KARNATAK UNIVERSITY, DHARWAD

"A" Grade
NAAC Accredited

Regulations and Syllabus

for

P.G. Department of Studies in

BOTANY

(I to IV Semesters)

Under Choice Based Credit System

From
2008-09 & onwards
1.4 Core paper (Ist Sem).
w.e.f.2011-2012

ಮೊದಲ ಮುದ್ರಣ – 2008–09 500 ಪ್ರತಿಗಳು

- ಮಾರಾಟಕ್ಕೆ 400 ಪ್ರತಿಗಳು (ಅನುಕ್ರಮ ಸಂಖ್ಯೆ ಹಾಗೂ ದರ ರೂ. 100/– ಮುದ್ರಿಸುವದು)
- 100 ಪ್ರತಿಗಳ ಕಾ0ರ್ಯಾಲ0ಯದ ಉಪ0ಯೋಗಕ್ಕೆ ("ಕಾ0ರ್ಯಾಲ0ಯದ ಉಪ0ಯೋಗಕ್ಕೆ" ಮುದ್ರಿಸುವದು)

Regulations Governing Post-Graduate Programmes in the Faculty of Science & Technology under Choice Based Credit System

(Framed under Section 44(1)(c) of the K. S.U. Act, 2000)

1.0 Title

These Regulations shall be called "Regulations Governing the Post-Graduate Programmes in the Faculty of Science & Technology under the Choice Based Credit System" in Karnatak University, Dharwad

2.0. Commencement

These Regulations shall come into force with effect from the academic year 2008-09.

3.0. Definitions

a In these Regulations, unless otherwise provided:
"Academic Council" means Academic Council of the University constituted according to the *Karnataka State Universities Act, 2000.*

b "Board of Studies" means P.G. Board of Studies of the University, Adhoc/ Combined and Steering Committees of International Diploma Programmes in the discipline/subjects concerned.

c "Compulsory Course" means fundamental paper, which the student admitted to a particular Post-Graduate Programme, should successfully complete to receive the Post Graduate Degree in the concerned subject.

d Course Weightage" means number of credits assigned to a particular course.

e "Credit" means the unit by which the course work is measured. One Credit means one hour of teaching work or two hours of practical work per week. As regards the marks for the courses, 1 Credit is equal to 25 marks, 2 credits are equal to 50 marks, 3 credits are equal to 75 marks and 4 credits are equal to 100 marks.

f "Cumulative Grade Point Average (CGPA)" refers to the cumulative Grade Point Averages weighted across all the semesters and is carried forward from first semester to subsequent semesters.

g "Degree" means Post-Graduate Degree.

h "Grade" is an index to indicate the performance of a student in the selected course. These Grades are arrived at by converting marks scored in each course by the candidate in both Internal Assessment and Semester-end Examinations.

i "Grade Point Average (GPA)" refers to an indication of the performance of the student in a given semester. GPA is the weighted average of all Grades a student gets in a given semester.

j "Open Elective Course" means a paper offered by a Department to the students of other Departments.

k "Post Graduate Programme" means semesterised Master's Degree Programmes

excluding P.G. Diploma.

l "Specialization course" means advanced paper offered by a Department that a student of that Department can opt as a special course.

m "Student" means the student admitted to programmes under (k).

n "University" means Karnatak University, Dharwad.

4.0. Minimum Eligibility for Admission

A candidate, who has successfully completed Bachelor's Degree programme in Science or any other Degree programme of this University or of any other University recognized as equivalent thereto by this University, shall be eligible for admission to the Post Graduate Programmes in science provided the candidate also satisfies the conditions like the minimum percentage of marks and other eligibility conditions as prescribed by the University from time to time.

Admissions shall be as per Government of Karnataka reservation policy and the directions issued in this regard from time to time.

5.0. Duration of the Programme

The duration of the study for the Post-Graduate Degree programme shall extend over a period of two (three in case of MCA) consecutive academic years, each academic year comprising two semesters, and each semester comprising sixteen weeks with a minimum of ninety working days.

However, the students, who discontinue the programme after one or more semesters due to extraordinary circumstances, are allowed to continue and complete the programme with due approval from the Registrar. Candidates shall not register for any other regular course other than Diploma and Certificate courses being offered on the campus during the duration of P.G. Programme.

6.0. Medium of Instruction and Evaluation

The medium of instruction shall be English. However, the students may write the examinations in Kannada if so provided by the concerned Board of Studies.

7.0 Programme Structure

7.1 The students of Post-Graduate Programme shall study the courses as may be approved by the concerned Board of Studies, Faculty and the Academic Council of the University from time to time subject to minimum and maximum credits as outlined in these regulations.

7.2 There shall be three categories of courses namely, Compulsory Courses,

Specialization Courses and Open Elective Courses.

7.3 Each programme shall have a set of Compulsory Courses, as stipulated in the regulations governing the concerned programme, that a student must complete to get the concerned degree.

7.4 In those programmes that offer specialization courses, the students shall choose the prescribed number of Specialization Courses offered within the Department.

7.5 Each Department shall offer Open Elective courses for students of other Departments. The students of a Department shall choose Open Elective courses from among those prescribed by the University and selected by the Department from time to time. P.G. Centers and affiliated colleges, can offer those Open Elective Courses which are approved or prescribed by their Parent Department of the University. Such Open Elective courses shall be taught by qualified teachers approved by the University.

7.6 The credits for each of the Compulsory Courses may vary from 2 to 4; for Specialization Course, from 2 to 4; and for Open Elective Course, from 2 to 4. Wherever project work/ field work/practical are involved in the course, the credits may extend to 6 or as otherwise provided by concerned programme.

7.7 The minimum credits for P.G. Programme shall be 96. In the case of MCA, the minimum number of credits shall be 158 and in case of M.Sc. Computer Science the minimum credits are 116.

7.8 The students shall undertake project/field work during the programme as a compulsory course or in lieu of Specialization Course or Open Elective Course if so specified by the concerned Board of Studies.

7.9 The ratio between Compulsory, Specialization and Open Elective may differ from department to department.

7.10 The detailed programme structure for Faculty of Science & Technology shall be as prescribed and shown in Annexure-I, Annexure –Ia & Annexure-Ib.

7.11 The Open Elective Courses generally will have practical component, unless otherwise specified by the respective Board of Studies. The number of students admitted to the course shall commensurate with the availability of infrastructure.

8.0. Attendance

8.1 Each course shall be taken as a unit for the purpose of calculating the attendance.

8.2 Each student shall sign the attendance register maintained by the Department for each course for every hour/unit of teaching/practical. The course teachers shall submit the monthly attendance report to the Chairperson of the Department who shall notify the same on the notice board of the Department during the second week of the subsequent month.

8.3 Marks shall be awarded to the student for attendance as specified in the regulations concerning evaluation.

8.4 A student shall be considered to have satisfied the required attendance for each course if he/she has attended not less than 75 % of the total number of instructional hours during the semester.

8.5 There is no provision for condoning shortage of attendance.

8.6 The students who do not satisfy the prescribed requirement of attendance shall not be eligible for the ensuing examination. Such candidates may seek admission afresh to the given semester.

8.7 Such of the candidates who have participated in State/National level Sports, NSS, NCC, Cultural activities and other related activities as stipulated under the existing regulations shall be considered for giving attendance for actual number of days utilized in such activities (including travel days) subject to the production of certificates from the relevant authorities within two weeks after the event.

9.0 Examination

9.1 There shall be an examination at the end of each semester. The odd semester examinations shall be conducted by the respective Departments/ P.G.Centres/ Colleges. The even semester examinations shall be conducted by the University.

9.1.1 Unless otherwise provided, there shall be semester-end examination of 3 hours duration for 75/100 marks; 1.5 hours for 50 marks and 2/4 hours for 35/75 marks practical examination.

9.1.2 Every student shall register for each semester-end examination as per the University Notification by submitting duly completed application form through the proper channel and shall also pay the fees prescribed.

9.1.3 The Office of the Registrar (Evaluation) shall allot the Register Number to the candidate at the 1st semester-end examination. That will be the Register Number of the candidate for all subsequent appearances at semester-end examinations.

9.1.4 The Answer scripts shall be in the safe custody of the University for a maximum period of six months from the date of announcement of results. These shall be disposed off after six months.

9.1.5 The programme under CBCS is a fully carry-over system. A candidate reappearing for either the odd or even semester examinations shall be permitted to take examinations as and when they are conducted (even semester examination in even semester and odd semester examination in odd semester).

9.1.6 Candidates who have failed, remained absent or opted for improvement in any course/ courses shall appear for such course/ courses in the two immediate successive examinations that are conducted. However, in the case of the candidates appearing for improvement of their marks, the marks secured in the previous examination shall be retained, if the same is higher.

9.1.7 Candidates who desire to challenge the marks awarded to them, in the even semester-

end examinations, may do so by submitting an application along with the prescribed fee to the Registrar (Evaluation) within 15 days from the announcement of results.

9.2. Odd Semester Examination

9.2.1 There shall be a Board of Examiners to set, scrutinise and approve question papers.

9.2.2 The BOE shall scrutinise the question papers submitted in two sets by the paper setters and submit the same to the office of the Registrar (Evaluation).

9.2.3 The office of the Registrar Evaluation shall dispatch the question papers to the Departments/ P.G.Centres/ Colleges who shall conduct the Examinations according to the Schedule announced by the University.

9.2.4 The Chairperson of the Department/ Administrator of the P.G.Centre/ Principal of the College shall appoint one of their full time course teachers as Post Graduate Programme (PGP) Coordinator who shall conduct the examinations and arrange for evaluation of answer scripts.

9.2.5 Answer scripts shall be valued by the examiners appointed by the University. However, in those centres where an examiner for a particular course is not available, then the answer scripts of that course shall be dispatched to the office of the Registrar (Evaluation) who shall arrange for valuation of the same.

9.2.6 There shall be single valuation. The examiners (Internal or External) shall value the answer scripts and shall indicate the marks awarded to each question on the answer script.

9.2.7 The Marks List, a copy of the Examination Attendance Sheet and the sealed bundles of the answer scripts shall be dispatched by the PGP Coordinator to the Registrar (Evaluation)'s Office at the conclusion of the valuation at the respective centres.

9.2.8 The Office of the Registrar Evaluation shall process and announce the results.

9.3. Even Semester

9.3.1 There shall be a Board of Examiners to set, scrutinise and approve question papers.

9.3.2 As far as practicable, it will be ensured that 50% of the paper setters and examiners are from other Universities/ Research Institutes.

9.3.3 Each answer script of the semester-end examination (theory and project report) shall be assessed by two examiners (one internal and another external). The marks awarded to that answer script shall be the average of these two evaluations. If the difference in marks between two evaluations exceeds 20% of the maximum marks, such a script shall be assessed by a third examiner. The marks allotted by the third examiner shall be averaged with nearer award of the two evaluations.

Provided that in case the number of answer scripts to be referred to the third examiner in a course exceeds minimum of 5 or 20% of the total number of scripts, at the even semester-end examinations, such answer scripts shall be valued by the Board of Examiners on the date to be notified by the Chairperson of the Board of Examiners and the marks awarded by the Board shall be final.

9.3.4 Wherever dissertation/ project work is prescribed in the even semesters of a programme, the same shall be evaluated by both internal and external examiners. The evaluation shall be as prescribed by the concerned Board of Studies.

9.3.5 In case of programmes with practical examination details of maximum marks, credits or duration may vary from Department to Department as specified by the concerned Board of Studies.

9.4. Evaluation

9.4.1 Each Course shall have two evaluation components - Internal Assessment (IA) and the Semester End Exams.

9.4.2 The IA component in a course shall carry 25% / 30% / 50% and the Semester End Examination shall carry 75% / 70% / 50% respectively, as the case may be. Courses having 25% & 30% / 50% marks as internal assessment shall have 3 / 5 marks allotted to attendance. However, in case of project work, the distribution of marks for Internal Assessment and Examination shall be left to the discretion of the concerned BOS.

9.4.3 Marks for attendance shall be awarded to the students according to the following table.

For courses carrying 25 % of marks for IA, the attendance marks shall be

Attendance (in percentage)	**Marks**
Above 90	3
Above 80 and up to 90	2
Above 75 and up to 80	1

9.4.4 Internal Assessment (IA) shall be based on written tests, practical and seminars. However, the number of IA components per course per semester shall not be less than two.

9.4.5 The IA marks list shall be notified on the Department Notice Board as and when the individual IA components are completed and the consolidated list shall be submitted to the Office of the Registrar Evaluation before the commencement of semester-end examination, or as directed by the University.

9.4.6 The tests shall be written in a separately designated book supplied by the University which shall be open for inspection by the students after evaluation.

9.4.7 There is no provision for seeking improvement of Internal Assessment marks.

9.4.8 The IA records, pertaining to Semester Examination, shall be preserved by the department/Centres/Colleges for a period of one year from the date of semester examination. These records may be called by the University or a body constituted by the University as and when deemed necessary.

9.4.9 The dissertation/project work viva-voce shall be conducted by an internal and external examiner.

10.0. Maximum duration for completion of the Programme

10.1 A candidate admitted to a post graduate programme shall complete it within a period, which is double the duration of the programme from the date of admission.

10.2 Whenever the syllabus is revised, the candidate reappearing shall be allowed for the examinations only according to the new syllabus.

11.0. Declaration of Results

11.1 The minimum for a pass in each course shall be 40% of the total marks including both the IA and the semester-end examinations. Further, the candidate shall obtain at least 40% of the marks in the semester-end examination. There is no minimum for the IA marks.

11.2 Candidates shall secure a minimum of 50% in aggregate in all courses of a programme in each semester to successfully complete the programme.

11.3 Candidates shall earn the prescribed number of credits for the programme to qualify for the PG Degree.

11.4 For the purpose of announcing the results, the aggregate of the marks secured by a candidate in all the semester examinations shall be taken into account. However, Ranks shall not be awarded in case the candidate has not successfully completed each of the semesters in first attempt or has not completed the programme in the stipulated time (vide Regulation 5) or had applied for improvement of results.

12.0 Marks, Credit Points, Grade Points, Grades and Grade Point Average

12.1 The grade points and the grade letters to candidates in each course shall be awarded as follows:

Percentage of marks	Grade Points	Grade Letter
75 and above, up to 100.00 %	7.50 to 10.00	A
60 and above but less than 75 %	6.00 and above but less than 07.5	B
50 and above but less than 60 %	5.00 and above but less than 6.0	C
40 and above but less than 50 %	4.00 and above but less than 05.00	D
less than 40.00 %	Less than 4.00	F

12.2 Credit Point (CP): The Credit Point for each course shall be calculated by multiplying the grade point obtained by the credit of the course.

12.3 The award of Grade Point Average (GPA) for any student is based on the performance in the whole semester. The student is awarded Grade Point Average for each semester based on the Total Credit Points obtained and the total number of credits opted for. The GPA is calculated by dividing the total credit points earned by the student in all the courses by the total number of credits of those courses of the semester.

12.4 The Cumulative Grade Point Average (CGPA) shall be calculated by dividing the total number of credit points in all the semesters by the total number of credits in all the semesters. The CGPA to date shall be calculated by dividing the total number of credit points in all the semesters to date by the total number of credits in all the semesters to date.

CGPA for the I Semester =

Sum of the CP of the I Semester ÷ Sum of the credits of the I Semester

CGPA for the II Semester =
Sum of the CP of the I Sem + Sum of the CP of II Sem. ÷ Sum of the credits of the I Semester + II Semester

CGPA for the III and IV Semesters shall be computed accordingly.

12.5 The Grade Card at each semester examination shall indicate the courses opted by the student, the credit for the course chosen by the student, the credit points obtained in each course, the grade letter and the grade point average. No class shall be awarded for each semester and the same would only be awarded at the end of all the semesters based on Cumulative Grade Point Average.

12.6 Class shall be awarded to the successful candidates based on the Cumulative Grade Point Average (CGPA) as specified below:

Cumulative Grade Point Average (CGPA)	Class to be awarded
7.5 to 10.0	First class with Distinction
6.0 and above but below 7.5	First Class
5.0 and above but below 6.0	Second Class

13. Miscellaneous:

a Notwithstanding anything contained in these regulations, the semester system at Post-Graduate level is hereby repealed.

b The provisions of any order, Rules or Regulations in force shall be inapplicable to the extent of its inconsistency with these Regulations.

c The University shall issue such orders, instructions, procedures and prescribe such format as it may deem fit to implement the provisions of this Regulations.

d The procedural details may be given by the University from time to time.

e Any unforeseen problems/ difficulties may be resolved by the Vice Chancellor, whose decision in the matter shall be final.

Annexure-I

The Programme structure of the Master of Science Degree shall be as follows:

Semester	No. of compulsory & Specialization courses (credits/course)	Total credits for compulsory & Specialization courses	No. of open elective course (credits/course)	Total credits of open elective course	Total credits for the semester
Sem. I	Th :03 (04) =12 Pra/Th*:03 (02)=06	18	Th :01 (04) =04 Pra/Th*:01(02)=02	06	24
Sem. II	Th :03 (04) =12 Pra/Th*:03 (02)=06	18	Th :01 (04) =04 Pra/Th*:01(02)=02	06	24
Sem. III	Th :03 (04) =12 Pra/Th*:03 (02)=06	18	Th :01 (04) =04 Pra/Th*:01(02)=02	06	24
Sem. IV	Th :03/04** (04) =12/16 Pra/Th:03/04** (02)=06/08 Pj# 01 (06) =06	24		-	24
Total	Th 12/13 (4) =48/52 Pra/Th 12/13(02)= 24/26 Pj:1 (06)=06	78	03 (04)=12 Pra/Th*:03(02)=06	18	96

Note: Except for IV semester, the concerned Department shall offer one each of open elective theory and practical course **or** two * open elective Theory courses for students of other science departments.

* Only for Mathematics; ** for Mathematics and Statistics; # except Mathematics & Statistics
Abbreviations: Th = Theory; Pra = Practical; Pj = Project;

GRADE CARD

Programme : M.Sc. (…….)

Name of the candidate :…… **Semester : IV**

Seat No.: Month & Year:

Course	**Course Code**	**Credit**	**IA Marks**		**Theory/ Practical**		**Max**	**Marks Obtained**	**Seme ster Grade Point**	**Credit Points**
			Max	Obt	Max	Obt				
Compulsory Courses										
Course – I	XX CT 4.1	04	25	15	75	45	100	60	6.00	24.00
Course – II	XX CT 4.2	04	25	15	75	59	100	74	7.40	29.60
Course – III	XX CT 4.3	04	25	15	75	28	100	43	4.30	17.20
Course – IV	XX CP 4.4	02	15	06	35	34	50	40	8.00	16.00
Course – V	XX CP 4.5	02	15	06	35	34	50	40	8.00	16.00
Course – VI	XX CP 4.6	02	15	06	35	34	50	40	8.00	16.00
Course – VII	XX CPJ$^{\#}$ 4.7	06	25	20	125	100	150	120	8.00	48.00
	Or									*or*
Course – VII	XX CT* 4.7	04	25	15	75	28	100	43	4.30	17.20
Course VIII*	XXCP^{+}/CT$^{\Psi}$ 4.8	02	15	05	35	35	50	40	8.00	16.00
Total		24					600			200.00/ 185.00

XX refers to course abbreviations, 4.1 refers to IV semester course 1; e.g. CHI CT 1.1= Chemistry Inorganic compulsory theory 1.1

except for Mathematics and Statistics ;* For Statistics and mathematics; +Only for Statistics; $^{\Psi}$ only for Mathematics

GPA for IV Semester = CP (IV Sem) / Credits (IV Sem) = 200/24.00 = 8.33

GPA for I Semester = CP (I Sem) / Credits (I Sem)

CGPA for I Semester = GPA for I Semester

$$\text{CGPA for II Sem} = \frac{\text{CP (ISem)} + \text{CP (II Sem)}}{\text{Credits (I Sem)} + \text{Credits (II Sem)}}$$

$$\text{CGPA for III Sem} = \frac{\text{CP (I Sem)} + \text{CP (II Sem)} + \text{CP (III Sem)}}{\text{Credits (I Sem)} + \text{Credits (II Sem)} + \text{Credits (III Sem)}}$$

$$\text{CGPA for the Programme} = \frac{\text{CP (I Sem)} + \text{CP (II Sem)} + \text{CP (III Sem)} + \text{CP (IV Sem)}}{\text{Credits (I Sem)} + \text{Credits (II Sem)} + \text{Credits(IIISem)} + \text{Credits(IVSem)}}$$

(*CP: Credit Points)

Annexure – Ia

The Programme structure of the **M.Sc. (Computer Science)** shall be as follows:

Semester	No. of Compulsory & specialization courses (credits/course)	Total credits For compulsory & Specialization Courses	No. of open Elective course (credits/courses)	Total credits Of open Elective Course	Total credits For the semester
Sem – I	Th: 05 (04) = 20 Pra: 01 (04) = 04	24	Th: 01 (04) = 04 Pra: 01 (02) = 02	06	30
Sem – II	Th: 05 (04) = 20 Pra: 01 (04) = 04	24	Th: 01 (04) = 04 Pra: 01 (02) = 02	06	30
Sem – III	Th: 05 (04) = 20 Pra: 01 (04) = 04	24	Th: 01 (04) = 04 Pra: 01 (02) = 02	06	30
Sem – IV	Th: 05 (04) = 20 Pj: 01 (06) = 06	26	-----	-----	26
Total	Th: 20 (04) = 80 Pra: 03 (04) = 12 Pj: 01 (06) = 06	98	Th: 03 (04) = 12 Pra : 03 (02) = 06	18	116

Note: Except for IV semester, the concerned Department shall offer one each of open elective theory and practical course for students of other departments.

Abbreviations: Th = Theory; Pra = Practical; Pj = Project;

GRADE CARD
Programme : M.Sc. (Computer Science)

Name of the candidate: **Semester: I / II / III**
Seat No.: **Month & Year:**

Courses	Course code	Credit	IA Marks		Theory/ Practical		Max. Marks	Marks Obtained	Semester Grade Point	Credit Point
			Max.	Obt	Max.	Obt.				
Compulsory Courses										
Course – I	CT X.1	4	25	15	75	45	100	60	6.00	24.00
Course – II	CT X.2	4	25	15	75	59	100	74	7.40	29.60
Course – III	CT X.3	4	25	15	75	50	100	65	6.50	26.00
Course – IV	CT X.4	4	25	15	75	45	100	60	6.00	24.00
Course – V	CT X.5	4	25	15	75	50	100	65	6.50	26.00
Course – VI	CP X.6	4	25	15	75	45	100	60	6.00	24.00
Open Elective courses:										
Course – VII	ET X.7	4	25	15	75	50	100	65	6.50	26.00
Course – VIII	ET X.8	2	10	05	40	35	50	40	8.00	16.00
TOTAL		**30**					**750**			**195.60**

CT **:** Core Theory

CP **:** Core Practical

X **:** Semester

GRADE CARD

Programme : M.Sc. (Computer Science)

Name of the candidate: **Semester: IV**

Seat No.: **Month & Year:**

Courses	Course code	Credit	IA Marks		Viva - voce		Theory/ Practical		Max. Marks	Marks Obtained	Semester Grade Point	Credit Point
			Max	**Obt**	**Max**	**Obt**	**Max**	**Obt**				
Compulsory Courses												
Course – I	CT 4.1	4	25	15			75	45	100	60	6.00	24.00
Course – II	CT 4.2	4	25	15			75	59	100	74	7.40	29.60
Course – III	CT 4.3	4	25	15			75	50	100	65	6.50	26.00
Course – IV	**CPR 4.4**	**6**	**25**	**15**	**50**	**40**	**75**	**45**	**150**	**120**	**08.00**	**48.00**
Course – V	CT 4.5	4	25	15			75	50	100	65	6.50	26.00
Course – VI	CT 4.6	4	25	15			75	45	100	60	6.00	24.00
Total		**26**							**650**			**177.60**

CT : Core Theory

CPR : Core Project

GPA for I Semester = 195.60/30 = 6.52

CGPA for I Semester = GPA = 6.52

$$\text{CGPA for II Semester} = \frac{\text{CP (I Sem) + CP (II Sem)}}{\text{Credits (I Sem) + Credit (II Sem)}}$$

$$\text{CGPA for III Sem} = \frac{\text{CP (I Sem) + CP (II Sem) + CP (III Sem)}}{\text{Credits (I Sem) + Credit (II Sem) + Credit (III Sem)}}$$

$$\text{CGPA for the Programme} = \frac{\text{CP (I Sem) + CP (II Sem) + CP (III Sem) + CP (IV Sem)}}{\text{Credits (I Sem) + Credit (II Sem) + Credit (III Sem) + Credit (IV Sem)}}$$

Annexure – Ib

The Programme structure of the **Master of Computer Applications (MCA)** shall be as follows:

Semester	No. of Compulsory & specialization courses (credits/course)	Total credits For compulsory & Specialization Courses	No. of open Elective course (credits/courses)	Total credits Of open Elective Course	Total credits For the semester
Sem – I	Th: 05 (04) = 20 Pra: 01 (04) = 04	24	Th: 01 (04) = 04 Pra: 01 (02) = 02	06	30
Sem – II	Th: 05 (04) = 20 Pra: 01 (04) = 04	24	Th: 01 (04) = 04 Pra: 01 (02) = 02	06	30
Sem – III	Th: 05 (04) = 20 Pra: 01 (04) = 04	24	Th: 01 (04) = 04 Pra: 01 (02) = 02	06	30
Sem – IV	Th: 05 (04) = 20 Pra: 01 (04) = 04 SR: 01 (02) = 02	26	-----	-----	26
Sem – V	Th: 05 (04) = 20 Pra: 01 (04) = 04 SR: 01 (02) = 02	26	-----	-----	26
Sem – VI	Pj: 01 (16) = 16	16	-----	-----	16
Total	Th: 25 (04) = 100 Pra: 05 (04) = 020 SR: 02 (02) = 004 Pj: 01 (16) = 016	140	03 (04) = 12 03 (02) = 06	18	158

Note: Except for IV, V and VI semester, the concerned Department shall offer one each of open elective theory and practical course or two * open elective theory courses for students of other departments.

Abbreviations: Th = Theory; Pra = Practical; Pj = Project; SR = Seminar

GRADE CARD
Programme : MCA

Name of the candidate: **Semester: I / II / III**

Seat No. **Month & Year**

Courses	Course code	Credit	IA Marks		Theory/ Practical		Max. Marks	Marks Obtained	Semester Grade Point	Credit Point
			Max	Obt	Max	Obt				
Compulsory Courses										
Course – I	CT X.1	4	25	15	75	45	100	60	6.00	24.00
Course – II	CT X.2	4	25	15	75	59	100	74	7.40	29.60
Course – III	CT X.3	4	25	15	75	50	100	65	6.50	26.00
Course – IV	CT X.4	4	25	15	75	45	100	60	6.00	24.00
Course – V	CT X.5	4	25	15	75	50	100	65	6.50	26.00
Course – VI	CP X.6	4	25	15	75	45	100	60	6.00	24.00
Open Elective Courses :										
Course – VII	ET X.7	4	25	15	75	50	100	65	6.50	26.00
Course – VIII	ET X.8	2	10	05	40	35	50	40	8.00	16.00
TOTAL		30					750			195.60

CT **:** Core Theory
CP **:** Core Practical
CSR **:** Core Seminar
X **:** Semester

GRADE CARD
Programme : MCA

Name of the candidate: **Semester : IV/ V**
Seat No.: **Month & Year**

Courses	Course code	Credit	IA Marks		Theory/ Practical		Max. Marks	Marks Obtained	Semester Grade Point	Credit Point
			Max	Obt	Max	Obt				
Compulsory Courses										
Course – I	CT X.1	4	25	15	75	45	100	60	6.00	24.00
Course – II	CT X.2	4	25	15	75	59	100	74	7.40	29.60
Course – III	CT X.3	4	25	15	75	50	100	65	6.50	26.00
Course – IV	CT X.4	4	25	15	75	45	100	60	6.00	24.00
Course – V	CT X.5	4	25	15	75	50	100	65	6.50	26.00
Course – VI	CP X.6	4	25	15	75	45	100	60	6.00	24.00
Course - VII	CSR X.7	2	--	--	--	--	50	40	8.00	16.00
TOTAL		26					650			169.60

CT : Core Theory

CP : Core Practical

CSR : Core Seminar

X : Semester

GRADE CARD
Programme : MCA

Name of the candidate: **Semester : VI**

Seat No.: **Month & Year**

Courses	Course code	Credit	IA Marks		Desertion Work		Viva-voce Marks		Max. Marks	Marks Obtai--ned	Sem--ester Grade Point	Credit Points
			Max	Obt	Max	Obt	Max	Obt				
Compulsory Courses												
Core Project	CPR 6.1	16	100	60	200	120	100	60	400	240	06.00	96.00
Total		16							400			96.00

GPA for I Semester = 195.60/30 = 6.52

CGPA for I Semester = GPA = 6.52

CGPA for II Semester = $\frac{\text{CP (I Sem) + CP (II Sem)}}{\text{Credits (I Sem) + Credit (II Sem)}}$

CGPA for III Sem = $\frac{\text{CP (I Sem) + CP (II Sem) + CP (III Sem)}}{\text{Credits (I Sem) + Credit (II Sem) + Credit (III Sem)}}$

CGPA for IV Sem = $\frac{\text{CP (I Sem) + CP (II Sem) + CP (III Sem) + CP (IV Sem)}}{\text{Credits (I Sem) + Credit (II Sem) + Credit (III Sem) + Credit (IV Sem)}}$

CGPA for the Programme = $\frac{\text{CP (I Sem)+ CP (II Sem) + CP (III Sem) + CP (IV Sem) + CP (V Sem) + CP (VI Sem)}}{\text{Credits (I Sem) + Credit (II Sem) +Credit (III Sem) + Credit (IV Sem) + Credit (V Sem) + Credit (VI Sem)}}$

P.G. DEPARTMENT OF STUDIES IN BOTANY

INTRODUCTION:

The Karnatak University, Dharwad introduced Post Graduate course in Botany as early as 1951 in Karnatak Science College, Dharwad and shifted to the independent building in the year 1966. The Department offered general course in Botany, such as Plant Systematics, Cryptogamic Botany, Mycology, Anatomy, Cell Biology, Plant breeding, Plant Physiology etc. Subsequently several new papers have been introduced like Microbiology, Plant Pathology, Developmental Biology, Biological Techniques, Biophysics, Biostatics and Computer Applications etc.

The Department in addition to imparting general courses in Botany has 5 options for specialization at M. Sc-IV semester viz. i) Genetics, Molecular Biology and Plant Breeding, ii) Tissue Culture and Biotechnology, iii) Reproductive Physiology and Morphogenesis, iv) Mycology, Plant pathology and Microbiology and v) Biodiversity and Environmental Biology. The teaching programme is designed to give our students current awareness in the wide variety of subjects with in-depth study of Plant Biology. Consequently, many of our students successfully completed National Level Examination like NET of UGC/CSIR/GATE. The excellent training given to the students has helped them to be placed in National/International Research Laboratories and Colleges and Universities in the Country and Abroad. Till today over 1000 students have taken their M. Sc. degree. The Department is also offering one year M. Phil Course in the above specializations. So far 50 candidates have obtained their M. Phil Degree and 134 candidates have obtained Ph.D. degree under different specializations.

Revision of the syllabus for updating the curriculum will be normally done in a span of 5-6 years. Introduction of the semester system and revision of the syllabus was made with effect from 2001-2002. Present syllabus includes all the topics of Botany prescribed for UGC-CSIR NET Examination. By now students have cleared NET and have qualified the SLET.

RESEARCH ACTIVITIES AND RESEARCH FACILITIES :

Members of the staff and Research Scholars of this Department are actively engaged in research in the different fields of Botany like Cytology, Genetics, Embryology, Phycology, Mycology, Plant Pathology, Histochemistry, Reproductive Biology, Tissue Culture, Plant Biotechnology, Plant Biochemistry, Phytodiversity and Environmental Biology.

Facilities for research in Molecular Genetics, Mutation Breeding, Reproductive Physiology, Morphogenesis, Hydrobiology, Mycology and Plant Pathology, Tissue Culture, Microbiology, Biotechnology, Phycology, Phytodiversity and Plant Biochemistry are available. Sophisticated instrumentation facilities like Gel documentation, Lyophilizer, UV spectrophotometer, Fermenter, Cold chamber, Research microscope, PCR machine, Cytophotometer, Computer internet connection, LAN net work etc. are available. The Department has Glass house, Orchidarium, Green house, Experimental garden, Herbarium facilities and Botanic garden harboring indigenous and exotic plants.

The Department has two glass houses for growing and acclimatization of Orchids and other plant species of Western Ghats. The Botanic garden of Karnatak University is a member of Botanic Garden Conservation International an International Organization involved in promotion, development and maintenance of Botanic Gardens and Biodiversity. It has over 400 species of higher plants.

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KARNATAK UNIVERSITY, DHARWAD

Post Graduate Department of Studies in Botany

SYLLABUS & ADMISSION RULES

For

M. Sc. (Botany)

(Choice Based Credit System)

w.e.f. 2008-2009

Admission rules

for

M. Sc. (Botany) Degree Course under

Choice Based Credit System (CBCS)

1.1. Duration of the Course:

The M. Sc. Degree Course is of two years duration, spread over four semesters each of four months duration.

1.2 (A) Eligibility for Admission:

B.Sc. Graduates of Karnatak University or of any other University recognized as equivalent there to with Botany as optional subject. The candidate should have obtained at least 45% of marks in optional subjects as well as in aggregate. Relaxation in respect of SC / ST / Cat-I etc. will be followed as per prevailing rules of the University.

(B) Admission:

(i) **Intake:** 40 + 4 (but may vary from time to time with the permission from the University) for the first semester. This includes admission under enhanced fee structure. Other rules for admission are as per University notification from time to time.

(ii) **Admission to other Semesters:** Students are allowed to take admissions to successive semesters under carry over benefit (COB) facility all the way from the first semester to fourth semester.

2. Attendance:

Every student must have at least 75% attendance in each of the courses (Theory & Practical) in each semester. Shortage of attendance will be dealt with as per the University rules from time to time.

3. Medium of Instruction:

The medium of instruction shall be in English.

4. Scheme of Instructions:

In the First Semesters 4 Core theory papers of 4 credits each second nad third semester there will be 3 Core Theory Papers of 4 credits each. In addition, in the I semester there will be 4 Practical Papers of 2 credits each, II and III Semester there will be 3 Practical Papers of 2 credits each.

In IV Semester there will be 3 Core Theory Papers of 4 credits each including one special paper, 3 Practical Papers of 2 credits each and one project work of 6 credits.

In each of II, III Semesters there will be one Elective paper of 6 Credits. These elective papers have to be chosen by the students of other departments.

Our M. Sc. students have to take one elective of 6 Credits in each of II, III Semesters offered by other departments. Study tour of minimum of 5 days is compulsory.

5. Scheme of Evaluation:

Examination will be conducted at the end of each semester.

Each Core theory paper of credits 4 will have an examination of 3 hours and carrying maximum of 75 marks. Each Core practical will have examination of 3 hours duration and carrying 35 marks.

For each theory / practical of 4 and 2 credits, there will be an internal assessment test carrying 25 and 15 marks respectively.

Each elective paper will have examination of 3 hours duration carrying 75 marks, and will have internal assessment test for 25.

6. All other rules and regulations not covered above are as per the University rules prevailing at that time.

M. Sc. COURSE IN BOTANY

CHOICE BASED CREDIT SYSTEM

Course Structure and scheme of Examination for M. Sc. course in Botany
M. Sc. Ist Semester

Sl. No	Paper code no and Title	Credits	No of hrs/week /Theory/ Practical	Duration of Exam. In hrs Theory/ Practical	Internal Assessment Marks/ Theory/ Practical	Marks at the end of Exams	Total Marks
	Core Subject						
1	Bot. CT 1.1 Microbiology & Phycology	4	4	3	25	75	100
2	Bot. C T1.2 Systematic Botany of Angiosperms	4	4	3	25	75	100
3	Bot .CT 1.3 Evol. Bio, Econ. Bot & Phy.geo	4	4	3	25	75	100
4	Bot.CT1.4 Molecular Biology	4	4	3	25	75	100
	Practicals						
5	Bot.CP.1.1 Based on Bot.CT 1.1	2	4	4	15	35	50
6	Bot. CP1.2 Based on Bot. CT 1.2	2	4	4	15	35	50
7	Bot. CP 1.3 Based on Bot. CT 1.3	2	4	4	15	35	50
8	Bot.CP 1.4 Based on Bot.CT1.4	2	4	4	15	35	50
	Total	**24**	**32**	**28**	**140**	**460**	**600**

M. Sc. IInd Semester

Sl. No	Paper code no and Title	Credits	No of hrs/week /Theory/ Practical	Duration of Exam. In hrs Theory/ Practical	Internal Assessment Marks/ Theory/ Practical	Marks at the end of Exams	Total Marks

	Core Subject						
1	Bot. CT 2.1 Ecology and Environmental Biology	4	4	3	25	75	100
2	Bot. C T 2.2 Concepts in Biochemistry and Biophysics	4	4	3	25	75	100
3	Bot. CT 2.3 Biotechnology, Computer applications and Biostatistics	4	4	3	25	75	100
	Elective						
4	Bot ET 2.4 Medicinal Plants	4	4	3	25	75	100
	Prcaticals						
5	Bot. CP2.1 Based on Bot. CT 2.1	2	4	4	15	35	50
6	Bot. CP2.2 Based on Bot. CT 2.2	2	4	4	15	35	50
7	Bot. CP 2.3 Based on Bot. CT 2.3	2	4	4	15	35	50
	Elective						
8	Bot. EP 2.4 Based on Bot ET2.4	2	4	4	15	35	50
	Total	**24**	**32**	**28**	**140**	**460**	**600**

M. Sc.-IIIrd Semester

Sl. No	Paper code no and Title	Credits	No of hrs/week /Theory/ Practical	Duration of Exam. In hrs Theory/ Practical	Internal Assessment Marks/ Theory/ Practical	Marks at the end of Exams	Total Marks
	Core Subject						

1	Bot. CT3.1 Plant Physiology	4	4	3	25	75	100
2	Bot. C T3.2 Cell Biology and Genetics	4	4	3	25	75	100
3	Bot. CT3.3 Developmental Biology of Plants and Tissue Culture	4	4	3	25	75	100
	Elective						
4	Bot. ET3.4 Plant Biotechnology	4	4	3	25	75	100
	Prcaticals						
5	Bot. CP3.1 Based on Bot. CT 3.1	2	4	4	15	35	50
6	Bot. CP3.2 Based on Bot. CT 3.2	2	4	4	15	35	50
7	Bot. CP 3.3 Based on Bot. CT 3.3	2	4	4	15	35	50
	Elective						
8	Bot. EP 3.4 Based on Bot. ET 3.4	2	4	4	10	40	50
	Total	**24**	**32**	**28**	**140**	**460**	**600**

M. Sc-IVth Semester

Sl.No	Paper code no and Title	Credits	No of hrs/week /Theory/ Practical	Duration of Exam. In hrs Theory/ Practical	Internal Assessment Marks/ Theory/ Practical	Marks at the end of Exams	Total Marks
	Core Subject						
1	Bot. CT4.1 Mycology and Plant Pathology	4	4	3	25	75	100
2	Bot. C T4.2 Plant Breeding and Plant Propagation	4	4	3	25	75	100
4.3.1	Bot. CT 4.3.1 Plant Tissue Culture	4	4	3	25	75	100
4.3.2	Bot. CT 4.3.2 Reproductive Biology of Higher Plants	4	4	3	25	75	100
4.3.3	Bot. CT 4.3.3 Applied Microbiology, Applied Mycology and Plant Pathology	4	4	3	25	75	100
4.3.4	Bot. CT 4.3.4 Phytodiversity and Environmental Biology	4	4	3	25	75	100
4	Bot. CT 4.4 Project	6	4	6 Dissertation evaluation 75 Marks	25	50 Marks Viva-Voce	150
	Prcaticals						
5	Bot. CP 4.1Based on Bot CT4.1	2	4	4	15	35	50
6	Bot. CP 4.2Based on Bot.CT4.2	2	4	4	15	35	50
7	Bot. CP 4.3.1/4.3.2/ 4.3.3/4.3.4 Based on Bot.CT4.3.1/4.3.2/ 4.3.3/4.3.4	2	4	4	15	35	50
	Total	**24**	**32**	**28**	**140**	**460**	**600**

M. Sc BOTANY

FIRST SEMESTER

Theory papers:

Bot. Core Theory	1.1 Microbiology and Phycology
Bot. Core Theory	1.2 Systematic Botany of Angiosperms
Bot. Core Theory	1.3 Evolutionary Biology, Economic Botany and Plant Geography
Bot.Core Theory	1.4 Molecular Biology

SECOND SEMESTER

Theory papers:

Bot. Core Theory	2.1 Ecology and Environmental Biology
Bot. Core Theory	2.2 Concepts in Biochemistry and Biophysics
Bot. Core Theory	2.3 Biotechnology, Computer applications and Biostatistics
Elective Theory	2.4 Medicinal Plants

THIRD SEMESTER

Theory papers:

Bot. Core Theory	3.1 Plant Physiology

Bot. Core Theory	3.2 Cell Biology and Genetics
Bot. Core Theory	3.3 Developmental Biology of Plants and Tissue Culture
Elective Theory	3.4 Plant Biotechnology

FOURTH SEMESTER

Theory papers:

Bot.Core Theory	4.1 Mycology and Plant Pathology
Bot.Core Theory	4.2 Plant Breeding and Plant Propagation
Bot. Core Theory	**4.3 Special Papers** (Allocated on the basis of choice cum merit basis) 4.3.1 Plant Tissue Culture 4.3.2 Reproductive Biology of Higher Plants 4.3.3 Applied Microbiology, Applied Mycology and Plant Pathology 4.3.4 Phytodiversity and Environmental Biology
Project	4.4

SEMESTER - I

Bot.CT-1.1 : MICROBIOLOGY AND PHYCOLOGY

MICROBIOLOGY:

Unit 1. Diversity in structure and organization and life cycles other than Eubacteria: Mycoplasmas, Spirochaetes, Rickettsias, Archaebacteria, Methanogens, Halobacteria,
Cyanobacteria, Plant Viruses and Prions. 4hrs

Unit 2. Fungi: Introduction, general features, classifications and Reproduction. 3hrs

Unit.3. Microorganisms in the ecosystem: Psychrophilic, Mesophilic, Acodophilic and Thermophilic microorganisms. Distribution of microorganisms in fresh and marine water and their useful and harmful role. Distribution of microorganisms in Soil and its role in Soil formation, Soil fertility, Symbiotic and Non- Symbiotic nitrogen fixation of VAM fungi, Biopesticides and Silage. Microbiology of **Air**: Algae, Fungi, Bacteria and Lichens, Pollen grains and others, Aeroallergens and Aeroallergy. 5hrs

Unit 4. Microbial genetics: Recombination, transformation, conjugation, transduction and parasexuality. bacteriophage, lytic and lysogenic cycles.
5 hrs

Unit 5. Role of Microbes in Metabolic pathways, Photosynthetic pigments in Bacteria-Oxygenic and Anoxygenic photosynthesis. Anabolic process (biosynthetic) pathways, catabolic (degradative) pathways, Microbial degradation of Cellulose, Lignin, Starch, Fermentation pathways, Homolactic acid fermentation pathway.
4hrs

Unit 6. Immunology: Introduction, physical and mechanical factors, Biochemical factors, Genetic factors, Cellular factors, Active immunity (Natural- Artificial), Passive immunity (Natural- Artificial). Precipitin test, inflammation and interferon. Scope of Immunology: Application in medicine, Application in treatment of diseases, Application in blood grouping, Application in organ transplantation and tissue grafting.
5hrs

REFERENCES

1. R.C. Dubey and Maheshwari.D.K.2002. A Text book of Microbiology, S.C.Chand and Company, Ltd. Ramnagar, New Delhi.
2. S.B. Sullia and Shantharam. S.1998. General Microbiology. Oxford and IBH publishing Co.Pvt.Ltd. New Delhi.
3. Sharma. P.D.1999. Microbiology and Plant Pathology. Rastogi publications. Meerut, India.
4. Ananthnarayan, R and Jayaram Panikar,C.K. 1986. Text book of Microbiology. Orient Longman ltd. New Delhi.
5. Allas, R.M. Microbiology: Fundamentals and Applications, Macmillan publishing co. New York.
6. Brook, T.D. Smith, D.W and Madigan, M.T. 1984. Biology of Microorganisms, 4th ed. Eaglewood Cliffts. N.J.Prentice- Hall. New Delhi.
7. Claus, William, G.1989. Understanding microbes. A laboratory text book for Microbiology. W.H.Freeman and Company. New York.

8. Jayaraman, J. 1985. Laboratory Manual of Biochemistry, Wiley Eastern Limited. New Delhi.
9. Ketchum, P.A. 1988. Microbiology, concepts and applications. John Wiley and Sons. New York.
10. Stainer, Roger, Y. Ingrahan, John, L. Wheelis, Mark,L and Painter, Page,R. 1990. Microbial World 5th edition. Prentice-Hall India, Pvt.Ltd. New Delhi.
11. Schlegel, H.G.1986. General Microbiology. Cambridge University Press. London, 587pp.
12. Sharma, R.2006. Text book of Microbiology. Mittal Publications. New Delhi. 305pp.
13. Reddy, S and Ram *et al.* 2007. Microbial Physiology. Scientific Publishers, Jodhpur, 385pp.

PHYCOLOGY:

Unit 1. Basic characters of Algae:

a. Origin of algae
b. Pigments in algae and classification 3 hrs.

Unit 2. The prokaryotic algae:

a. Structure and composition of prokaryotic algal cell
b. Distribution and morphology of prokaryotic algae
c. Reproduction in prokaryotic algae
d. Nitrogen fixation and economics of prokaryotic algae. 5 hrs.

Unit 3. The Eukaryotic Algae:

a. Structure and composition of eucaryotic algal cell
b. Range of thallus construction in eucaryotic algae
c. Mode of reproduction in eucaryotic algae 4 hrs.

Unit 4. Algae and water Pollution:

a. Phytoplankton and their classification
b. Algae as indicators of water quality
c. Algal blooms- causes and effect
d. Algae in water supplies and their control. 4 hrs.

Unit 5. Ecology of marine algae:

a. Distribution of marine algae
b. Factors controlling growth and distribution 2 hrs.

Unit 6. Cultivation of algae:

a. Mass cultivation of microalgae
b. Cultivation of –i) *Porphyra*: Structure, reproduction and protocol for cultivation of *Porphyra* ii) Agarophytes: Requirements, methodology, harvesting and processing of

agarophytes. 5 hrs.

Unit 7. Biochemicals from algae:

Pigments, enzymes, vitamins, antibiotics, essential fatty acids, polysaccharides, hydrocarbons, plant growth regulators, osmoregulators, biosurfactants, sterols, bioflocculants, aminoacids and liposomes. 2 hrs.

REFERENCES:

Fatma, T. 1999. Cyanobacterial and algal metabolism and environmental biotechnology.
Narosa Pub. House, New Delhi.

Kamat, N.D. 1982. Topics in Algae. Saikripa Prakashan, Aurangabad.

Palmer, C.M. 1980. Algae and Water pollution. CHP Pub.

Prescott, G.W. 1984. The Algae: A Review.

Robert Edward Lee 1995. Phycology. Cambridge Univ. Press.

Venkataraman, L.V. and E.W. Becker, 1985. Biotechnology and utilization of algae. The
Indian experience. DST, New Delhi

Verma B.N., A.N.Kargupta and S.K. Goyal 1998. Advances in Phycology. APC Pub. New
Delhi

Bot.CP-1.1: PRACTICALS (Based on Bot.CT1.1)

MICROBIOLOGY:

1. Safety measures in microbiology laboratory.
2. Study of instruments: Hot air oven, Autoclave, Inoculation needles, petriplates, incubator, ultraviolet lamp, laminar flow hood.
3. Preparation of Culture media: PDA, CZA, Nutrient media, preparation of agar slants, method of inoculum transfer (pouring techniques).
4. Serial dilution technique.
5. Staining of Bacteria, Simple, Positive and Negative staining.
6. Microbial Examination by Petriplate expose method.
7. Rotrod sampler, leavening of Bread Yeast/ Fermentation of Yeast.
8. Observation of VAM fungi by root maceration technique.

PHYCOLOGY:

1. Thallus in prokaryotic algae
2. Thallus in eucaryotic algae
3. Phytoplankton and indicator algae
4. Marine algae
5. Enrichment culture of algae and enumeration
6. Separation of algal pigment.

Bot.CT-1.2 : SYSTEMATIC BOTANY OF ANGIOSPERMS

Unit 1. Scope of systematic botany:

Aims and objectives, Floras, Monographs, Floral diagram, Floral formulas. 1 hr

Unit 2. Development and phases of classification:

Pioneer phase, consolidation phase, Biosystematic phase, Alpha taxonomy, Beta taxonomy, Gamma taxonomy, Omega taxonomy, Serotaxonomy, Holotaxonomy. Horizontal classification and vertical classifications. 2 hrs

Unit 3. Systems of classifications:

General classification of plant kingdom based on evolution.
Artificial classification- Linneous
Natural classification- Bentham and Hooker
Phylogenetic classification-
a. Transitional phylogenetic system- Engler and Prantl
b. Intentional phylogenetic system- Charles Bessey and John Hutchinson
c. Contemporary phylogenetic system-Taktajhan, Robert Thorne, Cronquist, Dahllgren, Angiosperm phylogeny group (APG). 10 hrs

Unit. 4. Taxonomic ranks and Numerical taxonomy:

Concept of family, genus, species, intraspecific clones, Numerical taxonomy, aims and objectives. Advantages of Phenogram, cladogram, and dendrogram.
5 hrs

Unit. 5. Taxonomic evidences:

Anatomical, Embryological, Palynological, Chromosomal, Phytochemical and Molecular. 10 hrs

Unit. 6. Plant nomenclature:

Vernacular names and botanical names
Principles of ICBN. Principles of priority
Names of genus species, Hybrids, Type method author citation publication of names, nomina conservenda, names nova, names of cultivated plants, rejection of names effective and valid publications. Unified biological nomenclature biocode and phylocode 4 hrs

Unit 7 Botanical Gardens and herbaria

Nature and importance of Botanical garden in plants conservation, BSI and its role in plants conservation Herbarium collection and preparation of herbarium specimen and preservation method significance of herbarium. 4 hrs

Unit 8 Salient features and systematic relationships of following families

Dicot Families:

a. polypetalous families:

Rananculaceae, Magnoliaceae, Capparaceae, Caryophyllaceae, Malvaceae, Tiliaceae, Sterculiaceae, Rhamnaceae, Sapindaceae, Rosaceae, Fabaceae

b. Gamopetalous families:

Apocynaceae, Bignoniaceae, Solanaceae, Scrophulariaceae.

c. Monochlamydous families:

Chenopodiaceae, Aizoaceae**,** Polygonaceae, Nyctaginaceae, Piperaceae, Lauraceae, Santalaceae, Loranthaceae, Urticaceae, Ulmaceae, Moraceae**,** Cannabinaceae.

Monocot families

Pontederiaceae**,** Hydrocharitaceae**,** Amaryllidaceae**,** Commelinaceae, Arecaceae and Cyperaceae.

14 hrs

REFERENCES:

1. Introduction to principles of plant taxonomy. By V. V. Sivarajan. C.U.P New York 1991.
2. Flowering plant- taxonomy and phylogeny. By B. Bhattacharya and BM Johri, Narasa Publishing House, New Delhi.1996
3. Current concepts in plant taxonomy. By V.H. Heywood and DN Moore, Academic Press London.1994
4. Taxonomy of Angisperms. By V.N. Naik. Tata Mc-Graw-Hill Publishing Company Ltd., New Delhi.1993
5. Experimental plant taxonomy. By S.K. Sachdeva and C.P. Malik. Kalyani publishers New Delhi.1986
6. Taxonomy of vascular plants. By G.H.M. Lawrence. Mc Millan, New York. 1959
7. Principles of numerical taxonomy. By Sokal R.R. and Sneath P.H.A. W.H. Freeman, San Francisco.1963
8. Taxonomy, Phytogeography and evolution. By D.H. Valetni (ED) Academic press London
9. Plant geography.. By Martin C. Lant.
10. Introduction to plant geography. By Polunin
11. Taxonomy of Angiosperms. By V.N. Naik.
12. Systematic Botany of Angiosperm. By R.K. Datta.
13. Plant taxonomy. By O.P. Sharma
14. Taxonomy of flowering plants. By Bhatacharya.

CP-1.2 : PRACTICALS (Based on CT 1.2)

1) Description of specimen from locally available families
2) Location of key characters and use of keys at family, genus and species level.
3) Field trips within and around the campus.
4) Training in using floras and herbaria for identification of specimen describing in the class.
5) Study of pollen grains useful in plant taxonomy
6) Preparation of herbarium sheets of wild and cultivated plants.
7) Preparation of key for available taxa.
8) Calculation of similarity coefficient and preparation of dendogram of different taxa.

Bot. CT.1.3 : EVOLUTIONARY BIOLOGY, ECONOMIC BOTANY AND PLANT GEOGRAPHY

EVOLUTIONARY BIOLOGY:

Unit 1. Origin of life:

Abiogenesis, hypothesis of panspermia. Theory of chemical evolution .origin of life at molecular level. Miller experiment, protenoids, microsphere, RNA first model. 5 hrs

Unit 2. Process of origin of life:

Structure of cosmos, primitive earth, prebiotic synthesis, evolution of progeno. origin and evolution of RNA world, ribonucleoproteins, adoptive radiation in progenote. evolution of eukaryotes : a. endosymbiotic hypothesis, invagination of surface membrane, molecular evolution, evolution of proteins, insulin, haemoglobin, cytochrom c and neutral theory of protein evolution.

5 hrs

Unit 3. Theories of Evolution:

Lamarckism Neolamarckism, Darwinism, Neodarwinism, Germplasm theory, Mutation theory and Synthetic theory.

5 hrs

Unit 4. Population genetics and evolution:

Mendelian population, Gene pool, gene frequency, genetic drift, founder effect, genetic polymorphism. Hardyweinbergh law: genetics equilibrium and mechanism of speciation.

Unit 5. Pattern of evolution in plants: 5 hrs

Evolution of vegetative, reproductive structures in Algae, fungi, bryophytes, pteridophytes and spermatophytes.(Evolution of sporophyte in bryophytes).Stelar evolution in pteridophytes, heterospory and seed habit. Fossil forms- lepidodendron, lepidocarpon, stigaria etc 5 hrs

ECONOMIC BOTANY:

Unit 6. Cultivation and economic uses of food plants, drug plants, food adjuncts, timber plants, rubber plants, beverage plant ,oil plants, sugar cellulose and starch plants. 10 hrs

Unit 7. Plants as renewable source of energy. 01 hr

Unit 8. Conservation of economically important plant genetic resources. 01 hr

PLANT GEOGRAGHY:

Unit 9. Principles of plants Geography. 02 hrs

Unit 10. Origin of Islands and continents:

Pangea, panthalasa, Laurasia, gondwana land, plate tectonics and continental drift.

02hrs

Unit 11. Centers of origin of Cultivated plants:

Vavilov centers and zhukosky centers with plants in each region. 03 hrs

Unit 12. Geography and plant distribution:

Floristic region of world, phytogeographical region of India, Hansesen's classification Distribution of plants based on altitude and latitude. 04hrs

Unit 13. Plant distribution and plant migration:

contism, dricontinism and endemic distribution. Age and area hypothesis, wills theroy, vicaridess and theroy of tolerence. Plant migration and barrier for plant migration.
03 hrs

REFERENCES :

1. Evolution , By Strickberger, M.W.
2. Genes and Evolution, By Jha, A.P. 1993.
3. Organic evolution. By Lull, R.C 1976.
4. Organic evolution. By Arumugam N. 1992.
5. Diversity and Evolutionary biology of tropical flowers, By Endress, P.K. 1994.
6. The Geography o flowering plants . By Ronald Good, Longman, London 1974.
7. An introduction to plant ecology, Phytogeography, economical Botany to paleobotany. A.K.
Ganguly and N.C. Kumar. Emkay Publications. New Delhi.
8. Economic Botany : A text book of useful plants and plant products. By Albert Hill. Tata Mc Graw Hill Publishing company Ltd. New Delhi.
9. Economic Botany. By B.P. Pandey S.Chand and Company Ltd New, Delhi.
10. Economic Botany. By S.Sen. New central Book Academy Calcutta.
11. A text book of Economic Botany. By V.Verma. Emkay publication , New Delhi.
12. Dictionary of Economic plants in India. By Maheshwari. P.W Umraosingh. ICAR,N. Delhi.
13. A text book of Biotechnology. By R.C. Dubey. S.Chand and Company Ltd.New Delhi.

Bot.CP-1.3 : PRACTICALS (Based on Bot.CT 1.3)

1. Models to be shown (fossils can be demonstrated)
2. Demonstration of models/Explanation of models.
3. Explanation of Hardyweinbergh law with some genetic problems.
4. Steles in Pteridophytes.
5. Sprophytes of Bryophytes.
6. Photographs of Evolutionary biologists.

Bot.CT-1.4 : MOLECULAR BIOLOGY

Unit 1. . Organization of prokaryotic and eukaryotic genome, genome size and C-value paradox. – 4 h.

Unit 2. Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extrachromosomal replicons, DNA damage and repair mechanisms, homologous and site-specific recombination. 6 h.

Unit 3. Genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer

and the cell cycle, virus-induced cancer, metastasis, interaction of cancer cells with normal cells, apoptosis, therapeutic interventions of uncontrolled cell growth. 6 h.

Unit 4. . Homologous and non-homologous recombination including transposition. 4 h.

Unit 5. Transgenic microbes, animals and plants, molecular approaches to diagnosis and strain identification. Methods for analysis of gene expression at RNA and protein level, large scale expression, such as micro array based techniques. 6 h.

Unit 6. Genomics and its application to health and agriculture, including gene therapy. DNA sequencing methods, strategies for genome sequencing. FISH and chromosome walk and jums. DNA chips and genome evolution. 6 h.

Unit 7 Protein sequencing methods, detection of post translation modification of proteins. Proteome and proteomics. 4 h.

Unit 8.. Molecular markers: RFLP, RAPD and AFLP techniques. Marker assisted selection. 4 h.

Unit 9. Cells and molecules involved in innate and adaptive immunity, antigens, antigenicity and immunogenicity. B and T cell epitopes, structure and function of antibody molecules. generation of antibody diversity, monoclonal antibodies, antibody engineering, antigen-antibody interactions, MHC molecules, antigen processing and presentation, activation and differentiation of B and T cells, B and T cell receptors, humoral and cell-mediated immune responses, primary and secondary immune modulation, the complement system, Toll-like receptors, cell-mediated effector functions. 6 h.

Unit 10. Mutagenesis, molecular basis of mutation. DNA repair mechanisms and evolutionary significance. 2 h.

References:

1. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter. Molecular Biology of the Cell. 2002. Fourth Edition, Garland Science Publishers, New York.
2. Harvey Lodish, Arnold Berk, Paul Matsudaira, Chris A. Kaiser, Monty Krieger, Matthew P. Scott, S. Lawrence Zipursky, James Darnell. 2004. Molecular Cell Biology, Fifth Edition, W. H. Freeman and Company, New York.
3. Benjamin Lewin, Genes VIII, 2004, Pearson Prentice Hall, New Jersey.
4. Dornell, J. Molecular Cell Biology, 2000. W. H. Freeman and Co., New York.
5. Karp, G. Cell and Molecular Biology: Concepts and Experiments, 2000. John Wiley and Sons, New York.

Bot. CP- 1.4 Practical: MOLECULAR BIOLOGY(Based on CT:1.4)

1. Isolation of genomic DNA and quantification.
2. Restriction digestion of DNA and agarose electrophoresis.
3. PCR amplification and agarose electrophoresis.
4. Isolation of proteins and quantification.
5. Electrophoretic separation of proteins.
6. Agrobacterium mediated transformation.
7. Isolation and purification of plasmid DNA.

SEMESTER- II

Bot.CT-2.1 : ECOLOGY AND ENVIRONMENTAL BIOLOGY

ECOLOGY:

Unit 1. Ecosystems:

Principles and concept of ecosystems- Components, production verses decomposition, Homeostasis (xenobiotics).

Principles and concept of energy in ecosystems- Energy and limiting factors, concepts of productivity, measurements of productivity, food chain, food webs and trophic levels

Diversity and characters of major ecosystems – Aquatic (Marine and Freshwater), Terrestrial and Agricultural ecosystems 10 hrs.

Unit 2. Biotic community and ecological niche-

A. Concept of biotic community:

Size and structure of biotic community- Physiognomy, Life-forms, stratification, ecotones and concept of edge-effect.

B. Ecological succession- causes and patterns of succession, concept of climax.

C. Concept of ecological niches, species coexistence, overlapping and niche segregation.

2 hrs.

Unit 3. Species Diversity-

A. Patterns of diversity in a community, Diversity measurement and indices.

B. Global distribution of organisms, concept of islands, biodiversity hotspots.

C. Conservation of biodiversity. 6 hrs.

Unit 4. Population biology:

Spacing and population density, Natality and mortality. Life table, population growth curves, carrying capacity. Regulation of population size, co-evolution. 5 hrs

Unit 5. Interactions among organisms:

A. Negative interactions. Inter specific competition, Predation, Parasitism and antibiosis.
B. Positive interaction- Commensalism, co-operation and mutualism.
C. Pollination Biology
D. Herbivores and plant defense mechanism. 5 hrs.

Unit 6. Impact on Biodiversity:

Anthropogenic impact-

Eutrophication, Heavy metal pollution, Ozone depletion, greenhouse effect, Global warming and its effect, Acid rains. Pesticide, particulate and nuclear radiation. Solid wastes. Noise Pollution. Pest population and its biological control, invasive species and their effects on native species in aquatic and terrestrial ecosystems.

12 hrs.

REFERENCES :

Odum, E.P. 1996. Fundamentals of Ecology, Saunders, Philadelphia. (First Indian Ed.)
Chapman, J.L. and M.J. Reiss. 2000. Ecology Principles and Applications.
Kormondy, E.J. 1996. Concepts of Ecology, Prentice Hall India, New Delhi.
Agarwal S.b. and M. Agarwal 2000. Environmental Pollution and responses, CRC Press, London.

Bot. CP- 2.1 : PRACTICALS (Based on CT 2.1)

1. Study of vegetation by quadrat and line transect method. Determination of Importance Value Index (IVI).
2. Ecological Instruments: Thermometers, Anemometer, Altimeter, Barograph, Thermograph, Hair Hydgrograph, Psychrometer, Rain Guage.
3. Analysis of Water Sample: pH, Conductivity, Dissolved Oxygen, Carbonates and Bicarbonates, Chlorides, Free Carbon Dioxide, Hardness, Organic Matter.
4. Analysis of Soil samples: pH, Conductivity, Organic carbon, Moisture Equivalent, Capillary Power of soil, Percolation through soil, Saturation Capacity.
5. Estimation of Dust deposit on leaves.
6. Noise level measurements in different environment.
7. Measurement of productivity by light and dark bottle method.
8. Phytoplankton of freshwater habitats.

Bot.CT- 2.2 : CONCEPTS IN BIOCHEMISTRY AND BIOPHYSICS

BIOCHEMISTRY:

Unit 1 Physical and chemical properties of water. Acid base chemistry, buffers, chemical bonding and bond energy in bimolecules 4-hrs

Unit 2 Nucleotides and nucleic acids: structures of nucleotides and poly nucleotides. Chemical and physical properties of nucleic acids. Chemical synthesis of poly nucleotides. 4-hrs

Unit 3 Amino acids- classification, properties, peptide bonds. 4-hrs

Unit 4 Protein – Structures, Sequence, Conformation. 3-hrs

Unit 5 Carbohydrates – Monosaccharide and Disaccharides. Structures of starch, cellulose, pectin and chitin.
4- hrs

Unit 6 Lipids – classification and Chemical structures and physical properties of saturated and un saturated fatty acids. 4-hrs

Unit 7 Enzymes – Nature and classification of enzymes. Enzymes kinetics, bisubstrate reaction. 5-hrs

BIOPHYSICS:

Unit 1 Atoms, bonds and molecules, basic Principle of diffusion, Osmosis and viscosity and their application in biology. 3-hrs

Unit 2 Electromagnetic radiation – spectrum and light scattering, adsorption and emission of electromagnetic radiation by biomolecules. 4-hrs

Unit 3 Fluorescence and phosphorescence of biomolecules – Theory of fluorescence, fluorescence detection. Spectroscopy applied to protein, nucleic acid and membranes. 5-hrs

Unit 4 Nuclear magnetic resonance – Solid state NMR, magnetic resonance imaging, application of NMR in the study of protein, nucleic acid membranes and metabolism. 5-hrs

Unit 5 Mass Spectrometry – Basic theory and instrumentation; Infrared spectroscopy basic theory and instrumentation. Laser - Knowledge of lasers, application in biology and Medicine .
5- hrs

REFERENCES:

Lehninger Principles of Biochemistry DL Nelson and MM Cox, Mac Millan Worth publisher, 2000.
Fundamentals of Biochemistry. D. Voet, J.G. Voet, and C.W. Pratt, John Wiley and Sons 1999.
Physical Biochemistry, K.E Van Holde, W.C. Johnson and P. Shing Ho, Prenta Hall International IN. 1998.
Essential of Biophysics, P. Naryanan. New Agri International publisher, 2000.
Modern Experimental Biochemistry, (3rd Edn.) R.Boyer, Benjamin Cumming, 2000.
Practical Biochemistry, Principle and Technique (5th Edn.) K. Wilsen and J. Walker, Cambridge University press. 2000.

Bot. CP - 2.2: PRACTICALS (Based on Bot. CT 2.2)

1. Extraction of chloroplast pigments and demonstration of their absorption spectra.
2. Extraction of seed proteins.
3. Determination of iodine –fats and oils
4. Estimation of proteins- spectrophotometer.
5. Estimation of Phospholipids.
6. UV and Visible spectra of biomolecules.
7. Fractionation of proteins by gel filtration.
8. Interpretation of IR and NMR Spectra of small molecules.

Bot. CT- 2.3 : BIOTECHNOLOGY , COMPUTER APPLICATIONS AND BIOSTATISTICS

BIOTECHNOLOGY:

Unit 1 Introduction, Aim and scope of Biotechnology. Extraction and purification of DNA from bacteria, Fungi and plants. Restriction digestion and electrophoretic separation. The restriction DNA fragments in physical maps. Southern, northern blotting and hybridization techniques.
6 hrs

Unit 2 Methods of cloning: Use of DNA linkers and adaptors for cloning. Selection methods for recombinant vectors. Methods for clone identification. Studying the location of cloned gene. Identifying and studying of the translation product of cloned gene. 5 hrs

Unit 3 Marker and reporter genes used in plant systems. Manipulation of gene expression in plants. Isolation and uses of different promoters.
2 hrs

Unit 4 *Agrobacterium* mediated gene transfer. Ti plasmid derived vector systems structure and restriction sites. The mechanism of T-DNA transfer from *Agrobacterium* to plant cells. Bt-toxin gene transfer to plants. And Transgenic expression.
2 hrs

Unit 5 Engineering herbicide resistant, insect resistant, disease resistant (Viral, bacterial, fungal) and stress (abiotic) tolerant plants. 6hrs

Unit 6 Antisense strategies for genetic manipulation in plants. Development of antisense technology for commercial purpose with special reference to fruit ripening and delay of senescence in flowering.
2hrs

Unit 7 Production of vaccines, antigens and antibodies from plants.
1hrs

Unit 8 Biotechnological application with reference to alkaloid biosynthesis.
1hrs

Unit 9 Fuel biotechnology: Bio-diesel from lipids and other hydrocarbons. Desirable and undesirable features of biofuels.
1hrs

Unit 10 Environmental applications of plant biotechnology and Phytoremediation.
1hrs

REFERENCES:

1. Brown,T.A. 1994. Gene cloning, chapman and Hall publication. London.
2. Narayan.L.M Moni.A, Selvaraj.A.M and Padmalatha Singh. 1998. Molecular biology and Genetic engineering, Saras publication. Nagercoil. Kanyakumari.
3. Trehan.K.1991 Biotechnology Wiley Easten ltd.
4. Papadiwal P.B 1985. Biotechnology. Aurangabad.
5. Satagura Prasad, M.G. 2000. A text book of molecular biology and Biotechnology.
6. Keshav trehan. 1990. Cell Biotechnology. Wiely Eastern ltd. New.Delhi.
7. Walkar John. M. and Guastra. 1989. Techniques in Molecular Biology. 2 editions. Croon Helus.

COMPUTER APPLICATIONS:

Unit 1 Knowledge of computer systems, hardware and software, CPU and other peripheral devices, software packages and programming language, scientific application packages.
3 hrs

Unit 2 Awareness of Windows, documentation data analysis and presentation techniques using Windows programme. 2 hrs

Unit 3 Computer and internet – The world wide web and local area network, information retrieval, communication using internet. Web data base directories, search engines, life science data bases, tools online and bioinformatics.
5 hrs

BIOSTATISTICS:

Unit 1 Principle and practice of statistical methods in biological research. 2 hrs

Unit 2 Basic statistics measures of dispersion Measures of central tendencies (Mean, Median, Mode) Frequency of distribution, Standard deviation coefficient of

variation and standard error.
4 hrs

Unit 3 Concept of probability – Probability distribution, binomial, possion and normal distribution, the Chi-Square distribution. 4 hrs

Unit 4 Tests of statistical significance – Hypothesis testing for a single population mean, difference between two population means, paired comparison. 5 hrs

Unit 5 Regression and correlation – scatter diagram, simple linear regression and non-linear regression, correlation and correlation coefficient and application. One way analysis of variance, two – way analysis of variance and multivariate analysis of variance.
5 hrs

REFERENCES:

Balaam LN, Fundamental of Biometry, George Allen and Unwin ltd.London, 1972.
Bliss CI, Statistic in Biology Vol. I and II, McGraw-Hill. USA, 1970.
Causton DR, A Biologist Mathematics, Edward Arnold (Publishers) Limited, London, 1977.
Daniel WW, Biostatistics, 6th edition, John Wiley and Sons, New York, 1995.
Daniel WW, Biostatistics, 7th edition, John Wiley and Sons, New York, 1995.
Minieka E and Kurzeja ZD, Statistics for business with computer application, South Western College publishers, Australia,2001.

Bot. CP- 2.3: PRACTICALS: (Based on CT 2.3)

BIOTECHNOLOGY:

1. Isolation and estimation of DNA
2. Isolation and estimation of RNA
3. SDS polyacrylamide gel electrophoresis of seed proteins.
4. Immobilization of cells and enzymes
5. Chromatographic purification of RNA fragments
6. Demonstration of agarose gel electrophoresis of DNA fragments.
7. Growth characteristics of *E. coli* using plating and Turbido-metric method.

COMPUTER APPLICATIONS AND BIOSTATISTICS

1. Determination of mean, median, mode, standard deviation and standard error from the given set of data.
2. Linear aggression analysis, Analysis of variance.
3. Use of statistical packages for data analysis.
4. Data documentation analysis of windows.
5. Information retrieval and communication using internet.
6. Web data base directories and tools for biological science.

Bot. ET- 2.4: MEDICINAL PLANTS

Unit 1. Introduction to the Medicinal Plants:

Classification of drugs-

a. Drugs from underground parts
b. Drugs from Bark
c. Drugs from stems & woods

d. Drugs from Leaves
e. Drugs from Flowers
f. Drugs from Fruits & seeds
g. Drugs from Lower plants 6 hrs.

Unit 2 . Milestones in the study of medicinal plants in India:

a. Hortus Malabaricus
b. Indian Medicinal Plants
c. Indian Meteria Medica
d. Poisonous plants of India
e. Dictionary of folk medicines in India 8 hrs.

Unit 3. Botany of medicinal plants:

a. Ethnomedicobotany and its scope
b. Collection, identification and preservation of medicinal plants 5 hrs.

Unit 4. Systems of medicines:

a. Evolution of systems of medicines
b. Ayurveda system of medicine
c. Sidda system of medicine
d. Unani system of medicine
e. Chinese system of medicine
f. Tibetan system of medicine
g. The Naturopathy and Aromatherapy
h. The Homoeopathy 5 hrs.

Unit 5. Indian Medicinal Plants Scenario:

a. Status and prospects of medicinal plants in India and Karnataka
b. Stress on medicinal plants
c. Conservation of medicinal plants 8 hrs.

Unit 6. Medicinal plants and biotechnology:

a. Outlines of cell and Tissue culture of medicinal plants.
b. Outlines of bioreactors and hairy root culture 6 hrs.

Unit 7. Therapeutic properties of medicinal plants

a. Plants with antimicrobial properties
b. Lectins and their applications
c. Saponins and their applications. 6 hrs.

Unit 8. Formulations of Traditional medicines:

a. Arishta and Asava
b. Arka
c. Avaleha and Paka
d. Ghruta
e. Churna
f. Satva 3 hrs.

Unit 9. Cultivation of important medicinal plants. 3 hrs.

REFERENCES:

Anonymous 1978. The Ayurvedic Formulary of India. Govt. of India Pub.

Farooqi, A.A., Khan, M.M. and Vasundhara, M. 1999. Production technology of medicinal and aromatic crops. Natural Remedies Pvt. Ltd., Bangalore.

Jain. S.K. 1991. Dictionary of Indian folk medicine and ethnobotany. Deep publications, Paschim Vihar, New Delhi.

Kameshwara Rao, C. 2000. Material for the Database of Medicinal Plants. Karnataka State Council for Science and Technology for the Department of Forests, Environment and Ecology, Govt. of Karnataka Pub.

Kirtikar, K.R. and Basu B.D. 2001 (Repr.) Indian Medicinal Plants. Oriental Enterprises Uttaranchal.

Manilal, K.S. 2001. Van Rheede's Hortus Malabaricus English Edition. Univ. of Kerala Pub.

Nadkarni, K.M. 1976 (Revised Ed.) Indian Materia Medica. Popular Prakashan, Bombay.

Sharma, O.P. 1996. Hill's Economic Botany. Tata McGraw Hill Pub. New Delhi.

Yoganarasimhan, S.N. 1996. *Medicinal plants of India. Vol. I. Karnataka*. Interline pub. Pvt. Ltd. Bangalore.

Bot. EP-2.4 :PRACTICALS (Based on Bot. ET 2.4)

1. Identification of medicinal plants including herbarium preparation
2. Study of Drug parts- Morphology and Anatomy
3. Phytochemical analysis (Pharmacognostic studies):
    1. Crude extract of drug by soxhlet extractor
    2. Test for phytochemicals- depending on available chemicals.
4. Preparation of drugs as per traditional system of medicine.
5. Estimation of Biomass of medicinal plants.
6. Visit to a field to document medicinal plants.

SEMESTER- III:

Bot. CT-3.1 : PLANT PHYSIOLOGY

Unit 1 Bioenergetics – First and second law of thermodynamics. Relation between reduction potential and free energy change. 3- hrs

Unit 2 Study of glycolysis and citric acid cycle metabolic regulation of glycolysis and citric acid cycle.. 3- hrs

Unit 3 Oxidative phosphorylation and photophosorylation. Electron transfer reaction in mitochondria, light absorption by chloroplast pigments. External manipulation of pH in isolated chloroplast and mitochondria and ADP phosphorylation. 10- hrs

Unit 4 Nitrogen metabolism –

Uptake of nitrate and its reduction. Catalytic and genetic regulation of nitrate

reductase. Symbiotic nitrogen fixation. 5-hrs

Unit 5 Carbohydrate biosynthesis and inter conversion photosynthetic carbon reduction cycle and its regulation. C-4 pathways and photorespiration. Biosynthesis of sucrose, starch and cellulose.
4- hrs

Unit 6 Lipid metabolism –
Fatty acid Biosynthesis and oxidation. Biosynthesis and catabolism of storage lipids. Biosynthesis and function of membrane lipids.
5- hrs

Unit 7 Membrane transport –
Organization of transport at plasma membrane and tonoplast, pumps carriers and ion channels, P-type and V-type ATPases , ABC transporters, measurement of membranes potential and channel current. Regulation of membrane transport in guard cells. 8-hrs

Unit 8 Plant growth regulators : Mechanism of action of Auxins, gibberellins, cytokinins,
ethylene, abscisic acid, jasmonic acid, triacontinol and salicylic acid. 10-hrs

REFERENCES:

Fundamentals of Biochemistry. D. Voet, J.G. Voet, and C.W. Pratt, John Wiley and Sons 1999.

Physical Biochemistry, K.E Van Holde, W.C. Johnson and P. Shing Ho, Prenta Hall International IN. 1998.

Essential of Biophysics, P. Naryanan. New Agri International publisher, 2000.

Plant Biochemistry, P.M dey and J.B. Harborne, Harcourt Asia Ltd. Academic press, 1997.

Signal and Signal transduction pathways in plants. K. Palme (Ed.) Kluwer Academic publishers 1994.

Annual review of Plant Physiology and Plant Molecular Biology.

Bot. CP- 3.1 : PRACTICALS (Based on CT 3.1)

1. Effect of time and enzyme concentration on the rate of enzyme action.
2. Effect of substrate concentration and pH on enzyme action.
3. Extraction of total lipids from plant tissue purification by column chromatography analysis by TLC
4. Determination of lipase activity in germinating seeds.
5. Determination of chlorophyll a/b ratio in C3 and C4 plants.
6. Crassulacean acid metabolism.
7. Estimation of proline from stressed plants.
8. Gibberellin induction of amylase activity in cereal grains.
9. Effect of light , K, Ca and some inhibitions and against stomatal opening.

10. Determination of Photosynthesis rates in C3 and C4 plants using IRGA.

Bot. CT- 3.2 : CELL BIOLOGY AND GENETICS

CELL BIOLOGY:

Unit 1 Organization of prokaryotic and eukaryotic cell, plasma membrane – molecular organization, cell differentiation.

Unit 2 Nucleus – microscopic and sub microscopic organization. Structure and function of nuclear membrane. Nucleolus- ultrastracture and role in ribosome synthesis. 5- hrs

Unit 3 Eukaryotic Chromosome – chromatin, its chemical nature, macro molecular organization. Heterochromatin and its significance, special types of Chromosomes, polytene and lamp brush Chromosome. Sex Chromosome, Structural change in Chromosomes. Numerical changes in Chromosome. Euploidy, haploidy, polyploidy. 6- hrs

Unit 4 Cytoskeleton – Microtubules, Cilia, flagella, structure and function of ER, Gogli complex, mitochondria, Chloroplast, lysosome and peroxisome. 4- hrs

Unit 5 Mechanism of cell division Mitotic apparatus, cytokinesis, Chromosome movement, molecular mechanisms of regulating mitotic events, meiotic stages, chromosome pairing, Chiasma formation. Cell signaling, Signaling pathways in plants. Molecular biology of signaling. 6- hrs

REFERENCES:

Alberts, B. Bray, D. Lewis, J.Raff, M. Roberts, K. and Watson, J.D. 1994. Molecular biology of the cell., 3rd Ed.

Garrett, R.H. and Gresham. C.M. 1995 : Molecular aspects of cell biology. Saunders publishers, New York.

Lodish, H. Berk,A., Zipursky, S.L. Matsudaira, P., Baltimore, D. Darnell.J. 2000. Molecular cell biology. Freeman W.H. and Co. New York.

Cooper, G.M. 1997. The cell : A molecular approach. ASM press, USA .

Karp, G. 2000: Cell and molecular Biology: concepts of experiments. John Wiley and sons Inc. New York.

GENETICS

Unit I. Classical Genetics:

a. Mendelism: Rediscovery of Mendel principles. Reasons for Mendel, character selected by Mendel. genotype, phenotype, back cross and test cross.

b. Multiple alleles: Self sterility in tobacco. Blood groups in man.

c. Gene interaction: Complementary genes (Flower colour in sweet pea)Albinism in maize (lethal genes in plants)

d. Multiple gene interaction: Colour of wheat kernal, corolla length in tobacco.

e. Linkage in sweet pea (coupling and repultion) T series of linkage: differential

multiplication theory and chromosome theory of linkage and factors affecting linkage.

f. Chomosome mapping in maize and Drosophila.

g. Sex determination in plants.

i. Extra chromosomal inheritance (chloroplast, mitochondria and episome). 8 hrs

Unit II. Gene and gene concept:

Structure of plant gene, function of gene, mutation of gene: Transition and transversion: silent mutation, frame-shift mutation, nonsense mutation and point mutation and role of mutation in evolution. Trasferons, as elements, split genes, selfish genes.

Regulation of gene expression in prokaryotes:

Concept of operon model and mechanism of operon model (structural genes, promoter genes, regulator genes and operator genes)

Regulation of gene expression in eukaryotes:

Regulation, transcription, processing, translation, one gene and one enzyme hypothesis, one gene and one polypeptide hypothesis.

8 hrs

Unit III. Genetic engineering:

Gene cloning recombinant DNA and PCR, vectors: plasmids, cosmids, molecular sensors restriction endonucleases and molecular sutures ligases . gene theory, gene banks DNA chips, cloning of *Nif* genes, isolation and introduction of Nif gene. Genetically modified plants and food.

9 hrs

REFERENCES:

Tamarin, R.M. 2000 : Principles of Genetics,. 6th Ed. WMC. Brown Publ. Co. London.

Watson, J.D., Hopkins, N.H., Robert, J.W., Steitz, J.A. and Weiner, A.M. 1987: Molecualr Biology of gene. 4th Ed. Bengimin. Publ. Co. New York.

Strickberger, M. W. 1995 : Genetics. 3rd Ed. Prentice Hall Inc. London.

Goodenough, U. 1990 : Genetics 4th Ed. Holt Saunders. Tokyo.

Bot. CP-3.2 : PRACTICALS (Based on CT 3.2)

CELL BIOLOGY:

1. Stains and dehydration grades for cytological studies.
2. Squash and smear preparations of mitotic and meiotic Chromosome, preparation of permanent slides.
3. Determination of Chromosome number at mitotic metaphase and diakinesis/metaphase I of meiosis.
4. Calculation of Chiasma frequency.
5. Isolation and separation of sub cellular organelles.
6. Identification of B – Chromosome. Polytene Chromosome in chironomos and fruit fly.

GENETICS:

1. Culture techniques and handling of fruit flies.
2. Life cycle of *Drosophila melanogaster*.
3. Identification of male and female flies.
4. Observation of mutant flies.
5. Crossing experiments and simple mendelian inheritance in fruit flies.
6. Study of growth curve in E. coli.
7. Conjugation in E. coli.
8. Problems in Genetics.

Bot. CT-3.3 : DEVELOPEMENTAL BIOLOGY OF PLANTS AND TISSUE CULTURE

Unit 1. Polarity in plants:

a. Acellular, (Dictyostelium)
b. Unicellular, (Acetabularia, Fucus egg, Equisetum spore)
c. Multicellular, (Root hair and stigma formation)
d. Organ, (Dorsiventral leaf)
e. Colonial, (Volvox colony). 07 hrs

Unit 2. Apical meristem:

Ultra structure, Biochemical activities, Regeneration and denovo in culture, split and damage apices. Bud dormance, Gene expression in shoot apex and SAM mutants.Quiscent center, genetics of root development. 07 hrs

Unit 3. Leaf primordium:

Phyllotaxis, Mechanism of leaf primordium initiation. Experimental model of modification of positioning, Genetics of phyllotaxy, plastochorns. Transition of reproductive phase, Phase change and developmental switching at the apex. Vernalization and changes in biochemical activity.
07 hrs

Unit 4. Developmental patterns at the flowering apex.

ABC model, and specification of floral organs homeotic mutants, reversal of flowering,
Molecular aspects of MADS box genes during, flower development. Modification of gene action by growth substances, Cellular differentiation between floral organs.
Senescence- a general account. 06 hrs

Unit 5. Androgenesis and Gynogenesis:

Ultrastrucural, Histochemical, Genetical and Functional aspects. Concept of male and female germ unit and there significance.

Unit 6. Pollination and Fertilization:

Structural, Functional aspects of pollen style stigma. Current view of double fertilization and development of endosperm and its function.
07 hrs

Unit 7. Cellular and biochemical aspects of embryogenesis:

Gene activity during zygotic embryogenesis. Structure and function of embryo suspensor.

Photo-morphogenesis, Photoreceptors. Structure and function. Photo-responses and molecular mechanism. 06 hrs

Unit 8. Plant tissue culture:

Laboratory organization, Nutrient media, Sterilization techniques, Micropropogation, Cell suspension culture, Haploid production, Protoplast isolation and fusion. Cryopreservation, Production of synthetic seeds. *In vitro* production of zygotes. 10 hrs

REFERENCES:

1. Embryology of Angiosperms (1984) Ed. B.M. Johri Springer-verlag Publications

2. Introduction to the Embryology and Angiosperms by P. Maheshwari (1950) Mc Graw Hill NY.

3. Recent advances in the Embryology of Angiosperms Ed. P. Maheshwari (1963). Intl. Soc. Plant morphol. Delhi

4. The embryology of angiosperms (2000) by Bhojwani S.S. and Bhatnagar S.A. . Vikas publications house New Delhi

5. Pollen biology and biotechnology (2003) by K.R. Shivanna, Oxfard and IBH publishing house New Delhi

6 Fertilization in Angiosperms /seed plants (Molecular and Cytological) by Cristi.

7. Plant morphogenesis by Sinnott

8. Plant tissue culture by M.K. Razdhan

Bot. CP 3.3 PRACTICALS (BASED ON Bot. CT 3.3)

1. Development of Anther and ovule / Permanent slide preparation
2. Histochemical test of Anther and ovule at different stages of development
3. Preparation of Brewbaker or Kwakh medium for pollen germination
4. Hanging drop technique for pollen germination
5. Pollen acetolysis to study pollen exine ornamentation and aperture
6. Mounting of embryo and endosperms
7. Preparation of MS media for plant tissue culture
8. Inoculation of explants on a nutrient medium
9. Root apical and shoot apical meristem
10. Callus histology/cytology

Bot. ET- 3.4 : PLANT BIOTECHNOLOGY :

Unit 1 Introduction: Definition Old and New Biotechnology. An interdisciplinary activity, Scope and importance, commercial potential, Biotechnology centers in India. 3 hrs.

Unit 2 Biofertilizers: Introduction, Types, Blue green algae, Sea weeds, Azolla, Vesicular arbuscular mycorrhizal fungi and Rhizobium. 6 hrs

Unit 3 Industrial Biotechnology: Introduction, Industrial microbial products: Alcohol production (Beer), Antibiotics production (penicillin), production of Vitamins (Vitamin B_{12}), production of Single Cell Protein, Algal protein: (Spirulina) Fungal protein: (Mushroom) and economic aspects. 10 hrs

Unit 4 Plant Tissue Culture: Introduction. Importance of plant tissue culture, Basic requirements for tissue culture laboratory, composition of tissue culture medium. Culture of plant tissues, Regeneration of plants, Root culture, meristem culture, Anther culture, Pollen culture. Role of tissue culture technology in crop improvements. 10 hrs

Unit 5 Biofuels: Introduction, Production of biogas, Structure of biogas plant, Biochemistry of methane production, Biogas research in India, Uses of biogas. 5 hrs

Unit 6 Plant Biotechnology Introduction, Somatic hybrids and cybrids, cytoplasmic gene transfer, gene transfer, Advantage and Limitations. 4 hrs

Unit 7 Genetic Engineering: Introduction, Genetic Engineering of microorganisms, Vectors of gene cloning direct transformations, Microinjection, Nuclear transplantation, Isolation and cloning plasmid and Mitochondrial genes. Transgenic plants with *nif* genes. Improvement of seed proteins, production of disease free and disease resistant plants. 12 hrs

REFERENCES:

1. Glazer, A.N and Nikaido. H. 1995. Microbial Biotechnology. W.H.Freeman And co. New York.
2. Glieck Barnard and Pasternak, Jack.J.1996. Molecular Biotechnology principles and application of recombinant DNA: Pavan publishers. New Delhi.
3. Kumar.H.C. 1992. Text book on Biotechnology. East west press. New York.
4. Walker.J.M and Gingold. W.B. 1989. Molecular Biology and Biotechnology. 2nd edition. Royal Society of chemistry, London.
5. Keshav Trehan.1990. Biotechnology. Wiley Eastern/td. New Delhi.
6. Gaurd.R.S. Gupta.G.D and Gukhade.S.B.2000. Practical Biotechnology: Nirali park ashan publishers. Pune.
7. Firn.R.K and Prave. P Biotechnology. 1988. Hanser Publisher publication. New York.
8. Dubey.H.C.1991. Fungi and Biotechnology. Today's and tomorrow's Printer and Publishers. New Delhi.

9. Stanbury. P.F and Whitaker.A. 1985. Principles and Fermentation technology, Pergaman press. Oxford.
10. Wiseman.A.1987. Hand book of enzyme Biotechnology. Ellis Horwood ltd. New York
11. Tejovathi.G, Vimala.Y and Rekha Bhadauria, 1996. A practical manual for plant Biotechnology. CBS publishers and distributors. New Delhi.
12. Narayanan. L.M., Selva Raj, A.M., Mani.A and Arumugam.N.1998. Molecular Biology and Genetic Engineering. Saras publication. Nagercoil. India.
13. Colin Ratledge and Bjorn Kristainsen.2004. Basic Biotechnology. Cambridge University press London.
14. Snyder.L. and Champness, W. 1997. Molecular Genetics of Bacteria. American Society for microbiology. Washington DC.
15. Asenjo, J.A.1990. Separation process in Biotechnology. Marcel Dakker, New York.

Bot. EP-3.4 : PRACTICALS (Based on ET 3.4)

PLANT BIOTECHNOLOGY

1. Basic laboratory principles and techniques
2. Equipments and instruments.
3. Culture media: Simple media, Synthetic media, Complex media, Semi defined media, Special media, Enriched media.
4. Culture of Mushroom.
5. Mass culture of Spirulina.
6. Plant tissue culture techniques.
7. Isolation of DNA from plant materials.
8. Production of Synthetic Seeds.
9. Preparation of Wines from Grapes.
10. Experiment to demonstrate biogas production.

SEMESTER- IV

Bot. CT-4.1 MYCOLOGY AND PLANT PATHOLOGY:

MYCOLOGY

Unit 1 Biological feature of fungi –
Structure, mobility, life cycle pattern in fungi, reproduction – Asexual and sexual. 10-hrs

Unit 2 Structure and types of soil. Biological population and its relation with mycoflora. Perdation, parasitism and antagonism. Rhizosphere, Rhizoplane and non- Rhizosphere

fungi. Ecosystem and fungal community. 8-hrs

Unit 3 Fungal physiology –

Nutrition of carbon nitrogen, mineral, vitamin and growth regulators. Metabolisms and biosynthesis of carbohydrates and non-carbohydrates and nitrogen. 4 hrs

Unit 4 Secondary metabolites and their role. Fungi as genetic organism for genetic study 4 hrs

PLANT PATHOLOGY

Unit 1 . The concept of disease in plants, classification of plant disease, attack of pathogens mechanical forces, chemical weapons, enzymes. Microbial toxins and growth regulators. 8 hrs

Unit 2. Plant defense mechanism against pathogens, genetics of plants disease epidemiology. 4 hrs

Unit 3. Management and control of plant disease. 3 hrs

Unit 4 Application of Biotechnology in relation to plant pathology. 4 hrs

Unit 5. Environmental factors that cause plant disease. 5 hrs

REFERENCES:

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Subramanin CV (1991) Hyphomycetes, ICAR, New Delhi.

Reynolds DR (1981) Ascomycetes systematics – The Luttrelian concept, Springer, Verlag, New York.

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Ingold, CT (1971) fungal spores – their liberation and dispersal. Oxford Univ. Press, Oxford.

Dickinson, CW and Pugh GJF (1974) Biology of plant litter decomposition. Vol I And II, Academic press London.

Ainsworth and Sussman, AS (1965,1966,1968,1973) The fungi, An advanced Treatise, Vol I- IV, Academic press New York.

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Rangaswamy, D (1988) Disease of crop plants in India, Prentice Hall India, Ltd New Delhi.

Asada, Y, Bbushnell, NR Ouchi. S, and Vance, P (1982) Plant infection. The physiology and Biochemical basis, Springer Verlag, Berlin Nee York.

Kosuge, T and Nester, EN (1984) Plant microbe interaction – molecular and genetic perspectives, MacMillan, New York.

Bot. CP. 4.1 PRACTICALS (Based on CT 4.1)

MYCOLOGY

1. Vegetative organization in fungi.
2. Asexual reproduction in fungi.
3. Sexual reproduction in fungi.
4. Rhziosphere, Rhzioplane, phylloplane studies of fungi.
5. Fungal physiology – Growth and nutritional studies.

PLANT PATHOLOGY

1. Disease of cereal crops.
    a) Blast disease of Rice.
    b) Yellow smut of wheat.
    c) Loose smut of wheat.
    d) Downy mildew of sorghum.
    e) Anthraenose of sorghum
2. Disease of plantation crops.
    a) Downy mildew of grapes.
    b) Leaf rust of coffee.
    c) Tikka disease of ground nut.
    d) Late blight of potato.
3. Others -
    a) Bean mosaic disease.
    b) Sandal spike.
    c) Tobacco mosaic virus disease.
    d) Citrus canker.
    e) Grass root sugarcane
    f) Root knot of mulberry.
4. Isolation and inoculation of plant pathogens.
5. Estimation of spore production of fungal pathogens of leaves using Haemocytometer method.

Air dispersal of plant pathogens – an investigation using rotord sampler.

Bot. CT-4.2: PLANT BREEDING AND PLANT PROPAGATION

PLANT BREEDING:

Unit 1. History and scope of plant breeding.

5 Hrs

Unit 2. Plant Genetic resources:

a. Importance and urgency.
b. Sources of germplasm
c. Systematic evaluation and utilization

d. Germplasm conservation
e. Global and National organization for crop improvement
f. Pattern of evolution in crop plants. 5 hrs

Unit 3. Conventional breeding methods:

a. Reproduction, Genetic basis, Sexual and crosspollination, Apomixis, Genetics induction and significance in plant breeding.
b. Domestication, Plant introduction and acclimatization. Selection in self, cross pollinated and vegetative propagated plants.
c. Hybridization: In self and cross pollinated plants. Vegetative propagated plants.
d. Back cross: Technique and importance. 7 hrs.

Unit 4. Heterosis breeding

a. Inbreeding depression
b. Homozygous and heterozygous balance
c. Genetic basis of heterosis
d. Heterosis and plant breeding 3 hrs.

Unit 5. Difference between production breeding to disease resistance

a. Types of resistance – Vertifolia effect, epiphytosis, vertical and horizontal resistance
b. Genetics of post and parasite relation ship.
c. Genetics of insect resistance
d. Mechanism of drought resistance
e. Genetics of drought resistance
f. Breeding methods for disease insect and drought resistance 7 hrs.

Unit 6. Distant hybridization

a. Introduction history
b. Barrier to the production of distant hybridization
c. Techniques for production of distant hybrids.
d. Sterility in distant hybrids.
e. Consequence of segregation in distant hybrids.
f. Importance of distant hybridization in crop improvement. 5 hrs.

Unit 7. Quality seeds.

a. Classes.
b. Production
c. Maintenance
d. Development of seed industry
e. The Indian seed act. 4 hrs.

PLANT PROPAGATION:

Unit 1. Principles and concepts of plant propagation. 1 hrs

Unit 2. Propagating structures :

Green house , shade house , net house, mist propagation unit, containers for growing plants. 2 hrs

Unit 3. Media for propagation –

Treatment of soil and soil mixtures, Fertilizers and sanitation 2 hrs

Unit 4. Plant nurseries –

Types, sites for their establishment, design and management. 2 hrs

Unit 5. Seed propagation –

Seed selection, testing and storage; principles and techniques, advantages and limitations; process of seed germination, seed dormancy, treatment to overcome pathogens. Seed viability tests, seed testing and seed certification (seed patent law). Hardening of seedlings.

2 hrs

Unit 6. Vegetative propagation –

Advantage and limitations. Sources, selection and management of the vegetative propagation 4 hrs

Unit 7. Clones- Breeding of asexually propagated plants

Source production and viability and maintenance. Genetic variability. Techniques of propagation by cutting; types of cuttings, rooting media, factors influencing rooting, treating cuttings with growth regulators, leafy cuttings. 2 hrs

Unit 8. Propagation by specialized vegetative structures ;

Bulbs, tubers, corms, rhizomes, runners, suckers, 2 hrs

Unit 10. Layering and its natural modifications:

Types and procedures of layering; Factors affecting regeneration by layering. 2 hrs

Unit 11. Techniques of grafting and budding :

Objectives ,methods and limitations, stock-scion relationship; micro grafting and microbudding; graft incompatibility : tools and accessories required for cutting, grafting and budding.

2 hrs

Unit 12. Propagation methods of some important plants :

Fruits and nuts; medicinal and aromatic plants; vegetables, ornamentals; succulents and cacti , house plants.

2 hrs

Unit 13. Hydroponics:

A general account. 2 hrs

REFERENCES:

Breeding of Asian plants. 1998. J.M. Poewman and Brothukar, I.B.H. New Delhi.

Breeding field crops 1999 J.M. Poehlman and D.A. Sleper Panima Publ. Crop New Delhi.

Plant Breeding 2000. B.D. Singh. Kalyani Publ. New Delhi.
Evolution of crop plants 1986. N.W. Simmonds (Ed).Longmann Sci. Tech. Pub. England
Apomixes and Plant breeding. S.S. Khoklov. Amerind. New York.
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Heterosis 1983. Edi. R. Frankel and Bet Dagan. Springer Verlag. Berlin.
Plant breeding for pest and disease resistance 1978. E.G. Russel. Butterworth. London.
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Hartman, H.J. et.al., 1990 : Plant propagation . Principles and practices. Prentice Hall, New Delhi.
Schwalz. M. 1975 : Guide to commercial hydrophonics. Israel Univerisity, Jerusalem.
Sharma, V.K. 1996 Plant Nurseries : Techniques, production and management. Indian Pub. New Delhi.
Sadhu, M.K. 1989 : Plant propagation. New Age Pub. New Delhi.

Bot. CP- 4.2 : PRACTICALS : (Based on Bot. CT 4.2)

1. Reproductive biology
   a. Self, b. Cross pollinated plants, c. Vegetative reproduction
2. Hybridization : Emasculation, bagging and production of hybrids if possible apparent pollen fertility.
3. Origin, distribution and centers of diversity of crop plants: Wheat, Sorghum, Rice, Chilly, sugarcane, Cotton, Potato, Coffee, Sunflower and Ground nut.
4. Preparation of media- treatment of soil and soil mixtures.
5. Breaking of seed dormancy and growing seedlings after treating with hormones.
6. Propagate the bulbs (Lilium, tubers (Potato, Begonia), corms(Gladiolus), Rhizome(Canna) Sucker (Banana).
7. Different types of layering (Simple layering, Tit layering, serpentine layering, Air layering; stool layering).
8. Grafting experiments – Whip (or splice) grafting methods; side grafting; bark grafting, T-budding; Inverted T- budding; chip budding.
9. Demonstrate the experiments on the propagation of succulents by cutting and cacti by grafting.

SPECIAL PAPERS:

Bot. CT-4.3.1. PLANT TISSUE CULTURE

TISSUE CULTURE:

Unit 1. Cellular toti potency –

Cytodifferentiation, organogenesis, factors affecting organogenic differentiation.2 hrs

Unit 2. Somatic embryogenesis –

Induction, development and maturation. Factors affecting somatic embryogenesis, applications of somatic embryogenesis and synthetic seeds. Molecular biology of somatic embryogenesis: induction, development, synchronizing somatic embryo

development. Hormonal regulation of somatic embryogenesis. Late embryogenesis abundant (LEA) gene expression. Genes isolated from somatic embryos. Expression of 'non embryonic' genes during somatic embryogenesis. Somatic embryo as a genetic system.

5 hrs

Unit 3. Haploid production –

Androgenesis, anther and microspore culture, factors influencing anther/microspore culture, gynogenesis, production of haploids by wide hybridization. Applications.4hrs

Unit 4. Triploid production –

Methods and applications. 2 hrs

Unit 5. In vitro pollination and fertilization –

Methods, factors affecting seed setting after in vitro pollinations, application. 2 hrs

Unit 6. Zygotic embryo culture –

Techniques, culture requirements, applications. 2 hrs

Unit 7. Somaclonal and gametoclonal variations:

Origin of somaclonal variation, mechanism underlying genetic variations, assessment of somaclonal variations. Isolation of variants – disease resistant lines, herbicide resistant lines, stress tolerant lines, applications.

4 hrs

Unit 8. Protoplast isolation and culture –

Isolation, culture and regeneration of protoplasts. 4 hrs

Unit 9. Somatic hybridization and cybridization –

Protoplast fusion methods, selection of hybrids and cybrids, assessment of hybridity. Molecular analysis of nuclear genes and organellar genes in the somatic hybrids/cybrids. Protoplasts as a tool in cell biology and biotechnology.

4 hrs

Unit 10. Production of disease free plants-methods of virus elimination, eradication of pathogens other than viruses.

2 hrs

Unit 11. Micro propagation:

Techniques, multiplication by axillary and apical shoots, multiplication by adventitious shoots, multiplication through callus cultures, factors influencing shoot multiplication and rooting. Acclimatization of plants transferred to soil. 4 hrs

Unit 12. Production of secondary metabolites –

Application of tissue culture for synthesis of useful compounds. Techniques of selecting cell lines for high yields of compounds of secondary metabolism. Mass cultivation of cells by bioreactors. Elicitor induced accumulation of products. 4 hrs

Unit 13. Germplasm conservation –

Methods of conservation, cryopreservation. 4 hrs

REFERENCES:

S. S. Bhojwani and M. K. Razdan. 1996. Plant tissue culture: Theory and Practice. Elsevier Publishers, Amsterdam.

J. R. Reinert and Y. P. S. Bajaj. 1977. Applied and fundamental aspects of plant cell, tissue and organ culture. Springer-Verlag, Berlin.

Y. P. S. Bajaj (Ed.) Biotechnology in agriculture and forestry. Various volumes published time to time. Springer-Verlag, Berlin.

T. A. Thorpe. 1981. Plant tissue culture. Academic Press, New York.

T. A. Thorpe (Ed.) 1995. Embryogenesis in plants. Kluwer Academic Publishers, Netherlands.

S. K. Sen and K. L. Giles (Ed.) 1983. Plant cell culture in crop improvement. Plenum Press, New York.

M. K. Razdan. 1993. An introduction to plant tissue culture, Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.

S. S. Bhojwani. 1990. Plant tissue culture: Applications and limitations. Elsevier Publishers, Amsterdam.

I. K. Vasil (Ed.) Cell culture and somatic cell genetics of plants. Various volumes. Academic Publishers, Orlando.

R. A. Dixon and R. A. Gonzales (Ed.) 1994. Plant cell culture, a practical approach. Second Edition. Oxford University Press, Oxford.

O. L. Gamborg and G. C. Phillips. 1995. Plant cell, tissue and organ culture, fundamental methods. Springer International student Edition.

Molecular Biotechnology (2nd Edn.) B.R. Glick and J.J. Pasternak, ASM Press, Washington DC. 1998.

Genes VII, B. Lewin, Oxford University, Press, 2000

Gene cloning, T.A. Brown, Chapman and Hall Publ. 1994.

Bot. CP-4.3.1 PRACTICALS : (Based on Bot. CT 4.3.1)

PLANT TISSUE CULTURE

1. Micropropagation by proliferation of axillary bud.
2. Anther culture for haploid production.
3. Microspore culture for haploid production.

4. Protoplast isolation and culture.
5. Embryogenesis in cultured cells/tissues.
6. Preparation of synthetic seeds.
7. Extraction and quantification of secondary metabolites from callus.
8. PCR technique
9. Co-cultivation of leaf discs with *Agrobacterium* and study of GUS.

Bot. CT-4.3.2 : REPRODUCTIVE BIOLOGY OF HIGHER PLANTS

Unit 1. Introduction Reproductive biology 1 hr

Unit 2. Anther – Composition and reorganization of cytoplasmic constituents in the meiocytes during meiosis; Pollen formation : Structure and composition of pollen. The concept and significance of Male Germ Unit ; Formation of Generative and male cells in the pollen- their isolation, biochemistry, physiology and cytoskeletal organization. Complexity and specificity of sporophytic and gametophytic gene expression during anther development.Anther tapetum- Structure, composition and function.Pollen wall biology- Composition and function.

10 hrs.

Unit 3. Pollen tube :

Growth, composition chemotropism and cytoskeletal organization. 04 hrs.

Unit 4. Ovule :

Composition and cytoplasmic reorganization in the megasporocyte during meiosis; Megagametophyte- Structure, Composition and role of its constituent cells. The concept and significance of Female Germ Unit. Cytoskeletal organization of the megagametophyte cells. Expression of sporophytic and gametophytic specific genes during ovule and female gametophyte formation. Mutants that affect the development of pistil, ovule and female gametophyte. 10 hrs.

Unit 5. Pollination :

Structure, composition and function of stigma and style. Composition and role of stigmatic exudate and stylar matrix; Pollen-pistil interaction,Fertilization- Current outlook of double and preferential fertilization and their significance.

05hrs.

Unit 6. *In vitro* fertilization and development of artificial zygotes and embryo through micromanipulation of male and female gametes. .

Unit 7. Male sterility-

Causes, biochemical and molecular aspects of cytoplasmic male sterility.
05hrs.

Unit 8. Sexual incompatibility-

Physiological and Biochemical mechanism of sporophytic and gametophytic self-incompatibility. Barriers of incompatibility

05hrs.

Unit 9. Embryogenesis-

Role of cellular and biochemical components during embryogenesis. Embryo suspensor- Biochemical, Physiological and Functional aspects. Regulation of gene activity during embryogenesis. Embryo mutants- lethal mutants, apical-basal mutants, pattern mutants and radial axis mutants.

05hrs.

Unit 10. Endosperm-

Biochemistry, Physiology and function. 05 hrs.

References:

1. Embryology of Angiosperms (1984) Ed. B.M. Johri Springer-verlag Publications

2. Introduction to the Embryology and Angiosperms by P. Maheshwari (1950) Mc Graw Hill NY.

3. Recent advances in the Embryology of Angiosperms Ed. P. Maheshwari (1963). Intl. Soc. Plant morphol. Delhi

4. The embryology of angiosperms (2000) by Bhojwani S.S. and Bhatnagar S.A. . Vikas publications house New Delhi

5. Pollen biology and biotechnology (2003) by K.R. Shivanna, Oxfard and IBH publishing house New Delhi

6 Fertilization in Angiosperms /seed plants (Molecular and Cytological) by Cristi.

7. Plant morphogenesis by Sinnott

8. Plant tissue culture by M.K. Razdhan

Bot. CP-4.3.2: PRACTICALS (Based on Bot CT 4.3.2)

1. Preparation of thin sections to assess the cytoplasmic contents in the meiocytes during meiosis, tapetum and pollen, using carbohydrates, proteins and RNA test.
2. Preparation of thin sections of ovule to verify the chemical composition of female germ unit using carbohydrates, proteins and RNA tests.
3. Effect of Boron, calcium and volatile substances polluted gases on pollen germination and tube growth.
4. Experiment to know the chemotropic effects of calcium and /or pistillar tissues and pollen.
5. Composition of pollen tube and stigmatic papillae using cytochemical tests.
6. *In vivo* growth of pollen tube using appropriate stains.
7. Conduct the experiment on isolation of generative/male cells from the pollen using osmotic shock method (*Vicia faba*).
8. Isolate the embryo sac by using micromanipulation method.
9. Isolate the embryo suspensor and analyze the chemical composition in it by using cytochemical tests.
10. Microtome sections of ungerminated and germinated monocot/dicot plant embryos to show the chemical composition in the root apical meristem and shoot apical meristem.

11. Diagrammatic representation of different ovular mutants.
12. Diagrammatic representation to show the expression of different genes during the development of embryo in Arabidopsis or any other plant investigated.

Bot. CT-4.3.3: APPLIED MICROBIOLOGY, APPLIED MYCOLOGY AND PLANT PATHOLOGY

APPLIED MICROBIOLOGY:

Unit 1 Agricultural Microbiology : The rhizosphere, rhizosphere effect, Nitrogen fixation in the rhizosphere, growth promoting rhizobacteria, siderophores, mycorrhizae, Phosphate solubilizing bacteria and Actinorhizal symbiosis i.e.(Frankia induced nodulation).The new green revolution, gene exchange in bacteria, *Agrobacterium* mediated transfer of genes(Gene protection technology for plants) Anti body mediated resistance , Resistance due to inter-feron related genes, Manipulation of host genes for plant protection. Risks and Benefits.

4 hrs

Unit 2 Industrial Microbiology: Fomenters : Fermentation process, types of fermentation , alcoholic fermentation (Beer and Wine) , Organic acid fermentation (Citric acid) antibiotics production : (Penicillin) Enzymes (amylase),Production of steroid hormones, vaccines and production of Methane.

4 hrs

Unit 3 Dairy Microbiology: Sources of microbial contamination of milk , Types of microorganisms in milk- bacteria, fungi and yeast. Microbial examination of milk. Lactic acid production. Fermented dairy products. Methods of preservation of milk and milk products, pasteurization and sterilization. 4 hrs

Unit 4 Environmental Microbiology : Bio remediation, bio remediation of hydrocarbons, bio remediation of heavy metals, bio remediation of xenobiotics, Microbial leaching, Biomining , Bioleaching of copper , uranium and gold. Recovering of minerals from microorganisms, recovering of oil and single cell oil.

3 hrs

Unit 5 Water Microbiology: Types of water- Atmospheric water and Surface water, stored water and ground water, Microbial analysis of water, sanitary test for coliforms (presumptive test, confirmed test, completed test). IMViC test, purification of water sedimentation, filtration (slow sand filtration, rapid sand filtration) disinfection

3hrs

Unit 6 Immunological Techniques: Serological tests, precipitation of VDRL test for syphilis, ABO blood typing, Enzyme –linked immunosorbent assay (ELISA). Hybridoma technology, Radio immunoassay, Monoclonal antibodies , man made antibodies, production of antisera, vaccines and common immunization.

4 hrs

APPLIED MYCOLOGY

Unit 1 Preservation and maintenance of cultures, Batch, synchronous, continuous, and phased culture and their applications. 6 hrs

Unit 2 Mushroom production technology – advancement in technology of Mushroom cultivation with reference to strain improvement, wild edible mushrooms,

cultivated species in India and abroad.
6 hrs

Unit 3 Non-industrial fungal metabolites, phytoalexins, hormones, pigments, lichen products and mycotoxins.
6 hrs

Unit 4 Production of pharmaceutical products, fungal enzymes and their industrial applications. Production of single cell protein and feed stuffs 6 hrs

PLANT PATHOLOGY:

Unit 1 Nature and concept of epidemiology of plant diseases. Inoculum production potential and distribution.
4 hrs

Unit 2 Mechanism of infection, effect of environment on multiplication of pathogen and outbreak of disease. 4 hrs

Unit 3 Defense mechanism systems in plants Biochemical and physiological changes in plants due to infection, Preventive measures – physical, chemical and biochemical methods. 6 hrs

Unit 4 Plant disease forecasting, post harvest pathology, forest pathology and plant Quarantine.
6hrs

Unit 5 Specific plant diseases – plant diseases caused by fungi, plant diseases caused by bacteria, virus, mycoplasma , nematodes, and parasitic higher plants. 6 hrs

REFERENCE:

APPLIED MICROBIOLOGY

1. Bisen, P.S. 1994. Frontiers in Microbial Technology. CBS. Publishers. New Delhi.
2. Rangaswami, G and Bagyaraj,D.J.1996. Agricultural Microbiology 2nd edition. Prentice Hall of India (Pvt) Ltd. New Delhi.
3. Jay, J.M 1987. Modern Food Microbiology. American Public Health Association. Washington. CBS Publishers. New Delhi.
4. Waites, M.J. 1995. Industrial Microbiology. An introduction. Parima publishing corporation, New Delhi.
5. Demain, D.1990. Manual of industrial microbiology and Biotechnology. Panima publishing corporation, New Delhi.
6. Pelczar,Jr. Chan, B.C.s and Krej, N.R. 1993. Microbiology. MC Graw Hill-Inc. New Delhi.
7. Prescott,L.M, Harley, J.P and Klein, D.A 1998. Microbiology W M C Brown Publishers. New Delhi.
8. Jerome, J. Perry and James, T. Staley. 1997. Microbiology. Dynamics and Diversity. Sannders College Publishing Co. USA.
9. Larry Mckane and Judykandel. 1986. Microbiology: essential and applications. Mc Graw Hill. Book Company Publication. New York.
10. Edward Alcame.1997. Fundamentals of Microbiology. Benjamin Cumming Publishing Company, Canada.

11. Schlegel, H.S.1986. General microbiology, 6th Ed. Cambridge University Press London.
12. Freeman, J.E.1982. Advances in microbiology. Ed. Subba Rao, (N.S) Oxford and IBH Co. New Delhi.

APPLIED MYCOLOGY AND PLANT PATHOLOGY

1. Hand book of Applied Mycology series Editor Dilip K. Arora
2. Volume 1 soil and plant edited by Dilip K. Arora Bharat Rai K.G. Mukerji, and gyu R. Knudsen Volume 2 Humans, Animals and Insects edited by Dilip K. Arora, Libero Ajello and K.G. Mukerji,
3. Volume 4 Biotechnology, edited by Dilip K. Arora, Richard P. Elnader , and K.G. Mukerji
4. Volume 5 Mycotoxins in ecological systems, edited by Deepak Bhatnagar, Eivind b. Lillehoj, and Dilip K. Arora,
5. J.E. Smith and D.R. Berry 1975. The Filamentous fungi. Volume I Industrial Mycology Edward Arnold London UK
6. J.E.Smith and D.R. Berry 1975. The Filamentous fungi. VolumeII Biosynthesis and metabolism Edward Arnold London UK
7. Agarios, GN (1995) plant pathology, IV Edn Academic press Inc. London New York.
8. Horsfall, JG and Cowling, EB (1977-80) Plant Disease, Vol – I to V Academic press New York.
9. Rangaswamy, D (1988) Disease of crop plants in India, Prentice Hall India, Ltd New Delhi.
10. Asada, Y, Bbushnell, NR Ouchi. S, and vance, P (1982) Plant infection. The physiology and Biochemical basis, Springer Verlag, Berlin Nee York.
11. Kosuge, T and Nester, EN (1984) Plant microbe interaction – molecular and genetic perspectives, MacMillan, New York.

Bot. CP-4.3.3: PRACTICALS (Based on Bot CT 4.3.3)
APPLIED MICROBIOLOGY

1. Study of diseases caused by Virus and Mycoplasm
2. study of rhizosphere microflora
3. study of phyllosphere microflora
4. Enumeration of micro organisms from spoiled vegetation
5. Examination of VAM in roots and isolation of VAM spores from rhizosphere soil.
6. Isolation and culturing of Rhizobium from root nodules in leguminous plants.
7. Microbial analysis of milk.

APPLIED MYCOLOGY:

1. Stimulatory effect of plant extracts on spore germination of fungal pathogens.
2. Mushroom cultivation.
3. Paper chromatographic separation of amino acids from culture filtrates.
4. Detection and separation of mycotoxins by TLC.
5. Enzymatic reactions – degradation of carbohydrates.

PLANT PATHOLOGY:

1. Market pathology of fruits, vegetables and seeds.
2. Qualitative and quantitative analysis of air borne pathogens.
3. Germination of powdery mildew conidia at different relative humidity levels.
4. Biochemical analysis of diseased plants.

Bot. CT 4.3.4 PHYTODIVERSITY AND ENVIRONMENTAL BIOLOGY

PHYTODIVERSITY

Unit 1. Introduction to phytodiversity and its classification- Genetic, specific and ecosystem diversity 2 hrs.

Unit 2. Floristic diversity in India:

a. Status of plant diversity
b. Types of forests and their status
c. Biogeographic zones of India. 6 hrs.

Unit 3. Climate and vegetation of Karnataka:

a. Floristics in Karnataka.
b. Physiography, Geology, Soil and bioclimate of Karnataka
c. Vegetation of Karnataka- A comparison of Western and Eastern Karnataka.
d. A brief account of forest covers in Karnataka. 6 hrs.

Unit 4. Special phytodiversity centers:

a. Concept of Hot spots
b. Hot spots in India
c. Phytodiversity of the Western Ghats
d. Mangrove ecosystems- Emphasis to Karnataka and Sunderbans.
e. The Myristica swamps.
f. The Tropical montane forests. 6 hrs.

Unit 5. Values and conservation of phytodiversity:

a. Ecological importance of species diversity.
b. Uses of plants.
c. Concept of RET plants.
d. Ex situ and in situ conservation
e. Biological Diversity Bill. 6 hrs.

ENVIRONMENTAL BIOLOGY

Unit 1. Structure and composition of Atmosphere, Lithosphere, Hydrosphere and Biosphere. Mass and energy transfer across the various interfaces. Material balance. 5 hrs

Unit 2. Chemicals in Environment: 5 hrs

a. Air- Chemical composition of air, ambient air quality standards. Natural and anthropogenic sources of pollution. Primary and secondary pollutants. PAN, Smog, Acid rain and effects of pollutants on biota and materials.

b. Water- Chemistry of water. Types, sources and effects of water pollutants. Water quality standards- Physico chemical and Biological.

c. Soil- Structure and physico-chemical properties of soil. Soil pollution and control. Soil microorganisms and their function.

5 hrs

Unit 3. Environmental toxicology:

Definition, Toxic chemicals, their routes, bioaccumulation (xenobiotics), effects. Pesticides in water. Biochemical aspects of arsenic, Cadmium, Lead and Mercury. 5 hrs

Unit 4. Environmental monitoring and management:

a. Physicochemical and biological monitoring

b. Remote sensing and geographical information system.

c. Biodegradation of pollutants- Role of microorganisms in the degradation of pollutants.

Unit 5. Environmental protection and conservation: 5 hrs

Environmental education and awareness. Environmental legislation (a brief review of constitutional provisions and various environmental Protection Acts). Current environmental issues in India. 5 hrs

REFERENCES

Haywood, V.H. and R.T.Watson 1995. Global Biodiversity Assessment UNEP Cambridge Univ. Press.

Krishnamurthy, K.V. 2004. An advanced textbook on Biodiversity Principles and Practice. Oxford and IBH Publishing Co. Pvt. Ltd.

Mohan Pai, 2005. The Western Ghats. Margao, Goa.

Negi, S.S. 1993. Biodiversity and its conservation in India. Indus publishing company, New Delhi.

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PRACTICALS Bot. CP.4.3.4 (Based on Bot. CT 4.3.4)

PHYTODIVERSITY

1. Phytodiversity of wetland ecosystem-Freshwater Plankton Study: Measurement and Diversity.
2. Phytodiversity of Wetland ecosystem- Marine Plankton study.
3. Study of mangroves- morphological and anatomical.
4. Phytodiversity of terrestrial ecosystem:
    a. Stomatal index
    b. Study of bark and branching.
    c. Study of vein-lets
5. Phytodiversity utilization:
    The agarophytes, biofertilizers, biopesticides, medicinal plants etc.

ENVIRONMENTAL BIOLOGY

1. Water Analysis:
    a. Estimation of BOD and COD
    b. Estimation of PO4, SO4 and NO3.
    c. Estimation of Major Cations- Na, K, Ca, Mg and Salinity
2. Effect of DDT and other pesticides on primary production.
3. Effect of Industrial effluent/Heavy metals on seed germination and seedling growth.
4. Estimation of Chlorophyll, Proline, Ascorbic acid in leaves of plants growing in polluted and unpolluted areas.
    a. Sampling and identification of air spora.
    b. Estimation of heavy metal content of road side plants.
    c. Field excursion to an industrial area to assess environmental impact.

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