

Bajaj College of Science, Wardha
Semester Pattern Syllabus
FOR B Sc. BOTANY
Session 2019-20

Semester – V
Biochemistry, Plant Physiology-I, Plant Ecology-I & Instrumentation and
Phytochemistry
(60 Hours)

Unit I : Biochemistry **(10)**

- 1.1 Carbohydrates: Definition, properties & role; Classification: Aldoses & ketoses; monosaccharides, disaccharides and polysaccharides;
- 1.2 Lipids: Definition, properties & role; fatty acids, oils & waxes.
- 1.3 Aminoacids- Chemistry of amino acids present in proteins (Classification),
- 1.4 Basics of Enzymology: Nomenclature & Characteristics of Enzymes, factors affecting enzyme activity, Holoenzyme, Apoenzyme, Co-enzymes & Co-factors, Theories for Mechanism of action of Enzymes

Unit II: Plant-water relations **(10)**

- 2.1 Properties of water; Diffusion, Osmosis Imbibitions & Plasmolysis : significance
- 2.2 Water conduction: Root pressure theory, Cohesion-adhesion theory; Transpiration role
- 2.3 Phloem transport: Munch hypothesis
- 2.4 Mineral transport: passive (Donnan's equilibrium), active (Carrier concept)

Unit III: Metabolism **(10)**

- 3.1 Photosynthesis: Concept, significance, photolysis of water (Hill's reaction), cyclic and non-cyclic photophosphorylation, Light independent reactions: C₃, C₄ and CAM pathways and their significance; factors affecting photosynthesis.
- 3.2 Respiration: Types (aerobic & anaerobic), glycolysis, Kreb's cycle, oxidative phosphorylation (ETS); fermentation (alcohol & lactic acid), photorespiration. Glyoxylate cycle

3.3 Nitrogen metabolism: Mechanism of biological nitrogen fixation, importance of nitrate reductase

Unit IV: Ecology and Environment: (10)

4.1 Climatic Factors: Light & Temperature (effect on vegetation).

4.2 Edaphic Factor : Pedogenesis, Soil profile, Soil properties (physical and chemical)

4.3 Biotic Factor: Interactions between a) plants, animals & human, b) plant community & plants & soil microorganisms.

4.4 Plant adaptations: Morphological, Anatomical & Physiological responses of Hydrophytes, Xerophytes, and Halophytes (with one example)

Unit V: Ecosystem (10)

5.1 Community characteristics: frequency, density, abundance, Life forms, Raunkier's Biological spectrum: Pond & Desert ecosystem

5.2 Autecology, Ecad, Ecotype, Natality, Mortality, Food chain, Food web, Ecological pyramids 5.3 Conservation of forest and water resources; Agricultural, noise and thermal pollution,

5.5 Plant succession: Hydrosere, Xerosere

Unit VI: Instrumentation and Phytochemistry (10)

(a) **Instrumentation**

6.1 Principle, types and application of: microscopy (Light, fluorescent, SEM, TEM),

6.2 Centrifugation, Electrophoresis (SDS-PAGE and Agarose), Spectroscopy (UV-Vis),

6.3 Chromatography (Paper chromatography, Thin layer chromatography)

(b) **Phytochemistry**

6.4 Active principles of Phytochemistry

6.5 Methods of their testing phytochemical substances

6.6 Identification and utilization of the medicinal herbs; *Catharanthus roseus*

(cardiotonic), *Withania somnifera* (drugs acting on nervous system), *Clerodendron phlomoides* (anti-rheumatic) and *Centella asiatica* (memory booster).

List of Practicals

Major Physiology experiments (Any 10)

To study the permeability of plasma membrane using different concentrations of organic solvents.

To study the effect of temperature on permeability of membranes.
To determine the osmotic potential of vacuolar sap by plasmolytic method.
To determine the water potential of any tuber.
To compare the rate of transpiration from two surfaces of leaf- a) bell jar method b) Cobalt chloride method.
To determine the path of water (Ascent of sap).
To separate chloroplast pigments a) by solvent method and preparation of their absorption spectra b) paper chromatography.
To separate amino acids from plant materials an paper chromatography and their identification by comparison with standards.
To measure rate of photosynthesis by Wilmott's bubbler under variable conditions of light, temperature and CO₂.
To compare rates of respiration of various plant parts.
To demonstrate bioassay of auxin, cytokinin, GA, ABA and ethylene using appropriate plant materials.
To perform microchemical tests for determination of reducing and non-reducing sugars, starch, cellulose, oils and proteins.
To study the effect of light intensity and quality, CO₂ concentration and temperature on rate of photosynthesis by suitable method.
To determine osmotic potential of the cell sap by plasmolytic method.
To study the activity of enzyme amylase, catalase and peroxidase.

Minor Physiology experiments (Any Seven)

To demonstrate the phenomenon of dispersion.
To demonstrate the phenomenon of adsorption.
To demonstrate the phenomenon of imbibitions.
To demonstrate the root pressure.
To demonstrate that the amount of water absorbed and the amount of water transpired is approximately equal.
To demonstrate that the light is necessary for photosynthesis (Ganong's light screen).
To demonstrate that the light, chlorophyll and CO₂ are necessary for photosynthesis (using Moll's half-leaf experiment).
To demonstrate fermentation by Kuhne's tube.
To demonstrate aerobic respiration.
To demonstrate the evolution of CO₂ in respiration.
To demonstrate that the part of energy is released in the form of heat during respiration.
To demonstrate the measurement of growth of germination pea seeds.
To demonstrate the phenomenon of gravitropism (geotropism), phototropism and hydrotropism. To demonstrate seed viability test by T.T.C. (Triphenyl-tetrazolium chloride)

Ecology Practicals

To determine frequent, density, abundance of the community by quadrat method.

To determine the homogeneity of vegetation by Raunkiaer's frequency diagram.

To determine the water holding capacity of the given soil samples.

To determine the water rising capacity of the given soil samples.

To determine the soil moisture of the given samples.

To study the morphological and anatomical characteristics of any one hydrophyte and xerophyte.

To study the morphological characteristics of cladode, phylloclade, phyllode and pneumatophores.

Principle and working of: spectrophotometer, microscope etc.

To determine the DO of water samples different sources.

To study the dust holding capacity of leaves.

To estimate transparency, pH and temperature of different water bodies

To estimate salinity (chlorides) of different water samples.

To determine the percent leaf-area injury of different leaf samples collected around polluted sites.

*To separate chlorophyll pigments by chromatography.

To measure chlorophyll by spectrophotometer.

To measure anthocyanin by spectrophotometer.

To separate chlorophyll pigments by chromatography.

Identification and utilization of the medicinal herbs.

To study methods of testing different drugs.

To study the active principles of herbal drugs.

Suggested Readings

- Hopkins, W. G. 1995. Introduction to plant physiology. John Wiley & Sons New York, USA
- Old, R. W. and Primrose S.B. Principles of Gene Manipulation. Blackwell scientific publications, Oxford U. K. [new edition could be there]
- Dey, P.M. & Harborne, J. B. (eds) 1997. Plant Biochemistry. Harcourt Asia Pte Ltd/Academic Press I Printed in India 2000J
- Raghavan, V. 1986 Embryogenesis in Angiosperms : A Developmental and Experimental Study. Cambridge University Press, Cambridge.
- Plummer, D.T. (1996). An Introduction to Practical Biochemistry. Tata McGrawHill Publishing Co. Ltd. New Delhi. 3rd edition.
- Ruzin, S.E. (1999). Plant Microtechnique and Microscopy, Oxford University Press, New York. U.S.A.
- Ausubel, F., Brent, R., Kingston, R. E., Moore, D.D., Seidman, J.G., Smith, J.A., Struhl, K. (1995). Short Protocols in Molecular Biology. John Wiley & Sons. 3rd edition.

Zar, J.H. (2012). Biostatistical Analysis. Pearson Publication. U.S.A. 4th edition.

Glossary of Indian medicinal plants, R.N.Chopra, S.L.Nayar and I.C.Chopra, 1956. C.S.I.R, New Delhi.

. The indigenous drugs of India, Kanny, Lall, Dey and Raj Bahadur, 1984. International Book Distributors.

Herbal plants and Drugs Agnes Arber, 1999. Mangal Deep Publications.

Ayurvedic drugs and their plant source. V.V. Sivarajan and Balachandran Indra 1994. Oxford IBH publishing Co.

Ayurveda and Aromatherapy. Miller, Light and Miller, Bryan, 1998. Banarsidass, Delhi.

Principles of Ayurveda, Anne Green, 2000. Thomsons, London.

Pharmacognosy, Dr.C.K.Kokate et al. 1999. Nirali Prakashan.

Semester V
Practical examination
Question Paper

Time : 5 hrs	Marks :
30	
Q. 1) To perform given Physiology Experiment [A] & report the findings	06
Q. 2) To perform the given Biochemical Experiment [B] & report the findings	04
Q. 3) To perform the given Ecological Experiment [C] & report the findings	05
Q. 4) To perform the given microchemical test [D] & report the findings	03
Q. 5) Spotting : E- Plant Physiology F-Plant Physiology G- Ecology (Component of aquatic ecosystems) H-Ecology(Component of terrestrial ecosystems) I.Instrumentation J. Phytochemistry	06
Q. 6) Viva Voice	03
Q. 7) Practical Record & Excursion Report	03

Semester VI

Plant Physiology-II, Biotechnology And Utilization of Plants & Nursery & Hybrid Seed Production (60 Hours)

Unit I Plant Responses (10)

- 1.1 Growth: Phases, Growth curve; Pr and Pfr forms, their role Circadian rhythms and biological clock. Growth regulators: Role of auxin, cytokinins, gibberellins, ABA and ethylene
- 1.2 Plant movements: Tropic and nastic movements.
- 1.4 Photoperiodism: photoperiodism & vernalization, role of florigen
- 1.5 Seed dormancy: Causes & role, methods to break seed dormancy.
- 1.6 Stress physiology- Concept, Types of stress, Water and Salinity stress

Unit II Plant tissue culture (10)

- 2.1 Totipotency, explant, aseptic culture, *in vitro*, micropropagation;
- 2.2 Methods of sterilization (autoclaving, dry heat, chemicals),
- 2.3 Culture media (MS media) hormone requirement & applications of tissue culture.
- 2.4 Callus & organ culture (shoot tip, anther) & its application, cybrid production & its application.

Unit III : Genetic engineering (10)

- 3.1 Tools and techniques of recombinant DNA technology,
- 3.2 Restriction Enzymes – Nomenclature and Types
- 3.3 Cloning vectors – Plasmids, Phages, Cosmids
- 3.4 Gene Source- Genomic and c-DNA library
- 3.5 Transgenic plants, example Bt cotton and golden rice.

Unit IV Phytogeography (10)

- 4.1 Principles of Phytogeography, Distribution (wides, endemics, discontinuous species),
- 4.2 Theories (Landbridge and continental drift),
- 4.3 Climatic & Phytogeographic regions of India (Chatterjee 1962; Name, distribution area, typical vegetation)
- 4.4 Ethnobotany: Introduction, definition, branches & importance of ethnobotany

Unit V Utilization of Plants (10)

- 5.1. Morphology, Utilization and Important chemical constituents of Food: Wheat;

Oil: Ground nut; Fibre: Cotton; Spices: Clove; Beverages: Coffee; Rubber.
5.2. General account and sources of firewood, timber and Bamboos.
5.3. Essential oils – General account, economic importance of Eucalyptus.
5.4. General account and uses of medicinal plants :*Aloe vera*, *Adathoda vasica*,
Asparagus racemosa, *Azadirachta indica*, *Catharanthus roseus*, *Emblica officinalis*,
Ocimum sanctum

Unit VI: **Nursery & Hybrid Seed Production**

(10)

(a) **Plant Nursery Management**

6.1 Nursery:- Concept, types & infrastructure requirements

6.2 Seed propagation:- Germination, Production, Collection, Storage & testing of seeds

6.3 Vegetative Propagation:- Natural and Artificial (Cutting, budding, grafting and layering)

(b) **Hybrid Seed Production:**

6.4 Seed production planning, Land and isolation requirement

6.5 Wild pollinators, maintenance of varietal purity, field inspection,

6.6 Harvesting and threshing in the following crops-(1) Maize, (2) Sun flower, (6) Cotton,

List of Practicals

To determine seed viability by a convenient method.

Principle and working of: oven, autoclave, laminar air flow hood.

To study the structure of following vectors on the basis of photographs and diagrams: plasmid vector, Binary vector.

To study the effect of various plant growth regulators on the growth and development of plants.

To study steps of genetic engineering from photograph example Bt cotton and golden rice.

Utilization of Plants: Morphology, Utilization and Important chemical constituents of plants mentioned in theory. To study the plants of ethnobotanical importance.

Microchemical Tests: Lipid, Proteins, starch, Lignin, Carbohydrates, Cellulose.

Electrophoretic /chromate graphic separation of amino acids carbohydrates

To study instruments and equipments required for plant tissue culture.

To study different components of M S medium.

To study methods of sterilization and Inoculation of explants materials.

*To study effect of biotic and biotic factors on seed germination of tomato and groundnut.

To study factors affecting vegetative propagation (rooting and new shoot formation) by cutting of plant species (*Duranta plumeri* and *Hibiscus, rosa-sinensis*).

To study T-shaped budding of rose plants.

Suggested Readings

Sharma, O. P. 1996. Hill's Economic Botany (Adapted by O.P. Sharma) Tata Mcgraw - Hill co.

Ltd.New Dehli.

Simpson, B. B. and Corner - Ogorzaly, M 1986.Economic Botany- Plants in our World.McGraw - Hill Book company, New York.

Shukla RS and Chandel (2005) A Text Book of Plant Ecology. S Chand and Co. Ltd., New Delhi.

Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.

Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.

Kumar, N., 1997, Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.

Edmond Musser & Andres, Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.

Agrawal, P.K. 1993, Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi.

Janick Jules. 1979. Horticultural Science. (3rd Ed.), W.H. Freeman and Co., San Francisco, USA.

SEMESTER –VI
BOTANY PRACTICAL EXAMINATION
QUESTION PAPER

Time : 5 hrs

Marks : 30

- Q. 1) To determine seed viability [A] & report the findings **05**
- Q. 2) To study the given Ecological material [B] & report the findings. **05**
- Q. 3) Electrophoretic /chromatographic separation of amino acid and carbohydrates [D].
04
- Q. 4) Morphology, anatomy and utilization of the given plant material [E]. **04**
- Q. 5) **Spotting:** **06**
E - Ecology (morphology) F - Biotechnology Instruments
G - Utilization of plant H -Utilization of plant I – Plant Nursery
Technique
J – Hybrid seed Production
- Q. 7) Viva Voice **03**
- Q. 8) Practical Record & Excursion Report **03**