

SYLLABUS

Master of Philosophy (M. Phil.)/ Doctor of Philosophy (Ph. D.) in Botany



**DEPARTMENT OF BOTANY
RAJIV GANDHI UNIVERSITY
RONO HILLS, DOIMUKH-791112
ARUNACHAL PRADESH, INDIA**

RAJIV GANDHI UNIVERSITY
Course Curriculum
Master of Philosophy/ Doctor of Philosophy (Ph. D.) (Botany)

Eligibility and Admission

Eligibility of candidates, admission process, duration of the course work, and examinations and result shall be governed as per relevant Ordinance, Rules and regulations and guidelines framed by the University for the Courses.

Medium of Instruction

Medium of Instructions will be English and candidate will have to answer the question papers and write the dissertation in English.

Attendance

Every candidate is required to attend a minimum of 75% lectures in each paper.

Paper Code, Title and Credit distribution

Semester		Paper Code & Title	Credit distribution	Internal Assessment (Marks)	Terminal Examination (Marks)	Total (Marks)	
I	Core papers	BOTC 601: Research methodology	4:0:0	20	80	100	
		BOTC 602: Research and Publication Ethics	1:0:1	25	25	50	
	Open Elective (any one)	BOT 611OE: Instrumentation and Research techniques in microbiology	2:0:0	10	40	50	
		BOT 612OE: Instrumentation and research techniques in phytochemistry	2:0:0	10	40	50	
	Departmental Elective (any one)	BOT 621DE: Ecology and Conservation Biology	4:0:0	20	80	100	
		BOT 622DE: Microbiology	4:0:0	20	80	100	
		BOT 623DE: Floristics and Ethnomedicobotany	4:0:0	20	80	100	
		BOT 624DE: Pharmacognosy and Phytochemistry	4:0:0	20	80	100	
	Total credit in I Semester			12	75	225	300
	II-IV	Dissertation	BOT 651: Dissertation	8:0:0	0	200	200
BOT 652: Seminar and Viva-voce			4:0:0	50	50	100	
Total credit for Dissertation, Seminar and Viva-voce			12	50	250	600	

M.Phil. & Ph.D.
SEMESTER I
PAPER – BOT 601C
RESEARCH METHODOLOGY

Credit: 4:1:1
Total Marks: 100
Terminal Examination Marks: 80
Internal Assessment Marks: 20

Unit I

Overview of research methodology: Concept and nature of research; Types and steps of research; Formulation of research problem with defined objectives.

6 Teaching Hours

Unit II

Data collection: Definition of Sampling; Concept and Types of data collection; Sampling designs and types; Characteristics of a good sample design; Measurement and scaling techniques.

8 Teaching Hours

Unit III

Computer application: Basics of MS word; Manuscript editing; Foot note and end note; Reference manager. MS Excel: tabulation, calculation and data analysis, preparation of graphs, histograms and charts. Statistical tools: MS Excel and SPSS. Power Point: preparation of presentations and scientific poster designing. Bioinformatics tools and its applications in biological sciences.

8 Teaching Hours

Unit IV

Statistical analysis of data: Measurement of central tendency; Measures of dispersion; Probability distributions; Test of significance: Chi-square, student's t-test, ANOVA, Non-parametric tests; Correlation and regression.

10 Teaching Hours

Unit V

Scientific writing: Different forms of scientific writing – article, notes, reports, review article, monographs. Dissertation/Thesis writing: format, content and chapterization, writing style, drafting titles & sub-titles, captions and legends. Proper description of methodology and research design, compilation and presentation of data with statistical analysis; Writing results, discussion and conclusions. Bibliography and references, referencing style. Appendices.

8 Teaching Hours

<p>Note: While setting the questions, paper setter may take care to cover entire part of paper. Ten (10) questions are to be set out of which students have to answer any five (5) questions.</p>
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Books and References

1. Calvin, D. 2003. Choosing and Using Statistics: A Biologists Guide. Blackwell Publisher.
2. DePoy, E, Gitlin, L. 2015. Introduction to Research: Understanding and Applying Multiple Strategies. Elsevier.
3. Gerry, PQ, Michael, JK. 2002. Experimental Design and Data Analysis for Biologists. Cambridge, University Press.
4. Gurumani, N. 2007. Research methodology for biological sciences. MJP Publishers, Chennai.
5. Harmon, JE, Gross, AG. 2010. The Craft of Scientific Communication (Chicago Guides to Writing, Editing, and Publishing).
6. Creswell, JW. 2009. Research Design: Qualitative, Quantitative, and Mixed method approaches. Sage Publication, USA.
7. Katz, MJ. 2009. From research to manuscript: A guide to scientific writing. Springer.
8. Lebrun, JL. 2007. Scientific writing: a reader and writer's guide [1 ed]. World Scientific Publishing Company.
9. Matthews, JR, Matthews, RW. 2007. Successful Scientific Writing: A Step-by-Step Guide for the Biological and Medical Sciences [3 ed.]. Cambridge University Press.
10. Mildred, LP. 2017. Understanding Research Methods. Routledge.
11. Mukherjee, SP. 2020. A Guide to Research Methodology-An Overview of Research Problems, Tasks and Methods [1 edition]. CRC Press and Taylor and Francis Group.
12. Phillips, PP, Stawarski, CA. 2008. Data Collection: Planning for and Collecting All Types of Data [1 ed.]. Pfeiffer.
13. Sapsford, R, Jupp, V. 2005. Data collection and analysis. Sage Publications.
14. Speed, T. 2003. Statistical analysis of gene expression microarray data [1 ed.]. Chapman & Hall/CRC.
15. Taylor, JK, Cihon, C. 2004. Statistical techniques for data analysis [2nd ed]. Chapman & Hall/CRC.
16. Willie, CKT. 2017. Research Methods: A Practical Guide For Students And Researchers Kindle Edition. World Scientific.
17. Zar, JH. 2006. Biostatistical Analysis: Prentice-Hall.

M.Phil. & Ph.D.
SEMESTER I
PAPER – BOT 602C
RESEARCH AND PUBLICATION ETHICS

Credit: 1:0:1
Total Marks: 50
Terminal Examination Marks: 25
Internal Assessment Marks: 25

Unit I

Philosophy and Ethics: Philosophy: Introduction to Philosophy, definition, nature and scope, concept, branches; Ethics: definition, moral philosophy, nature of moral judgement and reactions.

3 Teaching Hours

Unit II

Scientific Conduct: Ethics with respect to science and research; Intellectual honesty and research integrity; Scientific misconducts: falsification, fabrication and plagiarism (FFP); Redundant publications: duplicate and overlapping publications, salami slicing; selective reporting and misrepresentation of data.

5 Teaching Hours

Unit III

Publication Ethics: Publication ethics: definition, introduction and importance; Best practices/standard setting initiatives and guidelines: COPE, WAME etc.; Conflict of interest; Publication misconduct: definition, concept, problems that lead to unethical behavior, and vice-versa, types; Violation of publication ethics, authorship and contributorship; Identification of publication misconduct, complaints and appeals; Predatory publishers and journals.

5 Teaching Hours

Unit IV

Practical: Open Access Publishing: Open access publication and initiatives; SHERPA/RoMEO online resource to check publisher copyright and self-archiving policy; Software tool to identify predatory publications developed by SPPU; Journal finders/journal suggestion tools viz, JANE, Elsevier Journal Finders, Springer Journal Suggester, etc.

UNIT V

Publication Misconducts: Group discussions on subject specific ethical issues, FFP, authorship; Conflict of interests; Self-declaration; Complaints and appeals: example of frauds from India and abroad.

Software Tools: Use of plagiarism software like TURNITIN, URKUND, and other open sources software tools.

8 Teaching Hour

Unit VI

Databases: Indexing databases; Citation Databases: Web of Science, SCOPUS, Google Scholars etc.

Research Metrics: Impact factor of Journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score. h-index, g index, i10 index, i20 index, almetrics.

8 Teaching Hours

Note: While setting the questions, paper setter may take care to cover entire part of paper. In section A, four (4) questions of 10 marks each and in section B, two questions of five (5) marks each are to be set out. Students have to answer two questions from section A and one question from section B.

Books and References

1. Beall, J. 2012. Predatory publishers are corrupting open access. *Nature*, 489 (7415), 179-179. <https://doi.org/10.1038/489179a>
2. Bird, A. 2006. *Philosophy of Science*. Routledge.
3. Brady, E. 2013. *The sublime in modern philosophy: Aesthetics, ethics, and nature*. Cambridge University Press.
4. Briscoe, MH. 2012. *Preparing scientific illustrations: a guide to better posters, presentations, and publications*. Springer Science & Business Media.
5. Bunge, M. 2012. *Treatise on Basic Philosophy: Ethics: The Good and The Right*. Vol. 8. Springer Science & Business Media.
6. Chaddah, P. 2018. *Ethics in Competitive Research: Don not get scooped; do not plagiarized*. ISBN: 9789387480865, 9387480860.
7. D'Angelo, JG. 2018. *Ethics in science: Ethical misconduct in scientific research*. CRC Press,
8. Darwall, S. 2018. *Philosophical ethics: An historical and contemporary introduction*. Routledge.
9. Germano, W. 2021. *Getting it published*. University of Chicago Press.
10. Iphofen, R. 2020. *Handbook of Research Ethics and Scientific Integrity..* Springer International Publishing.
11. Waseem, J, Hamoudi, R, Hopper, C. 2018. *The Power of Research: Best Practices and Principles in Research Integrity and Publication Ethics*. Kugler Publications.
12. Mabbott, JD. 2020. *An introduction to ethics*. Routledge.
13. Mac Intrye, A. 1967. *A short History of Ethics*. London.
14. Resnik, DB. 2020. What is ethics in research and why it is important? National Institute of Environmental Health Sciences. 1-10. Retrieved from <https://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm>.
<https://doi.org/10.1038/489179a>
15. Sieber, JE. 2012. *The ethics of social research: Surveys and experiments*. Springer Science & Business Media.
16. Laake, P, Breien, H, Benestad, Olsen, BR. 2007. *Research methodology in the medical and biological sciences*. Elsevier.
17. Pruzan, P. 2016. *Research Methodology: The Aims, Practices and Ethics of Science*, Springer International Publishing Switzerland.

M.Phil. & Ph.D.
SEMESTER I
PAPER – BOT 6110E
INSTRUMENTATION AND RESEARCH TECHNIQUES IN MICROBIOLOGY

Credit: 1:0:1

Total Marks: 50

Terminal Examination Marks: 40

Internal Assessment Marks: 10

UNIT I

Field techniques: Collection and preservation techniques of specimens (bacteria, actinomycetes, algae and fungi). Lab and Field Safety Measures.

UNIT II

Culture techniques: Isolation, purification, cultivation and preservation of bacteria, actinomycetes, algae and fungi.

UNIT III

Microscopy: Principle and applications of microscopy, Fluorescence microscopy, Staining techniques, Applications of SEM & TEM, shadow casting, negative staining and tracers, image reconstruction from electron micrograph.

UNIT IV

Molecular techniques: Isolation of DNA, RNA, plasmids and proteins; Restriction digestion; Gel Electrophoresis; Blotting techniques; PCR based techniques. Nucleic acid and protein sequencing.

Note: While setting the questions, paper setter may take care to cover entire part of paper. In section A, four (4) questions of 15 marks each and in section B, two (2) questions of 10 marks each are to be set out. Students have to answer two questions from section A and one question from section B.

Books and References

1. Primrose, SB, Twyman, RM and Old, RW. 2001. Principles of gene manipulation, Blackwell Science.
2. Sambrook, J, Fritsch, EF, .Maiatis, T.2000. Molecular cloning: A laboratory manual, Cold Spring Harbor Laboratory Press, New York.
3. Slater, A, Scott, N, Fowler, A. 2003. Plant biotechnology. The genetic manipulation of plants. Oxford University Press.
4. Stewart Jr, CN. 2008. Plant Biotechnology and Genetics: Principles, Techniques and Applications. Wiley Publisher
5. Halford, N. 2006. Plant Biotechnology: Current and Future Applications of Genetically Modified Crops. Wiley Publisher
6. Allison, LA. 2007. Fundamental Molecular Biology. Wiley-Blackwell
7. Clark, D. 2009. Biotechnology, Elsevier Publication
8. Reece, RJ. 2004. Analysis of Genes and Genomes. Wiley
9. Mukerji, KG, Manoharachary, C, Chamola, BP. 2002. Techniques in Mycorrhizal Studies. Springer.
10. Starr, MP, Stolp, H, Trüper, HG, Balows, A, Schlegel, HG. 1981. The Prokaryotes: A Handbook on Habitats, Isolation, and Identification of Bacteria. Springer.
11. Ayache, J, Beaunier, L, Boumendil, J, Ehret, G, Laub, D. 2010. Sample Preparation Handbook for Transmission Electron Microscopy: Methodology Front Cover. Springer Science & Business Media
12. Egerton, RF. 2016. Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and AEM. Springer- Technology & Engineering.
13. Morris, K, Bell, S. 2009. An Introduction to Microscopy. CRC Press/ Taylor and Francis group.
14. Sengar, RS, Chaudhary, R, Kumar, A, Singh, A. 2018. Advances in Molecular Techniques. CRC Press.
15. O'donnell, M, Cox, MM. 2015. Molecular Biology: Principles and Practice. Publisher: Freeman Macmillan.
16. Hofmann, A. 2018. Principles and Techniques of Biochemistry and Molecular Biology. 8th South Asia Edition. Cambridge University Press.
17. Glick, BR, Patten, CL. 2017. Molecular Biotechnology: Principles and Applications of Recombinant DNA. ASM Press.
18. Bohr, HG. 2009. Handbook of Molecular Biophysics: Methods and Applications. Wiley
19. Prutton, M, Gomati, MME. 2006. Scanning Auger Electron Microscopy. Wiley

M.Phil. & Ph.D.
SEMESTER I
PAPER – BOT 612OE
INSTRUMENTATION AND RESEARCH TECHNIQUES IN PHYTOCHEMISTRY

Credit: 1:0:1
Total Marks: 50
Terminal Examination Marks: 40
Internal Assessment Marks: 10

UNIT I

Plant Histology: Collection, fixation and processing plant materials; Freeze drying (lyophilization) and freeze substitution; Embedding, microtomy and cryomicrotomy; Staining techniques; Microscopy and observation, Photomicrography.

UNIT II

Centrifugation: Principle and importance of centrifugation; Types of centrifuges – ultracentrifugation, density gradient centrifugation and continuous centrifugation.

UNIT III

Chromatography techniques: Principle and application of chromatography; Paper chromatography; TLC; Column chromatography (Gel filtration and ion exchange, affinity chromatography, GC, HPLC); HPTLC.

UNIT IV

Analytical techniques: Principle and applications of UV-VIS, IR, FTIR, AAS, ICP-AES and NMR spectroscopy.

Note: While setting the questions, paper setter may take care to cover entire part of paper. In section A, four (4) questions of 15 marks each and in section B, two (2) questions of 10 marks each are to be set out. Students have to answer two questions from section A and one question from section B.

Books and References:

1. Andri, B. 2021. Chromatography: Principles and Instrumentation. Excelic Press.
2. Rahman, A. 2019. Recent Advances in Analytical Techniques. Bentham Science Publisher.
3. Chamberlain, CJ. 2010. Methods in Plant Histology. Kessinger Publishing.
4. Graham, J. 2020. Biological Centrifugation. CRC Press.
5. Katoch, R. 2011. Analytical Techniques in Biochemistry and Molecular Biology. Springer New York.
6. Leung, WWF. 2020. Centrifugal Separations in Biotechnology. Elsevier Science.
7. Naidoo, S. 2017. Centrifugation Techniques. Arcler Press.
8. Nicole, M, Gianinazzi-Pearson, V. 2012. Histology, Ultrastructure and Molecular Cytology of Plant-Microorganism Interactions. Springer Netherlands.
9. Ramachandran, VS. 2000. Handbook of analytical techniques in concrete science and technology. Elsevier Science.
10. Sangha, SPS, Sharma, RK. 2020. Basic Techniques in Biochemistry and Molecular Biology First Edition. Dreamtech Press.
11. Segade, PG. 2017. Plant Histology at Optical Microscope. Lulu.com.
12. Singh, DP, Singh, JS. 2019. New and Future Developments in Microbial Biotechnology and Bioengineering: Microbial Biotechnology in Agro-environmental Sustainability. Elsevier Science.
13. Vaz, SJr. 2016. Analytical Techniques and Methods for Biomass. Elsevier International Publishing.
14. Vitha, MF. 2016. Chromatography: Principles and Instrumentation (Chemical Analysis: A Series of Monographs on Analytical Chem). Wiley Press.
15. Zachariou. 2008. Affinity Chromatography 2nd Edition. Humana Press.

PAPER – BOT 621DE
ECOLOGY AND CONSERVATION BIOLOGY

Credit: 4:0:0
Total Marks: 100
Terminal Examination Marks: 80
Internal Assessment Marks: 20

UNIT I

Ecology: Scope of ecology; Community organization; Concept of habitat, functional role and niche; Keystone species; Dominant species; Ecotone; Edge effect; Natural Resources.

UNIT II

Biodiversity: Pattern and levels of biodiversity (genetic, species, population, community, ecosystem and habitat), assessment of biodiversity, National Biodiversity Act 2002 and rules 2004; Biodiversity profile in India and Arunachal Pradesh; Plant and microbial diversity; Mega diversity zones and hotspots; Sacred grooves; Uses of biodiversity.

UNIT III

Biodiversity Conservation: Threats to Biodiversity; IUCN threat categories; Red Data Book; Strategies of biodiversity conservation; Agrobiodiversity: concept and significance.

UNIT IV

Management of global warming: Global warming; Plant in environment monitoring; Energy plantation; Carbon sequestration; EIA & EMP; Environmental related legislations and acts; International environmental policies, organizations and conventions.

<p>Note: While setting the questions, paper setter may take care to cover entire part of paper. Ten (10) questions are to be set out of which students have to answer any five (5) questions.</p>
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Books and references

1. Balakrishnan, M. 2016. Wildlife ecology and conservation. Scientific publisher.
2. Gurevitdh, J. 2002. The nature of design: ecology, culture, and human intention. Oxford University Press.
3. Haddow, G, Bullock, JA, Haddow, K. 2008. Global Warming, Natural Hazards, and Emergency Management. CRC Press.
4. Hester, RE, Harrison, RM. 2007. Biodiversity under Threat. Royal Society of Chemistry.
5. Jana, BK, Biswas, S, Majumder, M, Roy, P, Mazumdar A. 2010. Impact of Climate change on Natural Resource Management. Springer Netherlands.
6. Kruuk, H. 2006. Ecology, Behaviour and Conservation. Oxford University press.
7. Letcher, TM. 2018. Managing Global Warming: An Interface of Technology and Human Issues. Academic Press.
8. Levin. 2000. Encyclopedia of biodiversity. (Vol 1-5). Academic press.
9. Lindenmayer, D, Franklin, JF. 2002. Conserving Forest Biodiversity A Comprehensive Multiscaled Approach. Island press.
10. Maclaurin, J, Sterelny, K. 2008. What is Biodiversity? University of Chicago press.
11. Jeffries, MJ. 2005. Biodiversity and Conservation. Routledge
12. Pappis, CP. 2010. Climate Change, Supply Chain Management and Enterprise Adaptation: Implications of Global Warming on the Economy. IGI Global.
13. Pullin, AS. 2002. Conservation Biology. Cambridge University press.
14. Monson, RK. (Ed.) 2014. Ecology and the Environment. Springer
15. Sharma, P. D. 2017. Ecology and Environment Thirteenth Edition, Rastogi Publications, India

M.Phil. & Ph.D.
SEMESTER I
PAPER – BOT 622DE
MICROBIOLOGY

Credit: 4:1:1
Total Marks: 100
Terminal Examination Marks: 80
Internal Assessment Marks: 20

UNIT I

Microbes in Agriculture and Food: Biofertilizers; nitrogen fixing organisms (symbiotic, non-symbiotic and associative); Phosphate solubilizing microorganisms and mycorrhizae (ecto- & endo-) and their role in plant health; Concept of organic farming. Microbes in plant protection: Biological control of plant diseases; Integrated disease management. Fermented foods; food spoilage, food borne pathogens and food poisoning; SCP; Cultivation of edible mushrooms.

UNIT II

Industrial Microbiology: Basic function of fermentors (bioreactors); Types of fermenters; Microbes in production of alcoholic beverages, organic acids, amino acids, enzymes, vitamins, steroids and vaccines.

UNIT III

Microbes and Energy Production: Production of non-conventional fuel by microbes: methane (biogas), hydrogen, alcohols and algal hydrocarbons; microbes in petroleum augmentation and recovery.

UNIT IV

Environmental Microbiology: Bioremediation through microbes: management of organic contaminants, microbial degradation of xenobiotics and hydrocarbons; waste disposal and management; Biomining (microbial leaching and extraction).

<p>Note: While setting the questions, paper setter may take care to cover entire part of paper. Ten (10) questions are to be set out of which students have to answer any five (5) questions.</p>
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Books and references

1. Artiola, J, Pepper, IL. 2004. Environmental Monitoring and Characterization. Elsevier Academic Press.
2. Atlas, RM. 2005. Handbook of Media for Environmental Microbiology [2nd ed]. Taylor and Francis.
3. Baltz, RH, Demain, AL, Davies, JE, Bull, AT, Junker, B, Katz, L, Lynd, LR, Masurekar, P, Reeves, CD, Zhao, H. 2010. Manual of Industrial Microbiology and Biotechnology, Third Edition. ASM Press Washington DC.
4. Behera, B, Kumar, VA. 2016. Microbial Resources for Sustainable Energy. Springer.
5. Bitton, G. 2002. Encyclopedia of environmental microbiology [1st ed.]. Wiley.
6. Charles, WB. 2005. Food, Fermentation and Micro-organisms. Wiley-Blackwell
7. Gerard J, Tortora, Berdell R, Funke, Christine, Case L. 2001. Microbiology – An introduction,
8. Hui, YH. 2006. Food Biochemistry and Food Processing. Wiley-Blackwell
9. Hutkins, RW. 2006. Microbiology and Technology of Fermented Foods, Wiley-Blackwell
10. Kumar, SA. 2018. Microbes for Climate Resilient Agriculture. Wiley
11. Madsen, EL. 2008. Environmental Microbiology: From Genomes to Biogeochemistry. Wiley-Blackwell.
12. Mckinney, RE. 2004. Environmental Pollution control microbiology. M. Dekker Inc.
13. Patel, AH. 2015. Industrial Microbiology. Laxmi Publication.
14. Prescott JP, Harley, Klein DA. 2002. Microbiology, Mc Graw Hill, Boston.
15. Sangeetha, J, Thangadurai, D, Tanasupawat, S, Kanekar, PP. 2019. Biotechnology of Microorganisms: Diversity, Improvement, and Application of Microbes for Food Processing, Healthcare, Environmental Safety, and Agriculture. Apple Academic Press.
16. Stanbury PF, Whitaker. 1995. Principles of fermentation technology, Pergamon Press, Oxford.
17. Sundh, I, Wilcks, A, Goettel, MS. 1986. Beneficial Microorganisms in Agriculture, Food and the Environment. Centre for Agriculture and Bioscience International.
18. Verma, DK, Srivastav, PP. 2017. Microorganisms in Sustainable Agriculture, Food, and the Environment. Apple Academic Press.
19. Yadav, AN, Rastegari, AA, Yadav, N, Gaur R. 2020. Biofuels Production – Sustainability and Advances in Microbial Bioresources. Springer.

SEMESTER I

PAPER – BOT 623DE

FLORISTICS AND ETHNOMEDICOBOTANY

Credit: 4:1:1

Total Marks: 100

Terminal Examination Marks: 80

Internal Assessment Marks: 20

UNIT I

Angiosperm Taxonomy & Systematics: Definition, concept, scope; species concept; ICN Rules on plant nomenclature: Type methods; Author citations; Rules of priority; Taxonomic information: morphological and molecular information; Numerical taxonomy: concept, principles; Dendrogram and cladogram.

UNIT II

Field Survey Methods: Logistics preparation; Site selection; Collection of museum specimen, identification; Digital Herbarium; Taxonomic literatures: concept of flora, monographs, manual, journal; Revision and review work; Key construction.

UNIT III

Ethno botany: Concept and scopes; field methods – rapid appraisal and quantitative ethnobotany; Ethnomedicobotany; Indigenous Knowledge Systems (IKS); Ethnobotany and community development; Sacred groves; Conservation of ethnobotanical resources.

UNIT IV

Pharmacognosy and Ethnopharmacology: Definition, concept and scope; Crude drugs, Classification of crude drugs, Pharmacognosy tools and techniques; Pharmacognostic study of some potential medicinal plants of India; Ethnopharmacology, Ethnomedicine; Phytochemistry techniques; Herbal medicine preparation, Community healthcare.

<p>Note: While setting the questions, paper setter may take care to cover entire part of paper. Ten (10) questions are to be set out of which students have to answer any five (5) questions.</p>
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Books & References:

1. Balick, MJ, Cox, PA. 2020. Plants, People, and Culture: The Science of Ethnobotany [2 ed]. CRC press.
2. Cunningham, A. 2001. Applied Ethnobotany: people, wild plant use and conservation. Earthscan Publications Ltd. 2001.
3. Heinrich, M, Barnes, J, Garcia, JM, Gibbons, S, Williamson, EM. 2018. Pharmacognosy and Ethnopharmacology. 2nd edition. Elsevier. 2018.
4. Jain, SK and Goel, AK. 1995. Proformas for field work. In: Jain, SK (Eds), *A manual of ethnobotany*. Scientific Publishers, Jodhpur (India).
5. Jelke, B. 2009. Applied Survey Methods: A statistical perspectives. Wiley.
6. Jerald, EE, Jerald, SE. 2007. Textbook of Pharmacognosy and Phytochemistry. CBS Publishers and Distributors, New Delhi
7. Leadlay, E, Jury S. 2006. Taxonomy and plant conservation. Cambridge University Press. UK. 2006.
8. Martin, G. 1995. Ethnobotany: a methods manual. Chapman & Hall Co. London.
9. Pandey, A.K, Wen J, JVV Dogra, JVV. 2006. Plant Taxonomy: Advances and Relevance. CBS Publishers and Distributors, New Delhi.
10. Patel, DK. 2015. A Digital Herbarium Book - II on Medicinal and Aromatic Plants. LAP Lambert Academic Publishing.
11. Patwardhan, B. 2007. Drug Discovery and Development: Traditional Medicine and Ethnopharmacology. New India Publishing Agency, New Delhi.
12. Romeo, JT. 2003. Integrative Phytochemistry: from Ethnobotany to Molecular Ecology [1 ed.]. Elsevier Academic Press.
13. Simpson, MG. 2006. Plant Systematics. 3rd edition. Elsevier. 2006.
14. Singh, G. 2020. Plant Systematics - Theory and practice. 4th edition. Oxford and IBH Publishing Co.Ltd, New Delhi.
15. Singh, S, Govil, JN, Singh, VK. 2003. Recent Progress in Medicinal Plants Vol. 2: Phytochemistry and Pharmacology. SCI Tech Publishing LLC, Houston, Texas, USA.
16. Singh, VK, Govil, JN, Singh, G. 2002. Recent Progress in Medicinal Plants Vol. 1: Ethnomedicine and Pharmacognosy. SCI Tech Publishing LLC, Houston, Texas, USA. 2002

M. Phil./Ph. D.
SEMESTER I
PAPER – BOT 624DE
PHARMACOGNOSY AND PHYTOCHEMISTRY

Credit: 4:1:1
Total Marks: 100
Terminal Examination Marks: 80
Internal Assessment Marks: 20

UNIT I

Pharmacognosy: Definition, concept, scope; Crude drugs: definition, classification, sources; pharmacognostic studies of crude drugs; ethnomedicobotany; ethnopharmacology.

UNIT II

Cultivation of medicinal plants: Cultivation and harvesting methods; Factors affecting cultivation of medicinal plants; Nutraceuticals and medicinal food; Bio-prospecting; IPR Issues: protection of traditional herbal knowledge, bio-piracy, and patent.

UNIT III

Plant secondary metabolites: Definition, concept; Nitrogen Compounds – alkaloids; Nitrogen and sulphur containing compounds – glucosinolate; Terpenoids; Phenolic compounds – flavonoids, tannin, lignin, etc.

UNIT IV

Phytochemical analysis: Relevant tools and techniques in phytochemistry study: TLC, HPTLC, FPLC, CC, GC-MS, HPLC, LC-MS, FTIR, NMR.

<p>Note: While setting the questions, paper setter may take care to cover entire part of paper. Ten (10) questions are to be set out of which students have to answer any five (5).</p>
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Books and references

1. Kokate, CK, Alpana S. Gokhale, SB. 2007. Cultivation of medicinal plants. Nirali Prakashan.
2. Dhaduk, HL, Nakar, RN, Chovatia, VP. 2017. Medicinal Plants: Cultivation and Uses. Daya Publishing House.
3. Dhar P, Dhar DN. 2019. Medicinal Plants of India. World Scientific Publishing Co.
4. Egbuna, C, Ifemeje, JC, Udedi, SC, Kumar, S. 2019. Phytochemistry: fundamental, modern techniques and application. Apple academic press (Vol 1). 2019.
5. Evans, W. 2010. Pharmacognosy 15 th ed. Saunders.
6. Ghost, MN. 2019. Fundamentals of Experimental Pharmacology. 7th edition. Hilton and company.
7. Graff, A. 2011. American Herbal Pharmacopoeia: Botanical Pharmacognosy-Microscopic Characterization of Botanical Medicines. Taylor and Francis.
8. Harborne, JB. 1998. Phytochemical Methods A Guide to Modern Techniques of Plant Analysis.
9. Jetter R. 2014. Phytochemicals Biosynthesis, Function and Application. Springer International Publishing AG.
10. John T. Arnason, RM, Romeo, JT. 1995. Phytochemistry of Medicinal Plants. Springer-Verlag New York Inc.
11. Kar, A. 2017. Pharmacognosy and Pharmacobiotechnology. 7th edition. New age International publisher.
12. Lis-Balchin, M. 2002. *Geranium* and *Pelargonium*: History of Nomenclature, Usage and Cultivation (Medicinal and Aromatic Plants - Industrial Profiles) [1 ed.]. CRC Press
13. Mathur N. 2010. Medicinal Plants of India. RBSA Publishers.
14. Matthjas, A, Laisne, N. 2017. Medicinal Plants: Production, cultivation and uses (Herbs and Herbalism). Nova Science Publishers Inc.
15. Maud, G, Leyer, CF, Manya. M. 2015 A modern herbal. Volume 1, A-H: the medicinal, culinary, cosmetic and economic properties, cultivation and folk-lore of herbs, grasses, fungi, shrubs & trees with all their modern scientific uses. Dover Publications.
16. Seigler, DS. 2002. Plant Secondary Metabolites. Springer sciences+ Business Media.
17. Sherma, J. 2010. High Performance Liquid Chromatography in Phytochemical Analysis [1 ed.]. CRC Press. 2010.
18. Siddiqui, MW, Prasad, K, Bansal, V. 2017. Plant Secondary Metabolites: stimulation, extraction, and utilization. Apple academic press.
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