

Outline of the syllabus based on Choice Based Credit System (CBCS)**M. Sc. (Honours in Botany) (Two Year Course)****(Session 2018-19 & 2019-20)****M. Sc. (Honours in Botany) (Two Year Course) Part-I (Semester-I)**

| Paper Code | Paper | Paper Option | Hours Per Week | | | Credits | Marks | | |
|--------------|---|-----------------|----------------|---|---|-----------|------------|------------|------------|
| | | | L | T | P | | Ext. | Int. | Tot. |
| MBOT-TP 101 | Mycology | Core | 3 | 1 | 0 | 3.5 | 66 | 24 | 90 |
| MBOT-TP 102 | Phycology | Core | 3 | 1 | 0 | 3.5 | 66 | 24 | 90 |
| MBOT-TP 103 | Bryology | Core | 3 | 1 | 0 | 3.5 | 66 | 24 | 90 |
| MBOT-TP 104 | Cell Biology | Core | 3 | 1 | 0 | 3.5 | 66 | 24 | 90 |
| MBOT-TP 105 | Microbiology | Elective | 3 | 1 | 0 | 3.5 | 66 | 24 | 90 |
| MBOT-TP 106 | Biostatistics and Computational Skills | Elective | 3 | 1 | 0 | | | | |
| MBOT-PP 101 | Practical paper pertaining to MBOT -TP 101 & 102 | Core | 0 | 0 | 6 | 3.0 | 70 | 0 | 70 |
| MBOT-PP 102 | Practical paper pertaining to MBOT -TP 103, 104 & 105/106 | Core & Elective | 0 | 0 | 9 | 4.5 | 105 | 0 | 105 |
| Total | | | | | | 25 | 505 | 120 | 625 |

L=Lecture, T=Tutorial, P=Practical**INTERNAL ASSESSMENT**

| | | |
|--|----------|-----------|
| House Tests (Average of Two House Tests) | 50 Marks | 120 Marks |
| Permanent Slides (Minimum Fifteen) | 15 Marks | |
| Plant Album (Minimum Hundred Plants) | 16 Marks | |
| Tutorial | 15 Marks | |
| Attendance | 24 Marks | |

Internal Assessment marks will be distributed equally in all the theory papers. The duration of final practical paper will be from 04 to 06 hours depending upon the practical component.

M. Sc. (Honours in Botany) (Two Year Course) Part-I (Semester-II)

| Paper Code | Paper | Paper Option | Hours Per Week | | | Credits | Marks | | |
|---------------------------|---|------------------------|----------------|---|---|-----------|------------|------------|------------|
| | | | L | T | P | | Ext. | Int. | Tot. |
| MBOT-TP 201 | Pteridology | Core | 3 | 1 | 0 | 3.5 | 66 | 24 | 90 |
| MBOT-TP 202 | Gymnosperms | Core | 3 | 1 | 0 | 3.5 | 66 | 24 | 90 |
| MBOT-TP 203 | Cytogenetics | Core | 3 | 1 | 0 | 3.5 | 66 | 24 | 90 |
| MBOT-TP 204 | Molecular Biology | Core | 3 | 1 | 0 | 3.5 | 66 | 24 | 90 |
| MBOT-TP 205 | Plant Natural Resources, Conservation and Sustainable Development | Elective | 3 | 1 | 0 | 3.5 | 66 | 24 | 90 |
| MBOT-TP 206 | Forest Botany | Elective | 3 | 1 | 0 | | | | |
| MBOT-TP 207 | *MOOC | Elective | 3 | 1 | 0 | | | | |
| MBOT-PP 201 | Practical paper pertaining to MBOT -TP 201 & 202 | Core | 0 | 0 | 6 | 3.0 | 70 | 0 | 70 |
| MBOT-PP 202 | Practical paper pertaining to MBOT -TP 203, 204 & 205/206 | Core & Elective | 0 | 0 | 9 | 4.5 | 105 | 0 | 105 |
| Total | | | | | | 25 | 505 | 120 | 625 |
| (Optional Subject) | | **Open Elective | 3 | 0 | 0 | 3.0 | 70 | 30 | 100 |

L=Lecture, T=Tutorial, P=Practical**INTERNAL ASSESSMENT**

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| House Tests (Average of Two House Tests) | 50 Marks | 120 Marks |
| Permanent Slides (Minimum Fifteen) | 15 Marks | |
| Field Work | 16 Marks | |
| Tutorial | 15 Marks | |
| Attendance | 24 Marks | |

Internal Assessment marks will be distributed equally in all the theory papers. The duration of final practical paper will be from 04 to 06 hours depending upon the practical component.

* The subjects which the students can opt from MOOC will be notified by the department time to time.

** The students will opt any one open elective from the list of open elective subjects offered by the University. Open Elective Paper: BOT-OE: PLANTS FOR HUMAN WELFARE will be offered by the department for students of other departments who have not studied Biology at +2 level.

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|---|--------------------|---------------------------------------|-----------------|--------------|----------|----------|----------------|
| NAME OF THE COURSE: M. Sc. (HONOURS IN BOTANY) (TWO YEAR COURSE) | | | | | | | |
| PART: I | SEMESTER: I | SESSION: 2018-19 & 2019-20 | | | | | |
| PAPER: MYCOLOGY | | | | | | | 3 hrs. |
| PAPER CODE: MBOT-TP 101 | CORE | Theory | Internal | Total | L | T | Credits |
| MAXIMUM MARKS | | 66 | 24 | 90 | 3 | 1 | 3.5 |

Objective of the paper is to acquaint the students about the nomenclature, phylogeny, genetics, structure, reproduction, diversity and economic importance of different groups of fungi and fungi like organisms.

INSTRUCTIONS TO THE PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions each from the respective section of syllabus and will carry 10 marks each. Section C will consist of 13 short- answer type questions (8-10 lines) which will cover the entire syllabus uniformly and will carry 26 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

SECTION-A

1. A general account of fungi, fungal structure and ultrastructure of cell wall, growth and differentiation, fungal nutrition.
2. Fungal nomenclature, classification and phylogeny, impact of molecular systematics on fungal classification.
3. Fungal genetics: structure and organization of fungal genome, mitochondrial genes, non-sexual variation – haploidy, heterokaryosis, parasexuality; sexual variation – homothallism, heterothallism; sex hormones.
4. Fungi like organisms: General account of Kingdom *Chromista* with particular reference to *Oomycota*, *Hyphochytridiomycota* and *Labyrinthulomycota*; Kingdom *Protozoa* with particular reference to *Plasmodiophoromycota*, *Dictyosteliomycota*, *Acrasiomycota* and *Myxomycota*. Life cycle pattern in fungi like organisms.

SECTION-B

5. True Fungi: A general account of *Chytridiomycota*, *Zygomycota*, *Ascomycota* and *Basidiomycota*. Life cycle pattern in true fungi.
6. Mitosporic fungi: General characters, classification.
7. Range of variations and evolution of fructifications in fungi. Variations in asexual reproduction in fungi. Origin and evolution of sex in fungi including hormonal control.
8. Applied Mycology: Overview, Fungi for food, Fungi as symbionts (Lichens and Mycorrhiza), Fungi for enzymes and pharmaceuticals, Fungi as biological control agents, mushroom cultivation - a general account.

RECOMMENDED READINGS

1. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. 1996. *Introductory Mycology*, John Wiley and Sons, New York.
2. Aneja, K.R. and Mehrotra, R.S. 2015. *An Introduction to Mycology*. New Age International Publishers, New Delhi.
3. Deacon, J.W. 2007. *Modern Mycology*, 3rd Edition, Blackwell Science Ltd., U.K.
4. Kirk, P.M., Cannon, P.F., Minter, D.W. and Stalpers, J.A. 2008. *Dictionary of the Fungi* (Tenth ed.). CABI Europe – UK.
5. Sumbali, G. 2010. *The Fungi (Second Edition)*. Narosa Publishing House, New Delhi.
6. Webster, J. 1978. *Introduction to Fungi*, Cambridge University Press, London.

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| NAME OF THE COURSE: M. Sc. (HONOURS IN BOTANY) (TWO YEAR COURSE) | | | | | | | |
| PART: I | SEMESTER: I | SESSION: 2018-19 & 2019-20 | | | | | |
| PAPER: PHYCOLOGY | | | | | | | 3 hrs. |
| PAPER CODE: MBOT-TP 102 | CORE | Theory | Internal | Total | L | T | Credits |
| MAXIMUM MARKS | | 66 | 24 | 90 | 3 | 1 | 3.5 |

Objective of the paper is to acquaint the students about the classification range of thallus, structure and reproduction of different classes of algae including and cyanobacteria.

INSTRUCTIONS TO THE PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions each from the respective section of syllabus and will carry 10 marks each. Section C will consist of 13 short- answer type questions (8-10 lines) which will cover the entire syllabus uniformly and will carry 26 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

SECTION-A

1. Principles and systems of algal classification. Comparative account of algal pigments, food reserves, cell wall, flagellation, chloroplasts and eye spots; their phylogenetic and taxonomic importance. Economic importance of algae.
2. Cyanophyta: Cell Structure, thallus organization, heterocyst and akinete development and their role; chromatic adaptations and multiplication; paddy soil cyanophytes and their role.
3. Chlorophyta: Salient features, broad classification, range of thallus, methods of reproduction, life cycles and alternation of generation.
4. Xanthophyta and Bacillariophyta: salient features, broad classification, range of thallus structure, reproduction and life cycles.

SECTION-B

5. Phaeophyta: Salient features, broad classification, range of thallus structure, reproduction and life cycles and alternation of generation.
6. Rhodophyta: Salient features, broad classification, range of thallus structure, reproduction, life history and alternation of generations; post-fertilization development.
7. A detailed account of salient features of Chrysophyta, Glaucophyta and Euglenophyta
8. A detailed account on salient features of Dinophyta, Cryptophyta, Prymnesiophyta and Apicomplexa.

RECOMMENDED READINGS

1. Morris, I. 1986. An Introduction to the Algae. Cambridge University Press, UK
2. Van den Hoek, C., Mann, D.J. and John, M.H. (1995). Algae: An Introduction to Phycology. Cambridge University Press.
3. Round, F.E. 1986. The Biology of Algae. Cambridge University Press, Cambridge.
4. Robin, G.R and Whittick, A. (1987). Introduction to Phycology. Blackwell Scientific Publications, London
5. Kumar, H.D. 1998. Introductory Phycology, Affiliated East West Press Ltd., New Dehli.
6. Lee, R. (2008). Phycology, Cambridge University Press, UK.
7. Sarma, T.A. (2012) Handbook of Cyanobacteria. CRC press, Boca Raton, FL, USA
8. Sahoo, D. and Sechbach J. (2015) The Algae World. Springer, Netherland.

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| PART: I | SEMESTER: I | SESSION: 2018-19 & 2019-20 | | | | | |
| PAPER: BRYOLOGY | | | | | | | 3 hrs. |
| PAPER CODE: MBOT-TP 103 | CORE | Theory | Internal | Total | L | T | Credits |
| MAXIMUM MARKS | | 66 | 24 | 90 | 3 | 1 | 3.5 |

Objective of the paper is to give knowledge the students about the origin, classification, evolution of gametophyte and sporophyte of liverworts, hornworts and mosses.

INSTRUCTIONS TO THE PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions each from the respective section of syllabus and will carry 10 marks each. Section C will consist of 13 short- answer type questions (8-10 lines) which will cover the entire syllabus uniformly and will carry 26 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

SECTION-A

1. Bryophytes: General characters, origin and classification; evolution of gametophytic and sporophytic generations; economic and ecological importance; brief account of fossil bryophytes.
2. Hepaticopsida: General characters, classification, detailed account of morphology, structure, reproduction and affinities of Calobryales, Jungermaniales and Metzgeriales.
3. Hepaticopsida: detailed account of morphology, structure, reproduction and affinities of Sphaerocarpaceae, Monocleales and Marchantiales.
4. Anthocerotopsida: A general account of morphology, structure, life cycle pattern, spore morphology & germination and affinities of Anthocerotales.

SECTION-B

5. Bryopsida: General characters of Bryopsida, classification, account of morphology, structure, life cycle pattern and affinities of Andreaidae, Sphagnidae and Tetraphidaceae
6. Bryopsida: detailed account of morphology, structure, life cycle pattern and affinities of Polytrichaceae and Buxbaumiaceae
7. Bryopsida: detailed account of morphology, structure, life cycle pattern and affinities of Bryidae and Archidiaceae.
8. Comparative morphology and developmental anatomy of liverworts, hornworts and mosses.

RECOMMENDED READINGS

1. Glime, J. M. and Saxena, D. 1991. *Uses of Bryophytes*, Today & Tomorrow's Printers & Publication, New Delhi.
2. Kashyap, S.R. 1972. *Liverworts of the Western Himalayas and Punjab Plains*, Vol I & II. Researcho Publications, New Dehli.
3. Puri, P. 1986. *Bryophytes: Morphology, Growth and Differentiation*, Atma Ram & Sons, Dehli.
4. Rashid, A. 1998. *An Introduction to Bryophyta*. Vikas Pub. House Pvt. Ltd., New Dehli.
5. Schofield, W. D. 1985. *Introduction to Bryology*. MacMillan, New York.
6. Singh, S.K. 2006. *Textbook of Bryophyta*. Campus Books International, New Delhi.
7. Tiwari, S.D. and Pant, G. 1994. *Bryophytes of Kumaun Himalaya*. Bishen Singh Mahendra Pal Singh, Dehra Dun.

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| PART: I | SEMESTER: I | SESSION: 2018-19 & 2019-20 | | | | | |
| PAPER: CELL BIOLOGY | | | | | | | 3 hrs. |
| PAPER CODE: MBOT-TP 104 | CORE | Theory | Internal | Total | L | T | Credits |
| MAXIMUM MARKS | | 66 | 24 | 90 | 3 | 1 | 3.5 |

Objective of the paper is to give knowledge to the students about the ultra structure of prokaryotic and eukaryotic cell, cell organelles and cytoskeleton. The students will also learn about the structure of nucleic acids, chromosome organisation and macro molecules.

INSTRUCTIONS TO THE PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions each from the respective section of syllabus and will carry 10 marks each. Section C will consist of 13 short- answer type questions (8-10 lines) which will cover the entire syllabus uniformly and will carry 26 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

SECTION-A

1. Structural organisation of Cell: Prokaryotic and Eukaryotic cell structure, Plant and animal cell structure; Ultrastructure and function of cell organelles: Endoplasmic reticulum, golgi apparatus, lysosomes, vacuoles, ribosomes, peroxisomes.
2. Structural organisation and function of Cell wall, Plasma membrane, Plasmodesmata. Extracellular matrix and cell junctions.
3. Ultrastructure, functions, biogenesis and semiautonomous nature of mitochondria and chloroplasts.
4. Structural organisation and functions of nuclear envelop, nuclear pore, nucleolus and chromosomes.

SECTION-B

5. Genetic material: Types of DNA and RNA, C- value paradox, cot curve and its significance. Organisation of genetic material in Eukaryote and prokaryotes; nucleosome assembly, supercoiling. Heterochromatin and euchromatin.
6. Macromolecules: Classification, structure and function of proteins, carbohydrates (Polysaccharides, mucopolysaccharides, mucoproteins and glycoproteins) and lipids.
7. Cytoskeleton: Structure and organisation of filaments, microtubules and intermediate filaments, and their role in cell mobility and cell division.
8. Mechanism of cell cycle control: Cyclins, CDKs, MPF and genes involved in cell cycle control.

RECOMMENDED READINGS

1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K. and Walter, P. 2008. Molecular Biology of the Cell, 5th Edition. Garland Science Taylor & Francis Group, USA.
2. Cooper G.M. and Hausman, R.E. 2007. The Cell A Molecular Approach, 4th Edition. Sinauer Associates, MA, USA.
3. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
4. Hardin, J., Bertoni, G. and Kleinsmith, L.J. 2012. Becker's World of the Cell, 8th Edition. Benjamin Cummings, NY, USA.
5. Karp, G. 2014. Cell and Molecular Biology: Concepts and Experiments, 8th Edition. John Wiley & Sons Inc. USA.
6. Klug, W.S., Cummings, M.R. Spenser, C.A. and Palladino, M.A. 2012. Concepts of Genetics, 10th Edition. Pearson Education Inc. USA.
7. Lodish, H., Berk, A. Kaiser, C.A., Bretscher, A. Ploegh, H. Amon, A. and Martin, K.C. 2016. Molecular Cell Biology, 8th Edition. W. H. Freeman and company, New York, USA.
8. Nelson, D.L. and Cox, M.M. 2015. Lehninger's Principles of Biochemistry, 4th Edition.
9. Watson, J.D., Baker, T.A., Bell, S.P., Gann, A. Levine, M. and Losick, R. 2014. Molecular Biology of the Gene, 7th Edition. Pearson Education Inc. USA.

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| NAME OF THE COURSE: M. Sc. (HONOURS IN BOTANY) (TWO YEAR COURSE) | | | | | | | |
| PART: I | SEMESTER: I | SESSION: 2018-19 & 2019-20 | | | | | |
| PAPER: MICROBIOLOGY | | | | | | | 3 hrs. |
| PAPER CODE: MBOT-TP 105 | ELECTIVE | Theory | Internal | Total | L | T | Credits |
| MAXIMUM MARKS | | 66 | 24 | 90 | 3 | 1 | 3.5 |

Objective of the paper is to acquaint the students about the history of microbiology; characteristics of different microbial groups; structure and nutritional types of microbes; culture techniques, reproduction and economic importance of microbes.

INSTRUCTIONS TO THE PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions each from the respective section of syllabus and will carry 10 marks each. Section C will consist of 13 short- answer type questions (8-10 lines) which will cover the entire syllabus uniformly and will carry 26 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

SECTION-A

1. Introduction: Historical development and relevance of microbiology to Life sciences. Microbial groups: Prokaryotes (bacteria, archaeobacteria, cyanobacteria, mycoplasma, actinomycetes), eukaryotes (molds, slime molds, yeast, algae, fungi, protozoa) and viruses (bacterial, plant and animal); a general account of characteristics, structure and functions.
2. Nutrition of Microbes: Requirements for carbon, nitrogen, sulfur, growth factors, etc. role of oxygen in nutrition, nutritional categories among micro-organisms.
3. Techniques of microorganisms, isolation and purification: Pure culture techniques, preparation of culture media, types of media; sterilization techniques; methods for culturing anaerobes; cultural characteristics, maintenance and preservation of cultures.
4. Growth of Microorganisms: Definition, mathematical expression, growth curve(s) and measurement of growth; factors affecting growth; synchronous and continuous culture.

SECTION-B

5. Microbial Reproduction: Asexual and sexual. A detail account on bacterial conjugation, transformation and transduction.
6. Role of microorganisms in geochemical cycles: Microorganisms as agent of geochemical change; cycles of matter and microbial interactions.
7. Biological nitrogen fixation: Microbiology of symbiotic and non-symbiotic nitrogen fixation; root nodule formation and its functions; nitrogen fixation by cyanobacteria, structure and functions of heterocyst.
8. Role of Microbes in pharmaceutical, dairy and food industry. Role of microorganisms in biofuel production and bioremediation. A brief account on common microbial human diseases.

RECOMMENDED READINGS

1. Pelczar, M.J., Chan, E.C.S. and Krieg, N.R. (1993). Microbiology. Tata McGraw-Hill Education, India.
2. Atlas, R.M. (1997). Principles of Microbiology WC Brown Publishers, USA.
3. Stanier, R.Y., Ingraham, J.L., Wheelis, M.L. and Painter, P.R (2005). General Microbiology. Mac Millan, Hong Kong.
4. Tortora, G.J. (2008). Microbiology: An Introduction. Pearson Education, India (2008).
5. Black, J.G. (2008). Microbiology: Principles and Explorations. John Wiley & Sons, USA.
6. Goldman, E. and Green, H.L. (2009). Practical Handbook of Microbiology. CRC Press, USA.
7. Madigan, M.T., Martingo, J.M., Stahl, D.A. and Clark, D.P. (2011). Brock Biology of Microorganisms by Pearson Education Limited, USA.
8. Nester, E.W. Anderson, D., Roberts, Jr. and Evans, C. (2011). Microbiology: A Human Perspective. Mc Graw-Hill Education, India.
9. Pommerville, J.C (2012). Alcamo's Fundamentals of Microbiology. Jones & Bartlett Learning, USA.

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| NAME OF THE COURSE: M. Sc. (HONOURS IN BOTANY) (TWO YEAR COURSE) | | | | | | | |
| PART: I | SEMESTER: I | SESSION: 2018-19 & 2019-20 | | | | | |
| PAPER: BIostatISTICS AND COMPUTATIONAL SKILLS | | | | | | | 3 hrs. |
| PAPER CODE: MBOT-TP 106 | ELECTIVE | Theory | Internal | Total | L | T | Credits |
| MAXIMUM MARKS | | 66 | 24 | 90 | 3 | 1 | 3.5 |

Objective of the paper is to acquaint the students about the various techniques related to statistical methods, analysis of variance and role of computer application in biological sciences.

INSTRUCTIONS TO THE PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions each from the respective section of syllabus and will carry 10 marks each. Section C will consist of 13 short- answer type questions (8-10 lines) which will cover the entire syllabus uniformly and will carry 26 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

SECTION-A

1. Statistical Methods: Collection of Data, distribution and graphical representation, measurement of central tendency, Arithmetic mean, Median, Mode and their empirical relationship.
2. Measures of dispersion, mean deviation, standard deviation, variance and coefficient of variation, correlation and regression
3. Sample statistics and parameters, population and null hypothesis, level of significance, X^2 -test, t-test
4. Analysis of variance- ANOVA, one-way, Two way ANOVA

SECTION-B

5. General ideas on computers, computer application in Biological Sciences.
6. Computer Basic: Introduction, Input and output devices, computer memory, hardware and software of computer, MS- window.
7. MS words, Excel, Power Point.
8. Internet and web browser, mail, and file transfer, Microsoft Office. Bioinformatics- Application and Prospects.

RECOMMENDED READINGS

- 1) Chainy, G.B.N., Mishra, G. and Mohanty, P.K. 2008. Biostatistics Theory and Applications, Kalyani Publishers, Ludhiana.
- 2) Rastogi, V.B. 2011. Fundamentals of Biostatistics, Ane Books Pvt. Ltd., New Delhi.
- 3) Gupta, S.C. and Kapoor, V.K. Fundamentals of Applied Statistics, Sultan Chand and Sons, New Delhi.
- 4) Singh, Sukhminder and Singh, T.P., Bansal, M.L. and Kumar, Rakesh, 1998 Statistical Methods the Research Workless, Kalyani Publishers,
- 5) Gurumani, N. 2008. An Introduction to Biostatistics, M.J.P. Publishers, Chennai,
- 6) Panse V. G. & Sukhatme, P.V. 1995. Statistical Methods for Agricultural Workers, ICAR, New Delhi.,

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| PART: I | SEMESTER: I | SESSION: 2018-19 & 2019-20 | |
| PRACTICAL PAPER: PERTAINING TO MBOT-TP 101 & 102 | | | |
| PAPER CODE: MBOT-PP 101 | CORE | MAXIMUM MARKS: 70 | CREDITS: 3.0 |

MYCOLOGY

1. To study morphology of following Myxomycetous fungi: *Trichia*, *Hemitrichia*, *Stemonitis*.
2. To study comparative morphology of sporangiophores of following Oomycetous fungi: *Peronospora*, *Bremia* and *Sclerospora*.
3. To study comparative morphology of Ascocarps with particular reference to Cleistothecia (*Erysiphe*, *Phyllactinia*, *Uncinula*), Perithecia (*Phyllachora*, *Xylaria*) and Apothecia (*Pyronema*, *Peziza*) *Halvella* and *Morchella*.
4. To study symptoms and histopathological details of following: *Albugo candida*, *Synchytricum endobioticum*, *Protomyces microspors*, *Physoderma maydis*, *Erysiphe graminis*, *Urocystis tritici*, *Puccinia graminis tritici*, *P. recondita*, *P. striformis*, *Alternaria solani*, *Cercospora arachidicola* and *Colletotrichum capsici*.
5. To study symptoms and spore morphology of *Ustilago*, *Urocystis*, *Sphaelotheca* and *Toliposporium*.
6. To study range of variation in fructification of following basidiomycetous fungi: *Corticium*, *Thelephora*, *Clavaria*, *Ramaria*, *Trametes*, *Ganoderma*, *Agaricus*, *Boletus*, *Russula* and *Lactarius*.
7. To study different sopro stages in life cycle of *Puccinia* on primary and secondary host.
8. Study of crustose, foliose and fruiticose lichens.

PHYCOLOGY

Study of Morphological and reproductive parts of following Algal genera:

1. Cyanophyta: *Anabaena*, *Synechocystis*, *Microcystis*, *Oscillatoria*, *Scytanema* and *Westiellopsis*.
2. Chlorophyta: *Acetabularia*, *Chlorella*, *Cladophora*, *Chara*, *Caulerpa*, *Codium*, *Hydrodictyon*, *Halimeda*, *Oedogonium*, *Pithophora*, *Spirogyra*, *Volvox*, *Udotea*, *Ulothrix*, *Ulva*, *Zygnema*.
3. Xanthophyta: *Vaucheria*
4. Bacillariophyta: Identification of common fresh water diatoms.
5. Phaeophyta: *Dictyota*, *Ectocarpus*, *fucus*, *Padina* and *Zonaria*.
6. Rhodophyta: *Batrachosepermum*, *Gelidium*, *Gracillaria* and *Polysiphonia*
7. *Euglena* (Euglenophyta), *Gymnodinium* (Dinophyta), *Chryptomonas* (Cryptophyta), *Dinobryon* (Chrysophyta), *Prymnesium* (Prymnesiophyta), *Cyanophora* (Glaucophyta)
8. Permanent slide preparation: *Chara*, *Dictyota*, *Ulva*, *Padina*, *Zonaria* and *Saragassum*.

Note: The students are required to collect and submit 10 algal and 10 fungal specimens.

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| PART: I | SEMESTER: I | SESSION: 2018-19 & 2019-20 | |
| PRACTICAL PAPER: PERTAINING TO MBOT-TP 103, 104 & 105/106 | | | |
| PAPER CODE: MBOT-PP 102 | CORE & ELECTIVE | MAXIMUM MARKS: 105 | CREDITS: 4.5 |

BRYOLOGY

Study of morphological, anatomical and reproductive parts of following **Bryophyte** genera

1. Liverworts: *Marchantia*, *Reboulia*, *Conocephalum*, *Cryptometrium*, *Dumortiera*, *Athalamia*, *Plagiochasma*, *Targionia*, *Pellia* and *Fimbriaria*.
2. Hornworts: *Anthoceros*.
3. Mosses: *Funaria*, *Pogonatum*, *Polytrichum* and *Bryum*.
4. Museum Jar specimen study: *Palavicinia*, *Riccia*, *Ricciocarpus*, *Lunularia* *Sphagnum* and *Rhodobryum*.

CELL BIOLOGY

1. To measure the size of given pollen grains/ spores/ cells with the help of ocular micrometer.
2. To compare the stomatal index of surface of the leaf (Dicot, Monocot).
3. To isolate chloroplasts from Spinach leaves.
4. Experiments for qualitative identification of carbohydrates: Molisch's test for carbohydrates, Iodine test for starch, Barford's test or monosaccharides, Seliwanoff's test for ketoses, Fehling's test for reducing sugars and Bial's test for pentoses.
5. Quantitative determination of carbohydrate from plant material.
6. To draw and interpret Cot curves from the data.
7. Experiment to determine the quantity of proteins in the given plant sample.

MICROBIOLOGY

1. Preparation of culture media for culturing bacteria, blue-green algae and fungi.
2. Isolation of microorganisms from soil, air and water by plating technique.
3. Isolation of microorganisms by enrichment technique.
4. Enumeration of microorganisms from soil by plate count method.
5. Counting of cells in the culture using haemocytometer.
6. Study of Bacteria from curd and root nodules including Gram staining.
7. Study of growth of microorganism and determination of generation time and growth rate constant.

BIostatistics AND COMPUTATIONAL SKILLS

1. To study the different aspects related to collection of data.
2. To study the objectives and types of classification of data.
3. To study the aspects related to frequency distribution.
4. To study the different aspects of tabulation of data.
5. Diagrammatic and graphic presentation of data/
6. Correlation analysis.
7. Regression analysis.
8. To study the basic components of computers.
9. Basic aspects related to MS-Word.
10. Basic aspects related to MS-Excel.
11. Basic aspects related to MS-Power Point Presentation.
12. Use of MS-Excel for computation of data.
13. Practical aspects to calculating central tendency.
14. Basic principles of statistical designing an experiment.
15. Calculation of one way Analysis of variance.
16. Calculation of two way Analysis of variance.

Punjabi University, Patiala
DEPARTMENT OF BOTANY
PUNJABI UNIVERSITY, PATIALA

| NAME OF THE COURSE: M. Sc. (HONOURS IN BOTANY) (TWO YEAR COURSE) | | | | | | | |
|--|--------------|----------------------------|----------|-------|---|---|---------|
| PART: I | SEMESTER: II | SESSION: 2018-19 & 2019-20 | | | | | |
| PAPER: PTERIDOLOGY | | | | | | | 3 hrs. |
| PAPER CODE: MBOT-TP 201 | CORE | Theory | Internal | Total | L | T | Credits |
| MAXIMUM MARKS | | 66 | 24 | 90 | 3 | 1 | 3.5 |

Objective of the paper is to give knowledge to the students about the fossil pteridophytes, structure, reproduction and comparative account of different groups of fern and fern allies. The student will also learn about origin and evolution of vasculature and seed habit.

INSTRUCTIONS TO THE PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions each from the respective section of syllabus and will carry 10 marks each. Section C will consist of 13 short- answer type questions (8-10 lines) which will cover the entire syllabus uniformly and will carry 26 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

SECTION-A

1. Pteridophytes: General characters, classification of ferns and fern allies, distribution of Pteridophytes in India and economic importance of Pteridophytes.
2. Geological time scale and fossil formation, types of fossils, Apogamy and Apospory in ferns.
3. Evolution of stele, Telome theory.
4. Heterospory and seed habit.

SECTION-B

5. Psilotopsida: A concise and comparative account of the above groups with particular reference to morphology, fructification, gametophytes, evolutionary tendencies and interrelationships.
6. Lycopsidea: A comparative account of morphology, spore producing organs, gametophytes, evolutionary tendencies and interrelationships.
7. Sphenopsida: A comparative account of morphology, spore producing organs, gametophytes, evolutionary tendencies and interrelationships.
8. Pteropsida: A study of plant organization, anatomy, spore producing organs, gametophytic generations and interrelationships. Evolution of sorus and sporangium in eusporangiate and leptosporangiate ferns.

RECOMMENDED READINGS

1. Bhatanagar, S. P. and Moitra, A. 1996. *Gymnosperms*, New Age International Pvt. Ltd., New Delhi.
2. Chamberlain, C. J. 1934. *Gymnosperms : Structure and Evolution*. Doves (Reprinted New York).
3. Kubitzki, K. (Ed.) 1990. *The Families & Genera of Vascular Plants, Vol I Pteridophytes and Gymnosperms*, Springer-Verlag, Berlin, New York.
4. Pandey, S. N., Mirza, S. P. & Trivedi, P. S. 1997. *A Text Book of Botany - Vol II*, Vikas Pub. House Pvt.Ltd., New Delhi.
5. Pant, D. D. 1973. *Cycas and the Cycadales*, Central Book Depot, Allahabad.
6. Parihar, N. S. 1996. *Biology and Morphology of Pteridophytes*, Central Book Depot, Allahabad.
7. Raizda, M. B. & Salmi, K.C. 1958. *Indian Forest Records, Vol 5 No.2 - Living Indian Gymnosperms*, F. R. I. Pub. Dehra Dun.
8. Rashid A. 1999. *An Introduction to Pteridophyta*, Vikas Publication House Pvt. Ltd., New Delhi.
9. Sahni, K.C. 1990. *Gymnosperms of India and Adjacent Countries*, BSMPS, Dehra Dun.
10. Sharma, O. P. 2001. *Gymnosperms*, Pragati Prakashan, Meerut.
11. Sporne, K.R. 1965. *The Morphology of Gymnosperms*. MIS Hutchinson & Co. Ltd., London.
12. Sporne, K.R. 1991. *The Morphology of Pteridophytes*, M/s Publishing Pvt. Ltd., Bombay.
13. Stewart, W. N. 1983. *Paleobotany and the Evolution of Plants*, Cambridge Univ. Press, London.
14. Stewart, W. N. & Rathwell, G. W. 1993. *Paleobotany and the Evolution of Plants*, Cambridge University Press.
15. Vasishta, P. C. 2003. *Gymnosperms*. S.Chand & Co. Ltd., New Delhi.

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|---|---------------------|---------------------------------------|-----------------|--------------|----------|----------|----------------|
| NAME OF THE COURSE: M. Sc. (HONOURS IN BOTANY) (TWO YEAR COURSE) | | | | | | | |
| PART: I | SEMESTER: II | SESSION: 2018-19 & 2019-20 | | | | | |
| PAPER: GYMNOSPERMS | | | | | | | 3 hrs. |
| PAPER CODE: MBOT-TP 202 | CORE | Theory | Internal | Total | L | T | Credits |
| MAXIMUM MARKS | | 66 | 24 | 90 | 3 | 1 | 3.5 |

Objective of the paper is to give knowledge to the students about the fossil gymnosperms, origin and evolution of gymnosperms, structure and reproduction of different groups of gymnosperms.

INSTRUCTIONS TO THE PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions each from the respective section of syllabus and will carry 10 marks each. Section C will consist of 13 short- answer type questions (8-10 lines) which will cover the entire syllabus uniformly and will carry 26 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

SECTION-A

1. Gymnosperms: Characteristic features, origin and evolution, classification, economic importance and distribution of gymnosperms in India.
2. Variation and evolution of cone in Gymnosperms, structure and evolution of gametophyte and seed in Gymnosperms, polyembryony in Gymnosperms.
3. General characters and evolutionary significance of Progymnosperms, Pteridosperms, Cycadeoideales and Cordaitales.
4. A generalized account of structure and reproduction in Cycadales, Ginkgoales, Pentoxylales, Coniferales, Ephedrales, Welwitschiales and Gnetales.

SECTION-B

5. Cycadales and Ginkgoales: Comparative account of morphology, anatomy and reproduction.
6. Coniferales: Comparative account of morphology, anatomy and reproduction.
7. Taxales: Comparative account of morphology, anatomy and reproduction
8. Ephedrales, Welwitschiales and Gnetales: Comparative account of morphology, anatomy and reproduction

RECOMMENDED READINGS

1. Bhatnagar, S. P. and Moitra, A. 1996. *Gymnosperms*, New Age International Pvt. Ltd., New Dehli.
2. Chamberlain, C. J. 1934. *Gymnosperms: Structure and Evolution*. Doves (Reprinted New York).
3. Kubitzki, K. (Ed.) 1990. *The Families & Genera of Vascular Plants, Vol I Pteridophytes and Gymnosperms*, Springer-Verlag, Berlin, New York.
4. Pandey, S. N., Mirza, S. P. & Trivedi, P. S. 1997. *A Text Book of Botany - Vol II*, Vikas Pub. House Pvt.Ltd., New Dehli.
5. Pant, D. D. 1973. *Cycas and the Cycadales*, Central Book Depot, Allahabad.
6. Parihar, N. S. 1996. *Biology and Morphology of Pteridophytes*, Central Book Depot, Allahabad.
7. Raizda, M. B. & Salmi, K.C. 1958. *Indian Forest Records, Vol 5 No.2 - Living Indian Gymnosperms*, F. R. I. Pub. Dehra Dun.
8. Sahni, K.C. 1990. *Gymnosperms of India and Adjacent Countries*, BSMPS, Dehra Dun.
9. Sharma, O. P. 2001. *Gymnosperms*, Pragati Prakashan, Meerut.
10. Sporne, K.R. 1965. *The Morphology of Gymnosperms*. MIS Hutchinson & Co. Ltd., London.
11. Stewart, W. N. 1983. *Paleobotany and the Evolution of Plants*, Cambridge Univ. Press, London.
12. Stewart, W. N. & Rathwell, G. W. 1993. *Paleobotany and the Evolution of Plants*, Cambridge University Press.
13. Vasishta, P. C. 2003. *Gymnosperms*. S.Chand & Co. Ltd., New Dehli.

| NAME OF THE COURSE: M. Sc. (HONOURS IN BOTANY) (TWO YEAR COURSE) | | | | | | | |
|--|--------------|----------------------------|----------|-------|---|---|---------|
| PART: I | SEMESTER: II | SESSION: 2018-19 & 2019-20 | | | | | |
| PAPER: CYTOGENETICS | | | | | | | 3 hrs. |
| PAPER CODE: MBOT-TP 203 | CORE | Theory | Internal | Total | L | T | Credits |
| MAXIMUM MARKS | | 66 | 24 | 90 | 3 | 1 | 3.5 |

Objective of the paper is to give knowledge to the students about the structure of the chromosomes, chromosomal alterations with reference to structure and number, Mendelian inheritance, population genetics and basic techniques for studying mitotic and meiotic chromosomes.

INSTRUCTIONS TO THE PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions each from the respective section of syllabus and will carry 10 marks each. Section C will consist of 13 short- answer type questions (8-10 lines) which will cover the entire syllabus uniformly and will carry 26 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

SECTION-A

1. Chromosomes: Structure and nomenclature; Special type of chromosomes: B-chromosomes, polytene chromosomes, lampbrush chromosomes and sex chromosomes. Karyotype analysis and evolution.
2. Structural alterations in chromosomes: Origin, meiotic behaviour and applications of duplications, deficiencies, inversions, translocations. Robertsonian translocations, complex translocations (Renner complex), B-A translocations, translocation tester sets.
3. Euploidy: Classification, origin and meiotic behaviour of haploids and polyploids and their role in cytogenetics and plant breeding
4. Aneuploidy: General account of trisomics, monosomics, tetrasomics and nullisomics. Role of trisomics and monosomics in chromosome mapping.

SECTION-B

5. Alien gene transfer through chromosome manipulations with special reference to wheat, transfer of whole genome, transfer of individual chromosome and chromosome segments, production, characterization and utility of alien addition and substitution lines.
6. Mendelian Laws, Non-Mendelian inheritance, gene interaction, test cross, quantitative inheritance, Chromosome theory of inheritance. Multigene families.
7. Population genetics: gene pool and gene frequency, equilibrium of gene frequencies, change in gene frequencies.
8. The handling of plant chromosomes: Squash Technique – Pre- treatment, Fixation and Staining of Chromosomes. Smear Technique- from the root, Cell Suspension and Callus, Shoot; Pollen Staining; Pollen fertility. Brief idea about advanced techniques in chromosome staining : Chromosome banding, Fluorescence *in-situ* Hybridization (FISH), Genomic *in-situ* Hybridization (GISH), Multicolor Genomic *in-situ* Hybridization (McGISH), Primed *in-situ* (PRINS) DNA Labeling, Fiber- FISH, Flow cytometry (Determination of Nuclear DNA Content, ploidy, Genome size).

RECOMMENDED READINGS

1. Brown, T.A. 2011. Genomes, John Wiley & Sons, New York.
2. Gupta, P.K. 2014. *Cytogenetics*, Rastogi Publications, Meerut.
3. Karp, G. 2014, *Cell and Molecular Biology : Concepts and Experiments*, John Wiley & Sons Inc. USA.
4. Khush, G.S. 1973. *Cytogenetics of Aneuploids*, Academic Press, New York.
5. Schultz-Schaeffer, J. 1980. *Cytogenetics*, Springer_Verlag, New York.
6. Singh, B.D. 2006. *Genetics*. Kalyani Publishers, New Delhi.
7. Swanson, C.P. 1972. *Cytology and Cytogenetics*, Macmillan India, New Dehli.

| NAME OF THE COURSE: M. Sc. (HONOURS IN BOTANY) (TWO YEAR COURSE) | | | | | | | |
|--|---------------------|---------------------------------------|-----------------|--------------|----------|----------|----------------|
| PART: I | SEMESTER: II | SESSION: 2018-19 & 2019-20 | | | | | |
| PAPER: MOLECULAR BIOLOGY | | | | | | | 3 hrs. |
| PAPER CODE: MBOT-TP 204 | CORE | Theory | Internal | Total | L | T | Credits |
| MAXIMUM MARKS | | 66 | 24 | 90 | 3 | 1 | 3.5 |

Objective of the paper is to give knowledge to the students about the concept of gene, mechanism of replication of genetic material, transcription, translation and regulation of gene expression in prokaryotes and eukaryotes. The students will also learn about mutation and DNA repair mechanism.

INSTRUCTIONS TO THE PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions each from the respective section of syllabus and will carry 10 marks each. Section C will consist of 13 short- answer type questions (8-10 lines) which will cover the entire syllabus uniformly and will carry 26 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

SECTION-A

1. Gene concept: Structural and functional evolution of concept of gene, fine structure of a gene, split genes, overlapping genes and pseudogenes.
2. Replication of genetic material: Replication of DNA in bacteria and eukaryotes. Replication of genetic material in DNA and RNA viruses.
3. Genetic Recombination: Mechanism of recombination in bacteria (Conjugation, transformation and transduction) and viruses. Mechanism of recombination in eukaryotes, crossing over, molecular mechanism of recombination (role of RecA, Rec ACD enzymes), site specific recombination.
4. Mechanism of transcription in prokaryotes and eukaryotes; RNA modifications: Introns and exons, intron removal, spliceosome machinery, splicing pathways, alternative splicing, exon shuffling, RNA editing and mRNA transport.

SECTION-B

5. Regulation of Transcription: Action of activators and repressors, DNA binding domains, chromatin remodelling, histone acetylation, methylation and phosphorylation. Operon model (Lac and tryptophan), positive and negative control. Gene regulation in Lambda phage.
6. Mechanism of translation in prokaryotes and eukaryotes. Regulation of translation: role of cell signalling proteins and iRNA.
7. Transposons: Transposable elements in bacteria and eukaryotes including retrotransposons and their significance.
8. Mutations and DNA repair: Mechanism of spontaneous mutations and induced mutations, chemical and physical mutagens. Mechanism of DNA repair.

RECOMMENDED READINGS

1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K. and Walter, P. 2008. Molecular Biology of the Cell, 5th Edition. Garland Science Taylor & Francis Group, USA.
2. Cooper G.M. and Hausman, R.E. 2007. The Cell A Molecular Approach, 4th Edition. Sinauer Associates, MA, USA.
3. Hardin, J., Bertoni, G. and Kleinsmith, L.J. 2012. Becker's World of the Cell, 8th Edition. Benjamin Cummings, NY, USA.
4. Karp, G. 2014, Cell and Molecular Biology: Concepts and Experiments, 8th Edition. John Wiley & Sons Inc. USA.
5. Klug, W.S., Cummings, M.R. Spenser, C.A. and Palladino, M.A. 2012. Concepts of Genetics, 10th Edition. Pearson Education Inc. USA.
6. Krebs, J.E., Goldstein, E.S. and Kilpatrick, S.T. 2016. Lewin's Genes XII. Jones & Bartlett, USA.
7. Lodish, H., Berk, A. Kaiser, C.A., Bretscher, A. Ploegh, H. Amon, A. and Martin, K.C. 2016. Molecular Cell Biology, 8th Edition. W. H. Freeman and company, New York, USA.
8. Snustad, D.P. and Simmons, M.J. 2012. Principles of Genetics, 6th Edition. John Wiley & Sons Inc. USA.
9. Watson, J.D., Baker, T.A., Bell, S.P., Gann, A. Levine, M. and Losick, R. 2014. Molecular Biology of the Gene, 7th Edition. Pearson Education Inc. USA.

| NAME OF THE COURSE: M. Sc. (HONOURS IN BOTANY) (TWO YEAR COURSE) | | | | | | | |
|--|--------------|----------------------------|----------|-------|---|---|---------|
| PART: I | SEMESTER: II | SESSION: 2018-19 & 2019-20 | | | | | |
| PAPER: PLANT NATURAL RESOURCES, CONSERVATION AND SUSTAINABLE DEVELOPMENT | | | | | | | 3 hrs. |
| PAPER CODE: MBOT-TP 205 | ELECTIVE | Theory | Internal | Total | L | T | Credits |
| MAXIMUM MARKS | | 66 | 24 | 90 | 3 | 1 | 3.5 |

Objective of the paper is to give knowledge to the students about different types of natural resources, ecological restoration, terrestrial and aquatic ecosystems, plant resource conservation and sustainable development.

INSTRUCTIONS TO THE PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions each from the respective section of syllabus and will carry 10 marks each. Section C will consist of 13 short- answer type questions (8-10 lines) which will cover the entire syllabus uniformly and will carry 26 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

SECTION-A

1. Natural resources: types, renewable and non-renewable resources, plant natural resources: types, resource degradation, consequences of overexploitation of plant resources.
2. Ecological restoration: strategies and concerns in ecological restoration, restoration plan and rehabilitative measures.
3. A brief account of restoration of terrestrial and aquatic ecosystems.
4. Biomass/ bioenergy resources: hydrogen from algae and bacteria, methane/ biogas, energy plantations (dendrothermal), ethanol and biodiesel.

SECTION-B

5. Plant resource conservation: *in situ*, terrestrial and marine protected area, biosphere reserves, national parks, wild life sanctuaries, botanical gardens; *ex situ*, seed gene banks, *in vitro* gene banks, DNA storage, restoration of endangered species, sustainable use and public participation.
6. India's plant biodiversity and its conservation, international efforts for conserving biodiversity.
7. Sustainable development: causes of unsustainability, ecological foot prints, threat to sustainable development, guiding principles of sustainable development, sustainable indicators, environmental sustainability index.
8. Sustainable development in India: perspectives and strategies, International programmes on sustainable development, ecological economics.

RECOMMENDED READINGS

1. Singh, J.S., Singh, S.P. and Gupta, S.R. (2006). Ecology, Environment and Resource Conservation, Anamaya Publishers, New Delhi.
2. Sharma, P.D. (2015). Ecology and Environment. Rastogi Publications, Meerut.
3. Santra, S.C. (2001). Environmental Science, New Central Book Agency, Calcutta.
4. Tiwari, S.C. (1992). Concept of Modern Ecology. Bishen Singh Mahendra Pal Singh, Dehradun.
5. Smith, T.M. and Smith, R.L.(2008). Elements of Ecology. Pearson, New Delhi.
6. Begon, M. Colin, R.T. and John, L.H. (2006). Blackwell Publishing, Oxford.

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| NAME OF THE COURSE: M. Sc. (HONOURS IN BOTANY) (TWO YEAR COURSE) | | | | | | | |
| PART: I | SEMESTER: II | SESSION: 2018-19 & 2019-20 | | | | | |
| PAPER: FOREST BOTANY | | | | | | | 3 hrs. |
| PAPER CODE: MBOT-TP 206 | ELECTIVE | Theory | Internal | Total | L | T | Credits |
| MAXIMUM MARKS | | 66 | 24 | 90 | 3 | 1 | 3.5 |

Objective of the paper is to give knowledge to the students about the importance of forests, role of difference agencies dealing with forestry, forest laws, forest classification, forestry system, principal Indian timbers, forest utilization, forest management and forest pathology.

INSTRUCTIONS TO THE PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions each from the respective section of syllabus and will carry 10 marks each. Section C will consist of 13 short- answer type questions (8-10 lines) which will cover the entire syllabus uniformly and will carry 26 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

SECTION-A

1. Forests and Forestry: Introduction, Definition, Importance of forests in man's life. Forest types of India. Role of FRI, NGT and MOEF & C. C. in Indian Forestry, Forest Laws.
2. Forest areas, classification and surveys including a brief account of aerial photography interpretation and remote sensing and Geographic Informations Systems (GIS).
3. Forestry Systems: A brief account of Agroforestry, Social forestry, Farm Forestry, Productivity forestry and Commercial forestry.
4. Principal Indian timbers, their distribution, grading and uses of Teak, Sal, Shishum, Babul, Chir, Kail and Deodar. Wood structure, physical and mechanical properties of wood, wood seasoning.

SECTION-B

5. Forest Utilization: A brief account of non-wood forest products. Forest based industries with particular reference to paper and pulp, plywood, katha, Resins, Match sticks and sports goods.
6. Forest Management, deforestation, affortation. National Forest Policy, Joint forest managment, Village forest committees, Forest mensuration.
7. Silviculture and Silviculture systems, clear felling, uniform felling, shelter wood and coppice system; tending and regeneration.
8. Forest Pathology- a general account of different decay types, symptoms and management of important diseases of Sal, Shisham, Teak, Kiker, Deodar and Kail.

RECOMMENDED READINGS

1. Champion, H.G. and Seth, S. K. 1968. Revised Classification of Forest types in India. FRI Dehradun.
2. Pearson, R.H. and Brown, H.P. 1981. Commercial timbers of India (Vol. 1 & 2). A. J. Reprints Agency, New Delhi, India.
3. Puri, G.S. Indian Forest Ecology (Vol. 1 & 2). Oxford Books and Stationers, New Delhi.
4. Sageraiya, K. P. 1967. Forests and Forestry. National Book Trust India. National Book Trust, New Delhi, India.

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| NAME OF THE COURSE: M. Sc. (HONOURS IN BOTANY) (TWO YEAR COURSE) | | | |
| PART: I | SEMESTER: II | SESSION: 2018-19 & 2019-20 | |
| PRACTICAL PAPER: PERTAINING TO MBOT-TP 201 & 202 | | | |
| PAPER CODE: MBOT-PP 201 | CORE | MAXIMUM MARKS: 70 | CREDITS: 3.0 |

PTERIDOLOGY

1. Morphological study from show cases/museum jars/class work material of *Psilotum nudum*, *Tmesipteris tannensis*, *Lycopodium cernuum*, *L. clavatum*, *L. staceum*, *L. squarrosum*, *Phylloglossum drummondii*, *Azolla microphylla*, *A. pinnata*, *Selaginella monospora*, *S. bryopteris*, *S. chrysorrhizas*, *S. pallidissima*, *S. adunca*, *S. subdiaphana*, *Isoetes panchananii*, *I. indica*, *Equisetum debile*, *E. diffusum*, *E. ramosissimum*, *E. arvense*, *Marseilea*, *Salvinia*, *Regnellidium*, *Araistegia*, *Daplazium*, *Onychium contiguum*, *Polysticum settiferum*, *Osmunda regalius*, *O. clatiniana*, *Ophioglossum reticulatum*, *O. vulgatum*, *Botrychium lanuginosum*.
2. Section cutting: *Lycopodium*, *Equisetium*, *Sellaginella*, *Marsilea*, *Thelypteris*, *Pteris quadriaurita*, *Dicranopteris linearis* and *Angiopteris evecta*.
3. Study of fossil specimens of leaf impression of *Pecopteris phegopteroides*, *Dicksonia*, *phenophyllum speciosum*, *Gleichenia gleichenioides* and stem petrification of *Calamites*.

GYMNOSPERMS

1. Morphological studies from museum jars/shows cases of major genera of all the orders of Gymnosperms.
2. To cut and study T.S., T.L.S. & R.L.S. of wood of *Pinus*, *Cedrus*, *Taxus*, *Ginkgo*, *Gnetum* and stem of *Ephedra*.
3. To study wood elements by maceration of: *Pinus*, *Ephedra* and *Gnetum*.
4. To study the anatomical details of the leaf/leaflet of *Pinus*, *Cedrus*, *Podocarpus*, *Cupressus*, *Cryptomeria/Taxodium*, *Araucaria*, *Cycas*, *Ginkgo* and *Gnetum*.
5. To study male cones of *Pinus*, *Cedrus*, *Thuja*, *Cryptomeria*, *Podocarpus*, *Araucaria*, *Cycas*, *Zamia*, *Ginkgo*, *Ephedra* and *Gnetum*.
6. To Study of female cones of *Pinus*, *Cedrus*, *Abies*, *Picea*, *Thuja*, *Cupressus*, *Juniperus*, *Cryptomeria*, *Taxodium*, *Araucaria*, *Taxus*, *Ginkgo*, *Cycas*, *Zamia*, *Ephedra* and *Gnetum*.
7. Study of fossil Gymnosperms: Leaf impression of *Glossopteris*, *Pterophyllum*, *Ptilophyllum*, *Pecopteris*, *Sphenopteris*; Stem petrification of *Pentoxylon*, *Confieroxylon*, *Bucklanadia*, *Vertebraria*, wood petrification of *Cordaites*; Petrified reproductive structures - bisexual flower and female receptacle of *Cycadeoidea* and female cone of *Araucarites* and some seeds of Gymnosperms.
8. To study fossil slides of T.S. *Lygenodendron*, T.S. *Rachiopteris*, L.S. *Lygenostoma*, T.S. root of *Lygenopteris*, T.S. *Heterarangium* stem (young), T.L.S. *Cordaites* wood and V.S. *Cordaites* leaf.

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| NAME OF THE COURSE: M. Sc. (HONOURS IN BOTANY) (TWO YEAR COURSE) | | | |
| PART: I | SEMESTER: II | SESSION: 2018-19 & 2019-20 | |
| PRACTICAL PAPER: PERTAINING TO MBOT-TP 203, 204 & 205/206 | | | |
| PAPER CODE: MBOT-PP 202 | CORE & ELECTIVE | MAXIMUM MARKS: 105 | CREDITS: 4.5 |

CYTOGENETICS

1. Preparation of various stains for cytogenetic studies.
2. Preparation of different fixatives for cytogenetic studies.
3. Detailed study of meiosis in *Allium cepa*.
4. Detailed study of mitosis in *Allium* and *Vicia*.
5. Determination of chromosome number through meiosis in *Zea*, *Vicia*, *Chrysanthemum*, *Phlox*, *Tradescantia* and *Solanum*.
6. Analysis of Karyotype from given diagram.
7. Study of ploidy level in *Zea mays*.
8. Study of meiotic abnormalities like laggards, bridges, cytomixis, B-chromosomes, univalent/multivalent formation from permanent slides or microphotographs.
9. Calculations of gene frequencies in population.
10. Study of translocations in *Rhoeo*.
11. To study the pollen fertility using glyceracetocarmine and aniline blue.

MOLECULAR BIOLOGY

1. Numerical problems pertaining to epistasis.
2. Numerical problems pertaining to linkage and recombination.
3. Numerical problems pertaining to Gene mapping.
4. To deduce the sequence of polypeptide from given DNA sequences.
5. To deduce the change in polypeptide sequences due to various mutations in DNA sequences.
6. To isolate and purify DNA from given plant material.

PLANT NATURAL RESOURCES, CONSERVATION AND SUSTAINABLE DEVELOPMENT

1. To determine organic matter content in different soil samples.
2. Study of wood anatomy (T.S./T.L.S. and R.L.S.) of important timbers.
3. Study of vascular elements of soft and hard wood by maceration technique.
4. Anatomical identification of different types of wood: Soft and hard wood, porous and non-porous wood, ring porous and diffused porous wood.
5. To determine specific leaf area of terrestrial plants.
6. To determine leaf dry matter content of terrestrial plants.
7. To study phytogeographical regions of world from map.
8. To study biogeographical regions of India from map.
9. To study the botanical zones of India from map.
10. To study national parks, biosphere reserves and sanctuaries of India from map.

FOREST BOTANY

1. Study of wood anatomy (T.S./T.L.S. and R.L.S.) of important timbers.
2. Detailed study of different types of wood rots (Brown rot, White rot, Soft rot, root rot, etc.).
3. Study of vascular elements of soft and hard wood by maceration technique.
4. Anatomical identification of different types of wood: Soft and hard wood, porous and non-porous wood, ring porous and diffused porous wood.

Punjabi University, Patiala
DEPARTMENT OF BOTANY
PUNJABI UNIVERSITY, PATIALA

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|--|----------------------|---------------------------------------|-----------------|--------------|----------|----------|----------------|
| NAME OF THE COURSE: M.A./M. Sc. | | | | | | | |
| PART: I | SEMESTER: II | SESSION: 2018-19 & 2019-20 | | | | | |
| PAPER: PLANTS FOR HUMAN WELFARE (For those students who have not studied Biology at +2 level) | | | | | | | 3 hrs. |
| PAPER CODE: BOT-OE | OPEN ELECTIVE | Theory | Internal | Total | L | T | Credits |
| MAXIMUM MARKS | | 70 | 30 | 100 | 3 | - | 3.0 |

INSTRUCTIONS TO THE PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions each from the respective section of syllabus and will carry 10 marks each. Section C will consist of 15 short- answer type questions (8-10 lines) which will cover the entire syllabus uniformly and will carry 30 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

SECTION-A

1. Introduction to plant kingdom: General features of Algae, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms. Angiosperm diversity based on size, life span, habit and habitat. Brief account of plants and environment.
2. Morphology of root, stem and leaf: their characteristics, types, modifications and functions.
3. Morphology of flower and fruit: Inflorescence, Racemose, Cymose, Mixed types. Flower: floral phyllotaxy, calyx, corolla, stamens and carpel. Structure and types of fruit (Achenial, Capsular, Schizocarpic, Succulent and Aggregate and Composite), importance of fruits.
4. Common name, scientific name, family, season and area of cultivation, plant part used and economic importance of Cereal crops (Wheat, Rice & Maize) and Oil yielding crops (Mustard, Groundnut, Coconut & Sunflower).

SECTION-B

5. Common name, scientific name, family, season and area of cultivation, plant part used and economic importance of Spices and Condiments (Ginger, Turmeric, Coriander, Cumin, Fennel, Cardamom, Clove, Cinnamon, Nutmeg and Mace) and Medicinal plants (Mulathi, Ashwagandha, Tulsi, Aloe, Neem, Amla, Harar, Bahera & Genseng).
6. Name, family, area of cultivation, plant part used of vegetables: potato, sweet potato, colocasia, spinach, methi, brinjal, cauliflower, cucurbitaceous vegetables and ladyfinger; Fruits: apple, banana, guava, grapes, kinnow, mango, papaya and pear.
7. Common name, scientific name, family, season and area of cultivation, plant part used and economic importance of fibre yielding plants (Cotton, Jute and Sisal). Common name, scientific name, family, area of cultivation and economic importance of timber yielding plants (Shisham, Teak, Oak, Deodar & Pine).
8. Common name, scientific name, family, season and area of cultivation, plant part used and economic importance of Sugar crops (Sugarcane and Sugarbeet) and non-alcoholic beverages: Tea and Coffee.

SUGGESTIVE READING:

1. Khanna, S.K. 1996. Economic Botany. S. Vikas and Co., New Delhi.
2. Kochhar, S.L. 1998. Economic Botany in the Tropics, 2nd Edition, MacMillan Indian Ltd., New Delhi.
3. Plant Wealth of India 1997. Special Issue of Proceedings Indian National Science Academy B-63.
4. Sambamurty, A.V.S.S. and Subrahmanyam, N.S.1986. A Text Book of Economic Botany, Wiley Eastern Limited, New Delhi.
5. Saini, A. 2008. Ecology and Economic Botany. Trueman Book Company, Jalandhar.
6. Sharma, O.P. 1996. Hill's Economic Botany (Late Dr. A.F. Hill, adapted by O.P. Sharma), Tata McGraw Hill Co., Ltd., New Delhi.
7. Srivastava, H.N. 2007. Ecology and Utilization of plants. Pradeep Publications, Jalandhar.
8. Thakur, R.S., Puri, H.S. and Jussain, A. 1989. Major Medicinal Plants of India. Central Institute of Medicinal and Aromatic Plants, CSIR, Lucknow.