University of Kalyani

M.Sc. Botany
Choice Based Credit System

Syllabus

(2017 – onwards)

Department of Botany

Kalyani - 741235

REGULATIONS RELATING TO THE CONDUCT OF UNIVERSITY EXAMINATIONS IN

M.Sc. BOTANY - SEMESTER SYSTEM (CHOICE BASED CREDIT SYSTEM)

DEFINITIONS

1. ***'Programme'*** means the entire course of study and examinations (traditionally referred to as course).
2. ***'Duration of Programme'*** means the period of time required for the conduct of the program. The duration of post-graduate programme shall be 4 semesters.
3. ***'Semester'*** means a term consisting of a minimum of 90 working days including examination days distributed over a minimum of 18 weeks each of 5 working days.
4. ***'Course'*** means a segment of subject matter to be covered in a semester (traditionally referred to as paper).
5. ***'Credit'*** **(Cr*)*** of a course is a measure of the weekly unit of work assigned for that course.
6. ***'Letter Grade'*** or simply ***'Grade'*** in a course is a letter symbol (O, E, A, B, C, D, F) which indicates the broad level of performance of a student in a course.
7. Each letter grade is assigned a ***'Grade point'*** (G) which is an integer indicating the numerical equivalent of the broad level of performance of a student in a course.
8. ***'Credit point'*** (P) of a course is the value obtained by multiplying the grade point (G) by the Credit (Cr) of the course P=G x Cr.
9. ***Semester Grade point average'*** (SGPA) is the value obtained by dividing the sum of credit points (P) obtained by a student in the various courses taken in a semester by the total number of credits taken by him/her in that semester . The grade points shall be rounded off to two decimal places. SGPA determines the overall performance of a student at the end of a semester.
10. ***'Cumulative Grade point average'*** (CGPA) is the value obtained by dividing the sum of credit points in all the courses taken by the student for the entire program by the total number of credits and shall be rounded off to two decimal places.

PROGRAMME STRUCTURE

1. Students shall be admitted into post graduate Choice Based Course System in Botany under the Faculty of Science.
2. The programme shall include four types of courses, Hard core, Soft core, Elective and Open Courses. Hard core and Elective Courses have both theoretical and practical courses. Hard core courses are compulsory courses. Soft core and Elective courses should be opted by the students and allotted to them as per availability of the faculty. Open course should be offered to the

students of other departments and M.Sc. Botany students should opt one open course from the P.G. subjects other than Botany. There shall be a Project /Dissertation in the Elective Course, to be undertaken by all students.

3. The Course of study shall extend over a period of two academic years and will be offered in four semesters: I and III semester: July to December; II and IV semester: January to June
4. The admission to the PG programme shall be as per the rules and regulations of the University.
5. The eligibility criteria for admission shall be as announced by the University from time to time.
6. The admission to the course shall only be in the first semester at the beginning of each academic year.
7. M.Sc. degree will be awarded to students who complete a total of 64 credits in a minimum of two years.

ATTENDANCE

8. A student is required to attend all classes. General and Practical class attendance will be counted separately.
9. For candidates taking late admission in the 1st Semester, attendance will be counted from the date of their admission.
10. A candidate shall be allowed to appear at any of the Semester examinations if he/she has attended 75% or above of the course lectures/practical classes held during that semester. If the attendance falls short of 75% but not below 60%, he/she will be allowed to appear at the examination as non-collegiate candidate on payment of requisite fees. Candidates attending less than 60% classes in any semester will be treated as discollegiate and will be debarred from appearing at the examination of that semester. He/she will be allowed to take re-admission in subsequent one semester only in the next year.
11. Shortage of attendance up to a maximum of 10% will be condoned, if (i) A student was away representing the University/State /Country in Athletic /Sports and Games/Cultural/N.C.C or any other important socio-intellectual event; (ii) Parents' appeal on health or on other serious grounds duly recommended by the Head concerned (An authentic certificate from appropriate authorities must be produced).

EXAMINATION, EVALUATION AND GRADING

12. The evaluation scheme for each course shall contain two parts: (a) Term-end evaluation and (b) Internal Assessment. 20% weightage shall be given to internal assessment and the remaining 80% to Term-end evaluation. Therefore the ratio and weightage between term-end and internal assessment is 4:1. The Course pattern will be as follows:

Courses	Points in theoretical courses			Points in practical courses		
	Term-end evaluation	Internal Assessment	Total	Term-end evaluation	Internal Assessment	Total
Hard core	60	15	75	20	5	25
Soft core	40	10	50	-	-	-

Open course	80	20	100	-	-	-
Elective course	80	20	100	80	20	100
Project/review						50

13. Duration of examination of theoretical courses up to 50 points shall be two hours, up to 60 points two and half hours, up to 75 points three hours and up to 100 points four hours. The same for the practical courses up to 25 points shall be two hours and up to 75 points six hours generally.
14. To ensure transparency of the evaluation process, the internal assessment grade awarded to the students in each course in a semester shall be published on the notice board at least one week before the commencement of Term end examination.
15. In order to qualify in a semester examination, a student shall have to get minimum aggregate 40 points (**D and above on grade point scale**) in each course.
16. There shall generally be no retest for internal assessment. If a student misses a class test during an ongoing semester for health or other valid reasons, he/she may be given a second chance with the permission of the Departmental Committee. The student has to justify his/her absence by providing an authentic certified document. However, such a second chance shall not be the right of the student; it will be the discretion of the D.C. to give or not to give second chance to a student to appear for internal assessment.
17. For **Internal Assessment**, two class tests- each of 12 points (for hard core courses) or 07 points (for soft core courses) or 17 points (for Elective and open courses) will be conducted comprising of objective and/or descriptive questions. The Class test will be for a duration of 45 minutes (for 12 points), or 30 minutes (for 07 points), or 60 minutes (for 17 points). Thee (03) points will be awarded for class attendance and/or assignments for each course during each semester. The total out of 24 or 14 or 34 points will finally be converted to 12 or 07 or 17 points. For scoring of attendance the following principle will be followed: ≥80%, 3; 79-70%, 2; 69-60%, 1.
18. Internal marks will not change. A student cannot repeat Internal Assessment. Internal Assessment answer books shall be shown to the students concerned but not the end-semester answer scripts.
19. Students who have failed semester -end exam may reappear for the semester-end exam only twice in subsequent period. The student will be finally declared as failed if he\she does not pass in all credits within a total period of four years.
20. **(a)** A candidate who fails to qualify or fails to appear at not more than two theoretical / practical courses in a semester will be treated as Failed but Supplementary (FS) and will be allowed to prosecute studies in the next semester. He/she will generally be allowed to appear at supplementary examination for those papers in which he/she has failed. The date of supplementary examination will be announced later. However, his/her marks of qualified papers will be retained. **(b)** If a candidate fails to qualify or fails to appear at more than two theoretical /practical courses in a semester, he/she will be treated as Failed but Repeat (FR) and will have to repeat that semester as a whole in the next year. He/she will not be allowed to join classes of the next semester.
21. The candidate eligible for supplementary examination as per **20(a)** or eligible for repeat semester as per **20(b)** will get a chance to appear at maximum of two consecutive supplementary / total

examinations in any semester. However a candidate will have to qualify in all the semesters within a span of four years from the year of admission.

22. A candidate who has failed in a theoretical course but has passed the practical course, based on the former, need not appear in the practical course in the supplementary examination.

23. According to the University Regulations, candidates can review only their theoretical answer scripts of Semester-End examination through the Office of the Controller of Examinations, Kalyani University. No application for reviewing of a practical paper shall be entertained. Similarly the internal assessment answer scripts will also not be reviewed.

24. The written answer scripts of each term end semester examination will be preserved according to the University Rules. Class test answer scripts will however be preserved in the Department for two years from the date of start of the concerned Semester. After that period, the scripts will be disposed of.

25. The semester end and final grade sheets and transcripts will have only grades and grade points average.

GRADING SYSTEM

QUALIFICATION	GRADE	SCORE ON 100% POINTS	POINTS
Outstanding	O	90-100	10
Excellent	E	80-89	9
Very Good	A	70-79	8
Good	B	60-69	7
Fair	C	50-59	6
Below average	D	40-49	5
Fail	F	>40	

$$SGPA^{a} = \frac{\text{Sun of [Credits X Grade Point]}}{\text{Sum of credits of all papers in the semester}}$$ calculated for each semester

$$CGPA^{b} = \frac{\text{Sem1GP X1 + Sem2GP X1 + Sem3GP X1.5 + Sem4GP X 1.5}}{5}$$ for the entire course

[a] Semester Grade Point Average (SGPA)

[b] Cumulative Grade point Average (CGPA)

To satisfactorily complete the M.Sc. Course & qualify for the degree, a student must obtain a minimum CGPA of 5.

CGPA	Division
8-10	**1st Div with Distinction**
6.5-7.9	**1st Div**
5.5-6.4	**2nd Div**
6	**2nd Div with 55%***
5-5.4	**3rd Div**

(* To convert CGPA into %: CGPA – 0.5 X 100)

26. The following academic calendar will be followed for each semester:

a. Duration of classes: Four and half months

b. Preparatory leave - Fifteen days maximum

c. Examination including Practical - Twenty days

Outline of the Choice Based Course & Credit Semester System

Course Categories: **HC:** Hard Core; **SC:** Soft Core; **E:** Elective; **OC:** open course
Course Transaction Categories: **T:** Theory; **P:** Practical**; PW:** Project Work
Evaluation Categories: **IA:** Internal Assessment; **TEE:** Term End Examination

Course	Course Name	Points	Credit	Hrs/wk
SEMESTER I				
HARD CORE THEORY				
BOHCT1.1	Biology & Diversity of Virus, Bacteria & Fungi	75	3	4
BOHCT1.2	Biology & Diversity of Algae, Bryophytes & Pteridophytes	75	3	4
BOHCT1.3	Biology & Diversity of Gymnosperms, Taxonomy of Angiosperms & Biosystematics	75	3	4
BOHCT1.4	Cytology, Cytogenetics & Genetics	75	3	4
HARD CORE PRACTICAL				
BOHCP1.1	Practical based on BOHCT1.1	25	1	3
BOHCP1.2	Practical based on BOHCT1.2	25	1	3
BOHCP1.3	Practical based on BOHCT1.3	25	1	3
BOHCP1.4	Practical based on BOHCT1.4	25	1	3
LIBRARY/ FIELD WORK/ CLASS TEST/ TUTORIAL				2
Total Points & Credits in Semester I		**400**	**16**	**30**

Detailed Syllabus of the Choice Based Credit Semester System

SEMESTER I

Course	Subject	Points	Credits	Hrs./Wk.
BOHCT1.1 (Group A + B + C)	**Biology & Diversity of Virus, Bacteria & Fungi**	**75**	**3**	**4**
BOHCP1.1	**Practical based on BOHCT1.1**	**25**	**1**	**3**
TOTAL		**100**	**4**	**7**

EVALUATION SCHEME - THEORY: **Internal Assessment (15) + Term End Examination (60)**
TEE: Group A (20 points) + Group B (20 points) + Group C (20 points)
PRACTICAL: Internal Assessment (5) + Term End Examination (20)

Theoretical course
BOHCT1.1

Group A
Biology & Diversity of Virus

TEE points: 20 **Classes/ Semester: 20**

1. Nature and origin of virion. (2)
2. Nomenclature and classification, distinctive properties of viruses, morphology (symmetry) and a general account on different types of viruses, Viral genome. (3)
3. Structure & chemistry of viruses-capsid and their arrangements, types of envelopes and their composition, Molecular organization of virion with special reference to TMV and HIV. (4)
4. Isolation, purification and identification of viruses based on chemical, physical and immunological techniques. (3)
5. Transmission of plant viruses, genetic basis of cell to cell movement of plant viruses. (2)
6. Management of plant viruses following classical and modern technique. (2)
7. Molecular basis of Lytic and Lysogenic cycle. (2)
8. Prions, viroids, virusoids, Satellite virus. (2)

Group B
Biology & Diversity of Bacteria

TEE points: 20 **Classes/ Semester: 20**

1. Microbial taxonomy and phylogeny, major groups of Bacteria. (2)
2. Ultra structure of Gram positive and Gram negative bacteria. (2)
3. Bacterial motility, bacterial sporulation. (1)
4. Bacterial growth kinetics, factors affecting growth. (1)
5. Photolithotrophs, chemolithotrophs, photoorganotrophs & chemoorganotrophs, Mixotroph. (1)
6. Organization and replication of genetic material in bacteria. Genetic recombination (conjugation, transformation and transduction) in bacteria. (3)
7. Concept of microbial ecology with reference to air, water and soil. (2)
8. Microbes associated with food, food-borne infections and intoxications; preservation of food. (1)
9. Cells and organ of immune system, antigen (chemical nature and types), immunoglobulins (structure and types), brief idea about hypersensitivity and vaccine. (3)
10. Air, water, and soil-borne disease – causal organism, symptoms, control. (2)
11. Industrial production of ethanol, penicillin and vitamin B12. (1)
12. Cosmetic microbiology-current trends. (1)

Group C
Biology & Diversity of Fungi and their allies

TEE points: 20 **Classes/ Semester: 20**

1. Distinctive features of fungi to form a separate kingdom; modern trends in classification (1)
2. The architecture of fungal cell, cell wall, cell membrane, cell organelles and cytoskeleton, nucleus and its division; biogenesis and protoplast technology; translocation in mycelia (2)
3. Genome organization in fungi; extra chromosomal and transposable genetic elements in fungi (2)
4. Somatic recombination in fungi: heterothallism; heterokaryosis and parasexuality (3)

5. Diversity of somatic, reproductive and fruiting structures in different groups: Myxomycota, Oomycota, Chytridiomycota, Zygomycota, Ascomycota, Basidiomycota, Deuteromycota (10)
6. Fungal spores: types, dispersal, dormancy and germination (2)

Practical Course

BOHCP1.1

(Based on BOHCT1.1 – Biology & Diversity of Virus, Bacteria & Fungi)

Points: 25 **3 hours/ week**

1. Study of inclusion bodies in virus-infected plants, its distribution and orientation.
2. Study of epidermal pattern of virus-infected leaves with reference to change in stomatal index.
3. Biochemical study of detection of plant viruses.
4. Submission of field record along with herbarium sheets of virus-infected plants.
5. Isolation and enumeration of bacteria from soils and water samples.
6. Enrichment and isolation of free-living nitrogen fixing bacteria from soil.
7. Isolation and straining of *Rhizobium* from root nodule.
8. Determination of antibiotic sensitivity of some bacteria by disc diffusion method.
9. Determination of thermal death point of bacteria.
10. Construction of bacterial growth curve; Influence of inhibitor on bacterial growth.
11. Study of morphological and reproductive structures of some macro- and micro-fungi
12. Identification of different fruiting structures of macro-fungi, permanent slides with different reproductive structures of micro-fungi, spore forms of rust fungi, lichens

Note: Regularly checked Laboratory records, permanent slides prepared during practical classes, preserved and dried specimens collected during field works should be submitted at the time of TEE.

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Course	Subject	Points	Credits	Hrs./Wk.
BOHCT1.2 (Group A + B + C)	**Biology & Diversity of Algae, Bryophytes & Pteridophytes**	**75**	**3**	**4**
BOHCP1.2	**Practical based on BOHCT1.2**	**25**	**1**	**3**
TOTAL		**100**	**4**	**7**

EVALUATION SCHEME - THEORY: Internal Assessment (15) + Term End Examination (60)
TEE: Group A (20 points) + Group B (20 points) + Group C (20 points)
PRACTICAL: Internal Assessment (5) + Term End Examination (20)

Theoretical course

BOHCT1.2

Group A

Biology & Diversity of Algae

TEE points: 20 **Classes/ Semester: 20**

1. Modern trends: Outline of principles and recent trends in algal systematics; endosymbiotic theory of chloroplast evolution and algal origin. (2)

2. General overview & Resource utilization: Prochlorophyta; Glaucophyta; Dinophyta; Heterokontophyta: Bacillariophyceae, Xanthophyceae, Eustigmatophyceae; Bio-fertilizers and bio-molecules with commercial application. (7)
3. Cyanobacteria: Diversity of forms and habitats; cyanobacterial taxonomy; cyanobacterial evolution. (3)
4. Rhodophyta: Diversity of forms and habitats; evolutionary trends in red algae; ecology of red algae. (3)
5. Chlorophyta: Diversity of forms and habitats; evolutionary trends of green algal lineages; salient features of different classes of chlorophytes. (3)
6. Phytoplankton: Types of phytoplankton; algal blooms; algal toxins (2)

Group B

Biology & Diversity of Bryophytes

TEE points: 20 **Classes/ Semester: 20**

1. General classification: Criteria, recent trends and outline of classification of the liverworts, mosses and hornworts. (8)
2. Phylogeny: Evolutionary significance and interrelationships; recent concepts on evolution of the three lineages (liverworts, mosses and hornworts). (4)
3. Biogeography and Ecological significance: Diversity and distribution patterns; population and community dynamics; physiological ecology and adaptations; ecological roles of bryophytes. (4)
4. Economic significance and Conservation: Economic importance; threats and vulnerability; conservation strategies; restoration ecology. (4)

Group C

Biology & Diversity of Pteridophytes

TEE points: 20 **Classes/ Semester: 20**

1. Introduction: A general account and an outline of recent system of classification of Pteridophytes upto order level with characteristic features. (2)
2. Diversity and Evolution: Diversity in organography and the evolutionary trends in the members of Psilophyta, Lycophyta, Sphenophyta and Filicophyta - Early ferns, Eusporangiate ferns (Ophioglossales, Marattiales), Leptosporangiate ferns (Filicales, Marsileales, Salviniales). (5)
3. Gametophyte: Patterns of spore germination; patterns of gametophyte development in homosporous and heterosporous pteridophytes; mating system in fern. (3)
4. Sporophyte: Variations in vegetative and reproductive structures and their evolution with special emphasis on shoot apex, stelar organization, and soral characters. (4)
5. Cytogenetics and Speciations: Pteridophytes with low and high chromosome number; polyploidy in microphyllous and megaphyllus forms; intergeneric and interspecific hybridity; obligate interbreeding forms. (2)
6. Antheirdiogen in ferns. (2)
7. Habitat diversity of pteridophytes and their conservation; endemic and endangered pteridophytes with special reference to India. (2)

Practical Course

BOHCP1.2

(Based on BOHCT1.2 – Biology & Diversity of Algae, Bryophytes & Pteridophytes)

Points: 25 **3 hours/ week**

1. Morphological study and identification of members of the major algal groups – Cyanobacteria, Rhodophyta and Chlorophyta.

2. Seaweed identification – *Enteromorpha, Ulva, Catenella, Padina* and *Sargassum.*
3. Phytoplankton identification – desmids, diatoms, dinoflagellates.
4. Collection of algae from different localities and through local tours; their preservation and identification.
5. Field record, collection and preservation of common algal taxa.
6. Morphological study and identification of members of the three lineages – Marchantiophyta, Bryophyta and Anthocerotophyta.
7. Identification of diagnostic features of preserved bryophytic specimens and permanent slides.
8. Collection of bryophytes from different localities and through local tours; their preservation and identification.
9. Field record, collection and preservation of common bryophyte taxa.
10. Comparative morpho-anatomical studies of vegetative and reproductive organs of some members of available pteridophytes with identification up to generic level.
11. Study of diagnostic features of important pteridophytic taxa .
12. Field record, collection and preservation of common pteridophytic taxa.

Note: Regularly checked laboratory records, permanent slides prepared during practical classes, specimens collected during compulsory field works (preferably one long field visit) should be submitted in a standard manner along with Field Note Books at the time of TEE.

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Course	Subject	Points	Credits	Hrs./Wk.
BOHCT1.3 (Group A + B)	**Biology & Diversity of Gymnosperms, Taxonomy of Angiosperms & Biosystematics**	**75**	**3**	**4**
BOHCP1.3	**Practical based on BOHCT1.1**	**25**	**1**	**3**
TOTAL		**100**	**4**	**7**

EVALUATION SCHEME - THEORY: Internal Assessment (15) + Term End Examination (60)
TEE: Group A (20 points) + Group B (40 points)
PRACTICAL: Internal Assessment (5) + Term End Examination (20)

Theoretical course
BOHCT1.3

Group A
Biology & Diversity of Gymnosperms

TEE points: 20 **Classes/ Semester: 20**

1. Introduction: A general account and an outline of recent system of classification of gymnosperms upto order level with characteristic features. (2)
2. Palaeozoic Pteridosperms (Seed Ferns): Major events in evolution of Palaeozoic Pteridosperms; brief account of Lyginopteridaceae, Calamopityaceae, Medullosaceae, Callistophytaceae. (5)
3. Cycads & Cycadeoids: General traits, circumscriptions of the families of Cycads, early evidence, Cycad and Cyadeoid foliage. (2)
4. More diversification among gymnosperms: Brief account of Caytoniaceae, Corystospermaceae, Peltaspermaceae, Glossopteridceae, Pentoxylaceae. (5)

5. Ginkgos: General traits, early evidence, distribution in time and space. (1)
6. Conifers: General traits of conifers; first evidence of conifer organization - Cordaitales, Voltziales; origin of conifer cones and leaves; circumscriptions of the families of extant conifers and their interrelationships; comparative account among conifers on basis of the male gametophyte, pollination mechanisms, female gametophytes, proembryo development. (4)
7. Gnetophytes: General traits; characteristics features of the genera of Gnetopsida; comparisons amongst *Ephedra*, *Gnetum* and *Welwitschia.* (1)

Group B

Taxonomy of Angiosperms & Biosystematics

TEE points: 40 **Classes/ Semester: 40**

1. Systems of angiosperms classification: Outline of classification of Cronquist (1988) and Takhtajan (1997) up to Subclasses / Super orders. Broad outline of angiosperm phylogeny Group (APG) III, 2009 with the outline concept of Palaeoherbs and Eudicots. (4)
2. A general survey of the following taxa of angiosperms (*sensu* Cronquiust, 1988) with reference to their characteristics, inter-relationship, evolutionary trends, changed concepts and economic importance in the light of recent researches: Amborellaceae, Magnoliales, Caryophyllidae, Nepenthales, Podostemales, Asterales, Alismatales and Poaceae. (10)
3. ICBN : Changes, addition and alteration of latest four codes; principles, rank of taxa and names of taxa, nomenclatural types, priority of publication and limitation of the priority of publications, effective and valid publications, author's citation; changes and rejection of names, preliminary concept of appendices. Principle idea about Bio-codes and Phylocodes. (4)
4. Concepts of phytogeography: Endemism in India; invasion and introduction of plants in India. (2)
5. Botanic Gardens and Herbaria: Importance, examples from India and abroad. (2)
6. Biosystematics: Definition, methods, categories, differences with classical taxonomy. (2)
7. Numerical Taxonomy: Definition, principles, logical steps, applications, merits and demerits. (3)
8. Evolutionary concept ; Basic idea about following terms - Plagiomorphy and Apomorphy; Parallelism and Convergence; Homology and Analogy; Monophyly and Polyphyly including the concept of Heterobathmy, Cline, Polarity, Anagenesis and Cladogenesis, Symplesiomorphy, Synapomorphy, Autopomorphy, Stasigenesis, Catagenesis, Paraphyly, Holophyly, Homoplasy; Phylogram, Dendrogram and Cladogram. (3)
9. Cladistics system of classifications of Angiosperms: Principles, methods, merits and demerits. (2)
10. Data sources of taxonomy: Embryology, photochemistry with brief account of DNA - Taxonomy, DNA - barcoding, e - Taxonomy; nuclear rDNA, chloroplast and mitochondrial DNA; ultrastructure of sieve tube plastids. (5)
11. Taxonomic literatures: Definitions with examples of classical books, index, flora and manual, revision and monograph, icons, bibliography, catalogue, encyclopedias, glossary and dictionary. Important periodicals of India and abroad. (3)

Practical Course

BOHCP1.3

(Based on BOHCT1.3 – Biology & Diversity of Gymnosperms, Taxonomy of Angiosperms & Biosystematics)

Points: 25 **3 hours/ week**

1. Studies of morpho-anatomy of conifer leaves and their identification (at least five taxa).
2. Studies of reproductive structures of at least two conifers.
3. Characterization of at least four taxa of gymnosperms for identification.
4. Studies of morpho-anatomy of *Gnetum* and *Ephedra*.
5. Field record and plant collection to be submitted (not more than 10 herbarium specimens).
6. Drawing and description of specimens from representative locally available families.
7. Identification of family with the help of Keys of angiosperms by Davis and Cullen's book and Hutchinson's book.
8. Identification of genera and species with the help of local and regional floras.
9. Preparation of an artificial indented /bracketed key at family/generic/ species level, from locally available plants as well as, from the worked out plants.
10. Two compulsory local field excursions for familiarization with the local flora.
11. Herbarium specimens (at least 25) of wild plants abundant in the locality to be submitted at the term-end examination.

Note: Regularly checked laboratory records and specimens collected during compulsory field works should be submitted in a standard manner along with Field Note Books at the time of TEE.

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Course	Subject	Points	Credits	Hrs./Wk.
BOHCT1.4	**Cytology, Cytogenetics & Genetics**	**75**	**3**	**4**
BOHCP1.4	**Practical based on BOHCT1.4**	**25**	**1**	**3**
TOTAL		**100**	**4**	**7**

EVALUATION SCHEME - THEORY: Internal Assessment (15) + Term End Examination (60)
TEE: 60 points
PRACTICAL: Internal Assessment (5) + Term End Examination (20)

Theoretical course
BOHCT1.4

Cytology, Cytogenetics & Genetics

TEE points: 60 **Classes/ Semester: 60**

1. Genome organization in Eukaryotes: DNA packing in nucleosome; repetitive, satellite and unique DNA sequences; C-value paradox; structural and functional organization of telomeres and centromeres; spindle organization, polymerization and significance. (5)
2. Karyotype concept in relation to evolution; banding techniques; GISH and FISH techniques. (4)
3. Sex determination: Sex determination in plants and their interrelationship with human, *Drosophila* and mice models; dosage compensation; sex linked inheritance. (4)
4. Special type chromosomes: Cytogenetical significance of polytene and B-chromosome; deletion mapping; recombination. (3)
5. Linkage and crossing over: chiasma frequency and genetic map distance; Evolutionary significance of recombination; tetrad analysis; centromere mapping with ordered tetrad. (5)
6. Reciprocal translocation: Cytogenetics of reciprocal translocation in plant species; Gaudens and Velans complex; reciprocal translocation in humans. (3)

7. Polyploidy: Polyploids and aneuploids; Inheritance of autopolyploids and trisomics; significance and limitations of polyploidy; aneuploidy in humans. (4)
8. Plastids and mitochondrial DNA influenced traits. (2)
9. Microbial genetics: Transformation, conjugation and transduction and their significance in gene mapping. (2)
10. Gene mutation: Induction, types, molecular basis, significance; paramutation; DNA repair mechanism; epigenetic changes; genetic imprinting; prion particles; site directed mutagenesis; gene complementation test; rII locus. (5)
11. Biology of DNA and RNA: DNA forms; DNA replication; transcription and translation processes; RNA types; characterization of rRNA; pre mRNA processing. (5)
12. Genetic regulation: Regulation of prokaryotic gene expression – *lac*, *trp* and *ara* operons; regulation of eukaryotic gene expression – brief account. (4)
13. Transposonal elements: Ac-Ds, IS elements, P-elements and their role in genetics. (2)
14. Population genetics: Hardy-Weinberg principle; gene frequency in a population, genetic equilibrium, factors affecting gene frequency. (3)
15. Cell cycle regulation and cancer: Role of proteins in controlling cell cycle; apoptosis; oncogenes and protooncogenes; tumour suppressor genes; role of E2F and p^{53} in controlling cell cycle; cancer therapy. (6)
16. Recombinant DNA technology – brief account (3)

Practical Course
BOHCP1.4
(Based on BOHCT1.4 – Cytology, Cytogenetics & Genetics)

Points: 25 **3 hours/ week**

1. Concept of karyotype analysis; karyotype analysis and ideogram preparation.
2. Determination of chiasma frequency.
3. Pollen mitosis – *Allium cepa*.
4. Determination of nucleolar frequency in a plant specimen?
5. Determination of mitotic index in a plant species.
6. Study of sex chromatin in cell population.
7. Determination of gene/allelic frequency from ABO blood group in human population.
8. Pollen fertility and viability analysis.
9. Localization of DNA *in situ*.
10. Testing goodness of fit from the supplied samples.
11. Reciprocal translocation and inversion heterozygosity (demonstration).
12. Macromutation and polyploidy (demonstration).
13. Protein and DNA separation by gel electrophoresis (demonstration).

Note: Regularly checked laboratory records, permanent slides prepared during practical classes should be submitted in a proper way at the time of TEE.