UNIVERSITY OF PUNE

BOARD OF STUDIES IN BOTANY

T.Y.B.Sc. Botany Revised Syllabus

As Per Semester System

(Subject to modifications to be made time to time)

Applicable From June 2010

Minimum Requirements For Under Graduate Courses in Botany

Infrastructure-Laboratoey and Equipment, Instruments etc.

- Laboratory-30'x40'-at least two laboratories.
- Staff room-15'x10'-1
- Head Cabin with w.c15'x10'
- Instrument Room 10'x10'
- Research Lab 30'x30'
- A well established tissue culture room with AC
- Mushroom cultivation room
- Fungal culture room

Instrument :

1. Autoclave-minimum -1
2. Laminar air flow cabinet-minimum-1
3. Binocular microscope(Dissecting)-60
4. Compound Microscope -30
5. Dissecting Microscope-24
6. Microtome-Rotary-01 and hand microtome-01
7. Centrifuge machine 01
8. Spectrophotometer and Calorimeter-01 each
9. pH meter-01
10. Tilak air sampler-01
11. Rotorod air sampler-01
12. Chromatography plates and Jars-12 each
13. Computer with printer, Internet connection and scanner-minimum-2(recent P4)
14. Burette potometer-12
15. Arc indicator-2
16. Water bath-01
17. Electronic balance (Digital)-01
18. Analytical Balance-03
19. Rough Balance-01
20. Respirometer-06
21. Gas connection-01
22. Charts as per syllabus
23. Permanent slides & class work material and specimen as per syllabus.
24. Over Head Project(OHP)-minimum-01
25. Slide Projector minimum-01
26. Projection microscope-minimum-01
27. Camera Lucida-12
28. Stage micrometer and ocular 06
29. Hair hygrometer-02

30. Minimum and maximum thermometer-02
31. Water distillation plant-01
32. Suction pump-01
33. Buchner funnel-06
34. Oven-01
35. Culture racks with Lux meter-01
36. Paleobotany slides and specimen as per syllabus
37. Zoom lens camera and digital camera-01 each
38. Soil and water analysis kit-01 each
39. Imbibition pressure apparatus-01
40. Chromatography chamber-04
41. Museum specimen as per syllabus
42. Construction of poly house naturally ventilated at least 100 sq. meter area
43. Construction of shade net 120 sq. meter area
44. Construction of polyhouse-Tunnel type(80 sq. meter) for B.G.A. biofertilizer with concrete types of 3 mtrs X 1 mtrs size and 21 cm depth.
45. Vasculum, plant press and cabinet plankton Net-01 Each
46. B. O. D.Chamber-01
47. Conductivity Meter-01
48. Digital Camera-01

In addition to above list the Instruments & Equipments mentioned in earlier syllabus of T.Y.B.Sc. and S.Y.B.Sc. must be procured.

UNIVERSITY OF PUNE

BOARD OF STUDIES IN BOTANY

T.Y.B.Sc. Botany Revised Syllabus As Per Semester System

Class-T.Y.B.Sc.(To be implemented From June 2010)
Theory Courses

Paper	Course	Semester-III	Course	Semester-IV
I	BO. 331	Algae, Fungi and Bryophytes	BO. 341	Plant Physiology and Biochemistry
II	BO. 332	Molecular Biology	BO. 342	Plant Pathology
III	BO. 333	Angiosperms and Evolution	BO. 343	Pteridophytes, Gymnosperms and Palaeobotany
IV	BO. 334	Genetics and Plant Breeding	BO. 344	Plant Biotechnology
V	BO. 335	Biometry and Computer Applications	BO. 345	Botanical Techniques
VI	BO. 336	Cell Biology and seed technology	BO. 346	Pharmacognosy

Practicals based on theory papers-

Practical No.	Course	Practicals based on
Practical I	**BO. 347**	BO. 331 Algae, Fungi and Bryophytes BO. 332 Molecular Biology BO. 341 Plant Physiology and Biochemistry BO. 342 Plant Pathology
Practical II	**BO. 348**	BO. 333 Angiosperms and Evolution BO. 334 Genetics and Plant Breeding BO. 343 Pteridophytes, Gymnosperms and Palaeobotany BO. 344 Plant Biotechnology
Practical III	**BO. 349**	BO. 335 Biometry and Computer Applications BO. 336 Cell Biology and seed technology BO. 345 Botanical Techniques BO. 346 Pharmacognosy

UNIVERSITY OF PUNE
Equivalence of The T.Y.B.Sc. Botany Revised Syllabus
Semester III

Paper	Course	Semester-III New Syllabus	Course	Semester-III Old Syllabus
I	BO. 331	Algae, Fungi and Bryophytes	BO. 331	Biology of lower Cryptogams
II	BO. 332	Molecular Biology	BO. 332	Biology of higher cryptogams
III	BO. 333	Angiosperms and Evolution	BO. 333	Biology of seed Plants I (Angiosperms and Environmental Biology)
IV	BO. 334	Genetics and Plant Breeding	BO. 334	Cell Biology and Biometrics
V	BO. 335	Biometry and Computer Applications	BO. 335	Microbiology and Plant pathology
VI	BO. 336	Cell Biology and seed technology	BO. 336	Botanical Techniques and Computer Applications.

Semester IV

Paper	Course	Semester-IV(New Syllabus)	Course	Semester-IV(Old Syllabus)
I	BO. 341	Plant Physiology and Biochemistry	BO. 341	Biology of Seed Plants II (Gymnosperms and Palaeobotany)
II	BO. 342	Plant Pathology	BO. 342	Biology of Seed Plants III (Anatomy and Embryology)
III	BO. 343	Pteridophytes, Gymnosperms and Palaeobotany	BO. 343	Plant Physiology and Biochemistry
IV	BO. 344	Plant Biotechnology	BO. 344	Genetics and Plant Breeding
V	BO.345	Botanical Techniques	BO.345	Molecular Biology
VI	BO. 346	Pharmacognosy	BO. 346	Optional Paper

Semester III

Paper I: BO.331 ALGAE, FUNGI AND BRYOPHYTA (48 L)

ALGAE : **(16 L)**

1. Introduction : (2 L)

General Characters, Classification of algae as per G.M.Smith (1955) upto classes only.

2. Study of general characters, thallus structure, reproduction with example of – (9 L)

Cyanophyta, Chlorophyta, Charophyta, Phaeophyta, Rhodophyta, Pyrrophyta, Bascillariophyta, Euglenophyta, Xanthophyta.

3. Study of life cycle of algae with respect to Taxanomic position occurance, thallus structure, reproduction and economic importance of- (5L)

Nostoc, Chara, Sargassum, Batrachopermum.

FUNGI : **(16 L)**

1. Introduction : (3 L)

General Character

Classification of fungi as per Alexopoulus (1996)

Mycorrihzae: Types and application.

2. Study of general characters, somatic and reproductive phase of following classes of fungi with example- (7 L)

Myxomycetes, Chytridiomycetes, Oomycetes, Zygomycetes, Ascomycetes, Basidiomycetes, Deuteromycetes.

3. Life cycle of fungi with reference to systematic position, thallus structure, reproduction and economic importance of following fungi- (6 L)

Rhizopus, Saccharomyces, Puccinia, Cercospora

BRYOPHYTA : **(16 L)**

1. General characters and economic importance, of brayophyta, Classification up to order levels as per G.M.Smith (1955) (2 L)

2. Study of general characters, thallus structure and reproduction with examples of- (4 L)

Hepaticopsida, Anthocerotopsida and Bryopsida.

3. Study of life cycle of *Marchentia, Anthoceros, Polytrichum* with respect to thallus (Morphology and Anatomy), Sporophyte structure and reproduction. (10 L)

Reference Books :

1. **Vashistha B.R.Singh** Botany for degree students-Algae
2. **Das, Datta, Gangulle**-College Botany Vol I
3. **O.P. Sharma**-Algae
4. **Vashishta B.R. et al** Botany for degree students- Fungi
5. **P.D.Sharma** -The Fungi
6. **O.P.Sharma** -Fungi
7. **Chopra G.L. and Yadav D.L** A Text book of Bryophytes.
8. **Parihar, N.S.** An introduction to Embryoohyta: Bryophyte-I
9. **Puri Prem.** Brayophytes, Atmaram and Sons. Delhi.
10. **Vashishta B.R**. Botany for degree students Bryophytes- Vol-III
11. **Parihar N.S.** 1991. Bryophyta. Central Book Depot Allahabad.

12.**Puri P.** 1980. Bryophytes. Atma Ram and Sons, Delhi.

13.**Alexopoulus C.J** , **Mims C.W. and Blacwel M.I** 1996. Introductory Mycology. John Wiley and Sons Inc.

14.**Kumar H.D.** 1988. Introductory Phycology. Affiliated East-West Press Ltd., New Delhi.

15. Cryptogamic Botany. Vol I and II G.M.Smith

Semester III

Paper II : BO. 332 MOLECULAR BIOLOGY (48 L)

1. Molecular Biology Introduction and Concept: (6 L)

1.1 Introduction
1.2 Definition, Importance and application.
1.3 Central Dogma of molecular biology.
1.4 Model Organism for studying molecular biology.
1.5 Molecules of cell- Carbohydrates, Lipid, Nucleic Acid, Proteins

2. Nature of genetic material : (4 L)

2.1 Brief History-Emphasizing characteristics of genetic material
2.2 Physical and biological Evidences to prove DNA as genetic material(Transformation, Transduction, Conjugation)
2.3 Chargoff's Law
2.4 Franklin's and Wilkin's Work
2.5 Watson and Crick's Model of DNA
2.6 Forms of DNA A, C, D,, E, and Z and companion between of A, B and Z.
2.7 DNA content of the cell and C-value paradox
2.8 RNA as genetic material- TMV
2.9 Comparison of RNA and DNA as genetic material

3. Replication of DNA : (4 L)

3.1 Introduction and types of DNA replication.
Dispersive, Conservative and Semi-conservative.
3.2 Messelson and Stahl's Experiment.
3.3 General feature of DNA replication.
3.4 Molecular mechanism of DNA replication in Prokaryotes.
3.5 Molecular mechanism of DNA replication in eukaryotes.

4. DNA damage and repair : (5 L)

4.1 Introduction
4.2 Causes and Types of DNA damage
4.3 DNA repair system: Photo-reaction method, dark excision repair method, Mismatch repair system and Double Stranded break repair system.

5. Organization of Gene : (5 L)

5.1 Promoters-structure and function
5.2 Terminators
5.3 Units of Gene-Cistron, recon, muton
5.4 Enhancers
5.5 Split genes
5.6 Overlapping genes
5.7 Comparison in prokaryotic and eukaryotic genes

6. Transcription : (6 L)

6.1 Introduction related to formation of mRNA, tRNA, rRNA

6.2 Transcription apparatus in Prokaryotes and eukaryotes
6.3 Transcription of mRNA in Prokaryotes
6.4 Transcription of mRNA in eukaryotes
6.5 Post transcriptional event eukaryotes splicing, RNA editing and processing of mRNA.

7. Genetic Code : (3 L)

7.1 Concept
7.2 Work of Nierenberg and Khorana
7.3 Genetic code dictionary
7.4 Properties of genetic code with evidences

8. Translation-Protein synthesis : (5 L)

8.1 Introduction
8.2 Structure and role of mRNA
8.3 Structure and role of tRNA
8.4 Structure and role of ribosome
8.5 Mechanism of Translation-initiation, elongation and termination.

9. Gene action and Regulation : (4 L)

9.1 Relation of Gene and enzymes- one gene one enzyme hypothesis
9.2 Regulation of metabolism
9.3 Inducible and repressible enzymes
9.4 Gene regulation in prokaryotes-Lac operon concept
9.5 Gene regulation in eukaryotes-Britten and Davidson's Model

10. Genomics and Proteomics : (6 L)

10.1 Introduction
10.2 Method of gene sequencing(BAC sequencing, Random shotgun sequencing)
10.3 Types of Genomics- structural, functional and comparative genomics
10.4 Future of genomics
10.5 Proteomics-Scope and types.

Reference Books :

J.K.Pal and S.S.Ghaskadabi (2008) Oxford**.**-Fundamentals of Molecular Biology
R.C.Dube(2008) A Text Book of Biotechnology S. Chand
Verma and Agrawal Molecular Biology S. Chand
Devi, P. 2000 Principles and Practices of Molecular Biology
Lewin B. 2000. Genes VII. Oxford University Press, New York.
Alberts, B., **Bray, D Lewis, J., Raff, M., Roberts, K and Walter** 1999. Molecular Biology of the Cell. Garland Publishing, Inc., New York
Krishnamurthy, K.V 2000. Methods in Cell Wall Cytochemistry. CRC Press, Boca Raton, Florida.
Buchanan B.B, Gruissm W. and Jones R.L 2000. Biochemistry and Molecular.
De D.N 2000. Plant Cell Vacuoles : An Introduction. CISRO Publication, Collingwood, Australia.
Kleinsmith L.J and Kish V.M 1995. Principles of Cell and Molecular

Biology (Second Edition). Happer Collins College Publishers, New York, USA.
Lodish H., Berk A., Zipursky, S.L Matsudaira P., Baltimore D. and Darnell J. 2000. Molecular Cell Biology (Fourth Edition). W.H. Freeman and Company, New USA.
Rastogi V.B Concepts in Molecular Biology.
Twxman R.M 2003 (Third Reprint). Advanced Molecular Biology. Viva Books Pvt. Ltd., New Delhi.
Watson J.D et al**.** Molecular Biology of Gene.

Semester III

Paper III : BO.333 ANGIOSPERMS AND EVOLUTION (48 L)

1 Introduction : **(2 L)**

Review of artificial, natural and phylogenetic systems (general account)

2 Phylogenetic systems of classification : **(4 L)**

Engler and Prantl and Hutchinson systems with reference to outline and assumptions , merits and limitations.

3) Study of following families : **(16 L)**

According to Bentham & Hookers system of classification with reference to systematic position, distinguishing characters, economic importance, phylogenetic significance (if any), floral formula and floral diagram of Magnoliaceae, Papavaraceae, Leguminosae, Asteraceae, Acanthaceae, Lamiaceae, Amaranthaceae, Nyctaginaceae, Orchidaceae, Cannaceae, Poaceae

4) Origin of angiosperms : **(5 L)**

Monophyletic or Polyphyletic origin

Origin with reference to time, place and ancestry-

1) Pteridosperms theory 2) Bennettitalean theory 3) Gnetalean theory

5) Herbarium Technique : **(5 L)**

Criteria for collecting plants for herbarium, preparation of specimen for herbarium, drying, specing and disinfecting the specimens, disinfecting or poisoning of specimen, mounting, labeling, preservation of specimens, arrangement and maintenance, identification of specimens, dichotomous key for identification, major herbaria of the world, importance of herbaria.

6) Phytogeographical regions of India : **(2 L)**

7) **Endemism :** **(3 L)**

Types of endemism-

True endemics, pseudoendmics, neoendemics and palaeoendemics.

Endemic plants of Maharashtra.

8) Botanical survey of India : **(2 L)**

Organizations, aims and objectives of BSI, achievements and contribution of Western circle(Pune) of BSI

9) Floristic studies : **(3 L)**

Floristic studies in Maharashtra

Major contribution of J.D. Hooker and H. Santapau

10) Evolution : **(6 L)**

1a) Variations and speciations in plants:

Sources of variations- Mutations and recombinations, natural selection, Allopatric and sympatric speciation.

Refernces-

Stewart W.N. and Rathwell G.W. 1993. Paleobotany and the Evolution of plants. Cambridge University Press.

Cronquist, A. 1968. The Evolution and Classification of Flowering Plants. Thomas Nel and Sons, Ltd. London.

Davis P.H and V.H Heywood 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd London.

Heywood V.H 1967. Plant Taxonomy, London.

Lawrence, G.H.M 1951. Taxonomy of Vascular Plants. N.Y.

Lawrence G.H.M 1955. An Introduction to Plant Taxonomy N.Y.

Rendle A.B. 1925. The Classification of flowering plants. 2 Vols. London.

Santapau H. 1953. The Flora of Khandala on the Western Ghats of India.

Singh V. and D.K Jain, 1981 Taxonomy of Angiosperms. Rastogi Publication, Meerut.

Swingle D.B. 1946. A Text book of Systematic Botany. Mc Graw Hill Book Co. New York.

Takhtajan A. 1969. Flowering Plants; Origin and Disposal.

Pande B.P 1997. Taxonomy of Angiosperms. S.Chand.

Gurucharan Singh 2005- Systematics theory and practice (Oxford IBH)

Naik V.N.- Taxonomy of Angiosperms.

Yadav S.R. and Sardesai M.R.- Flora of Kolhapur District.

V.V.Shivrajan-Introduction to Principles plant taxonomy

Theodore Cooke(1903)- The flora of The Presidency of Bombay Vol. I, II, III

Chopra G.L.- Angiosperms

Datta S.C.- A Hand Book of Systematic Botany

Priti Shukla and **Shital Mishra-** An introduction to Taxonomy of angiosperms.

O.P.Sharma: Plant taxonomy (Tata Mc grow Hill)

Semester III

Paper IV : BO. 334 GENETICS AND PLANT BREEDING

GENETICS **(36L)**

1. Mendel's contribution to inheritance pattern-experiments, laws/ principles, monohybrid, dihybrid, test cross, back cross. (3 L)

2. Neomendelism- (6 L)

Deviations from mendelian dihybrid ratios (modified dihybrid ratios)
Interaction of genes- complementary genes, supplementary …….. duplicate/

3. Multiple allelism (2 L)

Concept, examples, *Drosophila*(eye colour), human(blood groups), self incompatibility in plants.

4.Quantitative genetics (2 L)

Multiple factor concept and heritabilsm. Qualitative and quantitative trait, inheritance of quantitative traits(*Nicotiana* and Maize)

5. Cytoplasmic Inheritance: (3 L)

Involving chloroplast(*Mirabilis*) and mitochondria(cytoplasmic male sterlity).
Mitochondrial and chloroplast genome.

6. Linkage and recombination : (5 L)

Concept, types, applications, detection of linkage.
Concept and type of recombination.
Estimation of recombination percentage and map distance.
Two and three point test crosses and significance in gene mapping.

7. Sex chromosomes in Drosophila, man and Melanodrium (5 L)

Balance concept of sex determination in Drosophila
Mechanism of sex determination.
Sex linked inheritance in Drosophila
Sex linked characters.

8.Alternation in genetic makeup (10 L)

Spontaneous and induced mutations.
Mutagens- types and mode of action (Transaction, frame shift mutations transversions.)
Changes in chromosomes structure- Origin types and effects of auto and allopolyploidy origin and meiosis in nullisomics, monosomics and trisomics

PLANT BREEDING

(12 L)

1. Introduction, scope and importance (1 L)

2. Plant introduction and acclimatization (3 L)

Concept , objectives
Advantage, disadvantage and achievement.

3. Selection (2 L)

Concept , types-mass, pure line and clonal selection.
Advantage and diadvantage

4. Hybridization (2 L)

Concept, difficulties and precaution
Procedure
Achievement

5. Heterosis and hybrid vigour (3 L)

Concept
Causes of heterosis- dominance hypothesis
Application

6. Mutation breeding (1 L)

Gamma gardens
Application

References:-

Gardner and Simmons Snustad 2005 (Eighth Edition). Principles of Genetics, John Wiley and Sons, Singapore.

Gupta P.K (1995) Genetics and Cytogenetics. Rastogi Publications, Meerut .

Sharma J.R 1994 Principles and practices of Plant Breeding. Tata McGraw-Hill Publishers Company Ltd., New Delhi.

Singh B.D 1996 Plant Breeding – Principles and methods. Kalyani Publications, Ludhiana.

Pawar C.B 2003 (First Edition). Genetics Vol. I and II. Himalaya Publishing House, Mumbai.

Burus and Bottino 1989. (Sixth Edition). The Science of Genetics. Macmillan Publishing Company, New York (USA).

Atherly, A.G., Girton, J.R. and McDonald, J.F 1999. The Science of Genetics Saunders College Publishing, Frot Worth, USA.

Strickberger 2005. (Third Edition). Genetics. Prentice Hall of India Pvt. Ltd., New Delhi.

Allard R.W 1995. Priniples of Plant Breeding. John Wiley and Sons, Ice., Singapore.

Verma P.S. and Agarwal V.K.(1991**)**, Genetics. S Chand Comp. Ltd. Ramnagar, New Delhi.

Singh B.D 2004. Genetics. Kalyani Publication, Ludhiana.

Lewin, B. 2000. Gene VII. Oxford University Press, New York, USA.

Ahluwalia K.B 2005 (First Edition). Genetics. New Age International Private Ltd. Publishers, New Delhi.

Semester III

Paper V : BO. 335 BIOMETRY AND COMPUTER APPLICATIONS (48 L)

BIOMETRY: (24 L)

1. Introduction : (4 L)

1.1 Importance and scope of statistical methods in biology
1.2 Important terms in biometry
1.3 Sampling of data: random and non random sampling
1.4 Graphic representation of data. Histograms and line graphs

2. Measures of central tendency and desperation : (5 L)

2.1 Measurement of central tendency, mean (arithmetic), mode median.
2.2 Measure of disperation- Range, mean deviation, variane standard errors, standard deviation & coefficient of variation.

3. Probability and probability distribution : (6 L)

3.1 Concept of probability definition and rules for combining probability estimation of probability and its applications
3.2 Probability distribution- Introduction, Discrete distribution
3.3 Binomial distribution and Poison distribution, Continuous distribution, Normal distribution.

4. Statistical method for testing goodness of fit : (5 L)

4.1 Testing of hypothesis- Null hypothesis
4.2 Chi-square test, level of significance
4.3 Degree of freedom, application of chi-square, limitation of chi-square .

5. Correlation and regression : (4 L)

5.1 Correlation- Introduction, types, measures of correlation coefficient of correlation and application.
5.2 Regression- Introduction, linear regression.

COMPUTER APPLICATIONS : (24 L)

1. Introduction of Computer : (3 L)

Basic Structure, ALU, CPU, memory/Input and output devices.

2. Operating devices and environment : (6 L)

2.1 Windows.
2.2 Operating environment, GUI desktop , task bar control panel, clip board, running window, applications accessories, calculator, paint brush, coral draw, Photoshop.
2.3 Windows applications.

3. Microsoft Office : (9 L)

3.1 MS-Word
3.2 MS-Excel
3.3 MS-PowerPoint

4. Computer Networking : (3 L)

4.1 Introduction
4.2 Modem
4.3 LAN and WAN.

5. Internet : (3 L)

5.1 Introduction

Internet browsing and searching biological data by using search engines.
(Web page, E-mail, Chatting, Website, Blog etc.)

References:-

Bailey, N. Statistical methods in Biology.

Panse and Sukatme – Statistical methods in Biology.

Snedecure, G.W. and Cochran- Statistical methods

Purohit S.G., V.D. Ranade, A.V.Dusane 2002 Introduction to Biometry Narendra Prakashan Pune-2.

Veer Bala Rastogi- Fundamentals of Biostatistics

Wayne W. Daniel-Biostatistics

Basendra- Computer Today

Evice A. Smith Ctall- V.B.6 Programming Files

V.Rajaraman- Fundamentals of Computer

Semester III

Paper VI: BO. 336 CELL BIOLOGY AND SEED TECHNOLOGY

CELL BIOLOGY		**(36L)**
	1. The Cell : Cell theory, comparative account of prokaryotic and eukaryotic cell	(2 L)
	2. Evolution of eukaryotic cell Development of eukaryotic cell as a predator cell, development of mitochondria and chloroplast in eukaryotic cell, development of genome.	(3 L)
	3. Cell Division (Cell replication) Types **–** Mitosis**,** Meiosis, significance, cell cycle and regulation of cell cycle.	(6 L)
	4. Structural organization of plant cell : Sub cellular organization, properties and organization of cytoplasmic matrix.	(3 L)
	5. Biogenesis, ultra structure, chemical composition, types, role (functions) of –cell wall, cell membrane, endoplasmic reticulum(ER), Golgi bodies, mitochondria, plastids, ribosomes, peroxisomes, lysosomes, glyxysomes, nucleus, chromosomes(normal, lamp brush, polytene). Concept and significance of apoptosis	(22 L)
SEED TECHNOLOGY		**(12 L)**
1.Introduction :		(2 L)
	Definition of seed, Stages of Seed Production, Classes of Seed (nucleus seed, breeders seed, foundation seed, certified seed and truthful seed), Role of sees technology.	
2. Seed certification :		
	General procedure of seed certification, field inspection, observation during inspection, field count, duties of seed inspector.	(2 L)
3. Seed processing :		(2 L)
	Principle and technique of processing of seeds	
4. Seed storage :		(2 L)
	Definition, factor affecting seed storage and need of seed storage, types of storage structure, methods of protection and control, integrated pest management, air conditioning and dehumidification, sanitation and fumigation of seed stores.	
5. Seed sampling :		(2 L)
	Seed sampling and dividing, Types of seed samples, sampling equipment.	
6. Seed Marketing :		(2 L)

	Demand forecasting, Seed pricing, projection of supply and demand for different kind of seeds	

References:-

De Robertis and De Robertis 2005 (Eight edition) (Indian) Cell and Molecular Biology, Lippincott Williams, Philadelphia. [B.I Publications Pvt. Ltd. New Delhi].

Sadova David – 2004 (First Indian Edition). Cell Biology, New Delhi.

Albert Etal 2002 (Fourth Edition). Molecular Biology of the cell, Garland Science (Iaylar and Francis) New York Group (wt)

Lodish Etal 2004 (Fifth Edition). Molecular Cell Biology, W H Freeman and company, New York.

Giese Arthur 1979 (Fifth Edition). Cell Physiology, Toppan company Ltd., Tokyo, Japan.

Cooper G.M and Hausman R.E 2007 (Fourth Edition). The Cell molecular approach Sinauer associate, Inc, Suderland (USA).

Powar C.B 2005 (Third Edition). Cell Biology, Himalaya Publishing, Mumbai.

Roy S.C and KKDe 2005 (Second Edition). Cell Biology, New central Book Agency Private Ltd., Kolkata.

Verma P.S and Agarwal V.K 2006 Cell Biology, Genetics, Molecular Biology, Evolution, Ecology. S.Chand and Company, New Delhi.

Gerald Karp 1999 Cell and Molecular Biology- Concept and Expts. John Wiley and Scne Ine., USA.

Verma and Agarwal – Seed Technology

Semester IV

Paper I : BO. 341 PLANT PHYSIOLOGY AND BIOCHEMISTRY(48 L)

PLANT PHYSIOLOGY(24 L) :

1. Photosynthesis : **(7 L)**

Ultra structure of chloroplast**,** accessory pigments and their role in photosynthesis, light reaction, electron transport chain, light harvesting complexes, Calvin cycle, photorespiration and its significance, HSK and CAM pathways.

2. Respiration : **(7 L)**

Ultra structure of mitochondria, types of respiration, Glycolysis – EMP and PPP, TCA cycle and its regulation, mitochondrial ETS, chemiosmotic theory of ATP synthesis, balance sheet of ATPs in aerobic respiration, complexes of respiratory chain.

3. Translocation of organic solutes **(3 L)**

Mechanism of translocation – diffusion, Munch hypothesis, source and sink relationship, phloem loading and unloading.

4. Seed physiology : **(3 L)**

Types and causes of seed dormancy, methods of overcoming seed dormancy.

5. Stress physiology : **(4 L)**

Concept of biotic, abiotic and xenobiotic stresses, Types of stresses – salinity, drought, heavy metals and allelobiogenesis.

BIOCHEMISTRY : (24 L)

1. Energy transformations : **(2 L)**

Laws of thermodynamics, free energy, redox potentials, activation and binding energy

2. Amino acids and proteins : **(5 L)**

Structure of Proteins-primary, secondary, tertiary and quaternary proteins), synthesis and properties of amino acids, importance of amino acids and proteins, Nonprotein amino acids – types, structure and role in plants.

3. Carbohydrates : **(4 L)**

Classification, structure and properties of carbohydrates, synthesis and breakdown of starch and cellulose

4. Lipids : **(2 L)**

General classification of lipids, properties and functions of lipids, β oxidation.

5. Enzymology : **(5 L)**

Classification, properties and mechanism of enzyme action, lock and key hypothesis, active sites of enzyme and coenzyme, enzyme kinetics - Michaelis – Menton equation, factors affecting enzyme activity – pH, temperature, inhibitors (Competitive, uncompetitive and non competitive inhibition.)

6. Metabolic pool and secondary metabolites : **(5 L)**

Metabolic pool and production of secondary metabolites through - malonic, mevalonic, shikimic acid, Acetyl CoA, TCA pathways, Role of secondary metabolites in plant defense.

References: -

Buchanan B.B, Gruissem W. and Jones R.L (2000). Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists Maryland, USA.

Salisbury F.B and Ross C.W (1992). Plant physiology (Fourth Edition) Wadsworth Publishing Company, California,USA.

William G. Hopkins (1995) Introduction to Plant Physiology, Published by – John Wiley and Sons, Inc.

Lincoln Taiz and Eduardo Zeiger (2003). Plant Physiology (3rd edition), Published by – Panima Publishing Corporation

R. G. S. Bidwell (revised edn.)-Plant Physiology

Verma S.K. and Verma Mohit (2007). A.T.B of Plant Physiology, Biochemistry and Biotechnology, S.Chand Publications.

Leninger A.C (1987). Principles of Biochmistry, CBS Publishers and Distributers (Indian Reprint)

Dennis D.T., Turpin, D.H. Lefebvre D.D. and Layzell D.B. (eds) 1997. Plant Metabolism (Second Edition) Longman, Essex, England.

Galstone A.W. 1989. Life processes in Plants. Scientific American Library, Springer Verlag, New York, USA..

Moore T.C. 1989. Biochemistry and Physiology of Plant Hormones Springer – Verlag, New York, USA.

Singhal G.S., Renger G., Sopory, S.K. Irrgang K.D and Govindjee 1999. Concept in Photobiology; Photosynthesis and Photomorphogenesis. Narosa Publishing House, New Delhi
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Taiz L. and Zeiger E. 1998. Plant Physiology (Second Edition). Sinauer Associates, Inc. Publishes, Massachusetts, USA.

Verma S.K. and Mohit Verma 2007. A.T.B of Plant Physiology, Biochemistry and Biotechnology, S.Chand Publications.

Semester IV

Paper II : BO. 342 PLANT PATHOLOGY

1 Fundamentals of plant pathology **6**

Introduction, Important terminology- Incitants, Host, Parasite, Pathogen, Inoculum, Penetration, Infection, Incubation, Disease, Disease development, Symptom, Sign, Disease cycle , Endophyte, Predisposition, Suscept, Resistance, Epidemic, Epidemiology, Etiology.
Concept of plant disease, common symptoms of plant disease, types of plant diseases according to major causal agents.
Economic importance of plant diseases, general account of history of plant pathology, Introduction to Indian Agricultural Research Institute (IARI), International Crop Research Institute for Semi Arid Tropics (ICRISAT), Contribution of Anton Bary and Prof. B.B. Mundkur.

Ref. 2,4,5,7,11,12.

2 Disease Development **6**

Concept of disease cycle, Inoculation, Prepenetration, Penetration, Infection, Dissemination.
Epidemics- Forms, Decline,, Exponential model.
Disease forecasting, Measurement of plant disease and yield loss.

Ref. 2,3,4,5,8.

3 Defence Mechanisms **3**

Concept and Definition, Types- Preexisting- Structural and chemical, Induced- Structural and Biochemical

Ref. 1,2,4,5.

4 Methods of Studying Plant Diseases **5**

Macroscopic study, Microscopic study,, Koch"s postulates.
Culture technique, Media Types and Preparation,
Pure culture methods- streak plate, Pour plate, spread plate, Serial dilution.

Ref. 5,7,8,9,10.

5 Fungal Plant Diseases **4**

Introduction to fungi as plant pathogens.
Study of Diseases- Club root of Crucifers,
Downy mildew of Grapes,
Head smut of Jowar,
Leaf spot of Turmeric,
Tikka disease of Groundnut
with reference to causal organism, symptoms and signs, disease cycle and control measures.

Ref. 1,2,4,5,7,11,12.

6 Bacterial Plant Diseases **3**

Introduction to bacteria as plant pathogens.,
Study of Diseases- Citrus Canker,
Black arm of Cotton
with reference to causal organism, symptoms and signs, disease cycle and control measures.

Ref.. 1,2,4,5,7,11,12.

7 Mycoplasma Plant Diseases **3**

Introduction to Mycoplasma as plant pathogens.,
Study of Diseases- Grassy shoot disease of sugarcane,
Little leaf of brinjal
with reference to symptoms and signs, disease cycle and control measures.

Ref. 1,2,4,5,7,11,12.

8 Nematodal Plant Diseases **2**

Introduction to Nematodes as plant pathogens.
Study of Diseases- Root knot disease of vegetables,
Ear cockle of Wheat
with reference to causal organism, symptoms and signs, disease cycle and control measures.

Ref. 1,2,4,5,7,11,12.

9 Viral Plant Diseases **3**

Introduction to Viruses as plant pathogens.
Study of Diseases- Tobacco Mosaic Disease,
Bunchy top of Banana
with reference to causal organism, symptoms and signs, disease cycle and control measures.

Ref. 1,2,4,5,7,11,12.

10 Principles of Plant Disease Control **5**

General account, Quarantine, Eradication, cultural control practices, Biological control,
Curative measures, Chemical control, Use of EMS, Microbial Pesticides, Plant Quarantine, IPM

Ref. 1,2,3,4,5,7,8,11.

11 Molecular Diagnostics **4**

Introduction, Classical approaches,
Use of antibodies- Polyclonal antibodies, Monoclonal antibodies
Serological test-Lateral flow technique

Ref. 6,7

12	**Transgenic approaches for Crop Protection** Pathogen derived resistance against bacterial and fungal diseases Plantibodies, Expression of vaccines in plants	**4**

Ref. 3,6,7

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2. **.Mehrotra, R.S.** 1991, *Plant Pathology*, Tata Mc Graw Hill Co.Delhi
3. **Chattergee, P.B.,** 1997,*Plant Protection Techniques*, Bharati Bhawan, Publ. Patana
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5. **Pandey, B.P**.2009, *Plant Pathology*, S.Chand Co.
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9. **Aneja, K.R.** 2001, *Experiments in Microbiology,plant pathology, tissue culture and Mushroom production technology*, New Age International Publishers.
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Semester IV

Paper III: BO. 343 PTERIDOPHYTES, GYMNOSPERMS AND PALAEOBOTANY (48 L)

PTERIDOPHYTES: (16 L)

1. General characters and economic importance of Pteridophytes, classification upto order as per G.M. Smith (1955). (2 L)
2. Salient features of Psilopsida, Lycopsida, Sphenopsida and Pteropsida, with examples. (2 L)
3. Study of life cycle of *Psilotum, Seleaginella,Equisetum* and *Marsilea* with reference to distribution, morphology, anatomy, reproduction, gametophyte, sporophyte and alternation of generations. (10 L)
4. Heterospory and seed habit in Pteridophytes (2 L)

GYMNOSPERMS : (16 L)

1. Introduction, economic importance and classification according to Chamebrlain(1934). (2 L)
2. Study of life cycle of *Cycas, Pinus* and *Gnetum* with reference to distribution, morphology, anatomy, reproduction, gametophyte, sporophyte, seed structure and alternation of generations. (14 L)

PALAEOBOTANY : (16 L)

1. Geological time scale. (1L)
2. Fossil- Definition, process of fossil formation, types of fossils.- impression, compression, petrifaction, pith cast and coal ball. (3L)
3. Study of following fossil groups. (12 L)
   a) Psilopsida- Salient features of order Psilophytales, external and internal morphology of *Rhynia*.
   b) Lycopsida- Salient features of order Lepidodendrales, external and internal morphology of *Lepidodendron, Sitgmaria, Lepidostrobus, Lepidocarpon, Lepidophyllum.*
   c) Sphenopsida- Salient features of Calamitales, external and internal morphology of *Calamites, Annularia, Calamostachys & Paleostachys*
   d) Pteridosperms- External and internal morphology of *Lyginopteris oldhamia*.
   e) Pentoxylae- Salient feature, external and internal morphology of stem [*Pentoxylon*], Leaf [*Nipaniophyllum*].

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1. **Sporne K.R.** 1991. The Morphology of Pteridophytes. B.I Publishing Pvt. Ltd. Bombay.
2. **Stewart W.N. and Rathwell** G.W. 1993. Paleobotany and the Evolution of plants. Cambridge University Press.
3. **Bhatnagar S.P and Moitra Alok** 1996. Gymnosperms. New Age International Pvt. Ltd. Publishers, New Delhi, 470 pp.
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15. **Parihar N.S.** 1996. Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.
16. **Arnold C.R.**-An Introduction to Palaeobotany

17. E.H.N.Andrews-Studies in Palaeobotany (Botany for Degree Students Vol.-V)

18. Shukla A.C. and **Mishra S.P.**- Essentials of Palaeobotany.

Semester IV
Paper IV : BO. 344 PLANT BIOTECHNOLOGY -(48L)

1. **Introduction to Biotechnology** **(10L)**
   - 1.1 Introduction
   - 1.2 History of Biotechnology
   - 1.3 Traditional and Modern Biotechnology
   - 1.4 Global Impact and Current excitements of Biotechnology - Health care, Environment, genomics and proteomics.
   - 1.5 Biotechnology in India and Global Trends
   - 1.6 Achievements of Biotechnology-
     Genetic Foods (GMO's), Prevention and Misused biotechnology, Biodiversity conservation, Intellectual Property Rights and Protection- forms of protection, Cryopreservation of plant stock cells and Gene bank

2. **Genetic Engineering** **(12L)**
   - 2.1 Introduction
   - 2.2 Brief history of G.E.
   - 2.3 Molecular Tools of G.E.-Restriction endonuclease, DNA ligase, Alkaline Phosphatase, DNA modifying enzymes.
   - 2.4 Steps and tools in G.E: Gel permeation, PAGE, SDS-PAGE, 2-D gel electrophoresis, spectroscopy, colorimeter,
   - 2.5 Genetic engineering and human welfare-
     Insulin, Genes for Vaccine,
     DNA probe, Monoclonal antibodies, Hybridoma

3. **Bioinformatics** **(8L)**
   - 3.1 Introduction
   - 3.2 History
   - 3.3 Database
   - 3.4 Sequence and Nomenclature
   - 3.5 Information sources
   - 3.6 Use of Bioinformatics tools in analysis

4 **Agricultural Biotechnology** **(10L)**
   - 4.1 Introduction
     Bio fertilizers-Algal, Bacterial, Azolla, Frankia, Mycorrhizal with reference to Structure, Characterization, Mass production and application
   - 4.2Biotechnology of Biological Nitrogen Fixation-
     Non symbiotic Nitrogen Fixation-Diazotrophs and their ecology, special features, Mechanism of N_2 Fixation
     Symbiotic N_2 Fixation- establishment of symbiosis, factors affecting and mechanism of symbiotic N_2 Fixation

4.2 Genetics of Diazotrophs- Nod genes, Nif gene

5 **Plant Tissue Culture** **(8L)**

5.1 Brief History
5.2 Plant protoplast culture
5.3 Somaclonal variation
5.4 Plant tissue culture in Forestry
5.5 Application of Tissue culture in GMO's, Plant pathology, Plant breeding, molecular farming
5.6 Nutritional quality (cyclodextrins, Vit. A, quality of seed protein, edible vaccines, edible antibodies, edible interferons)

Reference Books:-

R. C. Dube(2008)- A Text Book of Biotechnology, S. Chand
P.K. Gupta-Elements of Biotechnology
Satyanarayana-Biotechnology
Kalyan Kumar De-Plant tissue culture
Pal J.K. and Ghaskadabi S.S.(2008)- Fundamentals of Molecular Biology.
Verma and Agrawal- Molecular Biology
Devi P.2008-Principle and Methods of plant Molecular Biology, Biochemistry and Genetics Agrobios, Jodhpur, India.
Glick B.R. and Tompson J.E. 1993 Methods in Plant Molecular Biology and Biotechnology CRC Press Boca Raton, Florida.
Hall R.D. (Ed.)1999 Plant cell culture Protocol human press Inc., New Jersey, USA
Kumar H.D. 2002 A Text Book of Biotechnology 2nd Edn. Affiliated Easyt-West Press Private Ltd New Delhi.
Ramawat K.G. 2003 Plant Biotechnology, S. Chand & Co. Ltd . Ramnagar New Delhi. 110055
Trivedi P.C.2000 Plant Biotechnology, Panima Publishing Carpation, New Delhi.
Rajdan- Plant tissue culture.

Semester IV
Paper V : BO. 345 BOTANICAL TECHNIQUES (48 L)

1 **Microscopy** (6 L)

Introduction, Image formation(properties of light),
Lens-refraction, dispersion of light , Images, Intricacies of seeing objects, Image quality,
Magnification concept, expression, Choice of eye piece and objective combinations to ensure optimal magnification, magnification power,
Resolution -phenomenon, resolving power of microscope, contrast and resolution of images.

Ref. 1,2,3,6.

2 **Microscopes** (4 L)

Introduction, history, purpose of microscopic examination,
Types-Dissecting-uses, stereoscopic- optic principle and uses,
Compound- Construction-parts, working, optic principle, uses,

Ref. 1,2,3,6.

3 **Image Documentation** (4 L)

Camera lucida- principle, types,
Photomicrography-principle, use of SLR cameras,
Digital imaging- New opportunities, Advantages of digital camera, advantages of digitization.

Ref. 2,6.

4 **Micrometry** (3 L)

Introduction, principle, micrometer types, Eye piece Reticle/inserts , stage micrometer, calibration of ocular scale and microscope.

Ref. 1,5,6.

5 **Microtechnique** (10 L)

Introduction, preparations for microscopic observation- WM, smears, squashes, sections, Materials- cover glass, microslides- types, culture slides, watch glass, embryo cup, syracause dish, stender dish, specimen vial, couplin jar.
Equipment-Working and Use of- Hot air oven, slide warming table,
Stains-nature and use of- Brazilin, Haematoxyline, Cotton blue, Fast green, Light Green, Safranin O, Sectioning-Free hand,
Microtome Types-Hand and Rotary, Technique – Killing, fixation,dehydration, paraffin infiltration, embedding, Fixing of wax block, Microtoming, Fixing (Mounting) the ribbon of micro sections on slides, Dewaxing (Clearing), Staining, mounting , Advantages.

Ref. 2,5,8

6 **Chromatography** (5 L)

Introduction, definition, concept of partition coefficient,
Paper chromatography- principle, method, Advantages.
TLC-. principle, method, Advantages.

Ref. 1,3,7

7 **Spectroscopy** (4 L)
Definition and general principle, Beer and Lambert's law,
Mechanics of measurement.
Spectrophotometer- working and applications.

Ref. 1,3,7

8 **Centrifugation** (2 L)
Definition, factors affecting rate of sedimentation,
Types-passing remark

Ref. 1,3,7

9 **Electrochemical Techniques** (3 L)
Principle, pH meter, reference electrode, indicator electrode, oxygen electrode,
Calibration , applications.

Ref. 1,3,7

10 **Techniques with Radioisotopes** (3 L)
Isotopes and Radioactivity, Ionisation effects, Measurement units,
Measurement technique- Scintillation counting system.

Ref. 1,

11 **Aeropalynological Techniques** (4 L)
Acetolysis, slide exposure, culture plate technique,
Air samplers-Tilak, Rotorod -Working

Ref. 4,

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1 **Bisen, P.S. and Shruti Mathur** 2006, *Life science in tools and techniques*, CBS , Publishers. Delhi.

2 **Marimuthu, R**.2008, *Microscopy and Microtechnique*,MJP Publishers , Chennai.

3 **Sharma, V.K.** 1991,*Techniques in microscopy and cell biology*, Tata Mc Graw Hill Publishing Co. Ltd. Delhi.

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5 **Prasad and Prasad**, 1984, *Outlines of Microtechnique*, Emkay Publications, Delhi.

6 **Srivastava, Sharad and Singhal,Vineeta** 1995, *Laboratory Methods in Microbiology*, Anmol Publ. Pvt. Ltd., Delhi

7 **Annie and Arumugam**, 2000, *Biochemistry and Biophysics*, Saras Publication, Tamilnadu.

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Semester IV
Paper VI : BO. 346 PHARMACOGNOSY (48 L)

1. Introduction to Pharmacognosy (8L)

1.1 History, definition and Scope of Pharmacognosy
1.2 Traditional and alternative systems of medicine
1.3 Classification of crude drugs.
1.4 Concept of active principle, and major metabolic Pathways (TCA , Mevalonic, Schikkmic acid) leading to the
Production of therapeutically active Chemical Constituents

2. Ayurvedic Pharmacy (10L)

2.1 Introduction
2.2 Tridosha concept, Humoral, Indigenous systems of medicine
(Ayurveda, Siddha, Unani,Tibi)
2.3 Ayurvedic principles- Ras, Guna, Vipaka, Virya, Prabhava,
2.4 Ayurvedic formulations –
Asava, Arishta, Kvatha, Churna, Ksharas, Leha, Vatika, Taila, Bhasma.
2.5 Nutraceuticals & Cosmaceuticals,

3. Analytical Pharmacognosy (6L)

3.1 Drug adulteration
3.2 Methods of drug evaluation- Morphological, Microscopic, Chemical and Physical methods.
3.3 Biological and chemical evaluation of drugs

4. Cultivation, collection and processing of herbal drugs (8L)

4.1 Cultivation- Methods, Factors affecting cultivation
4.2 Collection and Processing
Collection, harvesting, drying, garbling, packing, storage of crude drugs.

5. Study of drugs (10L)

Study of drugs w.r.t. occurrence, distribution cultivation, microscopic characters, constituents and uses of the following.

Root Rhizome drugs :- *Glycyrrhiza , Asparagus*
Stem drugs: - *Ephedra, Tinospora*
Bark drugs: - *Cinnamon, Cinchona*
Leaf drugs: - *Aloe, Adhatoda*
Flower drugs: - *Woodfordia, Sizygium aromaticum*
Fruit drugs: - *Coriandrum, Emblica officinalis*
Seed drugs: - *Myristica, Plantago ovata*
Unorganized drugs :- *Acacia* Gum, *Asafoetida*.

6. Ethno botany (6L)

- Introduction, Definition, concepts and relevances.
- Branches of Ethno botany
- Methodology, importance of Ethnobotany in research and conservation
- Ethnic Socicties of india and world & their contribution

- Ethnobotany of Aegle marmelos, Butea monosperma, Neem (Azadirachta indica) Ficus, benghalensis w.r.t. Taxonomic description, distribution, phytochemistry and uses, Social & religious practices,

References:-

- A Pharmacognosy and Pharmacobiotechnology. New Age international (P) Limited, Publishers (formerly wiley Easterm Limited)
- **Kokate C.K.** Practical Pharmacognosy, Vallabh prakashan, New Delhi,
- **Kokate C.K. Purohit A.P. and Gokhale S.B**. Pharmacognosy, Nirali Prakashan pune
- **Trease G.E. and Evans. W.C.** Pharmacognosy ELBS Twelfth Edition
- **Tyler V.E Brady L,R and Robbers J.E.** Pharmacognosy Lea and Febiger. Philadelphia.8th edition KM Varghese and Co.Mumbai,
- **Vaidya S.S. and Dole.V.A**. Bhaishyajakalpana, Anmol Prakashan, pune
- **Wallis,T.E.** Test books of pharmacognosy CBS publishers and distributors New Delhi (Latest Edition)
- **Ashalota Razario eta**l. A Hand Book of Ethno biology Kalyani Pablishes 1999
- **Sinha R.R.& Sinha starlit** 2005 Ethnobiology, Surabhi Publ.

PRACTICALS

Practical I	**BO. 347**	BO. 331 Algae, Fungi and Bryophytes BO. 332 Molecular Biology BO. 341 Plant Physiology and Biochemistry BO. 342 Plant Pathology

Practicals based on BO. 331 Algae, Fungi and Brayophyta : **(6 P)**

Practicals based on BO. 331 Algae, Fungi and Bryophyta (2 P)

1. Study of Algae with respect to Thallus structure and reproduction of *Nosotc, Chlorella, Chara, Sargassum, Batrachospermum.*
2. Study of Fungi *Stemonites, Pythium, Rhizopus, Saccharomyces, Puccinia* and *Cercospora* with respect to thallus structure and reproductive structure. (2 P)
3. Study of bryophyte (Morphology and anatomy), structure of reproductive bodies and sporophyte of Marchantia, Anthoceros, Polytrichum. (2 P)

Practicals based on BO. 332 Molecular Biology **(6 P)**

1. Plant genomic- DNA isolation(from Cauliflower). (1 P)
2. Estimation of DNA by DPA method. (1 P)
3. Purification and quantification of DNA (1 P)
4. Isolation and estimation of RNA by Arcinol method. (1 P)
5. Problems based on transcription and translocation (2 P)

Practicals based on BO. 341 Plant Physiology and Biochemistry : **(6 P)**

1.To determine diurnal fluctuation in TAN values of CAM plants (1 P)
2. Estimation of chlorophyll- a and b by spectrometric or calorimetric method. (1 P)
3. Estimation of proteins by *Lowery* et al. method (1 P)
4. Study activity of enzymes peroxidase/ dehydrogenase/amylase (1 P)
5. Separation of Amino acids by Paper Chromatography (1 P)
6. Demonstration of: (1 P)
    a. Effect of hormones on seed germination.
    b. Ringing experiment for path of translocation
    c. Qualitative test for alkaloids, proteins, carbohydrates and tannins.

Practicals based on BO. 342 Plant Pathology : **(6 P)**

1. Study of important plant diseases- Fungal (2), Bacterial (1), Mycoplasma (1), Nematode (1), Viral (1) with reference to causal organism, symptoms, signs and control. (2 P)
   Ref. 1,2,4,5,7,11,12
2. Pathogenicity Assay OR Demonstration of Koch's postulate for a bacterial OR Fungal pathogen.OR Disease diagnosis of fungal leaf spot. (1 P)
   Ref. 3,7,9,10.
3. Isolation and maintenance of pure culture of bacterial OR fungal plant pathogen by streak/ Pour/ Spread plate/ Serial dilution method. (1 P)
   Ref. 7,9,10.

4. a) Study of Biological control OR Demonstration of Antagonism. (1 P)
   b) Demonstration Practical- Microbial pesticides, EMS, Serological test, culture media.
   Ref. 2,3,4,6,7,9,10
5. a) Visit to plant protection lab,/plant disease clinic/Agri. clinic/Bio control lab/Plant protection research institute/KVK and report writing. (1 P)
   b) Survey of plant diseases in nearby area and report writing.
   Ref. 1,2,4,5,7,11,12.

Practical II	**BO. 348**	BO. 333 Angiosperms and Evolution BO. 334 Genetics and Plant Breeding BO. 343 Pteridophytes, Gymnosperms and Palaeobotany BO. 344 Plant Biotechnology

Practicals based on BO. 333 Angiosperms and evolution: **(6 P)**

1. Study of any eight families (as per theory course) (4 P)
2. Identification of plants with the help of regional flora (1 P)
3. Preparation of an artificial key based on multiple characters/ androecium/ gynaecium/ vegetative characters (at least two keys) (1 P)

***Botanical excursion is compulsory for the students to study the endemic species, phytogeography and species of botanical interest. Student should submit visit report and ten herbarium specimens of local/common wild plants or photographs of rare, endemic or endangered plants species.**

Practicals based on BO. 334 Genetics and plant breeding : **(6 P)**

1. Testing goodness of fit of the observed F_2 phenotypic ratio with excepted Mendelian ratios. (1 P)
2. Genetic mapping using 3 points cross data. (1 P)
3. Effect of physical or chemical mutagens on crop plants (photographs) of M_1 and M_2 population. (1 P)
4. Induction of tetraploidy in onion root cells. (1 P)
5. Demonstration of techniques of hybridization (emasculation, pollination, tagging and bagging etc.) (1 P)
6. Multiple translocations in *Rhoeo discolor*. (1 P)

***Visit to plant breeding station is compulsory** (1 P)

Practicals based on BO. 343 Pteridophytes, Gymnosperms and Palaeobotany (6 P)

1. Study of Pteridophytes (Morphology and anatomy), structure of reproductive bodies of *Psilotum, Sileaginella,Equisetium* and *Marsilea* (2 P)
2. Study of Gymnosperms (Morphology and anatomy), structure of reproductive bodies of *Cycas*, *Pinus* and *Gnetum*. (2 P)
3. Study of fossil types : Impression, Compression, Petrifaction, Pithcast and Coal balls. (1 P)
4. Study of Fossil groups as per theory syllabus- Psilopsida, Lycopsida, Sphenopsida, Pteridosperms and Pentoxylae. (1 P)

Practicals based on BO. 344 Plant Biotechnology : **(6 P)**

1. Preparation and sterilization of the medium, slant preparation and inoculation-MS medium. (1 P)
2. Micro propagation of Banana / Sugarcane/ Gerbera (1 P)
3. Aseptic seed germination-legume seed (1 P)
4. Study of different biofertilizers. (1 P)
5. Gene data retrieval from the NCBI (1 P)
6. Homology Modeling through the BLAST(For Genes) (1 P)

Practical III	**BO. 349**	BO. 335 Biometry and Computer Applications BO. 336 Cell Biology and seed technology BO. 345 Botanical Techniques BO. 346 Pharmacognosy

Practicals based on BO. 335 Biometry and Computer Applications **(6 P)**

1. Analysis of data for measures of variation, estimation of Probability and calculation of correlation. (3 P)
2. Creation of folders/ files for different types of document(letter/Bio-data/ curriculum vitae) using MS-Word (1 P)
3. Preparation of pivot tables and generation of graphs using MS-Excel. Preparation of a Power Point presentation and Internet Browsing. (1 P)

Practicals based on BO. 336 Cell Biology and seed technology **(6 P)**

1. a) Cytological techniques-preparation of Fixatives, preparation of stains (Aceto-carmine and Aceto-orcein). (2 P)
   b) Study of various stages of mitosis and meiosis.
2. Study of Chromosomes Morphology (from colchicines pretreated Onion root tip cells, polytene chromosome) (1 P)
3. Procedure to adapted for obtaining certified seeds. (1P)
4. Principles and working of different seed processing equipment.(conver, elevator, indented, seed separator, gravity separator) (1 P)
5. Visit to seed processing unit/ seed storage house. (1P)

Practicals based on BO. 345 Botanical Techniques **(6 P)**

1. Image documentation of suitable botanical microscopic preparation by using camera lucida and digital camera. (1 P)
   Ref. 1,2,3,
2. Micrometry of suitable botanical material. (1 P)
   Ref. 1,2,3,5.
3. Microtomy- Preparation and processing of suitable material. (1 P)
4. Microtomy- Sectionning. (1 P)
5. Microtomy- Fixing, staining and mounting (1 P)
   Ref. 2,3,5,
6. Demonstrations- TLC chromatogram, Rotorod sampler (1 P)
   Ref. 1,3,4,
7. Verification of Beer and Lambert's law. (1 P)
   Ref. 1,3,7 ,

Practicals based on BO. 346 Pharmacognosy **(6P)**

1. Study of any six drug plants from theory syllabus(Macroscopic and Microscopic (2P)
2. Study of ethno botany of any two locally available Plants (1P)
3. Study and preparation of ayurvedic formulations - Asav, Arishtia, Churna (1P)
4. Visit to pharmaceutical industry where plant formulations are prepared (1P)
5. Extraction and Qualitative analysis of Alkaloid, Glycoside and Tannin (1P)

***All the tours and visits are compulsory as per the rules and regulations of University of Pune as an integral part of the curriculum.**

UNIVERSITY OF PUNE
T.Y.B.SC. BOTANY PRACTICAL COURESE AS PER RECISED SYLLABUS APPLICABLE FROM JUNE 2010

(EXAMINATION PATTERN 80:20 SEMESTER)

1. 20 marks internal (5 marks for attendance, sincerely, punctually, 5 marks for time to time journal completion. 5 marks for involvement of the student in the departmental activities and plantation and conversation of rare/ endangered/ plant/ medicinal/ plant in the botanical garden. 5 marks for attendance of excursion tours)
2. 80 marks for annual; examination e conducted by University and there will be two examiners one will be internal and second will be from any college of University which the examiners should have at least 5 years teaching experience at T.Y.B.Sc. level, there will be no restriction of district.
3. A batch of 12 students will be called for examination and not more than that.
4. The practical examination will be more than five hours. For which both the examiners will set the papers collectively before one hour of the examination for this the external examiners will visit the botanical garden as well by near by area and will select the required fresh plant material. All the colleges should plant mostly all the plants required for the practical and the plant which can not be planted in the garden or which are seasonal must be made available in the preserved from as class work material.
5. Each student should plant at least one medical/ plant/ endangered plant in the botanical garden and conserved it. He/ she will write a report about the growth of plants its importance, uses , status and submit at the time of examination for which certain marks will be reserved by the examiners.
6. The examiners should also reserve some marks at the time of annual examination for excursion tour report and the photographs of medicinal/ plant/ endangered plant taken during the excursion tour.