Annexure-B
FACULTY OF LIFE SCIENCES

SYLLABUS

Of

Botany For

B.Sc. Medical (Semester II)

(Under Continuous Evaluation System)

(12+3 System of Education)

Session: 2020-21

The Heritage Institution

KANYA MAHA VIDYALAYA

JALANDHAR

(Autonomous)

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULLUM OF EXAMINATION OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Medical) Session 2020-21

BOTANY

Semester II

Course Name	Program Name	Course Code		Course Type	Marks					Examination time (in Hours)
					Total	Course Title	Ext.		CA	
							L	P		
Botany	B.Sc. (Medical)	BSMM-2075	I	E	100	Cell Biology	30	-	20	3
			II			Genetics	30	-		3
			P			Practical (Based on Papers–I and II)	-	20		3

B.Sc. Medical (Semester-II) (Session 2020-21)

BOTANY

Course Code: BSMM-2075 (I)

CELL BIOLOGY

(Theory)

Course outcome: -

After passing this course the course the student will be ableto:-

CO1: Explain cellular processes and mechanisms that lead to physiological functions as well as examples of pathological state.

CO2: Describe the intricate relationship between various cellular structures and their corresponding functions.

CO3: Describe cytological, biochemical, physiological and genetic aspects of the cell, including cellular processes common to all cells, to all eukaryotic cells as well as processes in certain specialized cells.

CO4: Relate normal cellular structures to their functions.

B.Sc. Medical (Semester-II) (Session 2020-21)

BOTANY

Course Code: BSMM-2075 (I)

CELL BIOLOGY

(Theory)

Time: 3Hrs **Max. Marks: 30**

Instructions for the Paper Setters:

Eight questions of equal marks (6 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.

UNIT-I

Structure and Function of Nucleus; Ultrastructure; nuclear membrane; nucleolus. An Overview: prokaryotic and eukaryotic cells, cell size and shape and *Escherichiacoli*.

UNIT-II

Extranuclear Genome: Presence and function of mitochondrial and plastid DNA; plasmids. Structure and Function of other Organelles: Golgi bodies, Endoplasmic reticulum, Peroxisomes, Vacuoles.

UNIT-III

Chromosome Organization: Morphology; centromere and telomere; chromosome alterations; deletions, duplications, translocations, inversions; variations in chromosome number, aneuploidy, polyploidy; sex chromosomes.

UNIT-IV

The Cell Envelopes: Plasma membrane; bilayer lipid structure; functions; the cell wall.

Suggested Readings:

1. Gupta, P.K. (2017). A Text–book of Cell and Molecular Biology (5th edition).Rastogi

Publications, Meerut, India

2. Johnson, A., Raff, L. and Walter, R. (2008). Molecular Biology of the Cell (5th Edition). Taylor and Francis Group, USA.

3. Karp, G. (2013). Cell and Molecular Biology: Concepts and Experiments (7th Edition). Wiley Publishers, USA.

4. Kleinsmith, L.J. and Kish, V.M. (1995). Principles of Cell and Molecular Biology (2nd

edition). HarperCollinsCollege Publishers, New York, USA.

5. Lodish, H., Berk, A., Kaiser, C. A., Krieger, M., Bretscher, A. and Ploegh, H. (2016).

Molecular Cell Biology (5th edition) , W.H. Freeman & Co., New York, USA.

6. Snustad, D.P. and Simmons, M.J. (2012). Principles of Genetics (8th Edition). John Wiley and Sons Inc., U.S.A.

B.Sc. Medical (Semester-II) (Session 2020-21)

BOTANY

Course Code: BSMM-2075(II)

GENETICS

(Theory)

Course outcome: -

After passing this course the student will be able to develop:-

CO1: Comprehensive, detailed understanding of the chemical basis of heredity

CO2: Comprehensive and detailed understanding of genetic methodology and how quantification of heritable traits in families and populations provides insight into cellular and molecular mechanisms.

CO3: Understanding of how genetic concepts affect broad societal issues including health and disease, food and natural resources, environmental sustainability, etc.

CO4: Understanding the role of genetic mechanisms in evolution. The knowledge required to design, execute, and analyze the results of genetic experimentation in animal and plant model systems.

CO5: The ability to evaluate conclusions that are based on genetic data. Insight into the mathematical, statistical, and computational basis of genetic analyses that use genome-scale data sets in systems biology settings.

B.Sc. Medical (Semester-II) (Session 2020-21)

BOTANY

Course Code: BSMM-2075(II)

GENETICS

(Theory)

Time: 3Hrs **Max. Marks: 30**

Instructions for the Paper Setters:

Eight questions of equal marks (6 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.

UNIT-I

DNA the Genetic Material: DNA structure; replication; DNA–protein interaction; thenucleosome model; genetic code; satellite and repetitive DNA.

UNIT-II

Cell Division: Mitosis; meiosis.
Genetic Inheritance: Mendelism; laws of segregation and independent assortment; linkage analysis; allelic and non–allelic interactions.

UNIT-III

Gene expression**:** Structure of gene; transfer of genetic information; transcription, translation, protein synthesis, tRNA; ribosomes; regulation of gene expression in prokaryotes and eukaryotes; proteins, ID, 2D, and 3D structure.

UNIT-IV

Genetic Variations: Mutations, spontaneous and induced; transposable genetic elements; DNA, damage and repair.

Suggested Readings:

1. Brown, T.A. (2011). Genetics: A Molecular Approach (3rd Edition). BIOS Scientific

Publishers, UK.

2. Fletcher, H., Hickey, I. and Winter, P. (2010). Instant Notes on Genetics (3rd edition) Taylor and Francis Group, USA.

3. Gardner, E.J., Simmons, M.J. and Snustad, D.P. (2012). Principles of Genetics (8th Edition). Wiley Sons, USA.

4. Gupta, P.K. (2017). Cell and Molecular Biology (5th edition), Rastogi Publications, Meerut, India.

5. Kleinsmith, L.J. and Kish, V.M. (1995). Principles of Cell and Molecular Biology (2nd

Edition).Harper Collins College Publishers, New York, USA.

6. Krebs, B. E., Goldstein, E.S. and Kilpatrick, S.T. (2014). Lewin's Genes XI. Jones and Bartlett Publishers, LLC, UK.

7. Lodish, H., Berk, A., Kaiser, C. A., Krieger, M., Bretscher, A. and Ploegh, H. (2016).

Molecular Cell Biology (5th edition), W.H. Freeman & Co., New York, USA.

8. Singh, B.D. (2018). Molecular Genetics.Kalyani Publishers, India.

9. Snustad, D.P. and Simmons, M.J. (2012). Principles of Genetics (5th Edition). John Wiley and Sons Inc., U.S.A.

B.Sc. Medical (Semester-II) (Session 2020-21)

BOTANY

Course Code: BSMM-2075(P)

PRACTICAL – GENETICS AND CELL BIOLOGY

Course outcome: -

After passing this course the course the student will develop:

CO1: A critical awareness of how genetics techniques can be applied to biological problems.

CO2: A critical awareness of current thinking in a specialist area of cell biology and genetics.

CO3: the ability to evaluate methodologies in the design of experimental procedures.

CO4: The ability to critically evaluate experimental data.

CO5: The ability to synthesize hypotheses from a wide range of information sources.

CO6: The ability to design and implement a wide range of experimental procedures.

CO7: to be able to make sound judgments on the significance of incomplete data sets.

CO8: Demonstration of independence and originality in solving problems.

CO9: The ability to exercise initiative and personal responsibility.

CO10: The development of independent learning skills required for continuing professional development.

B.Sc. Medical (Semester-II) (Session 2020-21)

BOTANY

Course Code: BSMM-2075(P)

PRACTICAL – GENETICS AND CELL BIOLOGY

TIME: 3Hours **Practical: 20**

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 Laboratory Exercises

Teachers may select plants/material available in their locality/institutions.

1. To study cell structure from onion leaf peels; demonstration of staining and mounting

methods.

2. Comparative study of cell structure in onion cells, *Hydrilla* and *Spirogyra.* Study of cyclosis in *Tradescantia* Staminal Cells.

3. Study of plastids to examine pigment distribution in plants (e.g. *Cassia, Lycopersicon* and *Capsicum*).

4. Examination of electron micrographs of eukaryotic cells with special reference to organelles.

5. Study of electron micrographs of viruses, bacteria, cyanobacteria and eukaryotic cells for comparative cellular organization.

6. Microscopy- Theoretical knowledge of Light and Electron microscope.

7. Examination of various stages of mitosis and meiosis using appropriate plant material

(e.g. onion root tips, onion flower buds).

8. Preparation of karyotypes from dividing root tip cells and pollen grains.

9. Cytological examination of special types of chromosomes: bar body, lampbrush and polytene chromosomes.

10. Working out the laws of inheritance using seed mixtures.

11. Working out the mode of inheritance of linked genes from test cross and/or F2 data.

Suggested Readings:-

1. Fukui, K. and Nakayama, S. 1996. Plant Chromosomes; Laboratory Methods, CRC Press, Boca Raton, Florida.

2. Gunning, B.E.S. and Steer, M.W. 1996. Plant Cell Biology; Structure and Function, Jones AndBarllett Publishers, Boston, Massachusetts.

3. Harns, N. and Oparka, K.J. 1994. Plant Cell Biology, A Practical Approach. IRL Press,at OxfordUniversity Press, Oxford, UK.

4. Sharma, A.K. and Sharma, A. 1999. Plant Chromosomes; Analysis. Manipulation and

Engineering, Harwood Academic Publishers, Australia.

5. Plopper, G. (2016). Principles of Cell Biology. Jones and Barnett Learning, Boston,

Massachusetts.

Annexure-C

FACULTY OF LIFE SCIENCES

SYLLABUS

Of

Botany For

B.Sc. Medical (Semester IV)

(Under Continuous Evaluation System)

(12+3 System of Education)

Session: 2020-21

The Heritage Institution

KANYA MAHA VIDYALAYA

JALANDHAR

(Autonomous)

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULLUM OF EXAMINATION OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Medical) Session 2020-21

BOTANY

Semester IV

Course Name	Program Name	Course Code		Course Type	Marks					CA	Examination time (in Hours)
					Total	Course Title	Ext.				
							L	P			
Botany	B.Sc. (Medical)	BSMM-4075	I	E	100	Diversity of seed Plants and their systematics -I	30	-		20	3
			II			Diversity of seed Plants and their systematics -II	30	-			3
			P			Practical (Based on Papers–I and II)	-	20			3

B.Sc. (Medical) Semester-IV(Session 2020-21)

BOTANY

Course Code: BSMM-4075(I)

DIVERSITY OF SEED PLANTS AND THEIR SYSTEMATICS-I

(Theory)

Course outcome: -

After passing this course the student will develop:

CO1: Understanding of characters of seed plants, origin and evolution of seed habit, angiosperms and gymnosperms

CO2: Understanding of general characters of gymnosperms, their classification and evolution including fossil and living gymnosperms.

CO3:Understanding of morphology of vegetative and reproductive parts of *Pinus* and *Cycas*

CO4: Understanding of morphology of vegetative and reproductive parts of *Ephedra* and *Ginkgo*

B.Sc. (Medical Semester-IV(Session 2020-21)

BOTANY

Course Code: BSMM-4075(I)

DIVERSITY OF SEED PLANTS AND THEIR SYSTEMATICS-I

(Theory)

Time: 3Hrs **Max. Marks: 30**

Instructions for the Paper Setters:

Eight questions of equal marks (6 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.

Unit–I

Characteristics of seed plants; Evolution of the seed habit; Distinguishing features of angiosperms and gymnosperms. Angiosperms: Origin and evolution. Some examples of primitive angiosperms.

Unit–II

General features of gymnosperms and their classification; evolution and diversity of Gymnosperms including fossil and living gymnosperms; Geological time scale and fossilization.

Unit–III

Morphology of vegetative and reproductive parts; Anatomy of root, Stem and leaf; reproduction and life cycle of *Pinus*, *Cycas*.

Unit–IV

Morphology of vegetative and reproductive parts; Anatomy of root, Stem and leaf; reproduction of life cycle of *Ephedra* and *Ginkgo*.

Suggested Readings:-

1. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms, New Age Internationl Limited, New Delhi.

2. Gifford, E.M. and Foster, A.S. (1988). Morphology and Evolution of Vascular Plants, W.H.Freeman& Company, New York.

3. Pellant, C. (1994). Fossils, Dragon's World, Great Britain

4. Sporne, K.R. (1965). The Morphology of Gymnosperms, Hutchinson & Co. (Publishers) Ltd., London.

5. Taylor, T. N., Taylor, E. L. and Krings, M. (2008). Paleobotany: The Biology and Evolution of Fossil Plants (2nd Edition). Elsevier Inc. Netherlands.

6. Vashistha, P. C. (2016). Botany for degree students. S.Chand and Company, New Delhi.

B.Sc. (Medical) Semester-IV(Session 2020-21)

BOTANY

Course Code: BSMM-4075(II)

DIVERSITY OF SEED PLANTS AND THEIR SYSTEMATICS-II

(Theory)

Course outcome: -

After passing this course the student will develop:

CO1: Plant description, describe the morphological and reproductive stretch of plant and also identify the different families.

CO2: Understanding of Botanical Nomenclature, classification of angiosperms and Salient features of the systems proposed by Bentham and Hooker, Engler and Prantl

CO3: Understanding diversity of flowering plants in families like Ranuculaceae, Brassicaceae, Rutaceae, Fabaceae, Apiaceae, Acanthaceae.

CO4: Understanding diversity of flowering plants in families like Apocynaceae, Asclepiadaceae, Solanaceae, Lamiaceae, Chenopodiaceae, Euphorbiaceae, Liliaceae, Orchidaceae and Poaceae.

B.Sc. (Medical)Semester-IV(Session 2020-21)

BOTANY

Course Code: BSMM-4075(II)

DIVERSITY OF SEED PLANTS AND THEIR SYSTEMATICS-II

(Theory)

Time: 3Hrs **Max. Marks: 30**

Instructions for the Paper Setters:

Eight questions of equal marks (6 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.

Unit–I

Angiosperm taxonomy; Brief history, Aims and fundamental components (alpha-taxonomy, Omega-taxonomy, Holotaxonomy); Identification, keys. Taxonomic literature. Botanical nomenclature: Taxonomic ranks; Type concept; Principle of priority.

Unit–II

Botanical nomenclature: Taxonomic ranks; Type concept; Principle of priority. Major contribution of cytology, Phytochemistry and taximetrics to taxonomy. Classification of angiosperms; Salient features of the systems proposed by Bentham and Hooker, Engler and Prantl

Unit–III

Diversity of flowering plants as illustrated by members of the families Ranuculaceae, Brassicaceae, Rutaceae, Fabaceae, Apiaceae, Acanthaceae.

Unit–IV

Diversity of flowering plants as illustrated by members of the families Apocynaceae, Asclepiadaceae, Solanaceae, Lamiaceae, Chenopodiaceae, Euphorbiaceae, Liliaceae, Orchidaceae and Poaceae.

Suggested Readings:-

1. Bendre, A. (2007). Practical Botany, Rastogi Publications, Meerut.

2. Davis, P.H. and Heywood, V.H. (1963). Principles of Angiosperm Taxonomy, Oliver and Boyd, London.

3. Gifford, E.M. and Foster, A.S. (1988). Morphology and Evolution of Vascular Plants, W.H. Freeman & Company, New York.

4. Jeffrey, C. (1982). An Introduction to Plant Taxonomy, CambridgeUniversity Press,

Cambridge, London.

5. Jones, S.B., Jr. and Luchsinger, A.E. (1986). Plant Systematics (2nd edition). McGraw- Hill Book Co., New York.

6. Radford, A.E. (1986). Fundamental of Plant Systematics, Harper and Row, New York

B.Sc. (Medical) Semester-IV (Session 2020-21)

BOTANY

Course Code: BSMM-4075(P)

DIVERSITY OF SEED PLANTS AND THEIR SYSTEMATICS (I&II)

(PRACTICAL)

Course outcome: -

After passing this course the student will able to:

CO1: Identify different plants from different families through their vegetative and reproductive characters.

CO2: Understanding different types of placentation system.

B.Sc. (Medical) Semester-IV (Session 2020-21)

BOTANY

Course Code: BSMM-4075(P)

PRACTICAL – DIVERSITY OF SEED PLANTS AND THEIR SYSTEMATICS

(I &II)

TIME: 3Hours **Practical: 20**

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 Laboratory Exercises

1. Angiosperms The following species are suitable for study.

2. This list is only indicative. Teachers may select plants available in their locality. Teachers may select plants/material available in their locality/institution.

1. Ranunculaceae: *Ranunculus, Delphinium*

2. Brassicaceae: *Brassica, Alyssum, Iberis, Coronopus.*

3. Malvaceae*: Hibiscus, Abutilon.*

4. Rutaceae: *Murraya, Citrus*.

5. Fabaceae: Faboideae: *Lathyrus, Cajanus, Melilotus, Trigonella*, Caesalpinioideae*: Cassia, Caesalpinia*, Mimosoideae: *Prosopis, Mimosa, Acacia*.

6. Apiaceae: *Coriandrum. Foeniculum, Anethum*.

7. Acanthaceae: *Adhatoda, Peristrophe*.

8. Apocynaceae: *Vinca, Thevetia, Nerium.*

9. Asclepiadaceae: *Calotropis*.

10. Solanaceae: *Solanum, Withania, Datura*.

11. Euphorbiaceae: *Euphorbia, Phyllanthus*.

12. Lamiaceae: *Ocimum, Salvia*.

13. Chenopodiaceae: *Chenopodium, Beta*.

14. Liliaceae: *Asphodelus, Asparagus*.

15. Poaceae: *Avena, Triticum, Hordeum, Poa, Sorghum*.

The Students should be made familiar with the use of identification keys including use ofcomputers in taxonomy. The teachers should prevent students from collecting plants fromthe wild and submitting them for the practical examination. Instead, the student should be asked to prepare field reports.

Gymnosperms

Cycas (i) Habit, armour of leaf bases on the stem (if specimen is not available showphotography), very young leaf (circinate vernation) and old foliage leaves, scale leaf, bulbils, male cone (specimen); Microsporophyll, megasporophyll mature seed. (ii) Study through permanent slides—normal root (T.S.), stem (T.S.) (if sections are not available show photographs), ovule (L.S.). (iii) Study through hand sections or dissections-coralloid root (T.S.), rachis (T.S.), leaflet (V.S.), microsporophyll (V.S.) pollen grains (W.M.).

Pinus (i) Habit, long and dwarf shoot showing cataphylls and scale leaves, T.S. wood showing growth rings, male cone, 1st year, 2nd year and 3rd year female cones, winged seeds. (ii) Study through permanent slides-root (T.S.), female cone (L.S.) ovule (L.S.), embryo (W.M.) showing polycotyledonous condition. (iii) Study through hand sections or dissections-young stem (T.S.), old stem (wood) (T.L.S. and R.L.S.), needle (T.S. male cone (L.S.), male cone (T.S.), Pollen grains (W.M.).

Ephedra (i) Habit and structure of whole and female cones. (ii) Permanent slides-female cone (L.S.). (iii) Hand sections/dissections-node (L.S.), internode (T.S.), macerated stem to see vessel structure; epidermal peel mount of vegetative parts to study stomata, male cone (T.S. and L.S.), pollen grains.

Ginkgo (i) Habit and structure of whole plant. (ii) Permanent slides-male and female reproductive parts. (iii) pollen grains

Suggested Readings:

1. Angiosperm Phylogeny Group (2003). An update of the Angiosperm Phylogeny Group

classification for the orders and families of the flowering plants: APG

2. Botanical Journal of the Linnaean Society 141: 399-436. 2. Cronquist, A. (1981). An

Integrated System of Classification of Flowering Plants. ColumbiaUniversity Press, New

York.

3. Simpson, M.C. (2006). Plant Systematics. Elsevier, Amsterdam

Annexure-D

FACULTY OF LIFE SCIENCES

SYLLABUS

Of

Botany For

B.Sc. Medical (Semester VI)

(Under Continuous Evaluation System)

(12+3 System of Education)

Session: 2020-21

The Heritage Institution

KANYA MAHA VIDYALAYA

JALANDHAR

(Autonomous)

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULLUM OF EXAMINATION OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Medical) Session 2020-21

BOTANY

Semester VI

Course Name	Program Name	Course Code		Course Type	Marks					Examination time (in Hours)
					Total	Course Title	Ext.		CA	
							L	P		
Botany	B.Sc. (Medical)	BSMM-6075	I	E	100	Ecology	30	-	20	3
			II			Economic Botany	30	-		3
			P			Practical (based on Paper-I and Paper-II)	-	20		3

B. Sc. (Medical) Semester-VI (Session 2020-21)

BOTANY

Course Code: BSMM-6075 (I)

Ecology

(Theory)

Course outcome: -

After passing this course the student will develop:

CO1. Demonstrate practical fieldwork skills.

CO2. Demonstrate an understanding of key ecological interactions and processes:

CO3. Explain scales and patterns in ecology and biodiversity

CO4. Appreciate the relationships between ecology and society

B. Sc. (Medical) Semester-VI (Session 2020-21)

BOTANY

Course Code: BSMM-6075(I)

Ecology

(Theory)

Examination Time: 3Hrs **Max. Marks: 30**

Instructions for the Paper Setters:

Eight questions of equal marks (6 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.

.Unit-I

Plants and Environment: Atmosphere (gaseous compositions), water (properties of watercycle),light (global radiation, photosynthetically active radiation), temperature, soil (development, soil profiles, physico-chemical properties), and biota.
Morphological, anatomical and physiological responses of plants to water (hydrophytes andxerophytes), temperature (thermoperiodicity and vernalization), light (photoperiodism, heliophytes and sciophytes) and salinity.

Unit-II

Community Ecology: Community characteristics, absolute and relative frequency, density anddominance, basal area and importance value index (IVI), Whittaker's classification ofbiodiversity,indices of alpha, beta and gamma diversity, life forms, biological spectrum, ecologicalsuccession.

Unit-III

Population Ecology: Growth curves, ecotypes, ecads.
Ecosystem: Structure, abiotic and biotic components, food chain, food web, ecologicalpyramids,energy flow, biogeochemical cycles of carbon, nitrogen and phosphorus.

Unit-IV

Biogeographical Regions of India
Vegetation types of India: Forests and grasslands

Landscape Ecology: Definition & concept, effect of patch size and shape on biodiversity, dynamics of land use.

B. Sc. (Medical) Semester-VI (Session 2020-21)

Suggested Readings

1. De, Debapriya and De, Debasish (2014). Fundamentals of Environment and Ecology. S. Chand Publishing, New Delhi
2. Kumar, H.D. (2018). Modern Concepts of Ecology 8th edition.Vikas Publishing House, New Delhi.
3. Mackenzie, A., Ball,A. and Virdee, S. (2001). Instant Notes in Ecology. Taylor & Francis, London, United Kingdom
4. Odum, E.P. and Barrett, G.W. (2012). Fundamentals of Ecology.Cengage Learning India Pvt.Ltd., New Delhi.
5. Saini, A. (2019). Plant Ecology. Trueman Book Company. New Delhi.
6. Sharma, P.D. (2017). Environmental Biology and Toxicology. 3rd edition. Rastogi Publications, Meerut.
7. Srivastava, H. N. (2020). Botany Vol VI, Ecology and Utilization of Plants. Pradeep publications, Jalandhar.

B. Sc. (Medical) Semester-VI (Session 2020-21)

BOTANY

Course Code: BSMM-6075(II)

Economic Botany

(Theory)

Course outcome: -

After passing this course the students will be able to:

CO1:- Understand core concepts of Economic Botany and relate with environment, populations, communities, and ecosystems.

CO2:-Develop critical understanding on the evolution of concept of organization of apex new crops/varieties, importance of germplasm diversity, issues related to access and ownership.

CO3:-Develop a basic knowledge of taxonomic diversity and important families of useful plants.

CO4:-Increase the awareness and appreciation of plants& plant products encountered in everyday life.

CO5:-Appreciate the diversity of plants and the plant products in human use.

B. Sc. (Medical) Semester-VI (Session 2020-21)

BOTANY

Course Code: BSMM-6075(II)

Economic Botany

(Theory)

Examination Time: 3Hrs **Max. Marks: 30**

Instructions for the Paper Setters:

Eight questions of equal marks (6 marks each) are to be set, two in each of the four Sections (I-IV). Questions of Sections I-IV 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.

Unit-I

Food Plants: *Oryza sativa* (Rice), *Triticum aestivum*(Wheat), *Zea mays* (Maize), *Solanum tuberosum* (Potato), *Saccharum officinarum* (Sugarcane).
Fibres: *Gossypium hirsutum*(Cotton) and *Corchorus capsularis* (Jute).
Vegetable Oils: *Arachis hypogea* (Groundnut), *Brassica campestris* (Mustard) and *Cocos nucifera* (Coconut).

Unit-II

Spices : General account of *Piper nigrum* (Black pepper), *Eugenia caryophyllum*(Cloves),*Cinnamomum verum* (Cinnamomum), *Elettaria cardamomum* (Cardamom), *Zingiber officinalis* (Ginger), *Curcuma longa* (Turmeric), *Coriandrum sativum* (Coriander), *Foeniculum vulgaris* (Fennel) and *Mentha arvensis* (Mint).

Unit-III

Medicinal Plants: General account of *Terminalia chebula*(Harar), *Terminalia belerica*(Bahera), *Azadirachta indica* (Neem), *Phyllanthus emblica*(Amla), *Aconitum napellus*(Aconite), *Rauwolfia serpentina* (Sarpagandha), *Atropa belladonna* (Belladonna), *Datura stramonium* (Datura),*Withaniasomnifera*(Ashwagandha) *and Papaver somniferum*(Poppy).

Unit-IV

Beverages: *Camellia sinensis* (Tea) and *Coffea arabica* (Coffee).

Rubber: Morphology of *Hevea brasiliensis*(Rubber), Processing and Uses. General account of sources of firewood, timber and bamboos.

Suggested Readings:

1.Verma, V. (2016). Textbook of Economic Botany, ANE Books, New Delhi.

2. Das, K. (2014). Medicinal plants- Their importance in Pharmaceutical Sciences, Kalyani

Publishers, New Delhi.

3. Kochhar, S.L. (2016). Economic Botany of the Tropics, Macmillan India Pvt. Ltd., New Delhi.

4. Prinentel, D. and Hall, C.W. (Eds.) (2001). Food and Natural Resources. Academic

Press,London, New York.

5. Reddy, K. et al. (2015). Advances in Medicinal plants, Universities Press, Hyderabad.

6. Sharma, O.P. (1996). Hill's Economic Botany. Tata McGraw Hill Co. Ltd., New Delhi.

7. Swaminathan, M.S. and Kohchar, S.L. (Eds) (2009). Plants and Society. Macmillan Publications Ltd., London.

8. Council of Scientific & Industrial Research (1986). The Useful Plants of India. Publications and Information Directorate. CSIR, New Delhi.

B.Sc. Medical (Semester-VI) (Session 2020-21)

BOTANY

Course Code: BSMM-6075(P)

PRACTICAL: - Ecology and Economic botany

(I &II)

Course Outcomes:

On completion of this course, the students will be able to:

CO1. Determine abundance and frequency of species by quadrate method.

CO2. Measure the dissolved oxygen content in polluted and unpolluted water samples.

CO3. Study of anatomical peculiarities with reference to ecological adaptations .

CO4. Preparation of different stains, solutions and reagents as per theory paper.

CO5. To understand the economic importance of plants.

CO6. To acquire knowledge in the preparation of herbarium techniques. Submission of field report and practical records.

B.Sc. Medical (Semester-VI) (Session 2020-21)

BOTANY

Course Code: BSMM-6075(P)

PRACTICAL: - Ecology and Economic botany

(I &II)

TIME: 3Hours **Practical: 20**

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 Laboratory Exercises

1. To determine minimum number of quadrats required for reliable estimate of biomass ingrasslands through species area curves.
2. To study the frequency of herbaceous species in grassland and to compare the frequency
3. distribution with Raunkiaer's Standard Frequency Diagram.
4. To estimate Importance Value Index for grassland species on the basis of relativefrequency,relative density and relative dominance in protected and grazed grassland.
5. To measure the vegetation cover of grassland through point frame method.
6. To measure the above ground plant biomass in a grassland.
7. To study the morphological anatomical features of hydrophytes (*Hydrilla, Eichhornia*)
8. Xerophytes (*Nerium, Calotropis*).
9. To determine diversity indices (richness, Simpson, Shannon-Weaver) in grazed and protectedgrassland.
10. To estimate bulk density and porosity of grassland and woodland soils.
11. To determine moisture content and water holding capacity of grassland and woodland soil.
12. To study the vegetation structure through profile diagram.
13. To estimate transparency, pH and temperature of different water bodies.

14. To measure dissolved oxygen content in polluted and unpolluted water samples.

15. To estimate salinity of different water samples.

16. To determine the percent leaf area injury of different leaf samples collected around polluted sites.

17. To estimate dust-holding capacity of the leaves of different plant species.

18. **Food Plants:** Study of the morphology, structure and simple microchemical tests of thefoodsstoring tissues rice, wheat, maize, potato and sugarcane. Microscopic examination ofstarchinthese plants (excepting sugarcane).

19. **Fibres:** Study of cotton flowers, sectioning of the cotton ovules/developing seeds to trace theorigin and development of cotton fibers. Microscopic study of cotton and test for cellulose.

20. Sectioning and staining of jute stem to show the location and development of fibers.Microscopic structure.Tests for lignocelluloses.

21. **Vegetable Oils:** Study of hand sections of groundnut, mustard and coconut and staining ofoildroplets by Sudan III and Sudan Black.

22. **Field Visits:** To study sources of firewood (10 plants)/timberyielding trees (10trees)/bamboos,list to be prepared mentioning special features, collection of plantbased articlesofcommonuse.

23. **Spices:** Examine black pepper, cloves, cinnamon (hand sections) and opened of cardamomanddescribe them briefly.

25. Preparations of an illustrated inventory of 10 medicinal plants used in indigenous systems of medicine or allopathy: Write their botanical and common names parts used anddiseases/disorders for which they are prescribed.

26. **Beverages:** Section boiled coffee beans and tea leaves to study the characteristic structuralfeatures.

27. Visit to *in situ* conservation site/Botanical Garden.

Suggested Readings (for laboratory exercises)

1. Council of Scientific & Industrial Research. (1986). The Useful Plants of India. PublicationsandInformation Directorate. CSIR, New Delhi.
2. Kochhar, S.L. (2016). Economic Botany of the Tropics, Macmillan India Pvt. Ltd., New Delhi.
3. De, Debapriya and De, Debasish (2014). Fundamentals of Environment and Ecology. S. Chand Publishing, New Delhi
4. Kumar, H.D. (2018). Modern Concepts of Ecology 8th edition. Vikas Publishing House, New Delhi.
5. Mackenzie, A., Ball,A. and Virdee, S. (2001). Instant Notes in Ecology. Taylor & Francis, London, United Kingdom
6. Prinentel, D. and Hall, C.W. (Eds.) (2001). Food and Natural Resources. Academic Press,London, New York.
7. Sharma, O.P. (1996). Hill's Economic Botany. Tata McGraw Hill Co. Ltd., New Delhi.
8. Swaminathan, M.S. and Kocchar, S.L. (Eds.) **(2009).** Plants and Society. MacmillanPublicationsLtd., London.

Annexure-E
FACULTY OF LIFE SCIENCES

SYLLABUS

of

Botany For

B.Sc. Biotechnology (Semester IV)

(Under Continuous Evaluation System)

(12+3 System of Education)

Session: 2020-21

The Heritage Institution

KANYA MAHA VIDYALAYA
JALANDHAR

(Autonomous)

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULLUM OF EXAMINATION OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Biotechnology) Session 2020-21

BOTANY

Semester IV								
Course Name	**Program Name**	**Course Code**	**Course Type**	**Marks**				**Examination time (in Hours)**
				Total	**Ext.**		**CA**	
					L	**P**		
Botany-C	B.Sc. Biotechnology	BBTM-4074	C	60	30	18	12	3+3

B.Sc. (Biotechnology) Semester-IV (Session 2020-21)

Course Code: BBTM-4074

Botany-C

(Theory)

Course outcome: -

After passing this course the student will be able to:

CO1: Understand the plants and plant cells in relation to water

CO2: Understand the chemical contents of the plant products

CO3: Know the prevention and control measures of plant diseases and its effect on economy of crops.

B.Sc. (Biotechnology) Semester-IV (Session 2020-21)

Course Code: BBTM-4074

Botany-C

(Theory)

Time:3Hrs **Max. Marks: 60**

Theory: 30

Practical: 18

CA: 12

Instructions for the Paper Setter

Eight questions of equal marks (6 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.

Unit-I

Water relations, osmosis, transpiration, water potentials, its components, physiological & molecular adaptations in plants with respect to cold – heat - drought and salt stress.

Unit-II

Heat shock proteins, dehydrins, late embryogenesis abundant proteins, role of different osmolytes in stress tolerance.

Unit-III

Plant Pathology & epidemiology: Definition, classification, mode of transmission & control measures of plant diseases. Disease resistance host pathogen interaction. Phytoalexins, Pathogen related (PR) proteins.

Unit-IV

A detailed account of the following plant diseases with respect to casual agents, symptoms, epidemiology, disease cycle & their control measures: Black stem rust of wheat, Loose smut of wheat, Late and early blight of potato, False smut of rice, Bacterial blight of rice, Red rot of sugarcane, TMV of potato, Yellow vein mosaic of bhindi, Bunchy top of banana, Downy mildew of bajra.

Suggested Readings:

1. Salisbury, F.B. and C.W. Ross (1992), Plant Physiology, Wadsworth Publication Company
2. Taiz, L. and Zeiger, E. (2002), Plant Physiology. 3rd Edn., Sinauer Associates
3. Srivastava, H.N. (2005) Plant Physiology, Pardeep Publications .
4. Pandey, B.P. (2014) Plant Pathology, S Chand .
5. M.J. Carlile, S.C. Watkinson & G.W. Gooday (2001), The Fungi 2ndEd. Academic Press.
6. G.N. Agrios (2008), Plant Pathology 5thEd., Academic Press.
7. R.S. Mehrotra and Ashok Aggarwal (2003) Plant Pathology Tata McGraw Hill New Delhi.

B.Sc. (Biotechnology) Semester-IV (Session 2020-21)

Course Code: BBTM-4074

Botany-C

(Practical)

Course outcome: -

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

CO1: Practical skill on plants and plant cells in relation to water

CO2: Know the symptoms and control measures of plant diseases and its effect on economy of crops.

B.Sc. (Biotechnology) (Semester-IV) (Session 2020-21)

Course Code: BBTM-4074(P)

Botany-C

(Practical)

Time: 3Hrs **Practical: 18**

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

1. Estimation of relative water content of leaf.

2. Measurement of osmotic potential of different tissues by Chardokov method.

3. Study of Plant pathogens

(a) Symptoms of the diseases

(b) Morbid anatomy of the plants infected with following diseases:

Black stem rust of wheat, Loose smut of wheat, Late and early blight of potato, False smut of rice, Bacterial blight of rice, Red rot of sugarcane, TMV of potato, Yellow vein mosaic of bhindi, Bunchy top of banana, Downy mildew of bajra.

Books:

1. Salisbury, F.B. and C.W. Ross (1992), Plant Physiology, Wadsworth Publication Company
2. Taiz, L. and Zeiger, E. (2002), Plant Physiology. 3rd Edn., Sinauer Associates
3. Srivastava, H.N. (2005) Plant Physiology, Pardeep Publications.
4. Pandey, B.P. (2014) Plant Pathology, S Chand.
5. M.J. Carlile, S.C. Watkinson & G.W. Gooday (2001), The Fungi 2ndEd. Academic Press.
6. G.N. Agrios (2008), Plant Pathology 5thEd., Academic Press.
7. R.S. Mehrotra and Ashok Aggarwal (2003) Plant Pathology Tata McGraw Hill New Delhi.

Annexure-F

FACULTY OF LIFE SCIENCES

SYLLABUS

Of

Botany For

M.Sc. Botany(Semester II)

(Under Continuous Evaluation System)

Examinations: 2020-21

The Heritage Institution

Kanya Maha Vidyalaya, Jalandhar

(Autonomous)

Kanya MahaVidyalaya, 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 (Based on MBTL-2071 MBTL-2072 and MBTL-2073),	6	75	-	60	15	3
MBTP-2078	C	Botany PracticalsII (Based onMBTL-2074, MBTL-2075 and MBTL-2076)	6	75	-	60	15	3
MBTV-2079	C	On Job Training or Assignment		**Satisfactory/ Not Satisfactory**				

		Total		**450**	

Master of Science (Botany) Semester-II

Session 2020-21

MBTL-2071- Bryology

Course outcomes

After passing this course the student will be able to:

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

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*,*Tarigonia*,*Cyathodium*,*Lunularia*);Sphaerocarpales (*Sphaerocarpus*);Calobryales, Jungermanniales (*Porella*);Metzgeriales (*Pellia*);Anthocerotales (*Anthoceros*);Sphagnales (*Sphagnum*);Andreaealas (*Andrea*);Bryales (*Funaria*)

UNIT-III

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

UNIT-IV

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

Master of Science (Botany) Semester-II

Session 2020-21

Books Recommended

1. Campbell, D.R. (1985). The Evolution of Land Plants (Embryophyta) Reprinted Central Book Depot, Allahabad
2. Goffinet, B. and Shaw, A.J. (2008) Bryophyte Biology, 2nd edition, Cambridge University Press, Cambridge, pp. 476
3. Willis, K. 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:

1. Comprehend taxonomic and biological features of Pteridophyta.
2. Understand taxonomic and biological features of Pteridophyta.
3. 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

Books Recommended

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

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:

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

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.Classificationof 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

Books Recommended

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

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:

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

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 ofeach 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.

Books Recommended

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

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:

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

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 andIntracellular 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 cellcycle. Microbial Physiology: Growth, yield and characteristics, strategies of cell division, stress response Cell Signaling: Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways

UNIT-IV

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

Master of Science (Botany) Semester-II

Session 2020-21

Books Recommended

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

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:

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

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

UNIT-III

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

UNIT-IV

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

Master of Science (Botany) Semester-II

Session 2020-21

Books Recommended

1. Barbour, M.G., Burk, J.H. and Pitts, W.D. (1998). Terrestrial Plan Ecology, 3rd edition, Benjamin/Cummings Publication Company, California.
2. Begon, M., Townsend, C. R., & Harper, J. L. (2006). Ecology: from individuals to ecosystems (No. Sirsi) i9781405111171).
3. Chapman, J.L. and Reiss, M.J. (1998). Ecology: Principles and Applications, 2nd edition, Cambridge University Press, Cambridge.
4. De, A.K. (1990). Environmental Chemistry. Wiley Eastern Pvt. Ltd., New Delhi.
5. Hapke, A. (2017). **ForestEcology**. 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

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

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.

Master of Science (Botany) Semester-II

Session 2020-21

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.

Annexure-G
FACULTY OF LIFE SCIENCES

SYLLABUS

Of

Botany For

M.Sc. Botany (Semester IV)

(Under Continuous Evaluation System)

Session: 2020-21

The Heritage Institution

KANYA MAHA VIDYALAYA
JALANDHAR
(Autonomous)

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**				

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.

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

Books Recommended

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 occuring 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.

Books Recommended

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.

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

Books Recommended

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.

Books Recommended

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 hylogenetic 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, hybridandpolyploid 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 vegetationaltypes, endemism, hotspots and hottest hotspots, plant explorations, invasions andintroductions, local plant diversity and its socioeconomic importance.

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

Books Recommended

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 ofthe Linnaean Society 141: 399-436.
2. Cole, A.J. 1969. Numerical Taxonomy,Academic Press, LondonCracknell 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 TreeTechnology, 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. SinauerAssociaes, 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 aci

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

Book Recommeded

1. Patnaik, P. (1999). A Comprehensive Guide to the Hazardous Properties ofChemicalSubstances.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, relativeimmunogenicity 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, determiningbifunctionality, cross reactivity, Antigen antibody interactions: primary interactions, secondaryinteractions. 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, NewYork.
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,KanyaMahaVidyalaya, Jalandhar.

Suggested practical'sbased on MBTL-4071

1. Study of apical meristems with the help of dissections, whole mount preparations, sections andpermanent slides.
2. Study of xylem and phloem elements using maceration, staining, light and electronmicrographs (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, Boerhaaviadiffusa, 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, rootlength, fresh weight and dry weight of seven days old seedlings.
4. Study the effect of Cytokinin on morphological parameters such as shoot length, rootlength, 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,KanyaMahaVidyalaya, Jalandhar.

Suggested practical'sbased 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: AGE 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 oflocally 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: *Corriandrum, Foeniculum*
- Apocynaceae: *Vinca, Nerium, Thevetia*
- Asclepiadaceae: *Calatropis*
- Solanaceae: *Petunia, Solanum, Datura*
- Euphorbiaceae: *Euphorbia, Phyllanthus*
- Lamiaceae: *Ocimum, Salvia*
- Chenopodiaceae: *Chenopodium*
- Liliaceae: *Asparagus, Asphodelus*

Poaceae: *Triticum*, *Avena*

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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.