FACULTY OF LIFE SCIENCES

SYLLABUS

Of

Botany For

M.Sc. Botany (Semester I - IV)

(Under Continuous Evaluation System)

Session: 2020-21

The Heritage Institution

KANYA MAHA VIDYALAYA JALANDHAR (Autonomous)

KanyaMahaVidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATIONS OF TWO YEAR DEGREE PROGRAMME

Master of Science in Botany Semester I

Session-2020-21

Course Code	Course Type	Course Title	Hours/ Week	Marks				Examination time (in Hours)
				Total	Ext.		CA	
					L	P		
MBTL-1071	C	Fungi and Plant Pathology	3	50	40	-	10	3
MBTL-1072	C	Phycology	3	50	40	-	10	3
MBTL-1073	C	Plant Physiology	3	50	40	-	10	3
MBTL-1074	C	Genetics and Evolution	3	50	40	-	10	3
MBTL-1335	C	Theoretical Biology	3	50	40	-	10	3
MBTL-1046	C	Computer Applications and Bioinformatics	3	50	40	-	10	3
MBTP-1077	C	Botany Practicals I	6	75	-	60	15	3
MBTP-1078	C	Botany Practicals II	6	75	-	60	15	3
		Total		450				

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATIONS OF TWO YEAR DEGREE PROGRAMME

Master of Science (Botany) Semester II

Session-2020-21

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

SCHEME AND CURRICULUM OF EXAMINATIONS OF TWO YEAR DEGREE PROGRAMME

Master of Science (Botany) Semester III

Session-2020-21

Course Code	Course Type	Course Title	Hours/ week	Marks				Examination time (in Hours)
				Total	Ext.		CA	
					L	P		
MBTL-3071	C	Developmental Botany	3	50	40	-	10	3
MBTL-3072	C	Plant Molecular Biology	3	50	40	-	10	3
MBTL-3073	C	Plant Breeding and IPR	3	50	40	-	10	3
MBTL-3074	C	Plant Biochemistry	3	50	40	-	10	3
MBTL-3075	C	Applied Botany	3	50	40	-	10	3
MBTL-3076	C	Plant Morphogenesis	3	50	40		10	3
MBTP-3077	C	Botany Practicals I	6	75	-	60	15	3
MBTP-3078	C	Botany Practicals II	6	75	-	60	15	3
		Total		**450**				

Kanya Maha Vidyalaya, Jalandhar

SCHEME AND CURRICULUM OF EXAMINATIONS OF TWO YEAR DEGREE PROGRAMME

Master of Science (Botany) Semester IV

Session-2020-21

Course Code	Course Type	Course Title	Hours/ week	Marks				Examination time (in Hours)
				Total	Ext.		CA	
					L	P		
MBTL-4071	C	Plant Anatomy	3	50	40	-	10	3
MBTL-4072	C	Structure and Metabolism of Plant Hormones	3	50	40	-	10	3
MBTL-4073	C	Plant Tissue Culture and Biotechnology	3	50	40	-	10	3
MBTL-4074	C	Analytical Techniques	3	50	40	-	10	3
MBTL-4075	C	Diversity and Biology of Angiosperms	3	50	40	-	10	3
MBTL-4076(A)	C	Hazardous Chemicals (Optional Paper)	3	50	40		10	3
MBTL-4076(B)	C	Immunology (Optional Paper)	3	50	40		10	3
MBTP-4077	C	Botany Practicals I	6	75	-	60	15	3
MBTP-4078	C	Botany Practicals II	4	75	-	60	15	3
MBTP-4079(A)	C	Field Study	Satisfactory/ Not Satisfactory					
MBTP-4079(B)	C	Research Techniques	3	Satisfactory/ Not Satisfactory				
		Total		**450**				

SEMESTER – I

Master of Science in Botany

Session 2020-21

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 Science and fundamental process of plants to study and analyze any plant form.

PSO5. 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.

Master of Science in Botany Semester-I

Session 2020-21

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.

Master of Science in Botany Semester-I

Session 2020-21

MBTL-1071 **Fungi and Plant Pathology**

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

Instructions for the Paper Setters:

Eight questions of equal marks (i.e. eight marks each) 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
  (iii)Myxomycetes: *Stemonitis*
- **MASTIGOMYCOTA**

1.Haplomastigomycotina
  (i) Chytridiomycetes: *Chytriomyces*, *Allomyces;* (ii) Hyphochytridiomycetes: *Rhizidiomyces*
  (iii) Plasmodiophromycetes: *Plasmodiophora*

2. Diplomastigomycotina(i) Oomycetes: *Pythium*, *Saprolegnia*, and *Achlya*

- **AMASTIGOMYCOTA** Zygomycotina (i) Zygomycetes: *Entomophthora* and *Pilobolus*
  (ii) Trichomycetes – a general account.

UNIT-II

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

AMASTIGOMYCOTA Ascomycotina (Ascomycetes)
(i) Hemiascomycetidae: *Protomyces*
(ii) Piectomycetidae: *Talaromyces*
(iii) Pyrenomycetidae: *Melanospora* and *Nectria*.
(iv) Discomycetidae:*Morchella*
(v) Laboulbeniomycetidae: *Laboulbenia*
vi) Loculoascomycetidae: *Mycospharella*

Basidiomycotina(Basidiomycetes)
(i) Teliomycetidae: *Ustilago*and *Puccinia*
(ii) Holobasidiomycetidae-I (Hymenomycetes): *Polyporus* and *Exobasidium*.
(iii) Holobasidiomycetidae-II (Gasteromycetes): *Lycoperdon*.

(**Deuteromycetes**) (i) Hyphomycetidae: *Alternaria, Cercospora and Rhizoctonia*
(ii) Blastomycetidae: *Sporobolomyces* and *Cryptococcus*.

Master of Science in Botany Semester-I

Session 2020-21

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 wheat, 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

Principles and methods for the prevention and control for plant diseases, toxins and enzymes in plant diseases, defence mechanisms of plants against pathogens, Genetics of plant pathogen interaction.
Sex hormones in fungi, Heterothallism, heterokaryosis, parasexual cycle. Mycorrhizaein 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.

Master of Science in Botany Semester-I

Session 2020-21

MBTL-1072 Phycology

Course Outcomes

After passing this course the student will be able to:

CO:1 Identify and classify different species of algae.

CO:2 Have an overview of the biology of algae.

CO:3 Use the study of algae to provide a basis for understanding the evolutionary pathways to higher plants.

CO:4 Understand the role of algae in various environments as primary producers, suppliers of nutrition and resources for humans.

Master of Science in Botany Semester-I

Session 2020-21

Phycology

MBTL-1072

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

Instructions for the Paper Setters:

Eight questions of equal marks (i.e. eight marks each) 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.

Master of Science in Botany Semester-I

Session 2020-21

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

Master of Science in Botany Semester-I

Session 2020-21

MBTL-1073 Plant Physiology

Course outcomes

After passing this course the student will be able to:

CO: 1 Understand the relationship between structure and function as it relates to plant macromolecules, cells, and tissues.

CO: 2 Understand the interaction between the environment, plant growth and development

CO: 3 Gain an appreciation of the metabolic and physiological processes unique to plant

CO: 4 Acquire a comprehension of plant biology from the sub cellular to the organism level.

Master of Science in Botany Semester-I

Session 2020-21

Plant Physiology

MBTL-1073

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

Instructions for the Paper Setters:

Eight questions of equal marks (i.e. eight marks each) 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.

Master of Science in Botany Semester-I

Session 2020-21

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 Environmental 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

Master of Science in Botany Semester-I

Session 2020-21

MBTL-1074 Genetics and Evolution

Course Outcomes

After passing this course the student will be able to

CO:1 Understand chemical basis of heredity.

CO:2 Understand genetic methodology and how quantification of heritable traits in families and populations provides insight into cellular and molecular mechanisms.

CO:3 Understand the effect of broad societal issues including health and disease, food and natural resources, environmental sustainability etc.

CO:4 Understand the role of genetic mechanisms in evolution.

Master of Science (Botany) Semester-I

Session 2020-21

Genetics and Evolution

MBTL-1074

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

Instructions for the Paper Setters:

Eight questions of equal marks (i.e. eight marks each) 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 gene, the cis-trans complementation for functional allelism; Mendelian Principles: Codominance, incomplete dominance, gene interactions, pleiotropy, penetrance, expressivity, fine structures of gene and "Complex loci" in eukaryotes, 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 ϕ X174.

UNIT-II

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 *Drosophila*; molecular basis of mutations; induced mutations (radiation and chemical mutagenesis), DNA repair mechanisms, DNA recombination mechanism.

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, attenuation.

Master of Science (Botany) Semester-I

Session 2020-21

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 Genetic 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. (2018). 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.

Master of Science in Botany Semester-I

Session 2020-21

MBTL-1075 – Theoretical Biology

Course Outcomes

After passing this course the student will be able to:

CO 1: Understand linear function, power function and periodic function.
CO 2: Recognize algebraic, exponential, logarithmic function and will come to know how to calculate their differentiation and apply derivatives of sum, difference, product and quotient of two functions.

CO 3: Recognize Integration as an inverse of differentiation and to calculate area under curve and understand integrals as limit of sum and its geometrical interpretation.

CO 4: Understand the concept of mathematical expectation and use it to find out the mean, variance, standard deviation, kurtosis etc. of normal probability distribution.

CO 5: Use Correlation to identify the strength and direction of a linear relationship between two variables and using Regression to predict how much a dependent variable changes based on adjustments to an independent variable and also apply Karl Pearson Correlation coefficient and Spearman's Rank Correlation and Least Square technique for Regression lines.

CO 6: Manage to solve problems using t and Chi-Square test.

Master of Science in Botany Semester-I

Session 2020-21

Theoretical Biology

MBTL- 1335

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

Instructions for the Paper Setters:

Eight questions of equal marks (08 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units 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. Question Paper must contain at least 35% of the theory from the prescribed books.

UNIT-I

Linear Function: y=ax and y=ax+b , Power Function: $y=ax^n$, Sine and cosine, trigonometric relations , Exponential and Logarithmic Functions: Exponential function $y=aq^x$, logarithmic function.

UNIT-II

Differentiation and Integration: differentiation of some important functions(Linear function, Power function , Logarithmic, Exponential, Trigonometric functions), product rule and quotient rule of differentiation, chain rule of differentiation , Integration: Rules of integration(Linear function, Power function, Logarithmic, Exponential, Trigonometric Functions), integration by substitution, integration of product of two functions

.

UNIT-III

Probability: Random experiment, sample space events, mathematical definition of probability, addition and multiplication law of probability.

UNIT-IV

Statistics: Mean, standard deviation, Normal Distribution, Simple linear regression and correlation, Hypothesis testing: Sample Statistics and parameters, standard error, Z-test, t-test as a test of single mean, chi square test as a goodness of fit and association of attributes (For uniformity, ratio and proportion)

Master of Science in Botany Semester-I

Session 2020-21

Text Books:

1. Hussain I. et. al. Mathematics, A textbook for class XI, NCERT.
2. Joshi, D.D. et. al. Mathematics, A textbook for class XII, NCERT.
3. S.C Gupta, V.K Kapoor Fundamentals of Mathematical Statistics

Reference Books:

1. Batschelet, E. (1971). Introduction to Mathematics for Life Scientists. Springer-Verlag, Berlin. 2nd edition
2. Ludwig, J and Reynolds, J.F. (1988). Statistical Ecology. John Wiley & Sons, New York.

Master of Science in Botany Semester-I

Session 2020-21

MBTL-1046 Computer Applications and Bioinformatics

Course outcomes

After passing this course the student will be able to apply:

CO1: Knowledge and awareness of the basic principles and concepts of biology, computer science and bioinformatics.

CO2: Existing software effectively to extract information from large databases and to use this information in computer modeling.

CO3: Problem-solving skills, including the ability to develop new algorithms and analysis methods.

CO4: 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.

Master of Science in Botany Semester-I

Session 2020-21

Computer Applications and Bioinformatics

MBTL - 1046

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

Instructions for the Paper Setters:

Eight questions of equal marks (i.e. eight marks each) 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 work sheet, 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

Master of Science in Botany Semester-I

Session 2020-21

UNIT-IV

Nucleic acidand 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: GlycoSuiteDB, 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. (2009). 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. Peter Norton's (2008). 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. (2004). Computer Fundamentals. BPB Publications, New Delhi.

Master of Science in Botany Semester-I

Session 2020-21

Botany Practicals I

(Based on MBTL-1071, MBTL-1072, MBTL-1335)

MBTP-1077

Course Outcomes:

After passing this course the student will be able to:

CO1: Characterize different disease symptoms of crop plants.

CO2: Identify pathogenic organisms responsible for plant diseases.

CO3: Perform different experiments on culturing of plant pathogens.

CO4: Understand different plant defence mechanisms against plant diseases.

CO5: Know about the history and time-scale of land plant evolution, and evaluation of the principal types of evidence underlying.

CO6: Understand algal diversity (incl. morphology, cell structure and level of organization) to phylum level, and their association as lichens.

Master of Science in Botany Semester-I

Session 2020-21

Botany Practicals I

(Based on MBTL-1071, MBTL-1072, MBTL-1335)

MBTP-1077

Time: 6 hrs **Max. Marks- 75**
Practical - 60
CA – 15

Suggested Practicals

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.

Master of Science in Botany Semester-I

Session 2020-21

Botany Practicals II

(Based on MBTL-1073, MBTL-1074, MBTL-1046)

MBTP-1078

Course outcomes:

After passing this course the student will be able to:

CO1: understand the lab structure of cytogenetics.

CO2: perform the different types of cell division in various plants.

CO3: perform the molecular level of practicals like DNA isolation.

CO4: understand the morphology of various chromosomes and karyotype analysis.

CO5: Understand Water relation of plants with respect to various physiological processes.

CO6: Interpret the Biological nitrogen fixation in metabolism.

Master of Science in Botany Semester-I

Session 2020-21

Botany Practicals II

(Based on MBTL-1073, MBTL-1074, MBTL-1046)

MBTP-1078

Time: 6 hrs **Max. Marks- 75**
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 *Alliumcepa*
14. Polyploidy induction methods in laboratory organisms-treatment with colchicine
15. Studies on chromosomal aberrations in *Alliumcepa*-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 *Pisumsativum*
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-*Alliumcepa*, *Viciafaba*, *Drosophila*
22. Studies of human karyotyes and genetic diseases associated.
23. Demonstration of Hardy-Weinberg Law using pea seeds.

Master of Science in Botany Semester-I

Session 2020-21

Based on MBTL-1046:

- **Introduction to MS Word:**

1)Creating Table in MS Word
2)Introduction to Page Formatting
3)Printing in MS Word
4) Page Layout
5) Inserting Header and Footers.

- **Introduction to PowerPoint:**

1) Creating Slide Presentation in MS PowerPoint
2) Viewing the Slideshow
3) Adding Images in MS PowerPoint
4) Inserting Sound and Videos in MS PowerPoint
5) Formatting and Enhancing text.

- **Introduction to MS Workbook:**

1) Creating different worksheets in MS Excel
2) Inserting Charts in MS Excel
3) Introduction to various functions in MS Excel
4) Previewing and printing workbook.

- **Literature Searching Using Pubmed**
- **Downloading the nucleic and Protein Sequence using Biological sequence**.

SEMESTER – II

Master of Science (Botany) Semester-II

Session 2020-21

MBTL-2071- Bryology

Course outcomes

After passing this course the student will be able to:

CO1: Understand the main characteristics of bryophytes.

CO2: Identify and classify different species of bryophytes.

CO3: Describe the distinguishing traits of liverworts, hornworts, and mosses.

CO4: Understand land adaptations in the bryophytes.

CO5: Describe the events in the bryophyte lifecycle.

Master of Science (Botany) Semester-II

Session 2020-21

Bryology

MBTL – 2071 **Max. Marks- 50**
Time: 3 hrs **Theory - 40**
CA – 10

Instructions for the Paper Setters:

Eight questions of equal marks (i.e. eight marks each)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*, *Targionia*, *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

Master of Science (Botany) Semester-II

Session 2020-21

Suggested readings:

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. and 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. and Goffinet, B. (2009). Introduction to Bryophytes. Cambridge University Press.

Master of Science (Botany) Semester-II

Session 2020-21

MBTL-2072- Pteridology

Course outcomes

After passing this course the student will be able to:

CO1: Comprehend taxonomic and biological features of Pteridophyta.

CO2: Understand taxonomic and biological features of Pteridophyta.

CO3: Understand land adaptations of Pteridophyta.

Master of Science (Botany) Semester-II

Session 2020-21

Pteridology

MBTL-2072 **Max. Marks-50**
Time: 3hrs **Theory-40**
CA-10

Instructions for the Paper Setters:

Eight questions of equal marks(i.e. eight marks each) 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.

Master of Science (Botany) Semester-II

Session 2020-21

Suggested readings:

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.

Master of Science (Botany) Semester-II

Session 2020-21

MBTL-2073 – Diversity and Biology of Gymnosperms

Course outcomes

After passing this course the student will be able to:

CO1: Describe general characters of gymnosperms.

CO2: Identify and classify different species of gymnosperm.

CO3: Understand the origin of gymnosperms and their distribution on earth surface.

Master of Science (Botany) Semester-II

Session 2020-21

Diversity and Biology of Gymnosperms

MBTL-2073 **Max. Marks-50**
Time: 3hrs **Theory-40**
CA-10

Instructions for the Paper Setters:

Eight questions of equal marks(i.e. eight marks each) 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.

Master of Science (Botany) Semester-II

Session 2020-21

Suggested readings:

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.

Master of Science (Botany) Semester-II

Session 2020-21

MBTL-2074– General Microbiology

Course outcomes

After passing this course the student will be able to:

CO1: Learn about classification, characteristics, ultrastructure of Prokaryotic and Eukaryotic microbes

CO2: Know about organisms and causal factors responsible for plant diseases & methods of studying plant diseases

CO3: Familiarize with some common plant diseases of India

CO4: Gain knowledge on host parasite interaction process

Master of Science (Botany) Semester-II

Session 2020-21

General Microbiology

MBTL-2074 **Max. Marks-50**
Time: 3hrs **Theory-40**
CA-10

Instructions for the Paper Setters:

Eight questions of equal marks (i.e. eight marks each)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, sterilization methods; culture media, pure culture methods. 2. Classification of bacteria, (Bergey's system) characteristics of each group, Nutrition of bacteria, nature of virulence, toxins and extracellular enzymes of pathogenic bacteria, conjugation, 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, characterization of an ideal antimicrobial chemical agent, selection of a chemical agent for practical application, major groups of antimicrobial agents.

Suggested readings:

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.

Master of Science (Botany) Semester-II

Session 2020-21

MBTL-2075– Cell Biology

Course outcomes

After passing this course the student will be able to:

CO1: Learn about structural organization and function of intracellular organelles.

CO2: Gain knowledge on the organization of genes and chromosomes.

CO3: Study about the structure of atoms, molecules and chemical bonds & Composition, structure and function of biomolecules.

CO4: Gain knowledge on cellular communication & cell signaling

Master of Science (Botany) Semester-II

Session 2020-21

Cell Biology

MBTL-2075 **Max. Marks-50**
Time: 3hrs **Theory-40**
CA-10

Instructions for the Paper Setters:

Eight questions of equal marks (i.e. eight marks each)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 adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation.

Master of Science (Botany) Semester-II

Session 2020-21

Suggested readings:

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)

Master of Science (Botany) Semester-II

Session 2020-21

MBTL-2076 – Ecological Modelling and Forest Ecology

Course outcomes:

After passing this course the student will be able to:

CO1: Understand the importance of Ecological models in simulating and analyzing the long-term dynamics and stability properties of complex ecological systems.

CO2: Integrate information from different disciplines.

CO3: Understand different Environmental Law & Policy.

CO4: Understand the distribution of vegetation with respect to environment.

Master of Science (Botany) Semester-II

Session 2020-21

Ecological Modelling and Forest Ecology

MBTL-2076 **Max. Marks-50**
Time: 3hrs **Theory-40**
CA-10

Instructions for the Paper Setters:

Eight questions of equal marks (i.e. eight marks each)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: Chisquare, Cole's measures and point correlation coefficient 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 theory of 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.

Master of Science (Botany) Semester-II

Session 2020-21

Suggested readings:

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

Master of Science (Botany) Semester-II

Session 2020-21

Botany Practicals I

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

MBTL-2077 **Max. Marks-75**
Time: 6 hrs **Theory-60**
CA-15

Instructions for the paper setter: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Suggested Practicals

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.

Master of Science (Botany) Semester-II

Session 2020-21

Botany Practicals II

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

MBTL-2078 **Max. Marks-75**
Time: 6 hrs **Theory-60**
CA-15

Instructions for the paper setter: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Suggested Practicals

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-sterilization, 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 microorganisms 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 visualize 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 percent 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.

SEMESTER – III

Master of Science in Botany Semester-III

Session 2020-21

MBTL-3071- Developmental Botany

Course outcomes:

After passing this course the student will be able to:

CO1: Know the structure and development of monocot and dicot embryos.

CO2: Compare the function and morphology of pollen grains.

CO3: Understand different aspects of embryology.

CO4: Understand role of Embryology in Plant Breeding.

Master of Science in Botany Semester-III
Session 2020-21

Developmental Botany

MBTL-3071 **Max. Marks- 50**
Time: 3 hrs **Theory - 40**
CA – 10

Instructions for the Paper Setters:

Eight questions of equal marks (i.e. eight marks each) 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

Pollination:
Ultrastructural and histochemical details of style and stigma, self and interspecific incompatibility, significance of pollen-pistil interaction, role of pollen pistil interaction, role of pollen wall proteins and stigma surface proteins, barriers to fertilization, methods of overcoming incompatibilities, intra-ovarian pollination, in vitro pollination.

Unit-II

Fertilization:
Heterospermy, differential behaviour of male gametes, discharge and movement of sperms, syngamy and triple fusion, post fertilization metabolic and structural changes in embryo sac.
Endosperm:
Types, ultrastructure, cellularization in nuclear endosperm, endosperm haustoria, their extension and persistence, function, storage, metabolites, endosperm culture.

Unit-III

Embryo:
Polarization of zygote, embryogenic types, histology and organogenesis of dicotembryos, organless (undifferentiated) embryos, delayed and differentiation of embryo, structure, cytology and function of suspensor, physiological and morphogenetical relationship of endosperm and embryo, embryo culture for rescue of hybrid embryo. Polyembryony: Types, genetic and somatic, pollen embryos.
Apomixis:
Apospory, Parthenogenetic Development of Embryo, Importance. Seed: Growth and Development, Seed Appendages.

Master of Science in Botany Semester-III
Session 2020-21

Unit-IV

Embryology & Taxonomy:
Diagnostic embryological characters, Primitive and advanced characters, Role of embryology and palynology in taxonomy.
Role of Embryology in Plant Breeding:
Embryology of hybrids, disfunction of endosperm, arrested development of embryo.

Books Recommended

1. Bhojwani, S.S. and Bhatnagar, S.P. (1975). The Embryology of Angiosperms.Vikas Publishing House Pvt. Ltd, Delhi.
2. Dafni, A., Hesse, M., and Pacini, E. (2012). Pollen and pollination. Springer Science & Business Media.
3. Eames, A.J. (1961) Morphology of the Angiosperms. Tata McGraw Hill Publishing Co.Ltd. Bombay.
4. Grossniklaus. U. (2019). Plant Development and Evolution. Academic Press
5. Maheshwari, P. (1950), An Introduction to the Embryology of Angiosperms. Tata McGraw HillPublishing Company Ltd. Bombay – New Delhi.
6. Parihar NS (1993) An Introduction to Embryophyta: Vol I – Bryophyta, Vol II – Pteridophyta, Central Book Dept. Allahabad.
7. Raghavan, V. (2012). Developmental biology of flowering plants. Springer Science & Business Media.
8. Raghavan, V. (1997). Molecular embryology of flowering plants. Cambridge University Press.
9. Shivanna KR (2003) Pollen Biology and Biotechnology, Science Publisher
10. Sinnet, E.W. (1960), Plant Morphogenesis, McGraw Hill Book Company Inc., NewYork.
11. Timmermans M. C.P. (2010). Plant Development. Academic press.

Master of Science in Botany Semester-III
Session 2020-21

Plant Molecular Biology

MBTL – 3072

Course outcomes:

After passing this course the student will be able to:

CO1: exhibit a knowledge base in genetics, cell and molecular biology.

CO2: understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles.

CO3: Exhibit clear and concise communication of scientific data

CO4: understand different techniques related to molecular biology.

Master of Science in Botany Semester-III
Session 2020-21

Plant Molecular Biology

MBTL – 3072 **Max. Marks- 50**
Time: 3 hrs **Theory - 40**
CA – 10

Instructions for the Paper Setters:

Eight questions of equal marks (i.e. eight marks each) 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

The Law of DNA constancy and C-value paradox, DNA sequencing. Organization of transcriptional units; mechanism of transcription of prokaryotes and eukaryotes; RNA processing (capping polyadenylation, splicing, introns and exons); ribonucleo–proteins, structure of mRNA.

Unit-II

Recombinant DNA technology, host cell restriction, restriction endonucleases, DNA ligases, topoisomerases, gyrases and methylases. Cloning strategies, selection and screening of recombinant clones, genomic DNA and cDNA libraries, biological and physical containment of recombinant DNA clones. Agarose gel electrophoresis, Southern/Northern/ Western blotting.

Unit-III

Cloning vehicles, plasmids, bacteriophages, viruses, cosmids, Ti-plasmid, CaMv plasmid, construction of plasmid vectors, M13 vectors, their use in cloning and sequencing, expression vectors, lysogeny and lytic cycles in bacteriophages.

Unit-IV

Genetic colonization of plants by Agrobacterium infection and tumour growth, Ti – plasmids, neoplastic transformation of plant cells, organization of T-DNA, nucleotide sequences of T-DNA. PCR, DNA fingerprinting by RAPDs and RFLPs.

Genomics and proteomics: Genetics and physical mapping of genes, molecular markers for transgenic plants, artificial chromosomes, high throughput sequencing, genome projects, bioinformatics, functional genomics, microarrays, protein profiling and its significance.

Master of Science in Botany Semester-III
Session 2020-21

Books Recommended

1. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
2. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
3. Hackett PB, Fuchs JA & Messing JW. 1988. An Introduction to Recombinant DNATechnology - Basic Experiments in Gene Manipulation. 2nd Ed. Benjamin Publ. Co.
4. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition.John Wiley &Sons. Inc.
5. Sambrook J &Russel D. 2001. Molecular Cloning - a Laboratory Manual. 3rd Ed. Cold Spring Harbor Lab. Press.
6. Singh BD. 2005. Biotechnology, Expanding Horizons. Kalyani Publishers, Delhi
7. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., (2008)
8. Molecular Biology of the Gene (VI Edition.). Cold Spring Harbour Lab. Press, Pearson Pub.

Master of Science in Botany Semester-III
Session 2020-21

Plant Breeding and IPR

MBTL –3073
Course outcomes:

After passing this course the student will be able to:

CO1: Understand historical evolution of plant breeding and different centers of origin.

CO2: Understand sources and types of genetic variation and

explain their importance for plant improvement.

CO3: Describe methods that are used in plant breeding.

CO4: Understand IPR (Intellectual property right)

Master of Science in Botany Semester-III
Session 2020-21

Plant Breeding and IPR

MBTL – 3074 **Max. Marks- 50**
Time: 3 hrs **Theory - 40**
CA – 10

Instructions for the Paper Setters:

Eight questions of equal marks (i.e. eight marks each) 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

Primary and secondary centres of diversity, utilization of wild plants in crop improvement, introduction and domestication as methods of plant breeding.
Types and introduction, vegetative sexual and apomictic, their effects on generating and fixing genotypic variation, male sterility and self-incompatibility mechanisms.

Unit-II

Breeding systems of crop species; systems of mating in sexually reproducing species and their genetic consequences. Breeding methods for self and cross pollinated crops; pureline and mass selection, recurrent selection and clonal selection.
Hybridization in self and cross pollinated crops. Inbreeding depression and hybrid vigour, genetic and physiological basis of heterosis, hybrid varieties, synthetic and composite varieties.

Unit-III

Breeding for disease resistance, classification of resistance, responses of the host to pathogens, variability systems of pathogenic fungi, breeding disease resistant varieties; multiline varieties.
Heritability, genetic advance, correlation of characters, path analysis, multiple comparison test, discriminant function and cluster analysis.

Unit-IV

Mutations, aneuploidy and polyploidy as methods of plant improvement, interspecific and intergeneric hybrids, role of genetic engineering.
Intellectual Property Rights: (IPR/TRIPS), International Intellectual Property System; Plant Variety Protection; the regular patent systems, trade secrecy, biosafety; laws and conventions related to intellectual property rights.

Master of science in Botany Semester-III
Session 2020-21

Books Recommended

1. Agrawal, R.L. (1998). Fundamentals of Plant Breeding and Hybrid Seed Production Oxford and IBM Publ. Co. Pvt. Ltd., New Delhi.
2. Allard, R. W. (1981), Principles of Plant Breeding. John Wiley & Sons, N. York.
3. Anonymous (1997). National Gene Bank: Indian Heritage on Plant Genetic Resources(Booklet). National Bureau of Plant Genetic Resources, New Delhi.
4. Bhandari, M.M. (1974). Practicals in Plant Breeding.A Manual cum practical record. Oxford and IBH Publ. Co. New Delhi.
5. Chopra, V.L. (Ed.) (2018). Plant Breeding: Theory and Practice. Oxfordand IBH Publ. Co. Pvt. Ltd., New Delhi.
6. Gupta SK. 2005. Practical Plant Breeding. Agribios
7. Poehlman, J.M. and Sleper, D.A. (1995). Breeding Field Crops (4th Edition) Panima Publishing Corporation, New Delhi.
8. Priyadarshan, P.M. (2019). Plant Breeding: Classical to Modern. Springer Singapore
9. Raghuvanshi, R.K., Chauhan, A.K.S and Sidhigui, B.A. (1995). Practical Excercises in Cytology, Genetics, Plant Breeding and Biostatistics (1st Edition). CBS Publishers and Distributors, New Delhi.
10. Roy Darbeshwar (2000). Plant Breeding - Analysis and Exploitation of Variation. Narosa Publishing House, New Delhi.
11. Sharma A.K. and Sharma A. (1999). Plant Breeding. Lecture Notes on Patents November 1999). Technology Information, Forecasting and Assessment Council(TIFAC), Department of Science and Technology(DST), Technology Bhavan, New Mehrouli Road, New Delhi.
12. Sharma, J.R. (1994). Principles and Practice of Plant Breeding, Tata McGraw Hill Publ.Comp. Ltd., New Delhi.
13. Singh, B.D. (2005), Plant Breeding - Principles and Methods, Kalyani Publishers, Ludhiana.
14. Singh, S.and Pawar, I. S. 2006. Genetic Bases and Methods of Plant Breeding. CBS Publishers & Distributors
15. Stoskopf, N. C., Tomes, D. T., Christie, B. R., & Christie, B. R. (2019). Plant breeding: theory and practice. CRC Press.
16. Sundararaj, D.D. and Thulsidas G. (1993). Botany of Field Crops (2nd Edition), MacMillan India Ltd., New Delhi.
17. Vijendra Das L.D (1998). Plant Breeding. New Age International Publishers, New Delhi.

Master of Science in Botany Semester-III
Session 2020-21

Plant Biochemistry

MBTL – 3074

Course outcomes:

After passing this course the student will be able to:

CO1: Understand cellular chemistry, its plant specific components.

CO2: Understand metabolism of lipids and carbohydrates.

CO3: Describe structure, functions and the mechanisms of action of enzymes.

CO4: Learn kinetics of enzyme catalyzed reactions and enzyme inhibitory and regulatory process.

Master of Science in Botany Semester-III
Session 2020-21

Plant Biochemistry

MBTL – 3074 **Max. Marks- 50**
Time: 3 hrs **Theory - 40**
CA – 10

Instructions for the Paper Setters:

Eight questions of equal marks (i.e. eight marks each) 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

Cellular Chemistry: Covalent and non-covalent interactions, hydrogen bond, electrostatic interactions, hydrophobic interactions, Van der Walls forces and their significance, structure and properties of water and its biological significance, pH and its significance, pH scale, Handerson-Haselbach equation, buffers (inorganic and organic) and their importance, ATP-the energy currency, phosphorylation / dephosphorylation of proteins.

Unit-II

Metabolism of Carbohydrates: Overview of intermediary metabolism, carbohydrates and lipids of physiologic significance, glycolysis and oxidation of pyruvate, citric acid cycle, catabolism of acetyl- CoA, metabolism of glycogen, gluconeogenesis and control of the blood glucose, pentose phosphate pathway and other pathways of hexose metabolism like uronic acid fructose metabolism pathways.

Unit-III

Lipid Metabolism: Biosynthesis of fatty acids, oxidation of fatty acids, ketogenesis, metabolism of fatty acids, ketogenesis, metabolism of acylglycerols and sphingolipids, lipid transport and storage, cholesterol, synthesis, transport and excretion, integration of metabolism and provision of tissue fuels.

Unit-lV

Enzymology: Introduction to enzymology, history of enzymes, nomenclature and classification. Specificity of enzymes: group specificity, absolute specificity, stereochemical specificity. Mechanism of enzyme catalysis: Activation energy, Nature of active sites, enzyme-substrate complex, induced fit hypothesis, strain and distortion theory.

Enzyme Kinetics: Michaelis-Menton Equation, Lineweaver-Burk plot. Regulation of enzyme activity and concentration: Brief account of enzyme induction and repression, covalent modification, isoenzymes and allosteric enzymes

Master of Science in Botany Semester-III
Session 2020-21

Books Recommended

1. Bowsher, C., Steer, M., & Tobin, A. (2008). Plant biochemistry. Garland Science.
2. Buchanan, B. B., Gruissem, W., & Jones, R. L. (Eds.). (2015). Biochemistry and molecular biology of plants. John Wiley & Sons.
3. Heldt, H. W., andPiechulla, B. (2010). Plant biochemistry. Academic Press.
4. Lubert, S., Berg, J., Tymoczko, J, andGatto, G. (2019). Biochemistry, ninth edition. Macmillan Publishers.
5. Murray, R. K., Granner, D. K., Mayes, P. A., and Rodwell, V. W. (2014). Harper's illustrated biochemistry. Mcgraw-hill.
6. Nelson, D. L., Lehninger, A. L., and Cox, M. M. (2017). Lehninger principles of biochemistry. Seventh Edition. Macmillan.
7. Voet, D., Voet, J. G., & Pratt, C. W. (2018). Principles of biochemistry, 5th Edition, Global Edition. John Wiley & Sons.
8. Voet, D., Voet, J. G., & Pratt, C. W. (2016). Fundamentals of biochemistry: life at the molecular level. John Wiley & Sons.

Master of Science in Botany Semester-III

Applied Botany

MBTL – 3075

Course outcomes:

After passing this course the student will be able to:

CO1: demonstrate knowledge of the value of plants in our everyday lives

CO2: identify and describe the impact of economic botany on the environment and society.

CO3: understand commercial use of different forest products.

CO4: demonstrate the ability to interpret scientific data and employ critical thinking to solve problems in applied botany.

Master of Science in Botany Semester-III
Session 2020-21

Applied Botany

MBTL – 3075 **Max. Marks- 50**
Time: 3 hrs **Theory – 40**
CA – 10

Instructions for the Paper Setters:

Eight questions of equal marks (i.e. eight marks each) 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

Food Plants: History and nature of food plants, major and minor cereals, legumes and pulses, vegetables, fruits and nuts, vegetable oils and fats. Extraction of sugar from sugarcane. Flow diagram of the process with a critical study of the steps involved, problems faced by the sugar industry in India. By-products of sugar industry, distillation of alcohol and other products with special reference to distilleries in Punjab. Food adjuncts: Spices condiments and other flavouring agents, beverages, fumitory and masticatory materials; functional foods.

Unit-II

Forest Products: Wood & Oak, gums and resins, rubber, oils. Physical characteristics of Indian woods, methods of seasoning and chemical treatment of specialized use, fireproofing of the wood. Industrial manufacturing of packing material and plywood and the classifications of plywoods according to their use. Some important commercial woods: *Dalbergia spp., Shorea robusta, Tectona grandis, Cedrus deodara*, Bamboo-the 'greengold' of India. Essential oil yielding plants of India, their use in perfumery.

Unit-III

Industrial Plant Products: Fibre yielding plants, essential oils, fatty oil and waxes, tanning and dyeing materials, rubber and other latex yielding products, gums and resins, sugars, starches and other cellulose products. Manufacturing of paper and board from raw plant material. Manufacturing of crude and high quality paper, recycled paper; soils; bio fuel producing plants.
Fibres: Classification of fibres, physical and chemical processes involved in the manufacturing of fibres from different types of fibre yielding plants.

Unit-IV

The Rubber Plants of India, Extraction of Raw Rubber and its Chemical Processing for the Manufacturing of Finished Rubber. Sources of gums and resins and their classifications according to their chemical nature. Extraction of the raw resin and down the line processing for terpentine and other products. Sources of natural dyes in India and their extraction methods, merits and limitations of plant based dyes.

Master of Science in Botany Semester-III
Session 2020-21

Books Recommended

1. Ambasta, S. P. (1994). The Useful Plants of India (3rd Ed.). Publications & Information Directorate, New Delhi.
2. Brown, H. P. (1989). An Elementary Manual on Indian Wood Technology (Reprinted). International Book Distributors, Dehra Dun, India.
3. Joshi, S. G. (2000). Medicinal Plants. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Kochhar, S. L. (1998). Economic Botany in the Tropics. MacMillan India Limited, Delhi.
5. Pandey, B. P. (1984). Economic Botany (3rd Ed.). S. Chand & Company Ltd., New Delhi.
6. Seidemann, J. (2005). World spice plants: economic usage, botany, taxonomy. Springer Science & Business Media.
7. Trotter, H. (1982). The Common Commercial Timbers of India and Their Uses. The Controller of Publications, Delhi.
8. Wickens, G.E. (2004) Economic Botany: Principles and Practices, Springer, ISBN 978-0-7923-6781-9.

Master of Science in Botany Semester-III
Session 2020-21

Plant Morphogenesis

MBTL – 3076

Course outcomes:

After passing this course the student will be able to:

CO1: learn about morphogenesis and organogenesis in plants.

CO2: understand basic principles in plant development.

CO3: read plant development biology literature.

CO4: understand different factors affecting plant morphogenesis.

Master of Science in Botany Semester-III
Session 2020-21

Plant Morphogenesis

MBTL – 3076 **Max. Marks- 50**
Time: 3 hrs **Theory - 40**
CA – 10

Instructions for the Paper Setters:

Eight questions of equal marks (i.e. eight marks each) 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

Correlation: Physiological and genetic correlations.
Polarity: Polarity as expressed in external and internal structures, polarity in isolated cells, polarity in plasmodia and coenocytes, physiological manifestations of polarity, developmental patterns.

Unit-II

Symmetry: Inorganic and organic symmetries, radial symmetry bilateral symmetry, dorsi ventral symmetry, development of symmetry.
Differentiation: Growth and differentiation, differentiation as expressed in structure, external and internal differentiation, differentiation during ontogeny, differentiation in relation to environment, physiological differentiation, differentiation without growth.

Unit-III

Regeneration: Regeneration in lower plants, regeneration in higher plants, reconstitution,restoration, reproductive regeneration.
Tissue Mixtures: Stock – scion interrelations, chimeras, somatic mutations.

Unit-IV

Abnormal Growth: Abnormal development of organs, production of new types of organized structures, amorphous structures.
Morphogenetic Factors: Introduction to factors-light, water temperature, physical factors, genetic factors and chemical factors in general.

Master of Science in Botany Semester-III
Session 2020-21

Books Recommended

1. Ainsworth C (2006) Flowering and its Manipulation, Annual Plant Reviews, Vol. 20. Blackwell Publishing, Oxford, U.K. 2. Brown TA. (2002) Genomes, BIOS Scientific Publishers Ltd, Oxford, UK.
2. Bhojwani, S.S. and Bhatnagar, S.P. (1975). The Embryology of Angiosperms. Vikas Publishing House Pvt. Ltd, Delhi.
3. Davies, J. (2013). Mechanisms of morphogenesis. Academic Press.
4. Eames, A.J. (1961) Morphology of the Angiosperms. Tata McGraw Hill Publishing Co. Ltd. Bombay.
5. Lyndon, R. F. (2012). Plant development: the cellular basis (Vol. 3). Springer Science & Business Media.
6. Maheshwari, P. (1950), An Introduction to the Embryology of Angiosperms.
7. Raghavan, V. (1997). Molecular embryology of flowering plants. Cambridge University Press.
8. Raghavan, V. (2012). Developmental biology of flowering plants. Springer Science & Business Media.
9. Sinnet, E.W. (1960), Plant Morphogenesis, McGraw Hill Book Company Inc., New York.
10. Wardlaw, C. W. (1952). Morphogenesis in plants. London: Methuen.

Master of Science in Botany Semester-III
Session 2020-21

Botany Practicals I
(Based on MBTL-3071, MBTL-3072 and MBTL-3073)

MBTP-3077
Course Outcomes:

After passing this course the student will be able to:

CO1: Perform immobilization of enzymes.

CO2: Wide application of enzymes and their fiture potential.

CO3: perform different experiments based on plant pollination.

CO4: understand embryology of dicot and monocot plants.

Master of Science in Botany Semester-III
Session 2020-21

Botany Practicals I
(Based on MBTL-3071, MBTL-3072 and MBTL-3073)

MBTP-3077 **Max. Marks- 75**
Time: 6 hrs **Practical – 60**
CA – 15

Instructions for the Paper Setters: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Suggested Practical's from MBTL-3071

1. Examination of the following with the help of hand sections, dissections and prepared longitudinal, transaction of Flowers: Transmitting tissue/canal in the stigma and style, Various types of flowers and placentation, Special types of flowers with emphasis on vasculature of androecium and gynoecium.
2. Study from permanent preparations, development and structure of anther, pollen, ovules, megasporogensis, embryo sac, endosperm and embryo.
3. Study of microsporogensis and gametogenesis in sections of anther.
4. Examination of modes of anther dehiscence and collection of pollen grains for microscopic examination (maize, grasses, *Cannabis sativa*, *Crotolaria, Tradescentia, Brassica, Petunia, Solanum melongena).*
5. Test for pollen viability using strain and in vitro pollination. Pollen germination using hanging drops, sitting drop culture and suspension culture.
6. Estimating percentage and average pollen tube length in vitro.
7. Field study of several types of flowers with different pollination mechanisms (wind, insects, bird pollination)

Suggested Practical's from MBTL-3072

1. Identification of the parts of bright- field microscope and demonstration of its use and care.
2. Perform basic microbiological techniques such as sterile plating and isolation of single colonies.
3. Isolation of DNA from biological samples.
4. Characterization of isolated DNA using agarose gel electrophoresis.
5. Graph and analyze agarose gel data.
6. Genetic transformation of bacteria.
7. Screening and selection of transformants.
8. Demonstration of PCR technique.
9. Spectrophotometric estimation of DNA.
10. Demonstration of DNA sequencing technique.

Master of Science in Botany Semester-III
Session 2020-21

Suggested Practical's from MBTL-3073

1. Floral biology in self and cross pollinated species,
2. Selfing and crossing techniques.
3. Numerical exercises on probability and biostatistics
4. Maintenance of experimental records;
5. Learning techniques in hybrid seed production
6. To study Breeders kit.
7. Studies on centres of origin of various useful crops.
8. To study Vegetative Propagation in – Potato, Onion bulb, Sugarcane, Ginger.
9. To perform exploration for determination of male sterility.
10. To perform Field exploration for determination of Dichogamy, Heterostyly and Dioecy.
11. To estimate Pollen viability in *Zea mays* and *Hibiscus*.

Master of Science in Botany Semester-III
Session 2020-21

Botany Practicals II
(Based on MBTL-3074, MBTL- 3075 and MBTL-3076)

MBTP-3078
Course outcomes:

After passing this course the student will be able to:

CO1: Understand concept of gene, gene cistron relationship in prokaryotes and eukaryotes.

CO2: Understand types of DNA damage, DNA repair pathways.

CO3: Exhibit clear and concise communication of scientific data.

CO4: Understand different techniques related to molecular biology.

Master of Science in Botany Semester-III
Session 2020-21

Botany Practicals II
(Based on MBTL-3074, MBTL-3075 and MBTL-3076)

MBTP-3078 **Max. Marks- 75**
Time: 6 hrs **Practical - 60**
CA – 15

Instructions for the Paper Setters: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Suggested Practical's based on MBTL-3074

1. Preparation of the solutions of different concentrations. Preparation of the inorganic and organic buffers of different conc. and pH.
2. Preparation of the standard curve of protein and determine the protein content in unknown samples by Lowry's method.
3. Estimation of the protein content in given plant sample by Bradford's method
4. Estimation of the protein content in given plant sample by Biuret's method
5. Estimation of the carbohydrates in given plant sample Anthrone's reagent.
6. Estimation of the carbohydrates in given plant sample Dubois's method
7. Estimation of the activity of enzyme catalase
8. Estimation of the activity of enzyme peroxidase.
9. Preparation of the standard curve of proline and determine the proline content in unknown samples by Bates's method.
10. SDS-PAGE for soluble proteins extracted from the given plant material and comparison of their profile by staining with Coomassie brilliant blue.

Suggested Practical's based on MBTL-3075

To study economic importance, distribution, centres of origin of following specimens:

1. Study of morphology and microchemical tests for stored food material for cereals: Wheat (*Triticum aestivum),* Rice (*Oryza sativa),* Maize *(Zea mays)*
2. Study of morphology and microscopic study of fibres: Cotton (*Gossypium sp.),* Jute (*Corchorus capsularis*), Flax (*Linum usitatissimum)* Sugar yielding plant: Sugarcane (*Saccharum officinarum)*
3. Study of morphology of oil yielding plants: Groundnut (*Arachis hypogea*), Mustard (*Brassica sp)*, Coconut (*Cocos nucifera*), Castor (*Ricinus communis)*, Soyabean (*Glycine max)*and performing tests for oil.
4. Study of morphology and alkaloid present in spices: Ginger (*Zingiber officinale)*, Turmeric (*Curcuma longa)*, Coriander (*Coriandrum sativum)*, Clove (*Eugenia aromaticum*), Black Pepper (*Piper nigrum)*, Cinnamon (*Cinnamomum zeylanicum*)

5. Study of morphology and medicinal value for medicinal plants: Amla (*Emblica officinalis)*, Bahera (*Terminalia belerica)*, Harhar (*Terminalia chibula)*, Sarpagandha (*Rauwolfia serpentine)*, Ashwgandha (*Withania somnifera*), Liquorice (*Glycyrrhiza glabra)*, Poppy (*Papaver somniferum*), Arjuna (*Terminalia arjuna)*
6. Study of morphology and nutrition value for pulses: Green Gram (*Phaseolus aureus)*, Black Gram (*Phaseolus mungo)*, Pigeon Pea (*Cajanas cajan)*, Kidney Bean *(Phaseolus vulgaris)*
7. Study of morphology of plants producing fruits Citrus (*Citrus sp)*, Apple (*Malus pumila)*, Mango (*Mangifera indica)*, Banana (*Musa sapientum)*, Pineapple (*Ananas comosus)*, Grapevine (*Vitis sp.)*
8. Vegetables: Potato (*Solanum tuberosum*), Radish (*Rapahnus sativus*), Turnip (*Brassica rapa*)
9. Study of morphology of Beverages: Tea (*Thea sinensis*), Coffee (*Coffea arabica*) and knowledge of processing method.

Suggested Practical's based on MBTL-3076

1. Emasculation, bagging, hand pollination to study pollen germination, seed set and fruit development.
2. Study of cleistogamous flowers and their adaptations.
3. Study of nuclear and cellular endosperm through dissection and staining.
4. Isolation of zygotic globular, heart shaped, torpedo stage and mature embryos from suitable seed.
5. Study of seed dormancy and methods to break dormancy
6. Study the primitive and advanced characters of plants in angiosperms
7. Study various methods of asexual reproduction and vegetative reproduction
8. Study effects light, gravity, humidity temperature on plants
9. To study effect of bending on plant morphogenesis.

SEMESTER – IV

M. Sc. Botany (Semester–IV) (Session 2020-21)

Plant Anatomy

MBT L –4071

Course outcomes:

After passing this course the student will be able to:

CO1: Understand anatomy of different types of woods and their commercial utilization.

CO2: Compare anatomy of vegetative and floral parts of flowering plants.

CO3: Relate anatomy of the plant part with their physiological role.

CO4: Understand role of anatomy in taxonomy.

M. Sc. Botany (Semester–IV) (Session 2020-21)

Plant Anatomy

MBTL –4071 **Max. Marks- 50**
Time: 3 hrs **Theory - 40**
CA – 10

Instructions for the Paper Setters:

Eight questions of equal marks (i.e. eight marks each) 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

The Shoot and Root System: Primary structure and basic vasculature, the root-stem transition, secondary growth in stems and roots, the origin of cambium and its activity, anamalous secondary growth, polycyclic vasculature, secondary meristems, origin and function, the role of pericycle, phellogen, phellem, phelloderm, distribution of sclerenchyma in leaves, stem and roots.

Nodal Anatomy: Types of nodes in dicots and monocots, the node-internode transition, formation of leaf and branch traces.

UNIT-II

Histology of Wood: Growth rings, types and ultrastructure of tracheids, vessels and wood rays, longitudinal parenchyma and its arrangement, grain and texture, knots, formation of resin cavities and tyloses, anatomy and chemistry of lignification, physical and anatomical features of common hard and soft woods of India, importance of density and weight in commercial utilization of woods.

UNIT-III

Floral Anatomy: The anatomy of floral axis and the whorls, the leaf origin of carpel, evidences from anatomy of essential and accessory whorls.

Fruit and Seed Anatomy: Gross and ultrastructural surface features of the fruits and seeds, role In taxonomy, internal anatomy of dicot and monocot seeds, organ and cellular anatomy of typical monocot and dicot seeds.

UNIT-IV

Laticifers and Lenticels: Types and distribution, anatomy in relation to physiological roles

Functional Anatomy: Anatomy of leaf in relation to photosynthesis and transpiration, modification of the root stem and leaf anatomy in relation to habit and habitat with special reference to aquatics, nitrogen fixers, xerophytes parasites and mycorrhizas.

Suggested Readings:

1. Carlquist S (2001). Comparative Wood Anatomy, Springer-Verlag, Germany.
2. Crang R., Lyons-Sobaski S., & Wise R. (2018). Plant anatomy: a concept-based approach to the structure of seed plants. Springer.
3. Cutler DF, Botha CEJ, Stevenson DW(2007). Plant Anatomy - An Applied Approach, Blackwell Publishing, USA
4. Cutter EG (1978) Plant Anatomy, Part I & II, Edward Arnold, United Kingdom.
5. Dickinson WC (2000). Integrative Plant Anatomy, Harcourt Academic Press, USA.
6. Nair MNB (1998). Wood Anatomy and Major Uses of Wood, Faculty of Forestry, University of Putra Malaysia, Malaysia.

M. Sc. Botany (Semester–IV) (Session 2020-21)

Structure and Metabolism of Plant Hormones

MBTL – 4072

Course outcomes:

After passing this course the student will be able to:

CO1: Understand role of different types of plant hormones in growth and development of plants.

CO2: Understand the mechanism of action and bioassays of plant hormones and their commercial use.

CO3: Relate microbial association with the production of growth regulators.

CO4: Understand biosynthesis of different plant growth regulators.

M. Sc. Botany (Semester–IV) (Session 2020-21)

Structure and Metabolism of Plant Hormones

MBTL – 4072 **Max. Marks- 50**

Time: 3 hrs

Theory - 40

CA – 10

Instructions for the Paper Setters:

Eight questions of equal marks (i.e. eight marks each) 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

General Features of Plant Hormones, their Analysis, and Quantitation: Discovery of auxin and other hormones, characteristics of plant hormones, hormone vs plant growth regulator, hormonal responses to a physiological state, bioassays, hormone extraction, analysis, and quantitation, determination of hormone synthetic pathways, regulation of hormone levels (hormonal homeostasis).

Auxins: Structure of auxins, physiological roles of IAA, IAA biosynthesis in higher plants, regulation of IAA levels (IAA homeostasis), inhibitors of IAA action, other naturally occurring auxins, synthetic auxins, structural diversity of auxins.

UNIT-II

Gibberellins: Discovery, structure of gibberellins (GAs) in higher plants, physiological roles of GAs in higher plants, terpenoid pathway, biosynthesis of GAs, regulation of GA levels in the plant, endogenous levels, why are there so many GAs?, other substances with GA-like activity.

Cytokinins: Discovery, biological functions and bioassays, structure of cytokinins, occurrence of cytokinins in the cytoplasm and as components of tRNA, relative distribution of natural cytokinins among plants, biosynthesis in higher plants, regulation of cytokinin levels, synthetic compounds with cytokinin like activity, cytokinin antagonists (anticytokinins).

UNIT-III

Brassinosteroids: Discovery, structure and distribution, physiological roles and bioassays, biosynthesis of brassinolide, synthesis mutants and their wild-type genes, inhibitors of brassinosteroid biosynthesis, brassinosteroid structure and biological activity regulation of castasterone and brassinolide levels.

Abscissic Acid: Discovery, structure and occurrence in plants and fungi, physiological roles of abscisic acid (ABA), biosynthesis of ABA, carotenoid and/or ABA synthesis, mutants, ABA synthesis inhibitiors, regulation of ABA levels.

Ethylene: Discovery as a hormone, structure, distribution, and internal concentrations, physiological roles and bioassays, biosynthesis in higher plants, ethylene synthesis mutants, regulation of ethylene levels in the plant, synthetic compounds that produce ethylene, inhibitors of ethylene action.

UNIT-IV

Jasmonates and other Defense-Related Compounds: Introduction, discovery,distribution, and structure of jasmonates, physiological roles of jasmonates, biosynthesis of jasmonic acid (JA), JA synthesis mutants, JA synthesis inhibitors, regulation of endogenous levels of JA.

Microbial Synthesis of Plant Hormones: Microbial associations with plants, infection by Agrobacterium, tumor induction by Pseudomonas, microbial genes involved in IAA and CK biosynthesis, expression of bacterial genes in higher plants, biology of genetic transformation by *A. tumefaciens*, production of plant hormones by other microorganisms.

Suggested Readings:

1. Buchanan, B. B., Gruissem, W., & Jones, R. L. (Eds.). (2015). *Biochemistry and molecular biology of plants*. John Wiley &Sons. American Society of Plant Physiologists, Maryland.
2. Davies, P. J. (Ed.). (2004). Plant hormones: biosynthesis, signal transduction, action! Springer Science & Business Media.
3. Dennis, D.T., Turpin, D.H., Lefebvre, D.D., and Layzell, D.B. (eds) (1997). Plant Metabolism.Longman, Essex.
4. Galston, A.W. (1989). Life Processes in Plants. Scientific American Library, Springer-Verlag, NewYork.
5. Hooykaas, P.J.J., Hall, M.A., and Libbenga, K.R. (eds) (1999). Biochemistry and Molecular Biology of Plant Hormones. Elsevier, Amsterdam.
6. Hopkins, W. G. (2007). Introduction to plant physiology 4th edition. John Wiley & Sons, Inc., NewYork.
7. Lodish, H., Berk, A., Zipursky, S.l., Matsudaira, P., Baltimore, D., and Darnell, J. (2000).Molecular Cell Biology. W.H. Freeman and Company, New York.
8. Taiz, L., Zeiger, E., Møller, I. M., & Murphy, A. (2015). Plant physiology and development, Sinauer Associates Inc

M. Sc. Botany (Semester–IV) (Session 2020-21)

Plant Tissue Culture and Biotechnology

MBTL – 4073
Course outcomes:

After passing this course the student will be able to:

CO1: Understand the concept of cytogenetics and differentiation in cell and tissue culture.

CO2: Understand mechanism, advantage and disadvantages of micropropagation.

CO3: Describe the role of tissue culture in the production of different types of transgenic plants.

CO4: Explain role of plant tissue culture and biotechnology in different fields of human interest.

M. Sc. Botany (Semester–IV) (Session 2020-21)

Plant Tissue Culture and Biotechnology

MBTL – 4073 **Max. Marks- 50**
Time: 3 hrs

Theory - 40
CA – 10

Instructions for the Paper Setters:

Eight questions of equal marks (i.e. eight marks each) 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

Cytogenetics and differentiation in cell and tissue culture, plant regeneration from callus, shoot apex culture and anthers. Micropropagation: Stages, somatic embryogenesis, usefulness, hardening of micropropagated plantlets, advantages and disadvantages, application of the technique in crop improvement.

UNIT-II

Somaclonal variations and isolation of useful mutants at cellular level, disease resistance, herbicide resistance and salt tolerance. Production of pathogen free plants through tissue culture. Production of artificial seeds, their use and application.

UNIT-III

Techniques for the production of transgenic plants: Concept, vector less transgenosis, gene targeting tools, crop improvement through transgenics, benefits and risk of producing transgenic plants, commercialization of transgenics. Cell culture and secondary metabolites like cinnamic acid, shikonin, flavonoids and related compounds production.

UNIT-IV

Cryobiology of plant cell cultures and establishment of plant banks, freeze preservation technology, factors influencing revival of frozen cells and future prospects. Terminator technology, verminator technology, apprehensions and challenges. Role of plant tissue culture and biotechnology in agriculture, medicine and human welfare, prospects of genetic engineering of plants.

Suggested Readings:

1. Bhojwani, SS and Dantu, PK (2013) Plant Tissue Culture: An introductory text, Springer Publications.
2. George, F.E., Hall, M., Klerk G. J (2008) Plant propagation by Tissue culture 3rd editionVolI, Springer Publications.
3. Gupta P.K., (1990), An Introduction to Biotechnology, Rastogi Publications, Meerut.
4. Kung, Shain – Dow and Arntzen, C.J. (1989). Plant Biotechnology, Butter Worths, London.
5. Old, R.W. and Primrose S.B. (1991). Principles of Gene Manipulation, And Introduction to Genetic Engineering, Blackwell Scientific Publications, Oxford.
6. Reinert, J. and Bajaj, Y.P.S. (1977). Applied and Fundamental Aspects of Plant Cell, Tissue and Organ Culture, Springer Verlang, Berlin.

M. Sc. Botany (Semester–IV) (Session 2020-21)

Analytical Techniques

MBTL – 4074
Course outcomes:

After passing this course the student will be able to:

CO1: Understand working of different microscopes.

CO2: Understand the basics of the major analytic techniques including sample preparation, standardization and data analysis of each technique.

CO3: Evaluate strengths and weakness of different analytical techniques.

CO4: Understand theory and practice of different bioanalytic techniques.

M. Sc. Botany (Semester–IV) (Session 2020-21)

Analytical Techniques

MBTL – 4074 **Max. Marks- 50**
Time: 3 hrs

Theory - 40
CA – 10

Instructions for the Paper Setters:

Eight questions of equal marks (i.e. eight marks each) 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

Principles and application of light, phase contrast, fluorescence scanning and transmission electron microscopy, cytophotometry and flow cytometry, fixation and staining.

UNIT-II

Principles and applications of gel filtration, ion-exchange and affinity chromatography, thin layer and gas chromatography, high pressure liquid chromatography (HPLC), electrophoresis and electrofocussing, ultra-centrifugation (velocity and density gradient).

UNIT-III

Principles of biophysical methods used for analysis of biopolymeric structure, X-ray diffraction fluorescence UV/CD, visible Nuclear Magnetic Resonance (NMR) and Electron Spin Resonance (ESR) spectroscopy, hydrodynamic methods, Atomic absorption and plasma emission spectroscopy.

UNIT-IV

Principles and techniques of nucleic acid: hybridisation and Cot curves; Sequencing of proteins and nucleic acids; Southern, Northern and Western blotting techniques; Polymerase chain reaction.

Suggested Readings:

1. Hackett PB, Fuchs JA & Messing JW. 1988. An Introduction to Recombinant DNA Technology -Basic Experiments in Gene Manipulation.2nd Ed. Benjamin Publ. Co.
2. Principles of Electroanalytical Methods. John Wiley and Sons Ltd., Chichester England.
3. Sambrook J & Russel D. 2001. Molecular Cloning - a Laboratory Manual. 3rd Ed. Cold
4. Spring Harbor Lab. Press. Sheehan, D. (2000). Physical Biochemistry: Principles and Applications, John Wiley andSons Ltd., Chichester, England.
5. Singh BD. 2005. Biotechnology, Expanding Horizons. Kalyani Publishers, Delhi
6. Wilson K. and Walker J. (Eds.) (2012). Practical Biochemistry: Principles and Techniques, Cambridge University Press, U.K. Riley, T. and Tomilson, C. (198)

M. Sc. Botany (Semester–IV) (Session 2020-21)

Diversity and Biology of Angiosperms

MBTL – 4075

Course outcomes:

After passing this course the student will be able to:

CO1: Learn about different systems of classification with their merits and demerits.

CO2: Understand principles of plant nomenclature and plant taxonomy.

CO3: Know about the National and international herbaria and botanical gardens.

CO4: Understand terminology related to plant taxonomy.

M. Sc. Botany (Semester–IV) (Session 2020-21)

Diversity and Biology of Angiosperms

MBTL – 4075 **Max. Marks- 50**

Time: 3 hrs

Theory - 40
CA – 10

Instructions for the Paper Setters:

Eight questions of equal marks (i.e. eight marks each) 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

Historical perspective of plant classification, phenetic versus phylogenetic system; cladistics in taxonomy, relative merits and demerits of major system of classification, a study of phylogenetic system of classification after Engler & Prantl, Bessey, Hutchinson, Cronquist, Takhtajan, Dahlgren and Thorne.

UNIT-II

Principles of plant nomenclature; salient features of the International code of Botanical Nomenclature, working knowledge of botanical latin, important herbaria of the World. Origin of angiosperms; interrelationships of dicots and monocots; Phylogeny of Ranales, Amentiferae, Centrospermae, Tubifilorae, Andhalobiales and their treatment in the modern systems of classification.

UNIT-III

Principles of plant taxonomy, alpha taxonomy vs modern taxonomy; chemotaxonomy, cytotaxonomy, numerical taxonomy, anatomy, palynology and embryology in relation totaxonomy. Biosystematic approach to taxonomy, biosystematic categories parameters in biosystematic analysis with particular examples of taxonomic problems; taxonomic study of agamic, hybrid and polyploid complexes; phylogenetic trees.

UNIT-IV

Taxonomic tools: Herbarium; floras; serology; electrophoresis; nucleic acid hybridization; computers and GIS. Concepts of pytogeography and its relevance, pytogeographic regions of the world and India, approaches to phytogeography, principles and practices; factors determining vegetational types, endemism, hotspots and hottest hotspots, plant explorations, invasions and introductions, local plant diversity and its socioeconomic importance.

M. Sc. Botany (Semester–IV) (Session 2020-21)

Suggested Readings:

1. Angiosperm Phylogeny Group (2003) An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG II. Botanical Journal of the Linnaean Society 141: 399-436.
2. Cole, A.J. 1969. Numerical Taxonomy, Academic Press, London Cracknell AP, Hayes L (2009) Introduction to Remote Sensing. CRC Press, Boca Raton, USA (Special Indian Edition)
3. Crawford DJ (2003) Plant Molecular Systematics. Cambridge University Press,
4. Cambridge, UK.: Brown, H.P. (1989). An Elementary Manual of Indian Tree Technology, Dehradun
5. Davis P.H. and Heywood, V.H. (1973). Principles of Angiosperms Taxonomy. Robert E. Kreiger. Co., New York.
6. Judd WS, Campbell CS, Kellogg EA, Stevens PA and Donoghue MJ (2002) Plant Systematics: A Phylogenetic Approach. Sinauer Associaes, Inc., Massachusetts.
7. Nei M and Kumar S (2000) Molecular Evolution and Phylogenetics. Oxford University Press, New York.
8. Raven PH, Begr LR, Hassenzahl DM (2008) Environment. 6th edition. John Wiley & Sons, Inc., New York.
9. Semple C and Steel MA (2003) Phylogenetics. Oxford University Press, Oxford

M. Sc. Botany (Semester–IV) (Session 2020-21)

Hazardous Chemicals
(Optional Paper)

MBTL-4076 A
Course outcomes:

After passing this course the student will be able to:

CO1: Understand different types of hazardous chemicals and how we can expose to them.

CO2: Understand control measures that reduce the risk associated with hazardous chemicals.

CO3: Manage hazardous chemicals effectively.

CO4: Describe the processes involved in hazardous waste treatment.

M. Sc. Botany (Semester–IV) (Session 2020-21)

Hazardous Chemicals
(Optional Paper)

MBTL -4076 (A) **Max. Marks- 50**
Time: 3 hrs

Theory - 40
CA – 10

Instructions for the Paper Setters:

Eight questions of equal marks (i.e. eight marks each) 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

Physical Properties of Chemicals: Vapour pressure, vapour density, solubility, octanol/water partition, coefficient odor.
Toxic Properties: Absorption and excretion detoxification and bioactivation, common terms used for toxicology.
Target Organs: Injury to liver, kidney, immune system, respiratory tract, skin, eyes, nervous system, cardiovascular system, carcinogens and teratogens.
Combustible and Explosive Properties: Flashpoint and autoignition temperature of some chemicals, explosive properties.

UNIT-II

Aldehydes: Acrolein.
Alkaloids: Nicotine, Morphine, Heroin, LSD, Colchichine.
Amines: Ethylenimine, aniline, benzidine, O-toluidine, Phenylhydrazine.
Azodyes: Acid Yellow 3, Sudan orange, acid red 18, acid blue-9, acid green-3.
Chlorohydrins: Ethylene, chlorohydrin.
Nitriles: Acrylonitrile, acetonitrile.
Cyanides: HCN, Sodium cyanide, potassium cyanide, cyanogen.
Organic Isocyanates: Methyl isocyanate.

UNIT-III

Dioxins: 2,3,7,8 – Tetrachlordibenzo-p-dioxin (TCDD).
Epoxy Compounds: Ethylene dioxide.
Halogenated Hydrocarbons: Chloroform, carbon tetrachloride, dichlorobenzene.
Aromatic Hydrocarbons: Benzene, Xylene.
Polynuclear Aromatics: Benzo -α- pyrene, Benzo - α- anthracene.
Toxic Gases: Arsine, Mustard Gas, Phosgene.
Explosives: Nitroexplosives – Nitroglycerine, dynamite, Nitrocellulose, 2,4,6-Trinitrotoluene, Picric acid

M. Sc. Botany (Semester–IV) (Session 2020-21)

UNIT-IV

Pesticides: Structure, LD50/ LC50, health hazards and exposure limit of following pesticides:
Carbamates: Aldicarb, Carbaryl, Carbofuran, Methiocarb.
Organochlorines: Aldrin, Dieldrin, Endrin, Heptachlor, Chloradane, Endsulphan, DDT, Methoxychlor, Lindane.
Organophosporus Pesticides: Parathion, Dichrolophos, Monocrotophos,Chloropyriphos.
Herbicides: 2,4 D, 2,4, T, Silvex, Atrazine, Metribuzin, Monouron, Diuron, Paraquat,Tribunil, Alchlor

Suggested Readings:

1. Patnaik, P. (1999). A Comprehensive Guide to the Hazardous Properties of Chemical Substances. Wiley, New York.

M. Sc. Botany (Semester–IV) (Session 2020-21)

Immunology
(Optional Paper)

MBTL –4076 (B)

Course outcomes:

After passing this course the student will be able to:

CO1: Understand principles of immunology.

CO2: Conceptualize how the innate and adaptive immune responses coordinate to fight invading pathogens.

CO3: Understand role of immunity in keeping our body healthy.

CO4: Exhibit clear and concise communication of scientific data.

M. Sc. Botany (Semester–IV) (Session 2020-21)

Immunology
(Optional Paper)

MBTL -4076 (B) **Max. Marks- 50**
Time: 3 hrs

Theory - 40
CA – 10

Instructions for the Paper Setters:

Eight questions of equal marks (i.e. eight marks each) 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

An Overview of the Immune System: Historical perspective, an introduction to the immune system – innate and adaptive immunity. Immuno deficiencies: secondary immunodeficiency disorders.

UNIT-II

Antigens and Antigen Recognition: Antigens: prerequisites for immunogenicity, relative immunogenicity of different types of molecules, Molecules that enhance immunogenicity. Activators of lymphocytes: antigens, superantigens, mitogens. Antigen recognition by cells of innate immunity & adaptive immunity.

UNIT-III

Antibodies: Gamma globulins; structure, bifunctional property of antibodies, determining bi-functionality, cross reactivity, Antigen antibody interactions: primary interactions, secondary interactions. Classification of antibodies: Isotypes, Allotypes, properties & biological functions of antibody isotypes, IgG, IgE, IgM, IgD, IgA, Monoclonal antibodies

UNIT-IV

Cells and Tissues of Immunity: Lymphoid tissues: primary & secondary lymphoid tissues, cells of innate immunity: phagocytes, antigen presenting cells, natural killer cells, Eosinophils, mast cells and basophil, B- cells, secondary immune responses. The major histocompatibility complex, antigen process and antigen presentation, complement.The immune system in Health & Disease, specially AIDS.

Books Recommended

1. Delves, P. J., Martin, S. J., Burton, D. R., &Roitt, I. M. (2017). Roitt's essential immunology. John Wiley & Sons.
2. Goldsby, R.A. Kindt, T.J., Oxborne B.A., Kuby, J. (2003). Immunology. W.H. Freemen & Company, New York.
3. Punt, J., Stranford, S. A., Jones, P. P., & Owen, J. A. (2019). Kuby immunology. Macmillan Learning
4. Stanley, J. (2002). Essentials of Immunology and Serology. Delmar Thomson Learning, USA.

M. Sc. Botany (Semester–IV) (Session 2020-21)

Botany Practicals I
(Based on MBTL-4071, MBTL-4072 and MBTL-4073)

MBTP -4077

Course outcomes:

After passing this course the student will be able to:

CO1: Develop skills of dissection,formation of temporary and permanent slides.

CO2: Understand commercial applications of plant growth hormones.

CO3: Perform bioassays of plant growth regulators.

CO4: Study the functions and operations of various instruments used in PTC

M. Sc. Botany (Semester–IV) (Session 2020-21)

Botany Practicals I
(Based on MBTL-4071, MBTL-4072 and MBTL-4073)

MBTP -4077 **Max. Marks- 75**
Time: 6 hrs

Practical – 60
CA – 15

Instructions for the Paper Setters: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Suggested practical'sbased on MBTL-4071

1. Study of apical meristems with the help of dissections, whole mount preparations, sections and permanent slides.
2. Study of xylem and phloem elements using maceration, staining, light and electron micrographs (xerophytes, hydrophytes and halophytes).
3. Study of secretory structures (nectaries and laticifers).
4. Study of leguminous roots with different types of nodules.
5. Anatomical studies of young and mature stem of *Helianthus*.
6. Comparative anatomy of dicot and monocot root, stem and leaf
7. To study anomalous stem behaviour in stem (*Mirabilis jalapa, Nycthanthus, Boerhaavia diffusa, Bignonia, Dracaena.)*
8. Study of anatomical features in xerophytes e.g.(leaf of *Nerium*. stem and leaf of *Calotropis*, phyllocladode of *Ruscus*.)
9. Study of anatomical features in hydrophytes e.g. (*Nelumbo* petiole, *Hydrilla* stem and leaf, *Eichhornia* petiole, leaf lamina, *Typha*)
10. To study anatomy of storage roots of e.g. (*Raphnus sativa, Beta vulgaris*,)
11. To study anatomy of halophytes e.g. (*Chenopodium* stem)
12. To study permanent tissues slides.

Suggested Practical's based on MBTL-4072

1. Study the effect of IAA on morphological parameters such as shoot length, root length, fresh weight and dry weight of seven days old seedlings.
2. To study the effect of IBA on morphological parameters such as shoot length, root length, fresh weight and dry weight of seven days old seedlings.
3. Study the effect of Gibberellins on morphological parameters such as shoot length, root length, fresh weight and dry weight of seven days old seedlings.
4. Study the effect of Cytokinin on morphological parameters such as shoot length, root length, fresh weight and dry weight of seven days old seedlings.
5. Estimation of the catalase activity by Aebi's Method.
6. Study of bioassays of Auxins, Gibberellins, Cytokinin, Ethylene, Absicisic Acid and Brassinosteroids.
7. Study of antagonistic effect of cytokinin/ethrel on senescence behavior of leaves of different field crops.

Suggested Practical'sbased on MBTL-4073

1. To study the functions and operations of various instruments used in PTC like Laminar Air Flow, Autoclave, incubators, oven, Distillation unit, Weighing balance, pH meter
2. Laboratory design set up of PTC lab Sterilisation techniques
3. Different types of Enclosures used in PTC
4. Preparation of stock solutions and media preparation
5. Selection, preparation and inoculation of explant Synthetic Seed Production
6. Micropropagation and its different steps. Significance of growth hormones in culture
7. Induction of callus from different explants Anther culture and ovary culture

M. Sc. Botany (Semester–IV) (Session 2020-21)

Botany Practicals II
(Based on MBTL-4074 and MBTL-4075)

MBTP-4078

Course outcomes:

After passing this course the student will be able to:

CO1: Understand and perform experiments based on different analytic techniques.

CO2: Identify different plants using identification keys.

CO3: Explore rich plant biodiversity.

CO4: Compare different species of a genus and different genera of family.

M. Sc. Botany (Semester–IV) (Session 2020-21)

Botany Practicals II
(Based on MBTL-4074 and MBTL-4075)

MBTP-4078 **Max. Marks- 75**
Time: 6 hrs **Practical – 60**
CA – 15

Instructions for the Paper Setters: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Suggested practicals based on MBTL-4074
(Experiments based on following techniques):

1. Paper Chromatography
2. Thin Layer chromatography
3. Column chromatography
4. Gel Filtration Chromatography
5. Ion Exchange Chromatography
6. Affinity Chromatography
7. Electrophoresis: PAGE and SDS-PAGE
8. UV-Vis Chromatography
9. Demonstration of PCR
10. Centrifugation
11. Flourescent Microscopy

Suggested Practicals based on MBTL-4075

Description of specimen from representatives of locally available families. This list is indicative only

- Ranunculaceae: *Ranunculus, Delphinium,*
- Brassicaceae: *Brasssica, Iberis*
- Malvaceae: *Hibiscus*
- Rutaceae: *Murraya, Citrus*
- Fabaceae: *Lathyrus, Cassia, Acacia, Mimosa*
- Rosaceae: *Rose, Prunus*
- Asteraceae: *Helianthus, Ageratum, Sonchus*
- Apiaceae: *Coriandrum, Foeniculum*
- Apocynaceae: *Vinca, Nerium, Thevetia*
- Asclepiadaceae: *Calotropis*
- Solanaceae: *Petunia, Solanum, Datura*
- Euphorbiaceae: *Euphorbia, Phyllanthus*
- Lamiaceae: *Ocimum, Salvia*
- Chenopodiaceae: *Chenopodium*
- Liliaceae: *Asparagus, Asphodelus*
- Poaceae: *Triticum, Avena*

1. Location of key character and use of keys at family level.
2. Field trips within and around the campus; compilation of field note and preparation of herbarium sheets of such plant, wild or cultivated as are abundant.
3. Training in using flora and herbaria for identification of specimen described in the class
4. Comparison of different species of a genus and different genera of family to calculate similarity coefficients.