

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)

Convener/ Academic Committee

Convenor

Academic Committee

Narajole Ra; College

Narajole, PIN 7212

Members :-

1. Dr. N. Bhattacharyya

Peague framite Mondel 2. Dr. R. Debnath 3. Prof. P. P. Mondal

4. Prof. N. Bhakat

5. * Arif Iqbal Mallick

6. Prof. Anustup Chattopadhyay

7. Dr. Md. Aziz

8. Dr. Mangal Kr, Nayak

9. Prof. Subhasis Das

10. Dr. Poulami Adhikari Mukherjee

11. Dr. Tanuka Achary

12. Dr. Akul Rana

13. Dr. Parimal Dua

14. Prof. Mosibul Ali Sk Mosibul Ale

15. Dr. Atanu Nanda

16. Prof. Barun Rout





মিটিং রেজল্যুশন বহি MEETING RESOLUTION BOOK

স্থান / Place উপস্তিত সভ্যগণের নাম निर नर / Meeting No. 2.30 P.M সময়/Time NAME OF MEMBERS PRESENT 26.07.202 তারিখ/Date VI B. Arif Igbal Mallich Sal 15. Wargod Kumon Nayou Sul 16. Soumendu 9. & Mosibul Ali soi 10. Subhasis Dens 59 1 17. 561 18. y 551 19. 201 20. 251 21. 917. Nanolitz Bhakak

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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. Soumendu Bisoi	22.12.2022	20



1						
3	Add on Course on Ancient Indian	AOCAIHC	History, Philosophy and Sanskrit	Dr. Bhakti Pada Jana, Dr.	02.03.2023 -23.03.2023	115
	History and Culture.		and Sanskiit	Rabindranath		
				Maity and		
				Singray Tudu		
4	Add on Course on	AOCFBG	Bengali	Dr. Dipak	23.03.2023	30
	Functional Bengali	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		Shom	-	
	and Grammar.			Approximation of the control of the	27.06.2023	
5	Add on Course on	AOCICP	Political	Prasenjit	03.05.2023-	25
	Indian Constitution &	10 00-200	Science	Senapoti and	30.06.2023	
	Polity.			Supen Sarkar		
6	Add on Course on	AOCAR	History	Dr. Mangal	22.05.2023	30
	Archival Research.			Kumar Nayak	-30.06.2023	
		¥		and Baisali		
				Guha	26052002	15
7	Add on Course on	AOCWRM	Geography	Ishita Biswas	26.05.2023	15
	Water Resource		10		-27.06.2023	
0	Management.	AOCEME	English	Dragna	01.06.2023	50
8	Add on Course on English Writing Skills.	AOCEWS	Eligiisii	Pragna Paramita	-30.06.2023	30
1	Eligiish writing skins.			Mondal	-50.00.2025	
9	Add on Course on	AOCHC	Chemistry	Dr. Sk	13.06.2023	15
	Household	Accirc	Chemistry	Mohammad	-	13
	Chemistry (Grihasthali			Aziz and	30.06.2023	
	rasayanik toirir jonnyo			Dr.		
	laboratoryte hate			Soumendu		
	kolome prasikkhan).			Bisoi		34
10	Add on Course on	AOCFPOSDA	Physics	Dr. Arif Iqbal	13.06.2023-	10
	"FORTRAN			Mallick and	30.06.2023	
	Programming and			Dr. Avradip		
	ORIGINLAB for			Pradhan		
	Scientific Data	14				
1	Analysis".	I	1	1	1 1	I

	on Yoga & Meditation.		1 To 10 To 10	Wallato	01.02.2023	
2	Value Added Course on Human Rights Education.	VACHRE	Political Science	Dr. Rajasree Debnath	25.08.2022	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	15

5	Value Added Course on the Study of Biodiversity and its impact on human	VACSBIHH	Botany, Zoology, Physiology	Prof. Nandita Bhakat	29.06.2023	30
6	health. 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
	1	1	Total			570
1	Certificate Course on English as a Second Language.	CCESL	Language Lab	Pragna Paramita Mondal	01.06.2023 - 30.06.2023	50
-	Dangager		Fotal			50

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

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.

Convenor

Convenor Academic Committee Narajole Rej College Narajole, PIN 721211 * 30%

Vice Principal

Vice-Principal

Narajole Raj College

P.O.- Narajole

Dist.- Paschim Madinipur, 7



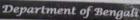




NARAJOLE RAJ COLLEGE

(NAAC Accredited B Grade Govt. - Aided College)

NARAJOLE: PASCHIM MEDINIPUR: PIN. 221215



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.

Dr. Ranajit Kumar Khahar 12012

Vice - Principal

Vice-Principal Narajole Raj College P.O. Narajole Dist- Reschim Medinipur, 7,71211 Nileyan Bhettocheryja Dr. Nilanjana Bhattacharyya Convenor



Members:
(1) Dr. Sadhan Ch. Pandit Addin Charles Const.
(2) Dr. Dipak Shom Dipak Thom
(3) Prof. Aviijit Chakraborty Arrivit Charrolly
(4) Prof. Madhumita Addya Mach 4 me +9 Addya
(5) Prof. Sanat Pan Sanat Tan

(6) Prof. Dipashri Roy

(7) Prof. Goulam Jana Goulam 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. Rarajit Kumar Khaluao . Varaje (Chairman Dist. Pareta admin

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MEETING RESOLUTION BOOK

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

মিটিং এর তারিখ / Date of Meeting : 09 · 12 · 20 22

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মিটিং এর স্থান / Venue of Meeting : উপস্থিত সভ্যগণের নাম / Name of Members Present 50/10 @/5 5/6 >9/16 রেজল্যুশন। RESOLUTIONS ADOPTED ক্রমিক সংখ্য Raja N. L. Khan womens' Colleg Panskura Banamali College 3rd Sem. - 2022 Bhattacherry

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EETING RESOLUTION BOOK

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Day	Semester	10.00-11.00	11.00-12.00	12.00-01.00	01.00-02.00	02.00-03.00	03.00-04.00	04.00-05.00
			CIT-Eng-G3 (SDR) CIT-Sun-G7 (AC) CIT-Suls (BM) CIT-Suls (BG)	CIT-Bang-SH (TX) CIT-Eng-G7 (MB) CIT-San-G (MB) CIT-PM-SH (NA) CIT-PM-SH (NA) CIT-PM-SH (NA)	CEIT-Beng-SH (TX) CEIT-Tag-SI (XX) CEIT-Sun-SI (EX) CEIT-Thi-SI (BM) CEIT-Thi-SI (UC)			
londay	I (II)	C174-01.50-51(R.D)	CIT-994-63 (BM) CIT-994-64 (BC)	CIT-PolSe-SS (cs)	GHT-Islo-LRR (M.A)			CIT-Beng-SH (SP)
	1(G)	DSC1AT/2AT-Phy.Edu-A1 (AN) DSC1AT/2AT-San-A2 (US)	DSC1_LRR-G DSCIAT/2AT- Phil-Ac (AC) DSCIAT/2AT-Hir-S2 (MKN)	AECCIT Core (ENG-I)-A5 (XX) C6T-Beng-LER (CI) C6T-Eng-C3 (MM) C8T-San-C4 (XS)	DSCIAT/2AT-PolSc-TR (XXX) CT-Essay-Gs (TX) CSI-Essay-Gs (AB) CT-Essar-Gs (AB) CT-Essar-Gs (AB) CT-Essar-Gs (AB) CT-Essar-Gs (AB)	DSCIAT/2AT-Phy.Edu-A8 (AN) DSCIAT/2AT-Sun-A5 (Ex) GEST-Eng-GS (BB) GEST-Eng-GS (BB) GEST-Eng-GS (Ex)	DSC1AT/2AT-8eng-LRR (XX) SECIT-8eng-G7 (NB) SECIT-8eng-G3 (MB) SECIT-8eng-G4 (XS)	DSC1AT/2AT-Eng-G (XX)
			CST-Seng-C6 (TX) CST-Sing-C6 (DX) CST-Sing-C6 (DX) CST-Sind-C6 (DX) CST-Sind-C6 (UC) CST-Sind-C6 (UC)	CST-San-GI (RS) CST-His-GI (RG) CST-Pol-Sc-A7 (RD)	CTI-Sun-GI (AB) CTI-Phi-S6 (ST) CTI-Phi-GI (MRN) CTI-Phi-S-S7 (PS)	GEST-San-GI (Ex) GEST-Phi-GS (EM) GEST-Phi-GS (EM) GEST-Phi-Sc-Se (BE) GEST-Edu-LER (SMA)	SECTI-BAILGE (KS) SECTI-PHI-GE (AG) SECTI-PHI-GE (MKN) SECTI-PHI-SO-ST (RD)	
	III (16)	CST-Sans-F1-RS) C7T-Beng-F3 SCP CST-Phio-F4(B.M) C7T-S4(MM)	CT-PM-SI (ST) CT-PM-GI (UC) CT-PM-Sc-AS(PS)					SECIT-Beng-GF (TX) SECIT-Eng-GI (MB) SECIT-San-G4 (AC)
								SECIT-Sam-G4 (AC) SECIT-Pid-G3 (XXX) SECIT-Pid-G6 (NS) SECIT-Pid-G4 (NS) SECIT-Pid-A2 (SMA SECIT-Pidy-Fidd (AN)
	III (G)	DSCICT/2CT-ling-A4 (SDR)	DSCICT/2CT-Phy.Edu-TR (AN) DSCICT/2CT-Sun-S6 (Ex)	DSCICT/2CT-Phy.Edu-TR (A.N)AECCST Core (ENG-II)-S1 (XX)		DSCICT/2CT-Ph8-A4 (XXX) DSCICT/2CT-H8-S2 (UC)	DSCICT/2CT-Relg-SH (AC)	(6.6)
			DSE2T-Beng-Gr (NB) DSE2T-Bang-A1 (XX) DSE2T-San-A2 (AB) DSE2T-Pals-A3 (XXX) DSE2T-Has-A4 (NS) DSE2T-Pals-A4 (NS)	C12T-Susp-LBR (TX) C11T-Eng-A1 (SDR) C11T-Sus-A2 (KS) C12T-Fisi-A3 (AG) C12T-Fisi-A4 (AGN) C12T-Fisi-A5-66 (RD)	CIII-Bang-GS (G) DSEII-Eng-A1 (SDR) CIZI-San-A2 (Ex) CIII-Pal-A3 (AG) CIII-Pal-A4 (BG) CIII-Pal-Sc-TR (BD)	DSELT-Beng-GF (EX) CLEF-Eng-S6 (MB) DSELT-San-G6 (EX) DSELT-Fal-S5 (A.G) DSELT-Fal-S4 (BC) DSELT-Fol-S6 (EX)	DSETT-Beng-LER (G) DSETT-Ing-G7 (MM) DSETT-Sun-S2 (AC) DSETT-Ind-S3 (ST) DSETT-Ind-S4 (BG) DSETT-Pol-Sc-S3 (BR)	
	V (II)		DSE2T-PuLSe-A7 (RD)	C12T-Rs-A4 (MEN) C12T-PoLSo-S6 (RD)	CTIT-Ha-A4 (BG) CTIT-PolSo-TR (BD)	DSELT-Ha-64 (BG) DSELT-Pol.Sc-F. Annex (PS)	DSEZT-Pol.Sc-S5 (BE)	DSEZT-Ha-54 (BG) C115T-Phil-A6(A.G) SECST-Beng-LBR (AG SECST-Beng-LBR (AB) SECST-San-54 (AB) SECST-Phil-53 (BM)
		GHT-Beng-SH (TX) GHT-Ing-GS (XXX) GHT-Sun-G4 (Ex) GHT-Hal-G3 (XT) GHT-Hal-G3 (UC) GHT-Hal-G3 (UC) GHT-Hal-G5 (SMA)			DSE1AT/2AT-Phy.Edu-A5		CETT-Phy.Edu-A3 (A.N) DSEIAT/2AT-PelSc-S1 (XXX) DSEIAT/2AT-Beng-A4 (TX)	SECST-Plu-S1 (MN) SECST-PolSc-S2 (OC SECST-Phy.Edu-A1 (A.N)
	V (G)	GEIT-Edu-Gi (SMA)	DSEIAT/2AT-He-A5 (XXX)	DSEIAT/2AT-PolSo-TR (XXX)	(AN) DSEIAT/2AT-San-A6 (RM)	DSEIAT/2AT-Phil-50 (S.T)	DSEIAT/2AT-Beng-A4 (TX)	
eday	1(10)	C17-Sam -61-(RM)	QT4ene(484GI)	CIT-Brag-Stf (DS) CIT-ling-CF (FFM) CIT-Stan-CS (IJ) CIT-Stah-St (Etd) CIT-His-G4 (EG)	CHT-Ing-CF (MM) CHT-San-GF (US) CHT-Pid-ST (BM) CHT-Pid-SG (MEN) CHT-Pid-SG (PS)	C2T-Bang-S2T (AC) C2T-Bang-G7 (MM) C2T-San-G5 (TR) C2T-Pall-S4 (ST) C2T-Pall-S- (ARCN) C2T-Pall-S- (S (BR)		
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	I (G)	DSCIAT/2AT-Psd-86(T.A) DSCIAT/2AT-Edu-S.H(L.A)		DSC1AT/2AT-San-S3 (US) DSC1AT/2AT-Thy-Edu-Field (AN)		DSC1AT/2AT-Edu-A6 (MA) DSC1AT/2AT-Eng-A5 (FPM) CEST-Beng-S2 (SCF) GEST-Beng-S4 (SOX) GEST-Ben-G2 (AB) GEST-Pal-G3 (NOX) GEST-Pal-G3 (NOX) GEST-Pal-G3 (NOX)	AECCIT Elective BENG- G6 (NB)	AECCIT Core (ENG- SH (MB)
	m (m)	CET-BEING-FB (AC) C7T- SU(PPM)	CoT-Beng-SH (AC) CoT-Eng-Co (SDR) CoT-Sun-GI (II) CoT-Fish-64 (Bish) CoT-Bis-55 (MRN) CoT-Fis-55 (MRN)	C7T-Beng-LRR (G) C7T-Ing-G3 (SDR) C7T-Sna-G4 (AB) C7T-Phi-95 (XXX) C7T-Phi-95 (XXX) C7T-Phi-95 (XXX)	CTI-Beng-SH (SCI*) CST-Eng-S2 (SDB) CST-San-S3 (RM) CST-Phil-S4 (ST) CST-Phil-S4 (ST) CST-Phil-S4 (SD)	CEST-Phil-G3 (XXX) CEST-His-G4 (NS) CEST-Pol.5c-Se (FS) CEST-Edu-G6 (LA)		
								SECTI-Beng-LRE (G) SECTI-Bing-GS (XX) SECTI-Sam-S4 (TI) SECTI-Bid-S1 (ST) SECTI-Bid-S1 (UC) SECTI-Bid-G7 (MA SECTI-Bid-G7 (MA SECTI-Bid-G7 (MA
	III (G)	DSCICT/2CT-Phil-52(S.T)	AECCST Con (ENG-II)-A2 (MB)	DSCICP/2CP-Phy.Edu-Field (PKM)	DSCICT/2CT-San-A3 (KS) DSCICP/2CP-Phy.Edu-Field (PKM)	DSCICT/2CT-Beng-S2 (TXX) DSCICT/2CT-PolSe-67 (RD)	SECIT-His-81 (UC) DSCICT/2CT-Eng-G3 (XX)	SECIT-PolSc-S2 (88) SECIT-Edu-G7 (M.A. SECIP-Phy.Edu-Field (AN)
	in (d)	100.1017.2017.10002(0.1)	CITT-Beng-LBR (TXX) CITT-Ing-G7 (MM) CITT-San-G3 (AC) CITT-Phil-S1 (XXX)	C12T-Beng-G6 (FXX) C11T-Bing-G3 (MM) C12T-San-A1 (KS) C12T-Phil-A2 (KT)	DSE2T-Eng-LER (PPM) DSE2T-San-A1 (EX) DSE2T-PhS-A2 (T.A)	DSE1TH-Beng-15 (DS) C12T-Eng-S5 (MB) DSE1T-San-A1 (TI) DSE1T-Phil-A2 (EM)	Doctor) Zer-augeorica)	DSELT-Se (SDR) DSELT-Sun-A3 (RM)
	V (18)		C11T-Phil-S1 (XXX) C11T-Phil-G4 (BG) C11T-PhilSc-83 (BD)	C12T-7645-A2 (ST) C12T-7645-A3 (UC) C12T-7645-67 (BB)	DSE2T-Pid-A2 (T.A) DSE2T-Pid-A3 (BG) DSE2T-Pid-Sc-A4 (BR)	DSELT-Pul-A2 (BM) DSELT-Hu-A3 (UC) DSELT-Pul-Sc-A4 (88)	C1179HGI	SECSTG-Beng-G7 (AC SECST-Bing-G8 (XXX)
		GRIT-Beng-LBR (TXX) GRIT-San-G4 (RM) GRIT-Plai-G3 (XXX)						SECSIG-Beng-G7 (AC SECSI-Bing-G3 (XXX) SECSI-Bin-G4 (AC) SECSI-Bin-G3 (BM) SECSI-Bin-G3 (NS) SECSI-Bin-G3 (RS) SECSI-Bin-A2 (IA)
	V (G)	GEIT-Pid-GI (MN) GEIT-Pid-Sc-AI (RD) GEIT-Edu-A2 (MA) GEIT-Fly, Edu-A3 (AN)	DSE1AT/2AT-Phy.Edu-G3 (AN) DSE1AT/2AT-San-A5 (RM)	DSEIAT/2AT-PolSc-TR (XXX) GEIT- Edu-A2-(LA)	DSE1AT/2AT-San-A5 (EX) DSE1AT/2AT-Phy.Edu-TR (AN)	DSEIAT/2AT-Eng-F. Annex (XXX)	C11-HEST-G4 (BG) DSE1AT/2AT-Beng-XX (XX)	SECST-Phy.Edu-A1 (PKM)
				C2T-Beng-SH (C) C2T-Eng-SI (MM) C2T-Eng-SI (MM) C2T-FHA-A3 (S.T) C2T-FHA-A3 (S.T) C2T-FHA-A3 (S.T) C2T-FHA-A3 (S.T)	CELT-Bong-SH (DS) CELT-Ing-SL (XX) CELT-Sun-G (XX)	CIT-Beng-St (DX)		
dnesday	I (II)	CLT#NII FH(T.A)		CTI-PRI-SS (E.I) CTI-Pri-SS (ES) CTI-Pri-SS (ES)	GETT-BE-GI (BF) GETT-BE-GI (BF) GETT-Bin-Se (LA)	CIT-Burg-SH (IDX) CIT-Bag-GI (SDR) CIT-Bull-SH (BG) CIT-PulSe-SS (BD)		CIT-San-A3 (RM) C2-HST-S4(NS)
	I(G)	DSC1AT/2AT-Edu-A4 (LA) DSC1AT/2AT-Eng-G7 (MM)	DSCIAP/2AF-Phy.Edu-Field (AN) DSCIAT/2AT-San-S1 (RM)	DSC1AP/2AP-Phy.Edu-Field (A.N)	DSCIAT/2AT-Phil-A5 (XXX) C7T-Brog-LRR (SCP)	AECCIT Core (ENG-I)-LER (XX)	DSCIAT/2AT-His-GF (EX)	DSCIAT/2AT-PolSc A1 (ED) DSCIAT/2AT-Beng-1 (MA)
			CST-Beng-SH (MA) CST-Bag-GC (SK) CST-Bag-GC (SK) CST-Bag-GC (ST) CST-Bag-GC (BT) CST-Pag-SG (BT)	(A.N) C6T-Beng-C6 (D5) C7T-Ing-C3 (PW) C6T-Pinls C1, A) C6T-Pinls C1, A) C6T-Pinls C5 (EG) C6T-Pinls C5 (PS)	CT-Bang-URE (SCP) CST-Ling-S2 (MB) CT-Sun-S3 (TB) CT-Pal-F5 (XXX) CT-Pal-F6 (XXX) CT-Pal-S6-S5 (XX)	GEST-Beng-G4 (SCP) GEST-Eing-15 (XXX) GEST-Stan-G5 (TI) GEST-Pid-G7 (BM) GEST-Pid-G8 (BP) GEST-Pid-S52 (BP) GEST-Pid-S-S6 (PS)	CET-Beng-Gé (GJ) CET-Eng-GS (MM) CTT-Sam-Gl (AC)	
	III (II)	CST-San-G4 (US)	CST-PM-SS (XX) CST-PM-SG (BP) CST-PM-Sc-SZ (BD)			G31-Pats-56 (15)	C7T-His-GI (NS) C7T-Pel-Sc-G7 (FS)	C7T-PhS-A6(S.T)
	III (G)	DSCICT/2CT-Eng-A5 (SK)	DSCICT/2CT-Edu-LNR (IA)	AECCST Core (ENG-II)-LER (SK)	DSCICT/2CP-Phy.Ltdu-Field (AN) DSCICT/2CT-Sun-G6 (US)	DSCICP/2CP-Phy.Edu-Field (A.N)	DSCICT/2CT-Pol.Sc-82 (98) DSCICT/2CT-Beng-S1 (MA)	DSCICT/2CT-Phi-S: (S:T) DSCICT/2CT-Hs-S2 (BQDSIC-Se (PPM)
			CTT 8 Ct (70)	CULT-Report BW (TXX)	DEST CT (CT)	C17LBeen-St (DXI)		(11)
	V (II)	GEI-HEST-GI[BPI] CII- HEST-GI[HE] DSEZTH-BENG GG-GI	CITI-Ing-Life (SDR) CITI-San-GF (KS) CITI-San-GF (KS) CITI-Ind-AZ (OOX) CITI-Ind-AZ (EX) CITI-Ind-AZ (EX)	DSET-Eng-GS (SDR) CHT-San-A1 (AC) CHT-Phil-A2 (BM) CHT-Phil-A2 (BM) CHT-Phil-Sc-A4 (BD)	CET-Tag GT (FPM) DSEIT-San-AI (RM) DSEIT-Pal-A2 (RM) DSEIT-Pal-A2 (RG) DSEIT-PolSc-A4 (XXX)	C12T-Eng-C3 (FFM) C12T-San-S3 (US) C12T-Fid-S7 (ST) C12T-Fid-S7 (NS) C12T-Fid-S0 (NS) C12T-Fid-S0 (NS)		
	V (G)	GEIT-Beng-SH (TXX) GEIT-Ing-GS (XXX) GEIT-Ing-GS (XXX) GEIT-Phil-GS (ER) GEIT-Phil-GS (EX) GEIT-Phil-GS (ES) GEIT-Phyl-Edu-A7 (AN)	DSEIAT/2AT-Phil-A4 (S.T) DSEIAT/2AT-Phil-S4 (EG)	DSE1AT/2AT-Eng-A5 (XXX)	DSE1AT/2AT-Ha-A6 (EX)	DSELAT/2AT-Pol-Sc-TR (S.S) DSELAT/2AT-Edu-S4 (TAX) DSELAT/2AT-Edu-S4 (LA)	DSEIAT/2AT-Phy.Edu-A2 (AN) DSEIAT/2AT-San-A3 (II)	GHT-Beng-SH (DX) GHT-Eng-GS (XXX) GHT-San-G4 (H) GHT-Shi-G3 (T.A) GHT-His-G3 (EX) GHT-PsiSc-S2 (RD) GHT-PsiSc-S2 (RD)
			C2T-Seng-SH (MA) C1T-Eng-C3 (SDR) C2T-San-S2 (US) C2T-PM-S3 (A.G) C2T-PM-S3 (A.G) C2T-PM-S5 (ASDN) C2T-PM-S5-S5 (PS)	CIT-Beng-S81 (DS) CIT-Ban-G3 (BM) CIT-Fisk-S3 (TA) CIT-Fisk-S4 (EX) CIT-Fisk-S5 (ES)	CELT-Tag-S1 (XX) CELT-San-S2 (TR) CELT-Tal-S3 (XXX) CELT-Tal-S3 (XXX) CELT-Tal-S-S4 (MEX) CELT-Tal-S-S5 (ES) CELT-Tal-C7 (LA)			
ursday	1 (11)	CLHIST-GRIPS)	CZT-Pol-Sc-85 (PS)	CIT-Palse-St (69)		ADCCIT Elective ENG-581 (5K)		C2T-ENG-S6 (SK) DSC1AT/2AT-Edu-C
	I(G)	DSCIAT/2AT-PolSc-53 (B.R) DSCIAT/2AT-Beng-G6 (TXXX)	DSCLAT/2AT-San-AS (IR) DSCLAT/2AT-Phy.Edu-AS (F.K.M)	DSCIAT/2AT-Phil-A5 (XXX)	DSCIAT/2AT-His-As (BG)	AECCIT Elective SENG-55 (MA) GEST-Berg-Gé (130)	AECCIT Core (ENG-I)-SH (XX)	(I.A) DSCIAT/2AT-Eng-G (MM)
		C6T6an+1 (US)	C6T-Berg-G6 (TXX) CST-Eng-A6 (SX) C6T-Pisi-G3 (ST) C6T-Pisi-G3 (BS) C6T-Pisi-S6 (BS)	CTI-Beng-G6 (NB) CSI-ling-G3 (SDR) CTI-San-G4 (IR) CTI-Philis (A.G) CTI-Philis (A.G) CTI-Philis (I.MEN)	CT-Beng-GS (DR) CT-Eng-GS (PPM) CST-Stan-GB (DS) CST-PM-GI (BS) CST-PM-GI (BS) CST-PM-GI (SS)	GET-Eurg-GE (100) GEST-Eurg-GS (000) GEST-Eurg-GS (000) GEST-Pails-AS (EFF) GEST-Pails-AS (EFF) GEST-Pails-AS (EFF) GEST-Eurg-GS (LA)	SECIT-Bing-G6 (NB) SECIT-Bing-SH (SK) SECIT-Sam-G4 (AC) SECIT-PHI-G3 (A.G) SECIT-HII-G1 (MEN)	C6T-PolSc-S1(P.S)
	III (II)		(BI) - FRESCOB (BB)		(51-7625-96 (8)		SECIT-PolSo-S6 (SS) DSCICT/2CT-San-A1 (TR) DSCICT/2CT-Shy Edu-A2	DSCICT/2CT-PMI-A
	III (G)	DSCICT/2CT-PolSe-S1 (98) DSCICT/2CT-Beng-LRR (TXX)	AECCST Com (ENG-II)-S1 (XX)	SECIP-Phy.Edu-Reld (PKM) DSEIT-Beng-LER (TXX)	SECUP-Phy.Edu-Reid (PKM) DSE2T-Beng-LER (TXX)	DSC1CT/2CT-Eng-S2 (MM)	DSCICT/2CT-Sun-A1 (TR) DSCICT/2CT-Phy.Edu-A2 (P.K.M) DSCICT/2CT-Edu- SS(LA)	(ST) DSCICT/2CT-His-A: (BS) SECIT-ENG-CS- (SK)
	V (18)		CHT-Ing-LSR (PTM) CHT-Sn-A1 (TJ) CHT-Sn-A2 (TA) CHT-HS-A3 (BP) CHT-PolSc-A4 (SS)	DSELT-Fag-SS (PPM) DSELT-San-A1 (TJ) DSELT-Fag-A2 (XXX) DSELT-Fag-A2 (XXX) DSELT-Fag-A3 (BS) DSELT-Fag-A4 (BS)	CHT-Eng-S5 (SDR) DSE2T-San-A1 (AB) DSE2T-Fid-A2 (ST) DSE2T-Fid-A3 (BP) DSE2T-Fid-A5 (BP)	C12-HST-55-MN		C12T-88NG-F3 (DR)
	V (G)	CELT-Beng-SH (D5) CELT-Ing-CS (XXX) CELT-San-G (BM) CELT-Fisi-G (TA) CELT-Fisi-G (TX) CELT-Fisi-G (XXX) CELT-Fisi-G (XXX) CELT-Fisi-G (XXX) CELT-Fisi-G (XXXX)		DSE1AT/2AT-Pol5c-A6 (85)		DSEIAT/2AT-Phy.Edu-54 (PKM) DSEIAT/2AT-Phy.Edu-54 (PKM)	DSELA-REST-A6-(BF)) DSELAT/2AT-Sun-SE (RM)	DSE1AT/2AT-Phil-S (A.G)
		, and a strong		and the state of t	GE17-Beng-SH (DB) GE17-Day-S1 (XX)	g one yearly	, (600)	
tay	1 (11)	C1T5an F1 (AC) 05C1A- HST-G7(UC)	C2T-Beng-SH (TXX) C2T-Bing-SS (PPM) C2T-Sain-SL (TR) C2T-Fish-SS (ST) C2T-Fish-S4 (UC) C2T-Fish-S4 (UC)	CIT-Bug-SH (SCF) CIT-Eng-SI (IG) CIT-FulSe-SI (IE) CIT-FulSe-SI (IE)	CELT-Sub-CS (AB) CELT-TRI-SS (BM) CELT-TRI-SS (BM) CELT-TRI-SS-SS (XXX) CELT-TRI-SS-SS (XXX) CELT-TRI-SS-SS (XXX)			CIT-Phil-A6(T.A)CI ENG-56 (MM)
	110	DSCIAT/2AT-His-G7 (NS)	DECLAT/24TC	DECIAL/2AY BAS	DSCIAT/2AT-Phy.Edu-TR (PKM)	DRC1AT/NAT BL	DSCIAT/2AT-ling-A2 (XX)	AECCIT Con (ENG-
	1(0)	DSCIAT/2AT-PMI-SI (000)	DSCIAT/2AT-Beng-SH_(SP) C71-Seng-G6 (NS) C31-Seng-G6 (SDR) C71-Seng-G6 (AS) C71-Phil-G3 (XXX)	DSCIAT/2AT-PelSc-TR (XXXX) CET-Bray-GS (TXX) CET-Bray-GS (TXX) CET-Bray-GS (TXX) CET-Bray-GS (TXX)	DSCIAT/2AT-San-G3 (TR) CST-Beng-G6 (TXX) CST-Bag-G2 (SDR) CST-San-A8 (EX) CST-Trial-F5 (T.A)	DSCIAT/2AT-Phil-AS (TA) GEST-Bary-GS (MA) GEST-Bary-GS (200) GEST-Bary-GS (AC) GEST-Phil-GS (BAS) GEST-Phil-GS (BAS) GEST-Phil-GS (BAS)	DSCIAT/2AT-Edu-A3 (M.A)	521 (TTM)
	III (II)	CST_GG (SP) CGT-HEI-G1 (MIN)	C7T-San-Gi (AB) C7T-Phil-Gi (XXX) C7T-Hil-Gi (MXX)	CET-San-G4 (I)) CET-Pid-C0 (ET) CET-Pid-C0 (EX) CET-Pid-Sc-S6 (ER)	CST-Sun-AS (EX) CST-PM-F5 (T.A) CST-His-S4 (UC) CST-Pol.Sc-Geo. Armex (RD)	GEST-His-GI (85) GEST-Falsi-Sis (85) GEST-Edu-GF (868A)	CST-BENG-GS (DR)	PolSc-A2(SS)
	III (G)	DSCICT/2CT-Hsi-GS (BS) DSCICT/2CT-Phil-G3 (BM)	DSCICT/2CT-PolSe-TR (XXX)	DSCICT/2CT-Beng-LRR (SF)	DSC1CT/2CT-Phy.Edu-A5 (AN) DSC1CT/2CT-Sun-A6 (AC)	SEC ICT/2CT-Phy.Edu-A5 (P.K.M) DSCICT/2CT-Eng-S1 (PPM)	SEC CT/2CT-Phy.Edu-A5 (A.N) AECCST Core (ENG-II)- 521 (XX)	
			DSETT-Beng-GF (DR) DSETT-Ing-LRR (SDR) DSETT-Sun-LR (TJ) DSETT-Pall-A2 (BM) DSETT-Ha-A3 (BS)	CIIT-Beng-GT (NB) DSEIT-Ing-LEE (XX) DSEIT-San-A1 (AB) CIIT-Phi-A2 (BM) CIIT-Phi-A3 (UC)	DSE2T-Beng-LRR (DS) DSE2T-Eng-So (FPM) DSE2T-Eng-So (FPM) DSE2T-Fib-A2 (XX) DSE2T-Fib-A2 (XX)	C12T-Sung-SH (TOX) C12T-Sung-LBR (FFM) C12T-Sun-A1 (KS) C12T-Fisi-A2 (KS) C12T-Fisi-A5 (MKN)		
	V (18)	CEST-BENG-F5(DR) CEST-Beng-G6 (MA)	DSEIT-Hu-A3 (RS) DSEIT-PulSo-A4 (XXX)	CHT-PolSc-A4 (8)	DSE2T-PidSc-A4 (SS)	C12T-PoLSc-A4 (RD)		
		CEIT-Beng-Ge (MA) CEIT-Eng-A7 (XXX) CEIT-Sun-Ge (IXS) CEIT-Fill-A3 (ST) CEIT-Fill-GE (IX) CEIT-Fill-GE (IX) CEIT-Fill-GE (MA) CEIT-Fill-GE (MA) CEIT-Fill-GE (MA)	DSEIAT/2AT-18s-A8 (BG)	DSELAT/2AT-PM-A6 (XXX) CELTG-BENG-A5-(DE)	DSE1AT/2AT-Phy.EduPE Lab (A.N.B. P.K.M)	DSEIAT/2AT-Eng-SS (MM)	DSE1A-FEST-GJ(BS) DSE1AT/2AT-Beng-LER (SP) DSE1AT/2AT-PoLSc-S2 (XXX)	SEC-1F (A.N) DSE1A-HIST-GI(BS) DSE1AT/2AT-Phil-C (XXX)
	V (G)	CELT-Phy.Edu-AS (AN)			Lab (A.N.& P.K.M) DSELAT/2AT-San-G4 (T)) GEIT-Beng-G1 (D2) GEIT-Ing-G1 (MS) GEIT-Fisi-G3 (TA) GEIT-Fisi-G3 (TA)	- , ,	,	(0000)
turday	I (II)	C17-San-F1 (AB)	CIT-Berg-F3 (DB) CIT-Eng-S5 (SK) CIT-Sun-S2 (IR) CIT-Sun-S2 (IR) CIT-Sun-S3 (AG) CIT-Sun-S4 (ABCN) CIT-FolSt-S5 (BB)	CIT-Energistr (ET) CIT-Pid-SS (EM) CIT-Pid-SS (EM) CIT-Pid-SS (ES)	GETT-Pal-S4 (MEX) GETT-Pal-Se-Com Lab (PS)	GET-Edu-GF (IA)		
	169	AECCIT Company to	DSCIAT/2AT-His-G7 (NS)	DSCIAT/2AT-Eng-A5 (XX) DSCIAT/2AT-Edu-85 (MA)	DSC1AT/2AT-Beng-A5 TXX DSC1AT-ING-S8(MM)	FIELD-Phy.Edu (A.N) DSCIAT/2AT Pol.Sc-St (PS)	RELD-Phy.Edu-A5 (A.N	
	I (G)	AECCIT Com (ENG-I)-SH (SK)	CST-Seng-Gs (SP) CST-Sing-GS (MM) CST-Sin-GA (III) CST-Fill-GS (XXX) CST-Fill-GS (XXX) CST-Fill-GS (XXX)	DSC1AT/2AT-4de-85 (MA) OST-8eng-C& (D5) OST-8eng-C& (D5) OST-8eng-C& (D5) OST-8eng-C& (D1) OST-8end-C& (D1) OST-8end-C& (DN) OST-8end-C& (DN) OST-8end-C& (DN)	CEST-Beng-F3 (SCP) CEST-Ing-C3 (FYM) CEST-San-A (AC) CEST-Fid-62 (XXX) CEST-Fid-62 (XXX) CEST-Fid-62 (XXX) CEST-Fid-63 (XXX)	PolSc-SI (PS)	овые прави-A5 (A.N	
	III (II)	AECCST Com (ENG-II)-LER	DSCICT/2CT-His-As (D)	DSCICT/2CLEA-AS (LA)	HILD-Phy. (A.N)	HELD-Phy.Edu(A.N) DSCICT/2CT-Seng-F3 (DX)		
	III (G)	(XX) (XX) (XX) (XX) (XX) (XX) (XX) (XX)	SECTI-Edu-6-18(LA) SECTI-Edu-6-18(LA) CIT-Edu-6-18(LN) CIT-Edu-6-18(RPM) CIT-Has-LER (PPM) CIT-Has-LER (RM)	DSCICT/2CT-428-A6 (XX) DSCICT/2CT-428-A6 (XX) C12T-848-GC (SCF) C12T-848-A1 (MM) C12T-848-A1 (MM)	DSCICT/2CT-P68-A6 (XXX) DSCICT/2CT-P68-A6 (XXX) DSCIT-8eng-94 (TXX) DSCIT-8eng-95 (XX) DSCIT-9eng-188 (XX) DSCIT-9eng-188 (XX)	DSCICT/ACT-PolSe-52 (RD) DSCICT/2CT-PolSe-52 (RD) DSCICT-Seng-94 (DR) DSCICT-Seng-94 (DR) DSCICT-Seng-94 (DR) DSCICT-Seng-94 (DR) DSCICT-Seng-94 (DR) DSCICT-Seng-94 (DR) DSCICT-Seng-94 (DR)		
		DSE2TH-BENG- F3 (NB) DSE2T-PoLSc-51(SS)	CIIT-Phil-A2 (BM) CIIT-Phil-A3 (EX)	C12T-Sam-F2 (AB) C11T-Hs-A3 (BP) C12T-PoLSc-A4 (RD)	DSETT-Phi-S7 (RM) DSETT-Phi-A3 (EX)	DSI27-Hs-G6 (BF) DSI27-PolSc-S3 (BE) C117-PolSc-A4(R.D)		
	V (II)	DSEZT-PhD-F4(A.G)		C12T-FolSo-A4 (RD)		C11T-PolSc-A4(RD)		

		MASTER RO			SEMESTER-	-II, IV, VI (ART		
Day	Semester	10.00-11.00	21.06-12.00 CTI-lang-GF (MG) CTI-lan-GF (AG) CTI-lan-GF (AG) CTI-lan-AG (BM) CTI-lan-AG (BM)	22.00-02.00 CEE-Brog-SH (TX) CEE-Brog-CE (MB) CEE-Brog-CE (MB) CEE-Brid-SH (NE) CEE-Brid-SH (NE) CEE-Brid-SH (NE) CEE-Brid-SH (NE)	01.00-02.00 CEST Resp N1 (TX) CEST ResP (XX) CEST ResP (XX) CEST ResP (XX) CEST ResP (XX) CEST RESP (XX) CEST RESP (XX)	(02.00-03.00	03.00-04.00	04.00-05.00
londay	100	CET PAGE NA CESSE CO.			(8.7)			CIT day NE (IP)
	F(Q)	DISCURT/ZRT (Pay Educ A1 (AN) DISCURT/ZRT (base A2 (US))	DSCI_LERGE_DSCIET/ZET- PM-An (AG) DSCIET/ZET-04-3G (ARON)	ASCCIT Com (BARLE) AS (00) CYC Bring LEE (2) CYC Bring CO (MA) CYC Bare (DO) CYC Bare (DO) CYC Bare (DO)	TRICTET / 2017 (Pv.LSv.TE. (2000) C1000 Breng Cit (210) C1017 Breng Cit (200) C1017 Breng Cit (200) C1017 Breng Cit (200) C1017 Breng Cit (200) C1017 Breng Cit (200)	DICITI/ERI (Fig. Salas AA (AN)) DICITI/ERI (Inc. AA (En)) CELLE (Ing. CELLE) CELLE (Ing. CELLE) CELLE (Ing. CELLE) CELLE (Ing. CELLE)	TRCSRT/SRT deep LRK (XX) MICTE deep CT (XR) MICTE deep CS (XR) MICTE deeCS (XX) MICTE deeCS (XX) MICTE 100-CS (XXX) MICTE 100-CS (XXX) MICTE 100-CS (XXXX)	DSC1817/2811 Rag G
	DT (PE)	CET-Sams-F3 (CI) C327-Samp F5-927 CET-Prior-F4(E.M) C327-S4(MM)	OT-Brog Gr (TX) OT-Brog Gr (EX) OT-Brock (M) OT-Brid St (RT) OT-Brid St (RT) OT-Brid St (RT) OT-Brid St (RT)	OTT-FAREAU (BIS)	COST 894546 (R) COST 89454-R7 (R)	CRETIFIED (190) CRETIFIED (190) CRETIFIED (190) CRETIFIED LEE (190A)	HECT PAIN (RD) HECT PAIN (RD)	
			ENCUDY/2DT-Phy Salas DE					NBCZT-Bang CF (TX) NBCZT-Bang CE (MB) NBCZT-Ban CE (AC) NBCZT-Bal-CE (XX) NBCZT-Bal-CE (XX) NBCZT-Bal-CE (XX) NBCZT-Bal-CE (MB) NBCZT-Bal-CE (MB) NBCZT-Bal-CE (MB) NBCZT-Bal-CE (MB)
	PH (G)	ESCUDI/2DE-ling-A4 (600)	(AN) ENCUDE/2DE Sande (Es)	DECEDIT/200 Play Juliu TR (A.N), MCCCT Core (ENG-E), 61 (XX) CGT dang, LER (TX) CGT dang, LER (TX)	CITE Brog CI (CI) DRATI See Al (SDB	DRCIDT / 2018 Phil-A4 (2000) DRCIDT / 2018 Mar-Not (ACC)	INCIDT/2010 Pol. No. 82 (976) INCIDT/2010 Broug SHE (AC)	J
	V2 (RI)	GET Brown NO. (TX)	ENSET designal (OS)	CALL Brogg LEDS (CTS) CATH Stopp, SA (CESS) CATH Stopp, SA (CESS) CATH Stop, SA (CESS)	CIST Brog GT (E2) DISTST Brig AL (RES) CIST Sen AZ (Br) CIST STILLAS (AC) CIST STILLAS (AC) CIST STILLAS (BE) CIST STILLAS (BE)	DROTT-Beng CP (TX) CST dings (pBI) DROTT-Ben CB (EX) DROTT-Field (EX) DROTT-Field (EX) DROTT-Field (EX) DROTT-Field (EX) DROTT-Field (EX)	THROTT (long LBC (C2) THROTT (long C2" (long) THROTT (long) (long) THROTT (long) (long) THROTT (long) (RC2) THROTT (long) (RC2) THROTT (long) (RC2)	256 42 56-54 (8C) C1315 556-34(AC) SEC2T-Reg CB (8M) SEC2T-Res S (AB) SEC2T-Res S (AB) SEC2T-Res S (AB) SEC2T-Res S (M) SEC2T-Res S (M)
	мы	GB21 dings N6 (23) GB21 dings GB (200) GB21 Sen GB (84) GB21 Select (84) GB21 Select (84) GB21 Select (84) GB21 Select (84) GB21 Select (84) GB21 Select (84)	256182/2A1-Ha-A3 (XXX)	DBEHE / ZAT-Pal Se-TK (XXX)	DRESST/ZAT-Ploy Subs-An (AN) DRESST/ZAT-Sum-An (RDS)	DMIRT/2AT-Philate (S.T)	CEST-Phy-Ridor-A3 (A N) DREED/ZAT-Pulls-NI (XXX) DREED/ZAT-Broug-A4 (XX)	SECTIFICATION (NO.) SECTIFICATION (N.) SECTIFICATION (N.)
heroday	- 00	CET-Same #1 (RM) 0037	C47 Brog US (G4)	CTI-Brog-SH (TN) CTI-Brog-CF (FTN) CTI-Brog-CF (FTN) CTI-Brog-CF (BN) CTI-Bro-CF (BC)	CB2T Brog CT (NB) CB2T Brog CT (NB) CB2T Bro CB (NB)	CEE Brog AH (AC) CEE Bing CE (MR) CEE BinG CE (R) CEE Phil AE (R) CEE Phil AE (R) CEE Phil AE (R) CEE Phil AE (R)	ASCCIT Sinter SNG NS (MS)	
	10	ENCHIEF/2011 0 to CEF (D.S) ENCHIEF/2011 0 to CEF (D.S) ENCHIEF/2011 0 to do S (DEA)	ENCLAP/ZAP Phy Side Feld (PKM) ENCLET/ZET dale-LEROMA)	ESCLET/201 Sun NY (LN) ESCLET/2AF Phy Educ Feld (AN)	DSCHII/201 Brog-Gi (Q) DSCHII/201 Poble-A7 (R)	DICHE/ZET-Sale-As-(MA) DICHE/ZET-Sale-As-(MA)	ARCCIT Blotter BENG Or	ASCUT One (SNG SSI (MS)
	DT (M)	CNT 48966 #5/AC) CSOT Majorini	CVT-Brog-SH (AC) CVT-Brog Cit (SUS) CVT-Star Cit (SUS) CVT-Star Cit (SUS) CVT-Star Star (SUS) CVT-Star (SUS) CVT-Star (SUS) CVT-Star (SUS)	Card Bring LDX (C2) Card Bring C3 (RDB) Card Sin C4 (LDI) Card Frish 91 (XXX) Card Hall Sin D40 Card Hall Sin D40 Card Publisher (Pb)	C101 Brog SH (6CF) C9T-Fing SI (6DB) C9T-Fine SI (6DB) C9T-Fid-SI (6T) C9T-Fid-SI (6T) C9T-Fid-SI (6D)	CRET-Fidency SE (NOT) CRET-Fidency C (AE)		
								NECTT Beng LBE (C) NECTT Beng CB (CO) NECTT Ben NE (CI) NECTT PERSON (KT) NECTT HEART (KT) NECTT HEART (MC) NECTT HEART (ML) NECTT HEART (ML) NECTT HEART (ML)
	N1 (G)	DECUDE/2DT Philips (1)	ASCCST Core (SNG45) AZ (MR	DISCULP/2CP Physias Peta (PRM)	DSCIDT/2016 See A1 (80) DSCICT/2CP Phy Side Nobl (PKM)		SECRET/2010 Eng G3 (XX)	DNETE No (1876) DNETE Non AT (800)
	VI (M)		C110 Brog LEX (TXX) C110 Brog C7 (MA) C110 Brog C7 (MA) C110 Prid 64 (XXX) C110 Prid 64 (XXX) C110 Prid 64 (XXX) C110 Prid 64 (XXX)	CLEE Bring Cis (TXX) CLEE Bring Cis (Mid) CLEE Ann. A1 (DX) CLEE Field A2 (EX) CLEE Field A3 (EX) CLEE Field A3 (EX) CLEE Field A5 (EX)	19841 deg LBC (FFM) 19841 des A1 (IS) 19841 des A2 (IA) 19841 de A2 (IA) 19841 de LS-A3 (IS) 19841 de LS-A4 (IS)	DROTT-Boog PS (ER) CLET ding NS (BB) DROTT ding NS (BB) DROTT ding NS (BB) DROTT ding NS (BB) DROTT ding NS (BC) DROTT ding NS (BC) DROTT ding NS (BC)	crasses	
		CRIT Reng LEE (TXX) CRIT Reng CR (XXX) CRIT Ren CR (RM) CRIT Field (RM) CRIT Field (RM) CRIT Field (RM) CRIT Field (RM)	DSELEC/ZAT-Physiolo-GS (AN		INDIET/ZAT/Sen Ab (IO)		CTLOBAT GE (BC) ENGLET /2AT-Strage OX (DX)	SECTIC Brog CT (AN SECTI Brog CE (NC) SECTI Broc CE (AC) SECTI Broc CE (AC) SECTI Broc CE (AC) SECTI Broc CE (AC) SECTI Broc AC (LA) SECTI Broc AC (LA) SECTI Broc AC (LA)
	VI (G)	CEST (Sile-A3 (MA) CEST (Fig. Sile-A3 (AN)	ENGLET/ZAT-Play-Edu-CT (AN ENGLET/ZAT-Ham-Ah (EDI)	THE SET / JAT. Public TK (XXX) CR2T- EducA2 (SA) CET-Sung-SET (CE) CET-Sung-SET (AND CET-Sung-SET (AND CET-Sund-SET (R)	INSTRIT/ZAT/Sem AN (IX) INSTRIT/ZAT/Phy Ede: IX (AN) (IXII/Beng NE (IXI) (IXII/Beng NE (IXI) (IXII/Beng NE (IXI)	D801817/2A1 ding F. Amers (XXX)	ENGLET/ZAT-Broug-NX (NX)	
Vedenday	II (19)	CET PROTEET.A)	DICLAP/2AF-Ploy Educ Feda	CET-P-6%-St (RI)	(227 Feb. 24 (EX) (227 Feb. Ca (ET) (227 Feb. Con Asses (FS) (227 Feb. St (EA)	CTT Brog SH (CDS) CTT Brog CT (CDS) CTT Brog CT (CDS) CTT PA-S-AS (ED)		CST Sun-A3 (RM) C21887 S4(AS) DSC1887/2811 Pol-Su- A1 (823) DSC1887/2811 Biog-C (MA)
	II (G)	DISCRIT/28T (life-A4 (LA) DISCRIT/28T (ling-G7 (MM)	ESCLE/J/AP Physica Feb. (AN) ESCHET/20T does 1 (RM) CSL Beng SS (MA) CSL Beng SS (MA) CSL Beng CS (MA) CSL Beng CS (MA) CSL Philos CS (TI) CSL Philos CS (TI) CSL Philos CS (TI) CSL Philos CS (TI)	ERCLAP/2AF/Pbp Edu-Feld (AN) CYLERong Co (20) CYLERong Co (27M) CYLERO (00 (27M) CYLERO (00 (27M) CYLERO (00 (27M) CYLERO (00 (27M)	DECRET/2017 Phát AN (DOO) COST Bring-1300 (DCP) CVET-Eng-SC (MAS) COST ANNAS (DS) COST ANNAS (DS) COST ANNAS (DS) COST ANNAS (DS) COST ANNAS (DS)	ASCCIT Core (ENGL) LNC (DO) CHIT long GE (ECT) CHIT long GE (CC) CHIT long GE (CC) CHIT long GE (CE)	DECRET/2013 (No. CZ* (EXX) CYT-Brog CR* (EX) CYT-Brog CR* (AIX) CYT-Brog CR* (AIX)	(084)
	втра	CET Sam GL (ATE)	OT PLES (CO OT PLES (ED)			CERTIFICATION (PR)	Cart Havill (NR)	CHT.PM-AN(KT)
	N1 (C)	DICTOT/2DT-ling AS (NO)	DSCUDT/2DT-Side LBX (IA)	ASCCIT Com (SNG41) LBR (SIC) CLU Brog LBR (TXX)	DSCOCT/2CP-Phy Sides Field (AN) DSCUDT/2DT-Sear-CH-(DS) DSCUDT/2DT-Sear-CH-(DS)		ESCUDY/2010 the N=52 (60) ESCUDY/2010 throug S1 (MA)	(NT) (NT) (DECUDY/2DT-Ha-n (BC(ENEC na-)PPM)
	VI (RE)	GET-HEL-COMES DESCRIPTIONS OF CE	CITE Sing LISK (SEE) CITE Share C7 (SO) CITE Share C7 (SO) CITE Share C7 (SO) CITE Share C7 (SO)	CETE Burg LUSE (EXX) EIGHT Sing CS (SES) CETE Sing-AT (AVX) CETE Sing-AT (AVX) CETE Sing-AT (SIN) CETE Sing-AT (SIN) CETE Sing-AT (SIN) CETE Sing-AT (SIN)	DREAT Brog CF (CE) CLEE Sing CF (FTM) DREAT SING AT (BIA) DREAT ON A AT (BIA) DREAT ON A AT (BIA) DREAT ON A AT (BIA)	C11 dwg-86 (130) C11 dwg-C3 (974) C11 dws-C3 (13) C11 dws-C3 (13) C11 dws-C3 (13) C11 dws-C4 (10)		
	vi (q	GIST dimp Not (TXX) GIST dimp GIS (XXX) GIST dimp GIS (XXX) GIST dimp GIS (XX) GIST dimp Sides AT (AXX)	DREIEC/ZAT-Pid-Ad (AT) DREIEC/ZAT-Pid-Ad (RC)	ISBIBI / ZAT-Eng-Al (XXX)	DMINI/ZAT-Ha-An (EX)	INSIST/AAT PAIN-TE (KS) INSIST/AAT Sway-AA (TAX) INSIST/AAT Sale-St (LA)	ESSEET/ZAT-Play Sales AZ (AN) ESSEET/ZAT-Sam AT (T)	CB2T Streng SH (17XX) CB2T Streng CB (1XXX) CB2T Streng CB (1XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
bander		G-HV-GINI	CIT-Bring-801 (MA) CIT-Bring-GB (MEB) CIT-Brine-8CI (US) CIT-Brid-8S (M.C) CIT-Brid-8S (MEC) CIT-Brid-8S (PS)	CTI-Baseg SSE (ES) CTI-Same CT (SSA) CTI-Same CT (SSA) CTI-Same SS (EA) CTI-Same SS (ES) CTI-Same SS (ES)	GET Bag NI (IN) GET Fag NI (IX) GET Fac NI (IX) GET Fac NI (IX) GET He NI (IXIX) GET He NI (IXIX) GET He NI (IXIX) GET HE NI (IXIX)	AECCY Harter IND/RI (NO		CET ONG IN DED
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	0100	CRT fam F LOUIS	CYT-Bring-Gir (TXX) CYT-Bring-Mir (BX) CYT-Brid CIR (BX) CYT-Brid CIR (BX) CYT-Brid Cir (BX) CYT-Brid Cir (BX)	COST dang Ca (NR) CHT dang Ca (KR) CHT dang Ci (KR) CHT dang Ci (KL) CHT dang Ci (MR)	CHI Brog Cit (DS) CHI Brog Cit (PFM) CHI Bac Cit (US) CHI Bac Cit (US)	CEET Brog Ck (TXX) CEET Brog Ck (TXX) CEET Broc Ck (XX) CEET Broc Ck (XX) CEET Brock (XX) CEET Brock (XX) CEET Brock (XX) CEET Brock (XX)	NECTI Bing Gr (NR) NECTI Bing SH (NC) NECTI Bing SH (NC) NECTI BinG (NC) NECTI BinG (NC) NECTI BinG (NC)	CHIPALANTA
	N1 (G)	DECEDT/2DT-Public-SQ (80) DECEDT/2DT-Brog LSE (DO)	AllOCAT Case (BNG-II)-81 (XXI)	SECURITY EAST-FALL (PROS)	MICEP Phy Edw Hold (PROS)	DICITIT/2018 Aug ld (ABA)	ESCUDY/200 Sam A1 (10) ESCUDY/200 Sig Edu A2 (F.K.M) ESCUDY/200 Sidu (SSEA)	DSC1DT/2DT-Phi- (NT) DSC1DT/2DT-His-/ (NN) NECT ANGCA (NK)
	VI (RE)		CITE Brog SH (AC) CITE Brog LDE (PTH) CITE Brow AI (II) CITE Phi-AI (IV) CITE I Phi-AI (BT) CITE I Phi-AI (BT)	DREAT Brog LEE (DA) DREAT Brog AS (PTA) DREAT Brog AS (PTA) DREAT Brog AS (CO)	19841 deep LRC (133) C331 deep 50 (030) 19841 feer A1 (A8) 19841 feer A2 (81) 19841 feer A3 (87) 19841 feer A3 (87)	CLEARNY 40-MEN		CLET-MAND-FE (DR)
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	WE	COST Physical AT (PKM)	CH-Reg-St (TXX)	DREET/ZAT-PASs-A4 (98)	THE TETT / ZAT. How Gir (XXX) (2027 - Broug NH (XXX) (2027 - Broug NH (XXX) (2027 - Brown CH (AR) (2027 - Brown CH (BA))	D8187/2A1-ling-A2 (XXX)	DMINI/2AT-hank2 (004)	(A.G.
Waley	- 50	CTF Gar FL(IC) DECLE- MED GD(IC) DESCRIPT/ZET (Flow-CD* (FNE)	CET-FLOW-NO (BIS)	CTI-Bong-SH (SCP) CTI-Hop-SH (CQ) CTI-Ho-SH (EQ) CTI-FA-So-SH (EQ)	DECENT/SET (No. G) (100)		DECRET/ZET daug AZ (XX)	CHT 0146 AA(T A)CH BNC 80 (MM) ABCCHT Core (BNC)
	II (G)	ENCURT/2017-04-07 (NR) ENCURT/2017-04-01 (NN)	TRICIET / 2017 dlong 664, (687) CIRC Blong Cli (308) CIRC Blong Cli (308) CIRC Blong Cli (408) CIRC Blong Cli (300) CIRC Blong Cli (300)	ESCURT / 2017 (Feb. 100 (COO) CYC Bring Ca (TOO) CYC Bring Ca (TOO) CYC Bring Ca (TOA) CYC Brind Ca (CO) CYC Brind Ca (CO) CYC Brind Ca (CO) CYC Brind Ca (CO)		DECEMPANT OF DAY CHILDRANG OF DAY	ERCORT/2011 diag-A2 (XX) ERCORT/2011 diag-A3 (ALA)	ASCOT GAV (ENG.) SH (PTM)
	BTORI	CRT_GA(IP) CRTHIN-GE [MEXI] DRICCIDT/ZDT-RB-GE (RN) DRICCIDT/ZDT-RB-GE (RM)		CYLPIAC (B)C CYLPIAC (B)C CYLPIAC (B)C CYLPIAC (B)C CYLPIAC (B)C ESCHOT/TOU Sing LBE (B)C	CHE-Bring Cir (DDI) CHE-Bring Cir (DDI) CHE-Brink (DDI) CHE-Pid-PI (E.A) CHE-Pid-PI (E.A) CHE-Pid-PI (E.A) CHE-Pid-PI (E.A) CHE-Pid-PI (E.A) CHE-PId-PID (Phy-Pid-A) (AN)	SEC 107/2017/ing lide AN (FX.M) DEC107/2017/ing lide AN (FX.M)	CYLHENGOLDE) NEC CE/2CE Phy Edw. A3 (AN) AECCET Core (INGE)	PubA2(9)
	NT (G)		TRICUIDT/20T-Polito-TR (XXX) ERBOT doug CT (ER) ERBOT doug LEK (XDR) ERBOT doug LAX (XDR) ERBOT doug-A1 (T) ERBOT doug-A2 (EA) ERBOT doug-A2 (EA) ERBOT doug-A2 (EA) ERBOT doug-A2 (EA)	CERT Bang CF (AR) 198171 dag LRF (AX) 19817 dag LRF (AX) CERT Sub-At (AR) CERT Sub-At (AX) CERT Sub-At (AX)	(AN) DECEDY/2005 Sum As (AC) DISCRIPT/2005 Sum As (AC) DISCRIPT/SUM (AC) DISCRIPT/SUM (AC) DISCRIPT/SUM (AC) DISCRIPT/SUM (AC) DISCRIPT/SUM (AC) DISCRIPT/SUM (AC)	CHT dwg/88 (TXX) CHT dwg/88 (TXM) CHT dwg/18 (TYM) CHT dwg/18 (TYM) CHT dwg/18 (TXM) CHT dwg/88 (TXM) CHT dwg/88 (TXM)	pred (300)	
	VI (M)	CSET - (BENG-PR[10]) (227 - Beng-Car (MA) (227 - B	INSTRUMENT OF STREET,	COST PARIO - ÁS (ÉS)		CHT PARK - AL (PE)	ENGIB-DENT-COURS	NEC IF (A.N)
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	ие		CIT-ling 88 (RK) CIT-line 82 (TR)		GREET, PHARM (TA) GREET, 184-84 (MRXS) GREET, PHARM Cross Lade (PR)	(THE CAN)		
laterilay	- PA	C27 Sen #1 (MI)	CFL Bring P1 (DB) CFL Bring N (BA) CFL Bring N (BA) CFL Brid N (AC) CFL Brid N (AC) CFL Brid N (BRIN) CFL Brid N (BRIN)	CTI Brog NE (NY) CTI Brog NE (PRI) CTI Pri AN (BA)				
Lineslay	E (Q	C21 Gas #1,(98) AECCST Case (BNG-8)-881 (NO.	CEL FAGA-30 (80) ENCURT / 2011 046-62* (900)	ESCURT/2017 daug-A5 (XX) ESCURT/201 Edu-SS (M.A)	DSCIRT/2017 flowing AS TXX T DSCIAT (ING NI)/MAR)	PRILITENCE (A N) DECEPT/SET. Political (PR)	HILD Floy Sales Ald (A.N.	
Wantey	E (G)		CTT-Pade-80 (88) DECURT / 2011 des-C2 (200) CTT-Resig Cd (19) CTT-Resig Cd (10)	ESCUEF/20T ding-AA (OQ ESCUEF/20T Edwist (M.A) CVT-80-qc(d-(ES) CVT-80-qc(d-(ES) CVT-80-qc(d-(EA) CVT-80-qc(d-(EA) CVT-80-qc(d-(EA) CVT-80-qc(d-(EA) CVT-80-qc(d-(EA) CVT-80-qc(d-(EA) CVT-80-qc(d-(EA) CVT-80-qc(d-(EA)	TISCUET / JEET deep, AN YEAR TISCULAT ONG HIGHER GREET deep ER (FCT) GREET deep ER (FCT) GREET deep GR (FFT) GREET deep GR		HHLD Ploy Selon A3 (A N	
ishoolay	E (Q)	ARCCIT Care (INSCIPLINE) ARCCIT Care (INSCIPLINE) ARCCIT Care (INSCIPLINE) COLD Basel 1 (TO) COLD Basel 1 (TO) COLD Basel 2 (TO) COLD Basel 3 (TO) COLD Basel 3 (TO) COLD Basel 3 (TO) COLD Basel 3 (TO) COLD Basel 4 (TO) COLD Basel 4 (TO) COLD Basel 4 (TO)	CEL FAGA-30 (80) ENCURT / 2011 046-62* (900)	ESCURT/2017 daug-A5 (XX) ESCURT/201 Edu-SS (M.A)	DSCIRT/2017 flowing AS TXX T DSCIAT (ING NI)/MAR)		HILD Fly Salma AS (A. N.	



		MASTER RO	OUTINE :: SE	SSION:2022-2	3 :: SEMEST	ER - ODD (SC	IENCE)	
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VIDYASAGAR UNIVERSITY



$\begin{array}{c} \textbf{Curriculum for } \textbf{ 3-Year B Sc (HONOURS)} \\ \textbf{ in} \\ \textbf{ Botany} \end{array}$

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	Course	Course Title	Credit	L-T-P	Marks					
		Туре	Code				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								325			

Year	Semester	Course	Course	Course Title	Credit	L-T-P	Marks			
		Type	Code				CA	ESE	TOTAL	
2	Semester-III									
	Ш	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	
				26				350		
	Semester – III: total 26 35 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	
			26				350			

/ear	Semester	Course	Course	Course Title	Credit	L-T-P	Marks				
		Туре	Code				CA	ESE	TOTAL		
	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					
				24				300			
				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				300		
			-	tal in all semester:	142		1	1	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 MicrobiologyCC-2: Bio-molecules and Cell BiologyCC-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 PhysiologyCC-13: Plant MetabolismCC-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-archaebacteria, 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*, *Procholoron* 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 quarternary; 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: Bioenergenetics

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 theroy), 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 ofeukaryotic 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 Mashroom.

Unit- 5: Allied Fungi

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

Unit- 6: Oomvcota

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, pseudoelaters, 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, wholemount 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,
- Fahn, A. (1974). Plant Anatomy. Pergmon Press, USA.
- Mauseth, J.D. (1988). Plant Anatomy. The Benjammin/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-microchemical 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: ClB 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 chisquare.
- 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 Phytogeography

Credits 06

C9T: Plant Ecology and Phytogeography

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 (*Orobanche*) 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. Asclepiadaeceae- 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, psuedomonads, 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. 1 (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, crytochromes and phototropins

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

C12P: Plant Physiology

Credits 02

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, PCRmediated 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); Gentically 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
- 6. 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 sociocultural).

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; Bioprospecting; 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; Coefficient 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, Danniel, 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 emaculation
 - a) By applying higher temperature,
 - b) By amputing 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, CsCl2gradient, 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 emperical). 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 saltsolutions. 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.

<u>Generic Elective (GE)</u> [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 (*Orobanche*), 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

U nit 4: Spices

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

U nit 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

U nit 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

GE4P: Plant Anatomy and Embryology

Credits 02

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.

U nit 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.

C omposition 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.

U nit 5: Respiration

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

U nit 6: Enzymes

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

U nit 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.



NARAJOLE RAJ COLLEGE (NAAC Accredited 'B' Grade Government Aided College 4RAJOLE: PASCHIM MEDINIPUR: WEST RENGAL: PIN-72121





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

SEM	Paper	UKK	NB	ВН	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



$NARAJOLE\ RAJ\ COLLEGE$ (NAAC Accredited 'B' Grade Government Aided College

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

Name of the Department: Dept. of Botany Academic Session: 2022-23 (July'22 - Dec'22) Semester: ODD Dr. Uttam Kumar Kanp (Assistant Professor - Stage 2 & Head) Paper Paper Weekly Weekly Paper Weekly Paper Weekly Paper Weekly Paper Weekly Paper Weekly Total Code Code Code Code Classes Code Classes Code Classes Code Classes Classes Classes Weekly Classes (9)(11)(13)Classes (1) (2) (3)(4)(5)(6)(7) (8)(10)(12)(14)C₁T 02 C₁P 02 DSC-02 C6T 01 C₆P 02 DSC-01 C12T 02 1CT 1AT Dr. Uttam Kumar Kanp (Assistant Professor - Stage 2 & Head) Paper Paper Weekly Weekly Weekly Paper Weekly Weekly Weekly Weekly Total Paper Paper Paper Paper Code Classes Weekly (15)(16)(17)(18)(19)(20)(21)(22)(23)(24)(25)(26)(27)(28)Classes C12P DSE 2T Χ 22 02 DSE 2P 02 DSE1AT 02 DSE1AP Prof. Nandita Bhakat (Assistant Professor - Stage 1) Paper Paper Paper Weekly Weekly Weekly Paper Weekly Paper Weekly Paper Weekly Paper Weekly Total Code Code Code Classes Classes Classes Code Classes Code Classes Code Classes Code Classes Weekly (1) (3) (9)(10)(13)(14)Classes (2) (4)(5)(6) (7) (8)(11)(12)C7P GE3T C2T 02 C2P 02 C5T 02 C₅P 02 C7T 01 02 Prof. Nandita Bhakat (Assistant Professor - Stage 1) Weekly Paper Weekly Paper Weekly Paper Paper Weekly Total Weekly Paper Weekly Paper Weekly Paper Code Classes Weekly (22)(15)(17)(18)(19)(20)(21)(23)(24)(25)Classes (16)(26)(27)(28)GE3P 02 SEC-1T 01 DSE 1T DSE1P 02 DSE1AT SEC3T 22 02 01 Prof. Bangamoti Hansda (Assistant Professor - Stage 1) Paper Paper Weekly Paper Weekly Paper Weekly Paper Weekly Paper Weekly Weekly Paper Weekly Total Code Classes Weekly (12)(13)(1)(2)(3)(4)(5)(6)(7) (8)(9)(10)(11)(14)Classes 04SEC1T 01 GE3P 02 DSc1AT 02DSC1A C₆T 01 GE3T 02 SEC1T 01 Prof. Bangamoti Hansda (Assistant Professor - Stage 1) Paper Weekly Paper Weekly Paper Weekly Weekly Paper Paper Weekly Paper Paper Weekly Weekly Total Code Code Classes Code Classes Classes Code Classes Code Classes Code Classes Code Classes Weekly (25)(15)(17)(19)(20)(21)(23)Classes (16)(18)(22)(24)(26)(27)(28)C12T C12P DSE1T DSE2T SEC3T χ Χ 01 0202DSE1P 0201 01 22

Name of the Department: Dept. of Botany

Academic Session: 2022-23 (July'22 - Dec'22)

Semester: ODD



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

Dr. Prithwi Ghosh (Assistant Professor - Stage 1)														
Paper	Weekly	Paper	Weekly	Paper	Weekly	Paper	Weekly	Paper	Weekly	Paper	Weekly	Paper	Weekly	Total
Code	Classes	Code	Classes	Code	Classes	Code	Classes	Code	Classes	Code	Classes	Code	Classes	Weekly
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	Classes
C2T	02	C2P	02	GE1T	01	C6T	02	C6P	02	C7T	01	C11T	02	
Dr. Prithwi Ghosh (Assistant Professor - Stage 1)														
Paper	Weekly	Paper	Weekly	Paper	Weekly	Paper	Weekly	Paper	Weekly	Paper	Weekly	Paper	Weekly	Total
Code	Classes	Code	Classes	Code	Classes	Code	Classes	Code	Classes	Code	Classes	Code	Classes	Weekly
(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	Classes
C11P	02	DSE2T	01	DSE2P	02	DSE1AT	01	DSE1AP	02	C5T	02	Х	Χ	22
Prof. Sanjay Kumar Datta (State Aided College Teacher)														
Paper	Weekly	Paper	Weekly	Paper	Weekly	Paper	Weekly	Paper	Weekly	Paper	Weekly	Paper	Weekly	Total
Code	Classes	Code	Classes	Code	Classes	Code	Classes	Code	Classes	Code	Classes	Code	Classes	Weekly
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	Classes
C1T	02	C1P	02	GE1T	02	GE1P	02	C5P	02	SEC1T	01	DSC1CT	01	
Prof. Sanjay Kumar Datta (State Aided College Teacher)														
Paper	Weekly	Paper	Weekly	Paper	Weekly	Paper	Weekly	Paper	Weekly	Paper	Weekly	Paper	Weekly	Total
Code	Classes	Code	Classes	Code	Classes	Code	Classes	Code	Classes	Code	Classes	Code	Classes	Weekly
(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	Classes
DSC1CP	02	C12T	01	X	X	Х	Х	Х	Х	X	X	X	X	15
Prof. Arpita Chakraborty (State Aided College Teacher)														
Paper	Weekly	Paper	Weekly	Paper	Weekly	Paper	Weekly	Paper	Weekly	Paper	Weekly	Paper	Weekly	Total
Code	Classes	Code	Classes	Code	Classes	Code	Classes	Code	Classes	Code	Classes	Code	Classes	Weekly
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	Classes
GE1T	01	GE1P	02	C7T	02	C7P	02	DSC1CT	02	DSC1CP	02	C11T	02	
Prof. Ar	Prof. Arpita Chakraborty (State Aided College Teacher)													
Paper	Weekly	Paper	Weekly	Paper	Weekly	Paper	Weekly	Paper	Weekly	Paper	Weekly	Paper	Weekly	Total
Code	Classes	Code	Classes	Code	Classes	Code	Classes	Code	Classes	Code	Classes	Code	Classes	Weekly
(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	Classes
C11P	02	Χ	X	X	X	X	X	X	X	X	X	X	X	15



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

Name of the Department: Dept. of Botany Academic Session: 2022-23 (Jan'23-June'23) Semester: EVEN Dr. Uttam Kumar Kanp (Assistant Professor - Stage 2 & Head) Paper Paper Paper Weekly Weekly Weekly Paper Weekly Paper Weekly Paper Weekly Paper Weekly Total Code Code Code Code Classes Code Classes Code Classes Code Classes Classes Classes Weekly Classes (9)(5) (11)(13)Classes (1) (2) (3) (4)(6) (7) (8)(10)(12)(14)DSC2BT C8T C4T 02 C4P 02 02 01 C8P 02 DSC2D 01 C13T 02 Τ Dr. Uttam Kumar Kanp (Assistant Professor - Stage 2 & Head) Paper Paper Weekly Weekly Weekly Paper Weekly Weekly Weekly Weekly Total Paper Paper Paper Paper Code Classes Weekly (15)(16)(17)(18)(19)(20)(21)(22)(23)(24)(25)(26)(27)(28)Classes C13P C14T 02 Χ 02 C14P 02 18 Prof. Nandita Bhakat (Assistant Professor - Stage 1) Paper Paper Paper Weekly Weekly Weekly Paper Weekly Paper Weekly Paper Weekly Paper Weekly Total Code Classes Weekly (1) (3) (4)(9)(11)(13)Classes (2) (5) (6) (7) (8)(10)(12)(14)C3T C10T C10P GE4T GE4P 02 C8T 03 C8P 02 02 02 02 Prof. Nandita Bhakat (Assistant Professor - Stage 1) Paper Paper Weekly Paper Weekly Paper Weekly Paper Weekly Total Weekly Weekly Paper Weekly Paper Code Classes Weekly (22)(23)(24)(25)(15)(17)(18)(19)(20)(21)Classes (16)(26)(27)(28)C13T 02 C13P 02 19 Prof. Bangamoti Hansda (Assistant Professor - Stage 1) Paper Paper Weekly Paper Paper Weekly Weekly Paper Weekly Paper Weekly Weekly Paper Weekly Total Code Classes Weekly (9)(4)(1) (2)(3)(5)(6)(7) (8)(10)(11)(12)(13)(14)Classes DSC2BT DSC2BP 04 C9T SEC2T GE4P 02 01 01 GE4T 02 02 C14T 02 Prof. Bangamoti Hansda (Assistant Professor - Stage 1) Paper Weekly Total Code Code Weekly Classes Code Classes Code Classes Classes Code Classes Code Classes Code Classes (20)(15)(16)(17)(18)(19)(21)(22)(23)(24)(25)(27)(28)Classes (26)

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20

DSE4P

02

02

C14P

02

DSE4T



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

Name of the Department: Dept. of Botany Academic Session: 2022-23 (Jan'23-June'23) Semester: EVEN Dr. Prithwi Ghosh (Assistant Professor - Stage 1) Weekly Paper Weekly Paper Weekly Paper Weekly Paper Paper Weekly Paper Weekly Paper Weekly Total Code Code Code Code Code Classes Code Classes Code Classes Classes Classes Classes Weekly Classes (8)(9)(13)Classes (1) (2) (3)(4)(5) (6)(7) (10)(11)(12)(14)C3P C9P 02 C4T 02 C4P 02 GE2T 01 C9T 02 02 SEC2T 01 Dr. Prithwi Ghosh (Assistant Professor - Stage 1) Paper Weekly Paper Weekly Paper Weekly Paper Weekly Paper Weekly Paper Weekly Weekly Total Paper Code Classes Code Classes Code Code Code Code Classes Code Weekly Classes Classes Classes Classes (15)(17)(18)(19)(20)(21)(22)(23)(24)(25)Classes (16)(26)(27)(28)DSE3T 02 DSE₃P 02 DSE4T 02 DSF4P 02 20 Prof. Sanjay Kumar Datta (State Aided College Teacher) Weekly Weekly Weekly Weekly Weekly Paper Weekly Paper Total Paper Paper Paper Paper Weekly Paper Code Code Classes Code Classes Classes Code Classes Code Classes Code Classes Code Classes Weekly (9)(1) (2) (3)(4)(5) (6) (7) (8)(10)(11)(12)(13)(14)Classes C3T 02 C₃P 02 GE2T 02 GE2P 02 C9T 01 C9P 02 DSC2D 01 Τ Prof. Sanjay Kumar Datta (State Aided College Teacher) Paper Weekly Paper Weekly Paper Weekly Weekly Paper Weekly Paper Weekly Paper Weekly Total Paper Code Classes Weekly (18)(20)(23)(25)(15)(19)(21)(22)(28)Classes (16)(17)(24)(26)(27)DSC2D 02 Χ Χ Χ Χ Χ Χ Χ Χ Χ Χ Χ 14 Р Prof. Arpita Chakraborty (State Aided College Teacher) Paper Weekly Total Code Classes Code Classes Code Classes Code Code Classes Code Code Weekly Classes Classes Classes (9)(11)(13)Classes (1)(3)(5)(6)(7) (8)(10)(12)(14)(2)GE2T 01 GE2P 02 C10T 02 C10P 02 DSC2D 02 DSC2D 02 DSF3T 02 Р Τ Prof. Arpita Chakraborty (State Aided College Teacher) Paper Paper Paper Paper Paper Weekly Weekly Paper Weekly Paper Weekly Weekly Weekly Weekly Total Code Classes Code Classes Code Weekly Code Classes Code Classes Code Classes Classes Code Classes (15)(16)(17)(18)(19)(20)(21)(22)(23)(24)(25)(26)(27)(28)Classes DSE3P Χ Χ Χ χ 02 Χ Χ Χ Χ Χ Χ Χ X 15



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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	Broad Topic in	Topic to be covered in the Lecture
Lecture	University Syllabus	. 65
1.		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.	(TT *4 3)	Limit comparison test, problems
8.	(Unit-3)	Ratio test, problems
9.	Series	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.	X	Problems for testing absolute and conditional convergence of infinite series
15.		Tutorial on different types of convergence tests of infinite series
16.		Plotting of recursive sequences.
17.		Study the convergence of sequences through plotting
18.	Graphical	Problems
19.	Demonstration	Verify Bolzano-Weierstrass theorem through plotting of
	(Teaching Aid)	sequences and hence identify convergent subsequences from the
		plot
20.	Broad topic in	Problems
Sr. No. of	Dioua topic iii	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



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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	Broad Topic in University	Topic to be covered in the Lecture
ture	Syllabus	
1.		Introduction to Functions of several variables
2.		Limit and continuity of functions of two or more variables
3.		Problems
4.	(UNIT-1)	Partial differentiation
5.	Functions of Several	Total differentiability and differentiability
6.	Variables	Problems discussion
7.	v ariables	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 on chain rules
18.		Problem discussion on testing maxima or minima of
	Problem Discussion	functions of several variables
19.		Discussion on previous year University question papers
20.		Doubt clearing
21.		Double integration over rectangular region
22.	(Unit 2)	Examples
23.	Double Integration	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	Broad Topic in	Topic to be covered in the Lecture
Lecture	University Syllabus	
1.		Introduction to Partial Differential Equation(PDE)-Basic
		concepts, definition, mathematical problems
2.	/T I:	First order PDE and its classification
3.	(Unit-I)	Discussion of some problems
4.	Partial Differential	Construction and Geometrical Interpretation of first order pde
5.	Equation	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.	4/0	Doubt clearing
12.	~0X	Derivation of Heat equation with examples
13.	(Unit-II) Heat, Wave and Laplace	Solving problems of heat equation
14.	Equation	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.		Cauchy problem of an infinite string
23.		Problems
24.	(Unit-III)	Initial Boundary Value Problems
25.	Vibrating String and Heat	Semi-Infinite String with a fixed end
26.	Conduction Problem	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.	-07	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)	Problems of varying mass
44.	Dynamics	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	Broad Topic in	Topic to be covered in the Lecture	
Lecture	University Syllabus		
1.		Introduction to complex numbers	
2.			
	-	Limits, Limits involving the point at infinity	
3.	<u> </u> 	Continuity	
4.	(UNIT-3)	Properties of complex numbers	
5.		Region in the complex plane	
6.	Complex Numbers:	Functions of complex variables	
7.	Limit, Continuity and	Definition of Mappings, examples	
8.	Differentiability	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)	Examples of analytic functions	
17.		Exponential function	
18.	Analytic Function	Logarithmic function	
19.	LOY	Trigonometric function	
20.		Derivatives of functions	
21.	Contour Integrals	Contours	
22.		Contour integrals and its examples	
23.	1	Upper bounds for moduli of contour integrals	
24.	1	Cauchy- Goursat theorem	
25.	Broad topic in Examples		
Sr. No. of	university Syllabus	Topic to be covered in the Lecture	
Lect.	university Symaous	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.		Liouville's theorem
31.	/T In:4 E)	The fundamental theorem of algebra
32.	(Unit 5) Liouville's theorem	Convergence of sequences and series
33.		Examples
34.		Taylor series and its examples
35.	(Unit -6)	Laurent series and its examples
36.	I assume at Constant and	Power Series
37.	Laurent Series and Power Series	Absolute and uniform convergence
38.	Tower series	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	Broad Topic in University Syllabus	Topic to be Covered in the
Lecture		Lecture
Lecture 01	Theory	Discovery and general
	Unit 3: Bacteria	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	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 Vaucheria.
Lecture 19		Revision
Lecture 20		Revision
Lecture 21		Revision
Practical 1	Practical 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	
Lecture 01	Theory	Morphology cultivation,
	Unit 4: Source of sugars and	management and processing of
	starches	sugarcane, products and by-
I 4 02		products of sugarcane industry.
Lecture 02		Potato – morphology, propagation
1 4 02	II '4 # C '	& 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).
Lecture8		Essential Oils: General account,
		extraction methods, comparison
		with fatty oils & their uses.
Lecture 9		Revision
Lecture 10		Revision
Lecture 12		Revision
Practical 1	<u>Practical</u>	Cereals: Wheat (habit sketch, L.
		S/T.S. grain, starch grains, micro-
	Economic botany	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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Ph.: 9475429270 e-mail: narajolerajcollege@rediffmail.com

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	Broad Topic in University Syllabus	Topic to be Covered in the	
Lecture	(T)	Lecture	
Lecture 01	Theory	Discovery, chemical nature (basic	
	Unit 5: Plant growth regulators	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	Discovery, chemical nature, role	
	and phototropins	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 Avena
	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
Tractical	cuttings (Demonstration).
	cuttings (Demonstration).
Practical 10	Bolting experiment/Avena
	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	Broad Topic in University Syllabus	Topic to be Covered in the
Lecture		Lecture
Lecture 01	Theory	Introduction and objectives of
	Unit 1: Plant breeding	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	Introduction: Centres of origin
	improvement	and domestication of crop plants
Lecture 05	1	plant genetic resources;
		Acclimatization.
Lecture 067		Selection methods: For self
		pollinated propagated plants.
Lecture 07		cross pollinated and vegetative
2000010 07		propagated plants.
Lecture 08		Hybridization: For self,
Lecture 00		propagated plants – Procedure,
		advantages and limitations.
Lecture 9		Hybridization: For cross
Lecture		propagated plants – Procedure,
		advantages and limitations.
Lecture 10		Hybridization: For vegetative
2000010 10		propagated plants – Procedure,
		advantages and limitations.
Lecture 11		Revision
Lecture 12		Revision
Lecture 13		Revision
Practical 1	Practical	Identification of offspring's
		having parental genotypes and
	Plant Breeding	recombinant genotypes, based on
		combination of morphological
		attributes in a dihybrid cross.
Practical 2		Processes of emaculation – By
11000001 2		applying higher temperature.
		apprying ingher temperature.



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Practical 3	Processes	of	emaculation	-Ву
	amputing a	antho	ers	



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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
SI. No. of Lecture	Broad Topic in Oniversity Synabus	Lecture
T 01		
Lecture 01		Classification (up to family),
Lecture 02	Unit 3: Type studies- Bryophytes	Morphology, anatomy and
		reproduction of
		–Riccia
Lecture 03		-Marchantia
Lecture 04		-Pellia
Lecture 05		-Porella
Lecture 06		-Anthoceros
Lecture 07		-Sphagnum
Lecture 08		- Funaria and Pogonatum
Lecture 09		Reproduction and evolutionary
		trends in Riccia, Marchantia,
		<i>PlagichasmaAnthoceros</i> and
		Funaria (developmental stages not
		included).
Lecture 10		Ecological and economic
		importance of bryophytes with
		special reference to Sphagnum.
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		Historical perspective;
Lecture 02	Unit- 1: Nucleic acids: Carriers of	
	genetic information	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	DNA Structure: Miescher to
	RNA / Genetic Material	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
T	1	discontinuous replication,
Lecture 18	1	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		Introduction, anabolic and
Lecture 01	Unit 1: Concept of metabolism	catabolic pathways.
Lecture 02	ont 1. Concept of metabolism	Regulation of metabolism.
Lecture 03	-	Role of regulatory enzymes
Lecture 03		(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		CO2 reduction,
Lecture 09		photorespiration,
Lecture 10		C4 pathways;
Lecture 11		Crassulacean acid metabolism;
Lecture 12		Factors affecting CO2 reduction.
Lecture 13	Unit 3: Carbohydrate metabolism	Synthesis and catabolism of
		sucrose and starch.
Lecture 14		Glycolysis.
Lecture 15	Unit 4: Carbon Oxidation	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	1	Composition of media.
Lecture 03	1	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	Restriction Endonucleases -
	technology	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		Origins of Western Theatre
Lecture 02	Background Reading: <i>Theatre and Elizabethan England</i>	Greek and Roman Theatrical scenes
Lecture 03	O	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 W. L. J.	Introduction to Macbeth
Lecture 10	William Shakespeare: <i>Macbeth</i>	Story of Macbeth
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 Macbeth
Lecture 30		Characters in Macbeth
Lecture 31		Plot of Macbeth
Lecture 32		Role of Fate in Macbeth
Lecture 33		The Supernatural in <i>Macbeth</i>
Lecture 34		The opening Scene of Macbeth
Lecture 35		The Porter Scene and Humour in
Lecture 36		Macbeth Salila miss in Macheth
Lecture 30		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	Critical Terms	Allegory, Ballad, Blank-Verse, Heroic
Lecture 43	Critical Terms	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

Semester:3 ^{ru}	D 1/D • • • • •	
Sl. No. of Lecture	Board Topic in University	Topic to be Covered in the Lectures
	Syllabus	
Lecture 01		
	Background Reading: British Novel	19th century England: Society and
		Politics
Lecture 02		19th 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	Charles Dienens. Hara Times	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 Hard Times
Lecture 27	Major characters of Hard Times
Lecture 28	Minor characters of Hard Times
Lecture 29	Symbolism in <i>Hard Times</i>
Lecture 30	Class conflict in Hard Times
Lecture 31	Humour in <i>Hard Times</i>
Lecture 32	The title <i>Hard Times</i>
Lecture 33	Hard Times as a Dickensian novel
Lecture 34	Language of Hard Times
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: Women and	Women in India
Lecture 02	Violence	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	77 11	Analytical reading of the text: Karukku
Lecture 10	Karukku	Analytical reading of the text: Karukku
Lecture 11		Analytical reading of the text: Karukku
Lecture 12		Analytical reading of the text: Karukku
Lecture 13		Analytical reading of the text: Karukku
Lecture 14		Analytical reading of the text: Karukku
Lecture 15		Analytical reading of the text: Karukku
Lecture 17		Analytical reading of the text: Karukku
Lecture 18		Analytical reading of the text: Karukku
Lecture 19		Analytical reading of the text: Karukku



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Lecture 20		Analytical reading of the text: Karukku
Lecture 21		Analytical reading of the text: Karukku
Lecture 22		Analytical reading of the text: Karukku
Lecture 23		Analytical reading of the text: Karukku
Lecture 24		Analytical reading of the text: Karukku
Lecture 25		Analytical reading of the text: Karukku
	Sultana's Dream	
Lecture 26	Sutuna S Dream	Analytical reading of the text: Sultana's Dream
Lecture 27		Analytical reading of the text: Sultana's
		Dream
Lecture 28		Analytical reading of the text: Sultana's Dream
		2.00
Lecture 29		Analytical reading of the text: Sultana's
		Dream
Lecture 30		Analytical reading of the text: Sultana's
		Dream
Lecture 31		Analytical reading of the text: Sultana's
		Dream
Lecture 32		Analytical reading of the text: Sultana's
		Dream
Lecture 33		Analytical reading of the text: Sultana's
		Dream
Lecture 34		Analytical reading of the text: Sultana's
		Dream
Lecture 35		Analytical reading of the text: Sultana's
		Dream



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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	Topic to be Covered in the Lectures
Lecture 01	Syllabus	Western Colonisers: society/ culture/ tradition/ education
Lecture 02		De-colonising movements
Lecture 03	Background Reading: Colonial / Post Colonial	New literature in the making
Lecture 04	1 ost Cotoniui	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		The story: Things Fall Apart
Lecture 09		Analytical reading of the text <i>Things</i> Fall Apart
Lecture 10		Analytical reading of the text <i>Things</i> Fall Apart
Lecture 11		Analytical reading of the text <i>Things</i> Fall Apart
Lecture 12	Chinua Achebe: <i>Things Fall Apart</i>	Analytical reading of the text <i>Things</i> Fall Apart
Lecture 13		Analytical reading of the text <i>Things</i> Fall Apart
Lecture 14		Analytical reading of the text <i>Things</i> Fall Apart
Lecture 15		Analytical reading of the text <i>Things</i> Fall Apart
Lecture 16		Analytical reading of the text <i>Things</i> Fall Apart
Lecture 17		Analytical reading of the text <i>Things</i> Fall Apart



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Lecture 18		Analytical reading of the text <i>Things</i> Fall Apart
Lecture 19		Analytical reading of the text <i>Things</i>
		Fall Apart
Lecture 20		Analytical reading of the text <i>Things</i>
		Fall Apart
Lecture 21		Analytical reading of the text <i>Things</i>
Lecture 22		Fall Apart Analytical mading of the toyt Things
Lecture 22		Analytical reading of the text <i>Things</i> Fall Apart
Lecture 23		Analytical reading of the text <i>Things</i>
Ecotare 25		Fall Apart
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 Things Fall Apart
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
Lecture 35		Reading the story <i>The Collector of</i>
Lecture 33	Short Story: The Collector of	
Lecture 36	Treasures by Bessie Head	Reading the story <i>The Collector of</i>
	·	Treasures analytically
Lecture 37		Reading the story <i>The Collector of</i>
		Treasures analytically



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Lecture 38	Reading the story The Collector of Treasures analytically
Lecture 39	Reading the story <i>The Collector of Treasures</i> analytically
Lecture 40	Plot of the story The Collector of Treasures
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		Russian society and history
Lecture 02	Background Reading – Developments in Russian Literature	Literary movements and development of Russian novel
Lecture 03		The Detective novel and Psychoanalysis
Lecture 04		Crime and Punishment: 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	Fyodor Dostoevsky: <i>Crime and Punishment</i>	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