



**VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY**  
JNANASAGARA CAMPUS, BALLARI-583105

**Department of Studies in**  
**Botany**

**I & II Semester Syllabus**

**BACHELOR OF BOTANY**

Programme as per State Education Policy 2024

Under Choice Based Credit System (CBCS)

With effect from 2024-25 and onwards

## Semester – I MICROBIAL WORLD

<b>Course Title: Microbial World</b>	<b>Course Code: 24MJBOTN1L</b>
<b>Total Contact Hours: 56</b>	<b>No. of Credits: 04</b>
<b>L</b>	
<b>Internal Assessment Marks: 20</b>	<b>Duration of SEE: 3 Hours</b>
<b>Semester End Exam Marks: 80</b>	

### Course Outcomes (COs):

At the end of the course, students will be able to:

1. Understand the fascinating diversity, evolution, adaptive strategies and significance of microbes.
2. Comprehend the systematic position, structure, physiology and life cycles of microbes and their impact on humans and environment.
3. Gain laboratory skills such as microscopy, microbial cultures, staining, identification, preservation of microbes for their applications in research and industry.

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Unit	Description	Hours
<b>1</b>	<p><b>Introduction to microbial world:</b></p> <p>a) <b>History and Development of Microbiology:</b> Introduction to Microbiology, Aim and Scope of Microbiology. Microbiologists and their contributions (Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Dmitri Iwanowski, and MW Beijerinck).</p> <p>b) <b>Microbial Diversity:</b> Introduction to Microbial Diversity, Methods of estimation; Hierarchical organization of microbes in the living world. Distribution of microbes in soil, air, food and water. Significance of microbial diversity in nature.</p> <p>c) <b>Microscopy:</b> History and Development of Microscopes, Working principle and applications of light, dark field, phase contrast and electron microscopes (SEM and TEM). Microbiological stains (acidic, basic and special) and principles of staining. Simple, Gram's and differential staining.</p>	10
<b>2</b>	<p><b>Culture Media for Microbes:</b></p> <p>a) <b>Culture media:</b> Classification and types of Culture media (Natural and synthetic media, routine media, basal media, enriched media, selective media, indicator media, transport media and storage media).</p> <p>b) <b>Sterilization methods:</b> Principle of disinfection, antiseptic, tyndallization and Pasteurization, sterilization by heat, moist heat, UV light ionization radiation, filtration. Chemical methods of sterilization-phenolic compounds, anionic and cationic detergents.</p>	10

	<p>c) <b>Microbial Growth:</b> Microbial Growth measurement. Nutritional types of Microbes- autotrophs and heterotrophs, phototrophs and chemotrophs; lithotrophs and organotrophs.</p> <p>d) <b>Microbial cultures and preservation:</b> Microbial cultures. Pure culture and axenic cultures, subculturing, preservation methods-overlapping cultures with mineral oils, lyophilisation. Microbial culture collections and their importance. A brief account on ITCC, MTCC and ATCC.</p>	
3	<p><b>Viruses, Viroids and Prions:</b></p> <p>a) <b>Viruses:</b> Discovery, physiochemical and biological characteristics; classification (International Committee on Taxonomy of Viruses {ICTV} and Baltimore system), Structure and replication DNA virus (T-phage), lytic and lysogenic cycle; Structure and replication of RNA virus (TMV) and Brief account on SARS-Co-V-2. Economic importance of viruses.</p> <p>b) <b>Viroid's:</b> General characteristics and structure of Potato spindle tuber viroid (PSTVd).</p> <p>c) <b>Prions:</b> General characters and prion diseases.</p>	09
4	<p><b>Mycoplasma and Bacteria:</b></p> <p>a) <b>Mycoplasma:</b> Introduction, Discovery, Classification, Ultra-structure of Mycoplasma. Mycoplasma diseases caused to plants: Brinjal little leaf, Sandal spike, Sesamum phyllody, Sugarcane grassy shoot.</p> <p>b) <b>Bacteria:</b> Discovery, general characteristics and classification, Flagellation, Ultrastructure of bacteria. Reproduction-vegetative, asexual and recombination (conjugation, transformation and transduction). Bacterial plasmid and their characteristics. Role of Bacteria in Agriculture and nitrogen fixation. Economic importance of Bacteria.</p> <p>c) <b>Bacterial Plant Diseases:</b> Introduction to bacterial diseases, Survival, dissemination and host- plant interaction of bacterial disease. Casual organism, symptoms and control measures of Citrus canker, Black arm of cotton (angular leaf spot), bacterial soft rot of carrot.</p>	13
5	<p><b>Fungi and Lichens</b></p> <p>a) <b>Fungi:</b> General characteristics of fungi, Classification based on Alexopolous, Ecological Groups of Fungi, Thallus organization and nutrition in fungi. Ultra-structure and Composition of Fungal Cells, Reproduction in fungi (Asexual and Sexual). Heterothallism and Parasexuality. Type study of <i>Albugo</i>, <i>Rhizopus</i>, <i>Penicillium</i>, <i>Puccinia</i>, <i>Aspergillus</i> and <i>Cercospora</i>. Brief account and importance of Arbuscular mucorrhizal (AM) Fungi. Economic importance of fungi</p> <p>b) <b>Fungal Diseases:</b> Introduction to fungal diseases, Mode of entry of fungal pathogen and host- plant interaction of fungal disease. Causal organism, symptoms and control measures of late blight of Potato, Grain smut of sorghum, Tikka disease of Ground nut, Red rot of sugar cane, White rust of crucifer.</p> <p>c) <b>Lichens:</b> Introduction, Characteristics, Classification, External and Internal Structure of Thallus. Vegetative, asexual and sexual Reproduction in Lichens. Economic and ecological importance of Lichens.</p>	14

**References:**

1. Alexopoulos CJ and Mims CW. 1989. Introductory Mycology, Wiley Eastern Ltd., New Delhi.
2. Allas RM, 1988. Microbiology: Fundamentals and Applications, Macmillan Publishing co. New York.
3. Ketchum PA. 1988. Microbiology, concepts and applications. John Wiley and Sons. New York.
4. Michel J, Pelczar Jr. EC and Krieg CR. 2005. Microbiology. Mc. Graw-Hill, New Delhi.
5. Powar CB and Daginawala. 1991. General Microbiology, Vol-I and Vol -II. Himalaya, Publishing House, Bombay.
6. Reddy S and Ram 2007. Microbial Physiology. Scientific Publishers, Jodhpur, 385 pp.
7. Sullia SB and Shantharam S. 1998. General Microbiology. Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.
8. Schlegel HG. 1986. General Microbiology. Cambridge. University Press. London. 587 pp.
9. Roger S, Ingrahan Y, Wheelis JL, Mark L and Page PR. 1990. Microbial World. 5th edition. Printice-Hall India, Pvt Ltd. New Delhi.
10. Sullia SB and Shantharam S. 2005. General Microbiology, Oxford and IBH, New Delhi. Thomas H Nash, 2008. Lichen Biology, 3rd edn. Cambridge University Press. The Edinburgh Building, Cambridge CB2 8RU, UK.
11. Awasthi DD, 2000. Lichenology in Indian subcontinent: A supplement to "A hand book of lichens" Publisher: M/s Bishen Singh Mahendra Pal Singh, Dehra Dun.

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## Department Name:

### Semester - I

<b>Course Title: Microbial World</b>	<b>Course Code: 24MJBOTN1P</b>
<b>Total Contact Hours: 04 per week</b>	<b>No. of Credits: 02</b>
<b>P</b>	
<b>Internal Assessment Marks: 10</b>	<b>Duration of SEE: 3 Hours</b>
<b>Semester End Exam Marks: 40</b>	

#### Course Outcomes (COs):

At the end of the course, students will be able to:

1. Handle the microbiology instruments
2. Identify the different group of microbes based on their morphology or infection caused by them to the host plants
3. Understand the practical importance of microorganisms in nature.

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#### List of Experiments / Programs (For a Lab Course)

Sl.No	Experiment / Program
1	Safety measures in microbiology laboratory and study of equipment/ appliances used for microbiological studies (microscopes, Hot air oven, Autoclave/ Pressure cooker, Inoculation needles/ loop, petri-plates, incubator, laminar flow hood, colony counter, haemocytometer etc.
2	Enumeration of soil/ food/ seed microorganisms by serial dilution technique.
3	Determination of cell count by using Haemocytometer and determination of microbial cell dimension by using Micrometer
4	Simple staining of bacteria (crystal violet/ Nigrosine blue) / Gram's staining of bacteria
5	Mycoplasma diseases: Brinjal little leaf, Sandal spike, Sesamum phyllody, Sugarcane grassy shoot.
6	Bacterial diseases: Citrus canker, Black arm of cotton (angular leaf spot), bacterial soft rot of carrot.
7	Study of <i>Yeast</i> , <i>Rhizopus</i> , <i>Penicillium</i> , <i>Puccinia</i> , <i>Aspergillus</i>
8	Fungal Diseases: late blight of Potato, Grain smut of sorghum, Tikka disease of Ground nut, Red rot of sugar cane, White rust of crucifer.
9	Study of Lichens: Morphology
10	Observation of Arbuscular mycorrhizal (AM) fungi in plant roots

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**B. Sc. Botany First Semester**  
**THEORY EXAMINATION- MODEL QUESTION PAPER**  
**Title of the Paper: MICROBIAL WORLD**

**Time: 3.00 hours**

**Max Marks: 80**

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**Instructions:**

- a) Question paper comprises of four sections A, B, C, and D. All the sections are compulsory.
- b) Draw the diagrams wherever necessary.
- c) Drawings without label do not attract any marks.

**SECTION- A**

- I. Answer all the following questions. Each question carries ONE mark. 01x10=10**  
Questions number (1) to (10) Two questions from Each Unit

**SECTION- B**

- II. Answer all the following questions. Each question carries TWO marks. 02x10= 20**  
Questions number (11) to (20) Two questions from Each Unit

**SECTION- C**

- III. Answer any Four questions from the following. Each question carries FIVE marks. 04x05= 20**  
Questions number (21) to (25) one questions from Each Unit and 26<sup>th</sup> Question can be formed from unit III or IV

**SECTION- D**

- IV. Answer any Three questions from the following. Each question carries TEN marks. 10x03= 30**  
Questions number (21) to (25) one questions from Each Unit

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**B. Sc. Botany First Semester**  
**PRACTICAL EXAMINATION- MODEL QUESTION PAPER**  
**Title of the Paper: MICROBIAL WORLD**

**Time: 3.00 hours**

**Max Marks: 40**

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Q. No. 1. Conduct the experiment as per slip "A". Write the procedure and identify with reasons	10
Q. No. 2. Stain the given material "B" by the using Safranin / Crystal Violet/ Methylene Blue /Nigrosine. Write the procedure and identify with reasons	10
Q. No. 3. Mount and Prepare temporary slide of given specimen "C" and leave the preparation	05
Q. No. 4. Identify and Comment on "D & E"	04
Q. No. 5. Identify the disease, Name the casual organism and mention the control measures of given specimen "F & G".	06
Q. No. 6. Viva-Voce	02
Q. No. 7. Submission of Practical record	03

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**B. Sc. Botany First Semester**  
**SCHEME OF EVALUATION FOR BOTANY PRACTICAL-I B. SC. I SEMESTER**  
**Title of the Paper: MICROBIAL WORLD**

**Time: 3.00 hours**

**Max Marks: 40**

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- Q. No. 1. **A:** Determination of cell count/Determination of cell by micrometry/  
Observation of AM fungi in higher plant roots/Serial dilution technique 10
- (a) Procedure writing 03 marks
  - (b) Slide preparation 03 marks
  - (c) Identification 02 marks
  - (d) Mention the reasons 02 marks
- Q. No. 2. Stain the given material "B" by the using stain (Curd or Bacterial culture) 10
- (a) Procedure writing 03 marks
  - (b) Slide preparation 03 marks
  - (c) Identification 02 marks
  - (d) Mention the reasons 02 marks
- Q. No. 3. Mount and Prepare temporary slide of given specimen "C" 05  
*Rhizopus, Pencillium, Puccinia, Aspergillus, Lichen*
- (a) Preparation of slide 02 marks
  - (b) Identification 01 marks
  - (c) Reasons or Characters 02 marks
- Q. No. 4. **D:** Photographs of Microbiologists 04  
**E:** Microbiology Laboratory Instruments
- (a) Identification - 01 mark
  - (b) Application of Instrument or Contribution of Microbiologist - 01 mark
- Q. No. 5. **F:** Bacterial Diseases/Viral Diseases 06  
**G:** Fungal Diseases
- (a) Casual organism of disease - 01 mark
  - (b) Symptoms - 01 mark
  - (c) Control measures - 01mark
- Q. No. 6. Viva-Voce 02
- Q. No. 7. Submission of Practical record 03

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## Semester – II Non- Flowering plants

<b>Course Title: Non-Flowering Plants</b>	<b>Course Code: 24MJBOTN2L</b>
<b>Total Contact Hours: 56</b>	<b>No. of Credits: 04</b>
<b>L</b>	
<b>Internal Assessment Marks: 20</b>	<b>Duration of SEE: 3 Hours</b>
<b>Semester End Exam Marks: 80</b>	

### Course Outcomes (COs):

At the end of the course, students will be able to:

4. The diversity and distinguishing characters of non-flowering plants
5. Morphology, Anatomy, Reproduction, and Life cycle of lower plants
6. Evolutionary and Ecological significance of lower plants.
7. Fossil records in evidence to support of the origin of non-flowering plants

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Unit	Description	Hours
<b>1</b>	<p><b>Phycology:</b></p> <p><b>d) History and Introduction of Phycology:</b> Introduction to phycology, Aim and Scope of phycology. Phycologists and their contributions (Isabella Abbott, Carl Adolph Agardh, John Stackhouse, Gilbert Morgan Smith M.O.P. Iyengar, M.S. Balakrishnan, Vidyavati).</p> <p><b>a) Algae:</b> A general account (Characterstics). Thallus organization, Structure, Reproduction, Life cycle pattern and classification (Fritchz). Study of structure, reproduction and life cycle of <i>Volvox</i>, <i>Oedogonium</i>, <i>Chara</i>, <i>Sargassum</i>, <i>Ectocarpus</i> and <i>Polyshiponia</i>. Diatoms and their importance. Economic and Ecological importance of algae.</p> <p><b>b) Blue Green Algae:</b> General account of occurrence, ultra structure of cell. Photosynthesis and reproduction. Economic importance in N<sub>2</sub> fixation. Type study of <i>Scytonema</i>, <i>Gloeotrichia</i> and <i>Oscillatoria</i>.</p>	14
<b>2</b>	<p><b>Bryophytes:</b></p> <p><b>e) Bryophytes:</b> General Characters, Classification. Diversity- Habitat, Thallus Structure, Gametophytes and sporophytes. Ecological significance and economic importance of Bryophytes.</p> <p><b>f) Distribution, Morphology, Anatomy, Reproduction and Life cycle of</b> <i>Riccia</i>, <i>Anthoceros</i> and <i>Polytrichum</i>.</p> <p><b>g) Brief account of evolution of sporophyte in Bryophytes.</b></p>	08
<b>3</b>	<p><b>Pteridophytes:</b></p> <p><b>d) Pteridophytes:</b> Introduction, General characteristics; classification of Pteridophytes. Ecological significance and economic importance of Pteridophytes.</p>	09

	<p>e) Distribution, Morphology, Anatomy, Reproduction and Life cycles of <i>Lycopodium</i>, <i>Selaginella</i>, <i>Equisetum</i>, <i>Pteris</i>, <i>Marselia</i> and <i>Azolla</i>.</p> <p>f) A Brief account of Stellar Evolution in Pteridophytes, Heterospory and Seed Habit. Affinities and Evolutionary significance of Pteridophytes.</p>	
4	<p><b>Gymnosperms:</b></p> <p>d) <b>Gymnosperms:</b> Introduction, General Characteristics, Classification of Gymnosperms.</p> <p>a) Morphology and anatomy of root, stems &amp; leaf. Reproduction and life cycle in <i>Cycas</i>, <i>Pinus</i> and <i>Gnetum</i>.</p> <p>b) Affinities and Evolutionary significance of Gymnosperms. Ecological and Economic importance of Gymnosperms.</p>	13
5	<p><b>Evolution of lower plants and Paleobotany</b></p> <p>d) Origin and Evolution of plants through Geological Time scale</p> <p>e) <b>Paleobotany:</b> The History of Paleobotany, Paleobotanical records, Plant fossils, Fossilization processes (Casts and molds, Authigenic mineralization, Replacement and recrystallization, Carbonization and coalification) Conditions of Fossilisation (Sites of Fossilisation, Nature of the tissue undergoing fossilisation, Events that occur before, during and after fossilisation). General account on Birbal Sahni Institute of Paleoscience</p> <p>f) <b>Fossil Taxa:</b> Rhynia, Lepidodendron, Lepidocarpon, Lyginopteris.</p>	12

**References:**

1. Chopra R.N. 1988, Biology of Bryophytes. Willey Eastern Ltd., New- Delhi.
2. Singh, Pandey & Jain, Pteridophyta, Gymnosperm & Paleobotany, Rastogi Publication, Meerut.
3. S.Sundarajan, College Botany, Vol-II., Himalaya Publishing House, New Delhi.
4. Smith, G.M. 1971. Cryptogamic Botany, Vol. II. Bryophytes and Pteridophytes. Tata McGraw Hill Publishing Co., New Delhi.
5. Sharma, O.P. 1990. Text book of Pteridophyta. McMillan India, Ltd.
6. Puri, P. 1980. Bryophyta. Atma Ram & Sons, New Delhi.
7. Parihar, N.S. 1970. An Introduction to Embryophyta. Vol. 1. Bryophyta. Central Book Depot. Allahabad.
8. Sporne, K.R. 1966. Bryophytes.
9. Vashista, B.R. 1978. Bryophytes. S. Chand & Co., Ltd., New Delhi.

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## Department Name: Botany

### Semester - II

<b>Course Title: Non-Flowering plants</b>	<b>Course Code: 24MJBOTN2P</b>
<b>Total Contact Hours: 04 per week</b>	<b>No. of Credits: 02</b>
<b>P</b>	
<b>Internal Assessment Marks: 10</b>	<b>Duration of SEE: 3 Hours</b>
<b>Semester End Exam Marks: 40</b>	

#### Course Outcomes (COs):

At the end of the course, students will be able to:

1. Identify the different group of lower plants based on their morphology and anatomy.
2. Understand the practical importance of lower plants in nature.

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#### List of Experiments / Programs (For a Lab Course)

Sl.No	Experiment / Program
1	Study of Phycologists by using Charts/Photographs Isabella Abbott, Carl Adolph Agardh, John Stackhouse, Gilbert Morgan Smith M.O.P. Iyengar, M.S. Balakrishnan, Vidyavati,
2	Type study of <i>Volvox</i> , <i>Oedogonium</i> , <i>Chara</i> , <i>Sargassum</i> , <i>Ectocarpus</i> and <i>Polyshiponia</i> (Vegetative structure, Reproductive organs)
3	Type study of <i>Scytonema</i> , <i>Gloeotrichia</i> and <i>Oscillatoria</i> (Vegetative structure, Reproductive organs)
4	Type study of <i>Riccia</i> , <i>Anthoceros</i> and <i>Polytrichum</i> (Vegetative structure, Reproductive organs)
5	Type study of <i>Lycopodium</i> , <i>Selaginella</i> , <i>Equisetum</i> , <i>Pteris</i> , <i>Marselia</i> and <i>Azolla</i> . (Vegetative structure, Reproductive organs)
6	Type study of <i>Cycas</i> , <i>Pinus</i> and <i>Gnetum</i> (Vegetative structure, Reproductive organs)
7	Geological Time scale by using chart
8	Type study of fossils: <i>Rhynia</i> , <i>Lepidodendron</i> , <i>Lepidocarpon</i> , <i>Lyginopteris</i> by using specimens/ Charts

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**B. Sc. Botany Second Semester**  
**THEORY EXAMINATION- MODEL QUESTION PAPER**  
**Title of the Paper: NON- FLOWERING PLANTS**

**Time: 3.00 hours**

**Max Marks: 80**

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**Instructions:**

- d) Question paper comprises of four sections A, B, C, and D. All the sections are compulsory.
- e) Draw the diagrams wherever necessary.
- f) Drawings without label do not attract any marks.

**SECTION- A**

- V. Answer all the following questions. Each question carries ONE mark. 01x10=10**  
Questions number (1) to (10) Two questions from Each Unit

**SECTION- B**

- VI. Answer all the following questions. Each question carries TWO marks. 02x10= 20**  
Questions number (11) to (20) Two questions from Each Unit

**SECTION- C**

- VII. Answer any Four questions from the following. Each question carries FIVE marks. 04x05= 20**  
Questions number (21) to (25) one questions from Each Unit and 26<sup>th</sup> Question can be formed from unit I or V

**SECTION- D**

- VIII. Answer any Three questions from the following. Each question carries TEN marks. 10x03= 30**  
Questions number (21) to (25) one questions from Each Unit

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**B. Sc. Botany Second Semester**  
**PRACTICAL EXAMINATION- MODEL QUESTION PAPER**  
**Title of the Paper: NON-FLOWERING PLANTS**

**Time: 3.00 hours**

**Max Marks: 40**

Q.No. 1. Identify the specimens A, B, C, D and E. Sketch and label giving reasons A – Algae, B – Phycologists, C- Bryophytes, D– Pteridophytes, E - Gymnosperms	15
Q.No. 2. Describe the anatomy of specimen F and G F – Pteridophytes, G - Gymnosperm	06
Q.No. 3. Mount the given specimen H Identify giving reasons (Gemma cups, <i>Sex organs of Chara</i> , Blue Green algae)	04
Q.No. 4. Identify and comment on I, J, K, L and M. I-Bryophyte, J-Pteridophytes, K- Gymnosperm, L- Algae M-Fossil -Slide/Impression	10
Q.No. 5 Submission and Record	05

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**B. Sc. Botany Second Semester**  
**SCHEME OF EVALUATION FOR BOTANY PRACTICAL-II B. SC. II SEMESTER**  
**Title of the Paper: Non-flowering plants**

**Time: 3.00 hours**

**Max Marks: 40**

Q. No. 1. Identify the specimens (a) Identification 01 mark (b) Sketch and Label 01 mark (b) Mention the reasons 01 mark (A-Algae, B-Phycologists, C-Bryophytes, D-Pteridophytes, E-Gymnosperms) <b>Note:</b> for 'B' - Identification 01 mark, Contributions - 02 marks)	15
Q. No. 2. Anatomy of specimen "F and G" (a) Slide preparation 01 mark (c) Identification 01 mark (d) Mention the reasons 01 mark (F – Pteridophytes, G – Gymnosperm)	06
Q. No. 3. Mount and Prepare temporary slide of given specimen "H" (a) Preparation of slide 01 marks (b) Identification 01 marks (c) Reasons or Characters 02 marks (Gemma cups, <i>Sex organs of Chara</i> , Blue Green algae)	04
Q. No. 4. Identify and comment on I, J, K, L and M. (a) Identification - 01 mark (b) Reasons - 01 mark ( I-Bryophyte, J-Pteridophytes, K- Gymnosperm, L- Algae M-Fossil -Slide/Impression)	10
Q. No. 7. Submission of Practical record	05

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