

UNIVERSITY OF KALYANI

REVISED SYLLABUS

FOR THREE YEARS B.Sc. DEGREE COURSE

(HONOURS AND GENERAL)

IN

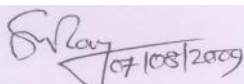
BOTANY

According to the New Examination Pattern

Part – I, Part- II & Part- III

WITH EFFECT FROM THE SESSION

2009 – 2010


Secretary, Faculty Councils (U.G.)
University of Kalyani
Kalyani, Nadia

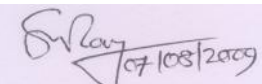
UNIVERSITY OF KALYANI
KALYANI NADIA
COUNCIL FOR UNDER GRADUATE STUDIES
PROCEEDINGS OF THE 21ST MEETING OF THE (PREVIOUS) COUNCIL FOR UG STUDIES
HELD ON 13/09/2005

Revised Structure and Distribution of Marks for Practical Based Subjects at
UG Level w.e.f. Academic Session 2005-2006

BACHELOR OF SCIENCE (GENERAL)	PART-I	PART-II	PART-III
Compulsory English : One half paper : 50 Marks Modern Indian Language : One half paper : 50 Marks	50 Marks 50 Marks	- - -	- - -
Environmental Studies : One full paper* : 100 Marks*	100 Marks*		
Elective Subjects : Three : Four full papers : 3x4x100 each =1200 Marks	3x1x100 =300 Marks	3x2x100 =600 Marks <div style="display: inline-block; vertical-align: middle; margin-left: 10px;"> { Th: 3x1x100 = 300 Marks Pr: 3x1x100 = 300 Marks </div>	3x1x100 =300 Marks <div style="display: inline-block; vertical-align: middle; margin-left: 10px;"> { Th : 3x1x 60 = 180 Marks Pr : 3x1x40 = 120 Marks </div>
AGGREGATE MARKS : 1400	500 Marks	600 Marks	300 Marks

BACHELOR OF SCIENCE (HONOURS)	PART-I	PART-II	PART-III
Compulsory English : One half paper : 50 Marks Modern Indian Language : One half paper : 50 Marks	50 Marks 50 Marks	- -	- -
Environmental Studies : One full paper* : 100 Marks*	100 Marks*	-	-
Elective subjects : Two : Three full papers : 2x3x100 each = 600 Marks	2x1x100 Marks =200 Marks	2x2x100 =400 Marks <div style="display: inline-block; vertical-align: middle; margin-left: 10px;"> { Th: 2x1x100 =200 Marks Pr: 2x1x100 =200 Marks </div>	- -
One Honours Subject = 800 Marks			
Theory: Seven Papers = 540 Marks Practical: Four Papers = 260 Marks	200 Marks (Th: 2 x 75 Marks) (Pr : 1 x 50 Marks)	200 Marks (Th: 2 x 75 Marks) (Pr : 1 x 50 Marks)	400 Marks (Th: 3 x 80 Marks) (Pr : 2 x 80 Marks)
<u>For Computer Science Honours</u>		<u>For Computer Science Honours</u>	
Theory : Seven Papers = 440 Marks Practical : Four Papers = 280 Marks Project : One Paper = 80 Marks	200 Marks (Th: 2 x 50 Marks) (Pr: 1 x 100 Marks)	200 Marks (Th: 2 x 50 Marks) (Pr: 1 x 100 Marks)	400 Marks (Th: 3 x 80 Marks) (Pr : 1 x 80 Marks) (Project : 1 x 80 Marks)
AGGREGATE MARKS : 1600	600 Marks	600 Marks	400 Marks

* With effect from the session 2009-2010.


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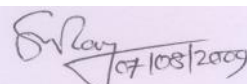
Revised Syllabus for B.Sc. (Honours) Course in

BOTANY

(w.e.f. the session 2009-2010)

According to the New Examination Pattern

Part – I, Part – II & Part – III


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University of Kalyani
Kalyani, Nadia

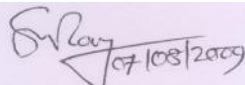
University of Kalyani

Revised Syllabus of Botany
(w.e.f. the session 2009-2010)

Contents

HONOURS COURSE

<u>PART-I</u>		
Paper-I	Biology & Diversity of Algae, Fungi and Bryophyta	(Page-H-1 to H-3)
Paper-II	Microbiology and Applied Microbiology ; Lichen and Plant Pathology	(Page-H-4 to H-6)
Paper- III	Practical	(Page-H-6)
<u>PART-II</u>		
Paper- IV	Biology and diversity of Pteridophytes and Gymnosperms; Paleobotany & Palynology	(Page-H-7 to H-9)
Paper- V	Systematic of Angiosperms and Morphology & Embryology	(Page-H-10 to H-11)
Paper- VI	Practical	(Page-H-12 to H-13)
<u>PART-III</u>		
Paper- VII	Plant Physiology and Plant Biochemistry	(Page-H-14 to H-16)
Paper- VIII	Genetics, Molecular Genetics and Plant Biotechnology	(Page-H-17 to H-18)
Paper- IX	Anatomy , Plant Breeding & Biometry, Ecology & Environmental Botany and Natural Resources and their utilization	(Page-H-19 to H-21)
Paper- X	Practical	(Page-H-21 to H-23)
Paper- XI	Practical	(Page-H-23 to H-24)


07/08/2009
Secretary, Faculty Councils (U.G.)
University of Kalyani
Kalyani, Nadia

University of Kalyani
B.Sc. (Honours) Syllabus in Botany
Total Marks : 800
(New pattern of examination system Part-I, Part-II and Part-III
from Academic Session 2005-2006)

Part I : Theoretical 2 x 75 marks, Practical 1 x 50 marks = 200

Part II : Theoretical 2 x 75 marks, Practical 1 x 50 marks = 200

Part III : Theoretical 3 x 80 marks, Practical 2 x 80 marks = 400

PART – I

Paper I :

(Full Marks :75)

Biology & Diversity of Algae, Fungi and Bryophyta

	Marks	Periods
Algae	25	25
Fungi	25	25
Bryophyta	25	25

ALGAE :

(25 marks, 25 periods) :

1. Common features of algae (4 periods)
 - 1.1 Habit and Habitat
 - 1.2 Range of thallus structure
 - 1.3 Reproduction and life cycle pattern
 - 1.4 Origin and evolution of sex
2. Classification of algae (1 period)
 - 2.1 Criteria 2.2 Classification by Lee (1989)
3. Cyanophyceae (4 periods)
 - 3.1 Salient features including chromatic adaptation
 - 3.2 Ultra Structure of cell
 - 3.3 Heterocyst
 - 3.4 Reproduction
 - 3.5 Life cycle pattern of *Anabaena* (Asexual cycle)
 - 3.6 Reasons for renaming the group as cyanobacteria and affinities with
Rhodophyceae

4. Chlorophyceae (3 periods)
 - 4.1 Salient features. Life histories of *Oedogonium* and *Coleochaete*.
5. Charophyceae (2 periods)
 - 5.1 Salient features
 - 5.2 Morphology, reproduction & life history of *Chara*
6. Bacillariophyceae (2 periods)
 - 6.1 Salient features
 - 6.2 Cell structure
 - 6.3 Vegetative multiplications
 - 6.4 Auxospore formations in centrales and pennales.
7. Phaeophyceae (2 periods)
 - 7.1 Salient features including life cycle patterns.
 - 7.2 Morphology, reproduction and life cycle of *Ectocarpus*.
8. Rhodophyceae (2 periods)
 - 8.1 Salient features
 - 8.2 Morphology, reproduction and life cycle of *Polysiphonia*
9. Economic importance of Algae (4 periods)
 - 9.1 Food
 - 9.2 Fodder
 - 9.3 Biofertilizer
 - 9.4 Phycocolloid (agar-agar, algin, caragenin)
 - 9.5 Diatomite
 - 9.6 Algal-toxin
10. An elementary knowledge about algal biotechnology. (1 period)

FUNGI**(25 marks – 25 periods)**

1. Introduction to Fungi (7 periods)
 - 1.1 Present Status. 1.2 Ultrastructure of fungal cell. 1.3 Cell wall. 1.4 Growth and nutrition. 1.5 Hyphal modifications and spore types. 1.6 Reproduction. 1.7 Life - cycle patterns. 1.8 Homothallism and Heterothallism. 1.9 Parasexuality.

2. Classification of Fungi (3 periods)
 - 2.1 Classification of Fungi (Ainsworth, 1973) upto the level of orders with distinguishing features and examples.
3. Life Histories (7 periods)
 - 3.1 *Synchytrium*. 3.2 *Rhizopus*. 3.3 *Saccharomyces*. 3.4 *Ascobolus*. 3.5 *Polyporus*. 3.6 *Agaricus*. 3.7 *Fusarium*.
4. Mushroom Cultivation (2 periods)
 - 4.1 Cultivation of oyster mushroom (*Pleurotus* sp.) and its food value.
5. A brief idea of mycotoxins and its special emphasis on aflatoxin (2 periods)
6. Mycorrhiza (2 periods)
 - 6.1 Types. 6.2 Salient features. 6.3 Role in agriculture and forestry.
7. Role of fungi as decomposers and bioremediation. (2 periods)

BRYOPHYTE THEORY**(25 Marks, 25 Periods)**

1. General Accounts : (2 periods)
 - 1.1 General Characters. 1.2 Habitats. 1.3 Amphibian nature.
2. Classification : (2 periods)
 - 2.1 Traditional and modern concepts (Smith, Cambel) in classification of bryophytes, with special reference to Shaw and Goffinet, 2000.
3. Life History : (9 periods)
 - 3.1 *Riccia*. 3.2 *Marchantia*. 3.3 *Anthoceros*. 3.4 *Sphagnum*. 3.5 *Funaria*. 3.6 Comparative studies of morphology and anatomy of gametophyte and sporophyte structures of different taxa and their broad interrelationship.
4. Phylogeny : (9 periods)
 - 4.1 Origin of Bryophytes (Algal and Pteridophycean hypothesis). 4.2 Origin of alternation of generation (Homologous and Antithetic theories). 4.3 Evolution of sporophyte (Progressive and Regressive concepts).
5. Importance of bryophytes as fuel and medicine. (3 periods)
 - 5.1 Role of bryophytes in pollution management and plant succession.

Paper II :**Microbiology and Applied Microbiology ; Lichen and Plant Pathology****(Full Marks : 75)**

	Marks	Periods
Microbiology and Applied Microbiology	40	40
Lichen	5	2
Plant Pathology	25	25

MICROBIOLOGY**(Marks – 25, Periods – 25)****VIRUS****(10 marks – 10 periods)**

1. Salient features and nature of viruses. (1 period)
2. Virus types according to capsid symmetry and nucleic acid . (1 period)
3. Structural organization and chemistry of TMV , T₄ and Influenza viruses. (2 period)
4. Replication/multiplication of T₄ – lytic cycle, and γ phage – lysogenic cycle. (2 periods)
5. Outline of plant virus transmission and its control . (2 periods)
6. Brief idea about – Viroids, Prion and HIV. (2 periods)

BACTERIA**(15 marks – 15 periods)**

1. History of bacteriology (1 period)
2. Salient features of Archeaea and Eubacteria (1 period)
3. Structure and functions of a typical bacterial cell. (1 period)
 - 3.1 Capsule and slime layer.
 - 3.2 Cell wall – physical and chemical nature.
 - 3.3 Cell membrane.
 - 3.4 Cell appendages – flagella, pilli and fimbriae.
 - 3.5 Cell inclusions.
 - 3.6 Nucleoid and plasmid.
4. Endospore (formation and structure) and Exospore (mention only)
5. Reproduction (1 period)
 - 5.1 Brief idea about binary fission. 5.2 Budding.

6. Bacterial growth : (3 periods)
 6.1 Definition and generation time.
 6.2 Growth kinetics – physical and nutritional conditions.
 6.3 Growth curve.
7. Bacterial Recombination : (4 periods)
 7.1 Transformation mechanism.
 7.2 Conjugation mechanism, concept of F' .
 7.3 Transduction – generalized and specialized.

APPLIED MICROBIOLOGY**(15 marks – 15 periods)**

1. Producing organising of Vinegar; Yogurt/Curd; Bread; SCP; Cheese; Idli; Soya sauce. (5 periods)
2. Primary and secondary metabolites producing organisms and uses of the followings : (3 periods)
 i) Enzymes (amylase and protease)
 ii) Amino acids (glutamic acid and lysine)
 iii) Organic acid (citric acid)
 iv) Antibiotics (Streptomycin, penicillin, griseofulvin)
 v) Alcohol and dextran
3. Biofertilizer: Production, application & uses of *Rhizobium* (5 periods) and *Azotobacter* (*in brief*).
4. Microbial Ecology : Rhizosphere & phyllosphere microbes, rizosp here effects, biofilm, bioremediation (definition with examples) (2 periods)

LICHEN**(5 marks, 2 periods)**

- 1 Types. 2 Economic and ecological importance.

PLANT PATHOLOGY**(30 Marks, 33 Periods)**

1. Disease Concept. 1.1 Causes of Disease. 1.2 Disease symptoms. 1.3 Types and classification of plant diseases. (6 periods)
2. Stages in disease development (In brief) (4 periods)
 2.1 Inoculum. 2.2 Infection. 2.3 Penetration. 2.4 Dissemination and perpetua tion of pathogens.
3. Mechanism of Pathogenesis (4 periods)
 3.1 Role of pathogen enzymes 3.2 Pathogen toxins – types and role.3.3 Kochs Postulates.

4. Host Defense Mechanism (4 periods)
4.1 Brief account of structural and chemical defense. 4.2 Phytoalexins – types and role in defense.
5. Brief account of genetics of resistance and susceptibility. (2 period)
6. An introduction to the concept of plant disease epidemiology (2 period)
7. Plant Disease Management (5 periods)
7.1 Physical. 7.2 Chemical. 7.3 Biological
8. Study of Plant Disease (6 periods)
8.1 Late Blight of Potato. 8.2 Brown spot of Rice. 8.3 Loose Smut of wheat. 8.4 Black Stem Rust of wheat. 8.5 Bacterial Blight of rice. 8.6 Tobacco Mosaic Virus Disease.

Paper III (Practical)**Full Marks : 50**

	Marks	
1. Work out Algae\Fungi	10 x1 = 10	10
2. Work out Bryophyta	10 x 1 =10	10
3. Microbiology work out/ Plant Pathology (comment on)	8 x 1 = 8 3 x 3 = 9	8 9
4. Spot Identification Algae (1), Fungi (1), Lichen\ Bryophyta (1), Plant Pathology (1)	3 x 1 =3	3
5. Practical Notebooks, Slide and other records	4 +2 = 6	6
6. Viva	4	4

ALGAE

- A. Work out of the following algal types with reproductive structures through staining, mounting, camera lucida drawing with magnification : *Anabaena*, *Oedogonium*, *Chara*, *Ecotocarpus*, *Polysiphonia* .
- B. Study from permanent slides :
Centric and pinnate diatom, *Volvox*, *Ulothrix*, *Pithophora*, *Coleochaete*, *Sargassum*.

FUNGI, LICHEN & PATHOLOGY

- A. Work out the following fungal specimens with reproductive structures (microscopic measurement of reproductive structures): *Rhizopus*, *Penicillium*, *Ascobolus*, *Agaricus*.
- B. Morphological studies
Lichen - Crustose, fruticose & foliose, *Cyathus*, *Lycoperdon*, *Polyporus*.
- C. Study from permanent slides
Zygosporangium of *Rhizopus*, Conidial stage of *Aspergillus*, Conidia of *Fusarium*, Uredial, Telial, Pycnidial & Aecial stages of *Puccinia graminis*.
- D. Study of the following pathological specimens:
Late blight of potato, Loose smut of wheat. Brown spot of Rice. Red rot of sugarcane, Citrus canker.
- E. **Preparation of PDA, sterilization process and aseptic culture technique.**

BRYOPHYTA

- A. Morphological study of the plant body. General as mentioned in Theoretical Syllabus.
- B. Work out for reproductive structures - *Riccia*, *Marchantia*, *Funaria*
- C. Study from permanent slides - *Anthoceros* (L. S. sporophyte), *Sphagnum* (L.S. of sporophyte)

MICROBIOLOGY

1. Preparation of bacterial media –
 - a) Nutrient agar and nutrient broth
 - b) Preparation of slants, Stab and pouring in Petri -plates.
2. Sub-culturing of bacterial culture.
3. Simple and Gram staining.
4. Microscopic examination of bacteria from curd by simple staining.

PART-II

**Paper IV : Biology and diversity of Pteridophytes and Gymnosperms;
Paleobotany & Palynology (Full Marks :75)**

	Marks	Periods
Pteridophyta	25	25
Gymnosperm	25	25
Palaeobotany & Palynology	25	25

Pteridophyta (25 Marks, 25 periods)

1. General characters and Classification : (3 periods)
 - 1.1 General features of sporophyte and gametophyte, habitat diversity,
 - 1.2 Classification (Stewart & Rothwell, 1994) upto class with brief characters and examples.

2. Structure and Life History : (10 periods)
 2.1 Basic concepts of life cycle patterns of homosporous and heterosporous pteridophytes. 2.2 Apospory and Apogamy. 2.3 Vegetative and reproductive morphology of sporophyte, structure and development of gametophyte and embryogeny of the following genera : *Psilotum*, *Lycopodium*, *Selaginella*, *Equisetum*, *Ophioglossum* and *Marsilea*
3. General account of fossil taxa : (6 periods)
 3.1 Rhyniopsida :General characters, distribution (geological and geographical) and life cycle of *Rhynia*.
 3.2 Zosterophyllopsida : General characters.
 3.3 Structural and anatomical features of *Lepidodendron* (Reconstructed) and *Calamites* (Reconstructed) and causes for their extinction
4. Origin and Evolution : (5 periods)
 4.1 Algal origin of pteridophytes. 4.2 Significance of Telome concepts in the origin of Psilopsida, Lycopsida, Sphenopsida, and Pteropsida (Zimmermann's concept).
 4.3 Evolution of leaves- Microphylls and megaphylls (Telome and Enation concepts).
5. Importance : (1 period)
 Economic importance of pteridophytes as food, medicine and agriculture

PROGYMNOSPERMS AND GYMNOSPERMS (25 Marks, 25 periods)

1. Progymnosperms : (5 periods)
 1.1 Diagnostic features of the group. 1.2 Vegetative and Reproductive features of *Archaeopteris*. 1.3 Phylogenetic importance of the group in the origin of gymnospermous stele.
2. Gymnosperms : (2 periods)
 2.1 Brief character diversity in gymnosperms, habitat. 2.2 Classification of gymnosperm (Stewart & Rothwell, 1993) with characters and examples.
3. Structure and Life history : (8 periods)
 3.1 Vegetative and reproductive morphology of sporophyte, wood anatomy, development of gametophyte, embryogeny and life history of the following genera : *Cycas*, *Pinus*, *Ginkgo*, *Gnetum*. 3.2 Indian distribution of each taxa.

4. Fossil gymnosperms (6 periods)
- 4.1 Pteridospermales : general characters of the order and structural features and geological distribution of *Lyginopteris oldhamia* (reconstructed).
- 4.2 Cordaitales : general characters of the order and its role in the origin of seed-cone complex.
- 4.3 Bennettitales : General characters of the order, structural features, geological and geographical distribution of *Williamsonia seawardiana* (reconstructed).
5. Origin of hetrospory & seed habit (2 periods)
6. Economic importance of gymnosperms (2 periods)

PALAEOBOTANY AND PALYNOLOGY (25 Marks, 25 periods)

1. Plant fossil : (3 periods)
- 1.1 Definition of fossil. 1.2 Types of fossil. 1.3 Modes of preservation (after J.M. Schopf, 1975). 1.4 Conditions favouring for fossilization.
2. Importance of fossil. (2 periods)
3. Geological time scale and major events of plant life through geological ages. (3 periods)
4. Method of Radiometric Dating with special reference to C¹⁴ dating. (2 periods)
5. Indian Gondwana System – A brief account of three-fold classification and major megafossil assemblages. (2 periods)
6. Palynology :
- 6.1 Definition. 6.2 Spore and Pollen : characteristics, polarity, symmetry, shape, NPC classification and sporoderm stratification. (8 periods)
- 6.2 A brief account of application of Palynology with reference to aeropalynology, forensic palynology, melissopalynology, hydrocarbon exploration. (5 periods)

Paper V**(Full Marks :75)**

	Marks	Periods
Systematics of Angiosperms	50	50
Morphology & Embryology	25	25

Systematic of Angiosperms (50 marks, 50 periods)

1. Introduction (Terms and Definition) (3 periods)
 - 1.1 Taxonomy and Systematics. 1.2 Aims and objectives of Taxonomy. 1.3 Phases of Taxonomy (Pioneer, Consolidated, Biosystematic, Encyclopedic phase).
2. Nomenclature : (6 periods)
 - 2.1 Definition. 2.2 Scientific names and its purposes. 2.3 Elementary knowledge of ICBN. Principles, Rank of Taxa, Effective and valid publication,. Principle of priority. Author citation. Retention and Rejection of names. 2.4 Type concept.
3. System of classification : (6 periods)
 - 3.1 Artificial, Natural and Phylogenetic systems of classification with examples. 3.2 Basic, broad outline and merits and demerits of Bentham and Hooker's system of classification. Cronquist (1988) system of classification. .
4. Systematics in Practice (Identification) (4 periods)
 - 4.1 Definition, keys – Dichotomous (indented and bracketed). 4.2 Herbarium and Botanical Gardens – their role; important Herbaria & Botanical Gardens of India and abroad. Floras, Monograph.
5. Phenetics : (8 periods)
 - 5.1 Phenetics definition, characters and character state. 5.2 Concept of OTUs and phenograms. 5.3 Cladistics – definition, cladogram, concept of monophyly and polyphyly, concept of plesiomorphy and apomorphy.
6. Theories of origin of Angiosperms. (3 periods)

7. Diagnostic features, Systematic position (B & H and Cronquist), economically important plants (parts and uses) of the following families :

7.1 Dicots – Magnoliaceae, Ranunculaceae, Cruciferae (Brassicaceae), Leguminosae (S.L.) – including subfamilies, Malvaceae, Euphorbiaceae, Solanaceae, Acanthaceae, Labiatae (Lamiaceae), Cucurbitaceae, Rubiaceae, Compositae (Asteraceae). (15 periods)

7.2. Monocots – Alismataceae, Palmae (Arecaceae), Gramineae (Poaceae), Orchidaceae. (5 periods)

Angiosperm Morphology and Embryology (25 Marks, 25 Periods)

1. Inflorescence (Types with example) (2 periods)

2. Flower : (3 periods)

2.1 Types, parts, calyx (modification), corolla (forms & aestivation), stamens -parts, types, attachment of anther and filament, cohesion and adhesion of stamens, carpels- types, placentation, ovules-structure & types.

3. Pollination : (3 periods)

3.1 Definition & types, Merits and demerits of self and cross pollination.

3.2 Contrivances of pollination (self and cross)

4. Fruits and Seeds : (4 periods)

4.1 Types of fruits, types of seeds. 4.2 Dispersal of seeds & fruits.

5. Apomixis : (2 period)

A brief idea on Apospory and Apogamy.

6. Fertilization : (8 periods)

7.1 Pre Fertilization events : (i) Microsporogenesis & Microgametogenesis.

(ii) Megasporogenesis & Megagametogenesis (Monosporic, bisporic &

Tetrasporic). 7.2 Fertilization process. 7.3 Post Fertilization events : (i)

Embryogenesis in Capsella. (ii) Development of endosperm (3 types) and Function..

Paper VI : (Practical)**Full Marks : 50**

		Marks
1. Work out Pteridophyta, Gymnosperm	7 + 6	13
2. Work out Angiospermic plant	10 x 1	10
3. Identification with reasons Specimen belonging to : Palaeobotany (2), Morphology of Angiosperm (2) & Pteridophyte/gymnosperms (1)	5x 2	10
4. Identification of angiospermic plant	3x1	3
5. Submission of field note, Herbarium sheets, Practical note books, Slides	2+2+3+2	9
6. Viva		5

PTERIDOPHYTES

1. Morphological study of the sporophytic plant body and reproductive structures of *Lycopodium*, *Selaginella*, *Equisetum* and *Marsilea*.
2. Study from permanent slides : *Psilotum* (T.S. of stem and Synangium), *Marsilea* (T.S. of rhizome and H.L.S. of sporocarp), L. S. of spike of *Ophioglossum*.

GYMNOSPERMS

1. Morpho-anatomical study : *Cycas* (V.S. of leaflet, external morphology of microsporophyll and megasporophyll with reproductive organs); *Pinus* (T.S. of needle, external morphology of male and female cone, microsporophyll and megasporophyll with reproductive organs), *Gnetum* (External morphology of male and female cone).
2. Study from permanent slides : *Cycas* (T.S. of root, L.S. of ovule), *Pinus* (T.S. and L.S. of stem; L.S. of male and female cone); *Gnetum* (T.S. of Stem; L. S. of male cone and ovule).

PALAEOBOTANY AND PALYNOLOGY

1. Morphological study of *Ptilophyllum*, *Glossopteris* leaf .
2. Study from permanent slides : T.S. of stem of *Lepidodendron*, *Calamites*, *Lyginopteris*.

3. Study of spore types (trilete, monolete) from permanent slides or from temporary preparation.
4. Study of pollen types (Monoporate – Gramineae, Pantoporate- Malvaceae, polyad – *Acacia auriculiformis*) from permanent slides or from temporary preparation.

ANGIOSPERMS

- A. Work out, preparation of floral formula & floral diagram, identification upto genus of the plants supplied under the following families :
Malvaceae, Solanaceae, Acanthaceae, Labiatae, Rubiaceae, Papilionaceae ,
Caesalpineae, Scrophulariaceae..
- B. Spot identification (Binomial name & family) of plants from families included in the Theoretical Syllabus.
- C. Morphology of Angiosperms : Inflorescence , fruit, stipules

3. LABORATORY RECORDS

- A. Laboratory Note Book of each section must be signed by the respective teacher with date.
- B. Slides : Submission of maximum 10 permanent slides.

4. FIELD WORK

- A. Excursions one in a different phytogeographical zone and one Indian Botanic Garden (Shibpur).

FIELD RECORDS

- A. Field Note Book
- B. Herbarium specimen : Knowledge of Herbarium preparation, submission of twenty mounted and identified (with author's citation) Angiospermic specimens.

PART- IIIPaper VII**Full Marks : 80****PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY**

	Marks	Marks
Plant Physiology	55	55
Plant Biochemistry	25	25

PLANT PHYSIOLOGY**(55 Marks, 55 periods)**

1. Water relations: (4 periods)
 - 1.1 Diffusion, osmosis, concept of water potential, components of water potential in plant system.
 - 1.2 Absorption of water – mechanism, symplastic and apoplastic pathway.
 - 1.3 Ascent of sap – path, cohesion-tension theory and its critical evaluation. Soil Plant Atmosphere continuum concept.
 - 1.4 Stomatal physiology – mechanism of opening and closing (modern concept only). Role of carbon dioxide, potassium ion, abscisic acid and blue light in stomatal movement
2. Mineral nutrition : (2 periods)

Criteria of essentiality of elements, macro – and micronutrients, role of essential elements, mineral deficiency - symptoms and plant disorders.
3. Organic translocation : (2 periods)
 - 3.1 Phloem sap, P-protein, phloem loading and unloading, mass flow and pressure flow hypothesis and its critical evaluation. (2 periods)
4. Photosynthesis : (12 periods)
 - 4.1 Photosynthetic pigments, absorption and action spectra, photoprotection mechanism of pigments.
 - 4.2 Light reaction – Hill reaction, Emerson effect, Photosynthetic reaction centres, components of photosystems, cyclic and noncyclic electron transport.
 - 4.3 Dark reaction – Calvin cycle (with a brief idea on tracer technique).
 - 4.4 Hatch and Slack pathway.

- 4.5 Photophosphorylation and its mechanism (chemiosmotic theory).
- 4.6 Photorespiration – organelles involved and pathway.
- 4.7 Crassulacean acid metabolism (CAM) – mechanism and its ecological significance.
5. Respiration: (10 periods)
- 5.1 Glycolysis and T.C.A. cycle (including oxidation of pyruvic acid to acetyl Co A).
- 5.2 Oxidative pentose phosphate pathway and its significance.
- 5.3 β -oxidation of fatty acids.
- 5.4 Electron transport system and site of energy conservation, P/O ratio, oxidative anabolism and stoichiometry (fuel efficiency/energy produced from oxidation of glucose and fatty acid), oxidative phosphorylation and its mechanism (chemiosmotic theory)
- 5.5 Respiratory quotient and its significance
6. Nitrogen metabolism : (5 periods)
- 6.1 Source of nitrogen for plants. Nitrification and denitrification. Assimilation of nitrate by plant and general principle of amino acid biosynthesis.
- 6.2 Nitrogen fixing organisms and biochemistry of dinitrogen fixation ion.
7. Growth substances : (9 periods)
- 7.1 Auxin – discovery, chemical nature (natural and synthetic), biosynthesis, physiological roles, mode of action and bioassay.
- 7.2 Gibberellins – Discovery, chemical nature, physiological roles, mode of action.
- 7.3 Cytokinins – Discovery, chemical nature (natural and synthetic), physiological roles.
- 7.4 Abscisic acid and ethylene – physiological roles.

8. Physiology of flowering :

8.1 Photoperiodism : (5 periods)

8.1.1 Classification of plants based on photoperiod responses, critical day length, concept of night length monitoring.

8.1.2 Perception of photoperiodic stimulus.

8.1.3 Phytochrome – chemical nature & role circadian rhythm.

8.1.4 Role of GA and florigen concept.

8.2 Vernalization : (1 period)

8.2.1 Role of cold temperature in flowering

BIOCHEMISTRY

(25 Marks, 25 Periods)

1. Molecules and their Interaction Relevant to Biology

1.1 Structure of atom, molecules and chemical bonds. (2 periods)

1.2 Stabilizing interactions (Vanderwals, electrostatic, hydrogen, bonding, hydrophobic reactions etc.). (2 periods)

1.3 Principle of Biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics. (4 periods)

1.4 Bio-molecules : Their composition, classification and structure (Carbohydrate, Lipids and Proteins). (8 periods)

1.5 Enzymes :Classification (numerical), mechanism of enzyme catalysis, isozymes. (4 periods)

1.6 Membrane transport : active, passive, electrogenic pump, facilitated diffusion, Uniport, Symport. (5 periods)

Paper – VIII :

Genetics, Molecular Genetics and Plant Biotechnology
(80- Marks, 80- Periods)

Genetics and Molecular genetics (Marks –55, Periods – 55)

1. **Cell Division :** (Periods-3)
 - 1.1. Mitosis and meiosis- process and significance. 1.2. Cell cycle and its regulation.

2. **Mendelian Principles and its Variations :** (Period – 8)
 - 2.1. Mendel's experiments and laws of inheritance. 2.2. Chromosomal basis of inheritance (parallelism of Mendel's laws with meiosis). 2.3. Test cross, back cross. 2.4. Post-mendelian modification-gene interaction : allelic-incomplete dominance (Mirabilis), non-allelic-complementary Factor (9:7), supplementary factor(9:3:4), inhibitory factor (13:3), multiple or duplicate factor (15:1), epistasis-dominant (12:3:1), recessive (9:3:4:)

3. **Chromosome and Nucleic Acids :** (Periods-5)
 - 3.1. Physical & Chemical structure of chromosome. 3.2. DNA packaging (Kornberg's Nucleosome Model). 3.3. Structure of Nucleic acids - DNA, RNA. 3.4. Types of DNA (A,B,Z). 3.5. DNA replication : Evidence for semi-conservative replication (Messelson & Stahl). 3.6. Mechanism of bi-directional replication in bacteria.

4. **Linkage, Crossing Over and Gene Mapping :** (Periods-6)
 - 4.1. Definition (Coupling, Repulsion, Linkage group, Linkage); Types of Linkage- Complete, Incomplete. 4.2. Detection of Crossing over (Mc Clintoc's Experiment). 4.3.Molecular Mechanism of Crossing over (Holiday model). 4.4. Principles of gene mapping by 3 –point cross. 4.5. Coincidence and Interference.

5. **Numerical and Structural changes of Chromosomes :** (Periods- 5)
 - 5.1. Euploidy – types with examples, origin, meiotic behavior, and importance in the evolution of new plants. 5.2. Aneuploidy – types with examples, origin, and meiotic behavior. 5.3. Chromosomal aberration – Deletion, duplication, translocation, inversion-origin and meiotic configurations.

- 6. Gene mutation :** (Periods- 5)
 6.1. Types (Spontaneous, Induced, Somatic, Germinal, Missense, Silent, Transition, Transversion, Frame shift, Lethal). 6.2. Detecti on- CLB method. 6.3. Significance in crop improvement. 6.4. Physical & Chemical mutagens. 6.5. Molecular mechanism of gene mutation (Tautomarism, Base analogue, HNO₂ alkylaton, UV). 6.6. Elementary knowledge of DNA repair mechanism (Excision repair, Photo-reactivation).
- 7. Concept of Gene :** (Periods-6)
 7.1. One gene one polypeptide hypothes is. 7.2. Complementation test (r^{II} locus). 7.3. Position effect (Bar eye). 7.4. Pseudoallele (lozenge locus). 7.5. Multiple allele (Coat colour of mice). 7.6. Overlapping gene (ϕ X 174). 7.7. Transposomal element (Ac-Ds system in maize).
- 8. Gene Expression : Protein Synthesis :** (Periods- 5)
 8.1. Process of transcription. 8.2. Processing of mRNA in Eukaryotes. 8.3. Translation-different steps.
- 9. Gene Regulation:** (Periods- 3)
 9.1. Concept of Operon. 9.2. Structure, mode of positive & negative control of Inducible (lac. Operon) and Repressable (trp. Operon) operons.
- 10. Genetic Code :** (Periods- 2)
 10.1 Properties. 10.2 Experimental evidence for triplet code.
- 11. Molecular Genetics :** (Periods- 6)
 11.1. Concept of recombinant DNA technology. 11.2. Restriction enzymes. 11.3. Cloning vector-types and properties. 11.4. Genomic and cDNA library. 11.5. Elementary idea of transgenics. 11.6. RFLP, RAPD, PCR, Ti Plasmids; DNA Finger printing (basic idea). 11.7. Elementary knowledge of Genomies and proteomics.

Plant Biotechnology (Marks-25, Lecturer periods – 25)

- 1. Plant Biotechnology :** (Periods- 2)
 1.1. History, scope and importance.
- 2. Plant Tissue Culture :** (Periods- 4)
 2.1. Concept – Differentiation, dedifferentiation, redifferentiation, celluar totipotency. 2.2. Tissue culture media-brief idea. 2.3. Aseptic techniques. 2.4. Application in Horticulture and Forestry.

3. Concept, culture methods, importance and application : (Periods- 13)

3.1. Embryo Culture. 3.2. Callus culture, characteristics of callus. 3.3. Suspension Culture. 3.4. Organogenesis and plant regeneration. 3.5. Somatic Embryogenesis, difference with zygotic embryogenesis ; Artificial seeds. 3.6. Micropropagation 3.7. Anther & Pollen Culture. 3.8. Protoplast Culture - isolation and culture; Protoplast Fusion-somatic hybridization, Cybridization.

4. Genetic transformation : (Periods- 6)

4.1. Transformation Techniques (basic idea); transformation technique using Agrobacterium system. 4.2. Direct DNA transfer method (Mention only). 4.3. Basic idea on selectable reporter gene and marker gene. 4.4. Mechanism of integration and expression of foreign DNA in plant cells. 4.5. Application in crop improvement.

PAPER IX**Full Marks : 80**

	Marks	Periods
Anatomy	20	20
Plant Breeding & Biometry	20	20
Ecology & Environmental Botany	25	25
Natural Resources and their utilization	15	15

ANATOMY**(25 marks, 20 periods) :**

1. Apical meristem – Organization of shoot apex (Tunica-carpus concept) & organization of root apex (Körper-Kappe concepts). (2 periods)
2. Structure of Xylem and Phloem tissue, ontogeny of trachery elements & sieve elements. (2 periods)
3. Types (Metcalf & Chalk and Pant), structure & ontogeny of stomata. (2 periods)
4. Types and evolution of stele. (2 periods)
5. Types, structure, origin & function of cambium. (2 periods)
6. Ecological Anatomy with reference to Hydrophytes, Xerophytes, Halophytes and epiphytes (3 periods)
7. Root-Stem transition & its significance. (1 period)
8. Normal secondary growth (interstellar & extrastelar) in dicot stem; Anomalous secondary growth in *Bignonia*, *Boerhaavia*, *Dracaena*, *Nyctanthes*, *Strychnos*, *Tecoma* & root of *Tinospora*. (4 period)

Plant Breeding and Biometry**Plant breeding :** (2 periods)

1. 1.1 Introduction, selection and hybridization. 1.2. Anthesis, emasculation, mass selection, pure line selection, bulk method and pedigree method of selections.
2. Backcross method of breeding and their merits and demerits. (4 periods)
3. Heterosis; male sterility and self incompatibility – their significance (3 periods)

Biometry :

- Terms and Definition – sample & population, quantitative & qualitative variables, random sampling, frequency distribution, arithmetic mean, mode and median (2 periods)
- Measurement of dispersion –standard deviation, coefficient of variation and standard error. (2 periods)
- Test of significance – Null Hypothesis, X^2 -test of goodness of fit, probability; Measurement of gene frequency (Hardy Weinberg hypothesis). (3 periods)

Natural resource and their utilization (15 Marks, 15 periods) :

1. Cultivation and uses of rice, potato. (4 periods)
2. Economic uses of the following: chickpea, mustard, coconut, jute, cotton, pine, rubber, tea, coffee, teak, sal and clover (3 periods)
3. General Introduction :
 - 3.1. What is Pharmacognosy ? 3.2. Crude drugs, 3.3 Pharmacognosy and modern medicine. 3.4. Classification of drug – morphological and chemical. 3.5. Drug evaluation – organoleptic, microscopic, chemical, physical and biological (definition/brief notes only). (5 periods)
4. Important secondary metabolites of pharmacological importance : source plants, parts used, active principles and uses -
 - 4.1 Glycosides - Diosgenin (*Discorea alata*, *Digitalis purpurea*), Aloe (*Aloe vera*). 4.2 Tannins-Catechin (*Acacia catechu*). 4.3 Resins – Gingerol (*Zingiber officinale*), Cuccuminoids (*Curcuma longa*). 4.4 Alkaloids – Quinine (*Cinchona* sp.), Strychnins (*Strychnos nux-vomica*), Reserpine (*Rauwolfia* sp.), Vindoline (*Catharanthus roseus*), Conesine (*Holarrhena antidysenterica*). (3 periods)

ECOLOGY AND ENVIRONMENTAL BOTANY (25 Marks, 25 Periods)**Ecology: (3 periods)**

1. Introduction : Holocoenotic nature of environment, limiting factors, ecological amplitude, triggering factors (soil, water, atmosphere).
2. Ecological adaptation : Concept, ecads, ecotypes and ecoclines ; adaptations in relation to soil oligotrophy, adaptive significance of photosynthetic pathways. (3 periods)
3. Population : A brief idea on concepts, density and pattern . (1 periods)
4. Community : Community characteristics and their measurement ; species diversity (alpha, beta and gamma); niche. (3 periods)
5. Ecosystem : Concept, components and organization, energy flow; cycling of C, N and P; characterization and structure of ecosystem, the biotic and abiotic components and their inter relationship. (3 periods)
6. Ecological succession : Mechanism and types ; food chains and food webs; ecological pyramids.
7. Flow of energy : Models of energy flow; biogeochemical cycles. (2 periods)
8. Plant indicators and their role in environmental monitoring. (2 periods)
9. Phytogeography : General principles; phytogeographic regions of India (Chatterjee, 1960); Vegetation of Eastern & Western Himalayas and Sunderban vegetation. Endemism, theories of endemism [(Age & Area hypothesis of Willis, (1920)] ; Indian endemic flora. (3 periods)
10. Biodiversity and Conservation : Biodiversity – definition, types, importance and threats (IUCN Categories); knowledge on Red Data Book, Hotspots, *in situ* and *ex situ* conservation of rare and endangered plants. (3 periods)

PAPER X : (PRACTICAL)**Full Marks : 80**

1. Work out plant physiological experiment	25	25
2. Work out on Biochemistry		
A. Estimation Expt.	10 x 1	10
B. Detection Expt.	10 x 1	10
3. Anatomy work out	15 x 1	15

4.	Identification : Anatomy	2 x 2	4
5.	Submission of Practical note books, Field note book and slides	5 + 3 +2	10
6.	Viva		6

PLANT PHYSIOLOGY**25 marks**

1. Determination of stomatal frequency and loss of water per stoma per hour.
2. Rate of photosynthesis under varying HCO_3 concentration in an aquatic plant using bicarbonate and to find out the optimum and toxic concentration.
3. Determine the effect of promoter and inhibitor on the rate of aerobic respiration using Ganong's respirometer.
4. Measurement of oxygen uptake by respiring tissue (per gm./hr.).
5. Determine the R.Q. of any germinating seeds.
6. Measurement of osmotic pressure of storage tissue by weighing method.
7. Measurement of osmotic pressure of *Rhoeo* leaf by plasmolytic method.
8. Effect of temperature on absorption of water by storage tissue and determination of Q_{10} .
9. Comparison of imbibitions of water by starchy, proteinaceous and fatty seeds.

PLANT BIOCHEMISTRY**(10+10) = 20 Marks**

Detection :

1. Detection of organic , citric, tartaric, oxalic and malic acid from laboratory samples.
2. Detection of nature of carbohydrate – glucose, fructose, sucrose and starch from laboratory samples.
3. Detection of Ca, Mg, Fe, S from plant ash samples.

Estimation :

1. Estimation of nitrogen/amino acid by formal titration method (for any amino acid).
2. Estimation of glucose by Benedicts 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 by Folin phenol reagent.

ANATOMY**(20 Marks)**

1. Microscopic studies on :
Types of stomata, sclereids, raphids (*Colocasia*), cystolith (Ficus leaf), starch grains, aleurone grains, laticiferous ducts, oil glands.
2. Maceration techniques (with 5% KOH) to study tracheary and sieve elements in *Cucurbita* stem.
3. Study of secondary structure in *Xanthium* & *Dracaena* stem.
4. Study of anomalous structure :
Stem of *Bignonia*, *Boerhaavia*, *Tecoma*, *Nyctanthes*, and root of *Tinospora*.
5. Study of adaptive anatomical features :
Hydrophytes (*Nymphaea* – petiole) and Xerophytes (Nerium – leaf)
6. Field Note Book on Ecology : Study of community structure by Quadrature method and determination of i) minimal size of the quadrature, ii) frequency and density of components (to be done during excursion).

PAPER XI : (PRACTICAL)**Full Marks -80**

	<u>Marks</u>
1. Cytogenetics	
1.1. Work out stages of Mitosis from suitable metaphase plate with camera lucida drawing and comment on chromosome number	20x1= 20
1.2. Identification- normal stages of meiosis	4 x2= 8
1.3. Chromosomal abnormalities (mitosis & Meiosis)	3 x4 = 12
2. Biometry	12
3. Pharmacognosy	12
4. Lab. Note Books and Slides	6+2= 8
6. Viva-voce	8

Cytogenetics

1. Introduction to chromosome preparation : Pre-treatment. Fixation. Hydrolysis. Staining, squash and smear preparations. preparations of permanent slides.
2. Determination of mitotic index and frequency of different mitotic stages (to be calculated from dividing cells) in pre-fixed root tips of *Allium cepa*/*Lathyrus sativus*.
3. Study of mitotic chromosome : metaphase chromosome preparation, camera-ludica drawing and determination of chromosome number of the following specimens- *Allium cepa*, *Aloe Vera*, *Nigella sativa*, *Lathyrus sativus* from root tips.
4. Study of meiotic chromosome : smear preparations of microsporophylls, free-hand drawing and determination of chromosome number of the following specimens- *Allium cepa* and *Rhoeo spathacea* var. *discolor* flower buds (buds fixed in 70% alcohol/fresh may be supplied).
5. Identification from permanent slides
 - a) Meiosis – (i) normal stages (diplotene, diakinesis, metaphase I and II anaphase I); (ii) abnormal stages – dicentric chromatid bridge from anaphase I cells.
 - b) Mitosis – (i) abnormal stages - multipolarity, bridges, micronuclei, fragments.

Biometry

1. Analysis of statistical data : Calculation of mean, mode, median, standard deviation and standard error (samples should be taken from seedling population).
2. Determination of goodness of fit in normal and modified mono -and dihybrid ratios by Chi-square analysis and comment on the nature of inheritance.

Pharmacognosy

- 1.1 General tests for tannins and alkaloids.
- 1.2 Organoleptic study of rhizome of *Zingiber*, bark of *Alstonia*, and leaves of *Adhatoda*.

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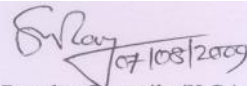
Complete Syllabus for B.Sc. (General) Course in

BOTANY

(w.e.f. the session 2009-2010)

According to the New Examination Pattern

Part – I, Part – II & Part – III


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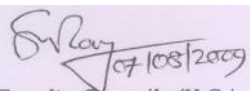
University of Kalyani

Revised Syllabus of Botany
(w.e.f. the session 2009-2010)

Contents

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UNIVERSITY OF KALYANI
B.Sc. (General) Syllabus in Botany
Total Marks : 400

(New pattern of examination system Part-I, Part-II and Part-III from Academic Session 2005-2006)

Part I : Theoretical 1 x 100 marks	= 100
Part II : Theoretical 1 x 100 marks, Practical 1 x 100 marks	= 200
Part III : Theoretical(60 marks) + Practical (40 marks)	= 100

PART- I

Paper – I

Full Marks : 100

Group A : Diversity of Microbes and Cryptogams	50 Marks
Group B : Morphology, Diversity of seed plants and Ecology	50 Marks

Group A : Diversity of Microbes and Cryptogams **50 Marks**

1. **Domains of life** : An idea about Archaea, Bacteria and Eukarya.
2. **Virus** : 2.1 General properties and nature of viruses. 2.2 Structural organization of TMV. 2.3 Lytic (T_4) and Lysogeny (Lambda phage) cycles. 2.4 Brief outline of transmission of plant viruses.
3. **Bacteria** : 3.1 Structure and form of bacteria. 3.2 Structure of a typical bacterial cell – cell wall of gram positive and gram negative cell. 3.3 Typical growth curve of bacteria. 3.4 Reproduction – binary fission, endospore. Recombination – brief idea of conjugation, transformation and transduction. 3.5 Economic importance of bacteria. 3.6 Molliantes and Actinomycetes – salient features.
4. **Algae** : 4.1 Common features of algae – habit, thallus organization. 4.2 Classification of algae- Lee (1989). 4.3 Characters of Cyanophyceae, Bacillariophyceae, Phaephyceae, Rhodophyceae, Chlorophyceae, Charophyceae. 4.4 Life history of *Nostoc*, *Oedogonium* and *Ectocarpus*. 4.5 Economic importances of algae with special reference to industrial uses.

5. **Fungi** : 4.1. Introduction. 4.2 Classification (Ainsworth,1973) up to sub-division with characters and examples from Mastigomycotina, Zygomycotina. Ascomycotina, Basidimycotina and Deuteromycotina. 4.3 Life Histories of Rhizopus, Penicillium and Agaricus. 4.4 Economic importance.
6. **Bryophyta** : 6.1 Introduction. 6.2 Classification (PROSKAUR) upto class with characters & examples of Hepaticopsida, Anthocerotopsida and Bryopsida. 6.3 Life histories of Marchantia, Anthoceros, Funaria.
7. **Pterodophyta** : 7.1 Introduction. 7.2 Classification (SPORNE) upto class with characters & examples of Psilopsida, Lycopsida, Sphenopsida & Filicopsida. 7.3 Life histories of Lycopodium, Selaginella, Pteris.

Group B : Morphology, Diversity of seed plants and Ecology 50 Marks

1. **Gymnosperm** : 1.1 Introduction. 1.2 Classification (SPORNE) upto class with characters and examples of Cycadopsida, Coniferopsida & Genetopsida, 1.3 Life histories of Cycas, Pinus, Gnetum.
2. **Palaeobotany** : 2.1 Introduction & Definition. 2.2 Types of Fossils. 2.3 Fossilization processes, 2.4 Importance of fossil study.
3. **Morphology of Angiosperm** : 3.1 Inflorescence types with examples. 3.2 Flower; types; parts-calyx (modification). Corolla (forms, aestivation). 3.3 Stamens (cohesion & adhesion). 3.4 Carpel (apocarpous & syncarpous), Placentation types. Ovule structure).
4. **Taxonomy of Angiosperms** : 4.1 Definition & its purpose; Preliminary knowledge about ARTIFICIAL, NATURAL & PHYLOGENETIC system of classification. 4.2 Elementary knowledge of ICBN. 4.3 knowledge of preparation, preservation & maintenance of Herbarium. 4.4 An outline of Bentham & Hooker's system of classification. 4.5 Diagnostic features of following families - Cruciferae, Malvaceae, Leguminosae (SL), Cucurbitaceae, Acanthaceae, Solanaceae, Verbenaceae, Labiatae, Euphorbiaceae, Compositae, Graminae, Palmae and Orchidaceae.

5. **Ecology** : 5.1 Ecological factors-climatic, edaphic, physiographic and biotic. 5.2 Ecological adaptations and characteristics of hydrophytes, xerophytes, halophytes. 5.3 Definition of phytogeography - phytogeographic regions of India according to Chatterjee 1959. 5.4 A brief idea on Endemism.

PART- II

Paper II

Full Marks = 100

Group A : Cytogenetics and Molecular Genetics	35 Marks
Group B : Plant Physiology and Biochemistry	35 Marks
Group C : Development and Reproduction in flowering plants	30 Marks

Group A : Cytogenetics and Molecular Genetics

35 Marks

1. 1.1 Structure and function of nucleus ; Ultra structure of nuclear membrane; nucleolus. 1.2 Chromosome organization and morphology; centromere and telomere; chromosome alterations- deletions, translocations, duplications and inversions; variations in chromosome number- aneuploidy and polyploidy; sex chromosomes. 1.3 DNA the genetic material : DNA structure and replication; DNA protein interaction; the nucleosome model; genetic code; satellite and repetitive DNA. 1.4 Cell cycle Definition and different phases; 1.5 Meiotic stages and its significance; differences with mitosis. 1.6 Mendelism- laws of segregation and independent assortment; linkage analysis. 1.7 Gene expression; Structure of gene; transfer of genetic information, transcription; translation and protein synthesis. 1.8 Genetic variations : Mutations, spontaneous and induced; DNA damage and repair. 1.9 Extranuclear genome : Presence and function of mitochondrial and plastid DNA. 1.10 Structure and function of other organelles : Golgi bodies and Endoplasmic reticulum.

Group B : Plant Physiology and Biochemistry

35 Marks

2. 2.1 Water relations-Osmotic pressure, turgor pressure, water potential. 2.2 Mechanism of ion absorption. 2.3 Transpiration, types, mechanism with reference to chemical basis of stomatal opening & closing, significance, difference with guttation. 2.4 Mineral nutrition-essential elements & their roles. 2.5 Enzyme -definition, types, properties. 2.6 Photosynthesis essential elements -light and dark reaction in C₃ plants, brief knowledge on C₄ ; CAM pathways (details of cycles not needed).

2.7 Respiration : Glycolysis, TCA Cycle, ETS, R.Q. 2.8 Nitrogen metabolism - biological nitrogen fixation (Symbiotic & Non-symbiotic), Ammonification, Nitrification, Nitrate assimilation. Reductive amination & Transamination. 2.9 Plant hormones-definition and role of IAA, Gibberellins, Cytokinin, ABA and Ethylene in plant growth & developments. 2.10. Photoperiodism -definition long day and short day plants with examples. 2.11. Stress Physiology: Definition and types only.

Group C : Development and Reproduction in flowering plants 30 Marks

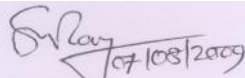
1. **Anatomy** : 1.1 Cell walls structure, composition & function. 1.2 Tissue Structure, distribution & function. 1.3 Vascular bundles, types with examples 1.4 Secondary growth – intra & extra stelar normal secondary growth in dicot stem.
2. **Reproduction and Embryology** : 2.1 Microsporogenesis and Megasporogenesis. 2.2 Structure of ovule. 2.3 Pollination contrivances. 2.4 Fertilization. 2.5 Embryogenesis in *Capsella*. 2.6 Embryosac development (Polygonum type). 2.7 Fruits & Seeds- types with examples.

PAPER III

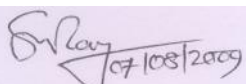
(Practical)

Full Marks – 100

1. Workout, microscopic preparation, drawing, description and identification of the following cryptogams : *Nostoc*, *Oedogonium*, *Chara*, *Rhizopus*, *Penicillium*, *Agaricus*, *Riccia*, *Funaria*, *Lycopodium*, *Selaginella*, *Pteris* .
2. Identification :
 - a) Cryptogamic specimens (macroscopic) as prescribed in the theoretical syllabus.
 - b) Gymnospermic specimens : Macroscopic – microsporophyll and megasporophyll of Cycas; male and female cone of Pinus; Microscopic – L. S. of ovule of Gnetum.
 - c) Morphological Specimens – Inflorescences & fruits.


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3. Dissection, drawing, description of angiospermic plant and preparation of floral formula & floral diagram, identification (family) from the following families; Cruciferae, Leguminosae, Malvaceae, Solanaceae, Verbenaceae and Labiatae
4. Spot identification (scientific names and families) of the following angiospermic plant; *Cynodon dactylon* (Graminae), *Cyperus rotundus* (Cyperaceae), *Eichornia crassipes* (Pontederiaceae), *Casuarina equisetifolia* (Casuarinaceae), *Chenopodium album* (Chenopodiaceae), *Amaranthus spinosa* (Amaranthaceae), *Mirabilis jalapa* (Nyctaginaceae), *Nymphaea rubra* (Nymphaeaceae), *Michelia champaka* (Magnoliaceae), *Croton bonplandianum* (Euphorbiaceae), *Catharanthus roseus* (Apocynaceae), *Ocimum tenuiflorum* (labiatae), *Cestrum diurnum* (Solanaceae), *Lagerstroemia speciosa* (Lythraceae), *Thevetia nerifolia* (Apocynaceae), *Clerodendrum viscosum* (Verbenaceae), *Cassia fistula* (Leguminosae), *Calotropis procera* (Asclepiadaceae), *Acacia arabica* (Leguminosae), *Coccinia cordifolia* (Cucurbitaceae).
5. Plant Physiology Experiments :
 - i) Demonstration of plasmolysis.
 - ii) Measurement of leaf area (graphical method) & determination of transpiration rate per unit area by weighing method.
 - iii) Imbibition of water by dry seeds – proteinaceous & fatty seeds.
 - iv) Evolution of O₂ during photosynthesis (using graduated tube)
 - v) Evolution of CO₂ during aerobic respiration and measurement of volume.
 - vi) Demonstration of transpiration pull
 - vii) Anthocyanin – Water solubility & pH indicator.
6. Anatomical studies following double staining method of;
 - i) Stem : Sunflower, Cucurbita, Maize
 - ii) Root : Gram, Orchid, Arum
 - iii) Leaf : Nerium, Tube rose.
7. Cytology;
 - i) Study of mitotic stages from squash preparation of Onion root tip.
 - ii) Determination of mitotic index (from Onion root tip)
 - iii) Study of Meiotic Stages – Prophase-I, Anaphase-I & Metaphase-I (from Permanent slides).


 07/10/2009
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 University of Kalyani
 Kalyani, Nadia

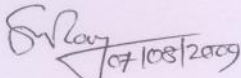
- 8 (i) Field excursions : Local (at least 3/5) excursions.
 (ii) Laboratory records : Laboratory note books (regularly signed/and slides are to be submitted at the time of Practical Examination.
 (iii) Field records : Field note book and note more than 20 Herbarium sheets of common angiospermic weeds to be prepared and submitted at the time of Practical Examination.

Distribution of Marks (Paper III)

Time : 6 hours

Full Marks 100

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| 1. Work out : Algae/Fungi (any one) | 12 |
| 2. Work out : Bryophytes/Pteridophytes (any one) | 10 |
| 3. Angiospermic plant | 12 |
| 4. Plant physiology expt. | 12 |
| 5. Anatomy | 10 |
| 6. Cytology- comment on Mitotic & Meiotic slides | 5+5=10 |
| 7. a) Spotting (name & family)- any two of Angiospermic plants from syllabus | 2+2=4 |
| b) Identification with reason | |
| i) Bacteriological slide (one) | 2 |
| ii) morphological specimens (Inflorescence/ Fruit) (one) | 2 |
| iii) Gymnosperm (two) | 2x2=4 |
| iv) any two specimen from cytograms (Algae/fungi/ Bryophytes/Pteridophytes) | 2x2=4 |
| 8. Submission : Laboratory records (laboratory note book slides) and field records (field notebook, herbarium sheet) | 12 |
| 9. Viva-voce | 6 |


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PART - IIIPAPER IV

Full Marks 100

Group A - Theory

60 Marks

Biotechnology, Plant pathology and Plant Breeding and utilization of plants :

1. Plant Biotechnology – definition, scope, importance and achievements.
2. Biofertilizer : 2.1 Definition: 2.2 Source (*Rhizobium*, *Azotobacter*, *Cyanobacteria*, *Mycorrhiza*, *Azolla*) 2.3 Production, 2.4 Application.
3. Mushroom : 3.1 Food value. 3.2 Cultivation technique of Volvariella & Pleurotus.
4. Plant Tissue Culture : 4.1 Introduction and Cellular totipotency. 4.2 Application of Plant tissue culture in improvement of crop plants.
5. Terms & Definition : 5.1 Central dogma. 5.2 Transcription & Translation. 5.3. Genetic code. 5.4 Recombinant DNA. Restriction enzymes, Plasmid (vector). 5.5 Gene cloning; DNA Library. 5.7 Transgenic plants; 5.8 DNA fingerprinting.
6. Plant Pathology : 6.1 Terms & definition : Disease, Pathogen, Inoculum Infection, Resistance, Incubation period, Koch's postulate. Symptoms - necrotic, hypoplastic & hyperplastic. 6.2 Symptom, causal organism, disease cycle, control measure of plant diseases – late blight of potato, brown spot of rice, stem rust of wheat.
7. Plant Breeding : 7.1 Definition and scope. 7.2 Mass and pure line selection. 7.3 Hybridization technique.
8. Biodiversity : 8.1 Brief knowledge. 8.2 Methods of in-situ conservation of rare and endangered plants.
9. Natural Resource Utilization : Study of the following economically important plants (Scientific names, families, Parts used and other importance), 9.1 Cereals-rice, wheat 9.2 Pulses- mung, gram 9.3 Species – ginger, cumun, 9.4 Beverages – tea, coffee.

Group B - Practical

40 Marks

1. Acquaintance with laboratory instruments : Autoclave, Incubator, Clinical centrifuge, Analytical balance, Colorimeter, Water bath, Distillation plant.
2. Preparation of Sucrose solution – normal, molar, molal and percentage.
3. Sterilization technique by autoclaving.

4. Preparation of PDA medium (slants, stabs, pouring of plates)
5. Bacterial staining by simple staining method (methylene blue/crystal violet) from curd.
6. Acquaintance with common medicinal plants & their useful parts : *Terminalia arjuna*, *Centella asiatica*, *Saraca asoca*, *Adhatoda vasica*, *Andrographis paniculata*, *Hygrophila Schullii*, *Eclipta alba*, *Aloe barbadensis*, *Rauwolfia serpentina*, *Vitex negundo*, *Bacopa moniaria*, *Holarhhena antidysenterica*, *Boerhaavia repens*.