



KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ



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NAAC Accredited
'A' Grade 2014

website: kud.ac.in

No.KU/Aca(S&T)/RPH-394A/2021-22/1155

Date: 29 OCT 2021

ಅಧಿಸೂಚನೆ

ವಿಷಯ: 2021-22ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಎಲ್ಲ ಸ್ನಾತಕ ಕೋರ್ಸುಗಳಿಗೆ 1 ಮತ್ತು 2ನೇ ಸೆಮಿಸ್ಟರ್
NEP-2020 ಮಾದರಿಯ ಪಠ್ಯಕ್ರಮವನ್ನು ಅಳವಡಿಸಿರುವ ಕುರಿತು.

- ಉಲ್ಲೇಖ: 1. ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು(ವಿಶ್ವವಿದ್ಯಾಲಯ 1) ಉನ್ನತ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಇವರ ಆದೇಶ
ಸಂಖ್ಯೆ: ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ-1), ದಿ:7.8.2021.
2. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ದಿನಾಂಕ: 19.08.2021
3. ಈ ಕಚೇರಿ ಸುತ್ತೋಲೆ ಸಂ.No. KU/Aca(S&T)/RPH-394A/2021-22/18 ದಿ:21.08.2021.
4. ಸರ್ಕಾರಿ ಆದೇಶ ಸಂ ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ-1),ಬೆಂಗಳೂರು ದಿ. 15.9.2021.
5. ಎಲ್ಲ ಅಭ್ಯಾಸಸೂಚಿ ಮಂಡಳಿ ಸಭೆಗಳ ನಡವಳಿಗಳು
6. ಎಲ್ಲ ನಿಖಾಯಗಳ ಸಭೆಗಳು ಜರುಗಿದ ದಿನಾಂಕ: 24,25-09-2021.
7. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 01 ದಿನಾಂಕ: 28.9.2021.
8. ಈ ಕಚೇರಿ ಸುತ್ತೋಲೆ ಸಂ.No. KU/Aca(S&T)/RPH-394A/2021-22/954 ದಿ:30.09.2021.
9. ಎಲ್ಲ ನಿಖಾಯದ ಡೀನರು / ಸಂಪನ್ಮೂಲ ತಜ್ಞರ ಸಭೆ ದಿನಾಂಕ 21.10.2021.
10. ಎಲ್ಲ ಸ್ನಾತಕ ಅಭ್ಯಾಸಸೂಚಿ ಮಂಡಳಿ ಅಧ್ಯಕ್ಷರುಗಳ ಸಭೆ ದಿನಾಂಕ 22.10.2021.
11. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 01 ದಿನಾಂಕ: 27.10.2021.
12. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 29-10-2021

ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಗಳನ್ವಯ ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶದ ಮೇರೆಗೆ, 2021-22ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ, ಎಲ್ಲ B.A./ BPA (Music)/BVA/ BTM/ BSW/ B.Sc./B.Sc. Pulp & Paper Science/ B.Sc. (H.M)/ BCA/ B.A.S.L.P./ B.Com/ B.Com (CS)/ & BBA ಸ್ನಾತಕ ಕೋರ್ಸುಗಳ 1 ಮತ್ತು 2ನೇ ಸೆಮಿಸ್ಟರ್‌ಗಳಿಗೆ NEP-2020 ರಂತೆ ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಅನುಮೋದಿತ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಈಗಾಗಲೇ ಪ್ರಕಟಪಡಿಸಿದ್ದು, ಮುಂದೆ ದಿನಾಂಕ 04.10.2021 ವರೆಗೆ ಸರ್ಕಾರವು ಕಾಲಕಾಲಕ್ಕೆ ನೀಡಿದ ನಿರ್ದೇಶನಗಳನ್ನು ಅಳವಡಿಸಿಕೊಂಡು ದಿನಾಂಕ 27.10.2021 ರಂದು ಜರುಗಿದ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯಲ್ಲಿ ಅನುಮೋದನೆ ಪಡೆದು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ www.kud.ac.in ದಲ್ಲಿ ಭಿತ್ತರಿಸಲಾಗಿದೆ. ಸದರ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲದಿಂದ ಡೌನ್‌ಲೋಡ್ ಮಾಡಿಕೊಳ್ಳಲು ಸೂಚಿಸುತ್ತ ವಿದ್ಯಾರ್ಥಿಗಳ ಹಾಗೂ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಬೋಧಕರ ಗಮನಕ್ಕೆ ತಂದು ಅದರಂತೆ ಕಾರ್ಯಪ್ರವೃತ್ತರಾಗಲು ಕವಿವಿ ಅಧೀನದ/ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಸೂಚಿಸಲಾಗಿದೆ.

ಆಡಕ: ಮೇಲಿನಂತೆ
ಗೆ.

ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ. (ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ ಹಾಗೂ ಮಿಂಚಂಚೆ ಮೂಲಕ ಭಿತ್ತರಿಸಲಾಗುವುದು)

ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ಅಧೀಕ್ಷಕರು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಗೌಪ್ಯ / ಜಿ.ಎ.ಡಿ. / ವಿದ್ಯಾಂಡಳ (ಪಿ.ಜಿ.ಪಿ.ಎಚ್.ಡಿ) ವಿಭಾಗ, ಸಂಬಂಧಿಸಿದ ಕೋರ್ಸುಗಳ ವಿಭಾಗಗಳು ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ / ವಿದ್ಯಾರ್ಥಿ ಕಲ್ಯಾಣ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

(Handwritten Signature)
ಕುಲಸಚಿವರು.



Practical Subject

KARNATAK UNIVERSITY, DHARWAD

04 - Year B.Sc. (Hons.) Program

SYLLABUS

Subject: BOTANY

[Effective from 2021-22]

**DISCIPLINE SPECIFIC CORE COURSE (DSCC) FOR SEM I & II,
OPEN ELECTIVE COURSE (OEC) FOR SEM I & II and
SKILL ENHANCEMENT COURSE (SEC) FOR SEM I**

AS PER N E P - 2020

Karnatak University, Dharwad
Four Years Under Graduate Program in BOTANY for B.Sc. (Hons.)
Effective from 2021-22

Sem	Type of Course	Theory/ Practical	Instruction hour per week	Total hours of Syllabus / Sem	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
I	DSCC 1	Theory	04hrs	56	02 hrs	40	60	100	04
		Practical	04 hrs	52	03 hrs	25	25	50	02
	OEC-1	Theory	03 hrs	42	02 hrs	40	60	100	03
	*SEC-1	Practical	03 hrs	30	02 hrs	25	25	50	02
II	DSCC2	Theory	04 hrs	56	02 hrs	40	60	100	04
		Practical	04 hrs	52	03 hrs	25	25	50	02
	OEC-2	Theory	03 hrs	42	02 hrs	40	60	100	03
Details of the other Semesters will be given later									

*** Student can opt digital fluency as SEC or the SEC of his/ her anyone DSCC selected**

Name of Course (Subject): BOTANY

Programme Specific Outcome (PSO):

On completion of the 03/04 years Degree in BOTANY students will be able to:

PSO 1: Skill development for the proper description using botanical terms, identification, naming, and classification of life forms especially plants and microbes.

PSO 2: Acquisition of knowledge on the structure, life cycle, and life processes that exist among plant and microbial diversity through certain model organism studies.

PSO 3: Understanding of various interactions that exist among plants and microbes; to develop the curiosity on the dynamicity of nature.

PSO 4: Ability to explain the diversity and evolution based on the empirical evidence in morphology, anatomy, embryology, physiology, biochemistry, molecular biology, and life history.

PSO 5: Skill development for the collection, preservation, and recording of information after observation and analysis- from simple illustration to molecular database development.

PSO 6: Making aware of the scientific and technological advancements- Information and Communication, Biotechnology, and Molecular Biology for further learning and research in all branches of Botany.

PSO 7: To enable the graduates to prepare for national as well as international level competitive examinations like UGC-CSIR, UPSC, KPSC, and others.

PSO 8: To enable the students for practicing the best teaching pedagogy as a biology teacher including the latest digital modules.

PSO 9: The graduates should be knowledgeable and competent enough to appropriately deliver on aspects of global importance like climate change, SDGs, green technologies, etc at the right opportunity.

PSO 10: The graduate should be able to demonstrate sufficient proficiency in the hands-on experimental techniques for their area of specialization within biology during research and their professional career.

B.Sc. Semester – I

Subject: **Fungi, Microbiology and Plant Pathology** Discipline-Specific Course (DSC)

The course **Fungi, Microbiology and Plant Pathology** in I semester has two papers (Theory Paper –I for 04 credits & Practical Paper-II for 2 credits) for 06 credits: Both the papers are compulsory. Details of the courses are as under.

Course No.-1 (Theory)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-01	DSCC	Theory	04	04	56 hrs	2hrs	40	60	100

Course No.1 (Theory): Title of the Course (Theory): **Fungi, Microbiology and Plant Pathology**

Course Outcome (CO):

After completion of the course (Theory), students will be able to:

CO 1: Develop an understanding of the concept of microbial nutrition, Classify viruses based on their characteristics and structures.

CO 2: Develop a critical understanding of plant diseases and their remediation. Examine the general characteristics of bacteria and their cell reproduction/recombination.

CO 3: Increase the awareness and appreciation of human-friendly viruses, bacteria, algae, and their economic importance. Identify true fungi and demonstrate the principles and application of plant pathology in the control of plant disease.

CO 4: Demonstrate skills in laboratory, field, and glasshouse work related to mycology and plant pathology.

CO 5: Develop an understanding of microbes, fungi, and lichens and appreciate their adaptive strategies. Identify the common plant diseases according to geographical locations and device control measures. Conduct experiments using skills appropriate to subdivisions

<p align="center">Syllabus- Course 1(Theory): Title- Fungi, Microbiology and Plant Pathology</p>	<p align="center">Total Hrs: 56</p>
<p>Unit-I Introduction to fungi and classification: Chytridiomycota, Zygomycota, Ascomycota, Basidiomycota, Oomycota and allied fungi</p>	<p align="center">14 hrs</p>
<p>General characteristics; Affinities with plants and animals; Thallus organization; Cell wall composition; Nutrition; Classification (Alexopoulos). Chytridiomycota and Zygomycota: Characteristic features; Ecology and significance; Thallus organization; Reproduction; Life cycle with reference to <i>Synchytrium</i>, <i>Rhizopus</i>. Ascomycota: General characteristics (asexual and sexual fruiting bodies); Ecology; Life cycle, Heterokaryosis, and parasexuality; Life cycle and classification with reference to <i>Saccharomyces</i>, <i>Penicillium</i>, <i>Alternaria</i> and <i>Peziza</i>.</p> <p>Basidiomycota, Allied fungi, and Oomycota: General characteristics; Ecology; Life cycle and Classification with reference to black stem rust on wheat <i>Puccinia</i> (Physiological Specialization), loose and covered smut (symptoms only), <i>Agaricus</i>; Bioluminescence, Fairy Rings and Mushroom Cultivation. Allied fungi: General characteristics; Status of Slime molds, Classification; Occurrence; Types of plasmodia; Types of fruiting bodies. Oomycota: General characteristics; Ecology; Life cycle and classification with reference to <i>Phytophthora</i>, <i>Albugo</i>.</p>	
<p>Unit-II Symbiotic associations and Applied Mycology</p>	<p align="center">14 hrs</p>
<p>Lichen – Occurrence; General characteristics; Growth forms and range of thallus organization; Nature of associations of algal and fungal partners; Reproduction; Mycorrhiza- Ectomycorrhiza, Endomycorrhiza, and their significance. Role of fungi in biotechnology; Application of fungi in the food industry (Flavour & texture, Fermentation, Baking, Organic acids, Enzymes, Mycoproteins); Secondary metabolites (Pharmaceutical preparations); Agriculture (Biofertilizers); Mycotoxins; Biological control (Mycofungicides, Mycoherbicides, Mycoinsecticides, Myconematicides); Medical Mycology.</p>	

Unit-III Introduction to the microbial world, Viruses, and Bacteria	14 hrs
<p>Microbial nutrition, nutritional types, growth, and metabolism. Economic importance of viruses with reference to vaccine production, role in research, medicine, and diagnostics, as causal organisms of plant diseases. Economic importance of bacteria with reference to their role in agriculture and industry (fermentation and medicine).</p> <p>Viruses and Bacteria: General characteristics; classification (Baltimore), structure and replication of DNA virus (T4 and λ), lytic and lysogenic cycle; RNA virus (TMV), viroids, and prions. General characteristics; Archaeobacteria, Eubacteria, wall-less forms (mycoplasmas); Cell structure; Reproduction and recombination (conjugation, transformation, and transduction). Binary fission and endospore.</p>	
Unit-IV Phytopathology	14 hrs
<p>Phytopathology: Terms and concepts; General symptoms; Geographical distribution of diseases; Etiology; Symptomology; Host-Pathogen relationships; Disease cycle and environmental relation; prevention and control of plant diseases, and role of quarantine.</p> <p>Bacterial diseases – Citrus canker and angular leaf spot of cotton. Viral diseases – Tobacco Mosaic viruses, vein clearing. Fungal diseases – Late blight of potato, Black stem rust of wheat, White rust of crucifers.</p>	

Books recommended.

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. 4th edition. John Wiley & Sons (Asia) Singapore.
3. Webster, J. and Weber, R. (2007). Introduction to Fungi. 3rd edition. Cambridge University Press, Cambridge.
4. Sethi, I.K. and Walia, S.K. (2011). Textbook of Fungi and Their Allies, Macmillan Publishers India Ltd.
5. Sharma, P.D. (2011). Plant Pathology, Rastogi Publication, Meerut, India.
6. Wiley, J.M, Sherwood, L.M. and Woolverton, C.J. (2013). Prescott's Microbiology. 9th Edition. McGraw Hill International.
7. Sharma T.A., Dubey, R.C. and Maheshwari, D.K. (1999). A Text-Book of Microbiology. S Chand and Co, New Delhi.
8. Pelczar, M.J. (2001). Microbiology, 5th edition, Tata McGraw-Hill Co, New Delhi. Agrios, G.N. (1997). Plant Pathology, 4th edition, Academic Press, U.K.
9. Sharma, P.D. (2011). Plant Pathology, Rastogi Publication, Meerut, India.

B.Sc. Semester – I

Subject: **Fungi, Microbiology and Plant Pathology** Discipline-Specific Course (DSC)

Course No.-1 (Practical)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-01	DSCC	Practical	02	04	52 hrs	3hrs	25	25	50

Course No.1 (Practical): Title of the Course (Practical): **Fungi, Microbiology and Plant Pathology**

Course Outcome (CO):

After completion of the course (Practical), students will be able to:

CO 1: Develop an understanding of the concept of microbial nutrition, Classify viruses based on their characteristics and structures.

CO 2: Develop a critical understanding of plant diseases and their remediation. Examine the general characteristics of bacteria and their cell reproduction/recombination.

CO 3: Increase the awareness and appreciation of human-friendly viruses, bacteria, algae, and their economic importance. Identify true fungi and demonstrate the principles and application of plant pathology in the control of plant disease.

CO 4: Demonstrate skills in laboratory, field, and glasshouse work related to mycology and plant pathology.

CO 5: 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. Conduct experiments using skills appropriate to subdivisions

List of the Experiments for 52 hrs / Semesters

1. *Rhizopus*: a study of the asexual stage from temporary mounts and sexual structures through permanent slides.
2. *Aspergillus* and *Penicillium*: a study of the asexual stage from temporary mounts. Study of Sexual stage from permanent slides/photographs.
3. *Peziza*: sectioning through ascocarp.

4. *Alternaria*: Specimens/photographs and temporary mounts.
5. *Puccinia*: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; sections/ mounts of spores on wheat and permanent slides of both the hosts.
6. *Agaricus*: Specimens of button stage and full-grown mushroom; sectioning of gills of *Agaricus*, fairy rings, and bioluminescent mushrooms are to be shown.
7. *Phytophthora infestans* – vegetative structure and reproduction.
8. *Albugo*: Study of symptoms of plants infected with *Albugo*; asexual phase study through section/temporary mounts and sexual structures through permanent slides.
9. Lichens: Study of growth forms of lichens (crustose, foliose, and fruticose) on different substrates. Study of thallus and reproductive structures (soredia and apothecium) through permanent slides. Mycorrhizae: ectomycorrhiza and endomycorrhiza (Photographs).
10. Electron micrographs/Models of viruses – T4 and TMV, Line drawings/ Photographs of Lytic and Lysogenic Cycle.
11. Gram-staining of root nodule and curd.
12. Phytopathology: Herbarium and live specimens of bacterial diseases; Citrus Canker; Angular leaf spot of cotton, Viral diseases: TMV, Vein clearing, Fungal diseases: Early blight of potato, Black stem rust of wheat, and White rust of crucifers.

General instructions:

- Q1. Give specimens A, B, and C from fungi**
- Q2. Give root nodule/curd for simple/Gram staining of bacteria (D)**
- Q3. Diseased specimen E-viral disease/bacterial disease; F-fungal disease**
- Q4. Give slide 'G' Fungi/mycorrhizae; 'H' slide/specimen from fungi**
- Q5. Study tour report**
- Q5. Viva voce**
- Q6. Journal**

Scheme of Practical Examination (distribution of marks): 25 marks for the Semester end examination

1. Identify, classify and write the salient features observed of specimen A, B, C **6 Marks**
2. Perform simple/Gram staining using material 'D'. Show the preparation to the examiners **4 Marks**
3. Identification of the disease and explain symptoms observed in specimen E and F **4 Marks**
4. Identify and describe the features observed in the slides/specimen G, and H **4 Marks**
5. **Study Tour Report 2 Marks**
6. **Viva voce 2 Marks**
7. **Journal 3 Marks**

Total 25 marks

Note: Same Scheme may be used for IA (Formative Assessment) examination

Books recommended.

1. Ashok Bendre and Ashok Kumar (2009) A textbook of practical botany, Rostakge Publications.
2. Sharma, O.P., and Sharma, K. D. (2017) Practical Botany-I, Pragathi Prakashan, Meerut.
3. Raghuram, M, and Rao, M. V. (2018) B. Sc. Practical Book of Botany First Year, Technical Publishers.
4. Verghese, N., Joy, P.P. Microbiology Laboratory Manual, Kerala Agricultural University.

B.Sc. Semester – I

Subject: Mushroom Cultivation Open Elective Course (OEC-1) (OEC for other students)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC-1	OEC	Theory	03	03	42 hrs	2 hrs	40	60	100

OEC-1: Title of the Course: **Mushroom Cultivation**

Course Outcome (CO):

After completion, of course, students will be able to:

- CO 1** : Identification of various types and categories of mushrooms
- CO 2** : Demonstrate various types of mushroom cultivating technologies
- CO 3** : Examine various types of food technologies associated with the mushroom industry
- CO 4** : Value the economic factors associated with mushroom cultivation
- CO 5** : Device new methods and strategies to contribute to mushroom production

Syllabus- OEC: Title: Mushroom Cultivation	Total Hrs: 42
Unit-I Introduction, Cultivation technology	14 hrs
Introduction, history. Nutritional and medicinal value of edible mushrooms; Nutrition and nutraceuticals – Proteins, amino acids, mineral elements nutrition, carbohydrates, crude fiber content, vitamins; Poisonous mushrooms. Cultivation Technology: Infrastructure: substrates (locally available) Polythene bag, vessels, Inoculation hook, inoculation loop, low-cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag. Pure culture: Medium, Sterilization, Preparation of spawn, Multiplication.	
Unit-II Cultivation	14 hrs
Cultivation practices of <i>Agaricus bisporus</i> , <i>Pleurotus</i> sp. and <i>Volvoriella volvacea</i> . Composting technology in mushroom production, Low-cost technology, Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves. Factors affecting the mushroom bed preparation.	
Unit-III Storage and Food preparation, Food preparation	14 hrs
Short-term storage (Refrigeration - up to 24 hours) Long-term Storage (canning, pickles, papads), drying, storage in salt solutions. Food Preparation: Types of foods prepared from the mushroom. Research Centres - National level and Regional level. Cost-benefit ratio - Marketing in India and abroad, Export Value	

Books recommended.

1. Biswas, S., Datta, M. and Ngachan, S.V. 2012. Mushrooms: A Manual for Cultivation. PHI Learning Private Limited, New Delhi.
2. Kapoor, J.N. 2010. Mushroom Cultivation. ICAR, New Delhi.
3. Nita Bahl (2000) Handbook of Mushrooms. Oxford & IBH Publishing Co. Pvt. Ltd.
4. Singh, M., Vijay, B., Kamal, S., and Wakchaure (Eds.) 2011. Mushrooms: Cultivation, Marketing, and Consumption. Directorate of Mushroom Research (ICAR), Solan
5. Tewari, Pankaj, and Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.

B.Sc. Semester - I

Subject: Gardening and landscaping SKILL ENHANCEMENT COURSE (SEC)-I

Title of Paper: Gardening and landscaping

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Mode of Examination	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
SEC-I	Theory + Practical	02	03hrs	30	Practical	2hr	25	25	50

Course Outcome (CO):

After completion of the Skill Enhancement course, students will be able to:

CO 1: Apply the basic principles and components of gardening

CO 2: Conceptualize flower arrangement and bio-aesthetic planning

CO 3: Design various types of gardens according to the culture and art of bonsai

CO 4: Establish and maintain special types of gardens for outdoor and indoor landscaping

List of the Experiments for 52 hrs / Semesters

1. Tools, implements, and containers used for propagation and nursery techniques.
2. Propagation by cutting, layering, budding, and grafting.
3. Seed propagation - preparation of portable trays, seed treatments, sowing, and seedling production.
4. Identification and description of annuals, herbaceous perennials, climbers, creepers, foliage, and flowering shrubs, trees, palms, ferns, ornamental grasses; cacti, and succulents.
5. Planning and designing of gardens, functional uses of plants in the landscape.
6. Preparation of land for lawn and planting.
7. Identification of commercially important flower crops and their varieties.
8. Propagation practices in flower crops, sowing of seeds, and raising of seedlings of annuals.
9. Use of chemicals and other compounds for prolonging the vase life of cut flowers.
10. Grading, packing, and marketing of cut flowers.
11. Visit commercial nurseries and commercial tissue culture laboratories.

General instructions:

Theoretical Knowledge of the following is essential:

Principles of gardening, garden components, adornments, lawn making, methods of designing rockery, water garden, etc. Special types of gardens, their walk-paths, bridges, constructed features. Greenhouse. Special types of gardens, trees, their design, values in landscaping, propagation, planting shrubs, and herbaceous perennials. Importance, design values, propagation, plating, climbers and creepers, palms, ferns, grasses, and cacti succulents.

Flower arrangement: importance, production details, and cultural operations, constraints, postharvest practices. Bioaesthetic planning, definition, need round country planning, urban planning, and planting avenues, schools, villages, beautifying railway stations, dam sites, hydroelectric stations, colonies, riverbanks, planting material for playgrounds.

Vertical gardens, roof gardens. Culture of bonsai, the art of making bonsai. Parks and public gardens. Landscape designs, Styles of the garden, formal, informal, and freestyle gardens, types of gardens, Urban landscaping, Landscaping for specific situations, institutions, industries, residents, hospitals, roadsides, traffic islands, dam sites, IT parks, corporate.

Scheme of Practical Examination (distribution of marks): 25 marks for the Semester end examination

1. Identify and describe the uses of tools **6 Marks**
2. Perform experiment – **Seed viability/Seed germination 6 Marks**
3. Identification of specimen **6 Marks**
4. **Study tour report 2 Marks**
5. **Viva 2 Marks**
6. **Journal 3Marks**

Total 25 marks

Note: Same Scheme may be used for IA (Formative Assessment) examination

Books recommended.

1. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
2. Edmond Musser & Andres, Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.
3. Janick Jules. 1979. Horticultural Science. (3rd Ed.), W.H. Freeman and Co., San Francisco, USA.
4. Hartmann and Kester, 2010. Plant Propagation: Principles and Practices. Pearson Publisher.
5. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.
6. Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
7. Thakur, A.K., Kashyap, B., Bassi, S.K. and Sharma, M. 2018. Floriculture. S. Dinesh & Co., Jalandhar.

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weightage for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8 th Week
Written test-2	10%	1 hr	12 th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	-----	--
Total	40% of the maximum marks allotted for the paper		

**Faculty of Science
04 - Year UG Honors programme:2021-22**

**GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)**

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions : 10marks

Part-B

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions: 20 marks

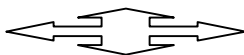
Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight-age shall be given to each unit based on number of hours prescribed.



B.Sc. Semester – II

Subject: Algae, Bryophytes, Pteridophytes and Gymnosperms
Discipline-Specific Course (DSC)

The course **Algae, Bryophytes, Pteridophytes, and Gymnosperms** in I semester has two papers (Theory Paper –I for 04 credits & Practical paper-II for 2 credits) for 06 credits: Both the papers are compulsory. Details of the courses are as under.

Course No.-2 (Theory)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-02	DSCC	Theory	04	04	56 hrs	2hrs	40	60	100

Course No.2 (Theory): Title of the Course (Theory): **Algae, Bryophytes, Pteridophytes, and Gymnosperms**

Course Outcome (CO):

After completion of the course (Theory), students will be able to:

CO 1: Demonstrate an understanding of Algae, Bryophytes, Pteridophytes, and Gymnosperms.

CO 2: Develop a critical understanding of morphology, anatomy, and reproduction of Algae, Bryophytes, Pteridophytes, and Gymnosperms.

CO 3: Understanding of plant evolution and their transition to land habitat.

CO 4: Demonstrate proficiency in the experimental techniques and methods of appropriate analysis of Algae, Bryophytes, Pteridophytes, Gymnosperms

CO 5: Economic importance of Algae, Bryophytes, Pteridophytes, Gymnosperms

Syllabus- Course 2(Theory): Title- Algae, Bryophytes, Pteridophytes, Gymnosperms	Total Hrs: 56
Unit-I Algae: Cyanophyta, Xanthophyta, Chlorophyta and Phaeophyta and Rhodophyta	14 hrs
Algae, Cyanophyta and Xanthophyta: Life histories of algae, commonly found algae in India, Classification (by Fritsch), Algal cultivation methods, Phylogenetic systematics of red, brown and green algae, Dinoflagellates, Diatoms, Cryptomonads and other unicellular algae, Algal evolution, Algal bioprospecting. Ecology and occurrence; Range of thallus organization; Cell structure; Morphology and reproduction in <i>Nostoc</i> and <i>Vaucheria</i> .	

Chlorophyta and Phaeophyta and Rhodophyta: General characteristics; Occurrence; Range of thallus organization; Cell structure; Reproduction. Morphology and life-cycles of <i>Volvox</i> , <i>Oedogonium</i> , <i>Chara</i> , <i>Ectocarpus</i> , and <i>Batrachospermum</i> Red tides and other algal adaptations. Commercial cultivation and economic importance of green algae, Brown and Red algae.	
Unit-II Bryophytes and type of bryophytes	14 hrs
Unifying features of and adaption of archegoniates; Transition to land habit; Alternation of generations. General characteristics; Classification (Smith/Fritsch); Range of thallus organization. Morphology, anatomy, reproduction and evolutionary trends in <i>Riccia</i> , <i>Marchantia</i> , <i>Anthoceros</i> , and <i>Funaria</i> ; Common mosses of India, Ecological and economic importance of bryophytes with special reference to <i>Sphagnum</i> .	
Unit-III Pteridophytes	14 hrs
Unifying features, morphology, anatomy, and reproduction of <i>Psilotum</i> , <i>Selaginella</i> , <i>Equisetum</i> , and <i>Pteris</i> (Developmental details not to be included). Apogamy and apospory, heterospory and seed habit, telome theory, stellar evolution; Common ferns of India, Ecological and economic importance.	
Unit-IV Gymnosperms	14 hrs
Unifying features, general characteristics, classification (Smith/Fritsch), morphology, anatomy, and reproduction of <i>Cycas</i> , <i>Pinus</i> , and <i>Gnetum</i> (excluding developmental details); <i>Cycas</i> and <i>Pinus</i> of India, Ecological and economic importance.	

Books recommended.

1. Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.
2. Vashishta B.R., Sinha A.K. and Singh V. P. (2008). Botany for Degree Students. Algae. S Chand and Co, New Delhi.
3. Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali International, New Delhi.
4. Campbell, N.A., Reece, J.B., Urry, L.A., Cain, M.L., Wasserman, S.A., Minorsky P.V. and Jackson, R.B. (2008). Biology, 8th edition. Pearson Benjamin Cummings, USA.
5. Vashishta, P.C., Sinha, A.K., Kumar, A. (2010). Pteridophyta. S. Chand. Delhi, India.
6. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International Publishers, New Delhi, India.
7. Parihar, N.S. (1991). An introduction to Embryophyta: Vol. I. Bryophyta. Central Book Depot, Allahabad.
8. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R. (2005). Biology. Tata McGraw Hill, New Delhi.
9. Vanderpoorten, A. and Goffinet, B. (2009). Introduction to Bryophytes. Cambridge University Press, Cambridge

B.Sc. Semester – II

Subject: **Algae, Bryophytes, Pteridophytes and Gymnosperms** Discipline-Specific Course (DSC)

Course No.-2 (Practical)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-02	DSCC	Practical	02	04	52 hrs	3hrs	25	25	50

Course No.2 (Practical): Title of the Course (Practical): **Algae, Bryophytes, Pteridophytes, and Gymnosperms**

Course Outcome (CO):

After completion of the course (Practical), students will be able to:

CO 1: Demonstrate an understanding of Algae, Bryophytes, Pteridophytes, and Gymnosperms.

CO 2: Develop a critical understanding of morphology, anatomy, and reproduction of Algae, Bryophytes, Pteridophytes, and Gymnosperms.

CO 3: Understanding of plant evolution and their transition to land habitat.

CO 4: Demonstrate proficiency in the experimental techniques and methods of appropriate analysis of Algae, Bryophytes, Pteridophytes, Gymnosperms

CO 5: Economic importance of Algae, Bryophytes, Pteridophytes, Gymnosperms

List of the Experiments for 52 hrs / Semesters

1. Microscopic observation of vegetative and reproductive structures of *Nostoc*, *Volvox*, *Oedogonium*, *Chara*, *Vaucheria*, *Ectocarpus*, *Fucus*, and *Batrachospreum* through temporary preparations and permanent slides.
2. *Riccia* – Morphology of the thallus.
3. *Marchantia*- Morphology of thallus, whole-mount of rhizoids and Scales, vertical section of thallus through Gemma cup (all temporary slides), vertical section of Antheridiophore, Archegoniophore, longitudinal section of Sporophyte (all permanent slides).
4. *Anthoceros*- Morphology of thallus, dissection of the sporophyte (to show stomata, spores, pseudoelaters, columella) (temporary slide), vertical section of the thallus (permanent slide).

5. *Funaria*- Morphology, whole-mount of leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, longitudinal section of a capsule; whole mount of protonema.
6. *Psilotum*- Study of the specimen, transverse section of synangium (permanent slide).
7. *Selaginella*- Morphology, whole-mount of the leaf with a ligule, transverse section of stem, whole-mount of strobilus, whole-mount of microsporophyll and megasporophyll (temporary slides), longitudinal section of strobilus (permanent slide).
8. *Equisetum*- Morphology, transverse section of internode, longitudinal section of strobilus, whole-mount of sporangiophore, whole-mount of spores (temporary slide), transverse section of rhizome (permanent slide).
9. *Pteris*- Morphology, transverse section of rachis, vertical section of sporophyll, whole-mount of the sporangium, whole-mount of spores (temporary slides), transverse section of rhizome, whole-mount of prothallus with sex organs, and young sporophyte (permanent slide).
10. *Cycas*- Morphology (coralloid roots, leaf), the whole mount of microsporophyll, transverse section of coralloid root, transverse section of rachis, vertical section of the leaflet, vertical section of microsporophyll, whole-mount of spores (temporary slides), longitudinal section of ovule, transverse section of root (permanent slide).
11. *Pinus*- Morphology (long and dwarf shoots, whole-mount of dwarf shoot, male and female cones), transverse section of the needle, transverse section of stem, longitudinal section of / transverse section of a male cone, whole-mount of microsporophyll, whole-mount of Microspores (temporary slides), longitudinal section of a female cone, tangential longitudinal section and radial longitudinal sections stem (permanent slide).
12. *Gnetum*- Morphology (stem, male and female cones), transverse section of stem, vertical section of the ovule (permanent slide).

General instructions:

Q1. Give specimen from Algae, Bryophytes, Pteridophytes, and Gymnosperms (A, B, C, and D)

Q2. Preparation and analysis of material Algae/Bryophytes/Pteridophytes/ Gymnosperms (E and F)

Q3. Specimen or Slides from Algae/Bryophytes/Pteridophytes/Gymnosperms (H, I, and J)

Q4. Study Tour Report

Q5. Viva

Q6. Journal

Scheme of Practical Examination (distribution of marks): 25 marks for the Semester end examination

1. Identify, classify and describe features observed in specimen **8 Marks**
2. Describe the internal structures of the given specimen **4 Marks**
3. Identification of Specimen/slides **6 Marks**
4. **Study Tour Report 2 Marks**
5. **Viva 2 Marks**
6. **Journal 3 Marks**

Total 25 marks

Note: Same Scheme may be used for IA (Formative Assessment) examination

Books recommended.

1. Ashok Bendre and Ashok Kumar (2009) A textbook of practical botany, Rostakge Publications.
2. Sharma, O.P., and Sharma, K. D. (2017) Practical Botany-I, Pragathi Prakashan, Meerut.
3. Raghuram, M, and Rao, M. V. (2018) B. Sc. Practical Book of Botany First Year, Technical Publishers.
4. Verghese, N., Joy, P.P. Microbiology Laboratory Manual, Kerala Agricultural University.

B.Sc. Semester – II

Subject: **Biofertilizers** Open Elective Course (OEC-2) (OEC for other students)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC-2	OEC	Theory	03	03	42 hrs	2hrs	40	60	100

OEC-2: Title of the Course: **Biofertilizers**

Course Outcome (CO):

After completion, of course, students will be able to:

CO 1: Develop their understanding of the concept of bio-fertilizer

CO 2: Identify the different forms of biofertilizers and their uses

CO 3: Compose the Green manuring and organic fertilizers

CO 4: Develop the integrated management for better crop production by using both nitrogenous and phosphate biofertilizers and vesicular-arbuscular mycorrhizal (VAM).

CO 5: Interpret and explain the components, patterns, and processes of bacteria for growth in crop production

Syllabus- OEC: Title- Biofertilizers	Total Hrs: 42
Unit-I	14 hrs
The general account about the microbes used as biofertilizer – Rhizobium – isolation, identification, mass multiplication, carrier-based inoculants, Actinorrhizal symbiosis. <i>Azospirillum</i> : isolation and mass multiplication – carrier-based inoculant, the associative effect of different microorganisms. <i>Azotobacter</i> : classification, characteristics – crop response to <i>Azotobacter</i> inoculum, maintenance, and mass multiplication.	
Unit-II	14 hrs
Cyanobacteria (blue-green algae), <i>Azolla</i> and <i>Anabaena azollae</i> association, nitrogen fixation, factors affecting growth, blue-green algae, and <i>Azolla</i> in rice cultivation. Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants.	
Unit-III	14 hrs
Organic farming – Green manuring and organic fertilizers, Recycling of bio-degradable municipal, agricultural, and industrial wastes – bio compost making methods, types, and method of vermicomposting – field Application.	

Books recommended.

1. Dubey, R.C. (2005). A Textbook of Biotechnology S.Chand & Co, New Delhi.
2. John Jothi Prakash, E. (2004). Outlines of Plant Biotechnology. Emkay Publication, New Delhi.
3. Kumaresan, V.(2005). Biotechnology, Saras Publications, New Delhi.
4. NIIR Board. (2012). The Complete Technology Book on Biofertilizer and organic farming. 2nd Edition. NIIR Project Consultancy Services.
5. Sathe, T.V. (2004) Vermiculture and Organic Farming. Daya publishers.
6. Subba Rao N.S. (2017). Biofertilizers in Agriculture and Forestry. Fourth Edition. Medtech.
7. Vayas, S.C, Vayas, S. and Modi, H.A. (1998). Bio-fertilizers and organic Farming Akta Prakashan, Nadiad

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weightage for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8 th Week
Written test-2	10%	1 hr	12 th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	-----	--
Total	40% of the maximum marks allotted for the paper		

**Faculty of Science
04 - Year UG Honors programme: 2021-22**

**GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)**

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions : 10marks

Part-B

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions : 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight-age shall be given to each unit based on number of hours prescribed.

