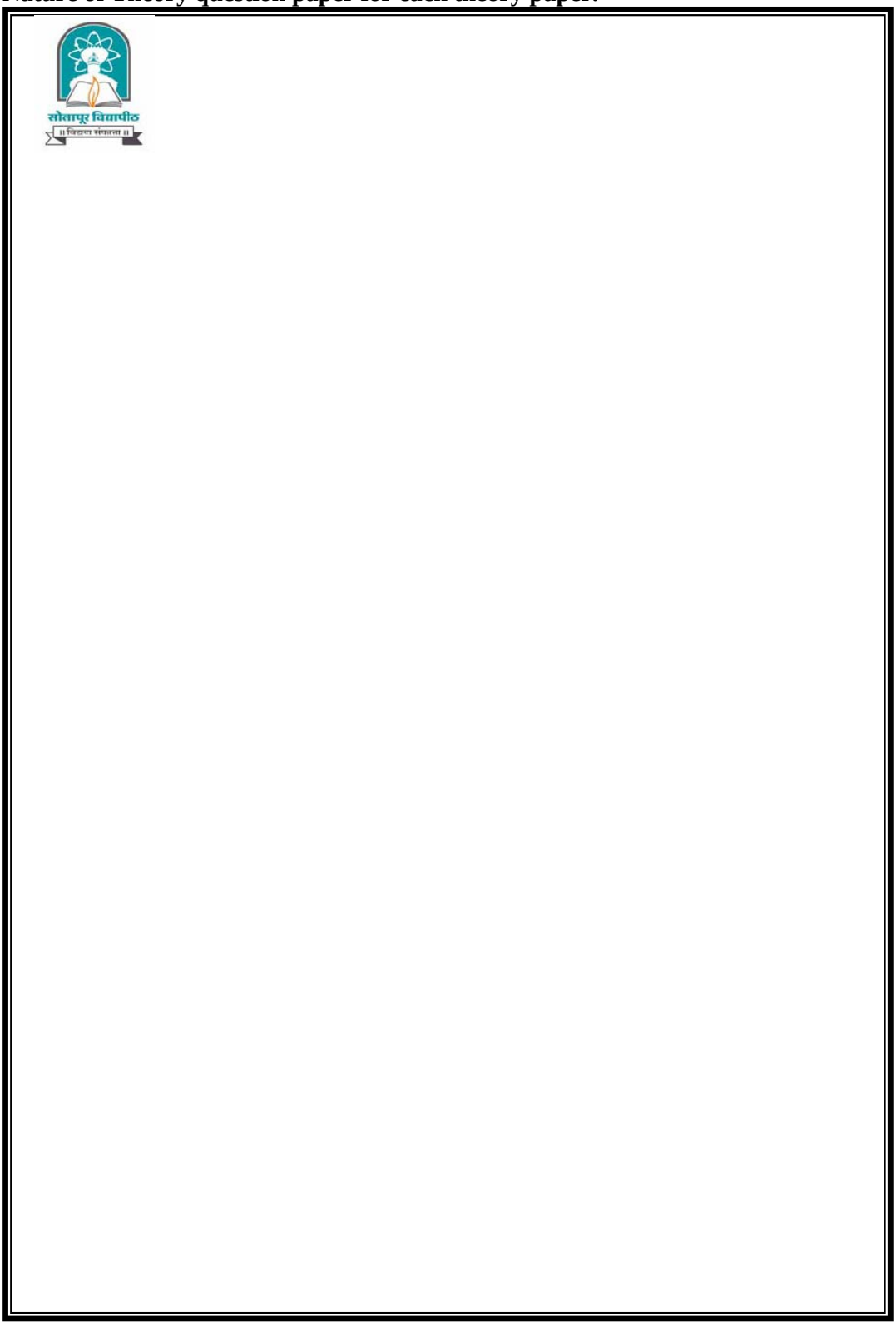
Laboratory Course – IV: (Based on BT 104 and BT 108) **4 Credits**

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. Study of different morphology of nucleus.
6. Study of different morphology of cell structure (animal, plants, microorganisms).
7. Determination of cell size by Micrometry.
8. Graphical representation of data (on MS-Excel):
   a) Histogram
   b) Ogive Curve
   c) Pie chart
9. Diagrammatic representation of data (on Excel)
   a) Simple bar diagram
   b) Multiple bar diagram
   c) Sub-divided and percentage bar diagram
10. Measures of central Tendency (on MS-Excel): To calculate mean, mode and median
11. Problems based on derivatives.
12. Problems based on integration.
13. Measures of dispersion (by calculation): To calculate mean deviation, standard deviation, and variance.
14. Preparing letter for purchase order on college letter head and take print out.
15. Preparing presentation with PowerPoint- on bio-technology subject.
16. Creating email Id and sending email.

Examination Pattern (UA - University assessment)

The examination for theory (70 marks) is conducted semester wise by university as per University Time Table.

Nature of Theory question paper for each theory paper.



The examination for Practical (70 marks) is conducted annually at the end of second term of academic year by university as per University Time Table.

a) The practical examination will be conducted for one day for each laboratory course with 6 hours on each day of the practical examination.
b) Each candidate must produce a certificate from the head of the department in his/her college stating that he/she has completed in a satisfactory manner the practical course on the guidelines laid down from time to time by Academic council on the recommendation of Board of studies and has been recorded in his/her observation in the laboratory journal and written a report on each exercise performed. Every journal is to be checked and signed periodically by a member teaching staff and certified by the Head of the department at the end of the year. It is mandatory that candidate have to produce their journal at the time of practical examination.

Nature of Practical question paper for each practical course.