

NARAJOLE RAJ COLLEGE
(NAAC Accredited B Grade)
NARAJOLE, PASCHIM MEDINIPUR, PIN-721211

Academic Committee Notice

19-07-2022

All the members of the Academic committee are hereby requested to attend a meeting on 26/07/22 at 3.00 PM to discuss the following agenda.

Agenda:

- 1) Read and confirm the previous resolution.
- 2) To discuss about the value added course, Add-on Course in the session 2022-2023.
- 3) To discuss about the Project work of ENVS in the session of 2022-2023.
- 4) To discuss about the commensment of class
- 5) Misc (With the permission of the chair)

Dipak Shom
Dr. Dipak Shom
Convener/ Academic
Committee

Members :-

1. Dr. N. Bhattacharyya *Nilanjana Bhattacharyya*
2. Dr. R. Debnath *R. Debnath*
3. Prof. P. P. Mondal *Pragnepremite Mondal*
4. Prof. N. Bhakat
5. ~~*~~ Arif Iqbal Mallick *Arif Iqbal Mallick*
6. Prof. Anustup Chattopadhyay
7. Dr. Md. Aziz
8. Dr. Mangal Kr, Nayak *Mangal Kr, Nayak*
9. Prof. Subhasis Das
10. Dr. Poulami Adhikari Mukherjee *Poulami Adhikari Mukherjee*
11. Dr. Tanuka Acharya *Tanuka Acharya*
12. Dr. Akul Rana *Akul Rana*
13. Dr. Parimal Dua *Parimal Dua*
14. Prof. Mosibul Ali *Mosibul Ali*
15. Dr. Atanu Nanda *Atanu Nanda*
16. Prof. Barun Rout *Barun Rout*

Convener
Academic Committee
Narajole Raj College
Narajole, PIN- 721211

মিটিং রেজল্যুশন বহি

MEETING RESOLUTION BOOK

মিটিং নং / Meeting No.	
তারিখ / Date	26-07-2022

উপস্থিত সভ্যগণের নাম
NAME OF MEMBERS PRESENT

স্থান / Place	Vice-principal Chamber
সময় / Time	2.30 P.M

- ১। 1. Ranajit K. Khalua.
- ২। 2. Dipak Ghosh
- ৩। 3. Pasimal Dha.
- ৪। 4. Rajree Debnath
- ৫। 5. Tanu Achary.
- ৬। 6. Abul Raul
- ৭। 7. Nandita Bhakat

- ৮। 8. Arif Iqbal Mallick
- ৯। 9. M. Mostafizul Ali
- ১০। 10. Subhasis Dera
- ১১। 11. Nilanjana Bhattacharya
- ১২। 12. Joubarna Adhikary Mukherjee
- ১৩। 13. A. Chattopadhyay
- ১৪। 14. S. Debroy

- ১৫। 15. Manjori Ummer Nayak
- ১৬। 16. Soumendru Bisoi
- ১৭। 17.
- ১৮। 18.
- ১৯। 19.
- ২০। 20.
- ২১। 21.



রেজল্যুশন / Resolution Adopted



Proceedings of the meeting of the Academic Committee held on 26-07-2022 at 2.30 pm

Venue: Vice-Principal's Chamber

The meeting was chaired by Dr. Ranajit Kumar Khalua, the Vice-Principal of the College and Chairman of the Academic Committee.

Detailed discussions took place on the agenda ongoing academic activities of the college and the following resolutions were adopted:

1. The resolutions of the previous meeting dated 29/04/2022 were read and confirmed without any change.
2. The convenor informed the house that IQAC Co-ordinator proposed to conduct some ADD On/ Value Added/ Certificate courses in our college. After detailed discussion, the following courses approved unanimously.

List of Add on / Value Added / Certificate / Innovative Hub Course
(Session : 2022 – 2023) [01.07.2022 – 30.06.2023]
Narajole Raj College, Narajole, Paschim Medinipur

ADD ON COURSES

Sl. No.	Title	Course Code	Department	Course Co-ordinators	Course duration	Intake capacity
1	Add on Course on Medicinal Plants: Conservation, Propagation and Uses.	AOCMPCPU	Botany	Nandita Bhakat	12.11.2022-30.06.2023	35
2	Add on Course on Application of Chemdraw Software for Scientific Drawing.	AOCACSSD	Chemistry	Dr. Soumendru Bisoi	22.12.2022 - 13.06.2023	20



3	Add on Course on Ancient Indian History and Culture.	AOCAIHC	History, Philosophy and Sanskrit	Dr. Bhakti Pada Jana, Dr. Rabindranath Maity and Singray Tudu	02.03.2023 -23.03.2023	115
4	Add on Course on Functional Bengali and Grammar.	AOCFBG	Bengali	Dr. Dipak Shom	23.03.2023 - 27.06.2023	30
5	Add on Course on Indian Constitution & Polity.	AOCICP	Political Science	Prasenjit Senapati and Supen Sarkar	03.05.2023- 30.06.2023	25
6	Add on Course on Archival Research .	AOCAR	History	Dr. Mangal Kumar Nayak and Baisali Guha	22.05.2023 -30.06.2023	30
7	Add on Course on Water Resource Management.	AOCWRM	Geography	Ishita Biswas	26.05.2023 -27.06.2023	15
8	Add on Course on English Writing Skills.	AOCEWS	English	Pragna Paramita Mondal	01.06.2023 -30.06.2023	50
9	Add on Course on Household Chemistry (Grihasthali rasayanik toirir jonnyo laboratoryte hate kolome prasikkhan).	AOCHC	Chemistry	Dr. Sk Mohammad Aziz and Dr. Soumendu Bisoi	13.06.2023 - 30.06.2023	15
10	Add on Course on "FORTRAN Programming and ORIGINLAB for Scientific Data Analysis".	AOCFOSDA	Physics	Dr. Arif Iqbal Mallick and Dr. Avradip Pradhan	13.06.2023- 30.06.2023	10

	on Yoga & Meditation.				01.02.2023	
2	Value Added Course on Human Rights Education.	VACHRE	Political Science	Dr. Rajasree Debnath	25.08.2022 - 30.11.2022	25
3	Value Added Course on Creative Writing in Bengali.	VACCWB	Bengali	Dr. Nilanjana Bhattacharyya	09.09.2022 - 03.01.2023	30
4	Value Added Course on Add on Course on ARC GIS Basics.	AOCAGB	Geography	Subhasis Das	24.12.2022 - 22.06.2023	15

5	Value Added Course on the Study of Biodiversity and its impact on human health.	VACSBIIH	Botany, Zoology, Physiology	Prof. Nandita Bhakat	20.02.2023 - 29.06.2023	30
6	Value Added Course on Basic Computer Training for SC and ST Students.	VACBCTSSS	Technology Sub-Committee	Dr. Avradip Pradhan	28.02.2023 - 07.04.2023	20
7	Value Added Course on Basic Mathematics	VACBM	Mathematics	Shilpa Patra	15.05.2023 - 30.06.2023	30
8	Value Added Course on Spoken Sanskrit.	VACSS	Sanskrit	Dr. Uttam Kumar Singha and Tumpa Jana	17.05.2023 - 31.05.2023	115
9	Value Added Course on Ethics & Value Education .	VACEVE	Philosophy & Education	Dr. Tanuka Acharya	17.05.2023 - 30.06.2023	45
10	Value Added Course on Basic Computer Skills for female students.	VACBCSFS	Technology Sub-Committee	Dr. Shreyasi Jana	20.05.2023- 30.06.2023	15
11	Value Added Course on Women's Health and Nutrition.	VACWHN	Physiology & Zoology	Dr. Parimal Dua and Dr. Poulami Adhikary Mukherjee	23.05.2023- 28.06.2023	30
12	Value Added Course on General English for Competitive Exams.	VACGECE	English	Pragna Paramita Mondal	01.06.2023 - 30.06.2023	50
13	Value Added Course on LED Based Device Production.	VACLBDP	Physics Department	Dr. Tapanendu Kamilya	02.06.2023 - 27.06.2023	15
14	Value Added Course on Vedic Culture and Karmakanda.	CCVCK	Sanskrit	Asis Bhattacharya and Barnali Banerjee	12.06.2023 - 30.06.2023	100
Total						570
1	Certificate Course on English as a Second Language.	CCESL	Language Lab	Pragna Paramita Mondal	01.06.2023 - 30.06.2023	50
Total						50

মিটিং রেজল্যুশন বহি



Total						50
1	Innovative Hub on Techniques for Mushroom Cultivation.	AOCTMC	Botany	Sanjay Kumar Dutta	03.12.2022 - 16.06.2022	30
Total						30
Grand Total (No. of Total Course 10+14+1+1 = 26)						995

It is further resolved that the Course Co-coordinator take approval of Department Committee to form the BOS as per UGC guidelines of VAC/ Add on/ certificate course and each course will be of 30 hours duration. The syllabus of these courses will be designed by the concerned department and it is to be approved by the BOS. An MCQ examination will be held at the end of each course and certificate will be provided to the successful candidates.

3. It is resolved that the project work of the paper AECC-2(ENVS-Environmental Science) is supervised by the following teachers:

- i) Prof. Bangomoti Hansda
- ii) Dr. Prithwi Ghosh
- iii) Prof Ishita Biswas
- iv) Dr. Parimal Dua
- v) Prof. Nandita Bhakat
- vi) Prof. Subhasis Das

The Project work of other departments will be supervised by the concerned departmental teacher and it is to be resolved in the departmental meeting.

4. After brief discussion, it was unanimously resolved that the class of the 5th Semester will begin on and from 16/08/2022 in offline mode.

As there was no further agenda for discussion, the meeting ended with a reciprocal vote of thanks to and from the Chair.

Dipak Ghosh
Convenor

Convenor
Academic Committee
Narajole Raj College
Narajole, PIN 721211



Rahma
Vice Principal

Vice-Principal
Narajole Raj College
P.O.- Narajole
Dist.- Paschim Medinipur, 72





NARAJOLE RAJ COLLEGE
(NAAC Accredited B Grade Govt. - Aided College)
NARAJOLE, PASCHIM MEDINIPUR, PIN-721211



Department of Bengali

Notice

Dated: 11.07.2022

Notice is hereby given that a meeting of Dept. of Bengali will be held on 19.07.2022 (Tuesday) at 2-00 PM in the office chamber of the Vice-Principal to discuss the following agenda. Please make it convenient to attend the meeting.

Agenda:

1. To read and confirm the proceedings of the meeting dated 28.05.2022.
2. Hand over the Charge of Head of the Department in the session 2022-23;
3. To discuss regarding Academic preparedness of the department for the coming session 2022-23;
4. Miscellaneous (if any) with the permission of the Chair.

Ranajit Kumar Khadua
Dr. Ranajit Kumar Khadua
Vice - Principal

Nilanjana Bhattacharyya
Dr. Nilanjana Bhattacharyya
Convenor

Vice-Principal
Narajole Raj College
P.O. - Narajole,
Dist- Paschim Medinipur, 721211



Members:

- (1) Dr. Sadhan Ch. Pandit *Sadhan Chandra Pandit*
- (2) Dr. Dipak Shom *Dipak Shom*
- (3) Prof. Avijit Chakraborty *Avijit Chakraborty*
- (4) Prof. Madhumita Addya *Madhumita Addya*
- (5) Prof. Sanat Pan *Sanat Pan*
- (6) Prof. Dipashri Roy
- (7) Prof. Goutam Jana *Goutam Jana*




Proceedings of the meeting of the Department of Bengali held on 19.07.2022
(Tuesday)
Meeting 01 of Academic session 2022-23

The meeting was chaired by Dr. Ranajit Kumar Khalua, the Vice - Principal of the College and Chairman of the concerned Departmental Committee. Detailed discussions took place on the noted agenda and the following resolutions were adopted:

1. Proceedings of the meeting dated 28.06.2022 were read out and confirmed without any amendment.
2. Members discussed at length regarding rotation of Headship of the department. After careful discussion, keeping in view the ensuing NAAC visit, members unanimously decided not to rotate Headship at this moment. So, Dr. Nilanjana Bhattacharyya, the existing Head of the department is requested to carry on her responsibilities as usual.
3. Dr. Ranajit Kumar Khalua, Hon. Vice Principal of the college enquired about the preparedness of the department for the session 2022-23 and members confirm their readiness regarding the matter. The preparation of routine, distribution of syllabus and all the teaching plans are done by the teachers. Dr. Khalua expressed his satisfaction and proposed to utilize the Google class room intensively in this session. Besides, he advised to continue other academic services as previous years. House affirmed with him.

As no other business left, meeting ended with a reciprocal vote of thanks to and from the Chair.


Dr. Ranajit Kumar Khalua
(Chairman) Vice-Principal
Dist. - Parbhani



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SCHOOL

MEETING RESOLUTION BOOK

মিটিং-এর ক্রমিক সংখ্যা / Serial No. of Meeting : 15

মিটিং এর তারিখ / Date of Meeting : 09.12.2022

মিটিং এর স্থান / Venue of Meeting : online

মিটিং এর সময় / Time of Meeting : 8.00 p.m.

উপস্থিত সভ্যগণের নাম / Name of Members Present	
১/১. <u>Bera</u>	
২/২. <u>Bani Ranjan De</u> ৯/৯	১৭/17
৩/৩. <u>Scrutinath Chakraborty</u> ১০/10	১৮/18
৪/৪. <u>Nitajana Bhattacharyya</u> ১১/11	১৯/19
৫/৫. <u>Dipak Ghosh</u> ১২/12	২০/20
৬/৬. <u>Sadhan Chandra Pandit</u> ১৩/13	২১/21
৭/৭. ১৪/14	২২/22
৮/৮. ১৫/15	২৩/23
৯/৯. ১৬/16	২৪/24

রেজল্যুশন | RESOLUTIONS ADOPTED

ক্রমিক সংখ্যা / Serial No.
 মে ০৯. ১২. ২০২২ তারিখ, বুধবার, সন্ধ্যা ৮ টায় সভাপতিত্ব পূর্ণ ধর্মসভা
 কর্তৃক স্বীকৃত হইয়াছে Board of Studies-এর অন্তর্গত সকল বিভাগের
 অধ্যাপকগণের মাধ্যমে Video Conference-র মাধ্যমে অনুষ্ঠিত হইল। এই সভায় সভাপতি
 কর্তৃক উপস্থিত হইয়া ড. সাদান চন্দ্র পন্ডিত কর্তৃক প্রস্তাবিত সকল প্রস্তাব
 গুলি গৃহীত হইয়াছে এবং সভার কার্য শেষ হইল।

১) সভায় গৃহীত Resolutions দ্রষ্ট হইল এবং তাহা গৃহীত হইয়াছে।

২) সভায় ২০২২-২০২৩ অর্থবছর কর্তৃক স্বীকৃত হইয়াছে প্রথম
 দফার (M.A. 1st Sem.-2022) ও দ্বিতীয় দফার (M.A. 3rd Sem. 2022)
 -২০২২ এর Paper-Setters (Internal & External), Examiners,
 Moderators, Reviewers & Scrutinier-কে নতুন নিয়োগিত
 হইল এবং তাহা গৃহীত হইল।

* M.A. 1st Sem. Exam. -2022

Paper	Paper-Setter (Internal)	Paper-setter (External)	Examiners
BENG-101	Dr. Dipak Ghosh	Dr. Nirmal Kr. Bera Dept. of Bengali Sabang S.K. Mahavidyalaya	Dr. Nirmal Kr. Bera Dept. of Bengali Sabang S.K. Mahavidyalaya
BENG-102	Dr. Sadhan Ch. Pandit	Dr. Bipal Kr. Mandal Dept. of Bengali Raja N.L. Khan Women's College, Midnapore.	Dr. Dipak Ghosh
BENG-103	Dr. Sadhan Ch. Pandit	Dr. Sujoy Kr. Maity Dept. of Bengali Raja N.L. Khan Women's College, Midnapore	Dr. Sadhan Ch. Pandit
BENG-104	Dr. Nitajana Bhattacharyya	Dr. Saradabrata Laha Dept. of Bengali Raja N.L. Khan Women's College, Midnapore	Dr. Nitajana Bhattacharyya

Paper	Internal Paper-Setter	External Paper-Setter	Examiner
BENG-105	Dr. Avijit Chakraborty	Dr. Hasamur Rahaman Dept. of Bengali Atatal R.S. Mahandyalan Paschim Medinipur	Avijit Chakraborty

* M.A. 3rd Sem. Exam. - 2022

Paper	Paper-setter (Internal)	Paper-setter (External)	Examiners
BENG-301	Dr. Sadhan Ch. Pandit	Dr. Amar Adikari Dept. of Bengali Kharagpur College	Dr. Sadhan Ch. Pandit
BENG-302	Dr. Nilanjana Bhattacharyya	Dr. Rita Sil Dept. of Bengali Garhbeta College Paschim Medinipur	Dr. Nilanjana Bhattacharyya
BENG-303	Dr. Dipak Shom	Dr. Amar Kr. Saha Dept. of Bengali Midnapore College (Autonomous)	Dr. Dipak Shom
BENG-304 (CBCS)	Avijit Chakraborty	Dr. Santanu Dolai Dept. of Bengali Egra S.S.B. College Purba-Medinipore	Avijit Chakraborty
BENG-305 (Project Paper)	=	=	① Dr. Bipul Kr. Mondal (External) Raja N.L. Khan Women's College, Midnapore ② Dr. Amar Adikari (External) Kharagpur College ③ Dr. Nilanjana Bhattacharyya (Internal) ④ Dr. Dipak Shom (Internal)

* M.A. 1st & 3rd Sem. Exam. - 2022 (Moderators) :

Papers	Moderators
BENG-101, 102, 103, 104, 105 &	① Prof. Bani Ranjan De (External) Dept. of Bengali, Vidyasagar University
BENG-301, 302, 303, 304 (CBCS)	② Prof. Srujanath Chakraborty (External) Former Professor, Dept. of Bengali, Vidyasagar University, Midnapore.
	③ Dr. Nilanjana Bhattacharyya (Internal)
	④ Dr. Dipak Shom (Internal)

MEETING RESOLUTION BOOK

মিটিং-এর ক্রমিক সংখ্যা / Serial No. of Meeting :

মিটিং এর তারিখ / Date of Meeting :

মিটিং এর স্থান / Venue of Meeting :

মিটিং এর সময় / Time of Meeting :

উপস্থিত সভ্যগণের নাম / Name of Members Present

১/১	৯/৯	১৭/১৭
২/২	১০/১০	১৮/১৮
৩/৩	১১/১১	১৯/১৯
৪/৪	১২/১২	২০/২০
৫/৫	১৩/১৩	২১/২১
৬/৬	১৪/১৪	২২/২২
৭/৭	১৫/১৫	২৩/২৩
৮/৮	১৬/১৬	২৪/২৪

ক্রমিক সংখ্যা
Serial No.

রেজল্যুশন / RESOLUTIONS ADOPTED

* M.A. 1st & 3rd Sem. - 2022 Examination — Reviewers :—

① Dr. Sujoy Kr. Maity → M.A. 1st Sem. Exam. - 2022
Dept. of Bengali
Raja N.L. Khan Womens' College
Paschim Medinipur

② Dr. Biswaranjan Ghorai → M.A. 3rd Sem. Exam. - 2022
Dept. of Bengali
Panskura Banamali College
Purba Medinipur

* M.A. 1st & 3rd Sem. - 2022 (Scrutinizers) :—

All Internal Teachers :

- ① Dr. Nilanjana Bhattacharyya
- ② Dr. Sadhan Ch. Pandit
- ③ Dr. Bipak Shom
- ④ Arjit Chakraborty

৩/ সভ্যগণের নামের তালিকা, বিধিমালা, প্রশ্নপত্রের Rules & Regulations অনুসরণে Question Pattern নির্দিষ্ট করা হবে এবং প্রশ্নপত্রের প্রস্তুতি ও প্রশ্নের নির্দিষ্ট প্রশংসা/নির্দোষতা যাচাই করার ক্ষমতা, নির্দিষ্ট প্রশ্নের মূল্যায়ন করার ক্ষমতা এবং PG Board of Moderators নির্দিষ্ট প্রশ্নের Moderation ক্ষমতা হবে।



রেজল্যুশন | RESOLUTIONS ADOPTED

সম্মেলনসহ আরও স্থানীয় ২৮ নং, M. A. (Bengali) 1st Sem. & 3rd Sem. - 2022 - এর Internal Assessment বিষয়সহ বিজ্ঞপত্রসহ সিদ্ধান্ত গ্রহণ করা হয়েছে।

সহকারী প্রিন্সিপাল (অধ্যয়ন) এবং অধ্যাপকগণের উপস্থিতিতে প্রিন্সিপাল মহোদয়ের সভাপতিত্বে সভা অনুষ্ঠিত হয়েছে।



(স্বাক্ষরিত) *Rhatha*
তারিখ: ৩. ১১. ২০২২

Chairman
Examination Cell
PG Board of Studies
Narajole Raj College
Paschim Medinipur



MEETING RESOLUTION BOOK

মিটিং-এর ক্রমিক সংখ্যা / Serial No. of Meeting : 16

মিটিং এর তারিখ / Date of Meeting : 22/5/2023

মিটিং এর স্থান / Venue of Meeting : online

মিটিং এর সময় / Time of Meeting : 8.00pm

উপস্থিত সভ্যগণের নাম / Name of Members Present

১/1	Rhahu	৯/9	১৭/17
২/2	Bani Ranjan De	১০/10	১৮/18
৩/3	Srutinath Chakraborty	১১/11	১৯/19
৪/4	Dipak Shom	১২/12	২০/20
৫/5	Sadhan Chandra Pandey	১৩/13	২১/21
৬/6		১৪/14	২২/22
৭/7		১৫/15	২৩/23
৮/8		১৬/16	২৪/24

ক্রমিক সংখ্যা
Serial No.

রেজল্যুশন / RESOLUTIONS ADOPTED

১) ২২.৫.২০২৩ তারিখ, সন্ধ্যায়, সন্ধ্যা ৮.০০টায় নড়াদাঙ্গা কলেজের অধ্যক্ষের সভায় অধ্যক্ষের সভাপতিত্বে Board of Studies-এর অন্তর্গত সকল প্রোগ্রামের অধ্যক্ষের Video Conference সভায় (Meeting Link: <https://meet.google.com/cpd-muwf-fot>) অংশগ্রহণ করা হয়। এই সভায় অধ্যক্ষের সভাপতি ড. বিনয়ী কুমার সরকার সভায় সভাপতিত্ব করেন এবং সভায় সভ্যগণের উপস্থিতিতে অসম্পূর্ণ সভার কার্যক্রম সম্পন্ন করা হয়।

১) সভায় গৃহীত Resolutions পাঠ করা হয় এবং তা মর্মেত্বের সাথে অনুমোদিত হয়।

২) সভায় ২০২২-২৩ অক্টোবর সভায় অধ্যক্ষের সভাপতিত্বে অধ্যক্ষের সভায় (External & Internal), Examiners (External & Internal) Moderators Reviewers এর নির্বাচন করা হয় এবং তা মর্মেত্বের সাথে গৃহীত হয়।

* M. A. 2nd Semester Examination (Final) - 2023 :

Papers	Internal Examiners Paper-setters	External Examiners Paper-setters	Examiners
BNG 201	Dr. Dipak Shom	Dr. Nirmal Bera Sabang S. K. Mahavidyalaya Sabang, Paschim Medinipur	Dr. Nirmal Bera (External) Sabang S. K. Mahavidyalaya
BNG 202	Dr. Sadhan Ch. Pandey	Dr. Kapatkishi Saha Chhatra R. S. Mahavidyalaya	Dr. Sadhan Ch. Pandey
BNG 203	Dr. Nilanjana Bhattacharya	Dr. Paramesh Acharya Tamlukta Mahavidyalaya	Dr. Nilanjana Bhattacharya

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	Internal Paper-setters	External Paper-setters	Examiners
BNG 204 (CBCS)	Avijit Chakraborty	Dr. Saradabrata Laha Raja N.L. Khan Women's College, Midnapore	Avijit Chakraborty
BNG 205 (Project Paper)	—	—	1. Amar Adikari, Kharagpur (External) 2. Dr. Nilanjana Bhattacharyya (Internal)
* M.A. 4th Semester Examination (Final) - 2023 :			
BNG 401	Avijit Chakraborty	Dr. Santanu Dhal Egra S.S.B. Mahavidyalaya Egra, Purba Medinipur	Avijit Chakraborty
BNG 402	Dr. Dipak Shom	Dr. Sujoy Maity Raja N.L. Khan Women's College, Midnapore	Dr. Dipak Shom
BNG 403	Dr. Nilanjana Bhattacharyya	Dr. Rita Sil, Garbha College → Dr. Rita Sil, Garbha College	Dr. Nilanjana Bhattacharyya
BNG 404	Dr. Sadhan Ch. Pandit	Dr. Amar Saha Midnapore College (Autonomous)	Dr. Sadhan Ch. Pandit
BNG 405 D (Natak)	Dr. Dipak Shom	Dr. Paipul Mondal Raja N.L. Khan Women's College, Midnapore	Avijit Chakraborty
BNG 405 F (Kothasahitya)	Dr. Sadhan Ch. Pandit	Dr. Amar Saha Midnapore College (Autonomous)	Dr. Sadhan Ch. Pandit

* M.A. 2nd & 4th Semester Exam. - 2023 Reviewers :

Paper: BNG 201, 202, 203, 204, 205 → Dr. Paramesh Acharya (External)
Tamralipta, Mahavidyalaya
Tamluk: Purba Medinipur.

Paper: BNG 401, 402, 403, 404, 405 D, 405 F → Dr. Biswaranjan Ghose
Panskura Banamali College
Panskura, Purba Medinipur
(External)

* M.A. 2nd & 4th Sem. Exam. - 2023 Moderators :

- Paper: 201, 202, 203, 204 (CBCS) →
- Paper: 401, 402, 403, 404, 405 D, 405 F →
- ① Prof. Bani Ranjan De (External)
Dept. of Bengali, V. U.
 - ② Prof. Soutinath Chakraborty (External)
Former Professor, Dept. of Bengali
Vidyasagar University.
 - ③ Dr. Nilanjana Bhattacharyya (Internal)
 - ④ Dr. Dipak Shom (Internal)



MEETING RESOLUTION BOOK

মিটিং-এর ক্রমিক সংখ্যা / Serial No. of Meeting :

মিটিং এর তারিখ / Date of Meeting :

মিটিং এর স্থান / Venue of Meeting :

মিটিং এর সময় / Time of Meeting :

উপস্থিত সভ্যগণের নাম / Name of Members Present

১/১	৯/৯	১৭/১৭
২/২	১০/১০	১৮/১৮
৩/৩	১১/১১	১৯/১৯
৪/৪	১২/১২	২০/২০
৫/৫	১৩/১৩	২১/২১
৬/৬	১৪/১৪	২২/২২
৭/৭	১৫/১৫	২৩/২৩
৮/৮	১৬/১৬	২৪/২৪

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৩) সকল অন্যান্য ৩য়, ৪, চিহ্নসহ রেজল্যুশন Rule & Regulation অনুযায়ী Question Pattern নির্দিষ্ট ২য় ৫ থেকে ৫০ প্রশ্নের প্রকারে তৈরি করে দেয়া হবে, নির্দিষ্ট সময়ের মধ্যে External & Internal paper-setting-এর কাজ শেষ করার সংক্রান্ত কাজ যা PG Board of Moderators নির্দেশ করে সেখানে Moderation সূত্র খসে।

৪) অন্যান্যসহ মোকদ্দমার ৩য়, ৪, M.A. ২নং & 4th Sem.- ২০২৩-২০ Internal Assessment চিহ্নসহ নির্দিষ্ট ২য় ৫ থেকে ৫০ প্রশ্নের প্রকারে তৈরি করা হবে।

সকল কাজ জোর জোরে সম্পন্ন হবে যাতে সকল অন্যান্য রেজল্যুশন সূত্র খসে মতামত দেয়া হয়।



Chairman
Examination Cell
PG Board of Studies
Narajole Raj College
Paschim Medinipur

VIDYASAGAR UNIVERSITY



**Curriculum for 3 -Year B Sc (HONOURS)
in
Botany**

**Under Choice Based Credit System (CBCS)
w.e.f 2017-2018**

VIDYASAGAR UNIVERSITY

B Sc (Honours) in Botany

[Choice Based Credit System]

Year	Semester	Course Type	Course Code	Course Title	Credit	L-T-P	Marks				
							CA	ESE	TOTAL		
Semester-I											
1	I	Core-1		CT1: Algae and Microbiology	6	4-0-0	15	60	75		
				CP1: Algae and Microbiology-Lab		0-0-4					
		Core-2		CT2: Biomolecule and Cell Biology	6	4-0-0	15	60	75		
				CP2: Biomolecule and Cell Biology-Lab		0-0-4					
		GE-1		TBD	6	4/5	15	60	75		
				TBD		2/1					
		AECC-1		English/MIL	2	1-1-0	10	40	50		
		Semester -I: total					20			275	
		Semester-II									
			II	Core-3		CT3: Mycology and Phytopathology	6	4-0-0	15	60	75
	CP3: Mycology and Phytopathology -Lab				0-0-4						
Core-4				CT4: Archegoniate	6	4-0-0	15	60	75		
				CP4: Archegoniate-Lab		0-0-4					
GE-2				TBD	6	4/5	15	60	75		
				TBD		2/1					
AECC-2				ENVS	4		20	80	100		
Semester-II : total					22			325			

Year	Semester	Course Type	Course Code	Course Title	Credit	L-T-P	Marks			
							CA	ESE	TOTAL	
2	Semester-III									
	III	Core-5		CT5: Morphology and Anatomy	6	4-0-0	15	60	75	
				CP5: Morphology and Anatomy - Lab		0-0-4				
		Core-6		CT6: Economic Botany	6	4-0-0	15	60	75	
				CP6: Economic Botany-Lab		0-0-4				
		Core-7		CT7: Genetics	6	4-0-0	15	60	75	
				CP7: Genetics -Lab		0-0-4				
		GE-3		TBD	6	4/5	15	60	75	
						2/1				
	SEC-1		TBD	2		10	40	50		
	Semester – III : total					26				350
	Semester-IV									
	IV	Core-8		CT8: Molecular Biology	6	4-0-0	15	60	75	
				CP8: Molecular Biology -Lab		0-0-4				
		Core-9		CT9: Plant Ecology and Phytogeography	6	4-0-0	15	60	75	
				CP9: Plant Ecology and Phytogeography -Lab		0-0-4				
		Core-10		CT10: Plant Systematics	6	4-0-0	15	60	75	
				CP10: Plant Systematics-Lab		0-0-4				
		GE-4		TBD	6	4/5	15	60	75	
						2/1				
	SEC-2		TBD	2		10	40	50		
	Semester – IV : total					26				350

Year	Semester	Course Type	Course Code	Course Title	Credit	L-T-P	Marks		
							CA	ESE	TOTAL
3	V	Semester-V							
		Core-11		CT11: Reproductive Biology Angiosperms	6	4-0-0	15	60	75
				CP11: Reproductive Biology Angiosperms -Lab		0-0-4			
		Core-12		CT12: Plant Physiology	6	4-0-0	15	60	75
				CP12: Plant Physiology -Lab		0-0-4			
		DSE-1		TBD	6	4-0-0	15	60	75
						0-0-4			
		DSE-2		TBD	6	4-0-0	15	60	75
						0-0-4			
		Semester –V : total					24		
	Semester-VI								
	VI	Core-13		CT13: Plant Metabolism	6	4-0-0	15	60	75
				CP13: Plant Metabolism -Lab		0-0-4			
		Core-14		CT14: Plant Biotechnology	6	4-0-0	15	60	75
				CP14: Plant Biotechnology-Lab		0-0-4			
		DSE-3		TBD	6	4-0-0	15	60	75
						0-0-4			
		DSE-4		TBD	6	4-0-0	15	60	75
						0-0-4			
		Semester – VI : total					24		
Total in all semester:					142			1900	

CC = Core Course , AECC = Ability Enhancement Compulsory Course , GE = Generic Elective , SEC = Skill Enhancement Course , DSE = Discipline Specific Elective , CA= Continuous Assessment , ESE= End Semester Examination , TBD=To be decided , CT = Core Theory, CP=Core Practical , L = Lecture, T = Tutorial ,P = Practical , MIL = Modern Indian Language , ENVS = Environmental Studies ,

List of Core Course (CC)

- CC-1: Phycology and Microbiology
- CC-2: Bio-molecules and Cell Biology
- CC-3: Mycology and Phytopathology
- CC-4: Archegoniate
- CC-5: Anatomy of Angiosperms
- CC-6: Economic Botany
- CC-7: Genetics
- CC-8: Molecular Biology
- CC-9: Plant Ecology and Phytogeography
- CC-10: Plant Systematics
- CC-11: Reproductive Biology of Angiosperms
- CC-12: Plant Physiology
- CC-13: Plant Metabolism
- CC-14: Plant Biotechnology

Discipline Specific Electives (DSE)

- DSE-1: Natural Resource Management
- Or
- DSE-1: Biostatistics
- DSE-2: Plant Breeding
- Or
- DSE-2: Stress Biology
- DSE-3: Industrial and Environmental Microbiology
- Or
- DSE-3: Bioinformatics
- DSE-4: Analytical Techniques in Plant Sciences
- Or
- DSE-4: Research Methodology

Skill Enhancement Course (SEC)

- SEC-1: Biofertilizers
- Or
- SEC-1: Floriculture

- SEC-2: Medicinal Botany
- Or
- SEC-2: Mushroom Culture Technology

Generic Electives (GE)

- GE-1: Biodiversity (Microbes, Algae, Fungi and Archegoniate)
- GE-2: Plant Ecology and Taxonomy
- GE-3: Economic Botany and Plant Biotechnology
- GE-4: Plant Anatomy and Embryology
- Or
- GE-4: Plant Physiology and Metabolism

Core Courses(CC)

CC-1: Phycology and Microbiology

Credits 06

C1T: Phycology and Microbiology

Credits 04

Course Contents:

Unit 1: Introduction to microbial world

Microbial nutrition, growth and metabolism. Economic importance of viruses with reference to vaccine production, role in research, medicine and diagnostics, as causal organisms of plant diseases. Economic importance of bacteria with reference to their role in agriculture and industry (fermentation and medicine).

Unit 2: Viruses

Discovery, physiochemical and biological characteristics; classification (Baltimore), general structure with special reference to viroids and prions; replication (general account), DNA virus (T-phage), lytic and lysogenic cycle; RNA virus (TMV).

Unit 3: Bacteria

Discovery, general characteristics; Types-archaeobacteria, eubacteria, wall-less forms (mycoplasma and spheroplasts); Cell structure; Nutritional types; Reproduction-vegetative, asexual and recombination (conjugation, transformation and transduction).

Unit 4: Algae

General characteristics; Ecology and distribution; range of thallus organization; Cell structure and components; cell wall, pigment system, reserve food (of only groups represented in the syllabus), flagella; methods of reproduction; Classification; criteria, system of Fritsch, and evolutionary classification of Lee (only upto groups) and Van – den Hoek et.al(1982); Significant contributions of important phycologists (F.E. Fritsch, G.M. Smith, R.N. Singh, T.V. Desikachary, H.D. Kumar, M.O.P. Iyengar). Role of algae in the environment, agriculture, biotechnology and industry.

Unit 5: Cyanophyta and Xanthophyta

Ecology and occurrence; Range of thallus organization; Cell structure; Reproduction, Morphology and life-cycle of *Nostoc* and *Vaucheria*.

Unit 6: Chlorophyta and Charophyta

General characteristics; Occurrence; Range of thallus organization; Cell structure; Reproduction. Morphology and life-cycles of *Chlamydomonas*, *Volvox*, *Oedogonium*, *Coleochaete*, *Chara*.

Evolutionary significance of *Prochloron*.

Unit 7: Phaeophyta and Rhodophyta

Characteristics; Occurrence; Range of thallus organization; Cell structure; Reproduction. Morphology and life-cycles of *Ectocarpus*, *Fucus* and *Polysiphonia*.

C1P: Phycology and Microbiology (Practical)

Credits 02

(Practical)

Microbiology

1. Electron micrographs/Models of viruses – T-Phage and TMV, Line drawings/ Photographs of Lytic and Lysogenic Cycle.
2. Types of Bacteria to be observed from temporary/permanent slides/photographs. Electron micrographs of bacteria, binary fission, endospore, conjugation, root Nodule.
3. Gram staining.
4. Endospore staining with malachite green using the (endospores taken from soil bacteria).
5. Study of bacteria from root nodules/Curd sample.

Phycology

Study of vegetative and reproductive structures of *Nostoc*, *Chlamydomonas* (electron micrographs), *Volvox*, *Oedogonium*, *Coleochaete*, *Chara*, *Vaucheria*, *Ectocarpus*, *Fucus* and *Polysiphonia*, *Prochloron* through electron micrographs, temporary preparations and permanent slides.

Suggested Readings:

- Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.
- Wiley JM, Sherwood LM and Woolverton CJ. (2013) Prescott's Microbiology. 9th Edition. McGraw
- Hill International.
- Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West Press, Delhi.
- 4.Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali International, New Delhi.
- Campbell, N.A., Reece J.B., Urry L.A., Cain M.L., Wasserman S.A. Minorsky P.V., Jackson
- R.B. (2008). Biology, Pearson Benjamin Cummings, USA. 8th edition.
- Pelczar, M.J. (2001) Microbiology, 5th edition, Tata McGraw-Hill Co, New Delhi.

CC-2 : Bio-molecules and Cell Biology

Credits 06

C2T : Bio-molecules and Cell Biology

Credits 04

Course Contents:

Unit-1: Biomolecules

Types and significance of chemical bonds; Structure and properties of water; pH and buffers.

Carbohydrates: Nomenclature and classification; Monosaccharides ; Disaccharides; Oligosaccharides and polysaccharides.

Lipids: Definition and major classes of storage and structural lipids; Fatty acids structure and functions; Essential fatty acids; Triacyl glycerols structure, functions and properties; Phosphoglycerides.

Proteins: Structure of amino acids; Levels of protein structure-primary, secondary, tertiary and quaternary; Protein denaturation and biological roles of proteins.

Nucleic acids: Structure of nitrogenous bases; Structure and function of nucleotides; Types of nucleic acids; Structure of A, B, Z types of DNA; Types of RNA; Structure of tRNA.

Unit- 2: Bioenergetics

Laws of thermodynamics, concept of free energy, endergonic and exergonic reactions, coupled reactions, redox reactions. ATP: structure, its role as a energy currency molecule.

Unit- 3: Enzymes

Structure of enzyme: holoenzyme, apoenzyme, cofactors, coenzymes and prosthetic group; Classification of enzymes; Features of active site, substrate specificity, mechanism of action (activation energy, lock and key hypothesis, induced - fit theory), Michaelis – Menten equation, enzyme inhibition and factors affecting enzyme activity.

Unit-4: The cell

Cell as a unit of structure and function; Characteristics of prokaryotic and eukaryotic cells; Origin of eukaryotic cell (Endosymbiotic theory).

Unit- 5: Cell wall and plasma membrane

Chemistry, structure and function of Plant cell wall. Overview of membrane function; fluid mosaic model; Chemical composition of membranes; Membrane transport – Passive, active and facilitated transport, endocytosis and exocytosis.

Unit- 6: Cell organelles

Nucleus: Structure-nuclear envelope, nuclear pore complex, nuclear lamina, molecular organization of chromatin; nucleolus. **Cytoskeleton:** Role and structure of microtubules, microfilaments and intermediary filament. **Chloroplast, mitochondria and peroxisomes:** Structural organization; Function; Semiautonomous nature of mitochondria and chloroplast. **Endomembrane system:** Endoplasmic Reticulum – Structure, targeting and insertion of proteins in the ER, protein folding, processing; Smooth ER and lipid synthesis, export of proteins and lipids; Golgi Apparatus – organization, protein glycosylation, protein sorting and export from Golgi Apparatus; Lysosomes

Unit -7: Cell division

Phases of eukaryotic cell cycle, mitosis and meiosis; Regulation of cell cycle- checkpoints, role of protein kinases.

C2P : Bio-molecules and Cell Biology

Credits 02

(Practical)

1. Qualitative tests for carbohydrates, reducing sugars, non-reducing sugars, lipids and proteins.

2. Study of plant cell structure with the help of epidermal peel mount of Onion/*Rhoeo/Crinum*.
3. Demonstration of the phenomenon of protoplasmic streaming in *Hydrilla* leaf.
4. Measurement of cell size by the technique of micrometry.
5. Counting the cells per unit volume with the help of haemocytometer. (Yeast / pollen grains).
6. Study of cell and its organelles with the help of electron micrographs.
7. Cytochemical staining of : DNA- Feulgen Acto carmin and Aceto Orcrin stain and cell wall in the epidermal peel of onion using Periodic Schiff's (PAS) staining technique.
8. Study the phenomenon of plasmolysis and deplasmolysis.
9. Study the effect of organic solvent and temperature on membrane permeability.
10. Study different stages of mitosis and meiosis.

Suggested Readings:

- Campbell, MK (2012) Biochemistry, 7th ed., Published by Cengage Learning
- Campbell, PN and Smith AD (2011) Biochemistry Illustrated, 4th ed., Published by Churchill Livingstone
- Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed., W.H.Freeman
- Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company
- Nelson DL and Cox MM (2008) Lehninger Principles of Biochemistry, 5th Edition., W.H. Freeman and Company.
- Karp, G. (2010). Cell Biology, John Wiley & Sons, U.S.A. 6th edition.
- Hardin, J., Becker, G., Skliensmith, L.J. (2012). Becker's World of the Cell, Pearson Education Inc. U.S.A. 8th edition.
- Cooper, G.M. and Hausman, R.E. (2009) The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
- Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009) The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco

CC-3 : Mycology and Phytopathology

Credits 06

C3 T : Mycology and Phytopathology

Credits 04

Course Contents:

Unit- 1: Introduction to true fungi

General characteristics; Affinities with plants and animals; Thallus organization; Cell wall composition; Nutrition; Classification.

Unit- 2: Chytridiomycota and Zygomycota

Characteristic features; Ecology and significance; Thallus organisation; Reproduction; Life cycle with reference to *Synchytrium*, *Rhizopus* .

Unit-3: Ascomycota

General characteristics (asexual and sexual fruiting bodies); Ecology; Life cycle, Heterokaryosis and parasexuality; Life cycle and classification with reference to *Saccharomyces*, *Aspergillus*, *Penicillium*, *Alternaria*, *Neurospora* and *Peziza*.

Unit- 4: Basidiomycota

General characteristics; Ecology; Life cycle and Classification with reference to black stem rust on wheat *Puccinia* (Physiological Specialization), loose and covered smut (symptoms only), *Agaricus*; Bioluminescence, Fairy Rings and Mushroom Cultivation with special reference to Oyster Mushroom..

Unit- 5: Allied Fungi

General characteristics; Status of Slime molds, Classification; Occurrence; Types of plasmodia; Types of fruiting bodies.

Unit- 6: Oomycota

General characteristics; Ecology; Life cycle and classification with reference to *Phytophthora*, *Albugo*.

Unit -7: Symbiotic associations

Lichen – Occurrence; General characteristics; Growth forms and range of thallus organization; Nature of associations of algal and fungal partners; Reproduction; Mycorrhiza-Ectomycorrhiza, Endomycorrhiza and their significance.

Unit- 8: Applied Mycology

Role of fungi in biotechnology; Application of fungi in food industry (Flavour & texture, Fermentation, Baking, Organic acids, Enzymes, Mycoproteins); Secondary metabolites (Pharmaceutical preparations); Agriculture (Biofertilizers); Mycotoxins; Biological control (Mycofungicides, Mycoherbicides, Mycoinsecticides, Myconematicides); Medical mycology.

Unit- 9: Phytopathology

Terms and concepts; General symptoms; Geographical distribution of diseases; Etiology; Symptomology; Host-Pathogen relationships; Disease cycle and environmental relation; prevention and control of plant diseases, and role of quarantine.

Bacterial diseases – Citrus canker and angular leaf spot of cotton. Viral diseases – Tobacco Mosaic viruses, vein clearing. Fungal diseases – Early blight of potato, Black stem rust of wheat, White rust of crucifers.

C3P: Mycology and Phytopathology

Credits 02

Practical

1. Introduction to the world of fungi (Unicellular, coenocytic/septate mycelium, ascocarps & basidiocarps).
2. *Rhizopus*: study of asexual stage from temporary mounts and sexual structures through permanent slides.
3. *Aspergillus* and *Penicillium*: study of asexual stage from temporary mounts. Study of Sexual stage from permanent slides/photographs.
4. *Peziza*: Ascobulus sectioning through ascocarp.
5. *Alternaria*: Specimens/photographs and temporary mounts.

6. *Puccinia*: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; sections/ mounts of spores on wheat and permanent slides of both the hosts.
7. *Agaricus*: Specimens of button stage and full grown mushroom; sectioning of gills of *Agaricus*, fairy rings and bioluminescent mushrooms to be shown.
8. Study of phaneroplasmodium from actual specimens and /or photograph. Study of *Stemonitis* sporangia.
9. *Albugo*: Study of symptoms of plants infected with *Albugo*; asexual phase study through section/ temporary mounts and sexual structures through permanent slides.
10. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose) on different substrates. Study of thallus and reproductive structures (soredia and apothecium) through permanent slides. Mycorrhizae: ectomycorrhiza and endomycorrhiza (Photographs)
11. Phytopathology : Herbarium specimens of bacterial diseases; Citrus Canker; Angular leaf spot of cotton, Viral diseases: TMV, Vein clearing, Fungal diseases: Early blight of potato, Black stem rust of wheat and White rust of crucifers.

Suggested Readings:

- Agrios, G.N. (1997) Plant Pathology, 4th edition, Academic Press, U.K.
- Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley & Sons (Asia) Singapore. 4th edition.
- Webster, J. and Weber, R. (2007). Introduction to Fungi, Cambridge University Press, Cambridge. 3rd edition.
- Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies, Macmillan Publishers India Ltd.
- Sharma, P.D. (2011). Plant Pathology, Rastogi Publication, Meerut, India.

CC-4: Archegoniate

Credits 06

C4T: Archegoniate

Credits 04

Course Contents:

Unit 1: Introduction

Unifying features of archegoniates; Transition to land habit; Alternation of generations.

Unit 2: Bryophytes

General characteristics; Adaptations to land habit; Classification; Range of thallus organization.

Unit 3: Type Studies- Bryophytes

Classification (up to family), morphology, anatomy and reproduction of *Riccia*, *Marchantia*, *Pellia*, *Porella*, *Anthoceros*, *Sphagnum* and *Funaria*; Pogonatum, Reproduction and evolutionary trends in *Riccia*, *Marchantia*, *Plagichasma* *Anthoceros* and *Funaria* (developmental stages not included). Ecological and economic importance of bryophytes with special reference to *Sphagnum*.

Unit 4: Pteridophytes

General characteristics; Classification; Early land plants (*Cooksonia* and *Rhynia*).

Unit 5: Type Studies- Pteridophytes

Classification (up to family), morphology, anatomy and reproduction of *Psilotum*, *Selaginella*, *Equisetum* and *Pteris* (Developmental details not to be included). Apogamy, and apospory, heterospory and seed habit, telome theory, stelar evolution; Ecological and economic importance.

Unit 6: Gymnosperms

General characteristics, classification (up to family), morphology, anatomy and reproduction of *Cycas*, *Pinus* and *Gnetum* (Developmental details not to be included); Ecological and economic importance.

C4P : Archegoniate

Credits 02

Practical

1. *Riccia* – Morphology of thallus.
2. *Marchantia*- Morphology of thallus, whole mount of rhizoids & Scales, vertical section of thallus through Gemma cup, whole mount of Gemmae (all temporary slides), vertical section of Antheridiophore, Archegoniophore, longitudinal section of Sporophyte (all permanent slides).
3. *Anthoceros*- Morphology of thallus, dissection of sporophyte (to show stomata, spores, pseudocelaters, columella) (temporary slide), vertical section of thallus (permanent slide).
4. *Pellia*, *Porella*- Permanent slides.
5. *Sphagnum*- Morphology of plant, whole mounts of leaf (permanent slide only).
6. *Funaria*- Pogonatum/ Polytrichum Morphology, whole mount of leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, longitudinal section of capsule and protonema.
7. *Psilotum*- Study of specimen, transverse section of synangium (permanent slide).
8. *Selaginella*- Morphology, whole mount of leaf with ligule, transverse section of stem, whole mount of strobilus, whole mount of microsporophyll and megasporophyll (temporary slides), longitudinal section of strobilus (permanent slide).
9. *Equisetum*- Morphology, transverse section of internode, longitudinal section of strobilus, transverse section of strobilus, whole mount of sporangiophore, whole mount of spores (wet and dry) (temporary slide), transverse section of rhizome (permanent slide).
10. *Pteris*- Morphology, transverse section of rachis, vertical section of sporophyll, whole mount of sporangium, whole mount of spores (temporary slides), transverse section of rhizome, whole mount of prothallus with sex organs and young sporophyte (permanent slide).

11. *Cycas*- Morphology (coralloid roots, bulbil, leaf), whole mount of microsporophyll, transverse section of coralloid root, transverse section of rachis, vertical section of leaflet, vertical section of microsporophyll, whole mount of spores (temporary slides), longitudinal section of ovule, transverse section of root (permanent slide).
12. *Pinus*- Morphology (long and dwarf shoots, whole mount of dwarf shoot, male and female cones), transverse section of Needle, transverse section of stem, longitudinal section of / transverse section of male cone, whole mount of microsporophyll, whole mount of Microspores (temporary slides), longitudinal section of female cone, tangential longitudinal section & radial longitudinal sections stem (permanent slide).
13. *Gnetum*- Morphology (stem, male & female cones), transverse section of stem, vertical section of ovule (permanent slide)
14. **Botanical excursion.**

Suggested Readings:

- Vashistha, P.C., Sinha, A.K., Kumar, A. (2010). Pteridophyta. S. Chand. Delhi, India.
- Bhatnagar, S.P. & Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
- Parihar, N.S. (1991). An introduction to Embryophyta: Vol. I. Bryophyta. Central Book Depot. Allahabad.
- Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R. (2005). Biology. Tata McGraw Hill, Delhi.
- Vanderpoorten, A. & Goffinet, B. (2009) Introduction to Bryophytes. Cambridge University Press.

CC-5: Anatomy of Angiosperms

Credits 06

C5T: Anatomy of Angiosperms

Credits 04

Course Contents:

Unit 1: Introduction and scope of Plant Anatomy: Applications in systematics, forensics and pharmacognosy.

Unit 2: Structure and Development of Plant Body

Internal organization of plant body: The three tissue systems, types of cells and tissues. Development of plant body: polarity, cytodifferentiation and organogenesis during embryogenic development, Root-stem transition, Nodal anatomy – Basic concept.

Unit 2: Tissues

Classification of tissues; Simple and complex tissues (no phylogeny); cytodifferentiation of tracheary elements and sieve elements; Pits and plasmodesmata; Wall ingrowths and transfer cells, adcrustation and incrustation, Ergastic substances. Hydathodes, cavities, lithocysts and laticifers.

Unit 3: Apical meristems

Evolution of concept of organization of shoot apex (Apical cell theory, Histogen theory, Tunica Corpus theory, continuing meristematic residue, cytohistological zonation); Types of vascular bundles; Structure of dicot and monocot stem. Origin, development, arrangement and diversity in size and shape of leaves; Structure of dicot and monocot leaf, Kranz anatomy. Organization of root apex (Apical cell theory, Histogen theory, Korper-Kappe theory); Quiescent centre; Root cap; Structure of dicot and monocot root; Endodermis, exodermises and origin of lateral root.

Unit 4: Vascular Cambium and Wood

Structure, function and seasonal activity of cambium; Secondary growth in root and stem. Anomalous secondary growth in *Bignonia*, *Boerhaavia*, *Aristolochia* and *Dracaena*. Axially and radially oriented elements; Types of rays and axial parenchyma; Cyclic aspects and reaction wood; Sapwood and heartwood; Ring and diffuse porous wood; Early and late wood, tyloses; Dendrochronology. Development and composition of periderm, rhytidome and lenticels.

Unit 5: Adaptive and Protective Systems

Epidermal tissue system, cuticle, epicuticular waxes, trichomes (uni- and multicellular, glandular and nonglandular, two examples of each), stomata (classification); Adcrustation and incrustation; Anatomical adaptations of xerophytes and hydrophytes. Mechanical tissue – distribution and significance.

C5P: Anatomy of Angiosperms

Credits 02

Practical

1. Study of anatomical details through permanent slides/temporary stain mounts/macerations/museum specimens with the help of suitable examples.
2. Apical meristem of root, shoot and vascular cambium.
3. Distribution and types of parenchyma, collenchyma and sclerenchyma.
4. Xylem: Tracheary elements-tracheids, vessel elements; thickenings; perforation plates; xylem fibres.
5. Wood: ring porous; diffuse porous; tyloses; heart- and sapwood.
6. Phloem: Sieve tubes-sieve plates; companion cells; phloem fibres.
7. Epidermal system: cell types, stomata types; trichomes: non-glandular and glandular.
8. Root: monocot, dicot, secondary growth.
9. Stem: monocot, dicot - primary and secondary growth; periderm; lenticels.
10. Leaf: isobilateral, dorsiventral, C4 leaves (Kranz anatomy).
11. Adaptive Anatomy: xerophytes, hydrophytes.
12. Secretory tissues: cavities, lithocysts and laticifers.

Suggested Readings:

- Dickison, W.C. (2000). Integrative Plant Anatomy. Harcourt Academic Press, USA.
- Fahn, A. (1974). Plant Anatomy. Pergmon Press, USA.
- Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA.
- Evert, R.F. (2006) Esau's Plant Anatomy: Meristems, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc.

CC-6: Economic Botany

Credits 06

C6T: Economic Botany

Credits 04

Course Contents:

Unit 1: Origin of Cultivated Plants

Concept of Centres of Origin, their importance with reference to Vavilov's work. Examples of major plant introductions; Crop domestication and loss of genetic diversity; evolution of new crops/varieties, importance of germplasm diversity.

Unit 2: Cereals

Wheat and Rice (origin, morphology, cultivation, management processing & uses); Brief account of millets.

Unit 3: Legumes

Origin, morphology cultivation, management and uses of Chick pea, Pigeon pea and fodder legumes. Importance to man and ecosystem.

Unit 4: Sources of sugars and starches

Morphology cultivation, management and processing of sugarcane, products and by-products of sugarcane industry. Potato – morphology, propagation & uses.

Unit 5: Spices

Listing of important spices, their family and part used. Economic importance with special reference to fennel, saffron, clove and black pepper

Unit 6: Beverages

Tea, Coffee (morphology, processing & uses)

Unit 7: Sources of oils and fats

General description, classification, extraction, their uses and health implications groundnut, coconut, linseed, soybean, mustard and coconut (Botanical name, family & uses). Essential Oils: General account, extraction methods, comparison with fatty oils & their uses.

Unit 8: Natural Rubber

Para-rubber: tapping, processing and uses.

Unit 9: Drug-yielding plants

Therapeutic and habit-forming drugs with special reference to *Cinchona*, *Digitalis*, *Papaver* and *Cannabis*; Tobacco (Morphology, processing, uses and health hazards).

Unit 10: Timber plants

General account with special reference to teak and pine.

Unit 11: Fibers

Classification based on the origin of fibers; Cotton, Coir and Jute (morphology, extraction and uses).

C6P: Economic Botany

Credits 02

Practical

1. **Cereals:** Wheat (habit sketch, L. S/T.S. grain, starch grains, micro-chemical tests)
Rice (habit sketch, study of paddy and grain, starch grains, micro-chemical tests).
2. **Legumes:** Soybean, Groundnut, (habit, fruit, seed structure, micro-chemical tests).
3. **Sources of sugars and starches:** Sugarcane (habit sketch; cane juice- micro-chemical tests), Potato (habit sketch, tuber morphology, T.S. tuber to show localization of starch grains, w.m. starch grains, micro-chemical tests).
4. **Spices:** Black pepper, Fennel and Clove (habit and sections).
5. **Beverages:** Tea (plant specimen, tea leaves), Coffee (plant specimen, beans).
6. **Sources of oils and fats:** Coconut- T.S. nut, Mustard–plant specimen, seeds; tests for fats in crushed seeds.
7. **Essential oil-yielding plants:** Habit sketch of *Rosa*, *Vetiveria*, *Santalum* and *Eucalyptus* (specimens/photographs).
8. **Rubber:** specimen, photograph/model of tapping, samples of rubber products.
9. **Drug-yielding plants:** Specimens of *Digitalis*, *Papaver* and *Cannabis*.
10. **Tobacco:** specimen and products of Tobacco.
11. **Woods:** *Tectona*, *Pinus*: Specimen, Section of young stem.
12. **Fiber-yielding plants:** Cotton (specimen, whole mount of seed to show lint and fuzz; whole mount of fiber and test for cellulose), Jute (specimen, transverse section of stem, test for lignin on transverse section of stem and fiber).

Suggested Readings:

- Kochhar, S.L. (2012). Economic Botany in Tropics, MacMillan & Co. New Delhi, India.
- Wickens, G.E. (2001). Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.
- Chrispeels, M.J. and Sadava, D.E. 1994 Plants, Genes and Agriculture. Jones & Bartlett_Publishers.

CC-7: Genetics

Credits 06

C7T: Genetics

Credits 04

Course Contents:

Unit 1: Mendelian genetics and its extension

Mendelism: History; Principles of inheritance; Chromosome theory of inheritance; Autosomes and sex chromosomes; Probability and pedigree analysis; Incomplete dominance and codominance; Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Recessive and Dominant traits, Penetrance and Expressivity, Numericals; Polygenic inheritance.

Unit 2: Extra-chromosomal Inheritance

Chloroplast mutation: Variegation in Four o'clock plant; Mitochondrial mutations in yeast; Maternal effects-shell coiling in snail; Infective heredity- Kappa particles in *Paramecium*.

Unit 3: Linkage, crossing over and chromosome mapping

Linkage and crossing over-Cytological and molecular basis of crossing over; Recombination frequency, two factor and three factor crosses; Interference and coincidence; Numericals based on gene mapping; Sex Linkage.

Unit 4: Variation in chromosome number and structure

Deletion, Duplication, Inversion, Translocation, Position effect, Euploidy and Aneuploidy

Unit 5: Gene mutations

Types of mutations; Molecular basis of Mutations; Mutagens – physical and chemical (Base analogs, deaminating, alkylating and intercalating agents); Detection of mutations: CIB method. Role of Transposons in mutation. DNA repair mechanisms.

Unit 6: Fine structure of gene

Classical vs molecular concepts of gene; Cis-Trans complementation test for functional allelism; Structure of Phage T4, rII Locus.

Unit 6. Population and Evolutionary Genetics

Allele frequencies, Genotype frequencies, Hardy-Weinberg Law, role of natural selection, mutation, genetic drift. Genetic variation and Speciation.

C7P: Genetics

Credits 02

Practical

1. Demonstration on pretreatment, fixation, staining and squash and smear preparation.
2. Study of Mitosis from Onion / Garlic / Lentil root.
3. Study of Meiosis with pollen mother cell (PMC) of Onion / Solanum / Datura by smear preparation.
4. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square.
5. Chromosome mapping using point test cross data.
6. Pedigree analysis for dominant and recessive autosomal and sex linked traits.
7. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4).
8. Blood Typing: groups & Rh factor.
9. Study of aneuploidy: Down's, Klinefelter's and Turner's syndromes.
10. Photographs/Permanent Slides showing Translocation Ring, Laggards and Inversion Bridge.
11. Study of human genetic traits: Sickle cell anemia, Xeroderma Pigmentosum, Albinism, red-green Colour blindness, Widow's peak, Rolling of tongue, Hitchhiker's thumb and Attached ear lobe.

Suggested Readings:

- Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, John Wiley & sons, India. 8th edition.
- Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics, John Wiley & Sons Inc., India. 5th edition.
- Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. Benjamin Cummings, U.S.A. 9th edition.
- Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.

CC-8: Molecular Biology

Credits 06

C8T: Molecular Biology

Credits 04

Course Contents:

Unit- 1: Nucleic acids: Carriers of genetic information

Historical perspective; DNA as the carrier of genetic information (Griffith's, Hershey & Chase, Avery, McLeod & McCarty, Fraenkel-Conrat's experiment).

Unit -2. The Structures of DNA and RNA / Genetic Material

DNA Structure: Miescher to Watson and Crick- historic perspective, DNA structure, Salient features of double helix, Types of DNA, Types of genetic material, denaturation and renaturation, cot curves; Organization of DNA-Prokaryotes, Viruses, Eukaryotes. RNA Structure- Organelle DNA -- mitochondria and chloroplast DNA. The Nucleosome-Chromatin structure- Euchromatin, Heterochromatin- Constitutive and Facultative heterochromatin.

Unit- 2: The replication of DNA

Chemistry of DNA synthesis (Kornberg's discovery); General principles – bidirectional, semiconservative and semi discontinuous replication, RNA priming; Various models of DNA replication, including rolling circle, θ (theta) mode of replication, replication of linear ds-DNA, replication of the 5' end of linear chromosome; Enzymes involved in DNA replication.

Unit- 3: Central dogma and genetic code

Key experiments establishing- The Central Dogma (Adaptor hypothesis and discovery of mRNA template), Genetic code (deciphering & salient features)

Unit 4: Transcription

Transcription in prokaryotes and eukaryotes. Principles of transcriptional regulation; Prokaryotes: Regulation of lactose metabolism and tryptophan synthesis in *E.coli*. Eukaryotes: transcription factors, heat shock proteins, steroids and peptide hormones; Gene silencing.

Unit 5: Processing and modification of RNA

Split genes-concept of introns and exons, removal of introns, spliceosome machinery, splicing pathways, group I and group II intron splicing, alternative splicing eukaryotic mRNA processing (5' cap, 3' polyA tail); Ribozymes; RNA editing and mRNA transport.

Unit 6: Translation

Ribosome structure and assembly, mRNA; Charging of tRNA, aminoacyl tRNA synthetases; Various steps in protein synthesis, proteins involved in initiation, elongation and termination of polypeptides; Fidelity of translation; Inhibitors of protein synthesis; Post-translational modifications of proteins.

C8P: Molecular Biology

Credits 02

Practical

1. Preparation of LB medium and raising *E.Coli*.
2. Isolation of genomic DNA from *E.Coli*.
3. DNA isolation from cauliflower head.
4. DNA estimation by diphenylamine reagent/UV Spectrophotometry.
5. Study of DNA replication mechanisms through photographs (Rolling circle, Theta replication and semi-discontinuous replication).
6. Study of structures of prokaryotic RNA polymerase and eukaryotic RNA polymerase II through photographs.
7. Photographs establishing nucleic acid as genetic material (Messelson and Stahl's, Avery et al, Griffith's, Hershey & Chase's and Fraenkel & Conrat's experiments)
8. Study of the following through photographs: Assembly of Spliceosome machinery; Splicing mechanism in group I & group II introns; Ribozyme and Alternative splicing.

Suggested Readings

- Watson J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M., Losick, R. (2007). Molecular Biology of the Gene, Pearson Benjamin Cummings, CSHL Press, New York, U.S.A. 6th edition.
- Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons Inc., U.S.A. 5th edition.
- Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. Benjamin Cummings. U.S.A. 9th edition.
- Russell, P. J. (2010). i-Genetics- A Molecular Approach. Benjamin Cummings, U.S.A. 3rd edition.
- Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.

CC-9: Plant Ecology and Phylogeography

Credits 06

C9T: Plant Ecology and Phylogeography

Credits 04

Course Contents:

Unit 1: Introduction

Basic concepts; Levels of organization. Inter-relationships between the living world and the environment, the components and dynamism, homeostasis.

Unit 2: Soil

Importance; Origin; Formation; Composition; Physical; Chemical and Biological components; Soil profile; Role of climate in soil development.

Unit 3: Water

Importance: States of water in the environment; Atmospheric moisture; Precipitation types (rain, fog, snow, hail, dew); Hydrological Cycle; Water in soil; Water table.

Unit 4: Light, temperature, wind and fire

Variations; adaptations of plants to their variation.

Unit 5: Ecosystems

Structure; Processes; Trophic organisation; Food chains and Food webs; Ecological pyramids.

Unit 6: Population ecology

Characteristics and Dynamics .Ecological Speciation

Unit 7: Plant communities

Concept of ecological amplitude; Habitat and niche; Characters: analytical and synthetic; Ecotone and edge effect; Dynamics: succession – processes, types; climax concepts.

Unit 8: Biotic interactions

Trophic organization, basic source of energy, autotrophy, heterotrophy; symbiosis, commensalism, parasitism; food chains and webs; ecological pyramids; biomass, standing crop.

Unit 9: Functional aspects of ecosystem

Principles and models of energy flow; Production and productivity; Ecological efficiencies; Biogeochemical cycles; Cycling of Carbon, Nitrogen and Phosphorus.

Unit 10: Phytogeography

Principles; Continental drift; Theory of tolerance; Endemism; Brief description of major terrestrial biomes (one each from tropical, temperate & tundra); Phytogeographical division of India; Local Vegetation.

C9P: Plant Ecology and Phytogeography**Credits 02****Practical**

1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter.
2. Determination of pH of various soil and water samples (pH meter, universal indicator/Lovibond comparator and pH paper)
3. Analysis for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency from
4. two soil samples by rapid field tests.
5. Determination of organic matter of different soil samples by Walkley & Black rapid titration
6. method.

7. Comparison of bulk density, porosity and rate of infiltration of water in soils of three habitats.
8. Determination of dissolved oxygen of water samples from polluted and unpolluted sources.
9. (a). Study of morphological adaptations of hydrophytes and xerophytes (four each).
(b). Study of biotic interactions of the following: Stem parasite (*Cuscuta*), Root parasite (*Orobancha*) Epiphytes, Predation (Insectivorous plants).
10. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus, by species area curve method (species to be listed).
11. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law.
12. Quantitative analysis of herbaceous vegetation for density and abundance in the college campus.
13. Field visit to familiarise students with ecology of different sites.

Suggested Readings:

- Odum, E.P. (2005). Fundamentals of ecology. Cengage Learning India Pvt. Ltd., New Delhi. 5th edition.
- Singh, J.S., Singh, S.P., Gupta, S. (2006). Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India.
- Sharma, P.D. (2010). Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
- Wilkinson, D.M. (2007). Fundamental Processes in Ecology: An Earth Systems Approach. Oxford University Press. U.S.A.
- Kormondy, E.J. (1996). Concepts of ecology. PHI Learning Pvt. Ltd., Delhi, India. 4th edition.

CC-10: Plant Systematics

Credits 06

C10T: Plant Systematics

Credits 04

Course Contents:

Unit 1: Significance of Plant systematics

Introduction to systematics; Plant identification, Classification, Nomenclature. Evidences from palynology, cytology, phytochemistry and molecular data. Field inventory; Functions of Herbarium; Important herbaria and botanical gardens of the world and India; Virtual herbarium; E-flora; Documentation: Flora, Monographs, Journals; Keys: Single access and Multi-access.

Unit 2: Taxonomic hierarchy

Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concept (taxonomic, biological, evolutionary).

Unit 3: Botanical nomenclature

Principles and rules (ICN); Ranks and names; Typification, author citation, valid publication, rejection of names, principle of priority and its limitations; Names of hybrids.

Unit 4: Systems of classification

Major contributions of Theophrastus, Bauhin, Tournefort, Linnaeus, Adanson, de Candolle, Bessey, Hutchinson, Takhtajan and Cronquist; Classification systems of Bentham and Hooker (upto series) and Engler and Prantl (upto series); Brief reference of Angiosperm Phylogeny Group (APG III) classification.

Unit 5: Biometrics, numerical taxonomy and cladistics

Characters; Variations; OTUs, character weighting and coding; Cluster analysis; Phenograms, cladograms (definitions and differences).

Unit 6: Phylogeny of Angiosperms

Terms and concepts (primitive and advanced, homology and analogy, parallelism and convergence, monophyly, Paraphyly, polyphyly and clades). Origin and evolution of angiosperms; Co-evolution of angiosperms and animals; Methods of illustrating evolutionary relationship (phylogenetic tree, cladogram).

C10P: Plant Systematics

Credits 02

Practical

1. Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification):

1. Ranunculaceae - *Ranunculus*, *Delphinium*.
2. Brassicaceae - *Brassica*, *Alyssum* / *Iberis*.
3. Malvaceae – *Sida Sp.* *Urena lobota*.
4. Myrtaceae - *Eucalyptus*, *Callistemon*
5. Umbelliferae - *Coriandrum* / *Anethum* / *Foeniculum*.
6. Asteraceae - *Sonchus/Launaea*, *Vernonia/Ageratum*, *Eclipta/Tridax*.
7. Solanaceae - *Solanum nigrum/Withania*, *Nicotina*, *Plumbaginefolia*.
8. Lamiaceae - *Salvia/Ocimum*.
9. Euphorbiaceae - *Euphorbia hirta/E.milii*, *Jatropha*.
10. Fasaceae – *Tephrosia Sp.*, *Crotalaria Sp.*,
11. Caesalpineaeceae – *Cassia Sp.*,
12. Asclepiadaeaceae- *Pesgularia Gygnema*,
13. Apocynaceae – *Hollorhen*, *Catharanthus*.
14. Rubiaceae – *Oldenladeae*, *Spermoeoceae*,
15. Liliaceae - *Asphodelus/Lilium/Allium*.
16. Poaceae - *Triticum/Hordeum/Avena*.

2. Field visit (local) – Subject to grant of funds from the university.

3. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).

Suggested Readings:

- Singh, (2012). *Plant Systematics: Theory and Practice* Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition.

- Jeffrey, C. (1982). *An Introduction to Plant Taxonomy*. Cambridge University Press, Cambridge.
- Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. (2002). *Plant Systematics-A*
- *Phylogenetic Approach*. Sinauer Associates Inc., U.S.A. 2nd edition.
- Maheshwari, J.K. (1963). *Flora of Delhi*. CSIR, New Delhi.
- Radford, A.E. (1986). *Fundamentals of Plant Systematics*. Harper and Row, New York.

CC-11: Reproductive Biology of Angiosperms

Credits 06

C11T: Reproductive Biology of Angiosperms

Credits 04

Course Contents:

Unit 1: Introduction

History (contributions of G.B. Amici, W. Hofmeister, E. Strasburger, S.G. Nawaschin, P. Maheshwari, B.M. Johri, W.A. Jensen, J. Heslop-Harrison) and scope.

Unit 2: Reproductive development

Induction of flowering; flower as a modified determinate shoot. Flower development: genetic and molecular aspects.

Unit 3: Anther and pollen biology

Anther wall: Structure and functions, microsporogenesis, callose deposition and its significance. Microgametogenesis; Pollen wall structure, MGU (Male Germ Unit) structure, NPC system; Palynology and scope (a brief account); Pollen wall proteins; Pollen viability, storage and germination; Abnormal features: Pseudomonads, polyads, massulae, pollinia.

Unit 4: Ovule

Structure; Types; Special structures—endothelium, obturator, aril, caruncle and hypostase; Female Gametophyte – megasporogenesis (monosporic, bisporic and tetrasporic) and megagametogenesis (details of *Polygonum* type); Organization and ultrastructure of mature embryo sac.

Unit 4: Pollination and fertilization

Pollination types and significance; adaptations; structure of stigma and style; path of pollen tube in pistil; double fertilization.

Unit 5: Self incompatibility

Basic concepts (interspecific, intraspecific, homomorphic, heteromorphic, GSI and SSI); Methods to overcome self- incompatibility: mixed pollination, bud pollination, stub pollination; Intra-ovarian and *in vitro* pollination; Modification of stigma surface, parasexual hybridization; Cybrids, *in vitro* fertilization.

Unit 6: Embryo, Endosperm and Seed

Structure and types; General pattern of development of dicot and monocot embryo and endosperm; Suspensor: structure and functions; Embryo-endosperm relationship; Nutrition

of embryo; Unusual features; Embryo development in *Paeonia*. Seed structure, importance and dispersal mechanisms

Units 7: Polyembryony and apomixis

Introduction; Classification; Causes and applications.

C11P: Reproductive Biology of Angiosperms

Credits 02

Practical

1. Anther: Wall and its ontogeny; Tapetum (amoeboid and glandular); MMC, spore tetrads, uninucleate, bicelled and dehisced anther stages through slides/micrographs, male germ unit (MGU) through photographs and schematic representation.
2. Pollen grains: Fresh and acetolyzed showing ornamentation and aperture, pseudomonads, polyads, pollinia (slides/photographs, fresh material), ultrastructure of pollen wall (micrograph); Pollen viability: Tetrazolium test, germination: Calculation of percentage germination in different media using hanging drop method.
3. Ovule: Types-anatropous, orthotropous, amphitropous/campylotropous, circinotropous, unitegmic, bitegmic; Tenuinucellate and crassinucellate; Special structures: Endothelium, obturator, hypostase, caruncle and aril (permanent slides/specimens/photographs).
4. Female gametophyte through permanent slides/ photographs: Types, ultrastructure of mature egg apparatus.
5. Intra-ovarian pollination; Test tube pollination through photographs.
6. Endosperm: Dissections of developing seeds for endosperm with free-nuclear haustoria.
7. Embryogenesis: Study of development of dicot embryo through permanent slides; dissection of developing seeds for embryos at various developmental stages; Study of suspensor through electron micrographs.

Suggested Readings:

- Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms, Vikas Publishing House. Delhi. 5th edition.
- Shivanna, K.R. (2003). Pollen Biology and Biotechnology. Oxford and IBH Publishing Co. Pvt. Ltd. Delhi.
- Raghavan, V. (2000). Developmental Biology of Flowering plants, Springer, Netherlands.
- Johri, B.M. I (1984). Embryology of Angiosperms, Springer-Verlag, Netherlands.

CC-12: Plant Physiology

Credits 06

Course Contents:**Unit 1: Plant-water relations**

Water Potential and its components, water absorption by roots, aquaporins, pathway of water movement, symplast, apoplast, transmembrane pathways, root pressure, guttation. Ascent of sap – cohesion-tension theory. Transpiration and factors affecting transpiration, antitranspirants, mechanism of stomatal movement.

Unit 2: Mineral nutrition

Essential and beneficial elements, macro and micronutrients, methods of study and use of nutrient solutions, criteria for essentiality, mineral deficiency symptoms, roles of essential elements, chelating agents.

Unit 3: Nutrient Uptake

Soil as a nutrient reservoir, transport of ions across cell membrane, passive absorption, electrochemical gradient, facilitated diffusion, active absorption, role of ATP, carrier systems, proton ATPase pump and ion flux, uniport, co-transport, symport, antiport.

Unit 4: Translocation in the phloem

Experimental evidence in support of phloem as the site of sugar translocation. Pressure–Flow Model; Phloem loading and unloading; Source–sink relationship.

Unit 5: Plant growth regulators

Discovery, chemical nature (basic structure), bioassay and physiological roles of Auxin, Gibberellins, Cytokinin, Abscisic acid, Ethylene, Brassinosteroids and Jasmonic acid.

Unit 6: Physiology of flowering

Photoperiodism, flowering stimulus, florigen concept, vernalization, seed dormancy.

Unit 7: Phytochrome , cryptochromes and phototropins

Discovery, chemical nature, role in photomorphogenesis, low energy responses (LER) and high irradiance responses (HIR), mode of action.

Practical

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. Determination of water potential of given tissue (potato tuber) by weight method.
3. Study of the effect of wind velocity and light on the rate of transpiration in excised twig/leaf.
4. Calculation of stomatal index and stomatal frequency from the two surfaces of leaves of a mesophyte and xerophyte.
5. To calculate the area of an open stoma and percentage of leaf area open through stomata in a mesophyte and xerophyte (both surfaces).
6. To study the phenomenon of seed germination (effect of light).
7. To study the effect of different concentrations of IAA on *Avena* coleoptile elongation (IAA Bioassay).

8. To study the induction of amylase activity in germinating barley grains.

Demonstration experiments

1. To demonstrate suction due to transpiration.
2. Fruit ripening/Rooting from cuttings (Demonstration).
3. Bolting experiment/*Avena* coleptile bioassay (demonstration).

Suggested Readings:

- Hopkins, W.G. and Huner, A. (2008). Introduction to Plant Physiology. John Wiley and Sons. U.S.A. 4th edition.
- Taiz, L., Zeiger, E., Møller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.
- Bajracharya D. (1999). Experiments in Plant Physiology-A Laboratory Manual. Narosa Publishing House, New Delhi.

CC-13: Plant Metabolism

Credits 06

C13T: Plant Metabolism

Credits 04

Course Contents:

Unit 1: Concept of metabolism

Introduction, anabolic and catabolic pathways, regulation of metabolism, role of regulatory enzymes (allosteric, covalent modulation and Isozymes).

Unit 2: Carbon assimilation

Historical background, photosynthetic pigments, role of photosynthetic pigments (chlorophylls and accessory pigments), antenna molecules and reaction centres, photochemical reactions, photosynthetic electron transport, PSI, PSII, Q cycle, CO₂ reduction, photorespiration, C₄ pathways; Crassulacean acid metabolism; Factors affecting CO₂ reduction.

Unit 3: Carbohydrate metabolism

Synthesis and catabolism of sucrose and starch.

Unit 4: Carbon Oxidation

Glycolysis, fate of pyruvate, regulation of glycolysis, oxidative pentose phosphate pathway, oxidative decarboxylation of pyruvate, regulation of PDH, NADH shuttle; TCA cycle, amphibolic role, anaplerotic reactions, regulation of the cycle, mitochondrial electron transport, oxidative phosphorylation, cyanide-resistant respiration, factors affecting respiration.

Unit 5: ATP-Synthesis

Mechanism of ATP synthesis, substrate level phosphorylation, chemiosmotic mechanism (oxidative and photophosphorylation), ATP synthase, Boyers conformational model, Racker's experiment, Jagendorf's experiment; role of uncouplers.

Unit 6: Lipid metabolism

Synthesis and breakdown of triglycerides, β -oxidation, glyoxylate cycle, gluconeogenesis and its role in mobilisation of lipids during seed germination, α oxidation.

Unit 7: Nitrogen metabolism

Nitrate assimilation, biological nitrogen fixation (examples of legumes and non-legumes); Physiology and biochemistry of nitrogen fixation; Ammonia assimilation and transamination.

Unit 8: Mechanisms of signal transduction

Receptor-ligand interactions; Second messenger concept, Calcium calmodulin, MAP kinase cascade.

C13P: Plant Metabolism

Credits 02

Practical

1. Chemical separation of photosynthetic pigments.
2. Experimental demonstration of Hill's reaction.
3. To study the effect of light intensity on the rate of photosynthesis.
4. Effect of carbon dioxide on the rate of photosynthesis.
5. To compare the rate of respiration in different parts of a plant.
6. To demonstrate activity of Nitrate reductase in germinating leaves of different plant sources.
7. To study the activity of lipases in germinating oilseeds and demonstrate mobilization of lipids
 1. during germination.
8. Demonstration of fluorescence by isolated chlorophyll pigments.
9. Demonstration of absorption spectrum of photosynthetic pigments.

Suggested Readings

- Hopkins, W.G. and Huner, A. (2008). Introduction to Plant Physiology. John Wiley and Sons. U.S.A. 4th edition.
- Taiz, L., Zeiger, E., Møller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.
- Harborne, J.B. (1973). Phytochemical Methods. John Wiley & Sons. New York.

CC-14: Plant Biotechnology

Credits 06

C14T: Plant Biotechnology

Credits 04

Course Contents:

Unit -1: Plant Tissue Culture

Historical perspective; Composition of media; Nutrient and hormone requirements (role of vitamins and hormones); Totipotency; Organogenesis; Embryogenesis (somatic and zygotic); Protoplast isolation, culture and fusion; Tissue culture applications (micropropagation, androgenesis, virus elimination, secondary metabolite production, haploids, triploids and hybrids; Cryopreservation; Germplasm Conservation).

Unit- 2: Recombinant DNA technology

Restriction Endonucleases (History, Types I-IV, biological role and application); Restriction Mapping (Linear and Circular); Cloning Vectors: Prokaryotic (pUC 18 and pUC19, pBR322, Ti plasmid, BAC); Lambda phage, M13 phagemid, Cosmid, Shuttle vector; Eukaryotic Vectors (YAC).

Unit- 3: Gene Cloning

Recombinant DNA, Bacterial Transformation and selection of recombinant clones, PCR mediated gene cloning; Gene Construct; construction of genomic and cDNA libraries, screening DNA libraries to obtain gene of interest by genetic selection; complementation, colony hybridization; PCR

Unit- 4: Methods of gene transfer

Agrobacterium-mediated, Direct gene transfer by Electroporation, Microinjection, Microprojectile bombardment; Selection of transgenics– selectable marker and reporter genes (Luciferase, GUS, GFP).

Unit - 5: Applications of Biotechnology

Pest resistant (Bt-cotton); herbicide resistant plants (RoundUp Ready soybean); Transgenic crops with improved quality traits (Flavr Savr tomato, Golden rice); Improved horticultural varieties (Moondust carnations); Role of transgenics in bioremediation (Superbug); edible vaccines; Industrial enzymes (Aspergillase, Protease, Lipase); Genetically Engineered Products–Human Growth Hormone; Humulin; Biosafety concerns.

C14P: Plant Biotechnology

Credits 02

Practical

1. (a) Preparation of MS medium.
(b) Demonstration of *in vitro* sterilization and inoculation methods using leaf and nodal explants of tobacco, *Datura*, *Brassica* etc.
2. Study of anther, embryo and endosperm culture, micropropagation, somatic embryogenesis & artificial seeds through photographs.
3. Isolation of protoplasts.
4. Construction of restriction map of circular and linear DNA from the data provided.
5. Study of methods of gene transfer through photographs: *Agrobacterium*-mediated, direct gene transfer by electroporation, microinjection, microprojectile bombardment.
7. Study of steps of genetic engineering for production of Bt cotton, Golden rice, Flavr Savr tomato through photographs.
8. Isolation of plasmid DNA.
9. Restriction digestion and gel electrophoresis of plasmid DNA.

Suggested Readings:

- Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
- Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.

- Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms. Vikas Publication House Pvt. Ltd., New Delhi. 5th edition.
- Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons, U.K. 5th edition.
- Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.

Discipline Specific Electives (DSE)

DSE-1: Natural Resource Management **Credits 06**

DSE1T: Natural Resource Management **Credits 04**

Course Contents:

Unit- 1: Natural resources : Definition and types.

Unit- 2: Sustainable utilization : Concept, approaches (economic, ecological and socio-cultural).

Unit- 3: Land : Utilization (agricultural, pastoral, horticultural, silvicultural); Soil degradation and management.

Unit- 4: Water

Fresh water (rivers, lakes, groundwater, aquifers, watershed); Marine; Estuarine; Wetlands; Threats and management strategies.

Unit- 5: Biological Resources

Biodiversity-definition and types; Significance; Threats; Management strategies; Bio-prospecting; IPR; CBD; National Biodiversity Action Plan).

Unit - 6: Forests

Definition, Cover and its significance (with special reference to India); Major and minor Forest products; Depletion; Management.

Unit- 7: Energy : Renewable and non-renewable sources of energy

Unit- 8: Contemporary practices in resource management

EIA, GIS, Participatory Resource Appraisal, Ecological Footprint with emphasis on carbon footprint, Resource Accounting; Waste management.

Unit- 9: National and international efforts in resource management and conservation

DSE-1P: Natural Resource Management **Credits 02**

Practical

1. Estimation of solid waste generated by a domestic system (biodegradable and nonbiodegradable) and its impact on land degradation.
2. Collection of data on forest cover of specific area.

3. Measurement of dominance of woody species by DBH (diameter at breast height) method.
4. Calculation and analysis of ecological footprint.
5. Ecological modeling.

Suggested Readings:

- Vasudevan, N. (2006). Essentials of Environmental Science. Narosa Publishing House, New Delhi.
- Singh, J. S., Singh, S.P. and Gupta, S. (2006). Ecology, Environment and Resource Conservation. Anamaya Publications, New Delhi.
- Rogers, P.P., Jalal, K.F. and Boyd, J.A. (2008). An Introduction to Sustainable Development. Prentice Hall of India Private Limited, New Delhi.

Or

DSE-1: Biostatistics

Credits 06

DSE1T: Biostatistics

Credits 04

Course Contents:

Unit 1: Biostatistics

Definition - statistical methods - basic principles. Variables - measurements, functions, limitations and uses of statistics.

Unit 2: Collection of data primary and secondary

Types and methods of data collection procedures - merits and demerits. Classification - tabulation and presentation of data - sampling methods.

Unit 3: Measures of central tendency

Mean, median, mode, geometric mean - merits & demerits. Measures of dispersion - range, standard deviation, mean deviation, quartile deviation - merits and demerits; Co-efficient of variations.

Unit 4: Correlation

Types and methods of correlation, regression, simple regression equation, fitting prediction, similarities and dissimilarities of correlation and regression

Unit 5: Statistical inference

Hypothesis - simple hypothesis - student 't' test - chi square test.

DSE1P: Biostatistics

Credits 02

Practical

1. Calculation of mean, standard deviation and standard error
2. Calculation of correlation coefficient values and finding out the probability
3. Calculation of 'F' value and finding out the probability value for the F value.

Suggested Readings

- Biostatistic, Danniell, W.W., 1987. New York, John Wiley Sons.

- An introduction to Biostatistics, 3rd edition, Sundarrao, P.S.S and Richards, J. Christian Medical College, Vellore
- Statistical Analysis of epidemiological data, Selvin, S., 1991. New York University Press. Statistics for Biology, Boston, Bishop, O.N. Houghton, Mifflin.
- The Principles of scientific research, Freedman, P. New York, Pergamon Press.
- Statistics for Biologists, Campbell, R.C., 1998. Cambridge University Press.

DSE-2: Plant Breeding

Credits 06

DSE2T: Plant Breeding

Credits 04

Course Contents:

Unit -1: Plant Breeding

Introduction and objectives. Breeding systems: modes of reproduction in crop plants. Important achievements and undesirable consequences of plant breeding.

Unit -2: Methods of Crop improvement

Introduction: Centres of origin and domestication of crop plants, plant genetic resources; Acclimatization; Selection methods: For self pollinated, cross pollinated and vegetatively propagated plants; Hybridization: For self, cross and vegetatively propagated plants – Procedure, advantages and limitations.

Unit -3: Quantitative inheritance

Concept, mechanism, examples of inheritance of Kernel colour in wheat, Skin colour in human beings. Monogenic vs polygenic Inheritance.

Unit - 4: Inbreeding depression and heterosis

History, genetic basis of inbreeding depression and heterosis : Applications.

Unit - 5: Crop improvement and breeding

Role of mutations; Polyploidy; Distant hybridization and role of biotechnology in crop improvement.

DSE2P: Plant Breeding (Practical)

Credits 02

Practical

1. Identification of offspring's having parental genotypes and recombinant genotypes, based on combination of morphological attributes in a dihybrid cross.

2. Processes of emasculation –

- a) By applying higher temperature,
- b) By amputating anthers.

3. Determination of genetic inheritance of characters in monohybrid and dihybrid crosses by Chi-square test (including Mendelian ratios and the ratios of gene interactions e.g. Dominant Epistasis, Supplementary gene action, Polymeric Gene action, Complementary Gene action, Inhibitory Gene action and Duplicating Gene action.

4. Identification of fertile and sterile pollens with carmine stain and TTC test.

Suggested Readings:

1. Singh, B.D. (2005). Plant Breeding: Principles and Methods. Kalyani Publishers. 7th edition.
2. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding. Oxford-IBH. 2nd edition.
3. Acquaah, G. (2007). Principles of Plant Genetics & Breeding. Blackwell Publishing.

Or

DSE-2: Stress Biology

Credits 06

DSE2T: Stress Biology

Credits 04

Course Contents:

Unit 1: Defining plant stress: Acclimation and adaptation.

Unit 2: Environmental factors: Water stress; Salinity stress, High light stress; Temperature stress; Hypersensitive reaction; Pathogenesis– related (PR) proteins; Systemic acquired resistance; Mediation of insect and disease resistance by jasmonates.

Unit 3: Stress sensing mechanisms in plants: Calcium modulation, Phospholipid signaling

Unit 4: Developmental and physiological mechanisms that protect plants against environmental stress: Adaptation in plants; Changes in root: shoot ratio; Aerenchyna development; Osmotic adjustment; Compatible solute production.

Unit 5: Reactive oxygen species–Production and scavenging mechanisms.

DSE2P: Stress Biology

Credits 02

Practical

1. Quantitative estimation of peroxidase activity in the seedlings in the absence and presence of salt stress.
2. Superoxide activity in seedlings in the absence and presence of salt stress.
3. Zymographic analysis of peroxidase.
4. Zymographic analysis of superoxide dismutase activity.
5. Quantitative estimation and zymographic analysis of catalase.
6. Quantitative estimation and zymographic analysis of glutathione reductase.
7. Estimation of superoxide anions.

Suggested Readings:

- Hopkins, W.G. and Huner, A. (2008). Introduction to Plant Physiology. John Wiley and Sons. U.S.A. 4th edition.
- Taiz, L., Zeiger, E., MØller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.

DSE-3: Industrial and Environmental Microbiology

Credits 06

DSE-3T: Industrial and Environmental Microbiology

Credits 04

Course Contents:

Unit 1: Scope of microbes in industry and environment

Unit 2: Bioreactors / Fermenters and fermentation processes

Solid-state and liquid-state (stationary and submerged) fermentations; Batch and continuous fermentations. Components of a typical bioreactor, Types of bioreactors-laboratory, pilotscale and production fermenters; Constantly stirred tank fermenter, tower fermenter, fixed bed and fluidized bed bioreactors and air-lift fermenter.

A visit to any educational institute/ industry to see an industrial fermenter, and other downstream processing operations.

Unit 3: Microbial production of industrial products

Microorganisms involved, media, fermentation conditions, downstream processing and uses; Filtration, centrifugation, cell disruption, solvent extraction, precipitation and ultrafiltration, lyophilization, spray drying; Hands on microbial fermentations for the production and estimation (qualitative and quantitative) of Enzyme: amylase or lipase activity, Organic acid (citric acid or glutamic acid), alcohol (Ethanol) and antibiotic (Penicillin)

Unit 4: Microbial enzymes of industrial interest and enzyme immobilization

Microorganisms for industrial applications_and hands on screening microorganisms for casein hydrolysis; starch hydrolysis; cellulose hydrolysis. Methods of immobilization, advantages and applications of immobilization, large scale applications of immobilized enzymes (glucose isomerase and penicillin acylase).

Unit 5: Microbes and quality of environment.

Distribution of microbes in air; Isolation of microorganisms from soil, air and water.

Unit 6: Microbial flora of water.

Water pollution, role of microbes in sewage and domestic waste water treatment systems. Determination of BOD, COD, TDS and TOC of water samples; Microorganisms as indicators of water quality, check coliform and fecal coliform in water samples.

Unit 7: Microbes in agriculture and remediation of contaminated soils.

Biological fixation; Mycorrhizae; Bioremediation of contaminated soils. Isolation of root nodulating bacteria, arbuscular mycorrhizal colonization in plant roots.

DSE-3P: Industrial and Environmental Microbiology

Credits 02

Practical

1. Principles and functioning of instruments in microbiology laboratory
2. Hands on sterilization techniques and preparation of culture media.

Suggested Readings:

- Pelzar, M.J. Jr., Chen E.C. S., Krieg, N.R. (2010). Microbiology: An application based approach. Tata McGraw Hill Education Pvt. Ltd., Delhi.
- Tortora, G.J., Funke, B.R., Case. C.L. (2007). Microbiology. Pearson Benjamin Cummings, San Francisco, U.S.A. 9th edition.

OR

DSE-3: Bioinformatics

Credits 06

DSE3T: Bioinformatics

Credits 04

Course Contents:

Unit 1. Introduction to Bioinformatics

Introduction, Branches of Bioinformatics, Aim, Scope and Research areas of Bioinformatics.

Unit 2. Databases in Bioinformatics

Introduction, Biological Databases, Classification format of Biological Databases, Biological Database Retrieval System.

Unit 3. Biological Sequence Databases

National Center for Biotechnology Information (NCBI): Tools and Databases of NCBI, Database Retrieval Tool, Sequence Submission to NCBI, Basic local alignment search tool (BLAST), Nucleotide Database, Protein Database, Gene Expression Database. EMBL Nucleotide Sequence Database (EMBL-Bank): Introduction, Sequence Retrieval, Sequence Submission to EMBL, Sequence analysis tools. DNA Data Bank of Japan (DDBJ): Introduction, Resources at DDBJ, Data Submission at DDBJ. Protein

Information Resource (PIR): About PIR, Resources of PIR, Databases of PIR, Data Retrieval in PIR. Swiss-Prot: Introduction and Salient Features.

Unit 4. Sequence Alignments

Introduction, Concept of Alignment, Multiple Sequence Alignment (MSA), MSA by CLUSTALW, Scoring Matrices, Percent Accepted Mutation (PAM), Blocks of Amino Acid Substitution Matrix (BLOSUM).

Unit 5. Molecular Phylogeny

Methods of Phylogeny, Software for Phylogenetic Analyses, Consistency of Molecular Phylogenetic Prediction.

Unit 6. Applications of Bioinformatics

Structural Bioinformatics in Drug Discovery, Quantitative structure-activity relationship (QSAR) techniques in Drug Design, Microbial genome applications, Crop improvement

DSE3P: Bioinformatics

Credits 02

Practical

1. Nucleic acid and protein databases.
2. Sequence retrieval from databases.
3. Sequence alignment.
4. Sequence homology and Gene annotation.
5. Construction of phylogenetic tree.

Suggested Readings:

- Ghosh Z. and Bibekanand M. (2008) Bioinformatics: Principles and Applications. Oxford University Press.
- Pevsner J. (2009) Bioinformatics and Functional Genomics. II Edition. Wiley-Blackwell.
- Campbell A. M., Heyer L. J. (2006) Discovering Genomics, Proteomics and Bioinformatics. II Edition. Benjamin Cummings.

DSE-4: Analytical Techniques in Plant Sciences

Credits 06

DSE4T: Analytical Techniques in Plant Sciences

Credits 04

Course Contents:

Unit- 1: Imaging and related techniques

Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; Use of fluorochromes: (a) Flow cytometry (FACS); (b) Applications of fluorescence microscopy: Chromosome banding, FISH, chromosome painting; Transmission and Scanning electron microscopy – sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching.

Unit- 2: Cell fractionation

Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, CsCl₂ gradient, analytical centrifugation, ultracentrifugation, marker enzymes.

Unit- 3: Radioisotopes

Use in biological research, auto-radiography, pulse chase experiment.

Unit- 4: Spectrophotometry

Principle and its application in biological research.

Unit- 5: Chromatography

Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ion-exchange chromatography; Molecular sieve chromatography; Affinity chromatography.

Unit- 6: Characterization of proteins and nucleic acids

Mass spectrometry; X-ray diffraction; X-ray crystallography; Characterization of proteins and nucleic acids; Electrophoresis: AGE, PAGE, SDS-PAGE

Unit- 7: Biostatistics

Statistics, data, population, samples, parameters; Representation of Data: Tabular, Graphical; Measures of central tendency: Arithmetic mean, mode, median; Measures of dispersion: Range, mean deviation, variation, standard deviation; Chi-square test for goodness of fit.

DSE4P: Analytical Techniques in Plant Sciences

Credits 02

Practical

1. Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs.
2. Demonstration of ELISA.
3. To separate nitrogenous bases by paper chromatography.
4. To separate sugars by thin layer chromatography.
5. Isolation of chloroplasts by differential centrifugation.
6. To separate chloroplast pigments by column chromatography.
7. To estimate protein concentration through Lowry's methods.
8. To separate proteins using PAGE.
9. To separation DNA (marker) using AGE.
10. Study of different microscopic techniques using photographs/micrographs (freeze fracture, freeze etching, negative staining, positive staining, fluorescence and FISH).
11. Preparation of permanent slides (double staining).

Suggested Readings:

- Plummer, D.T. (1996). An Introduction to Practical Biochemistry. Tata McGraw-Hill Publishing Co. Ltd. New Delhi. 3rd edition.
- Ruzin, S.E. (1999). Plant Microtechnique and Microscopy, Oxford University Press, New York. U.S.A.
- Ausubel, F., Brent, R., Kingston, R. E., Moore, D.D., Seidman, J.G., Smith, J.A., Struhl, K. (1995). Short Protocols in Molecular Biology. John Wiley & Sons. 3rd edition.

- Zar, J.H. (2012). Biostatistical Analysis. Pearson Publication. U.S.A. 4th edition.

OR

DSE-4: Research Methodology

Credits 06

DSE4T: Research Methodology

Credits 04

Course Contents:

Unit 1: Basic concepts of research

Research-definition and types of research (Descriptive vs analytical; applied vs fundamental; quantitative vs qualitative; conceptual vs empirical). Research methods vs methodology. Literature-review and its consolidation; Library research; field research; laboratory research.

Unit 2: General laboratory practices

Common calculations in botany laboratories. Understanding the details on the label of reagent bottles. Molarity and normality of common acids and bases. Preparation of solutions. Dilutions. Percentage solutions. Molar, molal and normal solutions. Technique of handling micropipettes; Knowledge about common toxic chemicals and safety measures in their handling.

Unit 3: Data collection and documentation of observations

Maintaining a laboratory record; Tabulation and generation of graphs. Imaging of Tissue specimens and application of scale bars. The art of field photography.

Unit 4: Overview of Biological Problems

History; Key biology research areas, Model organisms in biology (A Brief overview): Genetics, Physiology, Biochemistry, Molecular Biology, Cell Biology, Genomics, Proteomics Transcriptional regulatory network.

Unit 5: Methods to study plant cell/tissue structure

Whole mounts, peel mounts, squash preparations, clearing, maceration and sectioning; Tissue preparation: living vs fixed, physical vs chemical fixation, coagulating fixatives, non-coagulant fixatives; tissue dehydration using graded solvent series; Paraffin and plastic infiltration; Preparation of thin and ultrathin sections.

Unit 6: Plant microtechniques

Staining procedures, classification and chemistry of stains. Staining equipment. Reactive dyes and fluorochromes (including genetically engineered protein labeling with GFP and other tags). Cytogenetic techniques with squashed plant materials.

Unit 7: The art of scientific writing and its presentation

Numbers, units, abbreviations and nomenclature used in scientific writing. Writing references. Powerpoint presentation. Poster presentation. Scientific writing and ethics, Introduction to copyright-academic misconduct/plagiarism.

DSE4P: Research Methodology

Credits 02

Practical

1. Experiments based on chemical calculations.
2. Plant microtechnique experiments.
3. The art of imaging of samples through microphotography and field photography.
4. Poster presentation on defined topics.
5. Technical writing on topics assigned.

Suggested Readings:

- Dawson, C. (2002). Practical research methods. UBS Publishers, New Delhi.
- Stapleton, P., Yondeowei, A., Mukanyange, J., Houten, H. (1995). Scientific writing for agricultural research scientists – a training reference manual. West Africa Rice Development Association, Hong Kong.
- Ruzin, S.E. (1999). Plant microtechnique and microscopy. Oxford University Press, New York, U.S.A.

Skill Enhancement Course (SEC)

SEC-1: Biofertilizers

Credits 02

SEC1T: Biofertilizers

Credits 02

Course Contents:

Unit- 1: General account about the microbes used as biofertilizer – Rhizobium – isolation, identification, mass multiplication, carrier based inoculants, Actinorrhizal symbiosis.

Unit- 2: *Azospirillum*: isolation and mass multiplication – carrier based inoculant, associative effect of different microorganisms. *Azotobacter*: classification, characteristics – crop response to *Azotobacter* inoculum, maintenance and mass multiplication.

Unit- 3: Cyanobacteria (blue green algae), *Azolla* and *Anabaena azollae* association, nitrogen fixation, factors affecting growth, blue green algae and *Azolla* in rice cultivation.

Unit- 4: Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants.

Unit-5: Organic farming – Green manuring and organic fertilizers, Recycling of biodegradable municipal, agricultural and Industrial wastes – biocompost making methods, types and method of vermicomposting – field Application.

Suggested Readings:

- Dubey, R.C., 2005 A Text book of Biotechnology S.Chand & Co, New Delhi.
- Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.
- John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay _Publication, New Delhi.

- Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers.
- Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New _Delhi.
- Vayas,S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic _Farming Akta Prakashan, Nadiad

OR

SEC- 1: Floriculture

Credits 02

SEC1T: Floriculture

Course Contents:

Unit 1: Introduction: History of gardening; Importance and scope of floriculture and landscape gardening.

Unit 2: Nursery Management and Routine Garden Operations: Sexual and vegetative methods of propagation; Soil sterilization; Seed sowing; Pricking; Planting and transplanting; Shading; Stopping or pinching; Defoliation; Wintering; Mulching; Topiary; Role of plant growth regulators.

Unit 3:Ornamental Plants: Flowering annuals; Herbaceous perennials; Divine vines; Shade and ornamental trees; Ornamental bulbous and foliage plants; Cacti and succulents; Palms and Cycads; Ferns and Selaginellas; Cultivation of plants in pots; Indoor gardening; Bonsai.

Unit 4: Principles of Garden Designs: English, Italian, French, Persian, Mughal and Japanese gardens; Features of a garden (Garden wall, Fencing, Steps, Hedge, Edging, Lawn, Flower beds, Shrubbery, Borders, Water garden. Some Famous gardens of India.

Unit 5: Landscaping Places of Public Importance: Landscaping highways and Educational institutions.

Unit 6: Commercial Floriculture: Factors affecting flower production; Production and packaging of cut flowers; Flower arrangements; Methods to prolong vase life; Cultivation of Important cut flowers (Carnation, Aster, Chrysanthemum, Dahlia, Gerbera, Gladiolous, Marigold,Rose, Lilium, Orchids).

Unit 7: Diseases and Pests of Ornamental Plants.

Suggested Readings:

- Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.

SEC-2: Medicinal Botany

Credits 02

SEC-2T: Medicinal Botany

Course Contents:

Unit 1:

History, Scope and Importance of Medicinal Plants. Indigenous Medicinal Sciences; Definition and Scope - **Ayurveda**: History, origin, panchamahabhutas, saptadhatu and tridosha concepts, Rasayana, plants used in ayurvedic treatments, **Siddha**: Origin of Siddha medicinal systems, Basis of Siddha system, plants used in Siddha medicine. **Unani**: History, concept: Umoor-e- tabiya, tumors treatments/ therapy, polyherbal formulations.

Unit 2:

Conservation of endangered and endemic medicinal plants. Definition: endemic and endangered medicinal plants, Red list criteria; In situ conservation: Biosphere reserves, sacred groves, National Parks; Ex situ conservation: Botanic Gardens, Ethnomedicinal plant Gardens. Propagation of Medicinal Plants: Objectives of the nursery, its classification, important components of a nursery, sowing, pricking, use of green house for nursery production, propagation through cuttings, layering, grafting and budding.

Unit 3:

Ethnobotany and Folk medicines. Definition; Ethnobotany in India: Methods to study ethnobotany; Applications of Ethnobotany: National interacts, Palaeo-ethnobotany. Folk medicines of ethnobotany, ethnomedicine, ethnoecology, ethnic communities of India. Application of natural products to certain diseases- Jaundice, cardiac, infertility, diabetics, Blood pressure and skin diseases.

Suggested Readings:

- Trivedi P C, 2006. Medicinal Plants: Ethnobotanical Approach, Agrobios, India.
- Purohit and Vyas, 2008. Medicinal Plant Cultivation: A Scientific Approach, 2nd edn. Agrobios, India.

Or

SEC-2: Mushroom Culture Technology**Credits 02****SEC-2T: Mushroom Culture Technology****Course Contents:****Unit 1:**

Introduction, history. Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms. Types of edible mushrooms available in India - *Volvariella volvacea*, *Pleurotus citrinopileatus*, *Agaricus bisporus*.

Unit 2:

Cultivation Technology : Infrastructure: substrates (locally available) Polythene bag, vessels, Inoculation hook, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag. Pure culture: Medium, sterilization, preparation of spawn, multiplication. Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves. Factors affecting the mushroom bed preparation - Low cost technology, Composting technology in mushroom production.

Unit 3:

Storage and nutrition: Short-term storage (Refrigeration - upto 24 hours) Long term Storage (canning, pickels, papads), drying, storage in salt solutions. Nutrition - Proteins - amino acids, mineral elements nutrition - Carbohydrates, Crude fibre content - Vitamins.

Unit 4:

Food Preparation: Types of foods prepared from mushroom. Research Centres - National level and Regional level. Cost benefit ratio - Marketing in India and abroad, Export Value.

Suggested Readings:

- Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
- Swaminathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
- Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.
- Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition, Vol. I & Vol. II.

Generic Elective (GE)
[Interdisciplinary for other department]

GE-1: Biodiversity (Microbes, Algae, Fungi and Archegoniate) Credits 06

GE1T: Biodiversity (Microbes, Algae, Fungi and Archegoniate) Credits 04

Course Contents:

Unit 1: Microbes

Viruses – Discovery, general structure, replication (general account), DNA virus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV); Economic importance; Bacteria – Discovery, General characteristics and cell structure; Reproduction – vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance.

Unit 2: Algae

General characteristics; Ecology and distribution; Range of thallus organization and reproduction; Classification of algae; Morphology and life-cycles of the following: *Nostoc*, *Chlamydomonas*, *Oedogonium*, *Vaucheria*, *Fucus*, *Polysiphonia*. Economic importance of algae.

Unit 3: Fungi

Introduction- General characteristics, ecology and significance, range of thallus organization, cell wall composition, nutrition, reproduction and classification; True Fungi- General characteristics, ecology and significance, life cycle of *Rhizopus* (Zygomycota) *Penicillium*, *Alternaria* (Ascomycota), *Puccinia*, *Agaricus* (Basidiomycota); Symbiotic

Associations-Lichens:General account, reproduction and significance; Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance.

Unit 4: Introduction to Archegoniate

Unifying features of archegoniates, Transition to land habit, Alternation of generations.

Unit 5: Bryophytes

General characteristics, adaptations to land habit, Classification, Range of thallus organization. Classification (up to family), morphology, anatomy and reproduction of *Marchantia* and *Funaria*. (Developmental details not to be included). Ecology and economic importance of bryophytes with special mention of *Sphagnum*.

Unit 6: Pteridophytes

General characteristics, classification, Early land plants (*Cooksonia* and *Rhynia*). Classification (up to family), morphology, anatomy and reproduction of *Selaginella*, *Equisetum* and *Pteris*. (Developmental details not to be included). Heterospory and seed habit, stellar evolution. Ecological and economical importance of Pteridophytes.

Unit 4: Gymnosperms

General characteristics; Classification (up to family), morphology, anatomy and reproduction of *Cycas* and *Pinus* (Developmental details not to be included). Ecological and economical importance.

GE1P: Biodiversity (Microbes, Algae, Fungi and Archegoniate) (Practical) Credits 02

Practical:

1. EMs/Models of viruses – T-Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic Cycle.
1. Types of Bacteria from temporary/permanent slides/photographs; EM bacterium; Binary Fission; Conjugation; Structure of root nodule.
2. Gram staining.
3. Study of vegetative and reproductive structures of *Nostoc*, *Chlamydomonas* (electron micrographs), *Oedogonium*, *Vaucheria*, *Fucus** and *Polysiphonia* through temporary preparations and permanent slides. (* *Fucus* - Specimen and permanent slides).
4. *Rhizopus* and *Penicillium*: Asexual stage from temporary mounts and sexual Structures through permanent slides.
5. *Alternaria*: Specimens/photographs and tease mounts.
6. *Puccinia*: Herbarium specimens of Black Stem Rust of Wheat and infected Barberryleaves; section/tease mounts of spores on Wheat and permanent slides of both the hosts.

7. *Agaricus*: Specimens of button stage and full grown mushroom; Sectioning of gills of *Agaricus*.
8. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose)
9. Mycorrhiza: ecto mycorrhiza and endo mycorrhiza (Photographs)
10. *Marchantia*- morphology of thallus, w.m. rhizoids and scales, v.s. thallus through gemmacup, w.m. gemmae (all temporary slides), v.s. antheridiophore, archegoniophore, l.s. sporophyte (all permanent slides).
11. *Funaria*- morphology, w.m. leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, l.s. capsule and protonema.
12. *Selaginella*- morphology, w.m. leaf with ligule, t.s. stem, w.m. strobilus, w.m. microsporophyll and megasporophyll (temporary slides), l.s. strobilus (permanent slide).
14. *Equisetum*- morphology, t.s. internode, l.s. strobilus, t.s. strobilus, w.m. sporangiophore, w.m. spores (wet and dry)(temporary slides); t.s. rhizome (permanent slide).
13. Pteris- morphology, t.s. rachis, v.s. sporophyll, w.m. sporangium, w.m. spores (temporary slides), t.s. rhizome, w.m. prothallus with sex organs and young sporophyte (permanent slide).
14. *Cycas*- morphology (coralloid roots, bulbil, leaf), t.s. coralloid root, t.s. rachis, v.s. leaflet, v.s. micro sporophyll, w.m. spores (temporary slides), l.s. ovule, t.s. root (permanent slide).
15. *Pinus*- morphology (long and dwarf shoots, w.m. dwarf shoot, male and female), w.m. dwarf shoot, t.s. needle, t.s. stem, l.s./t.s. male cone, w.m. microsporophyll, w.m. microspores (temporary slides), l.s. female cone, t.l.s. & r.l.s. stem (permanent slide).

Suggested Readings:

- Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 2nd edition.
- Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction, Pearson Benjamin Cummings, U.S.A. 10th edition.
- Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi & Their Allies, MacMillan Publishers Pvt. Ltd., Delhi.
- Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4th edition.
- Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R., (2005). Biology. Tata McGraw Hill, Delhi, India.
- Vashishta, P.C., Sinha, A.K., Kumar, A., (2010). Pteridophyta, S. Chand. Delhi, India.
- Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
- Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot, Allahabad.

GE-2: Plant Ecology and Taxonomy

Credits 06

GE2T: Plant Ecology and Taxonomy

Credits 04

Course Contents:

Unit- 1: Introduction

Unit- 2: Ecological factors

Soil: Origin, formation, composition, soil profile. Water: States of water in the environment, precipitation types. Light and temperature: Variation Optimal and limiting factors; Shelford law of tolerance. Adaptation of hydrophytes and xerophytes

Unit -3: Plant communities

Characters; Ecotone and edge effect; Succession; Processes and types

Unit- 4: Ecosystem

Structure; energy flow trophic organisation; Food chains and food webs, Ecological pyramids production and productivity; Bio-geochemical cycling; Cycling of carbon, nitrogen and Phosphorous

Unit- 5: Phytogeography

Principle of Biogeographical zone; Endemism.

Unit- 6: Introduction to plant taxonomy

Identification, Classification, Nomenclature.

Unit- 7 : Identification

Functions of Herbarium, important herbaria and botanical gardens of the world and India; Documentation: Flora, Keys: single access and multi-access

Unit 8 : Taxonomic evidences from palynology, cytology, phytochemistry and molecular data.

Unit 9 : Taxonomic hierarchy

Ranks, categories and taxonomic groups

Unit 10: Botanical nomenclature

Principles and rules (ICN); ranks and names; binominal system, typification, author citation, valid publication, rejection of names, principle of priority and its limitations.

Unit 11: Classification

Types of classification-artificial, natural and phylogenetic. Bentham and Hooker (upto series), Engler and Prantl (upto series).

Unit 12: Biometrics, numerical taxonomy and cladistics

Characters; variations; OTUs, character weighting and coding; cluster analysis; phenograms, cladograms (definitions and differences).

GE2P: Practical

Credit 02

Practical:

1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter.
2. Determination of pH, and analysis of two soil samples for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency by rapid field test.
3. Comparison of bulk density, porosity and rate of infiltration of water in soil of three habitats.
4. (a) Study of morphological adaptations of hydrophytes and xerophytes (four each).
(b) Study of biotic interactions of the following: Stem parasite (*Cuscuta*), Root parasite (*Orobancha*), Epiphytes, Predation (Insectivorous plants).
5. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus by species area curve method. (species to be listed)
6. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law
7. Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification): Brassicaceae - *Brassica*, *Alyssum* / *Iberis*; Asteraceae - *Sonchus*/*Launaea*, *Vernonia*/*Ageratum*, *Eclipta*/*Tridax*; Solanaceae - *Solanum nigrum*, *Withania*; Lamiaceae - *Salvia*, *Ocimum*; Liliaceae - *Asphodelus* / *Lilium* / *Allium*.
8. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).

Suggested Readings:

1. Kormondy, E.J. (1996). Concepts of Ecology. Prentice Hall, U.S.A. 4th edition.
2. Sharma, P.D. (2010) Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
3. Simpson, M.G. (2006). *Plant Systematics*. Elsevier Academic Press, San Diego, CA, U.S.A.
4. Singh, G. (2012). *Plant Systematics: Theory and Practice*. Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition

GE-3: Economic Botany and Plant Biotechnology

Credits 06

GE3T: Economic Botany and Plant Biotechnology

Credits 04

Course Contents:

Unit 1: Origin of Cultivated Plants

Concept of centres of origin, their importance with reference to Vavilov's work.

Unit 2: Cereals

Wheat - Origin, morphology, uses

Unit 3: Legumes

General account with special reference to Gram and soybean

Unit 4: Spices

General account with special reference to clove and black pepper (Botanical name, family, part used morphology and uses)

Unit 5: Beverages

Tea (morphology, processing, uses)

Unit 6: Oils and Fats

General description with special reference to groundnut

Unit 7: Fibre Yielding Plants

General description with special reference to Cotton (Botanical name, family, part used, morphology and uses)

Unit 8: Introduction to biotechnology

Unit 9: Plant tissue culture

Micropropagation ; haploid production through androgenesis and gynogenesis; brief account of embryo and endosperm culture with their applications

Unit 10: Recombinant DNA Techniques

Blotting techniques: Northern, Southern and Western Blotting, DNA Fingerprinting; Molecular DNA markers i.e. RAPD, RFLP, SNPs; DNA sequencing, PCR and Reverse Transcriptase-PCR. Hybridoma and monoclonal antibodies, ELISA and Immuno detection. Molecular diagnosis of human disease, Human gene Therapy.

GE3P: Economic Botany and Plant Biotechnology

Credits 04

Practical:

1. Study of economically important plants : Wheat, Gram, Soybean, Black pepper, Clove Tea, Cotton, Groundnut through specimens, sections and micro chemical tests

2. Familiarization with basic equipments in tissue culture.
3. Study through photographs: Anther culture, somatic embryogenesis, endosperm and embryo culture; micropropagation.
4. Study of molecular techniques: PCR, Blotting techniques, AGE and PAGE.

Suggested Readings:

- Kochhar, S.L. (2011). Economic Botany in the Tropics, MacMillan Publishers India Ltd., New Delhi. 4th edition.
- Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
- Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.

GE-4: Plant Anatomy and Embryology

Credits 06

GE4T: Plant Anatomy and Embryology

Credits 04

Course Contents:

Unit 1: Meristematic and permanent tissues

Root and shoot apical meristems; Simple and complex tissues

Unit 2: Organs

Structure of dicot and monocot root stem and leaf.

Unit 3: Secondary Growth

Vascular cambium – structure and function, seasonal activity. Secondary growth in root and stem, Wood (heartwood and sapwood)

Unit 4: Adaptive and protective systems

Epidermis, cuticle, stomata; General account of adaptations in xerophytes and hydrophytes.

Unit 5: Structural organization of flower

Structure of anther and pollen; Structure and types of ovules; Types of embryo sacs, organization and ultrastructure of mature embryo sac.

Unit 6: Pollination and fertilization

Pollination mechanisms and adaptations; Double fertilization; Seed-structure appendages and dispersal mechanisms.

Unit 7: Embryo and endosperm

Endosperm types, structure and functions; Dicot and monocot embryo; Embryo endosperm relationship

Unit 8: Apomixis and polyembryony

Definition, types and Practical applications

Practical:

1. Study of meristems through permanent slides and photographs.
2. Tissues (parenchyma, collenchyma and sclerenchyma); Macerated xylary elements, Phloem (Permanent slides, photographs)
3. Stem: Monocot: *Zea mays*; Dicot: *Helianthus*; Secondary: *Helianthus* (only Permanent slides).
4. Root: Monocot: *Zea mays*; Dicot: *Helianthus*; Secondary: *Helianthus* (only Permanent slides).
5. Leaf: Dicot and Monocot leaf (only Permanent slides).
6. Adaptive anatomy: Xerophyte (*Nerium* leaf); Hydrophyte (*Hydrilla* stem).
7. Structure of anther (young and mature), tapetum (amoeboid and secretory) (Permanent slides).
8. Types of ovules: anatropous, orthotropous, circinotropous, amphitropous/campylotropous.
9. Female gametophyte: *Polygonum* (monosporic) type of Embryo sac Development (Permanent slides/photographs).
10. Ultrastructure of mature egg apparatus cells through electron micrographs.
11. Pollination types and seed dispersal mechanisms (including appendages, aril, caruncle) (Photographs and specimens).
12. Dissection of embryo/endosperm from developing seeds.
13. Calculation of percentage of germinated pollen in a given medium.

Suggested Readings:

1. Bhojwani, S.S. & Bhatnagar, S.P. (2011). Embryology of Angiosperms. Vikas Publication House Pvt. Ltd. New Delhi. 5th edition.
2. Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA.

OR**GE-4: Plant Physiology and Metabolism****Credits 06****GE4T: Plant Physiology and Metabolism****Credits 04****Course Contents:****Unit 1: Plant-water relations**

Importance of water, water potential and its components; Transpiration and its significance; Factors affecting transpiration; Root pressure and guttation.

Unit 2: Mineral nutrition

Essential elements, macro and micronutrients; Criteria of essentiality of elements; Role of essential elements; Transport of ions across cell membrane, active and passive transport, carriers, channels and pumps.

Unit 3: Translocation in phloem.

Composition of phloem sap, girdling experiment; Pressure flow model; Phloem loading and unloading

Unit 4: Photosynthesis

Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis; C₃, C₄ and CAM pathways of carbon fixation; Photorespiration.

Unit 5: Respiration

Glycolysis, anaerobic respiration, TCA cycle; Oxidative phosphorylation, Glyoxylate, Oxidative Pentose Phosphate Pathway.

Unit 6: Enzymes

Structure and properties; Mechanism of enzyme catalysis and enzyme inhibition.

Unit 7: Nitrogen metabolism

Biological nitrogen fixation; Nitrate and ammonia assimilation.

Unit 8: Plant growth regulators

Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene.

Unit 9: Plant response to light and temperature

Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far red light responses on photomorphogenesis; Vernalization.

GE4P: Plant Physiology and Metabolism

Credits 02

Practical

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. To study the effect of two environmental factors (light and wind) on transpiration by excised twig.
3. Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophyte.
4. Demonstration of Hill reaction.
5. Demonstrate the activity of catalase and study the effect of pH and enzyme concentration.
6. To study the effect of light intensity and bicarbonate concentration on O₂ evolution in photosynthesis.
7. Comparison of the rate of respiration in any two parts of a plant.
8. Separation of amino acids by paper chromatography.

Demonstration experiments (any four)

1. Bolting.
2. Effect of auxins on rooting.
3. Suction due to transpiration.
4. R.Q.
5. Respiration in roots.

Suggested Readings

- Taiz, L., Zeiger, E., MØller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.
- Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4th Edition.
- Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.



Routine : BOTANY: July'2022 - Dec'2022 Teacher wise class and syllabus distribution

SEM	Paper	UKK	NB	BH	PG	SKD	AC
I (H)	C1T	2 (U: 3,4,5)				2 (U: 1,2,6,7)	
	C1P	1 (U: Microbi				1 (U: Phycolo	
	C2T		2 (U: 1-4)		2 (U: 5-7)		
	C2P		1 (U: 1-5)		1 (U: 6-10)		
	GE1T				1 (U: 4-5)	2 (U: 1-3)	1 (U: 6-7)
	GE1P					1 (U: 1-8)	1 (U: 9-15)
I (G)	DSC - 1AT	2 (U: 4-7)		2 (U: 1-3)			
	DSC - 1AP			2 (U: All)			
III (H)	C5T		2 (U: 1-4)			2 (U: 5-6)	
	C5P		1 (U: 1-7)			1 (U: 8-12)	
	C6T	1 (U: 4-7)		1 (U: 1-3)	2 (U: 8-11)		
	C6P	1 (U: 1-6)			1 (U: 7-12)		
	C7T		1 (U: 3-4)		1 (U- 5-7)		2 (U: 1-2)
	C7P		1 (U: 1-7)				1 (U: 8-11)
	SEC - 1T			1 (U: 1-3)		1 (U: 4-6)	
	GE3T		2 (U: 5-8, 10)	2 (U: 1-4, 9)			
	GE3P		1 (U: 1, 4)	1 (U: 1,2,3)			
III (G)	DSC – 1CT	1 (U: 4-5)				1 (U: 1-3)	2 (U:6-8)
	DSC – 1CP					1 (U: 1-6)	1 (U: 7-13)
	SEC – 1T		1 (U: 4-5)	1 (U: 1-3)			
V (H)	C11T				2 (U:6-8)		2 (U: 1-5)
	C11P				1 (U: 4-7)		1 (U: 1-3)
	C12T	2 (U: 5-7)		1 (U: 3-4)		1 (U: 1-2)	
	C12P	1 (U: 4-8)		1 (U: 1-3)			
	DSE -1T		2 (U: 6-9)	2 (U: 1-5)			
	DSE -1P		1 (U: 3-5)	1 (U: 1-2)			
	DSE -2T	2 (U: 1-2)		1 (U: 5)	1 (U: 3-4)		
	DSE -2P	1 (U: 1,2)			1 (U: 3,4)		
V (G)	DSE -1AT	2 (U: 5-7)	1 (U: 1-4)		1 (U: 8-10)		
	DSE -1AP	1 (U: 1)			1 (U: 2-4)		
	SEC – 3T		1 (U: 3-4)	1 (U: 1-2)			
Total credit: 118		12T+5P=22	12T+5P=22	12T+5P=22	12T+5P=22	7T+4P=15	7T+4P=15



NARAJOLE RAJ COLLEGE
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Website: <http://www.narajolerajcollege.ac.in>





Data Capturing Format (DCF) for Distribution of Papers & Classes

Name of the Department: Dept. of Botany													Semester: ODD	
Academic Session: 2022-23 (July'22 - Dec'22)														
Dr. Uttam Kumar Kanp (Assistant Professor - Stage 2 & Head)														
Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Total Weekly Classes
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	
C1T	02	C1P	02	DSC-1AT	02	C6T	01	C6P	02	DSC-1CT	01	C12T	02	
Dr. Uttam Kumar Kanp (Assistant Professor - Stage 2 & Head)														
Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Total Weekly Classes
(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	
C12P	02	DSE 2T	02	DSE 2P	02	DSE1AT	02	DSE1AP	02	X	X	X	X	22
Prof. Nandita Bhakat (Assistant Professor - Stage 1)														
Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Total Weekly Classes
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	
C2T	02	C2P	02	C5T	02	C5P	02	C7T	01	C7P	02	GE3T	02	
Prof. Nandita Bhakat (Assistant Professor - Stage 1)														
Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Total Weekly Classes
(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	
GE3P	02	SEC-1T	01	DSE 1T	02	DSE1P	02	DSE1AT	01	SEC3T	01	X	X	22
Prof. Bangamoti Hansda (Assistant Professor - Stage 1)														
Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Total Weekly Classes
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	
DSc1AT	02	DSC1A P	04	C6T	01	SEC1T	01	GE3T	02	GE3P	02	SEC1T	01	
Prof. Bangamoti Hansda (Assistant Professor - Stage 1)														
Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Paper Code	Weekly Classes	Total Weekly Classes
(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	
C12T	01	C12P	02	DSE1T	02	DSE1P	02	DSE2T	01	SEC3T	01	X	X	22
Name of the Department: Dept. of Botany													Semester: ODD	
Academic Session: 2022-23 (July'22 - Dec'22)														



Data Capturing Format (DCF) for Distribution of Papers & Classes

Name of the Department: Dept. of Botany													Semester: EVEN		
Academic Session: 2022-23 (Jan'23-June'23)															
Dr. Uttam Kumar Kanp (Assistant Professor - Stage 2 & Head)															
Paper Code (1)	Weekly Classes (2)	Paper Code (3)	Weekly Classes (4)	Paper Code (5)	Weekly Classes (6)	Paper Code (7)	Weekly Classes (8)	Paper Code (9)	Weekly Classes (10)	Paper Code (11)	Weekly Classes (12)	Paper Code (13)	Weekly Classes (14)	Total Weekly Classes	
C4T	02	C4P	02	DSC2BT	02	C8T	01	C8P	02	DSC2DT	01	C13T	02		
Dr. Uttam Kumar Kanp (Assistant Professor - Stage 2 & Head)															
Paper Code (15)	Weekly Classes (16)	Paper Code (17)	Weekly Classes (18)	Paper Code (19)	Weekly Classes (20)	Paper Code (21)	Weekly Classes (22)	Paper Code (23)	Weekly Classes (24)	Paper Code (25)	Weekly Classes (26)	Paper Code (27)	Weekly Classes (28)	Total Weekly Classes	
C13P	02	C14T	02	C14P	02					X	X	X	X	18	
Prof. Nandita Bhakat (Assistant Professor - Stage 1)															
Paper Code (1)	Weekly Classes (2)	Paper Code (3)	Weekly Classes (4)	Paper Code (5)	Weekly Classes (6)	Paper Code (7)	Weekly Classes (8)	Paper Code (9)	Weekly Classes (10)	Paper Code (11)	Weekly Classes (12)	Paper Code (13)	Weekly Classes (14)	Total Weekly Classes	
C3T	02	C8T	03	C8P	02	C10T	02	C10P	02	GE4T	02	GE4P	02		
Prof. Nandita Bhakat (Assistant Professor - Stage 1)															
Paper Code (15)	Weekly Classes (16)	Paper Code (17)	Weekly Classes (18)	Paper Code (19)	Weekly Classes (20)	Paper Code (21)	Weekly Classes (22)	Paper Code (23)	Weekly Classes (24)	Paper Code (25)	Weekly Classes (26)	Paper Code (27)	Weekly Classes (28)	Total Weekly Classes	
C13T	02	C13P	02									X	X	19	
Prof. Bangamoti Hansda (Assistant Professor - Stage 1)															
Paper Code (1)	Weekly Classes (2)	Paper Code (3)	Weekly Classes (4)	Paper Code (5)	Weekly Classes (6)	Paper Code (7)	Weekly Classes (8)	Paper Code (9)	Weekly Classes (10)	Paper Code (11)	Weekly Classes (12)	Paper Code (13)	Weekly Classes (14)	Total Weekly Classes	
DSC2BT	02	DSC2BP	04	C9T	01	SEC2T	01	GE4T	02	GE4P	02	C14T	02		
Prof. Bangamoti Hansda (Assistant Professor - Stage 1)															
Paper Code (15)	Weekly Classes (16)	Paper Code (17)	Weekly Classes (18)	Paper Code (19)	Weekly Classes (20)	Paper Code (21)	Weekly Classes (22)	Paper Code (23)	Weekly Classes (24)	Paper Code (25)	Weekly Classes (26)	Paper Code (27)	Weekly Classes (28)	Total Weekly Classes	
C14P	02	DSE4T	02	DSE4P	02							X	X	20	



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TEACHING PLAN

Name of the Department: Mathematics

Name of the Teacher: Dr. Shreyasi Jana

Name and Distinctive No. of the paper: Real Analysis (C3T)

Session: 2022-2023

Semester: II

Sr. No. of Lecture	Broad Topic in University Syllabus	Topic to be covered in the Lecture
1.	(Unit-3) Series	Introduction to infinite series, preliminaries and examples
2.		Basic properties of infinite series
3.		Convergence and divergence of infinite series
4.		Cauchy criterion for convergence of infinite series
5.		Discussion on different types of convergence tests of series
6.		Comparison test, problems
7.		Limit comparison test, problems
8.		Ratio test, problems
9.		Cauchy's nth root test and testing of convergence by using Cauchy's nth root test
10.		Idea for Integral test
11.		Discussion on Alternating series
12.		Idea for Leibniz test and convergence test of alternating series by Leibniz test
13.		Introduction to Absolute and conditional convergence of alternating series
14.		Problems for testing absolute and conditional convergence of infinite series
15.	Graphical Demonstration (Teaching Aid)	Tutorial on different types of convergence tests of infinite series
16.		Plotting of recursive sequences.
17.		Study the convergence of sequences through plotting
18.		Problems
19.		Verify Bolzano-Weierstrass theorem through plotting of sequences and hence identify convergent subsequences from the plot
20.	Broad topic in	Problems
Sr. No. of		Topic to be covered in the Lecture



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TEACHING PLAN

Lect.	university syllabus	
21.		Study the convergence/divergence of in finite series by plotting their sequences of partial sum
22.		Problems
23.		Cauchy's root test by plotting nth roots
24.		Problems
25.		Ratio test by plotting the ratio of nth and (n+1)th term
26.		Problems
27.		Tutorial on plotting
28.		Doubt Clearing
29.		Previous year university question papers discussion
30.		Class Test

Dept. of Mathematics



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TEACHING PLAN

Name of the Department: Mathematics

Name of the Teacher: Dr. Shreyasi Jana

Name and Distinctive No. of the paper: Multivariate Calculus (C9T)

Session: 2022-2023

Semester: IV

No. of Lecture	Broad Topic in University Syllabus	Topic to be covered in the Lecture	
1.	(UNIT- 1) Functions of Several Variables	Introduction to Functions of several variables	
2.		Limit and continuity of functions of two or more variables	
3.		Problems	
4.		Partial differentiation	
5.		Total differentiability and differentiability	
6.		Problems discussion	
7.		Sufficient condition for differentiability	
8.		Chain rule for one and two independent parameters	
9.		Examples	
10.		Directional derivatives	
11.		The gradient	
12.		Maximal and normal property of the gradient	
13.		Tangent planes	
14.		Extrema of functions of two variables Problems	
15.		Method of Lagranges multiplier	
16.		Constrained optimization problems	
17.	Problem Discussion	Problem discussion on chain rules	
18.		Problem discussion on testing maxima or minima of functions of several variables	
19.		Discussion on previous year University question papers	
20.		Doubt clearing	
21.		(Unit 2) Double Integration	Double integration over rectangular region
22.			Examples
23.			Double integration over non-rectangular region
24.			Examples



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TEACHING PLAN

Name of the Department: Mathematics

Name of the Teacher: Dr. Shreyasi Jana

Name and Distinctive No. of the paper: Partial Differential Equations and Applications (C11T)

Session: 2022-2023

Semester: V

Sr. No. of Lecture	Broad Topic in University Syllabus	Topic to be covered in the Lecture
1.	(Unit-I) Partial Differential Equation	Introduction to Partial Differential Equation(PDE)-Basic concepts, definition, mathematical problems
2.		First order PDE and its classification
3.		Discussion of some problems
4.		Construction and Geometrical Interpretation of first order pde
5.		Problem Solving
6.		Method of Characteristics for obtaining General Solution of Quasi Linear Equations
7.		Canonical Forms of First order Linear Equations
8.		Discussion of different problems
9.		Method of Separation of Variables for solving first order pde
10.		Worked examples
11.		Doubt clearing
12.	(Unit-II) Heat, Wave and Laplace Equation	Derivation of Heat equation with examples
13.		Solving problems of heat equation
14.		Derivation of Wave equation
15.		Solving problems of wave equation
16.		Derivation of Laplace equation with examples



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TEACHING PLAN

17.		Classification of second order linear equations as hyperbolic, parabolic or elliptic
18.		Reduction of second order Linear Equations to canonical forms
19.		Problem Discussion
20.		Doubt Clearing
21.		Class Test
22.	(Unit-III) Vibrating String and Heat Conduction Problem	Cauchy problem of an infinite string
23.		Problems
24.		Initial Boundary Value Problems
25.		Semi-Infinite String with a fixed end
26.		Semi-Infinite String with a Free end
27.		Discussion of problems on vibrating string
28.		Equations with non-homogeneous boundary conditions
29.		Non- Homogeneous Wave Equation
30.		Problem solving
31.		Method of separation of variables
32.		Problems
33.		Solving the Vibrating String Problem
34.		Solving the Heat Conduction problem
35.		Examples
36.		Solving Various Problems
37.		Doubt Clearing
38.		Tutorial
39.		Introduction to Central force
40.		Problems of central orbit
41.		Discussion on Constrained motion
42.		Examples



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43.	(Unit-IV) Dynamics	Problems of varying mass
44.		Solving different problems of constrained motion
45.		Derivation of tangent and normal components of acceleration
46.		Problems
47.		Discussion on modelling ballistics and planetary motion
48.		Different problems on planetary motion
49.		Kepler's second law
50.		Examples
51.		Problems
52.		Doubt Clearing
53.		Doubt Clearing
54.		Tutorial
55.		Different problem solving
56.		Previous year question papers solving
57.		Previous year question papers solving
58.		Different problem solving
59.		Summary
60.		Class Test



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TEACHING PLAN

Name of the Department: Mathematics

Name of the Teacher: Dr. Shreyasi Jana

Name and Distinctive No. of the paper: Metric Spaces & Complex Analysis (C13T)

Session:2022-2023

Semester: VI

Sr. No. of Lecture	Broad Topic in University Syllabus	Topic to be covered in the Lecture
1.	(UNIT- 3) Complex Numbers: Limit, Continuity and Differentiability	Introduction to complex numbers
2.		Limits, Limits involving the point at infinity
3.		Continuity
4.		Properties of complex numbers
5.		Region in the complex plane
6.		Functions of complex variables
7.		Definition of Mappings, examples
8.		Discussion on Derivatives
9.		Differentiation formulas
10.		Cauchy- Riemann equations
11.		Problems
12.		Sufficient conditions for differentiability
13.		Problem Discussion
14.		Tutorial on Cauchy Riemann equations
15.		Doubt Clearing and previous year university questions discussion
16.	(Unit 4) Analytic Function	Examples of analytic functions
17.		Exponential function
18.		Logarithmic function
19.		Trigonometric function
20.	Contour Integrals	Derivatives of functions
21.		Contours
22.		Contour integrals and its examples
23.		Upper bounds for moduli of contour integrals
24.		Cauchy- Goursat theorem
25.		Examples
Sr. No. of Lect.	Broad topic in university Syllabus	Topic to be covered in the Lecture



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TEACHING PLAN

26.		Cauchy integral formula
27.		Problem discussion
28.		Tutorial
29.		Tutorial
30.	(Unit 5) Liouville's theorem	Liouville's theorem
31.		The fundamental theorem of algebra
32.		Convergence of sequences and series
33.		Examples
34.		Taylor series and its examples
35.	(Unit -6) Laurent Series and Power Series	Laurent series and its examples
36.		Power Series
37.		Absolute and uniform convergence
38.		Problem Discussion
39.		Doubt Clearing and previous year university questions discussion
40.		Class test



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Name of the Department: BOTANY

Name of the Teacher: DR. UTTAM KUMAR KANP

Name and Distinctive Number of the Paper: PHYCOLOGY AND MICROBIOLOGY
(CC1 T & P)

Session: 2022-2023 (JULY'2022 –DEC'2022)

Semester: I (HONOURS)

Sr. No. of Lecture	Broad Topic in University Syllabus	Topic to be Covered in the Lecture
Lecture 01	Theory Unit 3: Bacteria	Discovery and general characteristic of bacteria.
Lecture 02		Eubacteria and wall less forms
Lecture 03		Cell structure, Nutrition types of bacteria.
Lecture 04		Reproduction- vegetative and asexual
Lecture 05		Reproduction-Recombination.
Lecture 06	Unit 4: Algae	General characteristics of algae.
Lecture 07		Ecology, distribution, range of thallus organization of algae.
Lecture 08		Cell structure and components
Lecture 09		Cell wall, Pigment system, reserve food of Algae.
Lecture 10		Types of flagella, methods of reproduction of algae.
Lecture 11		Classification: Criteria, system of Fritsch.
Lecture 12		Evolutionary classification of Lee and Van-den Hoeke t. al.
Lecture 13		Significant contributions of important phycologists.
Lecture 14		Role of algae in the environment, agriculture, biotechnology and industry.
Lecture 15	Unit 5: Cyanophyta and Xanthophyta	Cyanophyta: Ecology and occurrence, range of thallus organization, cell structure, reproduction, morphology.
Lecture 16		Xanthophyta: Ecology and occurrence range of thallus organization, cell structure, reproduction, morphology.



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Lecture 17		Life cycle of <i>Nostoc</i> .
Lecture 18		Life cycle of <i>Vaucheria</i> .
Lecture 19		Revision
Lecture 20		Revision
Lecture 21		Revision
Practical 1	<u>Practical</u> Microbiology	Electron micrographs/Models of viruses – T-Phage and TMV, Line drawings/ Photographs of Lytic and Lysogenic Cycle.
Practical 2		Types of Bacteria to be observed from temporary/permanent slides/photographs.
Practical 3		Electron micrographs of bacteria, binary fission, endospore, conjugation, root Nodule.
Practical 4		Gram staining.
Practical 5		Endospore staining with malachite green using the (endospores taken from soil bacteria).
Practical 6		Study of bacteria from root nodules/Curd sample.



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Name of the Department: BOTANY

Name of the Teacher: DR. UTTAM KUMAR KANP

Name and Distinctive Number of the Paper: ECONOMIC BOTANY (CC6 T & P)

Session: 2022-2023 (JULY'2022 – DEC'2023)

Semester: III (HONOURS)

Sr. No. of Lecture	Broad Topic in University Syllabus	Topic to be Covered in the Lecture
Lecture 01	Theory Unit 4: Source of sugars and starches	Morphology cultivation, management and processing of sugarcane, products and by-products of sugarcane industry.
Lecture 02		Potato – morphology, propagation & uses.
Lecture 03	Unit 5: Spices	Listing of important spices, their family and part used. Economic importance with special reference to fennel, saffron, clove and black pepper
Lecture 4	Unit 6: Beverages	Tea: morphology, processing & uses.
Lecture 5		Coffee: morphology, processing & uses.
Lecture 6	Unit 7: Sources of oils and fats	General description, classification, extraction, their uses and health implications of groundnut, coconut, linseed (Botanical name, family & uses).
Lecture 7		General description, classification, extraction, their uses and health implications of soybean, mustard and coconut (Botanical name, family & uses).
Lecture 8		Essential Oils: General account, extraction methods, comparison with fatty oils & their uses.
Lecture 9		Revision
Lecture 10		Revision
Lecture 12		Revision
Practical 1	Practical Economic botany	Cereals: Wheat (habit sketch, L. S/T.S. grain, starch grains, micro-chemical tests) Rice (habit sketch,



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		study of paddy and grain, starch grains, micro-chemical tests).
Practical 2		Legumes: Soybean, Groundnut, (habit, fruit, seed structure, micro-chemical tests).
Practical 3		Sources of sugars and starches: Sugarcane (habit sketch; cane juice- micro-chemical tests), Potato (habit sketch, tuber morphology, T.S. tuber to show localization of starch grains, w.m. starch grains, micro-chemical tests).
Practical 4		Spices: Black pepper, Fennel and Clove (habit and sections).
Practical 5		Beverages: Tea (plant specimen, tea leaves), Coffee (plant specimen, beans).
Practical 6		Sources of oils and fats: Coconut- T.S. nut, Mustard–plant specimen, seeds; tests for fats in crushed seeds



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Name of the Department: BOTANY

Name of the Teacher: DR. UTTAM KUMAR KANP

Name and Distinctive Number of the Paper: PLANT PHYSIOLOGY (CC12 T & P)

Session: 2022-2023 (JULY'2022 –DEC'2022)

Semester: V (HONOURS)

Sr. No. of Lecture	Broad Topic in University Syllabus	Topic to be Covered in the Lecture
Lecture 01	Theory Unit 5: Plant growth regulators	Discovery, chemical nature (basic structure), bioassay and physiological roles of - Auxin,
Lecture 02		-Gibberellins,,
Lecture 03		-Cytokinin
Lecture 04		-Abscisic acid,
Lecture 05		-Ethylene,
Lecture 06		-Brassinosteroids and Jasmonic acid
Lecture 07	Unit 6: Physiology of flowering	Photoperiodism, flowering stimulus, florigen concept,
Lecture 08		vernalization,
Lecture 09		seed dormancy.
Lecture 10	Unit 7: Phytochrome, crytochromes and phototropins	Discovery, chemical nature, role in photomorphogenesis.
Lecture 11		low energy responses (LER) and high irradiance responses (HIR), mode of action.
Lecture 12		Revision
Lecture 13		Revision
Lecture 14		Revision
Practical 1	Practical	Calculation of stomatal index and stomatal frequency from the two surfaces of leaves of a mesophyte.
Practical 2		Calculation of stomatal index and stomatal frequency from the two surfaces of leaves of a xerophyte.
Practical 3		To calculate the area of an open stoma and percentage of leaf area open through stomata in a mesophyte (both surfaces).
Practical 4		To calculate the area of an open stoma and percentage of leaf area open through stomata in a



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		xerophyte (both surfaces).
Practical 5		To study the phenomenon of seed germination (effect of light).
Practical 6		To study the effect of different concentrations of IAA on <i>Avena</i> coleoptile elongation (IAA Bioassay).
Practical 7		To study the induction of amylase activity in germinating barley grains.
Practical 8		To demonstrate suction due to transpiration.
Practical 9		Fruit ripening/Rooting from cuttings (Demonstration).
Practical 10		Bolting experiment/ <i>Avena</i> coleoptiles bioassay (demonstration).



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Name of the Department: BOTANY

Name of the Teacher: DR. UTTAM KUMAR KANP

Name and Distinctive Number of the Paper: PLANT BREEDING (DSE 2T & P)

Session: 2022-2023 (JULY'2022 –DEC'2022)

Semester: V (HONOURS)

Sr. No. of Lecture	Broad Topic in University Syllabus	Topic to be Covered in the Lecture
Lecture 01	Theory Unit 1: Plant breeding	Introduction and objectives of breeding systems.
Lecture 02		Modes of reproduction in crop plants.
Lecture 03		Important achievements and undesirable consequences of plant breeding.
Lecture 04	Unit 2: Methods of Crop improvement	Introduction: Centres of origin and domestication of crop plants
Lecture 05		plant genetic resources; Acclimatization.
Lecture 067		Selection methods: For self pollinated propagated plants.
Lecture 07		cross pollinated and vegetative propagated plants.
Lecture 08		Hybridization: For self, propagated plants – Procedure, advantages and limitations.
Lecture 9		Hybridization: For cross propagated plants – Procedure, advantages and limitations.
Lecture 10	Hybridization: For vegetative propagated plants – Procedure, advantages and limitations.	
Lecture 11		Revision
Lecture 12		Revision
Lecture 13		Revision
Practical 1	Practical Plant Breeding	Identification of offspring's having parental genotypes and recombinant genotypes, based on combination of morphological attributes in a dihybrid cross.
Practical 2		Processes of emaculation – By applying higher temperature.



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Practical 3		Processes of emaculation –By amputing anthers
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Name of the Department: BOTANY

Name of the Teacher: DR. UTTAM KUMAR KANP

Name and Distinctive Number of the Paper: ARCHEGONIATE (CC 4 T)

Session: 2022-2023 (JAN'2023 –JUNE'2023)

Semester: II (HONOURS)

Sr. No. of Lecture	Broad Topic in University Syllabus	Topic to be Covered in the Lecture
Lecture 01	Unit 3: Type studies- Bryophytes	Classification (up to family),
Lecture 02		Morphology, anatomy and reproduction of - <i>Riccia</i>
Lecture 03		- <i>Marchantia</i>
Lecture 04		- <i>Pellia</i>
Lecture 05		- <i>Porella</i>
Lecture 06		- <i>Anthoceros</i>
Lecture 07		- <i>Sphagnum</i>
Lecture 08		- <i>Funaria and Pogonatum</i>
Lecture 09		Reproduction and evolutionary trends in <i>Riccia</i> , <i>Marchantia</i> , <i>Plagichasma</i> , <i>Anthoceros</i> and <i>Funaria</i> (developmental stages not included).
Lecture 10		Ecological and economic importance of bryophytes with special reference to <i>Sphagnum</i> .
Lecture 11		Revision
Lecture 12		Revision
Lecture 13		Revision



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Name of the Department: BOTANY

Name of the Teacher: DR. UTTAM KUMAR KANP

Name and Distinctive Number of the Paper: MOLECULAR BIOLOGY_(CC8 T)

Session: 2022-2023 (JAN'2023 –JUNE'2023)

Semester: IV (HONOURS)

Sr. No. of Lecture	Broad Topic in University Syllabus	Topic to be Covered in the Lecture
Lecture 01	Unit- 1: Nucleic acids: Carriers of genetic information	Historical perspective;
Lecture 02		DNA as the carrier of genetic information - Griffith's experiment.
Lecture 03		-Hershey & Chase experiment.
Lecture 04		-Avery, McLeod & McCarty experiment.
Lecture 05		-Fraenkel-Conrat's experiment.
Lecture 06	Unit -2. The Structures of DNA and RNA / Genetic Material	DNA Structure: Miescher to Watson and Crick- historic perspective.
Lecture 07		DNA structure, Salient features of double helix.
Lecture 08		Types of DNA.
Lecture 09		Types of genetic material, denaturation and renaturation.
Lecture 10		Cot curves; Organization of DNA-Prokaryotes, Viruses, Eukaryotes.
Lecture 11		RNA Structure.
Lecture 12		Organelle DNA - mitochondria and chloroplast DNA.
Lecture 13		The Nucleosome.
Lecture 14		Chromatin structure- Euchromatin.
Lecture 15		Heterochromatin- Constitutive and Facultative heterochromatin.
Lecture 16	Unit- 3: The replication of DNA	Chemistry of DNA synthesis (Kornberg's discovery);
Lecture 17		General principles – bidirectional, semiconservative and semi discontinuous replication,
Lecture 18		RNA priming;
Lecture 19		Various models of DNA replication, including rolling



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		circle,
Lecture 20		θ (theta) mode of replication,
Lecture 21		replication of linear ds-DNA,
Lecture 22		replication of the 5' end of linear chromosome;
Lecture 23		Enzymes involved in DNA replication.
Lecture 24		Revision
Lecture 25		Revision



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Name of the Department: BOTANY

Name of the Teacher: DR. UTTAM KUMAR KANP

Name and Distinctive Number of the Paper: PLANT METABOLISM (CC13 T)

Session: 2022-2023 (JAN'2023 –JUNE'2023)

Semester: VI (HONOURS)

Sr. No. of Lecture	Broad Topic in University Syllabus	Topic to be Covered in the Lecture
Lecture 01	Unit 1: Concept of metabolism	Introduction, anabolic and catabolic pathways.
Lecture 02		Regulation of metabolism.
Lecture 03		Role of regulatory enzymes (allosteric, covalent modulation and Isozymes).
Lecture 04	Unit 2: Carbon assimilation	Historical background, photosynthetic pigments.
Lecture 05		Role of photosynthetic pigments (chlorophylls and accessory pigments).
Lecture 06		Antenna molecules and reaction centres,
Lecture 07		Photochemical reactions, photosynthetic electron transport, PSI, PSII, Q cycle,
Lecture 08		CO ₂ reduction,
Lecture 09		photorespiration,
Lecture 10		C ₄ pathways;
Lecture 11		Crassulacean acid metabolism;
Lecture 12		Factors affecting CO ₂ reduction.
Lecture 13		Unit 3: Carbohydrate metabolism
Lecture 14	Unit 4: Carbon Oxidation	Glycolysis.
Lecture 15		Fate of pyruvate, regulation of glycolysis.
Lecture 16		Oxidative pentose phosphate pathway.
Lecture 17		Oxidative decarboxylation of pyruvate.
Lecture 18		Regulation of PDH, NADH shuttle.
Lecture 19		TCA cycle.
Lecture 20		Amphibolic role, anaplerotic



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		reactions, regulation of the cycle.
Lecture 21		Mitochondrial electron transport.
Lecture 22		Oxidative phosphorylation.
Lecture 23		Cyanide-resistant respiration.
Lecture 24		Factors affecting respiration.
Lecture 25		Revision
Lecture 26		Revision



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Name of the Department: BOTANY

Name of the Teacher: DR. UTTAM KUMAR KANP

Name and Distinctive Number of the Paper: PLANT BIOTECHNOLOGY(CC14T)

Session: 2022-2023 (JAN'2023 –JUNE'2023)

Semester: VI (HONOURS)

Sr. No. of Lecture	Broad Topic in University Syllabus	Topic to be Covered in the Lecture
Lecture 01	Unit -1: Plant Tissue Culture	Historical perspective.
Lecture 02		Composition of media.
Lecture 03		Nutrient and hormone requirements (role of vitamins and hormones).
Lecture 04		Totipotency; Organogenesis.
Lecture 05		Embryogenesis (somatic and zygotic).
Lecture 06		Protoplast isolation, culture and fusion.
Lecture 07		Tissue culture applications (micropropagation, androgenesis, virus elimination).
Lecture 08		Secondary metabolite production.
Lecture 09		Haploids, triploids and hybrids.
Lecture 10		Cryopreservation; Germplasm Conservation).
Lecture 11	Unit- 2: Recombinant DNA technology	Restriction Endonucleases - History, Types I-IV.
Lecture 12		Restriction Endonucleases biological role and application.
Lecture 13		Restriction Mapping (Linear and Circular).
Lecture 14		Cloning Vectors - Prokaryotic pUC 18 and pUC19.
Lecture 15		- pBR322, Ti plasmid, BAC.
Lecture 16		Lambda phage.
Lecture 17		M13 phagemid.
Lecture 18		Cosmid, Shuttle vector.
Lecture 19		Eukaryotic Vectors (YAC).
Lecture 20	Unit- 3:Gene Cloning	Recombinant DNA.
Lecture 21		Bacterial Transformation and selection of recombinant clones.
Lecture 22		PCR mediated gene cloning.



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Lecture 23		Gene Construct; construction of genomic and cDNA libraries.
Lecture 24		Screening DNA libraries to obtain gene of interest by genetic selection; complementation, colony hybridization.
Lecture 25		PCR.
Lecture 26		Revision
Lecture 27		Revision



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Name of the Department: **English**

Name of the Teacher: **Soma Debray**

Name and Distinctive Number of the Paper: **CC2 (C2T)**

Session: **2022-2023**

Semester: **1st**

Sl. No. of Lecture	Board Topic in University Syllabus	Topic to be Covered in the Lectures
Lecture 01	Background Reading: <i>Theatre and Elizabethan England</i>	Origins of Western Theatre
Lecture 02		Greek and Roman Theatrical scenes
Lecture 03		The Elizabethan Age
Lecture 04		The Elizabethan Age
Lecture 05		Theatre in the Elizabethan times
Lecture 06		Precursors of Shakespeare
Lecture 07		Shakespeare and his contemporaries
Lecture 08		Shakespearean dramatic canon and the poetry of Shakespeare
Lecture 09	William Shakespeare: <i>Macbeth</i>	Introduction to <i>Macbeth</i>
Lecture 10		Story of <i>Macbeth</i>
Lecture 11		Reading and Analysis of The Text 01
Lecture 12		Reading and Analysis of The Text 02
Lecture 13		Reading and Analysis of The Text 03
Lecture 14		Reading and Analysis of The Text 04
Lecture 15		Reading and Analysis of The Text 05
Lecture 17		Reading and Analysis of The Text 06
Lecture 18		Reading and Analysis of The Text 07
Lecture 19		Reading and Analysis of The Text 08
Lecture 20		Reading and Analysis of The Text 09
Lecture 21		Reading and Analysis of The Text 10
Lecture 22		Reading and Analysis of The Text 11



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Lecture 23		Reading and Analysis of The Text 12
Lecture 24		Reading and Analysis of The Text 13
Lecture 25		Reading and Analysis of The Text 14
Lecture 26		Reading and Analysis of The Text 15
Lecture 27		Shakespearean Tragedy
Lecture 28		Macbeth as a Tragic Hero
Lecture 29		Characters in <i>Macbeth</i>
Lecture 30		Characters in <i>Macbeth</i>
Lecture 31		Plot of <i>Macbeth</i>
Lecture 32		Role of Fate in <i>Macbeth</i>
Lecture 33		The Supernatural in <i>Macbeth</i>
Lecture 34		The opening Scene of <i>Macbeth</i>
Lecture 35		The Porter Scene and Humour in <i>Macbeth</i>
Lecture 36		Soliloquies in <i>Macbeth</i>
Lecture 37		Discussion of the Cinematic Adaptation and other Modern Adaptations & Translations
Lecture 38		Discussions of Short Questions
Lecture 39		Discussions of Short Questions
Lecture 40		Revision Class
Lecture 41		Revision Class
Lecture 42		Revision Class
Lecture 43	<i>Critical Terms</i>	Allegory, Ballad, Blank-Verse, Heroic Couplet, Bathos
Lecture 44		Comedy, Dramatic Monologue, Elegy, Image, Ode



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Lecture 45		Carpe-diem, Soliloquy, Symbol, Tragedy, Catharsis
Lecture 46		Hamartia, Three Unities, Anagnorisis, Antagonist, Chorus
Lecture 47		Denouement, Comic-relief, Aside, Anti-Hero, Catastrophe
Lecture 48		Revision
Lecture 49		Revision
Lecture 50		Revision

Lecture 44		Comedy, Dramatic Monologue, Elegy, Image, Ode
Lecture 45		Carpe-diem, Soliloquy, Symbol, Tragedy, Catharsis
Lecture 46		Hamartia, Three Unities, Anagnorisis, Antagonist, Chorus
Lecture 47		Denouement, Comic-relief, Aside, Anti-Hero, Catastrophe
Lecture 48		Revision
Lecture 49		Revision
Lecture 50		Revision



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Name of the Department: **English**

Name of the Teacher: **Soma Debray**

Name and Distinctive Number of the Paper: **CC5 (C5T)**

Session: **2022-2023**

Semester: **3rd**

Sl. No. of Lecture	Board Topic in University Syllabus	Topic to be Covered in the Lectures
Lecture 01	Background Reading: <i>British Novel</i>	19 th century England: Society and Politics
Lecture 02		19 th century philosophy
Lecture 03		Locke; Mill; Utilitarianism
Lecture 04		The rise of the novel
Lecture 05		The rise of the novel
Lecture 06		The rise of the novel
Lecture 07		The works of Dickens
Lecture 08		The story: <i>Hard Times</i>
Lecture 09	Charles Dickens: <i>Hard Times</i>	Analytical reading of the text
Lecture 10		Analytical reading of the text
Lecture 11		Analytical reading of the text
Lecture 12		Analytical reading of the text
Lecture 13		Analytical reading of the text
Lecture 14		Analytical reading of the text
Lecture 15		Analytical reading of the text
Lecture 17		Analytical reading of the text
Lecture 18		Analytical reading of the text
Lecture 19		Analytical reading of the text



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Lecture 20	Analytical reading of the text
Lecture 21	Analytical reading of the text
Lecture 22	Analytical reading of the text
Lecture 23	Analytical reading of the text
Lecture 24	Analytical reading of the text
Lecture 25	Analytical reading of the text
Lecture 26	Plot of <i>Hard Times</i>
Lecture 27	Major characters of <i>Hard Times</i>
Lecture 28	Minor characters of <i>Hard Times</i>
Lecture 29	Symbolism in <i>Hard Times</i>
Lecture 30	Class conflict in <i>Hard Times</i>
Lecture 31	Humour in <i>Hard Times</i>
Lecture 32	The title <i>Hard Times</i>
Lecture 33	<i>Hard Times</i> as a Dickensian novel
Lecture 34	Language of <i>Hard Times</i>
Lecture 35	Discussion of short questions
Lecture 36	Discussion of short questions
Lecture 37	Discussion of short questions
Lecture 38	Discussion of short questions
Lecture 39	Discussion of short questions
Lecture 40	Revision & practise
Lecture 41	Revision & practise
Lecture 42	Revision & practise
Lecture 43	Revision & practise



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Lecture 44		Revision & practise
Lecture 45		Revision & practise
Lecture 46		Revision & practise
Lecture 47		Revision & practise
Lecture 48		Revision & practise
Lecture 49		Revision & practise
Lecture 50		Revision & practise



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Name of the Department: **English**

Name of the Teacher: **Soma Debray**

Name and Distinctive Number of the Paper: **DSC1C (DSC1CT)**

Session: **2022-2023**

Semester: **3rd**

Sl. No. of Lecture	Board Topic in University Syllabus	Topic to be Covered in the Lectures
Lecture 01	Background Reading: <i>Women and Violence</i>	Women in India
Lecture 02		Violence faced by women down the ages
Lecture 03		Post-colonial women
Lecture 04		Dalit women in India
Lecture 05		Status of Minority women
Lecture 06		Women movements against women
Lecture 07		Women activists
Lecture 08		Marginalisation of women
Lecture 09	<i>Karukku</i>	Analytical reading of the text: <i>Karukku</i>
Lecture 10		Analytical reading of the text: <i>Karukku</i>
Lecture 11		Analytical reading of the text: <i>Karukku</i>
Lecture 12		Analytical reading of the text: <i>Karukku</i>
Lecture 13		Analytical reading of the text: <i>Karukku</i>
Lecture 14		Analytical reading of the text: <i>Karukku</i>
Lecture 15		Analytical reading of the text: <i>Karukku</i>
Lecture 17		Analytical reading of the text: <i>Karukku</i>
Lecture 18		Analytical reading of the text: <i>Karukku</i>
Lecture 19		Analytical reading of the text: <i>Karukku</i>



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Lecture 20		Analytical reading of the text: <i>Karukku</i>
Lecture 21		Analytical reading of the text: <i>Karukku</i>
Lecture 22		Analytical reading of the text: <i>Karukku</i>
Lecture 23		Analytical reading of the text: <i>Karukku</i>
Lecture 24		Analytical reading of the text: <i>Karukku</i>
Lecture 25		Analytical reading of the text: <i>Karukku</i>
	<i>Sultana's Dream</i>	
Lecture 26		Analytical reading of the text: <i>Sultana's Dream</i>
Lecture 27		Analytical reading of the text: <i>Sultana's Dream</i>
Lecture 28		Analytical reading of the text: <i>Sultana's Dream</i>
Lecture 29		Analytical reading of the text: <i>Sultana's Dream</i>
Lecture 30		Analytical reading of the text: <i>Sultana's Dream</i>
Lecture 31		Analytical reading of the text: <i>Sultana's Dream</i>
Lecture 32		Analytical reading of the text: <i>Sultana's Dream</i>
Lecture 33		Analytical reading of the text: <i>Sultana's Dream</i>
Lecture 34		Analytical reading of the text: <i>Sultana's Dream</i>
Lecture 35	Analytical reading of the text: <i>Sultana's Dream</i>	



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Lecture 36		Discussion of short questions
Lecture 37		Discussion of short questions
Lecture 38		Discussion of short questions
Lecture 39		Discussion of short questions
Lecture 40		Revision & practise
Lecture 41		Revision & practise
Lecture 42		Revision & practise
Lecture 43		Revision & practise
Lecture 44		Revision & practise
Lecture 45		Revision & practise
Lecture 46		Revision & practise
Lecture 47		Revision & practise
Lecture 48		Revision & practise
Lecture 49		Revision & practise
Lecture 50		Revision & practise



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Name of the Department: **English**

Name of the Teacher: **Soma Debray**

Name and Distinctive Number of the Paper: **CC11 (C11T)**

Session: **2022-2023**

Semester: **5th**

Sl. No. of Lecture	Board Topic in University Syllabus	Topic to be Covered in the Lectures
Lecture 01	Background Reading: <i>Colonial / Post Colonial</i>	Western Colonisers: society/ culture/ tradition/ education
Lecture 02		De-colonising movements
Lecture 03		New literature in the making
Lecture 04		The politics of identity, race & gender
Lecture 05		Africa: a new world vis-à-vis the old
Lecture 06		Writing from New Africa
Lecture 07		Chinua Achebe and the beginnings
Lecture 08	Chinua Achebe: <i>Things Fall Apart</i>	The story: <i>Things Fall Apart</i>
Lecture 09		Analytical reading of the text <i>Things Fall Apart</i>
Lecture 10		Analytical reading of the text <i>Things Fall Apart</i>
Lecture 11		Analytical reading of the text <i>Things Fall Apart</i>
Lecture 12		Analytical reading of the text <i>Things Fall Apart</i>
Lecture 13		Analytical reading of the text <i>Things Fall Apart</i>
Lecture 14		Analytical reading of the text <i>Things Fall Apart</i>
Lecture 15		Analytical reading of the text <i>Things Fall Apart</i>
Lecture 16		Analytical reading of the text <i>Things Fall Apart</i>
Lecture 17		Analytical reading of the text <i>Things Fall Apart</i>



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Lecture 18		Analytical reading of the text <i>Things Fall Apart</i>
Lecture 19		Analytical reading of the text <i>Things Fall Apart</i>
Lecture 20		Analytical reading of the text <i>Things Fall Apart</i>
Lecture 21		Analytical reading of the text <i>Things Fall Apart</i>
Lecture 22		Analytical reading of the text <i>Things Fall Apart</i>
Lecture 23		Analytical reading of the text <i>Things Fall Apart</i>
Lecture 24		Major characters in <i>Things Fall Apart</i>
Lecture 25		Minor characters in the novel
Lecture 26		Storytelling in Achebe
Lecture 27		Gender concerns in Achebe's novel
Lecture 28		Significance of the title
Lecture 29		Concept of time in <i>Things Fall Apart</i>
Lecture 30		Discussions of Short questions
Lecture 31		Discussions of Short questions
Lecture 32		Revision
Lecture 33		Revision
Lecture 34		Tradition of short story in African literature
Lecture 35	Short Story: <i>The Collector of Treasures</i> by Bessie Head	Reading the story <i>The Collector of Treasures</i> analytically
Lecture 36		Reading the story <i>The Collector of Treasures</i> analytically
Lecture 37		Reading the story <i>The Collector of Treasures</i> analytically



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Lecture 38		Reading the story <i>The Collector of Treasures</i> analytically
Lecture 39		Reading the story <i>The Collector of Treasures</i> analytically
Lecture 40		Plot of the story <i>The Collector of Treasures</i>
Lecture 41		Title of the story <i>The Collector of Treasures</i>
Lecture 42		Characters in the story <i>The Collector of Treasures</i>
Lecture 43		Discussion of short questions
Lecture 44		Revision
Lecture 45		Revision

Name of the Department: **English**



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Name of the Teacher: **Soma Debray**

Name and Distinctive Number of the Paper: **DSE1 (DSE1T)**

Session: **2022-2023**

Semester: **5th**

Sl. No. of Lecture	Board Topic in University Syllabus	Topic to be Covered in the Lectures
Lecture 01	Background Reading – <i>Developments in Russian Literature</i>	Russian society and history
Lecture 02		Literary movements and development of Russian novel
Lecture 03		The Detective novel and Psychoanalysis
Lecture 04	Fyodor Dostoevsky: <i>Crime and Punishment</i>	<i>Crime and Punishment</i> : story in brief
Lecture 05		Reading and Analysis of The Text
Lecture 06		Reading and Analysis of The Text
Lecture 07		Reading and Analysis of The Text
Lecture 08		Reading and Analysis of The Text
Lecture 09		Reading and Analysis of The Text
Lecture 10		Reading and Analysis of The Text
Lecture 11		Reading and Analysis of The Text
Lecture 12		Reading and Analysis of The Text
Lecture 13		Reading and Analysis of The Text
Lecture 14		Reading and Analysis of The Text
Lecture 15		Reading and Analysis of The Text
Lecture 16		Reading and Analysis of The Text
Lecture 17		Reading and Analysis of The Text
Lecture 18		Reading and Analysis of The Text
Lecture 19		Reading and Analysis of The Text



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Lecture 20		Reading and Analysis of The Text
Lecture 21		Reading and Analysis of The Text
Lecture 22		Technique of the detective
Lecture 23		The protagonist
Lecture 24		Major characters
Lecture 25		Minor characters
Lecture 26		Faith and redemption
Lecture 27		Morality
Lecture 28		Women in the novel
Lecture 30		Discussion of short questions
Lecture 31		Discussion of short questions
Lecture 32		Discussion of short questions