

BOTB3102T: PLANT GROWTH, DEVELOPMENT AND BIOTECHNOLOGY

Max. Marks: 50 marks

Pass Marks: 35% in Theory and Practical Separately

Theory Paper: 35 marks

Internal Assessment: 15 marks

Total Teaching hours: 45

Time Allowed: 3 Hours

Objective of the paper is to impart knowledge to students about the different technologies in biology of plants to understand its growth, growth kinetics and effect of light on germination and growth of seed and seedling under different environments.

INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective section of syllabus and will carry 6 marks each. Section C will consist of 11 short-answer type questions (4-5 lines) of 1 mark each which will cover the entire syllabus uniformly and will carry 11 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

SECTION-A

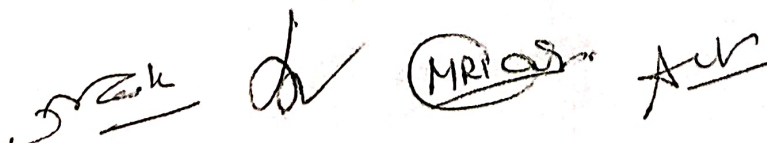
1. Growth, phases of growth, growth kinetics; plant hormones: discovery, bioassay, physiological effects and application of auxins, gibberellins, cytokinin, abscisic acid and ethylene.
2. Photomorphogenesis, discovery, structure, physiological role and mechanism of action of phytochrome and cryptochrome.
3. Photoperiodism, vernalization, biological clocks, physiology of senescence and abscission.
4. Physiology of seed dormancy and seed germination; plant movements.

SECTION-B

5. Tools and techniques of recombinant DNA technology with special reference to restriction enzymes, gel electrophoresis, Southern blotting, cloning vectors and PCR. Genomic and cDNA library.
6. Methods of G transfer in plants: physical, chemical and biological methods.
7. Basic concept of plant tissue, culture, totipotency, micropropagation, anther culture, embryo culture, synthetic seeds and somatic hybridization.
8. Plant Biotechnology and its application in human welfare with particular reference to industry, agriculture and molecular farming.

RECOMMENDED READINGS

1. Bhojwani, S.S. 1990. *Plant Tissue Culture: Applications and Limitations*, Elsevier

The bottom of the page features several handwritten signatures and initials. From left to right, there is a signature that appears to be 'S. Bhojwani', followed by a stylized 'd', a circular stamp containing the text 'MR. Bhojwani', and another signature that looks like 'A. Bhojwani'.

Punjabi University, Patiala, B.Sc. Part-III (Semester V & VI) Subject Botany
(Session 2025-2026)

B.Sc. (Botany) Part-III (SEMESTER-V)

BOTB3101T: PLANT PHYSIOLOGY

Max. Marks: 50 marks

Total Teaching hours: 45

Pass Marks: 35% in Theory and Practical Separately

Time Allowed: 3 Hours

Theory Paper: 35 marks

Internal Assessment: 15 marks

Objective of the paper is to impart knowledge to students about the functional aspects of plant metabolism in relation to its dynamic environment.

INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective section of syllabus and will carry 6 marks each. Section C will consist of 11 short-answer type questions (4-5 lines) of 1 mark each which will cover the entire syllabus uniformly and will carry 11 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

SECTION-A

1. Plant-water relations: Importance of water to plant life; diffusion and osmosis; absorption, transport of water and transpiration; mechanism of stomatal opening and closing.
2. Mineral nutrition: Essential macro- and micro- elements and their role; mineral uptake; deficiency and toxicity symptoms.
3. Transport of organic substances: Mechanism of phloem transport; source-sink relationship; factors affecting translocation.
4. Basics of enzymology: Discovery and nomenclature; characteristics of enzymes; concepts of holoenzyme, apoenzyme, coenzyme and cofactors; regulation of enzyme activity; mechanism of action.

SECTION-B

5. Photosynthesis: Significance; historical aspects; photosynthetic pigments; action spectra and enhancement effect; concept of two photosystems; Z-scheme; photophosphorylation; Calvin cycle; C₄ pathway; CAM plants; photorespiration.
6. Respiration: ATP- the biological energy currency; aerobic and anaerobic respiration; Krebs's cycle; electron transport mechanism (Chemi-osmotic theory) redox potential; oxidative phosphorylation; pentose phosphate pathway.
7. Nitrogen Fixation: Symbiotic and Asymbiotic, Nitrogen fixation, Mechanism of Nitrogen fixation; mechanism of nodule formation, Assimilation of fixed Nitrogen.
8. Lipid: Synthesis of fatty acids; structure and function of lipids; β -oxidation.

RECOMMENDED READINGS

1. Dennis, D.T., Turpin, D.H., Lefevre, D.D. and Layzell, D.B. (eds.) 1997, *Plant Metabolism* (2nd Edition). Longman, Essex, England.
2. Galston, A.W. 1989. *Life Processes in Plants*. Scientific American Library, Springer, Verlag, New York, USA.
3. Heldt, H.2003. *Plant Biochemistry*, Academic Press, Indian Edition, Reed Elsevier India Pvt. Ltd., New Delhi.



- 2) Weightage of different components in Internal Assessment is as: Attendance – 20%, Assignment- 40% and Internal Examination – 40% (So for each paper it is 15 marks i.e. Attendance: 3 + Assignment: 6 + Internal Examination 6)

SEMESTER-V
MOLECULAR BIOLOGY (ZOOB3101T)

Max. Marks: 50

Pass marks: 35%

Theory-35

Internal Assessment : 15

Time Allowed: 3 hours

INSTRUCTIONS FOR PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and will carry 6 marks each. Section C will consist of 11 short-answer type questions which will cover the entire syllabus uniformly and will carry 11 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

Section-A

1. The nature of genetic material: DNA Structure, Watson and Crick-model, Polymorphism of DNA Helix.
2. Replication of DNA: Enzymes and mechanism involved in DNA replication (prokaryotes and eukaryotes). DNA damage and repair.
3. Transcription: Mechanism of Transcription in Prokaryotes and Eukaryotes.
4. RNA Processing: Concept of introns and exons, spliceosome machinery and splicing pathways.

Section-B

5. Translation (Prokaryotes and Eukaryotes): Various steps and mechanism involved in protein synthesis.
6. Transcription Regulation: Principles of transcriptional regulation in prokaryotes with examples from *lac* and *trp* operons. Transcription Regulation in Eukaryotes.
7. Recombinant DNA technology: Introduction to the concept of Recombinant DNA Technology: Enzymes involved, vectors, transformation techniques (microbial), Construction and screening of DNA libraries.
8. Application of recombinant DNA technology: Application in medicine: vaccines, detection of genetic diseases (Sickle cell anemia), gene therapy.



DEVELOPMENTAL BIOLOGY (ZOOB3102T)

PAPER-X

Max. Marks: 50

Pass marks: 35%

Theory-35

Internal Assessment: 15

Time Allowed: 3 hours

INSTRUCTIONS FOR PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and will carry 6 marks each. Section C will consist of 11 short-answer type questions which will cover the entire syllabus uniformly and will carry 11 marks in all.



INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

SECTION-A

1. Introduction: Historical perspective and basic concepts: Phases of development, Cell-Cell interaction, Pattern formation, Differentiation and growth, Differential gene expression, Cytoplasmic determinants and asymmetric cell division Implications of Developmental Biology: Teratogenesis: Teratogenic agents and their effects on embryonic development.

2. Early Embryonic Development: Gametogenesis: Spermatogenesis, structure of sperm, variations in sperm structure, significance of spermatogenesis. Oogenesis, structure and functions of egg, Vitellogenesis, functions of yolk, Types of eggs, Egg membranes; Fertilization: mechanism and significance of fertilization, Monospermy and polyspermy,



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Blocks to polyspermy; Planes and patterns of cleavage; Morula and morulation, Blastula and blastulation, Types of Blastula.

3. Late Embryonic Development: Development of frog and chick upto gastrulation; Morphogenetic movements: Types and examples. Organizer: Spemann-Mangold organiser experiment; concept of induction, determination, and differentiation, Fate of Germ Layers

SECTION-B

4. Extra-embryonic membranes; Implantation of embryo in humans, Placenta (Structure, physiology, types and functions of placenta)

5. Post Embryonic Development: Metamorphosis: Changes, hormonal regulations in amphibians and insects; Regeneration: Modes of regeneration, epimorphosis, morphallaxis and compensatory regeneration (with one example each); Ageing: Concepts and Theories.

6. Control of Development: Fundamental processes in development (brief idea) – Gene activation, determination, induction, Differentiation, morphogenesis, intercellular communication, cell movements and cell death

SUGGESTED READINGS

1. Gilbert, S.F. and Barresi, M. J.F. (2016.) Developmental Biology. 11th Edition. ISBN No.-9781605354705.
2. Balinsky, B. I. (2012). An Introduction to Embryology. 5th Edition. ISBN No.-9788131517499.
3. Carlson, B.M. (2014). Patten's Foundations of Embryology. (2014) 6th Edition. ISBN No.-9780072871708.
4. Kalthoff, K. O. (2000). Analysis of Biological Developmental. 2nd Edition. ISBN No.-9780070920378.
5. Wolpert, L. (2015). Principles of Development. 5th Edition. ISBN No.-9780198709886.

Medical

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**B.Sc. Part-III (Semester-5th)
Organic Chemistry-III (Paper Code: CHEB3502T)**

Max Marks: 50 marks

End Semester Exam: 35 marks

Internal Assessments: 15 marks

Pass Marks: 35%

40 Hrs; Credits: 02

Time allowed: 3Hrs

3 hours/week

INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections, namely, Section A, B and C. Section A and B will have four questions from the respective section of syllabus. Each question will carry 6 marks and may be segregated into sub-parts. Section C will be compulsory with 11 short-answer type questions of 1 mark each covering the entire syllabus.

INSTRUCTIONS FOR STUDENTS

Students are required to attempt five questions selecting two questions from each of Section A & B while Section-C is Compulsory.

Section-A

Polynuclear Hydrocarbons:

Synthesis & reactions (nitration, bromination and acylation) of Naphthalene, Anthracene & Phenanthrene. General electrophilic substitution mechanism for relative reactivity of these compounds at various positions.

Heterocyclic Compounds:

Introduction: Classification and nomenclature, Molecular orbital picture & aromatic characteristics of pyrrole, furan, thiophene & pyridine. Chemical reactions with emphasis on general mechanism of electrophilic substitution. General Mechanism of nucleophilic substitution reactions in pyridine. comparison of basicity of pyridine, piperidine and pyrrole. Introduction to condensed five & six-membered heterocyclic compounds, preparation & reactions of indole quinoline & isoquinoline with special reference to Fisher indole synthesis Skraup synthesis & Bischler - Napieralski synthesis. General Mechanism of electrophilic substitution reactions of indole, and quinoline.

Section-B

Ultra Violet-Visible Spectroscopy:

Absorption Spectra Ultraviolet (UV) absorption spectroscopy-absorption laws (Beer-Lambert's law, Molar absorptivity, presentation and analysis of UV Spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes & enones using homocyclic and heterocyclic systems upto two rings as examples for both.

Infrared Spectroscopy:

Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (upto 4 C-atoms); inter and intramolecular hydrogen bonding, aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on C=O stretching absorptions of compounds upto 3C-atoms).


Professor & Head
Department of Chemistry,
Punjabi University, Patiala

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**B.Sc. Part-III (Semester-5th)
Physical Chemistry-III (Paper Code: CHEB3501T)**

Max Marks: 50 marks

40 Hrs; Credits: 02

End Semester Exam: 35 marks

Time allowed: 3Hrs

Internal Assessments: 15 marks

3 hours/week

Pass Marks: 35%

INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections, namely, Section A, B and C. Section A and B will have four questions from the respective section of syllabus. Each question will carry 6 marks and may be segregated into sub-parts. Section C will be compulsory with 11 short-answer type questions of 1 mark each covering the entire syllabus.

INSTRUCTIONS FOR STUDENTS

Students are required to attempt five questions selecting two questions from each of Section A & B while Section-C is Compulsory.

Section-A

I. Quantum Mechanics

Black-body radiations, Planck's radiation law, photoelectric effect, heat capacity of solids, Sinusoidal wave equation Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box.

Schrodinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions.

Section-B

II. Spectroscopy

Introduction :

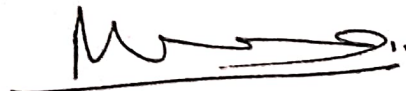
Electromagnetic radiation, regions of spectrum, basic features of different spectrometers, statement of Born-Oppenheimer approximation, degrees of freedom.

Rotational Spectrum :

Diatomic molecules. Energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, determination of bond length, qualitative description of non-rigid rotor, isotope effect.

Vibrational Spectrum:

Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups (hydroxyl, aliphatic: aldehyde, ketone, primary, secondary and tertiary amines).



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