



West Bengal State University
Berunanpukuria, Barasat, North 24 Parganas,
KOLKATA-700126

SYLLABI

FOR

THREE YEARS B. Sc. DEGREE COURSE

(3 years 1+1+1 Examination System)

BOTANY

(WBSU Code 121)

2009

West Bengal State University

Barasat

Syllabi for 3 years - B. Sc. Degree Course
[3 years 1+1+1 Examination System]

BOTANY (HONOURS/ADVANCE) [WBSU Code 1211]

2009

[To be effective from 2010 – 2011 Session]

Distribution of Marks

Total Allotment – 800 Marks			
Terminal Examinations	Theoretical Assessment	Practical Assessment [External]	Total Marks
	External		
Part - I First Year	Paper - I [100] 121101	Paper III[50] 121103	200
	Paper - II [50] 121102		
Part – II Second Year	Paper - IV [100] 121104	Paper VI[50] 121106	200
	Paper - V [50] 121105		
Part – III Third Year	Paper - VII [100] 121107	Paper IX[100] 121109	400
	Paper - VIII [100] 121108	Paper X[100] 121110	
Total Marks	500	300	800

BOTA

PART - I [First Year Terminal] : 200 Marks [Theoretical aspects 150 marks and Practical aspects 50 marks]

Paper - I Theoretical 100 Marks [4hr.] (Code - 121101)

1. Algae 25 Marks [25 Periods]
2. Fungi & Lichen25 Marks [25 Periods]
3. Microbiology 25 Marks [30 Periods]
4. Plant Pathology25 Marks [25 Periods]

Paper - II Theoretical 50 Marks [2hr.] (Code - 121102)

1. Bryophyta 10 Marks [10 Periods]
2. Pteridophyta15 Marks [15 Periods]
3. Gymnosperms15 Marks [15 Periods]
4. Palaeobotany.....10 Marks [10 Periods]

Paper - III Practical 50 Marks [5 hr.] (Code - 121103)

1. Algae (work out) 10 Marks
 2. Fungi (work out) 10 Marks
 3. Microbiology (work out) 6 Marks
 4. Plant Pathology (work out)6 Marks
 5. Identification..... [3 specimens x 3 marks each.].....9 Marks
[Not more than one from Algae/Fungi/Lichen/Plant Pathology]
 6. Laboratory Note Books [No Slide]..... 4 Marks
 7. *Viva Voce* [5 Qs. x 1 mark].....5 Marks
- [Laboratory Note Book of each section, signed by the respective Teachers with date, must be submitted at the time of examination]

PART - II [Second Year Terminal]: 200 Marks
[Theoretical aspects 150 marks and Practical aspects 50 marks (external)]

Paper - IV Theoretical 100 Marks [4hr.]
(Code - 121104)

1. Morphology & Palynology20 Marks [15 Periods]
2. Taxonomy of Angiosperms50 Marks [45 Periods]
3. Ecology & Plant geography30 Marks [25 Periods]

Paper - V Theoretical 50 Marks [2hr.]
(Code - 121105)

1. Anatomy & Embryology25 Marks [25 Periods]
2. Biochemistry25 Marks [25 Periods]

Paper - VI Practical 50 Marks [5hr.]
(Code - 121106)

1. Angiosperms (work out)10 Marks
2. Anatomy (work out – double staining)10 Marks
3. Plant recognition (Angiosperm) [genus1+species1+family1].....3 Marks
4. Identification [4 specimens x 3 marks each].....12 Marks
[From Bryophyta, Pteridophyta, Gymnosperms, Palaeobotany, Anatomy; not more than two from any group]
5. Laboratory Note Books & Slides..... 4 Marks
6. Field records.....4 Marks
7. Herbarium3 Marks
8. *Viva Voce*..... [5 Qs. x 1 mark each].....4 Marks

{2Local Excursions, a visit to the BSI/CAL and One Excursion to a different Phyto-Geographical Region - are all compulsory}

[Field Records and Laboratory Note Book of each section, signed by the respective Teachers with date, must be submitted at the time of examination]

PART - III [Third Year Terminal] : 400 Marks

[Theoretical aspects 200 marks and Practical aspects 200 marks]

Paper - VII Theoretical 100 Marks [4hr.]

(Code - 121107)

1. Plant Physiology60 Marks [50 Periods]
2. Pharmacognosy.....20 Marks [15 Periods]
3. Plant Biotechnology.....20 Marks [15 Periods]

Paper - VIII Theoretical 100 Marks [4hr.]

(Code - 121108)

1. Cell Biology25 Marks [20 Periods]
2. Genetics & Molecular Biology55 Marks [45 Periods]
3. Plant Breeding & Biometry20 Marks [15 Periods]

Paper - IX Practical 100 Marks [6 hr.]

(Code - 121109)

1. Plant Physiology (Major & Minor)30 Marks
2. Biochemistry (Qualitative & Quantitative)35 Marks
3. Pharmacognosy (Two Experiments)15 Marks
4. Laboratory Note Books10 Marks
5. *Viva Voce*10 Marks

[Laboratory Note Book of each section, signed by the respective Teachers with date, must be submitted at the time of examination]

Paper - X Practical 100 Marks [6 hr.]

(Code - 121110)

1. Study of Mitotic Chromosomes25 Marks
2. Study of Meiotic Chromosomes15 Marks
3. Study of Mitotic Index10 Marks
4. Biometry15 Marks
5. Identification..... [5 specimens x 3 marks each].....15 Marks
(Specimens / Slides: - as prescribed in the syllabus)
6. Laboratory Note Books & Slides10 Marks
7. *Viva Voce*10 Marks

[Laboratory Note Book of each section, signed by the respective Teachers with date, and Slides, must be submitted at the time of examination]

PART - I : 200 Marks

Paper - I Theoretical 100 Marks (Code - 121101)

- 1. Algae 25 Marks [25 Periods]**
- 2. Fungi & Lichen 25 Marks [25 Periods]**
- 3. Microbiology 25 Marks [30 Periods]**
- 4. Plant Pathology.....25 Marks [25Periods]**

Algae

1. General account: - 1.1 Thallus organization; 1.2 Ultra-structure of Plastid, Flagella and Flagellar roots; 1.3 Ultra-structure of Heterocyst and Nitrogen fixation; 1.4 Origin and Evolution of sex, and Alternation of Generations.
2. Classification: - 2.1 Classification by Bold & Wynne (1996) - upto class with characters and examples; 2.2 Salient features of Chlorophyceae, Charophyceae, Xanthophyceae, Phaeophyceae and Rhodophyceae.
3. Cyanophyceae: - 3.1 Ultra-structure of cell; 3.2 Reproduction; 3.3 Systematic position in the biological world.
4. Bacillariophyceae [Diatoms]: - 4.1 Salient feature and Cell structure; 4.2 Reproduction & Auxospore formation.
5. Thallus organization, Reproduction (including the development of zygote) and Alternation of Generations in - *Oedogonium*, *Chara*, *Vaucheria*, *Laminaria* and *Polysiphonia*.
6. Economic Importance: - 6.1 Food, Fodder & Phycocolloid (Agar-Agar, Algin & Carrageenan); 6.2 Diatomite; 6.3 Production of SCP & Biofertilizer; 6.4 Algal toxins.

Fungi & Lichen

1. General account: - 1.1 Habits; 1.2 Ultra-structure of cell; 1.3 Spore forms and spore liberation; 1.4 Homothallism & Heterothallism; 1.5 Anamorph, Teleomorph, Degeneration of sex and Parasexuality; 1.6 Aflatoxins; 1.7 Mycorrhiza - salient features, and role in agriculture and forestry.
2. Classification: - 2.1 Concept of Kingdoms - Protists/Protozoa, Stramenopila and Fungi/Mycota; 2.2 Classification of kingdom Fungi & Stramenopila, following Hawksworth *et al.* (1995), upto phylum with characters and examples.
3. Representatives of diverse groups: - 3.1 Reproduction, Life cycle pattern and systematic position (following any system prescribed after 1975) of the following genera - *Synchytrium*, *Rhizopus*, *Ascobolus* and *Agaricus*.

4. Lichen: - 4.1 Types; 4.2 Reproduction; 4.3 Economic importance. 4.4 Role of Lichens in plant succession and pollution monitoring.

5. Economic & Medicinal Importance: - 5.1 Mushrooms - Food value & binomials of the Indian cultivars of the genera - *Agaricus*, *Calocybe*, *Pleurotus* and *Volvariella*; 5.2 Fungal sources and uses of - SCP, Baker's yeast, Ethanol, Citric acid, Tryptophan, α -Amylase, Riboflavin, Griseofulvin, Nystatin and Cyclosporin; 5.3 Medical Mycology - Definition of Mycosis; Causal Organisms and Antibiotic used in the mycoses as 'Ring worm' or Trichophytosis and Candidiasis.

Microbiology

1. Microorganisms and study of Microbiology – Primary concept; 1.1 Classification of Microorganisms and Kingdoms of Prokaryotes (Prokaryotae) and Eukaryotes (G. E. Murray 1968 & R. H. Whittaker 1969)[Preliminary idea]; 1.2 Molecular basis of modern Classification, Signature Codons, Three Domain Concept of classification (Carl R. Woese 1978) and Concept of Universal Phylogenetic Tree (Norman R. Pace 1997)[Only basic concept].

2. Archaea: - 2.1 Characteristics (brief outline); 2.2 Cell wall; 2.3 Occurrence.

3. Bacteria: - 3.1 General features; 3.2 Bacterial Growth - Binary fission, Exponential growth & Growth curve (general pattern in a closed system with a single carbon source – single phase) 3.3 Chemical natures, ultra-structures and functions of Glycocalyx, Slime layer, Flagella, Pili, & Fimbriae; 3.4 Cell wall – chemical nature and differences between Gram positive and Gram negative bacteria; 3.5 Bacterial Genome and Plasmid; 3.6 Genetic Recombination – Transformation [general process, natural and induced competence & mechanism of DNA uptake], Conjugation ['F' factor, F^+ & Hfr males, and chromosome mobilization] and Transduction [General concept and applicability]; 3.7 Bacterial Diversity – General concept and Systematic Position of the following groups: - Photosynthetic bacteria (blue-green, purple & green bacteria, concept of oxygenic and anoxygenic groups), Chlamydiae, Nitrogen fixing bacteria (symbiotic & non-symbiotic), Firmicutes & Mollicutes, Endospore forming bacteria & structure of Endospore, and Actinomycineae.

4. Viruses: - 4.1 Types of viruses and Plant viruses; 4.2 Transmission of plant virus; 4.3 TMV – physicochemical characteristics and its mode of multiplication; 4.4 T₄ Phage – structure, infection and lytic cycle; 4.5 Lambda (λ) Phage - mechanism & significance of Lysogeny; 4.6 Viroids and Prions.

5. Applied Bacteriology: - 5.1 Sources (names only) & uses of – Bacitracin, Neomycin, Streptomycin, Chloramphenicol, Amphotericin B, Amylase, Cellulase, Protease, Lysine, & Dextran; 5.2 Bacteria used (only names) in the production of Biofertilizer, Bio-gas & Bio-pesticides ; 5.3 Causal organisms (only names) of Cholera, Bacterial dysentery, Typhoid, Diphtheria, Tuberculosis, Plague and Pneumonia.

Plant Pathology

1. Terms and Definitions: - 1.1 Parasite, Pathogen & Vector; 1.2 Primary & Secondary inocula; 1.3 Infection; 1.4 Susceptibility & Virulence; 1.5 Symptoms; 1.6 Necrotroph & Biotroph; 1.7 Disease, Disease Triangle, Disease Cycle (monocyclic, polycyclic & polyetic); 1.8 Sporadic, Endemic, Epidemic & Pandemic diseases; 1.9 Koch's Postulates.

2. Host - Parasite Interaction: - 2.1 Mechanism of Infection (Pre- & Post- penetration, Mechanical & Biochemical tools of the pathogens; 2.2 Role of Pathotoxins; 2.3 Host Defense - roles of Phytoalexins & Phytoanticipins; 2.4 Resistance - Acquired and Induced systemic resistance.

3. Disease Management: - 3.1 Management Planning; 3.2 Employing Methods (Chemical, Biological & Integrated); 3.3 Quarantine; 3.4 Disease Diagnosis and Disease forecasting (preliminary ideas)

4. Disease Study: - 4.1 Study of symptoms, causal organisms, disease cycles and control measures of the following diseases - (a) Tungro Virus disease of rice, (b) Bacterial Blight of rice, (c) Late Blight of potato (d) Black Stem Rust of wheat (e) Nematode Root knot of *Brassica*.

Bibliography

Algae

1. Chapman, V.J. & Chapman, D.J.The Algae [Macmillan, London]
2. Lee, R.E.Phycology [Cambridge Univ. Press]
3. Kumar, H.D. & Singh, H.N.Introductory Phycology [East-West Press Pvt. Ltd]
4. Sharma, O.P.text Book of Algae [Tata McGraw Hill]
5. Smith, G.M.Cryptogamic Botany Vol. 1 [McGraw Hill]
6. Vashistha, B.R., Singh, A.K. & Singh, V.P.....Algae [S. Chand & Co. Pvt. Ltd.]
7. Bold, H.C. & Wynne, M.J.Introduction to Algae: Structure & Reproduction [Prentice Hall]
8. Ganguly, H.C. & Kar, A.K.....College Botany Vol.-II [New Central Book Agency]
9. Chopra, G.L.A text book of Algae [S. Nagin & Co. New Delhi]
10. Hoek, C., Mann, D.G. & Jahns, H.M. 1995Algae: an..... [Cambridge Univ. Press]

Fungi

1. Ainsworth, G.C., Sparrow, F.K. and Sussman, A.S. (Eds)..... The Fungi: An Advanced Treatise Vol. IVA & B, [Academic Press]
2. Hawksworth, D.L., Kirk, P.M., Pegler, D.N. and Sutton, B.C. 1995.....Ainsworth & Bisby's Dictionary of Fungi, 8th Ed. [CAB International]
3. Webster, J.Introduction to Fungi [Cambridge University Press]
4. Alexopoulos, C.J., Mims, C.W. and Blackwell, M.Introductory Mycology [John Wiley & Sons Inc]

5. Moore-Landecker, E.Fundamentals of the Fungi 4th Ed [Prentice Hall]
 6. Ingold, C.T. and Hudson H.J. ...The biology of the Fungi 6th Ed [Chapman & Hall]
 7. Vashistha, B.R.Fungi [S. Chand & Co. Ltd.]
 8. Sharma, P.D.Fungi and Allied Organisms [Narosa Pub. House]
 9. Ganguly, H.C. and Kar, A.K....College Botany Vol. II [New Central Book Agency]
 10. Chopra, G.L. and Verma, V.A text Book of Fungi [Pradeep Publication]
-

Microbiology

1. Atlas, R.M.Principles of Microbiology [McGraw Hill]
 2. Willey, M.J., Sherwood, L.M. & Woolverton, C.J.....Prescott, Harley and Klein's
Microbiology [McGraw Hill]
 3. Madigan, M.T., Martinko, J.M. & Parker, J.Brock Biology of Microorganisms
[Prentice Hall]
 4. Tortora, G.J., Funke, B.R. & Case, C.L.Microbiology - An Introduction
[Dorling Kindersley India Pvt. Ltd. for Pearson Education]
 5. Pelczar, M.J., Chan, P.C.S. & Krieg, N.R.Microbiology [Tata McGraw Hill]
 6. Stanier, R. Y., Ingraham, J.L., Wheelis, M.L. & Painter, P.R.General Micro-
biology [Macmillan Education Ltd.]
 7. Banerjee, A.K. & Banerjee, N. ...Fundamentals of Microbiology and Immunology
[New Central Book Agency]
 8. Dey, N.C., Dey, T.K. & Sinha, D. Medical Bacteriology...Mycology..... [NCBA]
-

Plant Pathology

1. Singh, R.S.Introduction to Principles of Plant Pathology [Oxford & IBH Co.]
 2. Singh, R.S.Plant Diseases [Oxford & IBH Co.]
 3. Sharma, P.D.Plant Pathology [Narosa Pub. House]
 4. Agrios, G.N.Plant Pathology [Harcourt Asia: Academic Press]
 5. Bilgrami, K.S. and Dubey, H.C. ..A Text Book of Modern Plant Pathology
[Vikas Pub. House]
 6. Mehrotra, R.S.Plant Pathology [Tata-McGraw-Hill]
 7. Rangaswami, G.Diseases of Crop Plants in India [Prentice Hall India]
-

Paper - II Theoretical 50 Marks (Code - 121102)

1. Bryophyta 10 Marks [10 Periods]
2. Pteridophyta15 Marks [15 Periods]
3. Gymnosperms.....15 Marks [15 Periods]
4. Palaeobotany.....10 Marks [10Periods]

Bryophyta

1. General account: - 1.1 Characteristic features; 1.2 Amphibian nature; 1.3 An outline idea of classification system following Proskauer (1957) upto class.
2. Hepaticopsida: - 2.1 Class characters; 2.2 Characteristic features of gametophytes and sporophytes of *Marchantia*;
3. Anthocerotopsida: - 3.1 Class characters; 3.2 Gametophytic and Sporophytic features of *Anthoceros*. 3.3 Development of sporophyte.
4. Bryopsida: - 4.1 Class characters; 4.2 Characteristic features of gametophytes and sporophytes of *Sphagnum* and *Funaria*.
5. Specialized topics: - 5.1 Origin of Bryophytes; 5.2 Alternation of generations in different classes and Evolution of Sporophytes (Progressive and Regressive concepts), 5.3 Roles of Bryophytes in plant succession and pollution monitoring.

Pteridophyta

1. General account: - 1.1 Characteristics; 1.2 Classification (Sporne, 1975) - upto class with characters and examples.
2. Morphology and Anatomy of vegetative body, and reproductive organs of sporophytes, and alternation of generations in - *Psilotum*, *Lycopodium*, *Selaginella*, *Equisetum* and *Dryopteris*.
3. Fossil study: - 3.1 Characteristic features of *Rhynia*; 3.2 Structural and anatomical features of *Lepidodendron* and *Calamites*.
4. Progymnosperms: - 4.1 Diagnostic features of the group; 4.2 Vegetative and reproductive features of *Archaeopteris*.
5. Specialized topics: - 5.1 Life cycle patterns in Homosporous and Heterosporous forms; 5.2 Alternation of generations and origin of sporophyte (Antithetic & Homologous theories); Telome concept (Zimmermann's hypothesis) and its

significance in the origin of Psilopsida, Lycopsida, Sphenopsida and Pteropsida. 5.3 Heterospory and seed habit.

Gymnosperms

1. General characters and Classification (Sporne, 1975) upto class with characters and examples.
2. Distribution, vegetative and reproductive morphologies of sporophytes, wood anatomy, structures of ovules, development of gametophytes and embryogeny of - *Cycas*, *Pinus* and *Gnetum*.
3. Fossil Gymnosperms: - 3.1 General characters of Pteridospermales, Cordaitales and Bennettitales; 3.2 Structural features of *Lyginopteris oldhamia* and *Cordaites*; 3.3 Reconstruction of *Williamsonia Sewardiana*.
4. Economic importance of Gymnosperms with reference to wood, resin, essential oil, fatty acid & drugs

Palaeobotany

1. Fossils: - 1.1 Definition, Types and Mode of Preservation (Schoff 1975); 1.2 Conditions for fossilization; 1.3 Palaeopalynology - a brief idea about its application.
2. Geological time scale and major events of plant life through geological ages.
3. Indian Gondwana system with major mega-fossil assemblages.

.....

Bibliography

Bryophytes

1. Parihar, N.S.-Introduction to Embryophyta: Vol. I Bryophyta [Central Book Depot]
2. Rashid, A.An Introduction to Bryophyta [Vikas Publishing House]
3. Vashishta, B.R.Bryophyta [S. Chand & Co.]
4. Ganguly, H.C. & Kar, A.K.College Botany Vol. II [New Central Book Agency]
5. Chopra, R.N. & Kumar, P.K.Biology of Bryophyte [Wiley Eastern]
6. Puri, P.Bryophyte [Atmaram & Sons]

Pteridophytes

1. Sporne, K.R.The morphology of Pteridophytes [Hutchinson & Co.]
2. Vasishta, P.C.Pteridophyta [S. Chand & Co.]
3. Gifford, E.M. & Foster, A.S.Morphology and Evolution of Vascular Plants [Freeman & Co.]
4. Mukherjee, R.N. & Chakraborty, K.An Introduction to Vascular Cryptogams (Pteridophytes) [Kalyani Publishers]
5. Ganguly, H.C. & Kar, A.K.College Botany Vol. II [New Central Book Agency]

Gymnosperms

1. Sporne, K.R. ...The Morphology of Gymnosperms [Hutchinson University Library]
2. Vasishta, P.C.Gymnosperms [S. Chand & Co.]
3. Bhatnagar, S.P. & Moitra, A.Gymnosperms [New Age International]
4. Gifford, E.M. & Foster, A.S.Morphology and Evolution of Vascular Plants
[Freeman & Co.]
5. Chamberlain, C.J.Gymnosperms: Structure & Evolution [CBS Publishers...]
6. Ganguly, H.C. & Kar, A.K.College Botany Vol. II [New Central Book Agency]

Palaeobotany

1. Arnold, C.R.An Introduction to Palaeobotany [Agrobios India]
2. Andrews, Jr. H.N.Studies in Paleobotany [John Wiley & Sons Inc.]
3. Stewart, W.N. & Rothwell, G.W...Paleobotany and evolution of plants [Cambridge
University Press]
4. Agashe, S.N.Palaeobotany [Oxford & IBH]
5. Taylor, T.N.Paleobotany-An introduction to fossil plant biology [McGraw Hill]
6. Meyen, S.V.Fundamentals of Palaeobotany [Chapman & Hall]

Paper - III Practical 50 Marks [5 hr.]
(Code - 121103)

1. Algae (work out) 10 Marks
 2. Fungi (work out) 10 Marks
 3. Microbiology (work out) 6 Marks
 4. Plant Pathology (work out) 6 Marks
 5. Identification..... [3 specimens x 3 marks each.]..... 9 Marks
[Not more than one from Algae/Fungi/Lichen/Plant Pathology]
 6. Laboratory Note Books [No Slide]..... 4 Marks
 7. *Viva Voce* [5 Qs. x 1 mark]..... 5 Marks
- [Laboratory Note Book (no slide submission) of each section, signed by the respective teachers with date, must be submitted at the time of examination]

Algae

1. [Work out] Staining (no permanent slide preparation), Free Hand Drawing and drawing under Drawing - Prism with Magnification of the following genera with reproductive structures - *Nostoc*, *Oedogonium* & *Vaucheria*.
2. Study from permanent slides of the following genera - *Gloeotrichia*, *Chara*, *Coleochaete*, Pennate diatom, *Laminaria* & *Polysiphonia*.

Fungi & Lichen

1. [Work out] Staining (no permanent slide preparation), Drawing and Microscopic Measurement of the following genera with reproductive structures - *Rhizopus* (asexual) & *Ascobolus*.
2. Study from permanent slides of the following - Zygospore of *Rhizopus*, Conidiophores & Conidia of *Penicillium*, conidia of *Fusarium* and trama, hymenium, subhymenium, basidia & basidiospores of *Agaricus* in the V. L. S. of gills.
3. Morphological study of foliose & fruticose Lichens, *Polyporus* and *Cyathus*.

Microbiology

1. [Work out] Preparation of NA, sterilization and sub-culturing
2. [Work out] Simple staining (Ziel's Carbol Fuchsin stain) from curd sample and Gram Staining from culture.

Plant Pathology

1. [Work out] Preparation of PDA and Czapek-Dox Agar (CDA), sterilization and sub-culturing.
2. [Work out] Isolation of pathogen from diseased leaf.
3. [Work out] Inoculation of fruit
4. Identification: - Pathological specimens (diseased plant) of Bacterial blight of rice and late blight of potato; Slides showing uredial, telial, pycnidial & aecial stages of *Puccinia graminis* (any variety).

PART - II : 200 Marks

Paper - IV Theoretical 100 Marks (Code - 121104)

- 1. Morphology & Palynology20 Marks [15 Periods]**
- 2. Taxonomy of Angiosperms50 Marks [45 Periods]**
- 3. Ecology & Plant geography30 Marks [25 Periods]**

Morphology & Palynology

1. Inflorescence: - 1.1 Types with examples; 1.2 Concept of advance and primitive types.
2. Flower: - 2.1 Types with examples; 2.2 Aestivation; 2.3 Floral parts – various types of Cohesion and Adhesion with examples; 2.4 Carpel – Types, advance and primitive types and Placentations.
3. Fruit: - Types with examples.
4. Palynology: - 4.1 Spore & Pollen; 4.2 Pollen wall – chemical nature, stratification & ornamentation; 4.3 NPC classification; 4.4 Basic concepts of Aeropalynology & Melissopalynology.

Taxonomy of Angiosperms

1. Introduction: - 1.1 Components and Objectives of Plant Systematics; 1.2 Alpha and Omega Taxonomy; 1.3 Data source in plant taxonomy – anatomy, cytology, Phytochemistry, Palynology etc. 1.4 Phases and Functions of taxonomy; 1.5 Phenetics – Definition, Character-state, Phenogram and OTU; 1.6 Cladistics – Definition, Cladogram, concept of monophyletic, polyphyletic & paraphyletic groups; 1.7 Plesiomorphy & Apomorphy; 1.8 Principles of Parsimony.
2. Nomenclature: - 2.1 Elementary knowledge of ICBN [Vienna code 2005 (updated 2006-07)] – Principles, Valid names [Binomial, Authors' Citation, Legitimate & Correct names, Homonym, Basionym, Autonym, Synonyms], Typification, Principle of Priority, Effective and Valid Publication, Retention and Rejection of names.
3. Herbaria & Botanical Gardens: - 3.1 Their Roles/Functions; 3.2 Important Indian Botanical Gardens & CNH-India;
4. Identification: - 4.1 Use of Floras, Monographs, Manuals and Dichotomous Keys.
5. Systems of Classification: - 5.1 Broad outline of the system [upto series/cohorts] of Bentham & Hooker (1863) with merits and demerits; 5.2 Cronquist's system (1988) [upto sub-class with characters & showing affinities] - with merits and demerits.
6. Diagnostic features, systematic positions (as in B&H, and Cronquist's system) and economically important plants (parts used & uses) of the following families:-

6.1 Dicotyledonous families – Magnoliaceae, Malvaceae, Leguminosae (subfamilies), Euphorbiaceae, Solanaceae, Verbenaceae, Scrophulariaceae, Acanthaceae, Lamiaceae, Apiaceae, Rosaceae, Cucurbitaceae, Rubiaceae & Asteraceae.

6.2 Monocotyledonous families – Alismataceae, Arecaceae, Poaceae, Liliaceae, Zingiberaceae & Orchidaceae.

Ecology & Plant Geography

1. Plant and Environment: - 1.1 Niche (multidimensional, fundamental & realized niche); 1.2 Ecotype (Ecotone, Ecads & Ecoclines); 1.3 Microclimate.

2. Population Ecology: - 2.1 Unitary and Modular organisms, Ramets & Genets (clone); 2.2 Age pyramid; 2.3 Population growth (density dependent & independent); 2.4 Carrying capacity; 2.5 Simple population growth models (difference & logistic equations).

3. Community Ecology: - 3.1 Plant succession (primary & secondary) and Seral stages (with reference to Hydrosere); 3.2 Autogenic and Allogenic succession; 3.3 α , β , γ - diversity & diversity index (Simpson index)

4. Conservation: - 4.1 Biodiversity hot spots in India; 4.2 *in situ* & *ex situ* - conservation, seed bank and Cryopreservation.

5. Plant Geography: - 5.1 Phytogeographical regions in India (Chatterjee 1960); 5.2 Dominant flora of Eastern Himalayas, and Sunderban; 5.3 Endemism - types & factors; 5.4 Geographical Information System (GIS) - a brief idea.

Bibliography

Morphology of Angiosperms

1. Mitra, D., Guha, J. & Chowdhury, S.K....Studies in Botany, Vol.I [Moulik Library]
2. Eames, A.J.Morphology of Angiosperms [McGraw Hill]
3. Lawrence, G.H.M..... (Glossary in) Taxonomy of Vascular Plants [Oxford & IBH]

Palynology

1. Mehra, P.N.Evolution of spore through the ages [Palynological Society of India, National Botanic Garden, Lucknow]
 2. Nair, P.K.K.Pollen Morphology of Angiosperms [Scholar Publication]
 3. Erdtman, G.Pollen Morphology and Plant Taxonomy [Ielden: E.G. Brill]
 4. Faegri, K. & Iverson, J.Text Book of Pollen Analysis [Oxford: Blackwell Scientific Publication]
-

Taxonomy of Angiosperms

1. Lawrence, G.H.M.Taxonomy of Vascular Plants [Oxford & IBH]
 2. Datta, S.C.Systematic Botany [Wiley Eastern]
 3. Mukherjee, S.College Botany Vol. III [New Central Book Agency]
 4. Mitra, D., Guha, J. & Chowdhury, S.K...Studies in Botany, Vol. I [Moulik Library]
 5. Naik, V.N.Taxonomy of Angiosperms [Tata McGraw Hill]
 6. Heywood, V.H.Flowering Plants of India [Oxford University Press]
 7. Stace, C.A.Plant Taxonomy and Biosystematics [Arnold Publishers]
 8. Prain, D.Bengal Plants Vol. I & II [Bishen Singh, Mahendra Pal Singh]
 9. Sivarajan, V.V.Introduction to Principles of Plant Taxonomy [Oxford & IBH]
 10. McNeill, J. (Chairman), Barrie, F. R., Burdet, H. M., Demoulin, V., Hawksworth, D. L., Marhold, K., Nicolson, D.H., Prado, J., Silva, P. C, Skog, J. E., Wiersema, J. H. (Members) & Turland, N. J. (Secretary) - the Editorial Committee of the IAPT 2006 -International Code of Botanical Nomenclature - VIENNA CODE 2005...Regnum Vegetabile 146 [Gantner Verlag K.G., ISBN 0080 - 0694]
-

Ecology & Plant geography

1. Odum, E.P.Fundamentals of Ecology [Saunders]
 2. Ambasht, R.S and Ambasht, N.KA Text book of plant Ecology [CBS Publ.]
 3. Sukla, R.S. & Chandal, P.S.Plant Ecology [S. Chand & Co.]
 4. Verma, P.S. & Agarwal, V.K.Concept of Ecology [S. Chand & Co.]
 5. Kumar, H.D.Modern Concept of Ecology [Vikas Pub House]
 6. Dhaliwal, G.S., Sangha, G.S and Ralhan, P.KFundamentals of Environmental Sciences [Kalyani Pub.]
 7. Asthana, D.K and Asthana M.Environmental Problems and Solutions [S. Chand & Co.]
 8. Cox, C.B & Moore, P.DBiogeography –An Ecological and Evolutionary Approach [Blackwell Scientific Publ.]
 9. Mani, M.S.Biogeography of India [Springer-Verlag]
 10. Mitra, D., Guha, J. & Chowdhury, S.K.....Studies in Botany Vol. II [Moulik Library]
 11. Sharma, P.D.Elements of Ecology [Rastogi Publ.]
-

Paper - V Theoretical 50 Marks (Code - 121105)

1. Anatomy & Embryology25 Marks [25 Periods]
2. Biochemistry25 Marks [25 Periods]

Anatomy & Embryology

1. Cell Wall & Stele: - 1.1 Ultrastructure, chemical composition and functions of Cell wall and middle lamella; 1.2 Ontogeny of Trachea and Sieve tube; 1.3 Types & Evolution of Stellar forms; 1.4 Concept of Floral Anatomy.
2. Stomata: - 2.1 Types of Stomata (Metcalf and Chalk, Stebbins and Khush).
3. Cambium: - 3.1 Distribution & structure; 3.2 Secondary growth.
4. Specialized Growth & Tissue organization: - 4.1 Mechanical Tissues and their distribution; 4.2 Anomalous secondary growth – in the stems of *Bignonia*, *Boerhaavia*, *Tecoma* and *Dracaena*, -and in the root of *Tinospora*; 4.3 Parastichy, Plastochrone & Leaf – trace.
5. Development: - 5.1 Organization of Shoot Apex and Root Apex (Tunica-Corpus & Körper-Kappe); 5.2 Floral Meristem and Ontogeny of Floral Parts (Primary concept).
6. Embryology: - 6.1 Sporogenesis & Gametogenesis – 6.1.1 Microsporogenesis & Microgametogenesis; 6.1.2 Megasporogenesis & Megagametogenesis (monosporic – 8 nucleate type); 6.2 Fertilization; 6.3 Development of Embryo in *Capsella bursa-pastoris* (Brassicaceae); 6.4 Development of Endosperms.

Biochemistry

1. Fundamentals: - 1.1 Covalent, non - covalent & hydrogen bonds, van der Waals interactions; 1.2 Structure & properties of water; 1.3 pH and buffer, Henderson - Hasselbalch equation; 1.4 Isoelectric point.
2. Biomolecules: - 2.1 Nucleic acids - nucleosides, nucleotides, oligo- & poly - nucleotides, different forms of DNA and RNA, nucleic acids derivatives; 2.2 Proteins - structure and classification of amino acids; Primary, Secondary, Tertiary & Quaternary structures of proteins; 2.3 Carbohydrates - structures of mono-, di-, oligo- & poly- saccharides; stereoisomers, enantiomers, epimers and anomers; sugar derivatives; 2.4 Lipids - structures of triglycerides, phospholipids and glycolipids; saturated and unsaturated fatty acids.
3. Bioenergetics and oxidation-reduction reaction: - 3.1. Laws of thermodynamics, 3.2 Open and closed system; 3.3 Exergonic and endergonic reactions; 3.4 Standard free energy (G'^0) change and actual free energy (ΔG) change; 3.5 Relation between $\Delta G'^0$ and K'_{eq} ; 3.6 Coupling of biochemical reaction (with example) and its significance;

3.7 Energy rich bond with reference to ATP; 3.8 Electromotive force, half-reaction and conjugate redox pair; 3.9 Standard reduction potential (ΔE°)

4. Enzymology: - 4.1 Definition, mechanism of action (lock and key, and induced fit hypothesis) and classification (only major groups - according to IUBMB); 4.2 Basics - Co-factor, coenzyme, prosthetic group, apoenzyme, holoenzyme, active site, activation energy, rate equation, rate constant and first order reaction; 4.3 Allosteric regulation with example; 4.4 Enzyme kinetics - steady state, velocity, and equilibrium, Michaelis-Menten equation and Lineweaver-Burk plot, and enzyme inhibition.

Bibliography

Anatomy

1. Esau, K.Plant Anatomy [Wiley Eastern]
2. Fahn, A.Plant Anatomy [Pergamon press]
3. Mauseth, J.D.Plant Anatomy [Benjamin Cummings Publications]
4. Foster, A.S.Practical Plant Anatomy [D. Van Nestnand Co.]
5. Ganguly, H.C. & Kar, A.K.College Botany Vol. I [New Central Book Agency]

Embryology

1. Maheswari, P.An Introduction to the Embryology of Angiosperms
[Tata McGraw Hill]
2. Bhojwani, S.S. & Bhatnagar, S.D.The Embryology of Angiosperms
[Vikas Publishing House]

Biochemistry

1. Voet, D. & Voet, J.G.Biochemistry [John Wiley]
2. Conn, E.E., Stumpf, P.K., Bruening, G. & Doi, R.H.Outlines of Biochemistry
[John Wiley & Sons]
3. Lehninger, A.L., Nelson, D.L. & Cox, M.M.Principles of Biochemistry [CBS]
4. Elliot, W.H. & Elliot, D.C.Biochemistry and Molecular Biology
[Oxford University Press]
5. Goodwin, T.W. & Mercer, E.I.Introduction to Plant Biochemistry
[Oxford: Pergamon]
6. Lea, P.J. & Leegwood, R.C.Plant Biochemistry and Molecular Biology
[John Wiley]
7. Berg, J.M., Tymoczko, J.L. & Stryer, L.Biochemistry [Freeman Publ.]

Paper - VI Practical 50 Marks [5 hr.]
(Code - 121106)

<u>Topics</u>	<u>Marks</u>
1. Angiosperms (work out)	10
2. Anatomy (work out- double staining).....	10
3. Plant recognition (Angiosperm) [genus 1+species 1+family 1].....	3
4. Identification..... [4 specimens x 3 marks each].....	12
[From Bryophyta/ Pteridophyta/ Gymnosperms/ Palaeobotany/ Anatomy: - Not more than two from any group]	
5. Laboratory Note Books & Slides.....	4
6. Field records.....	4
7. Herbarium.....	3
8. <i>Viva Voce</i> [4 Qs. x 1 mark each].....	4
{2 Local Excursions, a visit to the BSI/CAL and One Excursion to a Different Phyto-Geographical Region - are all compulsory}	
[Field records, Laboratory Note Book of each section, Herbarium sheets [<u>only angiospermic weeds- at least 20 sheets</u>], signed by the respective Teachers with date, and Slides, must be submitted at the time of examination]	

Angiosperms

1. [Work out] Identification of the Genus, with drawings, description, floral diagram, floral formula and identifying characters, of the wild plant specimens from the following families - **Malvaceae, Fabaceae (Papilionaceae), Solanaceae, Verbenaceae, Scrophulariaceae, Acanthaceae, Lamiaceae and Rubiaceae.**
2. **Plant recognition** - Names & Families of the specimens from the angiospermic families included in the theoretical syllabus.

Anatomy

1. [Work out] Microscopic studies on - Types of Stomata, Sclereids, Raphides, Cystolith, Aleurone grains, Laticiferous ducts and oil glands.
2. [Work out] Staining, Preparation of permanent slides and study of Anomalous secondary structures - in the stems of ***Bignonia, Boerhaavia & Dracaena***, and in the root of ***Tinospora***.

Bryophytes

1. External Morphology (macroscopic - from preserved specimens) of the gametophyte plant body and Internal Morphological (microscopic - from permanent slides) study of the features given in parentheses, in the genera as - ***Riccia*** (V.T.S. of Thallus showing Antheridia/ Archegonia/ Sporophyte), ***Marchantia*** (L.S. of gemma cup/ Antheridiophore/ Archegoniophore), ***Anthoceros*** (L.S. of sporophyte) and ***Funaria*** (L.S. of capsule)

Pteridophytes

1. External Morphology (macroscopic - from preserved specimens) of the sporophyte plant body and Internal Morphological (microscopic - from permanent slides) study of the features found in the conditions / preparations given in parentheses, in the genera as - *Psilotum* (T.S. of synangium), *Lycopodium* (L.S. of strobilus), *Selaginella* (L.S. of strobilus), *Equisetum* (L.S. / T.S. of strobilus), *Ophioglossum* (L.S. of spike), *Dryopteris* (V.T.S. of fertile pinnule through sori) and *Marsilea* (H.L.S. / V.L.S. of sporocarp).

Gymnosperms

1. Morphological and Anatomical study (from preserved specimens and permanent slides) of different parts of certain genera as stated in the following - *Cycas* (Megasporephyll, Microsporephyll & L.S. of Ovule), *Pinus* (Male Cone, Female Cone and their L.S. views) and *Gnetum* (Male and Female Cones, and L.S. of male cone and Ovule).

Palaeobotany

1. Morphological study of *Ptilophyllum* and *Glossopteris* leaf fossils.

2. Study from slides - T.S. views of the stems of *Rhynia*, *Lepidodendron*, *Calamites*, *Lyginopteris* and *Cordaites*.

PART - III : 400 Marks

Paper - VII Theoretical 100 Marks (Code - 121107)

- 1. Plant Physiology60 Marks [50 Periods]**
- 2. Pharmacognosy.....20 Marks [15 Periods]**
- 3. Plant Biotechnology.....20 Marks [15 Periods]**

Plant physiology

1. Plant water relations: - 1.1 Water transport - short distance transport by diffusion (Fick's law) & long distance transport by mass flow; 1.2 Components of water potential - osmotic potential (Van't Hoff equation), pressure potential, relation between cell water potential with its components and relative cell volume (Hoffler diagram), cell water potential and its components; 1.3 Absorption by roots - apoplastic, symplastic & transmembrane pathways; 1.4 Ascent of sap - tensile strength of water & cohesion - tension theory, role of air-water interface in the development of transpiration pull, Cavitation.

2. Transpiration: - 2.1 Stomata - micellation of guard cell; 2.2 Role of CO₂, K⁺ - ion, sucrose, blue light & abscisic acid in stomatal movement; 2.3 Antitranspirant.

3. Membrane Transport: - 3.1 Transport proteins - channels and carriers; 3.2 Primary active transport (electrogenic pump) and secondary active transport (symport & antiport).

4. Phloem Transport: - 4.1 Source & Sink; 4.2 Phloem loading & unloading, and composition of phloem sap; 4.3 Mass flow hypothesis.

5. Photosynthesis: - 5.1 Pigments - Structure of chlorophyll a & b, importance of carotenoids, and nature of phycobilins and anthocyanins; 5.2 Photobiology - Absorption and Action spectra, Red drop & Emerson effect, Photosystems & Photochemical reaction centers, Water splitting, and Cyclic and non-cyclic Photophosphorylation; 5.3 Calvin cycle and Photorespiration (mechanism & significance); 5.4 C₄ cycle (an out line), and efficiency of C₃ & C₄ plants; 5.5 CAM and its ecological significance.

6. Respiration: - 6.1 Glycolysis & its significance, and synthesis of acetyl Co-A; 6.2 Krebs cycle and its significance; 6.3 Oxidative pentose phosphate pathway and its significance; 6.4 Electron Transport System and Mechanism of Oxidative Phosphorylation; 6.5 P/e ratio; 6.6 Stoichiometry of glucose oxidation.

7. Nitrogen metabolism: - 7.1 Nitrogen fixing organisms and process of nodule formation; 7.2 Biochemistry of N₂ - fixation; 7.3 Amino acid biosynthesis (by GS-GOGAT, Transamination and direct amination); 7.4 Nitrification, nitrate assimilation and denitrification; 7.5 A general idea about *nif* and *nod* genes.

8. Growth regulators: - 8.1 Source, chemical nature, structure and role of - auxins, gibberellins, cytokinins, ethylene and abscisic acid; 8.2 Biosynthesis of IAA; 8.3 Signal Transduction pathway; 8.4 G-proteins, Ca²⁺-ion & Calmodulin: 8.5 Mode of action of GA₃.

9. Photomorphogenesis: - 9.1 Definition with example; 9.2 Photoreceptors, chemical composition of phytochrome, photostationary state and active form of phytochrome and photoreversibility.

10. Photoperiodism: - 10.1 Classification of plants, on the basis of 'Critical day length', with examples; 10.2 Importance of dark period in flowering and phytochrome control of flowering; 10.3 Photoperiodic stimulus and translocation of floral hormone; 10.4 Florigen concept; 10.5 Vernalization.

11. Dormancy: - 11.1 Concept of bud & seed dormancy; 11.2 Factors causing seed dormancy and method of breaking seed dormancy.

Pharmacognosy

1. General account: 1.1 Pharmacognosy and its importance in modern medicine; 1.2 Crude drugs; 1.3 Pharmacological and chemical classification of drugs; 1.4 Drug evaluations - (Definitions with examples of the following) - organoleptic, microscopic, chemical & physical; 1.5 Bioassay of drug - Definition and examples.

2. Secondary metabolites of plants: - 2.1 Definitions of, and difference in between, Primary and Secondary Metabolites; 2.2 Secondary metabolites and plant protection; 2.3 Utilization of major types of metabolites as drug - phenolics & quinones, terpenoids, flavonoids and alkaloids.

3. Active constituents: - Source plants, parts used, chemical nature & uses of the following - 3.1 Glycosidic anthraquinone (Barbaloin); 3.2 Tannic acid derivative (Catechin); 3.3 Resins (Gingerol, Curcuminoids); 3.4 Steroids (Diosgenin, Digitoxin); 3.5 Alkaloids (Emetine, Caffeine, Quinine, Strychnine, Reserpine, Vinblastine).

Plant Biotechnology

1. Plant Tissue Culture: - 1.1 Cellular Totipotency; 1.2 Tissue culture media; 1.3 Methods of sterilization; 1.4 Methods and applications of Callus and Cell Suspension culture; 1.5 A brief idea about Organogenesis and Somatic Embryogenesis; 1.6 Factors affecting organ induction; 1.7 Artificial seeds.

2. Other Culture Techniques: - 2.1 Methods and applications of Embryo culture; 2.2 Techniques of Pollen and Haploid culture and their applications; 2.3 Protoplast isolation and culture; 2.4 Protoplast fusion (somatic hybridization) and its importance.

3. Micropropagation: - 3.1 Definition and applications.

4. Recombinant DNA Technology:- 4.1 Restriction Endonucleases (Definition and examples), 4.2 Cloning Vector (pBR322), 4.3 Genomic and cDNA library.

5. Genetic Engineering: - 5.1 Brief idea about gene transfer methods with special reference to Ti Plasmid; 5.2 Transgenic plants and their importance.

Bibliography

Plant Physiology

1. Taiz, L & Zeiger, E.Plant Physiology [Sinauser Associates Inc. Publishers]
 2. Wilkins, M.B.Advanced Plant Physiology [ELBS, Longman]
 3. Hopkins, W.G. & Hüner, M.P.Introduction to Plant Physiology
[John Wiley & Sons.]
 3. Jain, V.K.Fundamentals of Plant Physiology [S. Chand & Co.]
 4. Salisbury, F.B. & Ross, C.W.Plant Physiology [Wordsworth Publ. Co.]
 5. Mukherji, S. & Ghosh, A.Plant physiology [New central Book Agency]
 6. Pandey, S.N & Sinha, B.K.Plant Physiology [Vikas Publ. House]
 7. Verma, S.KA Text book of Plant Physiology & Biochemistry [S. Chand & Co.]
 8. Sinha, R.K.Modern Plant Physiology [Narosa Publishing House]
 9. Hall, D.O & Rao, K.K.Photosynthesis [Cambridge Publishing House]
 10. Singhal, G.S.Concepts Photobiology, Photosynthesis & photomorphogenesis
[Narosa Publishing House]
-

Pharmacognosy

1. Wallis, T.E.Text Book of Pharmacognosy [CBS Publishers....]
 2. Evans, W.C..... (G.E. Trease & W.C. Evans') Pharmacognosy [Saunders]
 3. Melentyeva, G. & Antonova, L.Pharmaceutical Chemistry [MIR Publishers]
 4. Beckett, A.H.Practical Pharmaceutical Chemistry [CBS Publishers.....]
-

Plant Biotechnology

1. Razdan, M.K.An Introduction to Plant Tissue Culture [Oxford & IBH]
 2. Bhojwani, S.S. & Razdan, M.K.Plant Tissue Culture: Theory and Practice
[Elsevier]
 3. Dixon, R.A. & Gonzales. M.K.Plant Cell Culture: A Practical Approach
[Oxford Univ. Press]
 4. Dubey, R.C.Biotechnology [S. Chand & Co.]
 5. Balasubramanian, D. et alConcepts in Biotechnology [Universities Press]
 6. ChannarayappaMolecular Biotechnology: Principles and Practices
[Universities Press]
 7. Gamborg, O.L. & Philips, G.C.Plant Cell, Tissue and Organ Culture -
Fundamental Method [Narosa Publications]
-

Paper - VIII Theoretical 100 Marks
(Code - 121108)

- 1. Cell Biology25 Marks [20 Periods]**
- 2. Genetics & Molecular Biology55 Marks [45 Periods]**
- 3. Plant Breeding & Biometry20 Marks [15 Periods]**

Cell Biology

1. Microscopy: - 1.1 Brief knowledge about microscopy (light, Phase contrast, TEM, SEM, Immunofluorescence and confocal) 1.2 Resolving power.
2. Origin and Evolution of cells: - 2.1 Ribozyme and RNA world; 2.2 The first cell; 2.3 Origin of Eukaryotic cell; 2.4 Organellar DNA (cp- & mt- DNA).
3. Cell Membrane: - 3.1 Ultrastructure and function; 3.2 Endomembrane system and Cytoskeleton; 3.3 Cellular Organelles - Mitochondria, Plastid and Golgi apparatus.
4. Nucleus and Chromosome: - 4.1 Ultrastructure of Nuclear pore complex; 4.2 Nucleolus ultrastructure and ribosome biogenesis; 4.3 Eukaryotic chromosome - chromatin organization and DNA packaging, euchromatin and heterochromatin; 4.4 Karyotype concept and its parameters; 4.5 Brief knowledge of chromosome banding (C, G, & Q) and its application.
5. Cell Cycle & its Regulation: - 5.1 Meiotic cell division and its significance; 5.2 structure & Functions of Centromere, Kinetochore & Spindle apparatus; 5.3 Structural organization & function of Telomere; 5.4 Dynamics of chromosome movement in anaphase; 5.5 Mechanism of cell cycle control in yeast (role of MPF); 5.6 Apoptosis (Preliminary idea).

Genetics & Molecular Biology

1. Inheritance: - 1.1 Mendelian basis of inheritance and Gene Interaction; 1.2 Epistasis; 1.3 Cytoplasmic inheritance; 1.4 Sex determination; 1.5 Sex linked inheritance.
2. Linkage, Crossing over and Gene mapping: - 2.1 Complete and incomplete linkage & linkage group; 2.2 Molecular mechanism of crossing over (Holliday Model) and Detection of crossing over (McClintock's experiment); 2.3 Gene mapping (Three point test cross); 2.4 Molecular mapping- FISH and GISH (brief idea),
3. Ploidy: - 3.1 concept and examples; 3.2 Aneuploidy and Polyploidy - types, examples, meiotic behavior and importance.
4. Chromosomal aberration: - 4.1 Definition and Factors responsible; 4.2 Types, meiotic behavior and significance of Deletion, Duplication, Translocation and Inversion.

5. Mutation: - 5.1 Definition and Types (Spontaneous, Induced, Point, Transition, Transversion and Frame-Shift); 5.2 Mutagens; 5.3 Mode of action of alkylating agents.

6. DNA Replication & Protein Synthesis: - 6.1 Semiconservative replication (Meselson & Stahl experiment); 6.2 Central dogma; 6.3. Transcription and Translation.

7. Structural organization and sequence complexity of gene: - 7.1 One Gene- one Polypeptide concept; 7.2 Split gene, Homoeotic gene (*Arabidopsis* - MADS box) and overlapping gene; 7.3 Repetitive DNA & Transposon (Ac-Ds element).

8. Gene Regulation: - 8.1 Concept of Lac operon; 8.2 Positive and negative controls; 8.3 Regulation of gene expression in eukaryotes.

9. Genetic Code: - 9.1 Properties and Decipherance of code.

10. Bioinformatics: - 10.1 Preliminary knowledge about bioinformatics; 10.2 Genetic data base; 10.3 Brief idea of Genomics and Proteomics.

Plant Breeding and Biometry

1. Introduction: - 1.1 Aim and Objective of plant breeding.

2. Methods of plant breeding:- 2.1 Methods of Hybridisation - Mass selection, Pureline selection; Bulk method and Pedigree method, Male sterility and its use; 2.3 Back cross and Test cross; 2.4 Heterosis; 2.5 Maintenance of germplasm.

3. Biometry: - 3.1 Terms & Definitions- Sample and Populations, random sampling, Quantitative & Qualitative variables and frequency distribution; 3.2 Central tendency (Arithmetic Mean, Mode, & Median); 3.3 Measurement of Dispersion- standard deviation and standard error of mean; 3.4 Analysis of correlation coefficient; 3.5 Test of significance- Null hypothesis and test for Goodness of Fit; 3.6 Probability (addition and multiplication rules); 3.7 Measurement of gene frequency (Hardy-Weinberg equilibrium).

Bibliography

Cell Biology

1. De Robertis, E.D.P. & De Robertis, E.M.M.Cell and molecular Biology [Waverly Pvt. Ltd. for Lea & Fabiger]
 2. Powar, C.B.Cell Biology [Himalaya Publishing House]
 3. Cooper, G.M.The Cell - A Molecular Approach [ASM Press]
 4. Verma, P.S. & Agarwal, V.K.Concept of Cell Biology [S. Chand & Co.]
 5. Lodish, H. et al.Molecular Cell Biology [Freeman Publishers]
 6. Karp, G.Cell and Molecular Biology: Concepts and Experiments [John Wiley & Sons. Inc]
-

Genetics & Molecular Biology

1. Watson, J.D. et al. Molecular Biology of the Gene [Benjamin/Cumming Publ. Co.]
 2. Gardner, E.J., Simmons, M.J. & Snustad, D.P...Principles of Genetics [John Wiley]
 3. Gupta, P.K.Genetics [Rastogi Publications]
 4. Stickberger, M.W.Genetics [McMillan]
 5. Lewin, B.Genes (any one: - VI or VII or VIII or IX) [Oxford University Press]
 6. Weaver, R.F. & Hedrick, P.W.Genetics [WCB Publications]
 7. Stent, G.S. & Calendar, R. ...Molecular Genetics-An Introductory Narrative [CBS]
 8. Freifelder, D.Molecular Biology [Narosa Publishing House]
 9. Russell, P.J.iGenetics [Benjamin / Cumming Publ. Co.]
 10. Klug, W.S. & Cummings, M.R.Concept of Genetics [Prentice Hall]
-

Plant Breeding & Biometry

1. Chawdhuri, H.K.Elementary Principles of Plant Breeding [Oxford & IBH]
 2. Allard, R.W.Principles of Plant Breeding [John Wiley]
 3. Poehlman, J.M. & Barthakur, D.Plant Breeding [Oxford & IBH]
 4. Singh, B.D.Plant Breeding: Principles and Methods [Kalyani Publishers]
 5. Bailey, N.T.J.Statistical Method in Biology [Cambridge University Press]
 6. Sokal, R.R. & Rohlf, F.J.Introduction to Biostatistics [W H Freeman]
-

Paper - IX Practical 100 Marks [6 hr.]
(Code - 121109)

1. Plant Physiology (Major & Minor)30 Marks
 2. Biochemistry (Qualitative & Quantitative).....35 Marks
 3. Pharmacognosy (Two Experiments)15 Marks
 4. Laboratory Note Books10 Marks
 5. *Viva Voce*10 Marks
- [Laboratory Note Book of each section, signed by the respective Teachers with date, must be submitted at the time of examination]

Plant Physiology

Major [20 marks]

1. Determination of stomatal frequency and rate of transpiration per stomata per hour.
2. Rate of photosynthesis under varying HCO_3^- concentration (using bicarbonate) in an aquatic plant to find out the optimum and toxic concentration.
3. Measurement of oxygen uptake by respiring tissue (per gram / hr.)- By germinating seeds.
4. Determination of R.Q. of germinating seeds.
5. Measurement of osmotic pressure of storage tissue by weighing method.
6. Measurement of osmotic pressure in the leaf cells of *Rhoeo discolor* by plasmolytic method.

Minor [10 Marks]

1. Determination of stomatal frequency.
2. Relationship between evaporation and transpiration.
3. Extraction and detection of anthocyanins pigments from plants.
4. Separation of plastidial pigments by usual solvent system method.
5. Comparison of imbibitions of water by starchy, proteinaceous and fatty seeds.

Plant biochemistry

A. Qualitative [15 Marks]

1. Detection of organic acids - citric, oxalic, malic & tartaric from laboratory samples.
2. Detection of protein from plant samples.
3. Detection of nature of carbohydrate- glucose, fructose and starch from laboratory samples.
4. Detection of Ca, Mg, Fe and S from plant ash samples.

B. Quantitative [20 Marks]

1. Estimation of amino-nitrogen in an amino acid by formol titration method.
2. Estimation of glucose by Benedict's quantitative reagent.
3. Estimation of titrable acidity from lemon.
4. Estimation of catalase activity in plant samples.
5. Estimation of urease activity in plant samples.
6. Colorimetric estimation of protein using Folin-Ciocalteu phenol reagent.

Pharmacognosy

Major [10 marks]

1. **Chemical tests** for - (a) **Tannin** (from *Camellia sinensis* & *Terminalia chibula* - any two confirmatory tests), and (b) **Alkaloids** (**Caffeine** and **Quinine** from any drug - single test - by I₂ Soln. in KI added to the sample in acidic medium).

Minor [5 Marks]

1. **Microscopic study** of powder (of parts used in drug) - *Zingiber officinale* and *Holarrhena antidysenterica*.

2. **Histo-chemical tests** of - (a) Curcumin (*Curcuma longa*), (b) Starch in non-lignified vessel (*Zingiber officinale*) and Alkaloids (in the stem of *Catharanthus roseus* and bark of *Holarrhena antidysenterica*)

Paper - X Practical 100 Marks [6 hr.]
(Code - 121110)

1. Study of Mitotic Chromosomes25 Marks
 2. Study of Meiotic Chromosomes15 Marks
 3. Study of Mitotic Index10 Marks
 4. Biometry15 Marks
 5. Identification.....[5 specimens x 3 marks each].....15 Marks
(Specimens / Slides: - as prescribed in the syllabus)
 6. Laboratory Note Books & Slides10 Marks
 7. *Viva Voce*10 Marks
- [Laboratory Note Book of each section, signed by the respective Teachers with date, and Slides, must be submitted at the time of examination]

Study of Chromosomes & Mitotic Index

1. Chromosome Preparation: - 1.1 Pretreatment, Fixation, Staining, Squash and Smear preparation; 1.2 Preparation of permanent slides.
2. Study of Mitotic Index: - 2.1 Determination of index and frequency of different mitotic stages (to be calculated from dividing cells) in normal pre-fixed growing root tips of *Allium cepa*.
3. Study of Mitotic Chromosomes: - 3.1 Metaphase chromosome preparation, free hand drawing and drawing under drawing prism (under oil-immersion lens); 3.2 Determination of 2n number and comment on chromosome morphology of *Allium cepa*, *Nigella sativa*, and *Lens culinaris*.
4. Study of Meiotic Chromosomes: - 4.1 Smear preparation of meiotic plates, identification and free hand drawing of different meiotic stages of *Allium cepa* flower bud.
5. Identification from permanent slides: - 5.1 Meiotic cells - normal stages, abnormal stages - laggards, anaphase bridge and ring chromosome (*Rhoeo discolor*); 5.2 Mitotic cells - Abnormal stages: early separation, late separation, multipolarity, sticky bridge, fragmentation and pollen mitosis.
6. Isolation of plant genomic DNA (from Rice or Mustard seedling).

BIOMETRY

1. Determination of goodness of fit in normal and modified mono and dihybrid ratios (3:1, 9:7, 13:3, 1:1:1:1, 15:1, 9:3:3:1) by Chi-square analysis and comment on the nature of inheritance.
2. Univariate analysis of statistical data: Statistical tables, mean mode, median, standard deviation, and standard error (using seedling population/leaflet size).

West Bengal State University

Barasat

Syllabi for 3 year - B. Sc. Degree Course
[3 years 1+1+1 Examination System]

BOTANY

(GENERAL)

[WBSU Code - 1212]

2009

[Syllabus to be effective from 2010 – 2011 Session]

[Mode of internal assessment is to be made as per the directive given in the respective pages vide page No. 34 & 37]

Distribution of Marks

Total Allotment – 400 Marks				
Terminal Examinations	Theoretical Assessment	Practical Assessment		Total Marks
	External	Internal	External	
Part - I (Paper I) First Year	Paper I [100] 121201	Shall start and continue till the 2 nd Yr. Part II examination *	Nil	100
Part – II (Paper II & III) Second Year	Paper II [100] 121202	Paper III Practical** 121203		200
		80	20	
Part – III (Paper IV & V) Third Year	Paper IV [70] 121204	Paper V Practical 121205		100
		20	10	
Total Marks →	270	100	30	400

***/** It is very important to note that the Practical Classes for the topics included in the Paper III (Scheduled for Part II Exam / 2nd year Terminal Exam), should be started from First Year so as to complete the curriculum in time (see detailed syllabus).**

BOTG

PART - I [First Year Terminal] : 100 Marks

Paper - I Theoretical 100 Marks [3hr.] (Code - 121201)

Group A: - Algae, Fungi & Lichen, Plant Pathology & Microbiology.....40 Marks

Group B: - Bryophyta, Pteridophyta, Gymnosperms & Palaeobotany.....30 Marks

Group C: - Morphology & Taxonomy of Angiosperms, and Palynology.....30 Marks

Group A: - [40 Marks / 25 Periods]

Algae - [10 Marks / 6 Periods] General account.// Morphology, Reproduction & Examples of Cyanophyceae, Chlorophyceae, Bacillariophyceae, Phaeophyceae & Rhodophyceae.// Alternation of Generations in Chlorophyceae and Phaeophyceae.// Sources and uses of edible algae, agar, algin & diatomite.

Fungi & Lichen - [10 Marks / 6 Periods] General characters & types of spores.// Primary features and examples of Oomycota, Chytridiomycota, Zygomycota, Ascomycota and Basidiomycota.// Concept of Anamorph & Teleomorph.// Fungal symbiosis - Mycorrhiza, Lichens and their importance.// Sources and uses of ethanol, alpha amylase, penicillin & Griseofulvin.

Plant Pathology - [10 Marks / 6 Periods] Terms & Definitions - Pathogen, Propagule, Vector, Inoculum, Infection, Symptoms (necrosis, wilt, spot, blight, hypoplastic & hyperplastic).// Disease & Disease Cycle, Disease Triangle, Disease Management // Koch's postulates // Phytoalexins.// Symptoms, Causal organisms, Disease cycle & Control measures of - (a) Tungro virus disease of rice & (b) Late blight of potato.

Microbiology - [10 Marks / 7 Periods] Three Domains of Life.// Prokaryote & Eukaryote.// Binary fission & Exponential Growth.// Bacterial Cell Wall.// Salient features of Plant Virus & Phage.// Lytic (by T₄ phage) cycle & Lysogeny (with λ Phage).// Horizontal gene transfer and gene recombination through - Transformation, conjugation & Transduction.// Sources & Uses of Amylase & Streptomycin.

Group B: - [30 Marks / 15 Periods]

Bryophyta - [8 Marks / 4 Periods] General character (the amphibian nature).// Characters and examples of Hepaticopsida, Anthocerotopsida & Bryopsida.// Reproductive Structures and Sporophytes of *Riccia*, *Anthoceros* and *Funaria*.

Pteridophyta - [8 Marks / 4 Periods] Characters and examples of Psilophyta, Lycophyta, Sphenophyta & Filicophyta.// Structure of reproductive organs in the Sporophytes of *Lycopodium*, *Selaginella* and *Dryopteris*.

Gymnosperms - [8 Marks / 4 Periods] Concept of Progymnosperms.// Characters and examples of Cycadophyta, Coniferophyta & Gnetophyta.// Structures of Microsporangia and Ovules of *Cycas*, *Pinus* & *Gnetum*.

Palaeobotany - [6 Marks / 3 Periods] Importance of fossil study.// Definitions and Examples of Impression, Cast and Amber // Organization of Reconstructed *Williamsonia Sewardiana*.

Group C: - [30 Marks / 15 Periods]

Morphology - [5 Marks / 3 Periods] Types of Inflorescences and Flowers with Examples.// Aestivation // Cohesion and Adhesion of floral parts.

Palynology - [5 Marks / 2 Periods] Definition.// Pollen Types.// Various Branches & Applications.

Taxonomy - [20 Marks / 10 Periods] Objectives & Functions.// Alpha & Omega taxonomy, Phylogenetic Classification & Data source.// ICBN - Principles, Binomial, Authors' citations, Suffixes for major taxa & sub-groups.// Definitions of Artificial, Natural and Phylogenetic systems of classification // Classification of Dicotyledonous angiosperms, following Bentham & Hooker, upto series with characters.// Diagnostic features of the following families - **Malvaceae, Leguminosae (Fabaceae), Solanaceae, Lamiaceae, Cucurbitaceae, Asteraceae, Poaceae & Orchidaceae.**

PART - II [Second Year Terminal] : 100 Marks

Paper - II Theoretical 100 Marks [3 hr.]
(Code - 121202)

Group A: - Anatomy, Embryology, Economic Botany & Ecology.....40 Marks

Group B: - Cell Biology and Genetics30 Marks

Group C: - Biochemistry and Plant Physiology.....30 Marks

Group A: - [40 Marks / 25 Periods]

Anatomy - [10 Marks / 8 Periods] Cell wall - chemistry, ultrastructure & function.//Stomatal types.// Evolution of stelar types.// Shoot apex (Tunica-Corpus) and root apex (Körper-Kappe).// Secondary growth in the stem of *Tecoma*.

Embryology - [10 Marks / 6 Periods] Sporogenesis and Gametogenesis.// Embryo development in *Capsella bursa-pastoris*.// Endosperm development.

Economic Botany - [10 Marks / 5 Periods] Study of the following economically important plants [only binomials, families, parts used and uses] - rice & wheat // sugarcane // mung & gram // ginger & cumin // onion & garlic // tea & coffee // cinchona, neem, ipecac & vasak // mustard, ground nut & coconut // potato, pumpkin & carrot // cotton & jute // sal & teak // mango, litchi & jack fruit.

Ecology - [10 Marks / 6 Periods] Ecotype and microclimate.// Plant community.// Plant succession - Hydrosere & Xerosere.// Adaptive features of Hydrophytes, Halophytes & Xerophytes.// Biodiversity - definition & levels of biodiversity (genetic, species & ecosystem).// Methods of *in situ* & *ex situ* conservation.

Group B: - [30 Marks / 25 Periods]

Cell Biology - [10 marks / 8 Periods] Endomembrane system & Cytoskeleton.// Ultrastructure of nuclear membrane & nucleolus.// Nucleosome, euchromatin & heterochromatin.// cell cycle, interphase & cell division with reference to meiosis.// Chromosomal aberration - deletions, duplications, inversion and translocation.// Aneuploidy and polyploidy – types, importance, and role in evolution.

Genetics - [20 Marks / 17 Periods] Central dogma.// DNA replication – Meselson and Stahl's experiment & mechanism of replication.// Transcription and translation (Protein synthesis).// Genetic code – Properties.// Mendelian basis of inheritance, predicting Mendelian ratios, sex determination, sex linked inheritance, gene concept, gene interactions (allele interactions) & epistasis.// Linkage group and genetic map (three point test cross).// Test cross and back cross.// Mutation, point mutation (tautomerization, transition, transversion and frame shift).// Mutagen – examples of physical & chemical mutagens.// Brief concept of split gene, transposons & repetitive DNA.

Group C: - [30 Marks / 25 Periods]

Biochemistry - [10 marks / 8 Periods] Carbohydrates - chemistry and importance of ribose, glucose, fructose, sucrose, maltose, starch, cellulose & dextran.// Protein - primary, secondary, tertiary & quaternary structures.// Enzyme- Definition, Types and examples, co-factors, co-enzymes.

Plant Physiology - [20 Marks / 17 Periods] Transpiration - transpiration stream and pathway of water movement.// Role sugar and K^+ ion in stomatal movement.// Xylem cavitation & embolism.// Source-sink relation in phloem transport.// Photosynthesis – Absorption and action spectra, enhancement effect, PS-I & PS-II, Z-scheme and photo-phosphorylation.// Calvin cycle & RUBISCO.// Significance of photorespiration, C4 cycle & CAM.// Respiration – Glycolysis, Role of ATP, Krebs cycle, ETS & oxidative phosphorylation.// N_2 fixation and amino acid synthesis (GS - GOGAT system).// Specific role of auxine, gibberellins, cytokinin, ethylene and abscisic acid in the biological cycle of a plant.// Photomorphogenesis - physiology of flowering, phytochrome, cryptochrome & Florigen concept.

Paper - III Practical 100 Marks

(Code - 121203)

[Internal - 80 Marks] & [External - 20 Marks]

Regular & Daily Internal Assessment [60 Marks]

<u>Topics</u>	<u>Marks [Completion & Performance]</u>
1. Cryptogams - Algae/Fungi.....	8
2. Angiosperms.....	10
3. Anatomy.....	8
4. Plant Physiology.....	10
5. Study of Mitotic Chromosome.....	8
6. Field Work.....	6
7. Attendance.....	10

Field record - stating date, types of vegetation & predominant plant species present in the area visited [Two local excursions (3 x 2 = 6 Marks) are to be attended by the students]

Centralized Internal Assessment [20 Marks]

8. Identification..... [10 specimens x 2 marks each].....20

Centralized External Assessment [20 Marks]

To be scheduled by the W. B. State University

9. Laboratory note books, Slides, Field records,

Herbarium sheets..... [5+3+3+3].....14

10. Viva Voce.....6

Laboratory note books [must regularly be checked and signed with date]; **Slides** [permanent slides prepared in the class]; **Herbarium** [at least 10 (ten) herbarium specimens (sheets) of common angiospermic weeds are to be prepared by the students, stating details of the specimens].

[The materials included under Topic No. 9 are to be submitted, as and when required, at the time of external centralized examination]-----

Internal Assessment System

Pro-forma of Log Book cum Attendance Register for continuous Internal Assessment of Paper III: Effective & Valid from 2008 -09 Session

College Roll	Name	WBSU ID No.	Students' Signature with Date								Remarks (Performance) & Teachers' Signature				

Number of Columns can be adjusted to accommodate maximum dates per page;
 Number of Rows must be increased to accommodate maximum number of students per page and Cell Space should be increased to adjust signature with date in the Log Book cum Attendance Register

Internal Assessment System

To be effective from 2008-2009 Session

Paper - III Practical 100 Marks

(Code - 121203)

[Internal - 80 Marks & External - 20 Marks]

Regular & Daily Internal Assessment [60 Marks]

Performance Calculation: Percent Achievement = $\frac{A}{B} \times 100 = C \% \text{ Achievement}$

Marks to be Awarded = C % of the marks allotted to specific topic / part/ portion
Symbols used: - **A** = The Number of - Classes Attended / Field Work Attended / Specimens Worked out / Tests & Experiments Completed by the student etc.; **B** = The Number of - Classes Held / Scheduled Field Work / Number of Specimens or Test or Experiment Scheduled etc.; **C** = Percent Achievement of a student or examinee.

[or, $\frac{A}{B} \times C$ where **C** is marks allotted to the part]

Centralized Internal Assessment [20 Marks]

8. Identification..... [10 specimens x 2 marks each].....20

As per the syllabus prescribed above.

Detailed Syllabus [To be effective from 2010 - 2011 Session]

1. **Cryptogams** - Microscopic preparation, drawing, labeling, description and identification of the following - *Nostoc*, *Oedogonium*, *Chara*, *Rhizopus* & *Penicillium*.

2. **Angiosperms** - Dissection, drawing, labeling, description, floral diagram, floral formula & identification of the family of the specimens from the following families - Malvaceae, Leguminosae (Caesalpinioideae & Papilionoideae), Brassicaceae, Solanaceae & Lamiaceae.

3. **Anatomy** - Double staining & preparation of permanent slides of T. S. s of the following - Stem - *Cucurbita* & Maize,
Root - Arum & Gram,
& Leaf - *Nerium* & Tube rose.

4. **Plant Physiology** -

- Demonstration of plasmolysis,
- Measurement of leaf area (graphical method) and determination of transpiration rate per unit area by weighing method,
- Imbibitions of water by dry, proteinaceous and fatty seeds,
- Evolution of O₂ (Vol. / unit time) during photosynthesis &
- Evolution of CO₂ (Vol. / gram of material) during aerobic respiration.

5. **Study of Chromosome** - staining with aceto - orcein stain and squash preparation of onion (*Allium cepa*) root tips (pre-treated and untreated) to study mitotic chromosome and mitotic index.

6. Identification: - A: - [With reason: **Identification 1 + Reason 1 = 2 x 8 specimens (to be set in the exam.) = 16**] - [To study from preserved specimens and permanent slides] - **Cryptogams** [*Nostoc* with heterocysts & akinetes, *Oedogonium* with oogonia, *Chara* with globules and nucules, *Ectocarpus* with plurilocular sporangia, Pennate diatom, *Rhizopus* with sporangiophores and sporangia, *Penicillium* with conidiophores and conidia, *Agaricus* - the V.L.S. of gills showing trama, hymenium, basidia & basidiospores, *Riccia* - V.T.S. of Thallus through archeogonium & sporophyte, *Anthoceros* - L.S. of sporophyte, *Funaria* - L.S. of capsule, *Lycopodium* - L.S. of strobilus, *Selaginella* - L.S. of strobilus, *Dryopteris* - T.S. of pinnule through sorus] ; **Gymnosperms** [*Cycas* - mega - & micro - sporophylls, *Pinus* - male & female cones, *Gnetum* - L.S. of ovule] ; **Anatomy** [haplostele, plectostele, transfusion tissue, sunken stomata, bicollateral vascular bundle, velamen] ; **Morphology** [Inflorescence types] ; **Cytology** [Different stages of mitotic & meiotic metaphase] ;

B: - [No reasoning] **Angiosperms** [Binomials & Families] [Genus $\frac{1}{2}$ + Species $\frac{1}{2}$ + Family **1 = 2 x 2 specimens (to be set in the exam.) = 4**] - *Sida acuta*, *Abutilon indicum*, *Cassia sophera*, *Tephrosia purpurea*, *Crotalaria pallida*, *Coccinia grandis*, *Nicotiana plumbaginifolia*, *Leucas aspera*, *Leonurus sibiricus*, *Parthenium hysterophorus*, *Tridax procumbens*, *Chrysopogon aciculatus*, *Setaria glauca*, *Eclipta alba*].

PART - III [Third Year Terminal] : 100 Marks
Paper - IV Theoretical - 70 Marks // Paper - V Practical - 30 marks
(Code - 121204) // (Code - 121205)

Paper - IV Theoretical 70 Marks [3 hr.]
(Code - 121204)

(To be effective from 2010-2011)

1. Biofertilizer: - [10 marks / 5 Periods] Types of Sources, Production and Application - with reference to Rhizobium, Azotobacter, Cyanobacteria, Azolla and Mycorrhiza.
2. Mushroom: - [10 marks / 5 Periods] Food value and cultivation technique of *Pleurotus*.
3. Plant Breeding: - [10 marks / 5 Periods] Aims and Objectives; Mass and Pure line selection; Heterosis and Hybrid seed production; Maintenance of germplasm; Seed storage.
4. Measures of Central Tendency: - [9 marks / 5 Periods] Mean, Mode & Median, and their utility; Goodness of fit (Chi-square test).
5. Plant Tissue Culture: - [9 marks / 5 Periods] Callus culture and plant regeneration; Somatic embryogenesis and artificial seed; Protoplast culture; Application in agriculture, horticulture & forestry.
6. Recombinant DNA Technology: - [9 marks / 5 Periods] Recombinant DNA & restriction enzymes; Plasmid as vector; Gene cloning; Transgenic plant.
7. Pharmacognosy: - [9 marks / 5 Periods] Scope & importance; Organoleptic evaluation of crude drugs (with reference to *Alstonia* and *Rauwolfia*).
8. Bioinformatics- [4 marks / 2 Periods] A brief knowledge about application.

Paper - V Practical 30 Marks
(Code - 121205)
[Internal- 20 Marks and External - 10 Marks]

The Assessment System to be effective from 2010- 2011 session
(For New Syllabus)

Internal Assessment-

Topics	Marks
1. Bacterial Staining	7
2. Biometry	7
3. Medicinal plant Identification..... [2 specimens x 3 marks].....	6
[Genus ½ + Species ½ + Family 1+ part used ½ + uses ½ = 3]	

External Assessment-

Topics	Marks
4. Laboratory note book & Herbarium.....	5
5. Viva voce..... [4 Qs x 1 mark each].....	5

Internal Assessment System

Pro-forma of Log Book cum Attendance Register for continuous Internal

Assessment of Paper V : Effective & Valid from 2010 -2011 Session

College Roll	Name	WBSU ID No.	Students' Signature with Date										Remarks (Performance) & Teachers' Signature					

(Number of Columns can be adjusted to accommodate maximum dates per page; Number of Rows must be increased to accommodate maximum number of students per page and Cell Space should be increased to adjust signature with date in the Log Book cum Attendance Register)

Detailed Syllabus [To be effective from 2010 - 2011 Session]

Paper - V Practical 30 Marks

(Code - 121205)

[Internal- 20 Marks and External - 10 Marks]

The Assessment System to be effective from 2009- 2010 session

Internal Assessment-

Topics	Marks
1. Instrumentations.....	4
2. Bacterial Staining	5
3. Biometry	5
4. Medicinal plant Identification..... [2 specimens x 3 marks].....	6
[Genus ½ + Species ½ + Family 1+ part used ½ + uses ½ = 3]	

External Assessment-

Topics	Marks
4. Laboratory note book & Herbarium.....	5
5. Viva voce..... [4 Qs x 1 mark each].....	5

1. Instrumentations: Demonstration of:- Incubator, Autoclave, Hot Air Oven, Centrifuge, Colorimeter, pH Meter.

1. Bacterial Staining: - Staining of bacteria present in curd sample (**as available in the market / not home made**) and in the sample prepared from pure culture (**must be non-pathogenic**) by Methylene Blue and Ziel's Carbol Fuchsin stains.

2. Biometry: - Determination of Goodness - of - fit of normal monohybrid and dihybrid ratios (3:1 and 1:1 ratios) by Chi-square analysis.

3. Medicinal plant Identification [Genus ½ + Species ½ + Family 1+ part used ½ + uses ½ = 3]: - To be acquainted with, to know the binomials and the families they belong to, and to have a brief knowledge about the medicinal uses of their parts, of the following common medicinal plants - *Centella asiatica* [thankuni], *Herpestis monniera* [brahmi], *Terminalia arjuna* [arjun], *Vitex negundo* [nishinda], *Saraca asoca* [asoke], *Adhatoda vasica* [vasak], *Andrographis paniculata* [kalmegh], *Rauvolfia serpentina* [sarpagandha], *Azadirachta indica* [neem], *Holarrhena antidysenterica* [kurchi], *Boerhaavia repens* [punarnava], and *Aegle marmelos* [bel].

4. Laboratory note book & Herbarium: - The laboratory note books, signed with date by respective teachers, and Herbarium specimens of the medicinal plants examined (plant parts press-dried and attached on a sheet of art paper with a pasted slip detailing the taxonomic, vernacular and medicinal identities of the plant) must be submitted at the time of examination.

5. Viva voce..... [4 Qs x 1 mark each]:- Questions from practical portions only.

References

(In English)

1. Mitra, JN, Mitra, D & Chaudhuri, SK.....Studies in Botany Vol. I [Moulik Library]
2. Mitra, D, Guha, J, & Chaudhuri, SK.....Studies in Botany Vol. II [Moulik Library]
3. Gangulee, HC, Das, KS & Datta, CTCollege Botany Vol. I
[New Central Book Agency]
4. Gangulee, HC, & Kar, AKCollege Botany Vol. II [New Central Book Agency]
5. Ignamuthu, SPlant Biotechnology [Oxford
IBH]
6. Kumar, HDMolecular Biology and Biotechnology [Vikas Publication]
7. Mukherjee, SCollege Botany Vol. III [New Central Book Agency]

(In Bengali)

1. Ghosh, SUdvid Vidya Prayog [Bharatiya Book Stall]
2. Samajpati, N & Kumar, NUdvid Vidya [Bharatiya Book Stall]
3. Nandi, B, Nandi, S & Nandi, DUdvid Vidya Vol. I & II [NCBA]
4. Mitra, D, Guha, J, Chaudhuri, SK & Dutta, NUdvid Vignyan [Moulik Library]