DEPARTMENT OF BOTANY

COURSE CURRICULUM & MARKING SCHEME

M.Sc. BOTANY

Semester - I

SESSION : 2024-25

ESTD: 1958

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG, 491001 (C.G.)

(Former Name – Govt. Arts & Science College, Durg)

NAAC Accredited Grade A+, College with CPE - Phase III (UGC), STAR COLLEGE (DBT)

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GOVT. V.Y.T. PG. AUTONOMOUS COLLEGE, DURG
Department of Botany
Session – 2024-2025

Objective of the Course:

M.Sc. Botany Degree Programme (2024-25 Academic year onwards) M.Sc. Botany Programme is a two-year post-graduate programme, which deals with basic and advanced study on plants. It is one of the multi-disciplinary fields with great demand in various fields of research and development. The programme envisages developing understanding and knowledge for applying into sectors like agriculture, horticulture, floriculture, biotechnology, genomics, forest and environment.

The programme is divided across 4 semesters. These are exciting times in Biology. The world of Biology has been transformed in the last few decades. There was too much to select from. However, the Board of studies designed the programme envisioning the following objectives:-

1. To encourage a clear, comprehensive and advance mastery in the field of botany.
2. To provide basic principles of biological sciences with special reference to Botany and its applied branches.
3. Enabling the students to explore the intricacies of life form at cellular, molecular and nano level.
4. To sustain student's motivation and enthusiasm and to help them not only to appreciate the beauty of different life forms but also to inspire them in the dissemination of the concept of biodiversity conservation.
5. To develop problem solving skills in students and encourage them to carry out innovative research projects thereby enkindling in them the spirit of knowledge creation.
6. To maintain a high level of scientific excellence in botanical research with added emphasis on the role of plants in the structure and functioning of terrestrial and aquatic communities and ecosystem.
7. To equip students to perform functions that demand higher competence in National/International fields.

Approved syllabus for M.Sc. Botany by the members of Board of Studies for the Sessions 2024-2025

S. No.	Paper No.	Course Code	Name of Paper	Marks		
				Internal	Semester	Total
SEMESTER I						
1.	I	MBO101	Cell Biology	20	80	100
2.	II	MBO102	Microbiology, Phycology and Mycology	20	80	100
3.	III	MBO103	Biology and Diversity of Bryophyta, Pteridophyta and Gymnosperm	20	80	100
4.	IV	MBO104	Plant Physiology	20	80	100
5.	Lab Course – I		Based on Paper I & III	-	-	
6.	Lab Course – II		Based on Paper II & IV	-	-	
SEMESTER II						
1.	I	MBO201	Genetics	20	80	100
2.	II	MBO202	Taxonomy of Angiosperm	20	80	100
3.	III	MBO203	Molecular Biology	20	80	100
4.	IV	MBO204	Plants Metabolism	20	80	100
5.	Lab Course - I		Based on Paper I & III	-	100	100
6.	Lab Course – II		Based on Paper II & IV	-	100	100
SEMESTER III						
1.	I	MBO301	Plant Development and Plant Resources	20	80	100
2.	II	MBO302	Plant Ecology – 1	20	80	100
3.	III	MBO303	Plant Biotechnology	20	80	100
4.	IV	MBO304	Microbial ecology {Elective Paper– I} Ethnobotany (Elective Paper-I)	20	80	100
5.	Lab Course – I		Based on Paper I & III	-	100	100
6.	Lab Course – II		Based on Paper II & IV	-	100	100
SEMESTER IV						
1.	I	MBO401	Plant Reproduction & Utilization of Resources	20	80	100
2.	II	MBO402	Ecology – II (Pollution & Biodiversity Conservation)	20	80	100
3.	III	MBO403	Genetic Engineering	20	80	100
4.	IV	MBO404	Microbial Ecology {Elective Paper – II} Ethnobotany (Elective Paper-II)	20	80	100
5.	Lab Course - I		Based on Paper I, II, III & IV	-	100	100
6.	Lab Course - II		Project / Dissertation Work	-	100	100

The syllabus for M.Sc. Botany is hereby approved for the sessions 2024-2025
Name and Signatures of Members Board of Studies

S. No.	Category	Name of Nominated Members	Signature
1.	**Chairperson**	**Dr. Ranjana Shrivastava**	
2.	Members	1. Dr. G. S. Thakur	
		2. Dr. Shriram Kunjam	
		3. Dr. Satish Kumar Sen	
		4. Dr. Vijay Laxmi Naidu	
		5. Mr. Motiram Sahu	
		6. Dr. Rajeshwari Prabha Lahare	
3.	Subject specialist	1. Prof. P.C. Panda Retd. Professor Borsi Durg C.G.)	
		2. Dr. N.B. Singh (Govt. N.PG. Science College Raipur C.G.)	
4.	VC Nominated member	Dr. Aruna Shrivastava (Govt. D.B. Girls PG College Raipur C.G.)	
5.	Corporate/ Industrial area Representative	Shri Manish Jain (Apollo College, Durg C.G.)	
6.	Ex Meritorious Student PG	Tanu Verma	
7.	Subject expert from other Department	Dr. Divya Minz (Department of Zoology, Govt. V.Y.T. PG. Autonomous College Durg C.G.)	

Syllabus and Marking Scheme for M.Sc. First Semester

Session 2024-2025

Paper No.	Title of the Paper/Paper Code	Marks Allotted in Theory		Marks Allotted in Internal Assessment		Credits
		Max	Min	Max.	Min.	
I CC- MBO101	Cell biology	80	16	20	04	05
II CC- MBO102	Microbiology, Phycology and Mycology	80	16	20	04	05
III CC- MBO103	Biology and diversity of Bryophyta, Pteridophyta and Gymnosperm	80	16	20	04	05
IV CC- MBO104	Plant Physiology	80	16	20	04	05
V	Lab Course I - based on paper I and II	100	33			04
VI	Lab Course II - based on paper III and IV	100	33			04
	Total	**520**		**80**		**28**

***CC- Course Code**

04 Theory papers - 320
04 Internal Assessments - 80
02 Practical - 200
Total Marks - 600

Note: 1. 20 marks = 01 credit in Theory Papers and 25 Marks = 01 Credit in Practical/Project work

M.Sc. (BOTANY) SCHEME 2024-2025
SEMESTER –I-LAB COURSE

LAB COURSE-1 (4 Hrs)	100
Part – I Exercise based on Cell biology	20
Part – II Exercise based on Microbiology, Phycology and Mycology	30
Part – III Spotting	15
Part – IV Field Study	15
Part – V Viva- Voce	10
Part – VI Sessional	10

LAB COURSE-2 (4 Hrs)	100
Part – I Exercise based on Biology and diversity of Bryophyta, Pteridophyta and Gymnosperm	25
Part – II Exercise based on Plant Physiology	25
Part – III Spotting	15
Part – IV Field Study	15
Part – V Viva- Voce	10
Part – VI Sessional	10

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GOVT. V.Y.T. PG. AUTONOMOUS COLLEGE, DURG (C.G.)
M.Sc. – BOTANY SEMESTER – I
SESSION– 2024-2025
PAPER – I (Course Code- MBO101)
CELL BIOLOGY

Max. M. 80 **Min. M. 16**

UNIT - I

- The dynamic cells, Structural organization of the plant cell, specialized plant cell type chemical foundation, biochemical energetics.
- **Cell wall**: Structure, functions, biogenesis, growth.
- **Plasma membrane**: structure, models, functions, Ion carriers, channels and pumps, receptors.

UNIT - II

- **Chloroplast**: Structure, functions, genome organization.
- **Mitochondria**: Structure, genome organization, biogenesis.
- **Ribosome**: Structure and functions.
- **Plant Vacuole**: Structure, Functions.

UNIT - III

- **Nucleus**: Structure, nuclear envelope, nuclear pore complex, nucleolus.
- **Cell cycle**: Control mechanisms, role of cyclin and cyclin dependent kinases.
- Retinoblastoma and E2F proteins
- **Apoptosis**: Programmed cell death, Mechanism.

UNIT - IV

- **Cell shape and motility:** The cytoskeleton; organization, role of microtubules, microfilaments; motor protein; implications in cilia, flagella and chromosome movement.
- **Other cellular organelles**: Structure and functions of Lysosome, Peroxysome, Golgi apparatus, Endoplasmic reticulum.
- **Techniques in cell biology:***In Situ*hybridization to locate transcripts in cell types FISH, GISH, Flow cytometry.

Laboratory Exercise

- Smear of root tips showing different stages of mitosis. {Onion,Garlic}
- Smear of anther showing different stages of meiosis. {Onion,Tradescantia}
- To study the effect of colchicines on mitosis cell division. {Onion root tip}
- Study of mitotic index from suitable plant materials.

Recommended Books:-

- Albert Etal 2002 (Fourth Edition). Molecular Biology of the cell, Garland Science (Iaylarand Francis) New York Group (wt)
- Buchanan B.B, Gruissm W. and Jones R.L 2000. Biochemistry and Molecular Biology of Plant. American Society of Plant Physiologist, Maryland, USA.
- Cooper G.M and Hausman R.E 2007 (Fourth Edition). The Cell molecular approach Sinauer associate, Inc, Suderland (USA).
- De Robertis and De Robertis 2005 (Eight edition) (Indian) Cell and Molecular Biology, Lippincott Williams, Philadelphia. [B.I Publications Pvt. Ltd. New Delhi].
- Gerald Karp 1999 Cell and Molecular Biology- Concept and Expts. John Wiley and ScneIne., USA.
- Gupta P.K Cell and Molecular biology Rastogi Publications.
- Krishnamurthy, K.V 2000. Methods in Cell Wall Cytochemistry. CRC Press, Boca Raton, Florida.
- Lewin, B. 2000. Gene VII. Oxford University Press, New York, USA.
- LodishEtal 2004 (Fifth Edition). Molecular Cell Biology, W H Freeman and company, New York.
- Powar C.B 2005 (Third Edition). Cell Biology, Himalaya Publishing, Mumbai.

Outcome:-

- To gain knowledge about "Cell Science.
- To understand the structure, chemistry and functions ofplantcell,cell wall and Plasma membrane.
- To know about the structure, biogenesis and functions of cell organelles.
- To understand genome organization in mitochondria and chloroplast.
- To understand the mechanism of cell cycle, growth and cell divisionin plants.
- To learn about mechanism of programmed cell death in plants.
- To have knowledge of the cell motility organization and functions of cytoskeleton.
- To develop skill in flow cytometry and hybridization techniques.
- Study of structure of plant cell organelles from electron micrographs.
- To study the Squash and Smear techniquesand showing the stages of mitosis (Onion root tips) and showing permanent slides/photographs of mitosis and meiosis.

Question Paper Format and Distribution of Marks for PG Semester Examination

Question paper format for the Post-Graduate Examination has been revised from the Session 2018-19. The revised format will be applicable for all the question papers of Semester I, II, III & IV. The following are the main points of the new format:

1. The question paper will be of **80 marks** (as before)
2. Questions will be asked Unit-wise in each question paper.
3. From each Unit, the questions will be asked as follows :
   - Q.1 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**
   - Q.2 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**
   - Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**
   - Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks
Short (1 Question) 200-250 words	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks
Long answer (1 Question) 400-450 words	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks

Note:

1. Question no. 1 and Question 2 will be compulsory.
2. Question no. 3 and 4 will consist of 2 optional questions of which one has to be attempted.
3. As mentioned above, two compulsory very short answer type questions (2+2 marks), one short answer type question with internal choice (4 marks) and one long answer type question with internal choice (12 marks) will be asked from each unit.
   Thus there will be questions of 20 marks from each unit and of total 80 marks from all the four units of the syllabus/syllabi.
4. Internal Assessment Examination will be as follows:
   i. Internal Test in each paper (20 marks)
   ii. Seminar (Power point presentation) in any one of the paper (20 marks)
   iii. Assignment in each of the remaining papers (excluding the paper of Seminar. (20 marks)
   iv. Average of marks obtained in internal test + seminar in any one paper and marks obtained in internal test + assignment in rest of the papers will be calculated and taken into consideration.

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GOVT. V.Y.T. PG. AUTONOMOUS COLLEGE, DURG (C.G.)
M.Sc. – BOTANY SEMESTER – I
SESSION– 2024-2025
PAPER – II (Course Code- MBO102)

MICROBIOLOGY, PHYCOLOGY AND MYCOLOGY

Max. M. 80 **Min. M. 16**

UNIT-I

A. Microbes

- Characteristics, structure and replication of viruses
- Structure, nutrition and genetic recombination of Bacteria
- General account of Mycoplasma.

B. Phycology -I

- General characters of Algae including diversified habitat, range of vegetative structure and reproduction.
- Classification of algae giving emphasis on pigment composition, flagellation, cell wall composition and reserve food material.

UNIT-II

Phycology -II

General account of -

a. Cyanophyceae
b. Chlorophyceae (Pandorina, Cladophora, Drapernaldiopsis)
c. Charophyceae (Chara)
d. Xanthophyceae (Botridium)
e. Bacillariophyceae (Pinnularia)
f. Phaeophyceae (Fucus)
g. Rhodophyceae (Batrachospermum)

- Economic importance with special reference to biofertilizers.

UNIT- III

Mycology - I

- General characteristics of fungi including its morphology, cellular structure and nutrition.
- Reproduction in fungi
- Heterothallism and Parasexuality
- Ainsworth system of fungal classification.
- General symptoms of plant disease.

UNIT - IV

Mycology -II

Brief life cycle of -

a. Myxomycotina (*Dictostelium*) b. Mastigomycotina (*Achlya*)
c. Zygomycotina (*Cunnighamella*) d. Ascomycotina (*Penicillium, Phyllactinia*)
e. Basidiomycotina (Rust- *Uromyces*, Smut - *Ustilago*)
f. Deuteromycotina (*Alternaria, Fusarium*
g. Economic importance, Mushroom cultivation.

Laboratory Exercise

- Bacterial staining and identification.
- Preparation of temporary mount and identification of algal material.
- Symptomlogy of some diseased specimens.
- Preparation of temporary mount and identification of fungal material.

Recommended Books

- A Textbook of Microbiology by S. S. Purohit.
- A Textbook of Microbiology by R. C. Dubey and D. K. Maheshwari.
- Microbiology, Vol. I and II by C. B. Powar and Daginawala.
- Algae by B. R. Vashishta.
- Algae by H. O. Kumar.
- Algae by Chapman.
- Structure and Reproduction of AlgaeVol.I and II by F. E. Fritsch.
- Cryptogamic Botany, Vol I by G. M. Smith.
- Introduction to Mycology by C. J. Alexopoulos.
- Mycology by Malothra and Aneja.
- An Introduction to Fungi by H. C. Dube.

Outcome :-

- Student will able to understand the structure and replication of different microbes and know the disease caused by them, disease symptoms and their control.
- They will know all about algae including their habitat, range of thallus organization, reproduction and classification.
- Student will know all about fungi including morphology,mode of nutrition, reproduction, heterothallism and para sexuality, classification, disease symptoms and their control.
- Student will get knowledge of the life cycle of all groups of algae and fungi and their economic importance.

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Q.1 Very short answer type question
(Answer in one or two sentences) **(02 Marks)**

Q.2 Very short answer type question
(Answer in one or two sentences) **(02 Marks)**

Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**

Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks
Short (1 Question) 200-250 words	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks
Long answer (1 Question) 400-450 words	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks

Note:

1. Question no. 1 and Question 2 will be compulsory.
2. Question no. 3 and 4 will consist of 2 optional questions of which one has to be attempted.
3. As mentioned above, two compulsory very short answer type questions (2+2 marks), one short answer type question with internal choice (4 marks) and one long answer type question with internal choice (12 marks) will be asked from each unit.
   Thus there will be questions of 20 marks from each unit and of total 80 marks from all the four units of the syllabus/syllabi.
4. Internal Assessment Examination will be as follows:
   i. Internal Test in each paper (20 marks)
   ii. Seminar (Power point presentation) in any one of the paper (20 marks)
   iii. Assignment in each of the remaining papers (excluding the paper of Seminar. (20 marks)
   iv. Average of marks obtained in internal test + seminar in any one paper and marks obtained in internal test + assignment in rest of the papers will be calculated and taken into consideration.

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GOVT. V.Y.T PG. AUTONOMOUS COLLEGE, DURG (C.G)
M.Sc. – BOTANY SEMESTER – 1
Session–2024-2025
Paper –III (Course Code- MBO103)

BIOLOGY AND DIVERSITY OF BRYOPHYTA, PTERIDOPHYTA AND GYMNOSPERM

M.M – 80 **Min – 16**

Unit – I

- General characters, classification, distribution and, Ecological significance of Bryophytes. Fossil bryophytes.
- General account including morphology, anatomy, reproduction and interrelationship of the following groups.
    - Marchantiales – *Plagiochasma*
    - Jungermanniales –*Porella*
    - Anthocerotales{eg.*Anthoceros}*
    - Sphagnals {eg.*Sphagnum}*
    - Polytricales {eg.*Polytrichum}*

Unit – II

- General characteristics, classification, and distributionofPteridophyta
- Evolution of stele, heterospory and seed habit.
- General account of following fossil Pteridophytes.
    - *Asteroxylon., Lepidodendron, Calamophyton.*
- Morphology, anatomy, and reproduction of the following groups:
    - Psilopsida {living Member} - *Psilotum.*
    - Lycopsida – *Isoetes.*
    - Pteropsida- *Ophioglossum, Osmunda*

Unit- III

- General Characteristics, Diversity, Classification,Evolution& Economic importance of Gymnosperms.
- General account of Cycadeoidales (Cycadeoidea, Williamsonia), Cordiatales (Cordiates).
- Brief account of following –
    - Pteridospermales –Lyginopteridaceae (*Lyginopteris*) .
    - Medullosaceae –*(Medullosa)*.
    - Caytonaceae –*(Caytonia)*.
    - Pentoxylales *(Pentoxylon)*.

Unit-IV

- Structure and Reproduction of the following–
    - *Cycadales (Zamia,).*
    - *Coniferales (Araucaria, Cedrus).*
    - *Ephedrales (Ephedra)*
    - *Welwischiales (Welwischia)*
    - *Gnetales (Gnetum, Ginkgo bioloba).*

Laboratory Exercise

- **Monographic** study of following genera: (Bryophyta)
  Plagiochasma, Fimbrieria, Porella, Fossombronia, Anthoceros, Sphagnum,Funaria, Polytrichum
- **Monographic** study of following genera (Pteridophyta)
  Psilotum, Isoetes,Equisetum, Ophioglossum, Osmunda, Marsilea
- **Monographic** study of the following members of (Gymnosperms)
  - *Cycas, Pinus, Araucaria, Thuja, Ginkgo biloba, Ephedra, Gnetum*
  - Fossil specimen and slides.

Recommended Books:

- Sporne, K.R. An introduction to Gymnosperms
- Coutler and chamberian
- Bhatnagar, S.P. Gymnosperms
- Vashishta, P.C. Gymnosperms
- Stewart, W.N. and Rathwell, G.W.1993, Paleobotany and Evolution on plants . Cambridge university press.
- Cavers, Interrelationship of Bryophyta.
- Udar, R. Bryophyta.
- Prempuri, Bryophyta
- Parihar , N.S An introduction of Embryophyta, Vol.I Bryophyta.
- Parihar , N.S An introduction of Embryophyta, Vol.II Bryophyta.
- Rashid A. An Introduction of pteridophyta.
- Vashishta, P.C. Pteridophyta.
- Smith, G.M. Cryptogamic Botany.
- Eames. J. Morphology of Vascular plants- Lower Groups.

Outcome:-

- Student will able to understand the evolutionary trends of Bryophyta, Pteridophyta and Gymnosperms.
- They will get knowledge about habitats, structure and life cycle of the different members of the plant groups of Bryophyta, Pteridophyta and Gymnosperms.
- They will get knowledge about economic importance of Bryophyta, Pteridophyta and Gymnosperms & also they will know about Azolla as a biofertilizer.
- They will able to understand about geological time scale and fossil plants.

Question Paper Format and Distribution of Marks for PG Semester Examination

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Q.2 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**

Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**

Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	**2 x 2 = 4 Marks**	**2 x 2 = 4 Marks**	**2 x 2 = 4 Marks**	**2 x 2 = 4 Marks**
Short (1 Question) 200-250 words	**1 x 4 = 4 Marks**	**1 x 4 = 4 Marks**	**1 x 4 = 4 Marks**	**1 x 4 = 4 Marks**
Long answer (1 Question) 400-450 words	**1 x 12 = 12 Marks**	**1 x 12 = 12 Marks**	**1 x 12 = 12 Marks**	**1 x 12 = 12 Marks**

Note:

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3. As mentioned above, two compulsory very short answer type questions (2+2 marks), one short answer type question with internal choice (4 marks) and one long answer type question with internal choice (12 marks) will be asked from each unit.
   Thus there will be questions of 20 marks from each unit and of total 80 marks from all the four units of the syllabus/syllabi.
4. Internal Assessment Examination will be as follows:
   v. Internal Test in each paper (20 marks)
   vi. Seminar (Power point presentation) in any one of the paper (20 marks)
   vii. Assignment in each of the remaining papers (excluding the paper of Seminar. (20 marks)
   viii. Average of marks obtained in internal test + seminar in any one paper and marks obtained in internal test + assignment in rest of the papers will be calculated and taken into consideration.

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		2. Dr. N.B. Singh (Govt. N.PG. Science College Raipur C.G.)	
4.	VC Nominated member	Dr. Aruna Shrivastava (Govt. D.B. Girls PG College Raipur C.G.)	
5.	Corporate/ Industrial area Representative	Shri Manish Jain (Apollo College, Durg C.G.)	
6.	Ex Meritorious Student PG	Tanu Verma	
7.	Subject expert from other Department	Dr. Divya Minz (Department of Zoology, Govt. V.Y.T. PG. Autonomous College Durg C.G.)	

GOVT. V.Y.T. PG. AUTONOMOUS COLLEGE, DURG (C.G.)
M.Sc. – BOTANY SEMESTER – I
SESSION-2024-2025
PAPER – IV (Course Code- MBO104)
PLANT PHYSIOLOGY

M.M. – 80 **Min. - 16**

UNIT - I

Energy flow: Principles and Application of thermodynamics, free energy & chemical potential, Redox reactions, structure & function of ATP, hierarchical structure of proteins; folding, degradation; purification, detection and functional characterization; sequence alignments. Conformation of proteins (Ramachandran plot, secondary structure, domains, motif and folds).

Fundamentals of Enzymology: General aspects, Nature of enzymes, mode of enzyme action, classification, enzyme kinetics, Michaelis Menten Equation & ribozymes, abzymes, artificial enzymes, enzyme technology its Significance, Enzyme inhibition, allosteric mechanism, regulatory & active sites, isozymes, factors affecting enzyme activity.

UNIT – II

Membrane Transport & Translocation of water & solutes:

- Plant water relations – properties of water, diffusion, osmosis, permeability, plasmolysis, imbibitions, DPD.
- Mechanism of water transport through xylem – absorption of water, ascent of sap, transpiration and mineral nutrition.
- Root microbe interaction (mycorrhiza) in facilitating nutrient uptake,
- Comparison of Xylem & Phloem transport.
- Phloem loading & unloading (translocation) - active & passive solute transport.

UNIT – III

Signal Transduction: Overview, second messengers, receptors and G-proteins, phospholipid signaling, role of cyclic nucleotides, calcium-calmodulin cascade, diversity in protein kinases and phosphatases, specific signaling mechanisms and their regulation, e.g. simple and hybrid type of two-component sensor-regulator system in bacteria and plants (examples of chemotaxis, osmosensing, ethylene and cytokinin signaling),quorum sensing.

UNIT – IV

Plant Growth Regulators & Elicitors: Physiological effects & mechanism of action of auxin, gibberllins, cytokinins, ethylene, abscisic acid, brassinosteroids, polyamines, jasmonic acid & salicylic acid, hormone receptors.

Stress Physiology: plant responses to biotic & abiotic stress, mechanism of biotic & abiotic tolerance, HR & SAR, water deficit & drought resistance, salinity stress, metal toxicity, cold & heat stress, oxidative stress.

Laboratory Exercise

- To determine osmotic pressure of cell sap by Plasmolytic method.
- To determine osmotic pressure of cell sap by Weight method.
- To determine the rate of transpiration by Ganong's photometer.
- To find out stomatal index of different mesophytic leaves.
- To determine absorption transpiration ratio.
- Comparison of cuticular and stomatal transpiration by Cobalt chloride method.
- Demonstration of Catalase activity.
- Demonstration of Peroxidase activity.
- Demonstration of Dehydrogenase activity.
- Demonstration of Amylase activity.
- Comparison of cuticular and stomatal transpiration by Blackman's apparatus.

- **Recommended Books:**

- Cell Physiology by Giese.
- Plant Physiology by Bidwell.
- Plant Physiology by Subhash chandra Dutta.
- Plant Physiology by Noggle and Frutz.
- Plant Physiology by Devlin.
- Plant Physiology by Taiz and Zeiger.

Outcome:-

- The basic principles of enzymology, to understand the relationship between proteins and the nucleic acids (DNA and RNA) that provide the blueprint for the assembly of proteins with in the cell.
- Genetic engineering is thus predominantly concerned with modifying the proteins that a cell contains, and genetic defects (in medicine) generally relate to the abnormalities that occur in the proteins within cells. Much of the molecular age of biochemistry is therefore very much focused on the study of the cell, its enzymes and other proteins, and their functions.
- Through this unit students understand Knowledge of plant water relationship. it is important because water is essential for both plants and animals. It serves as a medium for the dissolution of substances. A huge amount of water is taken up daily by plants and a considerable amount is lost in transpiration. The water requirement of different categories of plants is different.
- Students understand the signal transduction unit understand the basic principles of signal transduction mechanisms, in particular the concepts of response specificity, signal amplitude and duration, signal integration and intracellular location.

Question Paper Format and Distribution of Marks for PG Semester Examination

Question paper format for the Post-Graduate Examination has been revised from the Session 2020-21. The revised format will be applicable for all the question papers of Semester I, II, III & IV. The following are the main points of the new format:

1. The question paper will be of **80 marks** (as before)
2. Questions will be asked Unit-wise in each question paper.
3. From each Unit, the questions will be asked as follows :

Q.1 Very short answer type question
(Answer in one or two sentences) **(02 Marks)**

Q.2 Very short answer type question
(Answer in one or two sentences) **(02 Marks)**

Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**

Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks
Short (1 Question) 200-250 words	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks
Long answer (1 Question) 400-450 words	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks

Note:

1. Question no. 1 and Question 2 will be compulsory.
2. Question no. 3 and 4 will consist of 2 optional questions of which one has to be attempted.
3. As mentioned above, two compulsory very short answer type questions (2+2 marks), one short answer type question with internal choice (4 marks) and one long answer type question with internal choice (12 marks) will be asked from each unit.

   Thus there will be questions of 20 marks from each unit and of total 80 marks from all the four units of the syllabus/syllabi.
4. Internal Assessment Examination will be as follows:
   - ix. Internal Test in each paper (20 marks)
   - x. Seminar (Power point presentation) in any one of the paper (20 marks)
   - xi. Assignment in each of the remaining papers (excluding the paper of Seminar. (20 marks)
   - xii. Average of marks obtained in internal test + seminar in any one paper and marks obtained in internal test + assignment in rest of the papers will be calculated and taken into consideration.

Name and Signatures of Members Board of Studies

S. No.	Category	Name of Nominated Members	Signature
1.	**Chairperson**	**Dr. Ranjana Shrivastava**	
2.	Members	1. Dr. G. S. Thakur	
		2. Dr. Shriram Kunjam	
		3. Dr. Satish Kumar Sen	
		4. Dr. Vijay Laxmi Naidu	
		5. Mr. Motiram Sahu	
		6. Dr. Rajeshwari Prabha Lahare	
3.	Subject specialist	1. Prof. P.C. Panda Retd. Professor Borsi Durg C.G.)	
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