



પરિપત્ર:

ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટીની લાઈફ સાયન્સ વિદ્યાશાખાનાં અભ્યાસક્રમ ચલાવતી તમામ સંલગ્ન કોલેજોનાં આચાર્યશ્રીઓને સવિનય જણાવવાનું કે લાઈફ સાયન્સ વિદ્યાશાખા હેઠળનો NEP-૨૦૨૦ અંતર્ગત બોટની વિષય સેમેસ્ટર-૩, ૪નો અભ્યાસક્રમ આ સાથે સામેલ છે.

માનનીય કુલપતિશ્રીની મંજૂરી અનુસાર સદર અભ્યાસક્રમ શૈક્ષણિક વર્ષ જુન, ૨૦૨૪ થી અમલવારી કરવાની રહે છે. લાઈફ સાયન્સ વિદ્યાશાખાનાં અભ્યાસક્રમ ચલાવતી તમામ સંલગ્ન કોલેજો ધ્વારા તેની અમલવારી કરવા જણાવવામાં આવે છે.

નોંધ: તા. ૧૫.૧૦.૨૦૨૪ નાં પરિપત્રનં: ૧૩૭૩/૨૦૨૪માં બોટની અભ્યાસક્રમમાં ફેરફાર કરવામાં આવેલ છે.



[Signature]
18/6/2025

પ્રાસ ફરજ પરના અધિકારી
(એકેડેમિક)

ક્રમાંક/બીકેએનએમયુ/ એકેડેમિક/૨૮૫/૨૦૨૫

ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી,

સરકારી પોલીટેકનિક કેમ્પસ,

ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી રોડ,

ખડીયા, જૂનાગઢ-૩૬૨૨૬૩

તા.૧૮.૦૬.૨૦૨૫

પ્રતિ,

- ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી સંલગ્ન લાઈફ સાયન્સ વિદ્યાશાખાનાં અભ્યાસક્રમો ચલાવતી તમામ કોલેજોના આચાર્યશ્રીઓ તરફ....

નકલ સાદર રવાના:-

- માન.કુલપતિશ્રી/ કુલસચિવશ્રીનાં અંગત સચિવશ્રી.
- પરીક્ષા નિયામકશ્રી, ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી, જુનાગઢ

નકલ રવાના જાણ તથા યોગ્ય કાર્યવાહી અર્થે:

- સીસ્ટમ મેનેજરશ્રી, આઈ.ટી.સેલ વિભાગ (વેબસાઇટ ઉપર પ્રસિદ્ધ થવા અર્થે.)





DEPARTMENT OF LIFE SCIENCES

Bhakta Kavi Narsinh Mehta University

Government Polytechnic campus, Khadiya, Junagadh, Gujarat (India)

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Ref.DLS/2025/460

04/06/2025

To,

Academic officer,

Bhakta Kavi Narsinh Mehta University,

Junagadh

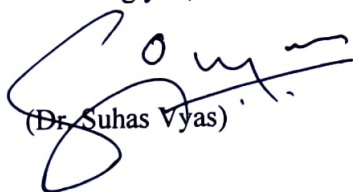
Sub: Submission of revised syllabus of Botany sem 1 to 4

Sir,

With reference to the subject mentioned above, it was noted in the recent Board of Studies (BoS) meeting of the Botany department that a minor revision is required in the Semester I to IV syllabus. The revised syllabus has been submitted to the Academic Section. You are kindly requested to take the necessary steps for its implementation. The revised syllabus shall be effective henceforth for the concerned subject.

Regards,

Thanking you,


(Dr. Suhas Vyas)

BHAKTA KAVI NARSINH MEHTA UNIVERSITY
JUNAGADH



BOARD OF STUDIES

FACULTY OF LIFE SCIENCE

SYLLABUS FOR BOTANY (HONOURS)

PROGRAMME (SEMESTER- III & IV)

EFFECTIVE FROM JUNE, 2024

BHAKTA KAVI NARSINH MEHTA UNIVERSITY
Syllabus of B.Sc. (Honors) as per NEP-2020
Faculty of Science
Effective from June 2024
Subject: Botany
SEMESTER- III & IV

SUMMARY OF THE SYLLABUS
SEM-III

Sr. No	Course Group	Course (Paper) Title	Credit	Teaching Hours/ Week	Theory Internal Marks	Theory External Marks	Practical internal Marks	Practical external Marks	Total Marks
1	MAJOR-5	MYCOLOGY AND PHYTOPATHOLOGY	4T	4	50	50	-	-	100
2	MAJOR-6	ARCHEGONIATE	4T	4	50	50	-	-	100
3	MAJOR-7	MYCOLOGY AND PHYTOPATHOLOGY ARCHEGONIATE	4P	8 (4+4)	-	-	50	50	100
4	MDC-3	MEDICINAL BOTANY	3T +1P	3 Theory 2 Practical	25	50	25	-	100
Total			16						

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SUMMARY OF THE SYLLABUS
SEM-IV

Sr. No	Course Group	Course (Paper) Title	Credit	Teaching Hours	Theory Internal Marks	Theory External Marks	Practical internal Marks	Practical external Marks	Total Marks
1	MAJOR-8	ANATOMY OF ANGIOSPERMS	4T	4	50	50	-	-	100
2	MAJOR-9	ECONOMIC BOTANY	4T	4	50	50	-	-	100
3	MAJOR-10	ANATOMY OF ANGIOSPERMS, ECONOMIC BOTANY	4P	8 (4+4)	-	-	50	50	100
4	MINOR-3	APPLIED BOTANY	3T + 1P	3 Theory 2 Practical	25	50	25	-	100
Total			16						

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Course Level	U.G. (5.0)	Internal Marks	50
Programme	B.Sc. Botany	External Marks	50
Semester	III	Practical Internal	-
Category of Course	MAJOR-5	Practical External	-
Course Credit	04 (Theory)	Prac. External Exam Duration	-
Teaching Hours	60	Total	100
Course Code		Exam Duration	2 hrs.
Course Title	MYCOLOGY AND PHYTO PATHOLOGY		

Course Learning Outcomes: On completion of the course, the students will be able to:

- Identify true fungi and demonstrate the principles and application of plant pathology in the control of plant disease.
- Demonstrate skills in laboratory, field and glasshouse work related to mycology and plant pathology.
- Develop an understanding of microbes, fungi and lichens and appreciate their adaptive strategies.
- Identify the common plant diseases according to geographical locations and devise control measures.

Pedagogy:

- Lectures/ Use of Multimedia / Assignments/ Hands-on experiments/ Demonstrations/ Field visit.

Course Contents

Sem	Unit No.	Syllabus	Teaching Hours
3	1	Fungi-1 • General characteristics, Thallus organization; Cell wall composition; Nutrition; Classification (Ainsworth).	15

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		Allied Fungi: General characteristics; Classification; Occurrence; Types of plasmodia; Types of fruiting bodies. Applied Mycology: Application of fungi in food industry (Fermentation, Organic acids, Enzymes and Mycoproteins); Medicines (Pharmaceutical preparations); Agriculture (Bio fertilizers).	
	2	Fungi-2 Mycorrhiza: Ectomycorrhiza, Endomycorrhiza and their significance. Zygomycetes: Characteristic features, Reproduction. Life cycle and classification with reference to <i>Rhizopus</i>. Ascomycetes: General characteristics (asexual and sexual fruiting bodies), Life cycle and classification with reference to <i>Claviceps</i>.	15
	3	Fungi and Phytopathology Basidiomycetes: General characteristics, Life cycle and Classification with reference to <i>Agaricus</i>. Lichens: General characteristics; Classification; Study of thallus (morphological and anatomical), Reproduction; Economic importance. Terms and concepts; General symptoms of phytopathology.	15
	4	Phytopathology - Geographical distribution of diseases. Host-Pathogen relationships. - Pathogen, Symptoms, Dissemination, Disease cycle and control measures of following plant diseases: Bacterial diseases – Citrus canker. Fungal diseases – White rust of crucifers. Black rust of wheat.	15

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Suggested Reading:

1. Agrios, G.N. (1997) Plant Pathology, 4th edition, Academic Press, U.K.
2. 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, P.D. (2011). Plant Pathology, Rastogi Publication, Meerut, India.

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Course Level	U.G. (5.0)	Internal Marks	50
Programme	B.Sc. Botany	External Marks	50
Semester	III	Practical Internal	-
Category of Course	MAJOR-6	Practical External	-
Course Credit	04 (Theory)	Prac. External Exam Duration	-.
Teaching Hours	60	Total	100
Course Code		Exam Duration	2 hrs.
Course Title	ARCHEGONIATE		

Course Outcomes: On completion of this course, the students will be able to:

- Demonstrate an understanding of archegoniatae, Bryophytes, Pteridophytes and Gymnosperms.
- Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.
- Understanding of plant evolution and their transition to land habitat.
- Demonstrate proficiency in the experimental techniques and methods of appropriate analysis of Bryophytes, Pteridophytes, and Gymnosperms.

Pedagogy:

- Lectures/ Use of Multimedia / Assignments/ Hands-on experiments/ Demonstrations/ Field visit.

Course Contents

Sem	Unit No.	Syllabus	Teaching Hours
3	1	Bryophytes -I • General characteristics of Bryophytes, Vegetative reproduction of bryophytes. • Classification (Rothmaler); Alternation Affinities of Bryophytes with Pteridophytes.	15
	2	Bryophytes -II • Classification only (up to family),	15

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		morphology, anatomy and reproduction of <i>Marchantia</i>. • Classification only (up to family), morphology, anatomy and reproduction of <i>Funaria</i>. • Economic importance of bryophytes.	
	3	Pteridophytes • General characteristics and economic importance of Pteridophytes; Classification (Smith). • Classification only (up to family), morphology, anatomy and reproduction of <i>Equisetum</i> (Developmental details not to be included). • Classification only (up to family), morphology, anatomy and reproduction of <i>Nephrolepis</i> • (Developmental details not to be included).	15
	4	Gymnosperms • General characteristics and economic importance of Gymnosperms. classification of Gymnosperms (Sporne, 1965). • Affinities with Pteridophytes and Angiosperms. Morphology, anatomy (leaflets and coralloid root) and reproduction of <i>Cycas</i> (Developmental details not to be included).	15

Suggested Reading:

1. 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.
2. Parihar, N.S. (1991). An introduction to Embryophyta: Vol. I. Bryophyta. Central BookDepot. Allahabad.
3. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R. (2005). Biology. Tata McGraw Hill, Delhi.
4. Vanderpoorten, A. & Goffinet, B. (2009) Introduction to Bryophytes. Cambridge University Press.

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Course Level	U.G. (5.0)	Internal Marks	-
Programme	B.Sc. Botany	External Marks	-
Semester	III	Practical Internal	50
Category of Course	MAJOR-7	Practical External	50
Course Credit	04 (Practical)	Prac. External Exam Duration	5 hrs.
Teaching Hours	120	Total	100
Course Code		Exam Duration	5 hrs.
Course Title	MYCOLOGY AND PHYTOPATHOLOGY, ARCHEGONIATE		

Course Learning Outcomes: After the completion of the course the students will be able:

- Understand the instruments, techniques, lab etiquettes and good lab practices for working in a lower groups.
- Develop skills for identifying Fungi, Lichens, Bryophytes, Pteridophytes, Gymnosperms and using them for Industrial, Agriculture and Environment purposes.
- Practical skills in the field and laboratory experiments in Mycology, Archegoniate & Pathology.
- Learn to identify lower group.
- Can initiate his own Plant & Seed Diagnostic Clinic and
- Can start own enterprise on lower group products.

Pedagogy:

- Lectures/ Use of Multimedia / Assignments/ Hands-on experiments/ Demonstrations/ Field visit.

Practical Course Content : MYCOLOGY AND PHYTOPATHOLOGY

Sr. No	Group- A	Teaching Hrs
1.	Rhizopus: study of asexual stage from temporary mounts and sexual structures through permanent slides/photographs/charts.	60
2.	Claviceps: study of asexual stage from temporary mounts. Study of Sexual stage from permanent slides/photographs/charts.	
3.	Agaricus: Specimen of fruiting body; sectioning of gills.	

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	Permanent slides/photographs/charts.	
4.	Lichens: Study of thallus (crustose, foliose and fruticose) and reproductive structure (apothecium) through Permanent slides/photographs/ charts/ specimen.	
5.	Mycorrhizae: Ectomycorrhiza and Endomycorrhiza (Photographs).	
6.	Phytopathology: Study of Plant diseases: Citrus Canker, White rust of crucifers and Black rust of wheat .	

Practical Course Content : ARCHEGONIATE

Sr. No	Group- B	Teaching Hrs
1.	Marchantia- Morphology of thallus with Gemma cup (whole mount), vertical section of thallus through Gemma cup (temporary slide), permanent slides of vertical section of Antheridiophore, Archegoniophore and Sporophyte.	60
2.	Funaria- Whole mount of plant, longitudinal section of capsule (temporary slide), permanent slides of antheridial and archegonial heads.	
3.	Equisetum- Morphology, longitudinal section of strobilus (temporary slide and permanent slide).	
4.	Nephrolepis- Morphology, transverse section of sori (temporary slide and permanent slide), prothallus (permanent slide).	
5.	Cycas- Morphology, vertical section of leaflet (temporary slide), whole mount of spores and specimen of coralloid roots, microsporophyll and megasporophyll.	

Suggested reading

- Bendra & Kumar (2018), A textbook of Practical Botany Volumes-I & II, Rastogi publication Meeruth-New Delhi.
- B.P. Pandey (2010), Modern practical Botany Volume Volume- I,II, and III, S. Chand Publication New Delhi.

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Sr. No	Group A	Marks
1.	Identify and classify giving reasons up to family of given specimen A .	06
2.	Make a temporary slide of the reproductive organ/Phytopathology from the given specimen B . Draw the labelled diagram of it and show your slide to the examiner.	06
3.	Identify and describe as per given instructions: - Specimen – C: Electron micrographs/Models/charts/permanent slide (Lichens/Mycorrhizae). (5 minutes) - Specimen – D: Electron micrographs/Models/charts/permanent slide (Rhizopus/Claviceps/Agaricus). (5 minutes)	06
4	Viva-voce	03
	Journal	04

Practical Paper Style for Major- 07**Time: 2:30 Hr.****Total Marks – 25**

Sr. No	Group B	Marks
1.	Identify and classify giving reasons up to family of given specimen E .	06
2.	Make a temporary slide of the reproductive organ from the given specimen F . Draw the labelled diagram of it and show your slide to the examiner.	06
3.	Identify and describe as per given instructions: I) Specimen – G: Permanent slide. (5 minutes) II) Specimen – H: Permanent slide. (5 minutes)	06
4	Viva-voce	03
	Journal	04

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Course Level	U.G. (5.0)	Internal Marks	25
Programme	B.Sc. Botany	External Marks	50
Semester	III	Practical Internal	-
Category of Course	MDC-3 (Theory)	Practical External	-
Course Credit	3 (Theory)	Prac. External Exam Duration	-
Teaching Hours	45	Total	75
Course Code		Exam Duration	2:00 Hrs
Course Title	MEDICINAL BOTANY		

Course Outcomes: On completion of the course, the students will be able to:

- Recognize the basic medicinal plants.
- This course gives a broader exposure to these very important economic plants in addition to their origin, general information, conservation and ethnobotany.
- The students who have opted for this course will be knowledgeable on several medicinally important plants.
- This will help them to pursue their career as economic botanist, conservation biologist, medicinal plants biologist, etc. will be able to deal with ethnobotanist, agricultural and horticultural scientist and social scientists.

Pedagogy:

- Lectures/ Use of Multimedia / Assignments/ Hands-on experiments/ Demonstrations/ Field visit.

Course Contents

Sem	Unit No.	Syllabus	Teaching Hours
3	1	Important Medicinal Plants-1 A brief account of the chief chemical constituents and medicinal uses of the following plant parts, used in indigenous and allopathic systems of medicine: • Root: Asparagus racemosus • Leaf: Vitex negundo • Stem: Tinospora cordifolia • Bark: Cinnamomum verum (syn. C. zeylanicum) –	15

2	Important Medicinal Plants- 2 A brief account of the chief chemical constituents and medicinal uses of the following plant parts, used in indigenous and allopathic systems of medicine: • Flower: Syzygium aromaticum (Clove) • Fruit: Moringa oleifera (syn. Moringa pterygosperma) • Seed: Datura metel	15
3	Pharmacognosy and Phytochemistry • Crude Drugs – Definition, classification (based on morphology and therapeutic uses) • Extraction Techniques – Methods of extraction: maceration, percolation, decoction • Phytochemicals – Alkaloids, flavonoids, glycosides, tannins, terpenoids: properties and uses	15
4	Conservation of Medicinal Plants • Introduction and types of Conservation • In-situ conservation – Conservation in natural habitats (e.g., sacred groves, biosphere reserves). • Ex-situ conservation – Conservation outside natural habitats (e.g., botanical gardens, seed banks, herbal gardens, nurseries).	15

Suggested Reading:

1. Kochhar S.L. (2012) Economic Botany in the Tropics. MacMillan India Ltd., New Delhi
2. Wickens G.E. (2001) Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.
3. Chrispeels M.J. and Sadava D.E. (1994) Plants, Genes and Agriculture. Jones & Bartlett Publishers.
4. Sambamurty A.V.S.S. and Subramanyam N.S. (1989) A Textbook of Economic Botany. Wiley Eastern Ltd., New Delhi.
5. Trivedi P.C. (2006) Medicinal Plants: Ethnobotanical Approach, Agrobios, India.
6. Purohit and Vyas (2008) Medicinal Plant Cultivation: A Scientific Approach. Agrobios, India.
7. Fuller K.W. and Gallon J.A. (1985) Plant Products and New Technology. Clarendon Press, Oxford, New York.
8. Hill A.F. (1952) Economic Botany: A Textbook of useful plants and plant products. McGraw Hill Publishing Company Ltd., New Delhi.
9. Sen S. (2009) Economic Botany. NCBA Publishers, New Delhi.

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Course Level	U.G. (5.0)	Internal Marks	-
Programme	B.Sc. Botany	External Marks	-
Semester	III	Practical Internal	25
Category of Course	MDC-3 (Practical)	Practical External	-
Course Credit	1 (Practical)	Prac. External Exam Duration	-
Teaching Hours	30	Total	25
Course Code		Exam Duration	02:30
Course Title	MEDICINAL BOTANY		

Course Outcomes: After the completion of the course the students will be able to:

- Recognize the basic medicinal plants.
- This course gives a broader exposure to these very important economic plants in addition to their origin, general information, conservation and ethnobotany.
- The students who have opted for this course will be knowledgeable on several medicinally important plants.
- This will help them to pursue their career as economic botanist, conservation biologist, medicinal plants biologist, etc. will be able to deal with ethnobotanist, agricultural and horticultural scientist and social scientists.
- Apply theoretical knowledge in utilization, and report generation of economical and medicinal plants. Create awareness on conservation of medicinal plants and use of natural plant products as alternatives to synthetic products.

Pedagogy:

- Lectures, Tutorials, Assignments, Demonstrations, live specimens, Herbarium specimens, Videos, Team based learning, Field visit and report writing.

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Practical Course Content

Sr. No	Medicinal Plant	Teaching Hrs
1.	Identification (botanical name and family), description and utilization of plants and/or plant parts studied in theory under each group.	30
2.	To study oil glands in T.S. of <i>Eucalyptus</i> leaf, <i>Citrus</i> pericarp.	
3.	Study of properties and measurement of diameter of plant fibres: cotton, jute and coir.	
4.	Testing for presence of alkaloids, Tannin.	
5.	Preparation of Holi colours using natural ingredients.	
6.	Enlist , Identification and medicinal value of locally available plants (field visit).	

Reference Books:

1. Bendra & Kumar (2018), A textbook of Practical Botany Volume-I & II, Rastogi publication Meeruth-New Delhi.
2. B.P. Pandey (2010), Modern practical Botany Volume Volume- I,II, and III, S. Chand Publication New Delhi.

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Paper Style: Medicinal Plant

Time: 2:30 Hr.

Total Marks – 25

Sr. No	Practical	Marks
1.	Identify and write local name, botanical name, family, useful part, medicinal important . (from unit 1). • Specimen A & B	06
2.	Identify and write local name, botanical name, family, useful part, medicinal important . (from unit 2). • Specimen C & D	06
3	Test for detection of alkaloid / Tannin	05
4	Expose and show oil gland to the examiner	05
5	Certified Journal	03

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INTERNAL EVALUATION SCHEME		
NO	Particulars	Marks
1	Mid Semester Exam/ Practical Exam (Mandatory)	25
2	Class Test	05
3	Open book exam/test	05
4	Open note exam/test	05
5	Self-test/ Online test	05
6	Essay/Article writing	05
7	Quizzes/Objective test	05
8	Class assignment	05
9	Home assignment	05
10	Reports Writing	05
11	Research/Dissertation	05
12	Case Studies	05
13	Viva/Oral exam	05
14	Group Discussion	05
15	Role Play	05
16	Paper presentation/Seminar	05
17	Language Lab work	05
18	Interview	05
19	Craft work	05
20	Co-curricular work	05
21	Field Assignment	05
22	Poster Presentation	05
23	Attendance	05
24	Project Work	05
	Total	50

Note: Sr.No.1 is mandatory. Select any five from Sr.No.2 to 24. Each Contains five marks. Student should secure 18 Marks for passing in internal Exam

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Paper Style:

EXTERNAL ASSESSMENT BY UNIVERSITY			
Que. No.	Particulars	Unit	Marks
Que. 1	Describe in detail:(Any one) (1) (2)	Unit 1	08
	Write short note:(Any one) (1) (2)		04
Que. 2	Describe in detail:(Any one) (1) (2)	Unit 2	09
	Write short note:(Any one) (1) (2)		04
Que. 3	Describe in detail:(Any one) (1) (2)	Unit 3	08
	Write short note:(Any one) (1) (2)		04
Que. 4	Describe in detail:(Any one) (1) (2)	Unit 4	09
	Write short note:(Any one) (1) (2)		04

SEMESTER- IV

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Course Level	U.G. (5.0)	Internal Marks	50
Programme	B.Sc. Botany	External Marks	50
Semester	IV	Practical Internal	-
Category of Course	MAJOR-8	Practical External	-
Course Credit	04 (Theory)	Prac. External Exam Duration	-
Teaching Hours	60	Total	100
Course Code		Exam Duration	2 hrs.
Course Title	ANATOMY OF ANGIOSPERMS		

Course Learning Outcomes: On completion of the course, the students will be able to:

- Develop an understanding of concepts and fundamentals of plant anatomy examine the internal anatomy of plant systems and organs.
- Develop critical understanding on the evolution of concept of organization of shoot and root apex.
- Analyze the composition of different parts of plants and their relationships.
- Evaluate the adaptive and protective systems of plants.

Pedagogy:

- Lectures/ Use of Multimedia / Assignments/ Hands-on experiments/ Demonstrations/ Field visit.

Course Contents

Sem	Unit No.	Syllabus	Teaching Hours
4	1	Anatomy: • The three tissue systems, types of cells and tissues. • Classification of tissues; Simple and complex tissues; tracheary elements and sieve elements. • Types of vascular bundles; Structure of dicot & monocot stem and leaf.	15

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	2	Anatomy: - Stomata: types, location, structure & function, classification (Metcalfe and Chalk). - Aleurone layer of Maize, Aleurone crystal of Castor seed, Hydathodes, Cavities, Cystolith and Laticifers. Ergastic substances: Starch grains of Potato and Wheat.	15
	3	Meristems: - Definition & characteristics of meristem, Evolution concept of organization of shoot apex (Apical cell theory, Histogen theory and Tunica Corpus theory). - Organization of root apex (Histogen theory, Korper-Kappe theory and Quiescent centre theory). - Epidermal tissue system; cuticle, epicuticular waxes, Trichomes (Uni-and Multicellular, Glandular and Nonglandular, two examples of each).	15
	4	Secondary growth: - Structure, function and activity of cambium; Secondary growth definition and types- normal and anomalous. - Secondary growth in Sunflower stem and root. - Anomalous Secondary growth in Salvadora stem and Tinospora aerial root.	15

Suggested Reading:

- Dickison, W.C. (2000). Integrative Plant Anatomy. Harcourt Academic Press, USA.
- Fahn, A. (1974). Plant Anatomy. Pergmon Press, USA.
- Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA.
- Evert, R.F. (2006) Esau's Plant Anatomy: Meristems, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc. Macmillan Publishers India Ltd.
- Sharma, P.D. (2011). Plant Pathology, Rastogi Publication, Meerut, India.

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Course Level	U.G. (5.0)	Internal Marks	50
Programme	B.Sc. Botany	External Marks	50
Semester	IV	Practical Internal	-
Category of Course	MAJOR-9	Practical External	-
Course Credit	04 (Theory)	Prac. External Exam Duration	-
Teaching Hours	60	Total	100
Course Code		Exam Duration	2 hrs.
Course Title	ECONOMIC BOTANY		

Course Outcomes: On completion of the course, the students will be able to:

- Understand core concepts of Economic Botany and relate with environment, populations, communities, and ecosystems.
- Develop critical understanding on the evolution of concept of organization of apex new crops/varieties, importance of germplasm diversity, issues related to access and ownership
- Develop a basic knowledge of taxonomic diversity and important families of useful plants
- Increase the awareness and appreciation of plants & plant products encountered in everyday life
- Appreciate the diversity of plants and the plant products in human use.

Pedagogy:

- Lectures/ Use of Multimedia / Assignments/ Hands-on experiments/ Demonstrations/ Field visit.

Course Contents

Sem	Unit No.	Syllabus	Teaching Hours
4	1	Plant Resources-1: • Introduction of plant resources. • Concept of centres of origin, their importance with reference to Vavilov's work. • Classification of economic important plants based on their uses.	15

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	2	Plant Resources- 2: • Origin, morphology, processing and uses of Wheat, Rice and Bajara. • Introduction, Origin, cultivation, morphology, family, scientific name, useful parts, chemical constituents and uses of Chick pea and Pigeon pea.	15
	3	Plant Resources- 3 • Introduction, Origin, cultivation, Botanical description, useful parts, chemical constituents and uses of Potato. • Introduction, Origin, Botanical description, cultivation, chemical constituents and uses of Clove, Black Pepper. • Introduction, origin, botanical description, Cultivation, chemical constituents and uses of Groundnut , Mustard	15
	4	Plant Resources- 4 • Introduction, Origin, cultivation, morphology, family, scientific name, useful parts, chemical constituents and uses of Fennel. • Introduction, origin, Botanical description, Cultivation, Processing, Chemical constituents & uses Tea. • Introduction, origin, botanical description, Growing region, Cultivation, and harvesting , processing and uses of cotton & Jute • Morphology and processing of Sugarcane, products and by-products of sugarcane industry.	15

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Suggested Reading:

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

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Course Level	U.G. (5.0)	Internal Marks	-
Programme	B.Sc. Botany	External Marks	-
Semester	IV	Practical Internal	50
Category of Course	MAJOR-10	Practical External	50
Course Credit	04 (practical)	Prac. External Exam Duration	5 hrs.
Teaching Hours	120	Total	100
Course Code		Exam Duration	5 hrs.
Course Title	ANATOMY OF ANGIOSPERMS, ECONOMIC BOTANY		

Course Learning Outcomes: After the completion of the course the students will be able:

- Develop an understanding of concepts and fundamentals of plant anatomy and examine the internal anatomy of plant systems and organs.
- Analyze the composition of different parts of plants and their relationships.
- Understand core concepts of Economic Botany and relate with environment, populations, communities, and ecosystems.
- Increase the awareness and appreciation of plants & plant products encountered in everyday life.
- Appreciate the diversity of plants and the plant products in human use.

Pedagogy:

- Lectures/ Use of Multimedia/ Assignments/ Hands-on experiments/ Demonstrations/ Field visit.

Practical Course Content: ANATOMY OF ANGIOSPERMS

Sr. No	Group- A	Teaching Hrs
1.	To identify and study various ergostic substances (a) Aleurone layer in maize (b) Aleurone crystal in castor seed	60
2.	To identify and study secretory structures (a) Hydathodes (Nephrolebis) (b) Cavities (Lysigenous and Schizogenous) (c) Cystolith (Ficus leaf)	

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3.	To study the structure of apical Meristem in root and shoot tips through permanent slides or prepared specimen.	
4.	To study and types of xylem elements tracheids and vessel elements with thickening patterns using maceration technique.	
5.	To study the components of phloem sieve tubes, sieveplates and companion cells through a maceration technique.	
6.	To study the epidermal system (a) Types of stomata (Dicot & Monocot) (b) Trichomes (Non - glandular & glandular) (c) Periderm & lenticels through permanent slides or prepared specimens.	
7.	To study anatomical features of secondary growth in dicot root (sunflower) and anomalous secondary growth aerial root (Tinospora)	
8.	To study anatomical features of secondary growth in dicot stem (sunflower) and anomalous secondary growth in (salvadora) stem.	

Practical Course Content: ECONOMIC BOTANY

Sr. No	Group- B	Teaching Hrs
Note: Write Scientific name, Family, Useful part, Chemical constitutes, economic important and draw labelled diagram of plant:		
1.	Cereals: To study Botanical features, chemical constituent, structure of grains, and economic importance of (A) Wheat, (B) Rice, (C) Bajra	60
2.	Legumes: To study botanical features, structure of fruits & seeds, chemical constituent and economic importance of (A) chick pea (B) pigeon pea	
3.	Sources of oils and fats: To study botanical features of plant specimens, chemical constituent and economic importance of (A) mustard (B) groundnut	

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4.	Sources of sugars and starches: To study botanical features plant specimens, chemical constituent and economic importance of (A) sugarcane stem (B) potato tuber.
5.	Spices: To study the morphological features, chemical constituents and economic importance of spices (A) black pepper, (B) fennel, (C) clove.
6.	Beverages: To study the plant specimen of tea (<i>Camellia sinensis</i>) and examine the morphological features of processed tea leaves.
7.	Fiber-yielding plants: To study the plant specimen of cotton & jute, prepare a whole mount of cotton seed to show lint and fuzz, and a whole mount of fiber.
8.	Microchemical tests: To detect Starch/Protein/Fat/Lignin to the given materials.

Suggested reading

1. Agrios, G.N. (1997) Plant Pathology, 4th edition, Academic Press, U.K.
2. 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, P.D. (2011). Plant Pathology, Rastogi Publication, Meerut, India.
6. Vashistha, P.C., Sinha, A.K., Kumar, A. (2010). Pteridophyta. S. Chand. Delhi, India.
7. Bhatnagar, S.P. & Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
8. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R. (2005). Biology. Tata McGraw Hill, Delhi.
9. Vanderpoorten, A. & Goffinet, B. (2009) Introduction to Bryophytes. Cambridge University Press.

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Sr. No	Group A	Marks
1.	To Study of secondary growth of given specimen A . Draw the labelled diagram of it and show your slide to the examiner.	05
2.	To Study of Ergastic substances (Aleurone layer of Maize /Aleurone crystal of Castor seed)/ Hydathodes(Nephrolepis)/ Cavities, Cystolith(Ficus leaf) from the given specimen B . Draw the labelled diagram of it and show your slide to the examiner.	05
3	To Prepare a slide of stomata, draw structure and describe from the given specimen .C	05
4.	Identify and describe as per given instructions: • Specimen – D: Permanent slide (Apical meristem of root /shoot). (5 minutes) • Specimen – E: permanent slide (Epidermal system). (5 minutes)	06
5	Certified journal	04

Practical Paper Style for Major- 10**Time: 2:30 Hr.****Total Marks – 25**

Sr. No	Group B	Marks
1.	Identify and write local name, botanical name, family, useful part, economicimportant. Specimen A, B & C (Cereals/ Legumes/ Source of oil/ Beverages)	09
2.	Identify and write local name, botanical name, family, useful part, economic important. Specimen D & E (Spices/ fiber yield plants / source of sugar & starch)	06
3.	Test for Starch/Protein/Fat/Lignin to the given material.	05
4	Certified Journal	05

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Course Level	U.G. (5.0)	Internal Marks	25
Programme	B.Sc. Botany	External Marks	50
Semester	IV	Practical Internal	-
Category of Course	MINOR-3 (Theory)	Practical External	-
Course Credit	3 (Theory)	Prac. External Exam Duration	-
Teaching Hours	45	Total	75
Course Code		Exam Duration	2:00 Hrs
Course Title	APPLIED BOTANY		

Course Outcomes: On completion of the course, the students will be able to:

- Understand core concepts of Economic Botany and relate with environment, populations, communities, and ecosystems.
- Develop critical understanding on the evolution of concept of organization of apex new crops/varieties, importance of germplasm diversity, issues related to access and ownership
- Develop a basic knowledge of taxonomic diversity and important families of useful plants
- Increase the awareness and appreciation of plants & plant products encountered in everyday life
- Appreciate the diversity of plants and the plant products in human use.

Pedagogy:

- Lectures/ Use of Multimedia / Assignments/ Hands-on experiments/ Demonstrations/ Field visit.

Course Contents

Sem	Unit No.	Syllabus	Teaching Hours
4	1	• Introduction, Origin, Botanical description, cultivation, chemical constituents and uses of Carrot , Sugar beet, Elephant yam • Introduction, Origin, Botanical description cultivation, chemical constituents and uses of Cabbage , Onion.	45

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2	• Introduction, Origin, Botanical discription cultivation, chemical constituents, Tapping, processing and industrial uses of Para-rubber , • Introduction, Origin, Botanical discription cultivation, chemical constituents, uses of Fennel. , Isabgol • Introduction, Origin, Botanical discription, cultivation, chemical constituents and Medicinal uses of Ashwagandha, Sarpgandha	
3	• Introduction, Origin, Botanical discription, cultivation, chemical constituents anduses of Clove, Black Pepper. • Introduction, origin, botanical discription, Cultivation, chemical constituents and uses of Groundnut , Mustard	
4	• Introduction, origin, Botanical discription, Cultivation, Processing, Chemical constituents & uses Tea, • Introduction, origin, botanical discription, Growing region, Cultivation, and harvesting , processing and uses of cotton & Jute • Morphology and processing of Sugarcane, products and by-products of sugarcane industry.	

Suggested Reading:

1. Kochhar, S.L. (2012). Economic Botany in Tropics, MacMillan & Co. New Delhi, India.
2. Wickens, G.E. (2001). Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.
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4. Bartlett Publishers.

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Course Level	U.G. (5.0)	Internal Marks	-
Programme	B.Sc. Botany	External Marks	-
Semester	IV	Practical Internal	25
Category of Course	MINOR-3 (Practical)	Practical External	-
Course Credit	1 (Practical)	Prac. External Exam Duration	-
Teaching Hours	30	Total	25
Course Code		Exam Duration	02:30
Course Title	APPLIED BOTANY		

Course Outcomes: On completion of the course, the students will be able to:

- Understand core concepts of Economic Botany and relate with environment, populations, communities, and ecosystems.
- Develop critical understanding on the evolution of concept of organization of apex new crops/varieties, importance of germplasm diversity, issues related to access and ownership
- Develop a basic knowledge of taxonomic diversity and important families of useful plants
- Increase the awareness and appreciation of plants & plant products encountered in everyday life
- Appreciate the diversity of plants and the plant products in human use.

Pedagogy:

- Lectures, Tutorials, Assignments, Demonstrations, live specimens, Herbarium specimens, Videos, Team based learning, Field visit and report writing.

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Practical Course Content:

Sr. No	APPLIED BOTANY	Teaching Hrs
1	To study botanical features of plant specimens, chemical constituent and economic importance of (A) Carrot, (B) Sugar beet, (C) elephant yam	45
2	To study botanical features of plant specimens, chemical constituent and economic importance of (A)Cabbage (B) Onion.	
3	To study botanical features of plant specimens, chemical constituent and Industrial uses of Para-rubber.	
4	To study botanical features of plant specimens, chemical constituent and Medicinal uses of (A) Isabgol ,(B) Ashwagandha,and (C) Sarp Gandha.	
5	To study botanical features of plant specimens, chemical constituent and economic importance of (A) Fennel,(B) Clove, (C) Black Pepper.	
6	To study botanical features of plant specimens, chemical constituent and economic importance of (A) mustard (B) groundnut	
7	To study botanical features of plant specimens, chemical constituent and economic importance of Tea	
8	To study botanical features of plant specimens, chemical constituent and economic importance of (A) Cotton, (B) Jute.	
9	To study botanical features of plant specimens, chemical constituent and economic importance of sugarcane	

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Practical Paper Style:

Time: 2:30 Hr.

Total Marks – 25

Sr. No	Applied Botany	Marks
1.	Identify and write local name, botanical name, family, useful part, economicimportant. • Specimen A, B & C (Source of oil/ Beverages/ Vegetables)	09
2.	Identify and write local name, botanical name, family, useful part, economicimportant. • Specimen D & E (Spices/ fiber yield plants / source of sugar & starch)	06
3.	Test for Starch/Protein/Fat/Lignin to the given material.	05
4	Certified Journal	05

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INTERNAL EVALUATION SCHEME		
NO	Particulars	Marks
1	Mid Semester Exam/ Practical Exam (Mandatory)	25
2	Class Test	05
3	Open book exam/test	05
4	Open note exam/test	05
5	Self-test/ Online test	05
6	Essay/Article writing	05
7	Quizzes/Objective test	05
8	Class assignment	05
9	Home assignment	05
10	Reports Writing	05
11	Research/Dissertation	05
12	Case Studies	05
13	Viva/Oral exam	05
14	Group Discussion	05
15	Role Play	05
16	Paper presentation/Seminar	05
17	Language Lab work	05
18	Interview	05
19	Craft work	05
20	Co-curricular work	05
21	Field Assignment	05
22	Poster Presentation	05
23	Attendance	05
24	Project Work	05
	Total	50

Note: Sr.No.1 is mandatory. Select any five from Sr.No.2 to 24. Each Contains five marks. Student should secure 18 Marks for passing in internal Exam.

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Paper Style:

EXTERNAL ASSESSMENT BY UNIVERSITY			
Que. No.	Particulars	Unit	Marks
Que. 1	Describe in detail:(Any one) (1) (2)	Unit 1	08
	Write short note:(Any one) (1) (2)		04
Que. 2	Describe in detail:(Any one) (1) (2)	Unit 2	09
	Write short note:(Any one) (1) (2)		04
Que. 3	Describe in detail:(Any one) (1) (2)	Unit 3	08
	Write short note:(Any one) (1) (2)		04
Que. 4	Describe in detail:(Any one) (1) (2)	Unit 4	09
	Write short note:(Any one) (1) (2)		04