



B.Sc. I Year (Semester I) Botany Core Paper 1

Certificate Course in Microbial Technology & Classical Botany (Theory)

Programme/Class: Certificate	Year: 1	Semester: 1
Subject: Botany		
Course Code: B040101T	Course Title: Microbiology & Plant Pathology	
Course outcomes: After the completion of the course the students will be able to: 1. Develop understanding about the classification and diversity of different microbes including viruses, Algae, Fungi & Lichens & their economic importance. 2. Develop conceptual skill about identifying microbes, pathogens, biofertilizers & lichens. 3. Gain knowledge about developing commercial enterprise of microbial products. 4. Learn host – pathogen relationship and disease management. 5. Learn Presentation skills (oral & writing) in life sciences by usage of computer of computer & multimedia 6. Gain Knowledge about uses of microbes in various fields. 7. Understand the structure and reproduction of certain selected bacteria algae, fungi and lichens 8. Gain Knowledge about the economic values of this lower group of plant community.		
Credits: 4	Core Compulsory	
Max. Marks: 25+75	Min. Passing Marks: 33 %	
Total No. of Lectures= 60		
Unit	Topics	Total No. of Lectures (60)
I	A. Introduction to Indian ancient, Vedic and heritage Botany and contribution of Indian Botanists, in context with the holistic development of modern science and technology, has to be taught, practiced and assessed via class interaction/ assignments / self study mentioned under Continuous Internal Evaluation (CIE). B. Microbial Techniques & instrumentation Microscopy – Light, phase contrast, electron, scanning and transmission electron microscopy, staining techniques for light microscopy, sample preparation for electron microscopy. Common equipments of microbiology lab and principle of their working – autoclave, oven, laminar air flow, centrifuge. Colorimetry and spectrophotometry, immobilization methods, fermentation and fermenters.	8
II	Microbial world Cell structure of Eukaryotic and prokaryotic cells, Gram positive and Gram negative bacteria, Structure of a bacteria; Bacterial Chemotaxis and Quorum sensing, Bacterial Growth curve, factors affecting growth of microbes; measurement of growth; Batch culture, fed batch culture and continuous culture; Synchronous growth of microbes; Sporulation and	8



	reproduction and recombination in bacteria; Viruses, general characteristics, viral culture, Structure of viruses, Bacteriophages, Structure of T4 & λ -phage; Lytic and Lysogenic cycles, viroids, Prions & myco& phytoplasma, Actinomycetes & plasmids and their economic uses.	
III	Phycology Range of thallus organization in Algae, Pigments , Reserve food –Reproduction – Classification and life cycle of- Nostoc; Chlorella, Volvox, Oedogonium , Chara; Sargassum, Ectocarpus, Polysiphonia . Economic importance of algae - Role of algae in soil fertility- biofertilizer- Nitrogen fixation- Symbiosis ;Commercial products of algae- biofuel, Agar.	7
IV	Mycology General characteristics, nutrition, life cycle, Economic importance of Fungi, Classification upto class. Distinguishing characters of Myxomycotina- General characters. Zygomycotina – Rhizopus , Ascomycotina - Saccharomyces, Penicillium, Peziza , Basidiomycotina- Ustilago, Puccinia , Agaricus ; Deuteromycotina – Fusarium, Alternaria , Heterothallism, Physiological specialization, Heterokaryosis & Parasexuality	7
V	Mushroom Cultivation, Lichenology & Mycorrhiza Mushroom cultivation. General account of lichens, reproduction and significance; Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance.	7
VI	Plant Pathology Disease concept, Symptoms, Etiology & causal complex, Primary and secondary inoculum, Infection, Pathogenicity and pathogenesis, Koch's Postulates. Mechanism of infection (Brief idea about Pre-penetration, Penetration and Post-penetration), Disease cycle (monocyclic, polycyclic and polyetic). Defense mechanism with special reference to Phytoalexin, Resistance- Systemic acquired and Induced systemic. fungicides- Bordeaux mixture, Lime sulphur, Tobacco decoction, Neem cake & oil	8
VII	Diseases and Control Symptoms , Causal organism, Disease cycle and Control measures of – Early & Late blight of Potato, Brown spot of rice, Black stem rust of wheat, Stem rot of Mustard , Red rot of Sugarcane, Wilting of Arhar, mosaic diseases on tobacco and cucumber, yellow vein mosaic of bhindi; citrus canker, little leaf of brinjal; damping off of seedlings, Disease management: - Quarantine, Chemical, Biological, Integrated pest disease management	8
VIII	Applied Microbiology Food fermentations and food produced by microbes, amino acids, Production of antibiotics, enzymes, vitamins, alcoholic	8



ख़्वाजा मुहम्मदुद्दीन चिश्ती भाषा विश्वविद्यालय, लखनऊ, उत्तर प्रदेश (भारत)
Khwaja Moinuddin Chishti Language University, Lucknow, U.P. (India)

U.P. STATE GOVERNMENT UNIVERSITY,
(Recognized Under Section 2(F) & 22(1) of the U.G.C. Act, 1956 & B.Tech. Approved by UGC/CIET)

	beverages, organic acid & genetic recombinant vaccines. Mass production of bacterial biofertilizers, blue green algae, Azolla and mycorrhiza. Plant growth promoting rhizobacteria & biopesticides—Trichoderma sp. and Pseudomonas, Single cell proteins, Organic framing inputs, Microbiology of water, Biopolymers, Bioindicators, biosensors, Bioremediation, Production of biofuels, biodegradation of pollutants and biodeterioration of materials& Cultural Property	
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Suggested Readings:

Course Books published in Hindi may be prescribed by the Universities.

- वनस्पति तवज्ञान (संपूर्ण) शैवाल, कवक, लाइकेन, जीवार्, तवषारु, ब्रायोफाइटा, टेरिडोफाइटा, तजम्नोस्पर्ण या प्ति-वनस्पति तवज्ञान : लेखक - ससंह, पांडे व जैन प्रकाशन: सिंगी प्रकाशन, रेठि
- सूक्ष्म जैतवकी कवक एवं पादप िग तवज्ञान तिवेदी शरण एवं धनकि rbd publisher 2019
- परिचयात्क पादप िग तवज्ञान डॉ आशीष कुरा तिपाठी डॉ सनि कुरा तिपाठी 2018 एग्रोबॉयोस इंतडया पतल्लशि
- पादप िग तवज्ञान : तजया लाल यादव 2012
- डॉ आशीष कुरा तिपाठी डॉ सनि कुरा तिपाठी 2018. परिचयात्क पादप िग तवज्ञान एग्रोबॉयोस इंतडया पतललशि
- िगि वरण 2020. सूक्ष्म जैतवकी, कवक एवं पादप िग तवज्ञान
- प्रांजल आयण 2020. पादप िग: उत्पति प्रसा एवं तनयंरि
- Microbiology Fundamental And Applications (hindi) (pb)
- ISBN : 9788188826230Edition : 03Year : 2016Author : Dr. Purohit SS , Dr. Deo PPPublisher : Student Edition Language : Hindi
- पादप िग तवज्ञान परिभाषा-कोश: Definitional Dictionary of Plant Pathology. Publisher Commission for Scientific and Technical Terminology.
- Modern Microbiology (hindi) (hb) ISBN : 9788177543599Edition : 1Year : 2018Author : Dr. Purohit SS , Dr. Singh T Publisher : Agrobios (India)

12.

Unit-I A:

- <https://indianculture.gov.in/rarebooks/economic-botany-india>
https://www.infinityfoundation.com/mandala/t_es/t_es_tiwari_botany_frameset.htm
- https://www.researchgate.net/publication/335715457_Ancient_Indian_rishi's_Sages_knowledge_of_botany_and_medicinal_plants_since_Vedic_period_was_much_older_than_the_period_of_Theophrastus_A_case_study-who_was_the_actual_father_of_botany
- <https://www.scribd.com/presentation/81269920/Botany-of-Ancient-India>
- https://insa.nic.in/writereaddata/UploadedFiles/LJHS/Vol17_2_17_PKBhattacharyya.pdf
- http://wgbis.ces.iisc.ernet.in/biodiversity/sahyadri/wgbis_info/botany_history.pdf
- Ancient Botany (Sciences of Antiquity) Paperback – 1 October 2015by Gavin Hardy (Author), Laurence Totelin (Author)

UNIT-I B.

- Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 2nd edition.
- Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction, Pearson Benjamin Cummings, U.S.A. 10th edition.
- Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi & Their Allies, MacMillan Publishers Pvt. Ltd., Delhi.
- Aggarwal, S. K. 2009. Foundation Course in Biology, A one books Pvt. Ltd., New Delhi.
- Aneja, K. R. 1993. Experiments in Microbiology, Pathology and Tissue Culture, Vishwa Prakashan, NewDelhi.
- Annie Ragland, 2012. Algae and Bryophytes, Saras Publication, Kanyakumari, India.
- Basu, A. N. 1993. Essentials of Plant Viruses, Vectors and Plant diseases, New Age International, New Delhi.
- Chopra. G. L. 1984. A text book of Algae, Rastogi publications, Meerut, India.
- Desikachari, T. V. 1959. Cyanophyta, ICAR, New Delhi.
- Dubey, R. C. and Maheshwari. D.K. 2012. Practical Microbiology, S. Chand & Company, Pvt. Ltd., NewDelhi.
- Fritsch, R. E. 1977. Structure and Reproduction of Algae, Cambridge University Press, London.
- Kodo, C.I. and Agarwal, H.O.1972. Principles and techniques in Plant Virology, Van Nostrand,



Reinhold Company, New York.

13. Agrios, G.N. (1997). Plant Pathology, 4th edition. Cambridge, U.K.: Academic Press.
14. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, 4th edition. Singapore, Singapore: John Wiley & Sons.
15. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies. Noida, U.P.: Macmillan Publishers India Ltd.
16. Reven, F.H., Evert, R. F., Eichhorn, S.E. (1992). Biology of Plants. New York, NY: W.H. Freeman and Company.
17. Sharma, P.D. (2011). Plant Pathology. Meerut, U.P.: Rastogi Publication.
18. Webster, J., Weber, R. (2007). Introduction to Fungi, 3rd edition. Cambridge, U.K.: Cambridge University Press..
19. Pandey B.P. 2001. College Botany Volume 1, S Chand & Company Pvt.Ltd, New Delhi.
20. Pandey. B.P. 2014 Modern Practical Botany, (Vol-I) S. Chand and Company Pvt. Ltd., New Delhi.
21. Pelzar, 1963. Microbiology, Tata Mc Graw Hill, New Delhi
22. Rangaswamy, G. 2009, Disease of Crop Plants in India, Prientice Hall of India, New Delhi.
23. Sambamurty. A.V.S.S. 2006, A Text book of Algae, I. K. International Publishing House, Pvt. Ltd., New Delhi.
24. Sharma, P. D. 2012, Microbiology and Plant Pathology, Rastogi Publication Pvt Ltd., Meerut, India.
25. Singh, R. P. 2007. Microbial Taxonomy and Culture Techniques, Kalyani Publication, New Delhi.
26. Smith. G. M. 1996. Cryptogamic Botany Volume I, Tata Mc Graw Hill, New Delhi.
27. Sundar Rajan. S. 2010.College Botany Volume I, Himalaya Publications, Mumbai.
28. Vashishta, B.R. Sinha, A.K. and Singh, V. P. 1991. Algae, S. Chand and Company, Pvt. Ltd., New Delhi



<https://microbenotes.com/laminar-flow-hood/>

B.Sc. I Year (Semester I) Botany Paper 2

CERTIFICATE COURSE IN MICROBIAL TECHNOLOGY & CLASSICAL BOTANY (Practical)

Programme/Class: Certificate	Year: 1	Semester: 1
Subject: Botany		
Course Code: B040102P	Course Title: Techniques in Microbiology & Plant Pathology	
<p>Course outcomes: After the completion of the course the students will be able:</p> <ol style="list-style-type: none"> 1. Understand the instruments, techniques, lab etiquettes and good lab practices for working in a microbiology laboratory. 2. Develop skills for identifying microbes and using them for Industrial, Agriculture and Environment purposes. 3. Practical skills in the field and laboratory experiments in Microbiology & Pathology. 4. learn to identify Algae, Lichens and plant pathogens along with their Symbiotic and Parasitic associations. 5. Can initiate his own Plant & Seed Diagnostic Clinic 6. Can start own enterprise on microbial products 		
Credits: 2	Core Compulsory	
Max. Marks: 25+75	Min. Passing Marks: 40 %	
Total No. of Lab Periods/Practical= 30 (60 hours)		
Unit	Topics	Total No. of Lectures (60)
I	INSTRUMENTS & TECHNIQUES 1. Laboratory safety and good laboratory practices 2. Principles and application of Laboratory instruments- microscope, incubator, autoclave, centrifuge, LAF, filtration unit, shaker, pH meter. 3. Buffer preparation & titration 3. Cleaning and Sterilization of glasswares 4. Preparation of media- Nutrient Agar and Broth 5. Inoculation and culturing of bacteria in Nutrient agar and nutrient broth 6. Preparation of agar slant, stab, agar plate 7. Phenol Coefficient method to test the efficacy of disinfectants	07
II	BACTERIAL IDENTIFICATION 1. Isolation of bacteria. 2. Identification of bacteria. 3. Staining techniques: Gram's, Negative, Endospore, Capsule and Cell Wall. 4. Cultural characteristics of bacteria on NA.	08



	<p>5. Pure culture techniques (Types of streaking).</p> <p>6. Biochemical characterization : IMViC, Carbohydrate fermentation test, Mannitol motility test, Gelatin liquefaction test, Urease test, Nitrate reduction test, Catalase test, Oxidase test, Starch hydrolysis, Casein hydrolysis.</p>	
III	<p>MYCOLOGICAL STUDY:</p> <p>1. Isolation of different fungi: Saprophytic, Coprophilous, Keratinophilic.</p> <p>2. Identification of fungi by lactophenol cotton blue method. Rhizopus Saccharomyces, Penicillium, Peziza , Ustilago, Puccinia; Fusarium, Curvularia, Alternaria.</p> <p>3. Agaricus: Specimens of button stage and full grown mushroom; Sectioning of gills of Agaricus.</p> <p>4. Lichens: crustose, foliose and fruticose specimens.</p>	08
IV	<p>PHYCOLOGY:</p> <p>1. Type study of algae and Cyanobacteria –Spinullina, Nostoc. Chlorophyceae - Chlorella, Volvox, Oedogonium, Cladophora, and Chara; Xanthophyceae – Vaucheria ;Bacillariophyceae – Pinnularia Phaeophyceae – Sargassum Rhodophyceae - Polysiphonia</p>	07
V	<p>EXPERIMENTAL PLANT PATHOLOGY</p> <p>1. Preparation of fungal media (PDA) & Sterilization process.</p> <p>2. Isolation of pathogen from diseased leaf. Identification: Pathological specimens of Brown spot of rice, Bacterial blight of rice, Loose smut of wheat, Stem rot of mustard, Late blight of potato; Slides of uredial, telial, pycnial & aecial stages of Puccinia , Few viral and bacterial plant diseases.</p>	08
VI	<p>PRACTICALS IN APPLIED MICROBIOLOGY-1</p> <p>1. Isolation of nitrogen fixing bacteria from root nodules of legumes.</p> <p>2. Enumeration of rhizosphere to non rhizosphere population of bacteria.</p> <p>3. Isolation of antagonistic Pseudomonas from soil.</p> <p>4. Microscopic observations of root colonization by VAM fungi.</p> <p>5. Isolation of Azospirillum sp. from the roots of grasses.</p> <p>6. Isolation of phyllosphere microflora.</p> <p>7. Isolation of P solubilizing microorganisms.</p>	08
VII	<p>PRACTICALS IN APPLIED MICROBIOLOGY-2</p> <p>1. Wine production.</p> <p>2. Isolation of lactic acid bacteria from curd.</p>	08



	<ol style="list-style-type: none">3. Isolation of lipolytic organisms from butter or cheese.4. Immobilized bacterial cells for production of hydrolytic enzymes.5. Enzyme production and assay – cellulase, protease and amylase.6. Immobilization of yeast.7. Isolation of cellulolytic and anaerobic sulphate reducing bacteria.8. Isolation and characterization of acidophilic, alkalophilic and halophilic bacteria.	
VIII	<ol style="list-style-type: none">1. Cultivation of Spirulina, & Chlorella in lab for biofuel2. Visit to NBAIM, Mau, Varanasi(Kashi)/IMT, Chandigarh for viewing Culture Repository3. Visit to biofertilizers and biopesticides unit to understand about the Unit operation procedures4. Mushroom cultivation for Protein5. Alcohol production. from Sugarcane Juice.	06

Suggested Readings:

Course Books published in Hindi may be prescribed by the Universities.

1. प्रयोगात्क वनस्पति तवज्ञान भाग 1 लेखक अशोक बेंद्रे याि अशोक कुर्रा प्रकाशन सिग्गी प्रकाशन र्ठेठि

2. प्रायोतगक वनस्पति तवज्ञान-I Dhankar - Sharma – Trivedi ISBN Code: 978-81-8142-697-0 65, RBD Publishing

House Shivaji Nagar Civil Lines, Jaipur - 302006 (Rajasthan)

3. प्रायोतगक वनस्पति तवज्ञान बी.एस-सी-1 एस बी अग्रवाल प्रकाशक : तशवलाल अग्रवाल एण्ड कम्पनी प्रकातशि वषण : 2018

4. Practical Botany (Part I) ISBN #:81-301-0008-8 Sunil D Purohit, Gotam K Kukda & Anamika Singhvi

Edition:2013 Apex Publishing House Durga Nursery Road, Udaipur, Rajasthan (bilingual)

5. Modern Mushroom Cultivation And Recipes (hindi) (hb)ISBN : 9788177545180Edition : 01Year : 2017Author : Singh Riti , Singh UC Publisher : Agrobios (India)

6. Biofertilizer Production Manual (hindi) (hb) ISBN : 9788177541274Edition : 01Year : 2014Author : Gehlot

D Publisher : Agrobios (India)Language : Hindi

1. Aneja, K. R. 1993. Experiments in Microbiology, Pathology and Tissue Culture, Vishwa Prakashan, New Delhi.

2. Dubey, R. C. and Maheshwari. D.K. 2012. Practical Microbiology, S. Chand & Company, Pvt. Ltd., New Delhi.

3. Kodo, C.I. and Agarwal, H.O.1972. Principles and techniques in Plant Virology, Van Nostrand, Reinhold Company, New York.

4. Madhavee Latha, P. 2012, A Textbook of Immunology, S. Chand & Company Pvt. Ltd., New Delhi.

5. Pandey. B.P. 2014 Modern Practical Botany, (Vol-I) S. Chand and Company Pvt. Ltd., New Delhi.

6. Sambamurty. A.V.S.S. 2006, A Text book of Algae, I. K. International Publishing House, Pvt. Ltd.,

7. Singh, R. P. 2007. Microbial Taxonomy and Culture Techniques, Kalyani Publication, New Delhi.

8. <https://agrimoon.com/wp-content/uploads/Mashroom-culture.pdf>

9. <http://nhb.gov.in/pdf/Cultivation.pdf>



10. https://www.k-state.edu/fungi/Greeting/Publications_files/2006%20Handbook.pdf
11. Sen, Surjit, Acharya, Krishnendu, Rai, Manjula 2019 ISBN - 978-93-88347-23-5 - Biofertilizers and Biopesticides .Technoworld,kolkatta
12. <http://www.kvkkendrapara.org/pdf/Bio%20Fertilizer%20Production%20and%20marketing.pdf>
13. <http://www.gbv.de/dms/tib-ub-hannover/751302945.pdf>
14. Hochman, Gal, Zilberman, David 2014 ISBN-1461493285-Algae Farming and Its Bio-Products Springer
18. Gokare A. Ravishankar , Ranga Rao Ambati 2019 Handbook of Algal Technologies and Phytochemicals
Volume II: Phycoremediation, Biofuels and Global Biomass Production Print ISBN: 9780367178192
19. Amos Richmond Ph.D., Prof. Emeritus, Qiang Hu Ph.D 2013. Handbook of Microalgal Culture: Applied Phycology and Biotechnology, Second Edition Print ISBN:9780470673898



ख्वाजा मुईनुद्दीन चिश्ती भाषा विश्वविद्यालय, लखनऊ, उत्तर प्रदेश (भारत)
Khwaja Moinuddin Chishti Language University, Lucknow, U.P. (India)

UNIVERSITY GOVERNMENT & SOCIETY,
(Recognized Under Section 3(1) & 12(1) of the U.C.C. Act, 1956 & B.U.V. Approved by UGC/CIQ)

This course can be opted as an elective by the students of following subjects: Open to all but special for B.Sc. Biotech, B.Sc. Microbiology, B.Sc. Agriculture, B.A. (Curators), B.A. Archaeology, B.A. Geology, BAMS.

Suggested Continuous Evaluation Methods:

- Seminar/ Presentation on any topic of the above syllabus
- Test with multiple choice questions/ short and long answer questions Attendance

Further Suggestions:

It widens the scope for students to join Government and Non-Government organization up skilling the people at different levels as per their socio-economic structure.

At the End of the whole syllabus any remarks/ suggestions:

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Suggested equivalent online courses:

<https://community.plantae.org/tags/mooc>

futurelearn.com/courses/teaching-biology-inspiring-students-with-plants-in-science

<https://microbiologysociety.org/publication/education-outreach-resources/basic-practical-microbiology-a-manual.html>

<https://microbiologyonline.org/file/7926d7789d8a2f7b2075109f68c3175e.pdf>

<http://allaboutalgae.com/benefits/>

<https://repository.cimmyt.org/xmlui/bitstream/handle/10883/3219/64331.pdf>

<https://www.mooc-list.com/tags/microbiology>

<http://www.agrifs.ir/sites/default/files/A%20text%20book%20of%20practical%20botany%201%20%7BAshok%20Bendre%7D%20%5B8171339239%5D%20%281984%29.pdf>

<https://www.coursera.org/courses?query=plants>

<http://egyankosh.ac.in/handle/123456789/53530>

<https://www.classcentral.com/tag/microbiology>

<https://www.edx.org/learn/microbiology>

<https://www.mooc-list.com/tags/microbiology>

<https://www.udemy.com/topic/microbiology/>