Syllabus for

M.Sc. Botany

(Under Choice Based Credit with

Continuous Evaluation Grading System)

(SEMESTER: I– II)

Examinations: 2019-20

Kanya Maha Vidyalaya, Jalandhar

(Autonomous)

The Heritage Institution

M.Sc. Botany (Session 2019-20)

Semester-I									
Course Code	**Course Type**	**Course Title**	**Hours/ Week**	**Credits L-T-P**	**Marks**				**Examination time (in Hours)**
					Total	**Ext.**		**CA**	
						L	**P**		
MBTL-1071	C	Fungi and Plant Pathology	3	3-0-0	50	40	-	10	3
MBTL-1072	C	Phycology	3	3-0-0	50	40	-	10	3
MBTL-1073	C	Plant Physiology	3	3-0-0	50	40	-	10	3
MBTL-1074	C	Genetics and Evolution	3	3-0-0	50	40	-	10	3
MBTL-1335	C	Theoretical Biology	3	3-0-0	50	40	-	10	3
MBTM-1046	C	Computer Applications and Bioinformatics	4	2-0-1	50	30	10	10	3+3
MBTP-1077	C	Botany Practicals I (Based on MBTL-1071, MBTL-1072)	6	0-0-3	75	-	60	15	3
MBTP-1078	C	Botany Practicals II (Based on MBTL-1073, MBTL-1074)	6	0-0-3	75	-	60	15	3
		Total		**24**	**450**				

M.Sc. Botany(Session 2019-20)

Semester II									
Course Code	**Course Type**	**Course Title**	**Hours/ week**	**Credits L-T-P**	**Marks**				**Examination time (in Hours)**
					Total	**Ext.**		**CA**	
						L	**P**		
MBTL-2071	C	Bryology	3	3-0-0	50	40	-	10	3
MBTL-2072	C	Pteridology	3	3-0-0	50	40	-	10	3
MBTL-2073	C	Diversity and Biology of Gymnosperms	3	3-0-0	50	40	-	10	3
MBTL-2074	C	General Microbiology	3	3-0-0	50	40	-	10	3
MBTL-2075	C	Cell Biology	3	3-0-0	50	40	-	10	3
MBTL-2076	C	Ecological Modelling and Forest Ecology	3	3-0-0	50	40		10	3
MBTP-2077	C	Botany Practicals I (Based on MBTL-2071 MBTL-2072 and MBTL-2073),	6	0-0-3	75	-	60	15	3
MBTP-2078	C	Botany Practicals II (Based onMBTL-2074, MBTL-2075 and MBTL-2076)	6	0-0-3	75	-	60	15	3
MBTV-2079	C	On Job Training or Assignment		Satisfactory/ Not Satisfactory					
		Total		**24**	**450**				

M.Sc. Botany (Semester-I) (Session 2019-20)

Program Specific Outcomes

PSO1. Understand the nature and basic concepts of cell biology, biochemistry, taxonomy and ecology.

PSO2. Analyze the relationships among animals, plants and microbes.

PSO3. Perform procedures as per laboratory standards in the areas of biochemistry, bioinformatics, taxonomy, economic botany and ecology.

PSO4. Apply the knowledge of basic science, life sciences and fundamental process of plants to study and analyze any plant form.

PO5. Identify the taxonomic position of plants, formulate the research literature, and analyze non reported plants with substantiated conclusions using first principles and methods of nomenclature and classification in Botany.

M.Sc. Botany (Semester-I) (Session 2019-20)

MBTL-1071 – Fungi and Plant Pathology

Course outcomes

After passing this course the student will be able to

CO: 1 Explain sources of diversity in the fungal kingdom
CO: 2 To understand the major virulence mechanisms that phytopathogens employ to colonize plants.
CO: 3 Develop an appreciation for the strategies that can be employed to incorporate disease resistance in crop plants.

M.Sc. Botany (Semester-I) (Session 2019-20)

MBTL-1071 Fungi and Plant Pathology

Credits: 3-0-0 **Max. Marks- 50**
Time: 3 hrs
Theory - 40
CA – 10

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four sections (A-D). Questions of section (A-D) should be set from Unit (I-IV) of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT-I

History, classification, study of structure, development, reproduction, life history of the following

- **GYMNOMYCOTA** (i) Acrasiomycetes - a general account (ii) Protosteliomycetes - a general account Myxomycetes: *Stemonitis*
- **MASTIGOMYCOTA** Haplomastigomycotina Chytridiomycetes: *Chytriomyces, Allomyces* Hyphochytridiomycetes: *Rhizidiomyces* Plasmodiophromycetes: *Plasmodiophora Diplomastigomycotina* (i) Oomycetes: *Lagenidium*, *Saprolegnia*, and *Achlya*
- **AMASTIGOMYCOTA** Zygomycotina (i) Zygomycetes : *Entomophthora* and *Pilobolus* (ii) Trichomycetes – a general account
- History, classification, study of structure, development, reproduction, life history of the following:
  AMASTIGOMYCOTA Ascomycotina (Ascomycetes) (i) Hemiascomycetidae: *Protomyces* and*Taphrina* (ii) Piectomycetidae : *Talaromyces* (iii) Pyrenomycetidae: *Melanospora* and *Nectria*. (iv) Discomycetidae; *Monilinia* and *Morchella* (v) Laboulbeniomycetidae : *Laboulbenia* (vi) Loculoascomycetidae : *Mycospharella* and *Venturia.*

UNIT-II

Basidiomycotina (Basidiomycetes) (i) Teliomycetidae : *Melampsora*, *Ustilago* and *Tilletia* (ii) Holobasidiomycetidae-I (Hymenomycetes): Polyporus and Exobasidium. (iii) Holobasidiomycetidae-II (Gasteromycetes): *Scleroderma*, *Clavatia* and *Nidularia*.
(Deuteromycetes) Hyphomycetidae: *Stibella Rhizoctonia* and *Sclerotium* Blastomycetidae: *Sporobolomyces* and *Cryptococcus*.
Principles and methods for the prevention and control for plant diseases, modelling and disease forecasting, plant quarantine, defense mechanisms of plants against pathogens, plant disease clinics, prediction of disease control decisions.

UNIT-III

Symptomatology: Identification, etiology and control measures of the following plant disease:

Fungal Diseases: Potato wart, damping-off diseases, Blight of colocasia, peach leaf curl, apple scab. Wilt of cotton and arhar, Anthracnose disease of chillies, Late blight of potato, Early blight of potato, Stem rust of wheat, Loose smut of wheat, Karnal bunt of rice, powdery mildew of bajra, White rust of crucifers, Tikka disease of groundnut.
Bacterial Diseases: Bacterial leaf blight of rice, ring rot of potato, citrus canker, brown rot of potato, tundu disease of wheat.
Viral Diseases: Papaya leaf curl, leaf curl of tomato and bunchy top of banana

UNIT-IV

Sex hormones in fungi, Heterothallism in Basidiomycetes, hyterokaryosis, parasexual cycle **Mycorrhizae** in agriculture and plant growth, Biological control and concept of mycoherbicides. Important contributions of the following mycologists/microbiologists: E.J.Butler, K.C. Mehta, B.B. Mundkur, Robert Koch, Alexander Flemming, S.A. Waksman, W.M. Stanley and Christian Gram. Important mycological and plant pathological journals and institutes.

Books Recommended

1. Agrios, G.N. (2005). Plant Pathology. 5th edition, Academic Press, New York.
2. Ainsworth, G. C. (2008). Ainsworth & Bisby's dictionary of the fungi. 10th edition, Cabi.
3. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. (2007). Introductory Mycology. 4th edition, John Wiley and sons, INC, New York.
4. Aneja, K.R. and Mehrotra, R.S. (2015). An Introduction to Mycology. 2nd edition, New Age International Private limited, New Delhi.
5. Carlile, M. J., Watkinson, S. C. and Gooday, G. W. (2001). The fungi. Gulf Professional Publishing.
6. Dube, H. C. (2013). An Introduction to Fungi, 4th Edition, Scientific Publisher, India
7. Mehrotra, R.S. (2017). Plant Pathology. 3rd edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
8. Vashista, B.R. and Sinha, A.K. (2008) Botany for degree students-Fungi. S. Chand and Company Ltd, New Delhi-pp 1-752.
9. Webster, J. and Weber, R. W. S. (2007). Introduction to Fungi. Cambridge University Press, Cambridge, London.

M.Sc. Botany (Semester-I) (Session 2019-20)

MBTL-1072 Phycology

Course Outcomes

After passing this course the student will be able to

1. Identify and classify different species of algae.
2. Have an overview of the biology of algae.
3. Use the study of algae to provide a basis for understanding the evolutionary pathways to higher plants.
4. Understand the role of algae in various environments as primary producers, suppliers of nutrition and resources for humans.

M.Sc. Botany (Semester-I) (Session 2019-20)

Phycology

MBTL-1072

Credits: 3-0-0

Max. Marks- 50
Time: 3 hrs
Theory - 40
CA – 10

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four sections (A-D). Questions of section (A-D) should be set from Unit (I-IV) of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT-I

Habitat and habit, Comparative account of important system of classification (Fritsch F.E.1937 and Lee R.E.2008).Organization of thallus, structure of algal cell, algal pigments and photosynthetic apparatus. Algal flagella food reserves,

UNIT-II

Comparative account of, reproductive diversity, life history patterns, nutrition, origin & evolution of sex in algae Chlorophyta (*Volvox*, *Hydrodictyon*, *Cladophora*, *Fritschiella*, *Oedogonium*, *Zygnema, Chara*). Xanthophyta (*Vaucheria).*

UNIT-III

Phaeophyta (*Ectocarpus*, *Laminaria, Dictyota*, *Fucus*), Rhodophyta (*Porphyra*, *Batrochospermum*, *Polysiphonia*).

UNIT-IV

Cyanophyta (*Nostoc*, *Oscillitoria, Rivularia, Stigonema*). Rhythms and bioluminescence in Dinoflagellates,. economic importance of algae, bacterial and fungal pathogens of algae, algae as indicators of water pollution and algal blooms.

M.Sc. Botany (Semester-I) (Session 2019-20)

Books Recommended

1. Ahluwalia, A.S. (Ed.) (2003). Phycology. Daya Publishing House, New Delhi-110035
2. Anderson, R.A. (2005). Algal Culturing techniques. Physiological society of America. Elseview Academic Press, USA.
3. Barsanti, L. and Gualtieri, P. (2014) Algae: Anatomy, Biochemistry, and Biotechnology 2nd Edition, CRC press
4. Fritsch, F.E. (1979) The structure and reproduction of algae (Vol.I and II). Vikas Publishers House Pvt. Ltd., New Delhi.
5. Kumar. H. D. (2017) Introductory Phycology, 2nd edition, East – West Press Pvt. Ltd. New Delhi.
6. Lee, R. E. (2018). Phycology. 5th edition, Cambridge University Press.
7. Vashishta, B. R., Singh, V. P. and Sinha, A. K. (2012) Botany for Degree Students – Algae S. Chand Publishing, New Delhi, India

M.Sc. Botany (Semester-I) (Session 2019-20)

MBTL1073– Plant Physiology

Course outcomes:

After passing this course the student will be able to:

1. Understand the relationship between structure and function as it relates to plant macromolecules, cells, and tissues.
2. Understand the interaction between the environment , plant growth and development
3. Gain an appreciation of the metabolic and physiological processes unique to plant
4. Acquire a comprehension of plant biology from the sub cellular to the organism level.

M.Sc. Botany (Semester-I) (Session 2019-20)

MBTL-1073 Plant Physiology

Credits: 3-0-0 **Max. Marks- 50**
Time: 3 hrs
Theory - 40
CA – 10

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four sections (A-D). Questions of section (A-D) should be set from Unit (I-IV) of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT-I

Properties of water, soil-plant, water relations kinetic theory, chemical and potential gradients, Raolt's Laws, rate of diffusion free energy of water, atmospheric H2O, measurement of water potential components.

Energy metabolism (concept of the energy), thermodynamic principles in biology, energy rich bonds, weak interactions, coupled reactions and oxidative phosphorylations, group transfers, biological energy transducers, bioenergetics.

UNIT-II

Signal transduction: Overview, receptors and G-proteins, phospholipid signalling, role of cyclic nucleotides, calcium-calmodulin cascade, diversity in protein kinases and phosphatases, specific signalling mechanisms e.g. two-component sensor-regulator system in bacteria and plants, sucrose-sensing mechanism.

UNIT-III

Nitrogen Metabolism: Introduction, Overview of nitrogen in the biosphere and in plants, Overview of nitrogen fixation, Enzymology of nitrogen fixation, symbiotic nitrogen fixation, Ammonia uptake and transport, Overview of nitrate uptake and reduction, Nitrate reduction, Interaction between nitrate assimilation and carbon metabolism.

UNIT-IV

Sulphur Metabolism: Overview of sulphate assimilation, Sulphur chemistry and function, Sulphur uptake and transport, the reductive sulphate assimilation pathway, Synthesis and function of glutathione and its derivatives.

M.Sc. Botany (Semester-I) (Session 2019-20)

Books Recommended

1. Buchann, B.B.,Gruissen, W.,and Jones, R.L(2010). Biochemistry and molecular biology of plants. American society of plant physiologists, Maryland.USA
2. Nobel, P.S. (2009). Physiochemical and Enviornmental Plant Physiology. Academic press, San Diego.U.S.A
3. Pandey, S. N. and Sinha, B. K. (2005). Plant Physiology, 4th edition, Vikas Publication House Pvt Ltd
4. Scott,P. (2008). Physiology and Behaviour of Plants. John Wiley and Sons Ltd. England.
5. Stewart, S.and Globig, S. (2011). Plant Physiology. Apple Academic Press Inc., Canada.
6. Taiz, L., and Zeiger, E. (2010). Plant Physiology. Sinauer Associates, Inc., Publishers, Massachusetts.
7. William, G., Hopkins and Norman P.A., Huner (2008). Plant Physiology. John Wiley & Sons. Inc. USA
8. Salisbury, B., Frank and Ross, W., Cleon (2004). Plants Physiology. Wadsworth ,U.S.A

M.Sc. Botany (Semester-I) (Session 2019-20)

MBTL-1074– Genetics and Evolution

Course Outcomes

After passing this course the student will be able to

1. Understand chemical basis of heredity.
2. Understand genetic methodology and how quantification of heritable traits in families and populations provides insight into cellular and molecular mechanisms.
3. Understand the effect of broad societal issues including health and disease, food and natural resources, environmental sustainability etc.
4. Understand the role of genetic mechanisms in evolution.

M.Sc. Botany (Semester-I) (Session 2019-20)

Genetics and Evolution

MBTL-1074

Credits: 3-0-0 **Max. Marks- 50**
Time: 3 hrs
Theory - 40
CA – 10

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four sections (A-D). Questions of section (A-D) should be set from Unit (I-IV) of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT-I

Fine Structure of Gene: Classical versus molecular concept of the gene, the cis-trans complementation for functional allelism, limitation of cis -trans test, fine structure of phage T4 II Locus; fine structures of gene and "Complex loci" in eukaryotes, genes within genes in phage ϕX124, over-lapping genes; concept of split gene; pseudogenes, nucleotide sequences.

Genetic Material: - Properties and replication, proof that the genetic information is stored in DNA, the Watson - Crick Model, the double helix, alternate forms of double helix, DNA replication, initiation and primer problem, complex replication apparatus, rolling circle replication of phage ϕX124.

UNIT-II

Genetic regulation of cell cycle, homologous chromosomes, polytene and Lampbrush chromosomes. Oncogenes, biochemistry and molecular biology of cancer, genetic disorders, Correlation between mutagenicity and carcinogenecity.

Mutations: Definition, types, detection in bacteria, Neurospora, maize and Drosphila; molecular basis of mutations; induced mutations (radiation and chemical mutagenesis), DNA repair mechanisms, DNA recombination mechanism, mutagen dosage.

UNIT-III

Transposable Genetic Elements: introduction, transposable elements in bacteria (Is elements, Tn 3 family), transposable elements in eukaryotes "Yeast Ty elements", maize transposons, Drosophila tranposons, significance of transposable elements. Somatic Crossing Over: Molecular mechanism of crossing over, gene conversion, ordered and unordered tetrad analysis, somatic cell hybridization.

Regulation of Gene Expression in Prokaryotes: The Operon model, lac, an inducible operon, trp, a repressible operon, positive control of the lac operon by CAP and CAMP, complex regulation of ara operon, attenuation.

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UNIT-IV

Polyploids: Inheritance pattern in autopolyploids (chromosome and chromatid segregation), diplodization, role of polyploidy in evolution.

Paleontology and Evolutionary History: The evolutionary time scale; eras, periods and epoch; major events in the evolutionary time scale; origins of unicellular and multicellular organisms; major groups of plants and animals; stages in primate evolution including Homo.

Organic evolution: Review of theories of evolution. Hardy-Weinberg law, speciation, modes of speciation (gradual and abrupt).

Books Recommended

1. Brown, T.A. (2017). Genomes 4, 4th edition, Garland Science, United States.
2. Griffiths, A. J., Wessler, S. R., Lewontin, R. C., Gelbart, W. M., Suzuki, D. T., & Miller, J. H. (2005). An introduction to genetic analysis. Macmillan. Freeman and Company, USA.
3. Hawley R.S. and Walker, M. Y. (2003) Advanced Genetics analysis-Finding meaning in Genome. Blackwell Publishing, USA.
4. Klug W. S., Cummings, M. R., Spencer, C. A. and Palladino M. A. (2015). Concepts of Genetics. 11th edition, Pearson Education, London, England.
5. Krebs, J. E., Goldstein, E. S., & Kilpatrick, S. T. (2017). Lewin's GENES XII. Jones & Bartlett Learning. Burlington, Massachusetts.
6. Simmons, M. J., & Snustad, D. P. (2006). Principles of genetics. John Wiley & Sons.
7. Smith, J.M. (1998). Evolutionary Genetics. 2nd edition, Oxford University Press.
8. Watson, J. D. (2004). Molecular biology of the gene. Pearson Education India.

M.Sc. Botany (Semester-I) (Session 2019-20)

MBTL-1075 – Theoretical Biology

Course Outcomes

After passing this course the student will be able to

1. Formulate discrete and differential equation models that represent a range of biological problems, including identifying assumptions that are appropriate for the problem to be solved.
2. Choose and apply computational tools to perform parameter estimation and to solve discrete and differential equation models.
3. Interpret model and data output in terms of the original biological problem, and use results to direct a follow-up experiment.
4. Perform appropriate data manipulations, and graphically display model output and data clearly and accurately.

M.Sc. Botany (Semester-I) (Session 2019-20)

MBTL-1335 Theoretical Biology

Credits: 3-0-0 **Max. Marks- 50**
Time: 3 hrs
Theory - 40
CA – 10

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four sections (A-D). Questions of section (A-D) should be set from Unit (I-IV) of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT-I

1. **Linear Function:** y=ax and y=ax+b
2. **Power Function:** $y=ax^n$, quadratic equation.
3. **Periodic Function:** Sine and cosine, trigonometric relations.

UNIT-II

4. **Exponential and Logarithmic Functions:** Exponential function $y=aq^x$, logarithmic function.$d/dx(e^x)$, d/dx(ln x), integral of 1/x.
5. **Integration:** Integrals, definite integral, rules of integration, second derivative.

UNIT-III

6. **Probability:** Concept of probability, permutations and combinations, normal distribution.
7. **Differentiation and Integration:** Limit Growth rates, instantaneous rate of change, differentiation ofsome important functions, product rule and quotient rule of differentiation, chain rule of differentiation.

UNIT-IV

8. **Statistics:** Mean, standard deviation, standard error,'t' test, chi square test.
9. One way ANOVA, simple linear regression and correlation.

Books Recommended

1. Batschelet, E. (1971). Introduction to Mathematics for Life Scientists. Springer-Verlag, Berlin. 2nd edition
2. Britton, N. F. (2012). Essential mathematical biology. Springer Science & Business Media.
3. Begon, M. Harper, J.L. and Townsend, C.R. (1996). Ecology, Blackwell Science, Cambridge. 6th edition
4. Chapman, J.L. and Reiss, M.J. (1988). Ecology: Principles and Applications. Cambridge University Press, Cambridge.
5. De, A.K. (1990). Environmental Chemistry. Wiley Eastern Pvt. Ltd., New Delhi. 6th edition
6. Heywood, V.H. and Watson, R.T. (1995). Global Biodiversity Assessment. Cambridge University Press, Cambridge.
7. Hill, M.K. (1997). Understanding Environmental Pollution. Cambridge University Press,Cambridge.
8. Krebs, C.J. (1989). Ecological Methodology. Harper and Row, New York, USA.)
9. Ludwig, J and Reynolds, J.F. (1988). Statistical Ecology. John Wiley & Sons, New York.
10. Murray, J. D. (2002). Mathematical Biology I. An Introduction. Springer-Verlag New York

M.Sc. Botany (Semester-I) (Session 2019-20)

MBTM-1046 Computer Applications and Bioinformatics

Course outcomes

After passing this course the student will be able to

1. Apply knowledge and awareness of the basic principles and concepts of biology, computer science and bioinformatics
2. Use existing software effectively to extract information from large databases and to use this information in computer modeling
3. Develop problem-solving skills, including the ability to develop new algorithms and analysis methods
4. Develop an understanding of the intersection of life and information sciences, the core of shared concepts, language and skills the ability to speak the language of structure-function relationships, information theory, gene expression, and database queries

M.Sc. Botany (Semester-I) (Session 2019-20)

MBTM-1046 Computer Applications and Bioinformatics

Credits: 2-0-1 **Max. Marks- 50**
Time: 3 hrs
Theory – 30
Practical -10
CA – 10

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four sections (A-D). Questions of section (A-D) should be set from Unit (I-IV) of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT-I

Overview of word processing software, creating, saving and opening a new file in MS-Word, various formatting tools, paragraphs and sections, indents and outdents, creating lists and numbering, types of lists, Headings, styles, fonts and font size. Editing, positioning and viewing texts, Finding and replacing text, inserting page breaks, page numbers, book marks, symbols and dates, Inserting header, footer

UNIT-II

Worksheet: Introduction to worksheet, worksheet basics, building a worksheet, moving within worksheet, entering data into worksheet, saving & quitting worksheet, opening and moving around in an existing worksheet,

Working with Formulae: cell referencing, use of formulae, auto sum, copying formulae, absolute & relative addressing, working with ranges- creating, editing and selecting ranges,

Previewing & Printing Worksheet: page setting, print titles, adjusting margins, page break, headers and footers. Graphs and Charts: using wizards, various charts type, formatting grid lines & legends, previewing & printing charts.

UNIT-III

Introduction to MS Power Point, presentation overview, power point elements, exploring power point Menu, entering information, presentation creation.Opening and saving presentation, slide view, slide sorter view, Notes view, outline view, Printing Slides, formatting and enhancing text formatting.

Introduction to Bioinformatics, History of Bioinformatics, milestones, objectives and applications of Bioinformatics. Introduction to Biological Databases, Types of Databases, Literature Databases: PUBMED, PUBMED Central, European PUBMED Central

M.Sc. Botany (Semester-I) (Session 2019-20)

UNIT-IV

Nucleic acid and protein databases: GenBank, EMBL, DDBJ, SWISSPROT, UNIPROT. Database Retrieval and Deposition Systems: SRS, Entrez, Bankit, Seqin, Webin. Biotechnological Databases: EST, SNP. Databases for species identification and classification: GBIF, taxonomy browser at NCBI. Plant Genome Databases: TAIR, Rice Genome Annotation Project, Maize GDB. Structural Databases: PDB, NDB. Carbohydrates and lipid databases: GlycoSuite DB, LIPIDAT

Books Recommended

1. Baxevais, B.F. and Quellette, F. (2004). Bioinformatics A Practical Guide to the Analysis of Genes and Proteins. Wiley-Interscience.
2. Bourhe, P. E. and Weissig, H. (2003). Structural Bioinformatics (Methods of Structural Analysis). Wiley-Liss.
3. Eidhammer, I., Jonassen, I. and Taylor, W. R. (2004). Protein Bioinformatics: An Algorithmic Approach to Sequence and Structure Analysis. Mathematics.
4. Mount, D. W. (2004). Bioinformatics & Genome Analysis. Cold Spring Harbor Laboratory Press.
5. Norton, P. (1998). Introduction to computers, Tata McGraw-Hill Publishing Company Limited, New Delhi
6. Orengo, C.A., Jones D.T. and Thornton J.M. (2003). Bioinformatics: Genes Proteins and Computers. Bios Scientific Pub.
7. Sinha, P.K. (1998). Computer Fundamentals. BPB Publications, New Delhi.
8. Xiong, J. (2013). Essential Bioinformatics. Cambridge University Press, New York, USA.

SUGGEESTED PRACTICALS

1. Introduction to MS Word.
2. Creating Table in MS Word.
3. Introduction to Page Formatting.
4. Printing in MS Word.
5. Page Layout.
6. Creating Slide Presentation in MS PowerPoint.
7. Viewing the Slideshow.
8. Adding Images in MS PowerPoint.
9. Inserting Sound and Videos in MS PowerPoint.
10. Introduction to MS Workbook.
11. Creating different worksheets in MS Excel.
12. Inserting Charts in MS Excel.
13. Introduction to various functions in MS Excel.
14. Literature Searching Using Pubmed
15. Downloading the nucleic and Protein Sequence using Biological sequence databases such as GenBank,EMBL,DDBJ,SWISSPROT,UNIPROT

M.Sc. Botany (Semester-I) (Session 2019-20)

Botany Practical I
(Based on MBTL-1071, MBTL-1072**)**

MBTP-1077
Credits: 3-0-0

Max. Marks- 75
Time: 6.0 hrs
Practical - 60
CA – 15

Suggested Practical's

Based on MBTL-1071:

1. Principles & working of instruments in the Mycology & Plant Pathology laboratory.
2. Characterization of disease symptoms and identification of pathogenic organisms (stem rust of wheat, damping off disease, white rust of crucifers, early and late blight of potato, loose smut of wheat, wilt of cotton, tikka disease of groundnut, citrus canker, leaf curl of papaya, yellow vein mosaic of bhindi, red rot of sugarcane, anthrocnose of chillies.)
3. To study type genus *Eurotium*, *Mucor*, *Peziza*, *Geastrum*, *Nidularia*, *Lycoperdon*, *Morchella*, *Agaricus*.
4. Comparative biochemical and physiological observations of healthy and infected leaves.
5. Ocular micrometry of spores of pathogenic fungi.
6. Obsevations on rhizosphere of infected plants.
7. Modelling for disease forecasting.
8. Studies on different defense mechanism adopted by plants against pathogenic attack.
9. Measurement of radial growth of fungi in petriplates.

Based on MBTL-1072:

10. Sectioning and permanent mounting of thalli of various species of Cyanophyta, Chlorophyta, Charophyta, Phaeophyta, Rhodophyta.
11. Study of diversity of freshwater and sewage water algae.
12. Preparation of synthetic media and cultivation of algae
13. Interpretation of electron micrograph of some algae.
14. Biochemical analysis of pigments present available in algal species
15. Studies on habit and habitat of various algae
16. Estimation of total carbohydrates from fresh water algae.

M.Sc. Botany (Semester-I) (Session 2019-20)

Botany Practical II
(Based on MBTL-1073, MBTL-1074**)**

MBTP-1078
Credits: 3-0-0

Max. Marks- 75
Time: 6.0 hrs
Practical - 60
CA – 15

Suggested Practicals

Based on MBTL-1073

1. Study on principles of pH meter, spectroscopy.
2. Studies on preparation of various concentrations of solutions.
3. Permeability observations on plasma membrane using different concentrations of organic solvents.
4. Effect of temperature on permeability of plasma membrane.
5. Preparation of standard curve of protein (e.g. BSA) and determine the protein content in unknown samples.
6. Estimation of activity of enzyme catalase.
7. Estimation the activity of enzyme glutathione reductase.
8. Determination of osmotic potential of vacuolar sap by plasmolytic method.
9. Determination of the water potential of any tuber by constant weight method.
10. Determination of the water potential of any tuber by Chardakov's dye method.
11. Separation of amino acids in a mixture by paper chromatography and their identification by comparison with standards.

Based on MBTL-1074:

12. Learning the cytogenetics laboratory-methods of microscopy, fixation, staining and dehydration
13. Meiotic and mitotic studies in *Allium cepa*
14. Polyploidy induction methods in laboratory organisms-treatment with colchicine
15. Studies on chromosomal aberrations in *Allium cepa*-using DDT and other pesticides
16. DNA isolation, purity and quantitative estimations.
17. Gel Scoring and data analysis
18. Demonstration of principles of Genetics in *Pisum sativum*
19. Numerical exercises on pedigree analysis, gene interactions, population genetics, chi-square & probability
20. Morphological observations in chromosomes- study on polytenic chromosomes of *Drosophila*.
21. Karyotypic analysis of laboratory organisms - *Allium cepa, Vicia faba, Drosophila*
22. Studies of human karyotyes and genetic diseases associated.
23. Demonstration of Hardy-Weinberg Law using pea seeds.

M.Sc. Botany (Semester-II) (Session 2019-20)

MBTL-2071- Bryology

Course outcomes

After passing this course the student will be able to

1. Understand the main characteristics of bryophytes.
2. Identify and classify different species of bryophytes.
3. Describe the distinguishing traits of liverworts, hornworts, and mosses.
4. Understand land adaptations in the bryophytes.
5. Describe the events in the bryophyte lifecycle.

M.Sc. Botany (Semester-II) (Session 2019-20)

MBTL-2071 Bryology

Credits: 3-0-0 **Max. Marks- 50**
Time: 3 hrs
Theory - 40
CA – 10

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four sections (A-D). Questions of section (A-D) should be set from Unit (I-IV) of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT-I

Habitat and habit and distribution of Bryophytes, origin of bryophytes (including fossil records), primitive Vs advanced/derived characters, economic importance

UNIT-II

Comparative morphological account of gametophytes and sporophytes and life cycle of Marchantiales (*Riccia, Marchantia,Tarigonia,Cyathodium,Lunularia*) Sphaerocarpales (*Sphaerocarpus*) Calobryales Jungermanniales (*Porella*) Metzgeriales (*Pellia*) Anthocerotales (*Anthoceros*) Sphagnales (*Sphagnum*) Andreaealas (*Andrea*) Bryales (*Funaria*)

UNIT-III

Origin of land habit, Evolution of gametophyte and sporogonium in liverworts and mosses (taking examples of above mentioned orders)

UNIT-IV

Means of spore dispersal, peristomal teeth in mosses, palynology of Bryophytes, method to conserve Bryophytes at national level. Morphogenetic changes in moss protonema, characteristic endohydric, ectohydric, myxohydric bryophytes

Books Recommended

1. Campbell, D.R. (1985). The Evolution of Land Plants (Embryophyta) Reprinted Central Book Depot, Allahabad
2. Goffinet, B. and Shaw, A.J. (2008) Bryophyte Biology, 2nd edition, Cambridge University Press, Cambridge, pp. 476
3. Willis, K., & McElwain, J. (2014). The evolution of plants. Oxford University Press.
4. Stewart, W.N. (1983). Palaeobotany and Evolution of Plants. Cambridge University Press,London.
5. Taylor, T.N. (1981). Palaeobotany. An Introduction to Fossil Plant Biology, McGraw Hill Book Company, New York.
6. Vanderpoorten, A., & Goffinet, B. (2009). Introduction to bryophytes. Cambridge University Press.

M.Sc. Botany (Semester-II) (Session 2019-20)

MBTL-2072- Pteridology

Course outcomes

After passing this course the student will be able to

1. Comprehend taxonomic and biologic features of Pteridophyta.
2. Understand taxonomic and biologic features of Pteridophyta.
3. Understand land adaptations of Pteridophyta.

M.Sc. Botany (Semester-II) (Session 2019-20)

Pteridology

MBTL-2072

Credits: 3-0-0 **Max. Marks- 50**
Time: 3 hrs
Theory - 40
CA – 10

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four sections (A-D). Questions of section (A-D) should be set from Unit (I-IV) of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT-I

Origin of land floras, differentiation of organs in vascular plants – telome and enation theories, significance and short comings. Monophyletic vs polyphyletic origin of pteridophytes, pteridophytic life cycle with reference to alternation of generations, homologous and the antithetic theories of the origin of the sporophyte.

UNIT-II

General characters and classification of pteridophytes, occurrence, comparative organography, systematics, reproduction and types of life cycle in: Psilophytales (*Psilophytum*) Rhyniales,(*Rhynia*) Psilotales, (*Psilotum*). Lycopodiales, (*Lycopodium*,) Selaginallales (*Selaginella*)

UNIT-III

Equisetales (*Equisetum*) Ophioglossales, (*Ophioglossum*) Marattiales, (*Marattia*) Filicales (*Pteris*, *Dryopteris*) Marsileales (*Marsilea*) Salviniales.(*Salvinia*, *Azolla*). Evolutionary trends in pteridophytes, prothallial evolution, organization and evolution of sorus in ferns.

UNIT-IV

Apomictic life cycle, apogamy, apospory, heterospory and seed habit. Spore structure, pattern of spore germination in ferns, Role of polyploidy and hybridization in speciation in ferns, Utility of ferns for phytoremediation.

Books Recommended

1. Parihar, N.S. (1992). The Biology and Morphology of Pteridophytes, Central Book
2. Rashid, A. (1999). An Introduction to Pteridophyta. 2nd edition, South Asia Books
3. Sporne, K.R. (1962). Morphology of Pteridophytes, BI Publications, New Delhi.
4. Stewart, W.N. (1983). Palaeobotany and Evolution of Plants. Cambridge University Press,London.
5. Vashishta P.C. (2010). Botany: For Degree Students: Pteridophyta. 2nd edition, S Chand & Company, New Delhi, India.

M.Sc. Botany (Semester-II) (Session 2019-20)

MBTL-2073 – Diversity and Biology of Gymnosperms

Course outcomes

After passing this course the student will be able to

1. Describe general characters of gymnosperms.
2. Identify and classify different species of gymnosperm.
3. Understand the origin of gymnosperms and their distribution on earth surface.

M.Sc. Botany (Semester-II) (Session 2019-20)

MBTL-2073 Diversity and Biology of Gymnosperms

Credits: 3-0-0 **Max. Marks- 50**
Time: 3 hrs
Theory - 40
CA – 10

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four sections (A-D). Questions of section (A-D) should be set from Unit (I-IV) of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT-I

Gymnosperms, the first seed plants, diversity of structure and complexity. Classification of gymnosperms and their distribution in India and in the globe in time and space. Geological time scale and important geological formations in India

UNIT-II

Morphology, general account, structure and reproduction of Progymnosperms (aneurophytales, archeopteridales etc.): Cycadofilicales, Glossopteridales, Pentoxylales, Cordaitales,

UNIT-III

Morphology, general account, structure and reproduction of Cycadeoidales Cycadales. Ginkgoales, Coniferales, Taxales, Ephedrales, Welwitschiales and Gnetales.

UNIT-IV

Evolutionary tendencies in gymnosperm organography and life cycle with particular reference to male and female sporophylls, cones, ovules, pollination mechanisms, seeds and archegonia. cytology of Gymnosperms, general survey of the cytology of gymnosperms.

Books Recommended

1. Bhatnagar, S.P., and Moitra, A. (1996). Gymnosperms. New age International, Private Limited.
2. Biswas, C. and Johri, B.M. (1997). Gymnosperms. Narosa Publishing House, New Delhi.
3. Rothwell, G.W. The Role of Comparative Morphology and Anatomy in Interpreting the Systematics of Fossil Gymnosperms, Bot. Rev., 51: 318-327, 1985.
4. Sharma, O.P. (2017). Gymnosperms. XIV edition, Pragati Prakashan, Meerut, India.
5. Sporne, K.R. The Morphology of Gymnosperms, B. I. Publications, Delhi, 1974.
6. Vashishta, P. C., Sinha, A. K. and Kumar, A. (2013). Botany for Degree Students-Gymnosperms, S. Chand & Company Ltd., New Delhi, India.

M.Sc. Botany (Semester-II) (Session 2019-20)

MBTL-2074– General Microbiology

Course outcomes

After passing this course the student will be able to

1. Learn about classification, characteristics, ultra structure of Prokaryotic and Eukaryotic microbes
2. Know about organisms and causal factors responsible for plant diseases & methods of studying plant diseases
3. Familiarize with some common plant diseases of India
4. Gain knowledge on host parasite interaction process

M.Sc. Botany (Semester-II) (Session 2019-20)

MBTL-2074 General Microbiology

Credits: 3-0-0 **Max. Marks- 50**
Time: 3 hrs
Theory - 40
CA – 10

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four sections (A-D). Questions of section (A-D) should be set from Unit (I-IV) of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT-I

Methods in Microbiology: Basic principles of microscopy, micrometry, staining, sterlization methods; culture media, pure culture methods. 2. Classification of bacteria, (Bergey's system) characteristics ofeach group, Nutrition of bacteria, nature of virulence, toxins and extracellular enzymes of pathogenetic bacteria, conjugaton, transformation and transduction.

UNIT-II

Nomenclature and classification of plant viruses, transmission of plant viruses with control measures, Viroids and origin of viruses, morphology and nature of virus particles, infection and replication with reference to TMV and bacteriophage, viral disease with special reference to encephalitis, hepatitis, AIDS, rabies, foot and mouth disease.

UNIT-III

Environmental Microbiology: Sewage (waste water) treatment : Ecological impact of raw sewage on receiving water, public health impact of raw sewage discharge. Primary, Secondary and tertiary waste water treatments. Total coliform bacteria analysis, Fecal coliform bacteria analysis in drinking water. Landfills, composting. Bioremediation: Biodegradative organisms, advantages of bioremediations, problem associated with bioremediation, methodology of bioremediation. Aeromicrobiology: Important airborne plant, animal and human pathogens, important airborne toxins, nature of bioaerosols aeromicrobiological pathways, sampling devices for the collection of bioaerosols.

UNIT-IV

Industrial Microbiology: The Microbe: Primary and secondary metabolites, major industrial products: foods, flavouring agents and food supplement, vitamins and beverages; organic acids; enzymes and microbial transformation; inhibitors; genetically engineered microorganisms – Human insulin and human growth hormones and vaccines Control of Microorganisms by Physical and Chemical Means: Fundamentals of control, physical agents, high temperature, low temperature, desiccation, osmotic pressure, radiation, surface tension and interfacial tension,

filtration, characterisation of an ideal antimicrobial chemical agent, selection of a chemical agent for practical application, major groups of antimicrobial agents.

Books Recommended

1. Cowan, M. K. (2018). Microbiology: a systems approach. McGraw-Hill.
2. Pelczar M. J., Chan E. C. S. and Krieg N. R. (2001). Microbiology. 5th edition. McGraw Hill Book Company.
3. Stanier, R. Y., Ingraham, J. L., Wheelis, M. L., and Painter, P. R. (2005). General Microbiology. 5th edition. McMillan.
4. Tortora, G. J., Funke, B. R. and Case, C. L. (2008). Microbiology: An Introduction. 9th edition. Pearson Education.
5. Willey J. M., Sherwood, L. M., and Woolverton, C. J. (2008). Prescott, Harley and Klein's Microbiology. 7th edition. McGraw Hill Higher Education.

M.Sc. Botany (Semester-II) (Session 2019-20)

MBTL-2075– Cell Biology

Course outcomes

After passing this course the student will be able to

1. Learn about structural organization and function of intracellular organelles.
2. Gain knowledge on the organization of genes and chromosomes.
3. Study about the structure of atoms, molecules and chemical bonds & Composition, structure and function of biomolecules.
4. Gain knowledge on cellular communication & cell signaling

M.Sc. Botany (Semester-II) (Session 2019-20)

MBTL-2075 Cell Biology

Credits: 3-0-0 **Max. Marks- 50**
Time: 3 hrs
Theory - 40
CA – 10

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four sections (A-D). Questions of section (A-D) should be set from Unit (I-IV) of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT-I

Levels of Structural Organization: Unicellular, colonial and multicellular forms; levels of organization of tissues, organs and systems; comparative anatomy. Membrane Structure and Function: Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, ion pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes.

UNIT-II

Structural Organization and Function of Cell wall and Intracellular Organelles: nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility. Organization of Genes and Chromosomes: Operon, interrupted genes, gene families, structure of chromatin and chromosomes, unique and repetitive DNA, heterochromatin, euchromatin, transposons

UNIT-III

Cell division and Cell Cycle: Mitosis and meiosis, their regulation, steps in cell cycle, and control of cell cycle. Microbial Physiology: Growth, yield and characteristics, strategies of cell division, stress response Cell Signaling: Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways

UNIT-IV

Bacterial and plant two-component signaling systems, bacterial chemotaxis and quorum sensing. Cellular communication: Regulation of hematopoiesis, general principles of cell communication, cell adhesionand roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation.

Books Recommended

1. Alberts, B., Bray, D., Hopkin, K., Johnson, A. D., Lewis, J., Raff, M. and Walter, P. (2013). Essential cell biology. Garland Science.
2. Becker, W.M., Kleinsmith, L.J. and Hardin, J. (2000). The World of the Cell. The Benjamin/Cummings Publishing Company.
3. Clark, D. P. (2009). Molecular Biology: Academic Cell Update Edition. Academic Press.
4. Cooper, G.M. (2000). The Cell – A Molecular Approach. ASM Press, Washington, D.C.
5. Karp, G., Iwasa, J. and Marshall, W. (2015). Cell and Molecular Biology: Concepts and Experiments. 8th edition. John Wiley & Sons Inc., New York.
6. Karp, G., Iwasa, J. and Marshall, W. (2018). Karp's Cell Biology Global Edition. John Wiley & Sons Inc., New York.
7. Lodish, H., Darnell, J. E., Berk, A., Kaiser, C. A., Krieger, M., Scott, M. P. and Matsudaira, P. (2008). Molecular cell biology. Macmillan.
8. Pollard, T.D. and Ernshaw, W.C. (2002). Cell Biology. Elsevier Science (USA)

M.Sc. Botany (Semester-II) (Session 2019-20)

MBTL-2076 – Ecological Modelling and Forest Ecology

Course outcomes

After passing this course the student will be able to

1. Understand the importance of Ecological models in simulating and analyzing the long-term dynamics and stability properties of complex ecological systems.
2. Integrat information from different disciplines.
3. Understand different Environmental Law & Policy.
4. Understand the distribution of vegetation with respect to environment.

M.Sc. Botany (Semester-II) (Session 2019-20)

Ecological Modelling and Forest Ecology

MBTL-2076
Credits: 3-0-0

Max. Marks- 50
Time: 3 hrs
Theory - 40
CA – 10

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four sections (A-D). Questions of section (A-D) should be set from Unit (I-IV) of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT-I

Exponential Population Growth: Differential equations, finite rate of increase, intrinsic rate of natural increase, stable age distribution, matrix model for population growth. Logistic Population Growth: Differential model for population growth in limited environment. Interaction Between Two Species: Competition – Differential equations, Leslie-Gower Model, Lotka-Volterra model for predator – prey interaction, Leslie model, simple epidemics

UNIT-II

Association Analysis and Community Classification: Chi square, Cole's measures and point correlationcoefficient for association,continuum concept. Species Diversity: Species area relationships, species abundance relationships – information measures of diversity. Brillouin's measure, Shannon-Weaver measure, Simpson's measure. Extinction and formation of single populations, McArthur – Wilson theoryof biogeography

UNIT-III

Production and Energy Flow: Production in animal populations, efficiency, measurement of ingestion. measurement of production in plants, litter decomposition. Forest types, climatic region of India, Central, characters and distribution of different forest type of India, Salient features of Indian forest act 1972, different methods employed for conservation of forest, Social and urban forest

UNIT-IV

Environmental Law & Policy: Constitutional provisions, Water (prevention and control of pollution) Act, 1974, Air (prevention and control of pollution) Act, 1981, Environment Protection Act, 1986, Forest (Conservation) Act, 1980, Wildlife (Protection) Act, 1972, the concept of biosphere reserves, International environmental perspectives

Books Recommended

1. Barbour, M.G., Burk, J.H. and Pitts, W.D. (1998). Terrestrial Plan Ecology, 3rd edition, Benjamin/Cummings Publication Company, California.
2. Begon, M., Townsend, C. R., & Harper, J. L. (2006). Ecology: from individuals to ecosystems (No. Sirsi) i9781405111171).
3. Chapman, J.L. and Reiss, M.J. (1998). Ecology: Principles and Applications, 2nd edition, Cambridge University Press, Cambridge.
4. De, A.K. (1990). Environmental Chemistry. Wiley Eastern Pvt. Ltd., New Delhi.
5. Hapke, A. (2017). Forest Ecology. Callisto Reference
6. Hill, M.K. (1997). Understanding Environmental Pollution. Cambridge University Press, Cambridge.
7. Kimmins, J. P. (2004). Forest Ecology: A foundation for sustainable forest management and environmental ethics in forestry. Prentice Hall.
8. Kormondy, E.J. (1996). Concepts of Ecology. 4th edition, Prentice Hall of India Pvt. Ltd., New Delhi.
9. Schulze, E-D., Beck**,** E. and Müller-Hohenstein, K. (2005) Plant Ecology. Springer-Verlag Berlin Heidelberg

M.Sc. Botany (Semester-II) (Session 2019-20)

Botany Practical I

(Based on MBTL-2071, MBTL-2072 and MBTL-2073)

MBTP-2077
Credits: 3-0-0

Max. Marks- 75
Time: 6.0 hrs
Practical - 60
CA – 15

Suggested Practical's

Based on MBTL-2071:

1. Morphological, reproductive and anatomical study of representative members of the bryophytes studied in theory using cleared whole mount preparation and sectioning (*Riccia, Marchantia, Porella, Pellia, Funaria, Sphagnum, Polytrichum*).
2. Studies on habit and natural habitat of bryophytes
3. Study of Peristomal teeth (WM)
4. Study of Scales, rhizoids (WM)
5. Study of dehiscence pattern of sporogonium

Based on MBTL-2072:

6. Morphological, reproductive and anatomical study of representative members of the pteridophytes studied in theory using cleared whole mount preparation and sectioning (*Selaginella, Lycopodium, Equisetum, Pteris, Dryopteris, Marselia, Salvinia*)
7. Studies on habit and natural habitat of pteridophytes
8. Study of spore morphology
9. Study of spore germination on Knop's medium

Based on MBTL-2073:

10. Study of morphology, structure and reproduction in *Cycas, Pinus, Cedrus, Ginkgo, Ephedra, Taxus, Podocarpus, Gnetum*
11. Study of fossils: *Williamsonia*
12. Understanding wood anatomy using T.S, T.L.S and R.L.S in *Pinus* and *Cedrus*
13. Study of secondary growth in stem and root

M.Sc. Botany (Semester-II) (Session 2019-20)

Botany Practical II

(Based on MBTL-2074, MBTL-2075 and MBTL-2076)

MBTP-2078
Credits: 3-0-0

Max. Marks- 75
Time: 6.0 hrs
Practical - 60
CA – 15

Suggested Practical's

Based on MBTL-2074:

1. Acquaintance with working, principle, parts and precautions of most commonly used instruments in a microbiology lab.
2. Calibration of microscope: determination of dimensions of microorganisms.
3. Acclimatization with aseptic techniques-sterilisation, preparation and cultivation media for bacteria.
4. To prepare temporary and permanent cotton plugs.
5. To prepare solid and liquid culture media.
6. To culture or cultivate bacteria.
7. To stain and study bacteria.
8. To measure bacterial cells through ocular micrometry.
9. Microscopic examination of milk and curd.
10. To isolate micro-organisms from mixed culture and grow a pure culture.
11. Isolation of microbes from soil sample by streaking method.
12. Isolation of micro organisms from given water sample by serial dilution.
13. Methylene blue reduction test for examining the microbial activity of milk.
14. To study radial growth of fungi on nutrient media.
15. To determine antibiotic staining of bacterial strain.
16. Demonstration of Lambert Beer's law by colorimeter.

Based on MBTL-2075:

17. Understanding the cytology laboratory- components of compound/electron microscope.
18. Examination of electron micrographs of eukaryotic cells with special reference to organelles.
19. Examination of various stages of mitosis and meiosis using appropriate plants material (e.g. onion root tips, onion flower buds).
20. Calculation of Mitotic and meiotic index from dividing root tip cells and pollen grains.
21. Study on cyclosis in *Tradescantia* and *Hydrilla* leaves.
22. Observations on Barr bodies in Squamous epithelium.
23. Preparation of Feulgen stained chromosomes in root tip cells.
24. Effect of colchicine on chromosome movements during mitosis.
25. Use of fluorescent dye to visualise cell components.

Based on MBTL-2076:

26. To determine minimum size and number of quadrats required for reliable estimate of biomass in grassland.
27. To find out association between grassland species using chi square test.
28. To analyse plant communities using Bray-Curtis ordination method.
29. To determine soil moisture content, porosity, bulk density of different soil samples collected from different locations.
30. To study chlorophyll content of SO_2 fumigated and unfumigated plant leaves.
31. To determine Na, K concentration of water sample using flame photometer.
32. To determine water holding capacity of different soil samples.
33. To determine per cent organic Carbon and organic matter in different soil samples.
34. To estimate chlorophyll content in SO_2fumigated and unfumigated plant leaves.
35. To estimate rate of CO_2 evolution from different soil using soda lime or alkali absorption method.
36. To determine sulphate content of water samples.
37. To determine O_2 content of water samples.