

UNIVERSITY OF NORTH BENGAL

PROPOSED COURSE STRUCTURE

FOUR YEAR UNDERGRADUATE PROGRAM (FYUGP) WITH SINGLE MAJOR

BOTANY

UNDER THE NEW CURRICULUM AND CREDIT FRAMEWORK, 2022

2023

COURSE STRUCTURE FOR IInd Year

Year	Semester	Course	Course code	Course name	Credits	Credit distribution	
		type					
		Theory	Practical				
		Major	UBOTMAJ23003	Microbiology	4	3	1
II		Major	UBOTMAJ23004	Mycology and Plant Pathology	4	3	1
	3	Major	UBOTMAJ23005	Phycology and Bryology	4	3	1
		Minor	UBOTMIN20002	Morphology, Anatomy and	4	3	1
				Taxonomy of Flowering Plants			
		Skill	UBOTSEC23003	Biofertilizers and	3	2	1
		enhanceme		Mushroom			
		nt course		Cultivation			
		Major	UBOTMAJ24006	Pteridology,	4	3	1
				Gymnology and			
				Palaeobotany			
	4	Major	UBOTMAJ24007	Morphology and Anatomy	4	3	1
		Major	UBOTMAJ24008	Taxonomy of Angiosperms	4	3	1
		Minor	UBOTMIN20002	Morphology, Anatomy and Taxonomy	4	3	1

*NUMBER OF TEACHING HOURS/WEEK

THEORY: 1 credit = 1 Lecture/week = 1 hour/week PRACTICAL: 1 credit = 1 Class/week = 2 hour/week

UGBOS Members -Str. Chandranie Choushwi Dr. Rakhi Chahruburty Dr. Protije Balu Dr. Bikham Saha Dr. Bikham Saha Dr. Swarenendle Roy Dr. Liych Matur Dr. Jyotsna Das.

Discipline:	Science	√ Arts, ⊦	umanities & Soc	ial Science
	Commerce	BBA		BCA
Subject Name:	Botany	_		
Subject Code:		(Will b	e provided by th	e University)
Semester:	Semester I 🗌	Semester II 🗌	Semester III \checkmark	Semester IV
	Semester V \Box	Semester VI 🗆	Semester VII 🗆	Semester VIII 🗆
Course Name:	Microbiology			
Course Code:	UBOTMAJ230	003	(Will be provid	ed by the University)
Course Credit:	Theoretical	3	Practical/Tuto	rial 1
Marks Allotted:	Theoretical	40	Practical/Tutor	rial 20
	Continuing Eva	aluation 10	Attendance	5
Course Type (tick the c	orrect alternativ	ves):		
Major Core		\checkmark	AEC	
Interdisciplina	ry/ DSE		SEC	
Minor / Gener	c Elective		VAC	
Research Proje	ct/Dissertation		Vocational	
Is the course focused o	n employability	/ entrepreneurs	hip? YES √	NO 🗆
Is the course focused o	n imparting life	skill?	YES 🗆	NO √
Is the course based on	Activity ?		Yes \checkmark	
Remarks by Chairman,	UG BOS, if any			
Syllahus fina	lized and annra			

450 /UG-23

SEMESTER - III

Semester- III

Course Type: MAJOR

Course Code: UBOTMAJ23003

Course Name: Microbiology

(Credits: Theory=3, Practical=1)

Full Marks: 75 (Theory-40, Practical-20, Continuing Evaluation-10, Attendance-5)

Brief Course Description: UBOTMAJ23003 deals with the history and scope of Microbiology along with the diversity of microbial world. It emphasizes the structural organization, growth, metabolism and reproduction of bacteria, viruses and other microbial forms. It also highlights the techniques practised in microbial laboratories and the application of microorganisms in agricultural and industrial sectors.

Prerequisite(s) and/or Note(s):

(1) High School Biology.

(2) Note(s): Syllabus may be modified after and not during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course.

Course Objectives:

Knowledge acquired:

(1) Diversity of microbial world.

- (2) Introduction to the laboratory techniques in Microbiology.
- (3) Agricultural and industrial application of microorganisms.

Skills gained:

- (1) Media preparation, culturing and preservation of microbial cells.
- (2) Basic sterilization techniques.

Competency Developed:

- (1) Selection of suitable media for growth and reproduction for microbes.
- (2) Choosing proper sterilization techniques.
- (3) Collection and preservation of specific microorganisms.

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Total Lectures:45

(7 Lectures)

(12 Lectures)

Unit 1: Microbial diversity

Introduction to microbial diversity; Hierarchical organization and positions of microbes in the living world: Distribution of microbes in soil, air, food and water. Significance of microbial diversity in nature. History and development of microbiology - Microbiologists and contributions of - Leeuwenhoek, Louis Pasteur, Robert Koch, Alexander Flemming, Joseph Lister, Dmitri Ivanovsky, Sergei Winogradsky, and M.W. Beijerinck and Paul Ehrlich. Contributions of Indian microbiologists.

Unit 2: Bacteria

Discovery, General characteristics; Types - Archaebacteria, Eubacteria, Wall less forms (Mycoplasma, Phytoplasma and Spheroplasts); Cell structure with special emphasis on cell wall, membrane, flagella, pili, endospore; nucleoid; Growth curve; Nutritional types of Microbes- autotrophs and heterotrophs, phototrophs, and chemotrophs; lithotrophs and organotrophs; the concept of aerobic and anaerobic respiration, fermentation- lactic acid fermentation (homolactic and heterolactic), alcohol fermentation, Pasteur effect; Reproduction-vegetative, asexual and recombination (conjugation, transformation, and transduction). Economic importance of bacteria.

Unit. 3: Viruses

General characteristics; classification (Baltimore), brief outline of ICTV system of classification; structure and multiplication of DNA virus (T-phage) and RNA virus (TMV, SARS-COV-2); viroids and prions - general characteristics and diseases; replication (general account), lytic cycle and lysogenic cycle; economic importance.

Unit. 4: Techniques in microbiology

Culture media for microbes - Natural and synthetic media, Routine media - basal media, enriched media, selective media, indicator media, transport media, and storage media. Microbial cultures. Pure culture and axenic cultures, subculturing. Sterilization methods - Methods of disinfection: antiseptic, tyndallisation, and Pasteurization. Sterilization-Physical methods: dry heat, moist heat, UV light, ionization radiation, filtration. Preservation methods-overlaying cultures with mineral oils, lyophilisation. Microbial culture collections and their importance. A brief account of ITCC, MTCC, and ATCC.

Unit 5: Applied microbiology

Scope of microbiology, Introduction to bioreactors, Basic structure & components; Role of microbes in industry (cheese, food, alcohol, wine, enzymes, organic acids); agriculture (PGPRs, biofertilizers); Bioremediation.

(8 lectures)

(10 Lectures)

(8 Lectures)

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PRACTICALS

- 1. Electron micrographs of bacterial cell; Study of different types of Bacteria from temporary/permanent slides; Endospore, Binary fission, Conjugation.
- 2. Study of Viruses: Electron micrographs / Models T-Bacteriophage and TMV; specimens/digital resources/ Line drawings of Lytic and Lysogenic Cycle.
- 3. Single staining using curd.
- 4. Gram staining to differentiate between Gram-positive and Gram-negative bacteria.
- 5. Demonstration of serial dilution technique for the isolation of pure culture of bacteria.
- 6. Study of *Rhizobium* from root nodules of a leguminous plant.
- 7. Study of Plant Growth Promoting Rhizobacteria (PGPR) and their role as biofertlizers through specimens/digital resources
- 8. Study of bioreactors/fermentors through photographs/video.

Suggested Readings:

- 1. Pelczar, M.J. (2001). Microbiology, 5th edition. New Delhi, Delhi, Tata McGrawHill Co.
- 2. Tortora, G.J., Funke, B.R., Case, C.L. (2016). Microbiology: An Introduction, Indian
- 3. Prescott, L.M., Harley J.P., Klein D. A. (2005). Microbiology, 6th edition: McGraw Hill, New Delhi.
- 4. Gupta, R., Chugh, G. (2022). Plants, Microbes and Diseases 1st Edition, I.K. International Pvt. Ltd., Delhi.
- 5. Subba Rao, N.S. (2000). Soil Microbiology, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
- 6. Talaro, K.P., Talaro, A. (2006). Foundations in Microbiology. McGraw Hill, New Delhi

IE	MPLATE FOR CO	OURSE SYLLABUS	5 FOR NEP IMPLE	EMEN	TATION		
Discipline:	Science	√ Arts, H	lumanities & Soc	cial Sci	ience 🛛		
	Commerce	□ BBA		BCA			
Subject Name:	Botany						
Subject Code:	ct Code: (Will be provided by the University)						
Semester:	Semester I 🗌	Semester II 🗌	Semester III \checkmark	Sem	ester IV		
	Semester V \Box	Semester VI 🗆	Semester VII 🗌	Sem	ester VIII 🗆		
Course Name:	Mycology and	d Plant Patholog	ÿ				
Course Code:	UBOTMAJ230	004	(Will be provid	led by	the University)		
Course Credit:	Theoretical	3	Practical/Tutorial 1		1		
Marks Allotted:	Theoretical	40	Practical/Tutorial 20				
	Continuing Eva	aluation 10	Attendance		5		
Course Type (tick the co	orrect alternativ	ves):					
Major Core		\checkmark	AEC				
Interdisciplinar	y/ DSE		SEC				
Minor / Generi	c Elective		VAC				
Research Proje	ct/Dissertation		Vocational				
Is the course focused o	n employability	/ entrepreneurs	hip? YES√	NO			
Is the course focused on imparting life skill? YES \square NO $$							
Is the course based on	Is the course based on Activity $$? YES $$ NO \square						
Remarks by Chairman,	UG BOS, if any						
Syllabus fina	lized and appro	ved by all the U	GBOS Botany m	embe	rs		

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SEMESTER - III

Course Type: MAJOR

Course Code: UBOTMAJ23004

Course Name: Mycology and Plant Pathology

Credits:4 (Theory=3, Practical=1)

Full Marks: 75 (Theory-40, Practical-20, Continuing Evaluation-10, Attendance-5)

Brief Course Description: UBOTMAJ23004 deals with the general account, nature, distribution, classification of true and allied fungi. Life cycle of fungal members representing different important phyla, symbiotic associations, application of fungi in different fields are discussed. Different terms of pathology, important plant pathogens, disease cycles, disease management are also emphasised.

Prerequisite(s) and/or Note(s):

(1) High School Biology.

(2) Note(s): Syllabus may be modified after and not during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course.

Course Objectives:

Knowledge acquired:

(1) Structure and modifications of fungal thallus

(2) Classification of Fungi and allied fungi

(3) Life cycles of representative fungi and allied fungi

(4) Symbiotic association and applications of fungi

(5) Mechanism of infection and defense in plant pathogenesis

(6) Disease cycles and disease management of representative fungal, bacterial and viral plant pathogens

Skills gained:

- (1) Identification and structure of fungi and allied fungi
- (2) Methods of collection and preservation of micro- and macrofungi.
- (3) Collection, preservation and study of diseased plant specimens
- (4) Isolation and culture of any one fungal plant pathogen.

Competency Developed:

(1) Collection, identification and preservation of different fungal and lichen specimens.

- (2) Knowledge of etiology of some representative plant pathogenic fungi, bacteria and virus
- (3) Media preparation and isolation of fungal plant pathogen.

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Total Lectures: 45

(8 lectures)

Unit:1 General account and classification of true and allied fungi

General characteristics-True and Allied Fungi; Thallus organization; Cell wall composition; Nutrition and lifestyle; Hyphal forms or modifications of thallus; classification of fungi and allied fungi by Kirk et al (2008) with characters of the phyla (especially Ascomycota, Basidiomycota, Zygomycota, Oomycota, Chytridiomycota) along with examples. Introduction to phylogenetic classification.; Slime moulds and mitosporic fungi - general idea.

Unit: 2 Fungal Reproduction and life cycle

Types of life cycles; Reproduction in Fungi - Asexual and Sexual, Fungal spore forms; Life cycles of Synchytrium, Rhizopus, Yeast (Saccharomyces and Schizosaccharomyces), Penicillium, Ascobolus, Agaricus, Puccinia. Degeneration of sex in fungi. Fruiting bodies in Ascomycota. Development of ascus and ascospore; development of basidium and basidiospore. Parasexuality and heterothallism.

Unit 3: Symbiotic associations and applied mycology

Lichen – Occurrence; General characteristics; types; Nature of associations of algal and fungal partners; Economic and ecological importance Mycorrhiza-Ectomycorrhiza, Endomycorrhiza and their role in Agriculture and forestry. Medical mycology - Mycoses, Mycotoxicosis and mycetismus. Application of fungi in Food industry - baking, important alcoholic beverages, acids, Mycoprotein. Edible mushrooms; Fungi in Medicine - important enzymes, vitamins, Antibiotics. Fungi based Biocontrol and Biofertilizer in brief with example. Bioluminescence.

Unit 4: Introduction to plant pathology

Disease, disease cycle, symptom and syndrome, etiology and causal complex, primary and secondary inoculum, penetration, infection, pathogenicity and pathogenesis, necrotroph, biotroph, endophyte; resistance, susceptibility, immunity, hypersensitive response; Koch's postulates, Endemic, Epidemic, Pandemic and Sporadic disease, disease pyramid and plant quarantine.

Unit 5: Host-pathogen interactions and disease management

Mechanism of infection (Brief idea about Pre-penetration, Penetration and Post-penetration). Basic concept of defense-structural and biochemical. Phytoalexin, Systemic Acquired Resistance (SAR); Induced systemic resistance (ISR), Plant Disease Management: Chemical, Biological and Integrated. Introduction to MAMPs, PAMPs.

Unit: 6 Disease cycles

Symptoms, Causal organism, Disease cycle and Control measures of - Late blight of Potato, Brown spot of rice, Blister blight of tea, Citrus canker, Mosaic diseases. Vein clearing, Angular leaf spot of cotton.

(6 lectures)

(7 lectures)

(7 lectures)

(9 lectures)

(8 lectures)

PRACTICAL

- 1. Work out the following fungi with microscopic measurement of reproductive structure: *Rhizopus, Penicillium/Aspergillus, Peziza/Ascobolus, Agaricus.*
- 2. Morphological identification of Macrofungi: *Pycnoporus/Polyporus, Auricularia, Ganoderma*.
- 3. Study of growth forms of lichens (crustose, foliose, and fruticose) through specimens available or through photographs.
- 4. Study of Mycorrhiza: ecto mycorrhiza and endo mycorrhiza (Photographs)
- 5. Preparation of PDA media and demonstration of fungal culture.
- 6. Isolation of pathogens from infected plant parts and subculturing.
- 7. Identification of Late blight potato, blister blight of tea, downy mildew of cucurbits, *Alternaria* spot, *Helminthosporium* spot, *Cercospora* leaf spot, *Stemphyllium* leaf blight of onion or garlic, Stem rot of jute, Citrus canker, Leaf mosaic/vein clearing.
- 8. Work out of late blight of potato and brown spot of rice.

Suggested Readings:

- 1. 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.
- 3. Webster, J. and Weber, R. (2007). Introduction to Fungi, Cambridge University Press, Cambridge. 3rd edition.
- 4. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies, Macmillan Publishers India Ltd.
- 5. Sharma, O. P. (2023). Text Book of Fungi and Allied Microorganisms, Medtech Publisher.
- 6. Sharma, P.D. (2016). Plant Pathology, 2nd EditionRastogi Publication, Meerut, India.

	TEMPLATE FOR C	OURSE SYLLABU	JS FOR NEP IMPLEME	NTATION			
Discipline:	Science	√ Arts,	Humanities & Social S	Science 🛛			
	Commerce	BBA	BC	CA 🗆			
Subject Name:	Botany						
Subject Code:	ubject Code: (Will be provided by the University)						
Semester:	Semester I 🗌	Semester II 🗌	Semester III √ Se	mester IV			
	Semester V 🗆	Semester VI	Semester VII 🗆 Se	mester VIII 🗆			
Course Name:	Phycology a	nd Bryology					
Course Code:	UBOTMAJ23	005	(Will be provided l	by the University)			
Course Credit:	Theoretical	3	Practical/Tutorial	1			
Marks Allotted:	Theoretical	40	Practical/Tutorial 20				
	Continuing Ev	aluation 10	Attendance	5			
Course Type (tick the	correct alternati	ves):					
Major Core		\checkmark	AEC 🗆				
Interdisciplina	ary/ DSE		SEC 🗆				
Minor / Gene	ric Elective		VAC				
Research Pro	ject/Dissertation		Vocational				
to the second free second		1					
Is the course focused	on employability	/ / entrepreneu	rship? YES 🗆 NG	γ			
Is the course focused on imparting life skill? YES \Box NO $$							
Is the course based on Activity ? YES $\sqrt{100}$ NO \Box							
Remarks by Chairman	n, UG BOS, if any						
Syllabus fin	Syllabus finalized and approved by all the UGBOS Botany members						

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SEMESTER - III

Course Type: MAJOR

Course Code: UBOTMAJ23005

Course Name: Phycology and Bryology

Credits:4 (Theory=3, Practical=1)

Full Marks: 75 (Theory-40, Practical-20, Continuing Evaluation-10, Attendance-5)

Brief Course Description: UBOTMAJ23005 deals with topic Phycology and Bryology. In particular, the course will cover general characteristics, classification, and economic importance of algae and bryophyte. Applied side of phycology. Type study of few algae and bryophyte with Life cycle. Ecological importance of Bryophytes.

Prerequisite(s) and/or Note(s):

(1) High School Biology.

(2) Note(s): Syllabus may be modified after and not during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course.

Course Objectives:

Knowledge acquired:

(1) Concept of algae and bryophyte

(2) Economic and ecological Importance of algae and bryophyte

(3) Application of phycology in different field.

(3) Diversity in habits, habitats, morphology internal structure and reproduction of different types of algae and bryophytes.

(4) Evolutionary trends within different types of algae and bryophytes.

Skills gained:

(1) Identification of few algae and bryophytes with the study of vegetative and reproductive structures.

(2) Familiarization with the technique of algal collection preservation.

(3) Preparation and study of temporary and permanent slides for the identification of algae and bryophytes through anatomical or morphological study.

(4) Study of ecosystem and report writing.

Competency Developed:

(1) Applying the concept of Identification students can identify of algae and bryophytes.
(2) With the understanding of role of algae in ecosystem during field visit, students will be able to analyze the algal diversity and predict their effect on the particular ecosystem.

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Unit-1: Introduction to phycology and classification of algae

General characters, Habit and Habitat, Organization of thallus, Algal pigments, Food reserves (of only groups represented in the syllabus), methods of reproduction; structure of algal flagella. Different types of life cycle and alternation of generations in algae. Classification: by Fritsch (1945); brief introduction to the modern classification by Lee (2009) [up to divisions], Economic importance of algae.

Unit-2: Type study

Salient features, thallus structure and reproduction of algae in the following groups with special reference to the type(s) mentioned: Cyanophyceae - Nostoc; Chlorophyceae - Volvox, Oedogonium, Coleochaete, Chara; Xanthophyceae - Vaucheria; Bacillariophyceae -Pinnularia; Phaeophyceae – Ectocarpus, Fucus; Rhodophyceae – Polysiphonia. Evolutionary significance of Prochloron.

Unit-3: Applied Phycology

Economic importance of algae: algae as food, single cell protein (SCR), fodder, green manure, role in N2 fixation, medicine and biofuels. Commercial products from Algae - carrageenin, agar-agar, alginates and diatomaceous earth. Role of algae in pollution studies: as indicators of pollution and as bioremediation agents. Role of algae in Biotechnology, Algae and space travel, Eutrophication – algal bloom; harmful and toxic algal blooms – neurotoxins and parasitic algae. Photobioreactor.

Unit-4: General Introduction and Classification of Bryophytes (5 Lectures) Introduction, general characters, and classification of bryophytes (Rothmaler 1951, Proskaure 1957), Introduction to phylogenetic classification system, Adaptations to land habit; Alternation of generations.

Unit-5: Type study

Distribution, morphology, anatomy, reproduction and life cycle and evolutionary trends in the following types (developmental details are not required): Hepaticopsida - Riccia, Marchantia; Pellia (Jungermanniales); Anthocerotopsida - Anthoceros; Bryopsida - Funaria. Evolution of gametophyte and sporophyte among Bryophytes, Peristome teeth – Types and function.

Unit 6: Applied Bryology

Ecological and Economic importance of Bryophytes - biological, ecological, medicinal with special reference to Sphagnum.

Total Lectures: 45

(7 Lectures)

(13 lectures)

(5 Lectures)

(12 Lectures)

(3 Lectures)

PRACTICAL

- 1. Study of vegetative and reproductive structures of *Nostoc, Volvox, Oedogonium, Coleochaete, Chara, Vaucheria, Ectocarpus,* and *Polysiphonia*, through temporary preparations and permanent slides
- 2. Demonstration of techniques of algal specimen collection and preservation.
- 3. Conduct a field visit to any one of the ecosystems rich in Algae to experience algal diversity. Submit a report with photographs.
- 4. *Riccia* Morphology of thallus.
- 5. *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).
- 6. *Anthoceros* Morphology of thallus, dissection of sporophyte (to show stomata, spores, pseudoelaters, columella) (temporary slide), vertical section of thallus (permanent slide).
- 7. Funaria- Morphology of thallus, longitudinal section of Sporophyte (permanent slides).
- 8. Demonstration of techniques of bryophyte specimen collection and preservation.

Suggested Readings

1. Anand N, 1989. Culturing and cultivation of BGA. Handbook of Blue Green Algae.

2. Fritsch F E, 1935. The structure and reproduction of the algae, Vol. 1 and II. Uni. Press. Cambridge.

3. Morris I, 1967. An Introduction to the Algae. Hutchinson and Co. London.

4. Robert Edward Lee, 2008. Phycology. Cambridge University Press,

5. Singh V, Pandey P C, Jain D K. A textbook of botany.

6. Vashishta B R. Textbook of Algae. New Delhi.

7. Gangulee Das and Dutta. College Botany Vol. I. Central Book Depot. Calcutta. 8. Ganguly, Kar A K. College Botany Vol. II. New Central Book Agency, Calcutta.

9. Khan M, 1983. Fundamentals of Phycology. Bishen Singh Mahendra Pal Singh, Dehradun.

10. Campbell H D, 1940. The Evolution of land plants (Embryophyta). Univ. Press, Stanford.

11. Chopra R N, P K Kumar, 1988. Biology of Bryophytes. Wiley Eastern Ltd. New Delhi. 12.

Parihar N S, 1965. An Introduction to Bryophyta. Central Book Depot, Allhabad.

12. Shaw J A, Goffinet B, 2000. Bryophyte Biology. Cambridge UniversityPress.

13. Smith G M, 1938. Crytogramic Botany Vol. II. Bryophytes and pteridophytes. McGraw Hill Book Company, London.

15. Sporne K R, 1967. The Morphology of Bryophytes. Hutchinson University Library,

London. 16. Vasishta B R. Bryophyta. S Chand and Co. New Delhi.

17. Watson E V, 1971. The structure and life of Bryophytes. Hutchinson University Library, London. 18. Bower F O, 1935. Primitive Land Plants. Cambridge, London.

	TEMPLATE FOR C	OURSE SYLLAE	SUS FOR NEP IMPLEM	ENTATION		
Discipline:	Science	√ Arts	, Humanities & Social	Science		
	Commerce	□ BBA	. D B	CA 🗆		
Subject Name:	Botany					
Subject Code:		(Wi	l be provided by the l	Jniversity)		
Semester:	Semester I 🗌	Semester II	Semester III √ S	emester IV \checkmark		
	Semester V \Box	Semester VI	Semester VII Se	emester VIII 🗌		
Course Name:	Morphology,	Anatomy and	l Taxonomy of Flowe	ring Plants		
Course Code:	UBOTMIN20	002] (Will be provided b	y the University)		
Course Credit:	Theoretical	3	Practical/Tutoria	l 1		
Marks Allotted:	Theoretical	40	Practical/Tutorial	20		
	Continuing Ev	aluation 10	Attendance	5		
Course Type (tick the	correct alternativ	ves):				
Major Core			AEC]		
Interdisciplin	ary/ DSE		SEC]		
Minor / Gen	eric Elective	\checkmark	VAC]		
Research Pro	ject/Dissertation		Vocational]		
Is the course focused	l on employability	/ entreprene	urship? YES 🗆 N	10 1		
Is the course focused	l on imparting life	skill?	YES 🗆 🛛 N	10 1		
Is the course based on Activity ? YES $$ NO \square						
Remarks by Chairma	n, UG BOS, if any					
Syllabus finalized and approved by all the UGBOS Botany members						

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SEMESTER – III/IV

Course Type: MINOR

Course Code: UBOTMIN20002

Course Name: Morphology, Anatomy and Taxonomy of Flowering Plants

Credits: 4 (Theory-3, Practical-1)

Full Marks: 75 (Theory-40, Practical-20, Continuing Evaluation-10, Attendance-5)

Brief Course Description: UBOTMIN20002 deals with the morphology, anatomy, and taxonomy of the angiospermic plants. It emphasizes the structural organization of vegetative and reproductive organs, their functions, the origin and distribution of plant tissues, and the process of secondary growth. It also discusses the history and development of plant taxonomy, focusing on the nomenclature, classification, and identification criteria of the angiospermic families.

Prerequisite(s) and/or Note(s):

(1) High School Biology.

(2) Note(s): Syllabus may be modified after and not during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course.

Course Objectives:

Knowledge acquired:

(1) Structure and function of plant organs.

- (2) Concept of secondary growth and its types.
- (3) Concept and importance of plant taxonomy.

Skills gained:

(1) Practical identification of plant parts and their modifications.

(2) Understanding of plant classification systems with their merits and demerits.

Competency Developed:

(1) Structural and functional differences between dicot and monocot.

(2) Dissection, description, and identification of representative plants of angiospermic families for proper identification using keys.

(3) Preparation and preservation of herbariums.

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Total Lectures:45

(8 lectures)

Unit-I: Morphology

Structure, function and types of root, stem and leaf; Concept of Flower as a Modified Shoot; types of flower, inflorescence, Cohesion and Adhesion; Ovule Types; Placentation; Floral Formula; Floral Diagram; Fruits and Seeds - Types and Dispersal.

Unit-II: Tissues

Internal organization of plant body: The three tissue system, types of cells and tissues; Shoot apical meristem; Root Apical Meristem; Lateral Meristem and their functions; Theories of Origin and their limitations; types of vascular bundles; Structure of Dicot and Monocot stem, root and leaf; Quiescent Centre, Root Cap.

Unit-III: Secondary Growth and Wood

Structure, function and seasonal activity of cambium; secondary growth in root and stem, different types of wood (Sap wood and heart wood, ring and diffuse porous wood, early and late wood); tyloses and its importance.

Unit-IV: Introduction to Plant Taxonomy

History; Identification, Classification, Nomenclature. ICN – Principles, rules and recommendations; ranks and names; binominal system, typification, author citation, valid publication, rejection of names, principle of priority and its limitations. Functions of Herbarium, important herbaria and botanical gardens of the world and India; Documentation: Flora, Keys: single access and multi-access.

Unit-V: Classification

Types of classification - artificial, natural and phylogenetic. Bentham and Hooker (upto series), Engler and Prantl (upto series) with merits and demerits; Introduction to APG IV system.

Unit-VI: Diagnostic Features and Economic Importance of Families (7 lectures)

Brassicaceae, Solanaceae, Lamiaceae, Fabaceae, Asteraceae, Poaceae, and Orchidaceae.

lified Shoot

(8 lectures)

(6 lectures)

(10 lectures)

(6 lectures)

<u>Practical</u>

- 1. Study of cohesion and adhesion of stamen.
- 2. Study of different types of ovule and placentas through photograph/living specimen.
- 3. Study of dicot and monocot stem, root and leaf by temporary slide preparation.
- 4. Study of vegetative and floral characters of the families (any three) mentioned in theory syllabus (Description, V.S. of flower, section of ovary, floral diagram, floral formula and their identification up to family)
- 5. Submission of properly dried and pressed specimen of wild plant (5 in number) with herbarium label.

	TEMPLATE FOR CO	OURSE SYLLAB	US FOR NEP IMP	LEMEN [®]	TATION
Discipline:	Science	√ Arts	, Humanities & S	ocial Sc	ience 🛛
	Commerce	□ BBA		BCA	
Subject Name:	Botany				
Subject Code:		(Wil	l be provided by	the Uni	versity)
Semester:	Semester I 🗌	Semester II	Semester III	√ Sem	hester IV \Box
	Semester V \Box	Semester VI	Semester VII	🗆 Sem	nester VIII 🗌
Course Name:	Biofertilizers	and Mushroo	m Cultivation		
Course Code:	UBOTSEC230	03	(Will be provid	ed by t	he University)
Course Credit:	Theoretical	3	Practical/Tu	Practical/Tutorial	
Marks Allotted:	Theoretical	40	Practical/Tutorial		20
	Continuing Eva	aluation 10	Attendance		5
Course Type (tick the	correct alternativ	ves):			
Major Core			AEC		
Interdisciplin	ary/ DSE		SEC	\checkmark	
Minor / Gene	eric Elective		VAC		
Research Pro	ject/Dissertation		Vocational		
Is the course focused	on employability	/ entrepreneu	rship? YES ۲	NO	
Is the course focused	on imparting life	skill?	YES	NO	
Is the course based o	n Activity ?		YES 1	NO	
Remarks by Chairman	n, UG BOS, if any				
Syllabus finalized and approved by all the UGBOS Botany members					

450 /UG-23

SEMESTER - III

Course Type: SKILL ENHANCEMENT COURSE

Course Code: UBOTSEC23003

Course Name: Biofertilizers and Mushroom Cultivation

(Credits: Theory=2, Practical=1)

Full Marks: 75 (Theory-40, Practical-20, Continuing Evaluation-10, Attendance-5)

Brief Course Description:

UBOTSEC23003 deals with the study of various bio-fertilizers used in agriculture during organic farming. The course will help the students to learn the process of isolation, characterization, and production of bio-fertilizer for commercial value. The course also emphasizes on basic concepts and techniques of mushroom cultivation. This course will help in the development of good entrepreneurial skills.

Prerequisite(s) and/or Note(s):

(1) High School Biology.

(2) Note(s): Syllabus may be modified after and not during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course.

Course Objectives:

Knowledge acquired:

(1) Role of bio-fertilizers and its mechanism of action in agriculture.

(2) Students will learn about the morphology and types of Mushrooms

(3) Students will understand various edible mushrooms and their cultivation status

Skills gained:

- (1) Isolation, characterization, mass inoculum production and field application of bio-fertilizers
- .(2) Students will familiarize themselves with the spawn production technique.

Competency Developed:

- (1) Students will be acquiring technical knowledge in Biofertilizer production technology.
- (2) Hands on practice of different processes related to mushroom farming and its management.
- (3) Apply the knowledge gained to generate opportunities of self-employability.

Martin A. P.B. P.

Lectures: 45

(6 Lectures)

N₂-fixing microbes; General account about the microbes used as biofertilizers – *Rhizobium*, Azotobacter Azosprillum. Cyanobacteria (blue green algae), Azolla and Anabaena azollae association, nitrogen fixation, Azolla cultivation, and their role in agriculture. Commercial production of Rhizobium.

Unit 2: AM fungi

Unit 1: Bio-fertilizers

Mycorrhizal association, types of mycorrhizal association, occurrence and distribution, AM, and its influence on growth and yield of crop plants.

Unit 3: Organic farming

Green manuring and organic fertilizers, bio composting and method of vermicomposting field Application. Recycling of bio-degradable municipal, agricultural and Industrial wastes, FYMs, PGPRs.

Unit 4: Introduction to mushrooms

Introduction, Types of edible mushrooms available in India. Nutrition and medicinal value of edible mushrooms; Poisonous mushrooms. Research Centres - National level and regional level. Types of food prepared from mushrooms.

Unit 5: Mushroom cultivation technology

Equipment, pure culture medium, and sterilization techniques, spawn production technology, multiplication. Mushroom bed preparation, Factors affecting the mushroom bed preparation: Cultivation of Oyster and White Button Mushroom. Storage and Cost-benefit ratio: Short-term storage, long-term storage, drying, storage in salt solutions, low-cost technology- Marketing in India and abroad, Export value.

(8 Lectures)

(6 Lectures)

(4 Lectures)

(6 lectures)

PRACTICAL

- 1. Study of *Rhizobium* from root nodules of leguminous plants.
- 2. Spots, Specimens/photographs of earthworm, *Azolla* and *Anabaena azollae* association, arbuscules vesicles.
- 3. Demonstration of bio-compost methods and vermicomposting using photographs.
- 4. Photographs/ live specimens Different parts of a typical mushroom & and variations in mushroom morphology.
- 5. Preparation of culture media: Potato Dextrose medium, Richard's medium.
- 6. Preparation of spawn: Grain spawn, Straw spawn, Sawdust spawn.

Suggested Readings

- 1. Dubey, R.C., 2005 A Textbook of Biotechnology S.Chand & Co, New Delhi.
- 2. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi. 3. John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay Publication, New Delhi.
- 3. Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers.
- 4. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New Delhi.
- 5. Vayas, S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic Farming Akta Prakashan, Nadiad
- 6. Kannaiyan, S. Ramasamy, K. (1980). A handbook of edible mushroom, Today & Tomorrows Printers & Publishers, New Delhi.
- Pandey, B. P. (1996). A textbook of fungi. Chand and Company N Delhi. 3. Subrata Biswas, M. Datta, S. V. Ngachan. (2012) Mushrooms: A Manual for Cultivation. PHI Learning Pvt Ltd.
- 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. Bappeo, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
- 10. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.
- 11. Nita Bahl (1984-1988) Handbook of Mushrooms, II Edition, Vol. I & Vol. II.

	TEMPLATE FOR C	OURSE SYLLABL	IS FOR NEP IMPL	EMEN	TATION
Discipline:	Science	√ Arts,	Humanities & So	cial Sci	ence 🗆
	Commerce	□ BBA		BCA	
Subject Name:	Botany				
Subject Code:		(Will	be provided by t	he Uni	versity)
Semester:	Semester I 🗌	Semester II 🗆	Semester III 🗸	Sem	ester IV 🛛
	Semester V 🗌	Semester VI	Semester VII	Sem	ester VIII 🗆
Course Name:	Pteridology,	Gymnology & P	alaeobotany		
Course Code:	UBOTMAJ23	006	(Will be provi	ded by	the University)
Course Credit:	Theoretical	3	Practical/Tuto	Practical/Tutorial 1	
Marks Allotted:	Theoretical	40	Practical/Tuto	orial	20
	Continuing Ev	aluation 10	Attendance		5
Course Type (tick the	correct alternati	ves):	-		
Major Core		\checkmark	AEC		
Interdisciplin	ary/ DSE		SEC		
Minor / Gene	eric Elective		VAC		
Research Pro	ject/Dissertation		Vocational		
Is the course focused	on employability	/ entrepreneur	ship? YES 🗆	NO ⁻	V
Is the course focused	on imparting life	skill?	YES 🗆	NO	V
Is the course based o	n Activity ?		Yes \checkmark	NO	
Remarks by Chairmar	n, UG BOS, if any				
Syllabus fir	nalized and appro	oved by all the l	JGBOS Botany m	nembe	rs

450 /UG-23

SEMESTER - IV

Semester- IV

Course Type: MAJOR

Course Code: UBOTMAJ24006

Course Name: Pteridology, Gymnology & Palaeobotany

(Credits: Theory=3, Practical=1)

Full Marks: 75 (Theory-40, Practical-20, Continuing Evaluation-10, Attendance-5)

Brief Course Description: UBOTMAJ24006 deals with the various types of earlier vascular plants viz. pteridophytes and gymnosperms, along with their fossil forms. It discusses and also emphasizes the characteristics and classification of these plant groups, along with the fossil record of the extinct members of these groups. It also includes a primary idea on the field of palaeobotany.

Prerequisite(s) and/or Note(s):

(1) High School Biology.

(2) Note(s): Syllabus may be modified after and not during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course.

Course Objectives:

Knowledge acquired:

- (1) Basic and Applied Concepts of Pteridophytes
- (2) Basic and Applied Concepts of Gymnosperms, and,
- (3) Different groups of fossils and working knowledge of paleobotany.

Skills gained:

(1) Handling Microscopy, Staining and Mounting of pteridophytic and gymnospermic specimens, and,

(2) Methods of Collection, Identification and Preservation of plant specimens of these plant groups.

(3) Study of natural ecological systems and writing of reports.

(4) Evolutionary trends of pteridophytes, gymnosperms and allied plants (both extant and extinct).

Competency Developed:

(1) Schematic knowledge of collection and subsequent plant specimens.

(2) Proper arrangement of preserved plant specimens.

(3) Choosing suitable staining and mounting protocols for study of plant specimens.

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Total Lectures: 45

(7 Lectures)

Unit 1: Introduction

Unifying features of archegoniates; Similarities & dissimilarities between Bryophytes, Pteridophytes and Gymnosperms; Paleobotany – General account of fossil groups and their importance.

Unit 2: Pteridophytes

Classification (Gifford & Foster, 1989 – up to Divisions), distribution, morphology, anatomy, reproduction and life cycle of *Psilotum, Lycopodium, Selaginella, Equisetum* and *Pteris* (Developmental details not to be included).; Ecological and economic importance; Stelar evolution; Telome theory; Heterospory & Seed Habit.

Unit. 3: Gymnosperms

Classification (Gifford & Foster, 1989 – up to Divisions), distribution, morphology, anatomy, reproduction and life cycle of *Cycas, Pinus, Ginkgo* and *Gnetum* (Developmental details not to be included); Ecological and economic importance; Ontogeny & structure of Seed; Apogamy, and apospory.

Unit. 4: Progymnosperms and other fossil plants

General Features of Progymnosperms, Characteristic features of different relevant Form Genera like Rhynia, Lepidodendron, Calamites, Archaeopteris, Williamsonia, Cordaites, Glossopteris.

Unit 5: Paleobotany

Nomenclature; Taphonomy and the process of fossilization, Methods of determination of age of fossils; Geological time scale, TimeTree 5 (2022), Tree of Life Web Project, The Open Tree of Life; and major events of plant life through geological times.

(15 Lectures)

(15 lectures)

(4 Lectures)

(7 Lectures)

PRACTICALS

- 1. Psilotum- Study of specimen, transverse section of synangium (permanent slide).
- 2. *Selaginella* Study of specimen, transverse section of stem, longitudinal section of strobilus.
- 3. *Equisetum* Study of specimen, longitudinal section of strobilus, transverse section of strobilus, transverse section of rhizome.
- 4. *Pteris* Study of specimen, transverse section of rachis, vertical section of sporophyll, transverse section of rhizome.
- 5. *Cycas* Study of specimen (coralloid roots, leaf), vertical section of leaflet, vertical section of microsporophyll, longitudinal section of ovule, transverse section of root.
- 6. *Pinus* Study of specimen (long and dwarf shoots, male and female cones), transverse section of Needle, longitudinal section of / transverse section of male cone, longitudinal section of female cone, tangential longitudinal section & radial longitudinal sections.
- 7. *Ginkgo-* Study of specimen, longitudinal section of ovule.
- 8. *Gnetum* Study of specimen (stem, male & female cones), transverse section of stem, vertical section of ovule.
- 9. Paleobotany Study of (at least two) fossil slides of Lepidodendron, Lepidocarpon, Sphenophyllum, Lyginopteris, Medullosa & Glossopteris.
- 10. Botanical Excursion and preparation of field note book.

Suggested Readings

- Gerald Audesirk, Teresa Audesirk, Bruce E Byers, 2019. Biology: Life on earth. (Twelfth Edition). Pearson.
- 2. James D Mauseth, 2019. Botany: An Introduction to Plant Biology. Jones & Bartlett.
- 3. Michael G Simpson, 2019. Plant Systematics (Third Edition). Academic Press.
- 4. P.C Vashistha, A.K Sinha, & Anil Kumar. Gymnosperms. S. Chand. Delhi, India.
- 5. P.C Vashistha, A.K Sinha, & Anil Kumar. Pteridophyta. S. Chand. Delhi, India.
- Peter Raven, George Johnson, Kenneth Mason, Jonathan Losos and Tod Duncan, 2023. Biology (Thirteenth Edition). McGraw Hill.
- 7. Timothy Walker, 2012. Plants: A Very Short Introduction. Oxford.

Т	EMPLATE FOR C	OURSE SYLLABU	S FOR NEP IMPLEME	NTATION		
Discipline:	Science	√ Arts, H	Humanities & Social S	Science		
	Commerce	BBA	BC	CA 🗆		
Subject Name:	Botany					
Subject Code:		(Will b	be provided by the U	niversity)		
Semester:	Semester I 🗌	Semester II \Box	Semester III 🗆 Se	emester IV 🛛 🗸		
	Semester V \Box	Semester VI 🗌	Semester VII 🗌 Se	mester VIII 🗆		
Course Name:	Morphology	and Anatomy				
Course Code:	UBOTMAJ23	007	(Will be provided l	by the University)		
Course Credit:	Theoretical	3	Practical/Tutorial	1		
Marks Allotted:	Theoretical	40	Practical/Tutorial	20		
	Continuing Ev	aluation 10	Attendance	5		
Course Type (tick the	correct alternati	ves):				
Major Core		\checkmark	AEC 🗆			
Interdisciplina	iry/ DSE		SEC 🗆			
Minor / Gene	ric Elective		VAC			
Research Proj	ect/Dissertation		Vocational			
Is the course focused	on employability	//entrepreneurs	ship? YES 🗆 N(V ⊂		
Is the course focused on imparting life skill? YES \square NO $$						
Is the course based on Activity ? YES $\sqrt{100}$ NO \Box						
Remarks by Chairman, UG BOS, if any						
Syllabus finalized and approved by all the UGBOS Botany members						

450 /UG-23

SEMESTER - IV

Semester- IV

Course Type: MAJOR

Course Code: UBOTMAJ24007

Course Name: Morphology and Anatomy

(Credits: Theory=3, Practical=1)

Full Marks: 75 (Theory-40, Practical-20, Continuing Evaluation-10, Attendance-5)

Brief Course Description: UBOTMAJ24007 deals with the morphology and anatomy of the flowering plants. It focuses on the external and internal organization of the plants and plant organs, tissues and tissue systems. It also highlights the origin, distribution patterns and specific structural and functional modifications of the vegetative and reproductive organs of the plant body.

Prerequisite(s) and/or Note(s):

(1) High School Biology.

(2) Note(s): Syllabus may be modified after and not during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course.

Course Objectives:

Knowledge acquired:

(1) Organization of the flowering plant body

(2) Introduction to the structure and functions of vegetative and reproductive organs

(3) Origin, development and distribution of plant tissues and organs

Skills gained:

(1) Practical knowledge of the morphological and anatomical features of plant tissues and organs

(2) Tissue-specific staining techniques.

Competency Developed:

- (1) Structural and functional differentiation between dicots and monocots
- (2) Understanding the process of secondary growth and its anomalies in plants.
- (3) Practical knowledge about the modifications of vegetative and reproductive plant organs.



Total Lectures: 45

(8 Lectures)

(5 Lectures)

(5 Lectures)

Organization of vascular plant body - root, stem, leaf, flower, and fruit: their characteristic features, types, and modifications; Concept of phyllotaxy; Inflorescence types, Concept of "Flower as a modified shoot", Aestivation, cohesion and adhesion of floral parts; Types of ovule and placentation.

Unit-2: Internal Organization of Plant Body

Development of plant body - Polarity, cytodifferentiation, and organogenesis; Structures, functions, and modifications of different types of plant cells and tissues - simple and complex (no phylogeny); Structure of dicot and monocot root, stem, and leaf.

Unit-3: Apical Meristems

Unit-1: Introduction

Structure and Organization of shoot apex (Apical cell theory, Histogen theory, Tunica Corpus theory, Continuing meristematic residue, Cytohistological zonation); Structure and Organization of root apex (Apical cell theory, Histogen theory, Korper-Kappe theory), structure and function of root cap and quiescent center.

Unit-4: Tissue System

Epidermal tissue system - Structural organization and function, multiple epidermis, epiblema, bulliform cells, cuticle, epicuticular waxes, epidermal outgrowths - trichomes - types and functions, root hairs, stomata- classification and ontogeny, hydathodes, lithocysts, adcrustations and incrustations. Ground Tissue System - Structural organization and function, endodermis and exodermis, passage cell, origin of lateral roots, mesophyll tissue, laticifers and cavities. Vascular Tissue System - Xylem and phloem - structure and function, cytodifferentiation of tracheary elements and sieve elements, root-stem transition. Principles governing the construction and distribution of mechanical tissues.

Unit-5: Secondary Growth

Secondary growth in root and stem; Anomalous secondary growth; Types of rays and axial parenchyma; Cyclic aspects and reaction wood; Sapwood and heartwood; Ring and diffuse porous wood; Early and late wood, tyloses and tylosoids; Structure, function, and seasonal activity of cambium, Development and composition of periderm, rhytidome and lenticels.

Unit-6: Scope of Plant Morphology and Anatomy

Applications in systematics, forensics, and pharmacognosy; Dendrochronology.

(14 Lectures)

(10 lectures)

(3 lectures)

PRACTICAL

- 1. Study of cohesion and adhesion of floral parts through photographs/ fresh specimens.
- 2. Study of phyllotaxy and aestivation through photographs/ fresh specimens.
- 3. Study of inflorescence and fruit types through photographs/ fresh specimens.
- 4. Study of anatomical features of dicot and monocot root, stem, and leaf through temporary slide preparations.
- 5. Study of distribution of parenchyma, sclerenchyma, and collenchyma through photographs/ fresh or preserved specimens.
- 6. Study of stomatal types through temporary slides.
- 7. Study of trichomes, lithocyst, and laticifers through temporary/permanent slides.
- 8. Study of apical meristems of root and shoot through photographs/permanent slides.
- Study of normal and anomalous secondary growth through temporary slide preparations.
- 10. Study of xylem and phloem elements through temporary/permanent slides.

Suggested Readings

- 1. Kaplan, D., Specht, C.D. Kaplan's Principles of Plant Morphology. CRC Press.
- Bell, A.D. Plant Form: An Illustrated Guide to Flowering Plant Morphology. Timber Press.
- 3. Dickison, W.C. (2000). Integrative Plant Anatomy. Harcourt Academic Press, USA.
- 4. Fahn, A. (1974). Plant Anatomy. Pergmon Press, USA.
- 5. 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.

Т	EMPLATE FOR C	OURSE SYLLABI	JS FOR NEP IMPLE	MEN	ΓΑΤΙΟΝ	
Discipline:	Science	√ Arts,	Humanities & Soci	ial Sci	ence 🗌	
	Commerce	□ BBA		BCA		
Subject Name:	Botany					
Subject Code:		(Will	be provided by the	e Uni	versity)	
Semester:	Semester I 🗌	Semester II 🗌	Semester III 🗆	Sem	ester IV √	
	Semester V 🗆	Semester VI	Semester VII 🗆	Sem	ester VIII 🗆	
Course Name:	Taxonomy of	f Angiosperms				
Course Code:	UBOTMAJ23	008	(Will be provide	ed by	the University)	
Course Credit:	Theoretical	3	Practical/Tutor	ial	1	
Marks Allotted:	lotted: Theoretical		Practical/Tutor	Practical/Tutorial		
	Continuing Ev	aluation 10	Attendance		5	
Course Type (tick the	correct alternativ	ves):				
Major Core		\checkmark	AEC			
Interdisciplina	ry/ DSE		SEC			
Minor / Gener	ric Elective		VAC			
Research Proj	ect/Dissertation		Vocational			
Is the course focused	on employability	/ ontropropou	rshin? VES 🗆		J	
Is the course focused	on importing life				J	
is the course focused on imparting life skill? YES \Box NO V						
Bomarks by Chairman			YES V	NU		
Syllabus fina	alized and appro	oved by all the	UGBUS Botany me	embe	rs	

450 /UG-23

SEMESTER - IV

Semester- IV

Course Type: MAJOR

Course Code: UBOTMAJ24008

Course Name: Taxonomy of Angiosperms

(Credits: Theory=3, Practical=1)

Full Marks: 75 (Theory-40, Practical-20, Continuing Evaluation-10, Attendance-5)

Brief Course Description:

Prerequisite(s) and/or Note(s):

(1) High School Biology.

(2) Note(s): Syllabus may be modified after and not during the term itself, depending on the circumstances. However, students will be evaluated only on the basis of topics covered in the course.

Course Objectives:

1. To realize the position of angiosperms in plant kingdom.

- 2. To make understand the features to identify plants.
- 2. To make them understand how naming of plants done.

3. To know various angiosperm families emphasizing their morphology, distinctive features and importance.

4. To realize the origin and evolution of Angiosperms.

5. To know various system of classification.

Knowledge acquired:

1. Clear idea about the identification, classification and analysis of different group of plants and their origin and evolution and terminologies related to them.

2. Detail knowledge of different classification system from past to recent for categorisation of plants.

Skills gained:

1. Identification of plant species by using different keys.

2. Preparation of plant specimen for identification.

Competency Developed:

1. Come to know about different key to identify and positioning of plants.

2. Come to know about method of work out and preparation of specimen for identification.

3. Come to know about ancient and present system of classification of plants.



Lecture:45

(8 lectures)

Plant identification, Classification, Nomenclature; alpha and omega taxonomy; Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concept (taxonomic, biological, evolutionary). 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: Botanical nomenclature

History of botanical nomenclature; Brief outline, ICN-Principles; Rules & recommendations; Typification, Author Citation, Valid & effective publications, Rejection of Names, Principle of Priority and its Limitations; Names of hybrids.

Unit 3: Classification systems

Major contributions of Theophrastus, Bauhin, Tournefort, Linnaeus, Adanson, de Candolle, Bessey, Hutchinson, Takhtajan and Cronquist; Classification systems of Bentham and Hooker (1862-1883) (upto series) and Takhatajan (1997) with merits and demerits; Brief reference of Angiosperm Phylogeny Group (APG IV) classification (Major clades)

Unit 4: Diagnostic features, exceptional characters and economic importance of Families

(10 lectures)

Magnoliaceae, Brassicaceae, Solanaceae, Lamiaceae, Fabaceae, Euphorbiaceae, Cucurbitaceae, Asteraceae, Poaceae, Araceae, Zingiberaceae, Liliaceae, Verbenaceae, Orchidaceae.

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; Methods of illustrating evolutionary relationship (phylogenetic tree, cladogram).

(7 lectures)

Unit 1: Introduction

(10 lectures)

(10 lectures)

PRACTICAL

- 1. Study of vegetative and floral characters of the families mentioned in the theory syllabus (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and their identification up to genus by following published keys in Bengal Plants by David Prain/Flora of Bhutan)
- 2. Spot identification up to genera, mentioning families of all locally available plants included under the theoretical syllabus,
- 3. Field visit (local/outside) Enlistment of plants observed in the field and submission of field note book with 10-25 photographs.
- 4. Submission of properly dried and pressed specimen of wild plant (not less than 10 and not more than 25) with herbarium label.

Suggested Readings

1. Singh G. (2012). *Plant Systematics:* Theory and Practice Oxford & IBH Pvt. Ltd., New Delhi. 3rdedition.

2. Jeffrey C. (1982). An Introduction to *Plant Taxonomy*. Cambridge University Press, Cambridge.

3. 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.

- 4. Maheshwari, J. K. (1963). Flora of Delhi. CSIR, New Delhi.
- 5. Radford, A. E. (1986). Fundamentals of *Plant Systematics*. Harper and Row, New York.
- 6. Singh G. (2021) Plant systematics: An Integrated approach. CRC Press. 4th Edition.
- 7. Sharma O. P. (2017) Plant Taxonomy. Mc Graw Hill. 2nd Edition.
- 8. Mitra J. N., Mitra D. Chaudhuri S. K. Studies in Botany. Moulik Library. Vol-1.
- 9. Datta S. C. (2018) Systematic Botany. New Age International Publisher. 5th Edition.