Kanya Maha Vidyalaya, Jalandhar City
(An Autonomous College)

Minutes of 7th Meeting of Board of Studies
PG Department of Botany

Date: 29-04-2022
Time: 10:30 AM
Via Zoom video conferencing

KANYA MAHA VIDYALAYA, JALANDHAR
(UGC Autonomous College)
P.G. Department of Botany

Proceedings of the Seventh Meeting of Board of Studies held on 29 -04-2022

The seventh meeting of the board of studies was held in online mode via zoom on 29th April 2022 at 10.30 am.

Date: Friday, 29-04-2022
Time: 10:30 am
Venue: Online meeting via Zoom

The following members have attended meeting and detailed minutes are listed below:

1.	Mrs Sadhna Tandon, **Dean of Life Sciences**, Kanya Maha Vidyalaya, Jalandhar	**Absent**
2.	Dr. Satwinderjeet Kaur, Professor, Department of Botanical and Environment Sciences, Guru Nanak Dev University, Amritsar (**VC Nominee**)	**Present**
3.	Dr. Amrik Singh Ahluwalia, Ex-Professor, Department of Botany, Panjab University, Chandigarh. Pro-Vice Chancellor, Eternal University, Baru Sahib, H.P. (**Outside GNDU Nominee**)	**Present**
4.	Dr. C. Nirmala, Professor, Department of Botany, Panjab University, Chandigarh (**Outside GNDU Nominee**)	**Present**
5.	Dr. D.S. Khurana, Dean Agriculture, Govind National College Narangwal 141203. (**Outside GNDU Nominee**)	**Present**
6.	Mr. Sukhjeet Singh Cheema, M.D. Pukhraj Organic, Jalandhar (**Industrial Expert**)	**Present**
7.	Ms. Sarushi, Assistant Professor, Department of Botany, Kanya Maha Vidyalaya, Jalandhar (**Alumni)**	**Present**
8.	Dr. V.K. Kaul, **Department of Agriculture**, KMV College, Jalandhar	**Present**

9.	Mrs. Shikha Vashist, Assistant Professor, Department of Botany, Kanya Maha Vidyalaya, Jalandhar (**Head of the Department**)	**Present**
10.	Mrs. Deepika Vashistha, **Assistant Professor**, Department of Botany, Kanya Maha Vidyalaya, Jalandhar	**Present**
11.	Dr. Sandeep Kaur, **Assistant Professor**, Department of Botany, Kanya Maha Vidyalaya, Jalandhar	**Present**
12.	Dr. Sandeep Singh, **Assistant Professor**, Department of Botany, Kanya Maha Vidyalaya, Jalandhar	**Present**

The Head of Botany Department Mrs. Shikha Vashisht welcomed and introduced the Members of seventh Board of studies. She apprised the members about the events organized by the department to enhance teaching learning activities. She also apprised the house about the research activities of department and members appreciated the achievement if CURIE grant.

After brief overview, she took up the agenda items for deliberation one by one with the permission of committee members.

Item: BOT: 2022: 7:1: To discuss and approve the proceedings of Sixth BOS held on 20th April 2021**.**

Proceedings: The Chairperson sent the proceedings of the previous Board of Studies meeting held on 20th April 2021 through email to all the members and were approved by all the members. The Chairperson however again put up the summary of the proceedings for approval of the house and they approved it through Zoom meeting. **(Attached herewith as Annexure A).**

The house approved the Item: BOT: 2022: 7:1

Item: BOT: 2022: 7:2: To discuss Action Taken Report (ATR) of sixth Board of Studies meeting held on 20th April 2021.

Proceedings: Action Taken Report (ATR) of sixth Board of Studies.

Sr.No.	Agenda Item	Decision taken in Meeting	Action Taken
Item No.: **BOT-6-2021-2**	To discuss the syllabus of Botany in **Bachelor of Science (Medical)**, Semesters I, II, III, IV, V & VI under continuous	The syllabus of Botany in Bachelor **of Science (Medical)**, Semesters I, II, III, IV, V & VI under continuous evaluation system for	The approved syllabus is executed.

<table>
<tr><td></td><td>evaluation system for the session 2021-22.</td><td>the session 2021-22 has been passed without any change.</td><td></td></tr>
<tr><td><u>Item No.:</u>

<u>BOT-6-2021-3</u></td><td>To discuss the syllabus of Botany in Bachelor of Science (Biotechnology), Semester I & III under continuous evaluation system for the session 2021-22.</td><td>1. The syllabus of Botany in Bachelor of Science (Biotechnology) Semester I & III under continuous evaluation system for the session 2021-22 has been passed.
2. The Botany paper from B.Sc. Biotechnology Sem IV was shifted to B.Sc. Biotechnology Sem III. The Course title also changes from Botany C to Botany II.
3. Some changes have been made in the syllabus by the parent university.</td><td>The approved syllabus is executed

The same has been incorporated.

The same has been incorporated.</td></tr>
<tr><td><u>Item No.:</u>

<u>BOT-6-2021-4</u></td><td>To discuss the syllabus of Botany in Bachelor of Science (Home Science) Semester V under continuous evaluation system for the session 2021-22.</td><td>The proposed syllabus and Course outcomes of class Bachelor of Science (Home Science) Semester V was passed by the members of the board in the meeting. The syllabus and course outcomes were same as that for the session 2020-21. The syllabus was approved without any change.</td><td>The approved syllabus is executed</td></tr>
<tr><td><u>Item No.:</u>

<u>BOT-6-2021-5</u></td><td>To discuss the outcome & syllabus of M. Sc. Botany in (Semester I, II, III & IV) under continuous evaluation system for the session 2021-22.</td><td>1. The proposed syllabus and Course outcomes of class M.Sc. Botany (Semester I) was passed by the members of the board in the meeting. Bryology (MBTL-1073) from Sem. II was swapped with Theoretical Biology (MBTL-2336) from Sem. I. The new scheme was passed by the members. The syllabus and course outcomes were same as that for the session 2020-21.
<table>
<tr><td colspan="2">Sem I (Old Scheme)</td><td></td><td colspan="2">Sem I (New Scheme)</td></tr>
<tr><td>Course Code</td><td>Course Title</td><td></td><td>Course Code</td><td>Course Title</td></tr>
<tr><td>MBTL-1071</td><td>Fungi and Plant Pathology</td><td></td><td>MBTL-1071</td><td>Fungi and Plant Pathology</td></tr>
</table></td><td>The same has been incorporated and the approved syllabus is executed.</td></tr>
</table>

MBTL-1072	Phycology		MBTL-1072	Phycology
MBTL-1073	Plant Physiology		MBTL-1073	Bryology
MBTL-1074	Genetics and Evolution		MBTL-1074	Plant Physiology
MBTL-1335	Theoretical Biology		MBTL-1075	Genetics and Evolution
MBTL-1046	Computer Applications and Bioinformatics		MBTL-1046	Computer Applications and Bioinformatics
MBTP-1077	Botany Practicals I		MBTP-1077	Botany Practicals I
MBTP-1078	Botany Practicals II		MBTP-1078	Botany Practicals II

2. The proposed syllabus and Course outcomes of class M.Sc. Botany (Sem. II) was passed by the members of the board in the meeting. Theoretical Biology (MBTL-2336) from Sem. I was swapped with Bryology (MBTL-1073) from Sem II. The new scheme is given below. The syllabus and course outcomes were same as that for the session 2020-21.

Old Scheme			**New Scheme**	
Course Code	Course Title		**Course Code**	Course Title
MBTL-2071	Bryology		MBTL-2071	Pteridology
MBTL-2072	Pteridology		MBTL-2072	Diversity and Biology of Gymnosperms
MBTL-2073	Diversity and Biology of Gymnosperms		MBTL-2073	General Microbiology
MBTL-2074	General Microbiology		MBTL-2074	Cell Biology
MBTL-2075	Cell Biology		MBTL-2075	Ecological Modelling and

					Forest Ecology
	MBTL-2076	Ecological Modelling and Forest Ecology		MBTL-2336	Theoretical Biology
	MBTP-2077	Botany Practicals I		MBTP-2077	Botany Practicals I
	MBTP-2078	Botany PracticalsII		MBTP-2078	Botany PracticalsII

3. The proposed syllabus and Course outcomes of class M.Sc. Botany (Semester III) was passed by the members of the board in the meeting. The syllabus for Applied Botany (MBTL- 3075) was revised and some changes were also done. The syllabus and course outcomes for the rest of the syllabus were same as that for the session 2020-21.
4. The proposed syllabus and Course outcomes of class M.Sc. Botany (Semester IV) was passed by the members of the board in the meeting. The syllabus for Plant Tissue Culture and Biotechnology (MBTL- 4073) was revised and some changes were done. The syllabus and course outcomes for the rest of the syllabus were same as that for the session 2020-21.

Item No.: **BOT-6-2021-6**	To discuss the syllabus of B.Sc. (Hons.) Agriculture, Semester V, VI, VII and VIII under continuous evaluation system for the session 2021-22.	The courses for B.Sc. (Hons.) Agriculture programme Semester V-VIII, were finalized in the light of recommendations of 5th Deans Committee, ICAR. Furthermore, the provisions for online internship as an alternative, in the eventuality of persistence of COVID wave were also finalized unanimously.	Suggestions implemented.
Item No.: **BOT-6-2021-7**	To discuss and approve list of proposed examiners for above stated courses.	List of Paper setters and evaluators proposed by internal committee members for the above stated courses were approved by BOS members for the session 2021-22.	List of Examiners was sent to COE Office.

Item No.: **BOT-6-2021-8**	To discuss teaching methodologies adopted in the Department and inputs required to upgrade the same for session 2021-22.	The chairperson apprised the committee members about the innovative teaching methodologies adopted by department like ICT based educational videos, projects & seminars- leading to critical & creative thinking. In the wake of current COVID 19 Pandemic situation, KMV continued its teaching on Learning Management System where teachers continued their online classes by taking online classes, uploading video lectures, assignments, power point presentations, lessons, notes, tests, quiz etc. So, the effectiveness of teaching could be well maintained and all teachers could finish their syllabi in time. Other highlights of department include student- student mentoring, group discussions, student mentoring by teachers & remedial classes for weak students. The Department is well equipped with smart class rooms, e-content and demonstrations for better understanding of concepts. The department is doing excellent work by organising virtual lab visits, competitions like power point presentation competition, quiz competition and e workshops through online platforms. **BOS members really appreciated the faculty for doing such activities.**	1. The PG Department of Botany, Kanya organized a National webinar on the occasion of Van Mahotsava on 5th July 2021on the topic "The Plantation Drive – A step to green INDIA" to connect our students with environment. Faculty of Science of KMV and other institutes and nearly 100 science students attended the event. 2. P.G. Department of Botany, K.M.V. Jalandhar participated in a three-day Bhai Vir Singh flower-cum-plant exhibition at Guru Nanak Dev University held from 15-17 December, 2021. More than 300 entries have been displayed in both plants as well as succulents by affiliated colleges, schools and individuals. The rangoli contest was also held to promote natural colours and flowers. P.G. Department of Botany, KMV, Jalandhar participated in 15 categories and secured overall Third position along with first and second prizes in various plant categories. Department also secured First position in Rangoli competition. 3. The P.G Department of Botany, Kanya organized an open online quiz "QUIZ

			ON WORLD ENVIRONMENT HEALTH DAY 2021" on 27th September 2021 to celebrate World Environment Health Day and to create awareness about the fragility of our environment and the importance of its protection. The online quiz has no registration fee. It started on 27th September and a total of 220 participants attempted. Students, Faculty and other professionals participated in the quiz from across the country. 4. P.G. Department of Botany celebrated World Mushroom Day on 14 October, 2021 with full zeal and enthusiasm. More than 50 students enthusiastically participated in various categories such as E-photography, Painting/ Drawing, Essay writing, E-poster and Powerpoint presentation competition both in online as well as offline mode. 5. Student- student mentoring workshop **"ANUBHOOTI"** was organized on 4th February 2022.The objective of the event was to develop the creative minds for implementation of the scientific ideas in day to day life. 6. P.G. Department of Botany celebrated

			National Science Day on 28th February 2022. Department organized various activities like Poster making, rangoli making, collage making and pot decoration. Students from the department participated in these activities with full zeal and enthusiasm. The theme of the event was "Integrated Approach in Science and Technology for a Sustainable Future". The event was organized through online mode. 7. P.G. Department of Botany, Kanya Maha Vidyalaya, Jalandhar organizes a Rangoli competition on the occasion of International Women's Day on 10th March 2022. Competition was categorized into Rangoli with natural material (flower petals) and artificial colours. Total 33 students from B. Sc. Medical and M. Sc. Botany have participated in the competition. Students presented their creativity in the traditional art form of colourful rangoli on the theme of women's day. The students of P.G. Department of Botany, Kanya Maha Vidyalaya, Jalandhar participated in

			intercollege Flower Show "SPRING 2022" from March 5 to 9, 2022 organised by Botanical and Environment Science Society, Post Graduate Department of Botany, Khalsa College Amritsar. Department bags first position in succulent category in the flower show. The students of the department bags first and third positions in model making competition. The organizers applauded the creativity and hard work of students in making and presenting their creativity. **BOS Members appreciated the teaching methodologies followed by the department.**
Item No.: **BOT-6-2021-9**	To discuss the course schemes and detailed syllabi for above stated programmes.	The course scheme and detailed syllabi for above stated programmes were approved.	Suggestions implemented
Item No.: **BOT-6-2021-10**	To discuss the outcomes of above stated courses and programs.	All the BOS members approved outcomes of above stated courses and programmes.	Students will be able to understand their future opportunities.

The house approved the Item: BOT : 2022:7:2

Item BOT: 2022: 7:3 To discuss the syllabus of Botany in **Bachelor of Science (Medical**) **Semester I - VI** under continuous evaluation system for the session 2022-23.

Proceedings: The proposed syllabus for **Bachelor of Science (Medical**) **Semester I - VI** under continuous evaluation system for the session 2022-23 was discussed by Board members and they approved the Syllabus with following changes:

Sem	Name of the course and course Code	Unit	2021-22	2022-23
IV	Diversity of seed plants and their systematics BSMM-4075(II)	II	**Deleted** Botanical nomenclature: Taxonomic ranks; Type concept; Principle of priority.	------
V	Plant Physiology BSMM-5075(I)	I		**Shifted from Unit II to Unit I** **Mineral Nutrition:** Essential macro- and micro-elements and their role, mineral uptake, deficiency and toxicity symptoms (hydroponics).
		II		**Shifted from UNIT IV to UNIT II** **Growth and Development:** Definitions, phases of growth and development, kinetics of growth, seed dormancy, seed germination and factors of their regulation, plant movements, the concept of photoperiodism, physiology of flowering, florigen concept, biological clocks, physiology of senescence, fruit ripening.

(Approved syllabus is attached here as Annexure B)

<u>The house approved the Item BOT: 2022: 7:3</u>

Item: BOT: 2022: 7:4 To discuss the syllabus of Botany in **Bachelor of Science (Biotechnology**) **Semester I & III** under continuous evaluation system for the session 2022-23.

Proceedings: The proposed syllabus and course outcomes of Botany in **Bachelor of Science (Biotechnology**) **Semester I & III** under continuous evaluation system for the session 2022-23 was discussed and approved by Board members without any change. **(Approved syllabus is attached here as Annexure- C)**

<u>The house approved the Item BOT: 2022: 7:4</u>

Item BOT: 2022: 7:5 To discuss the syllabus of Botany in **Bachelor of Science (Home Science) Semester V** under continuous evaluation system for the session 2022-23.

Proceedings: The proposed syllabus and course outcomes of Botany in **Bachelor of Science (Home Science) Semester V** under continuous evaluation system for the session 2022-23 was discussed and approved by Board members without any change. **(Approved syllabus is attached here as Annexure- D)**

The house approved the Item BOT: 2022: 7:5

Item BOT: 2022: 7:6 To discuss the syllabus of Botany in **Master of Science (Botany) Semester III & IV** under continuous evaluation system for the session 2022-23.

Proceedings: The proposed syllabus and course outcomes of Botany in **Master of Science (Botany) Semester III & IV** under continuous evaluation system for the session 2022-23 was discussed and approved by Board members without any change. (**Approved syllabus is attached herewith as Annexure- E)**

The house approved the Item BOT: 2022: 7:6

Item BOT: 2022: 7:7 To discuss the syllabus of Botany in **Master of Science (Botany) Semester I - IV** under Credit Based Continuous Evaluation Grading system for the session 2022-24.

Proceedings: Chairperson discussed in details the introduction of credit based continuous evaluation grading system (CBCEGS) for **Master of Science (Botany)** for the session 2022-24. The following points were highlighted and discussed and approved.

1. Overall **Master of Science (Botany)** for session 2022-24 will have **128 credits with 120 mandatory and 8 Inter Disciplinary.**

But the credits of Inter disciplinary courses will not be added in calculation of SGPA/CGPA. These will be qualifying courses only grades will be assigned.

2. The course scheme for credits is as follows:

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
SCHEME AND CURRICULUM OF EXAMINATIONS OF TWO-YEAR DEGREE PROGRAMME
Master of Science (Botany) Semester-I
Session: 2022-24

Course Code	Course Title	Course Type	Hours /Week	Credits L-T-P	Total Credits	Marks				Examination time (in Hours)
						Total	Th	P	CA	
MBTL-1071	Fungi and Plant Pathology	C	4	4-0-0	4	50	40	-	10	3

MBTL-1072	Phycology	C	4	4-0-0	4	50	40	-	10	3
MBTL-1073	Bryology	C	4	4-0-0	4	50	40	-	10	3
MBTL-1074	Plant Physiology	C	4	4-0-0	4	50	40	-	10	3
MBTL-1075	Genetics and Evolution	C	4	4-0-0	4	50	40	-	10	3
MBTL-1046	Computer Applications and Bioinformatics	IC	3	2-1-0	3	50	40	-	10	3
MBTP-1077	Botany Practicals I	C	6	0-0-6	3	75	-	60	15	3
MBTP-1078	Botany Practicals II	C	6	0-0-6	3	75	-	60	15	3
Student can opt any one of the following Interdisciplinary compulsory courses		IDE			4	100	80		20	3
		Total			**29**	**450**				
IDEC-1101 IDEM-1362 IDEH-1313 IDEI-1124 IDEW-1275				Effective Communication Skills Basics of Music (Vocal) Human Rights and Constitutional Duties Basics of Computer Applications Indian Heritage: Contribution to the world **(Credits of these courses will not be added to SGPA)**						

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATIONS OF TWO-YEAR DEGREE PROGRAMME

Master of Science (Botany) Semester-II

Session: 2022-24

Course Code	Course Title	Course Type	Hours /week	Credits L-T-P	Total Credits	Marks				Examination time (in Hours)
						Total	L	P	CA	
MBTL-2071	Pteridology	C	4	4-0-0	4	50	40	-	10	3

MBTL-2072	Diversity and Biology of Gymnosperms	C	4	4-0-0	4	50	40	-	10	3
MBTL-2073	General Microbiology	C	4	3-1-0	4	50	40	-	10	3
MBTL-2074	Cell Biology	C	4	4-0-0	4	50	40	-	10	3
MBTL-2075	Ecological Modelling and Forest Ecology	C	4	4-0-0	4	50	40		10	3
MBTL-2336	Theoretical Biology	IC	3	3-0-0	3	50	40	-	10	3
MBTP-2077	Botany Practicals I	C	6	0-0-3	3	75	-	60	15	3
MBTP-2078	Botany Practicals II	C	6	0-0-3	3	75	-	60	15	3
	Summer Training	C		0-0-2	2	50	-	40	10	3
		Total			**31**	**450**				

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATIONS OF TWO-YEAR DEGREE PROGRAMME

Master of Science (Botany) Semester-III

Session: 2022-24

Course Code	Course Title	Course Type	Hours/ week	Credits L-T-P	Total Credits	Marks				Examination time (in Hours)
						Total	L	P	CA	
MBTL-3071	Developmental Botany	C	4	4-0-0	4	50	40	-	10	3
MBTL-3072	Plant Molecular Biology	C	4	4-0-0	4	50	40	-	10	3
MBTL-3073	Plant Breeding and IPR	C	4	4-0-0	4	50	40	-	10	3

MBTL-3074	Plant Biochemistry	C	4	4-0-0	4	50	40	-	10	3
MBTL-3075	Applied Botany	C	4	4-0-0	4	50	40	-	10	3
MBTL-3076	Plant Morphogenesis	C	4	4-0-0	4	50	40		10	3
MBTP-3077	Botany Practicals I	C	6	0-0-3	3	75	-	60	15	3
MBTP-3078	Botany Practicals II	C	6	0-0-3	3	75	-	60	15	3
Student can opt any one of the following Interdisciplinary compulsory courses		IDE			4	100	80		20	3
		Total			**30**	**450**				
IDEC-1101 IDEM-1362 IDEH-1313 IDEI-1124 IDEW-1275			Effective Communication Skills Basics of Music (Vocal) Human Rights and Constitutional Duties Basics of Computer Applications Indian Heritage: Contribution to the world (Credits of these courses will not be added to SGPA)							

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATIONS OF TWO-YEAR DEGREE PROGRAMME

Master of Science (Botany) Semester-IV

Session: 2022-24

Course Code	Course Title	Course Type	Hours/ week	Credits L-T-P	Total Credits	Marks				Examination time (in Hours)
						Total	L	P	CA	
MBTL-4071	Plant Anatomy	C	4	4-0-0	4	50	40	-	10	3
MBTL-4072	Structure and Metabolism of Plant Hormones	C	4	4-0-0	4	50	40	-	10	3
MBTL-4073	Plant Tissue Culture and Biotechnology	C	4	4-0-0	4	50	40	-	10	3
MBTL-4074	Analytical Techniques	C	4	4-0-0	4	50	40	-	10	3

MBTL-4075	Diversity and Biology of Angiosperms	C	4	4-0-0	4	50	40	-	10	3
MBTL-4076 (Opt-I/II)	Optional Paper**	IE	3	3-0-0	3	50	40		10	3
MBTP-4077	Botany Practicals I	C	6	0-0-6	3	75	-	60	15	3
MBTP-4078	Botany Practicals II	C	4	0-0-4	2	75	-	60	15	3
MBTP-4079	Field Study and Research Techniques	C		0-2-0	2	50	-	40	10	-
		Total			**30**	**500**				

****Student can opt only one paper from the two optional papers.**
List of Optional Papers

1. **MBTL-4076 (I) Hazardous Chemicals**
2. **MBTL-4076 (II) Immunology**

(Approved syllabus attached herewith as Annexure F)

3. Examination and Evaluation Policy passed in the Second Meeting of Academic Council Dated 24-08-2018 under Agenda Item (AC 2: 2018: 4 (Annexure C)) for UG and PG Vocational Programmes under Credit Based Continuous Evaluation Grading System (CBCEGS), with modifications approved in the Fourth Meeting of Academic Council dated 23.11.2019 under Agenda Item (AC 4: 2019: 4(v)) will be extended and implemented to all PG Diploma and Degree Programmes.

   The detailed syllabus for Master of Science (Botany) under Credit Based Continuous Evaluation Grading System (CBCEGS) for session 2022-24 as discussed and passed in BOS meeting is attached herewith as an **Annexure F**.

The house approved the Item BOT: 2022: 7:7

Item BOT: 2022: 7:8: To discuss the syllabus of **Bachelor of Science (Hons.) Agriculture VII** and **VIII** under continuous evaluation system for the session 2022-23.

Proceedings: The syllabus and course outcomes of **Bachelor of Science (Hons.) Agriculture VII** and **VIII** under continuous evaluation system for the session 2022-23, was discussed by the members and they approved it without any change.
(Approved syllabus attached herewith as Annexure G)

The house approved the Item BOT: 2022: 7:8

Item BOT: 2022: 7:9: To discuss and approve syllabus of certificate course in **"Nursery Development and Management"** for the session 2022-23.

Proceedings: The chairperson discussed the introduction of new certificate course on "**Nursery Development and Management**" under Credit Based Continuous Evaluation Grading System (CBCEGS) for session 2022-23. The detailed syllabus was discussed with the members and they approved it. The following points were highlighted, discussed and approved. **(Approved syllabus attached herewith as Annexure H)**

1. **The course for the session 2022-23 will have 2 credits.**
2. **The course scheme for credits is as follows:**

Course Code	Course Title	Hours/ Week	Credits L-T-P	Total Credits	Marks				Examination time (in Hours)
					Total	Ext.		CA	
						L	P		
	Nursery Development and Management	3	1-0-1	2	50	20	20	10	3

The house approved the Item BOT: 2022: 7:9

Item BOT: 2022: 7:10: To discuss and approve list of proposed Examiners for above stated courses.

Proceedings: The chairperson discussed the Examiners and Evaluators for Botany papers in **Bachelor of Science (Medical) Semester I-VI, Bachelor of Science (Biotechnology) Semester I & III, Bachelor of Science (Home Science) Semester V** and **Master of Science (Botany) Semester I-IV** with the members and they approved it. **(Approved lists attached herewith as Annexure I)**

The house approved the Item BOT: 2022: 7:10

Item BOT: 2022: 7:11: To discuss research inputs and plans of department for session 2022-23.

Proceedings: Chairperson apprised the committee members about the research activities taken by department. She explained that department has two Ph.D. teachers, three M.Sc. (NET) and one M.Sc. teacher. Faculty members are engaged in quality research as evident from their publications in high impact factor journals of International and National repute. She apprised that Department has all major sophisticated instruments all supported from project grants like DBT star College, CPE & FIST from DST. Teachers also participated in online webinars, FDPs, Induction and refresher courses conducted by various institutions **(Attached as Annexure J)**

The house highly appreciated the research work of the department including CURIE grant, minor research projects by students and seed money projects undertaken by faculty.

Item BOT: 2022: 7:12: To discuss teaching methodologies adopted in department and inputs required to upgrade the same.

Proceedings: The chairperson apprised the committee members about the innovative teaching methodologies adopted by department like ICT based educational videos, projects & seminars-leading to critical & creative thinking. Department continued its teaching through blended mode. So, the effectiveness of teaching could be well maintained and all teachers could finish their syllabi in time. Other highlights of department include student- student mentoring, group discussions, student mentoring by teachers & remedial classes for weak students. The Department is well equipped with smart class rooms, e-content and demonstrations for better understanding of concepts. The extension lectures from luminaries across globe is regular feature of department and activities like virtual lab visits, power point presentation competition, quiz competition, workshops and educational trips for overall development of students and to create passion for science are regularly organized.

The house approved the (Item BOT: 2022: 7:12) teaching methodologies and various activities held in the department to enhance teaching learning process.

Dr. Satwinderjeet Kaur (VC Nominee)	Dr. Amrik Singh Ahluwalia (Outside GNDU Nominee)	Dr. C. Nirmala (Outside GNDU Nominee)	Dr. D.S. Khurana (Outside GNDU Nominee)
Mr. Sukhjeet Singh Cheema (Industrial Expert)	Ms. Sarushi (Alumni)	Dr. V.K. Kaul (Department of Agriculture, KMV)	Mrs. Shikha Vashist (Head of the Department, KMV)
Mrs. Deepika Vashistha (Assistant Professor, KMV)	Dr. Sandeep Kaur (Assistant Professor, KMV)	Dr. Sandeep Singh (Assistant Professor, KMV)	

ANNEXURE A

KANYA MAHA VIDYALAYA, JALANDHAR
(UGC Autonomous College)
P.G. Department of Botany
Proceedings of the Sixth Meeting of Board of Studies held on 20-04-2021
Meeting by Circulation

The sixth meeting of the board of studies was held through Zoom App on 20thApril, 2021 at11:00am. The minutes of meeting are compiled for your kind approval. Following Members of the Board of Studies were invited to attend the meeting.

External Expert Members:

1. Dr. Satwinderjit Kaur, Professor,

   Department of Botanical and Environmental Sciences,

   GNDU, Amritsar.

   (University Nominee)

2. Dr. Amrik Singh Ahluwalia, Professor,

   Department of Botany,

   Panjab University, Chandigarh.

   (Outside Parent University Nominee)

3. Dr. C. Nirmala, Professor,

   Department of Botany,

   Panjab University, Chandigarh.

   (Outside Parent University Nominee)

4. Dr. D.S. Khurana, Dean Agriculture,

   Govind National College

   Narangwal 141203

   (Special Invitee)

5. Ms. Sarushi **(Alumni)**

Internal Expert Members:

Mrs. Sadhna Tandon, Dean of Life Sciences, (Chairperson)

Dr. V.K. Kaul Professor, Department of Agriculture

Mrs. Shikha Vashisht, Assistant Professor, Department of Botany

Mrs. Deepika Vashistha, Assistant Professor, Department of Botany

Dr. Sandeep Kaur, Assistant Professor, Department of Botany

Dr. Sandeep Singh, Assistant Professor, Department of Botany

The Chairperson Mrs. Sadhana Tandon welcomed and introduced the Members of sixth Board of studies. She apprised the members about the programs in department along with teaching and research strengths of the department. Mrs. Shikha Vashist took up the agenda items for deliberation one by one with the permission of committee members.

Item: Bot 6: 2021-1: To discuss and approve the proceedings of fifth Board of Studies held on 25.11.20 and action taken report**.**

Proceedings:

House approved the proceedings of fifth Board of Studies and appreciated the implementation of proceedings of previous BOS as discussed in action taken report **(Annexure A)**.

Item: Bot 6: 2021-2: To discuss the outcome & syllabus of Botany in **Bachelor of Science (Medical)** (Semester I, II, III, IV, V and VI) under continuous evaluation system for the session 2021-22.

Proceedings:

2.1 The proposed syllabus and Course outcomes of class **B. Sc. (Medical) Sem I** was passed by the members of the board in the meeting. The syllabus and course outcomes were same as that for the session 2020-21. **(Annexure B)**.

2.2 The proposed syllabus and Course outcomes of class **B. Sc. (Medical) Sem II** was passed by the members of the board in the meeting. The syllabus and course outcomes were same as that for the session 2020-21. **(Annexure C)**.

2.3 The proposed syllabus and Course outcomes of class **B. Sc. (Medical) Sem III**was passed by the members of the board in the meeting. The syllabus and course outcomes were same as that for the session 2020-21. **(Annexure D)**.

2.4 The proposed syllabus and Course outcomes of class **B. Sc. (Medical) Sem IV**was passed by the members of the board in the meeting. The syllabus and course outcomes were same as that for the session 2020-21. **(Annexure E)**.

2.5 The proposed syllabus and Course outcomes of class **B. Sc. (Medical) Sem V**was passed by the members of the board in the meeting. The syllabus and course outcomes were same as that for the session 2020-21. **(Annexure F)**.

2.6 The proposed syllabus and Course outcomes of class **B. Sc. (Medical) Sem VI** was passed by the members of the board in the meeting. The syllabus and course outcomes were same as that for the session 2020-21. **(Annexure G)**.

Item: Bot 6: 2021-3: To discuss the syllabus of Botany in **B.Sc.**

Biotechnology (**SEM I& III)** under continuous evaluation system for the session 2021-22.

Proceedings:

3.1 The proposed syllabus and Course outcomes of Botany in **B.Sc.**

Biotechnology (**Sem. I)** was passed by the members of the board in the meeting.The syllabus and course outcomes were same as that for the session 2020-21. **(Annexure H).**

3.2 The Botany paper from B.Sc. Biotechnology Sem. IV was shifted to B.Sc.Biotechnology Sem. III. The Course title also changes from Botany C to Botany II.

(Annexure I)

Changes in syllabus:

- Macronutrients and micronutrients and their deficiency symptoms, ascent of sap and transport of organic solutes, biotic (pathogen and insects) topics were added to Unit I.
- Physiological & molecular adaptations in plants with respect to cold – heat - drought and salt stress topics were deleted from Unit I.
- Light harvesting complexes; mechanisms of electron transport; photoprotective mechanisms; CO2 fixation-C3, C4 and CAM pathways were added to Unit II.
- Heat shock proteins, dehydrins, late embryogenesis abundant proteins, role of different osmolytes in stress tolerance were deleted from Unit II.
- A brief account of the following plant diseases with respect to casual agents, symptoms, epidemiology and their control measures : Black stem rust of wheat, Loose smut of wheat, Late and early blight of potato, Red rot of sugarcane, TMV of potato, Yellow vein mosaic of bhindi topics were shifted to Unit III.
- False smut of rice, Bacterial blight of rice, Bunchy top of banana, Downy mildew of bajra topics were deleted from Unit IV.
- Biodiversity: Physical environment; biotic environment; biotic and abiotic interactions. Concept of habitat and niche; Characteristics of a population; population growth curves; population regulation; Major terrestrial biomes; biogeographical zones of India Topics were added to Unit IV.

- False smut of rice, Bacterial blight of rice, Bunchy top of banana, Downy mildew of bajra practicals were deleted from Practical syllabus.
- Three new practicals were added, which are as follows:
  1. Demonstrate the transpiration pull by mercury method.
  2. Demonstration that O_2 is evolved during photosynthesis.
  3. Separation of pigments by paper chromatography/TLC method.

Item: Bot 6: 2021-4: To discuss the syllabus of Botany in **B. Sc. Home Science**

Semester V under continuous evaluation system for the session 2021-22.

Proceedings: The proposed syllabus and Course outcomes of class **B. Sc. Home Science** Semester V was passed by the members of the board in the meeting. The syllabus and course outcomes were same as that for the session 2020-21. **(Annexure J).**

Item: Bot 6: 2021-5: To discuss the outcome & syllabus of M. Sc Botany in (Semester I, II, III & IV) under continuous evaluation system for the session 2021-22 of the below mentioned:

Proceedings:

5.1 The proposed syllabus and Course outcomes of class **M.Sc Botany (Semester I)** was passed by the members of the board in the meeting. Bryology (MBTL-1073) from Sem II **was swaped** with Theoretical Biology (MBTL-2336) from sem I. The new scheme is given below. The syllabus and course outcomes were same as that for the session 2020-21 **(Annexure-K).**

Sem I (Old Scheme)			**Sem I (New Scheme)**	
Course Code	Course Title		Course Code	Course Title
MBTL-1071	Fungi and Plant Pathology		MBTL-1071	Fungi and Plant Pathology
MBTL-1072	Phycology		MBTL-1072	Phycology
MBTL-1073	Plant Physiology		MBTL-1073	Bryology
MBTL-1074	Genetics and Evolution		MBTL-1074	Plant Physiology
MBTL-1335	Theoretical Biology		MBTL-1075	Genetics and Evolution
MBTL-1046	Computer Applications and Bioinformatics		MBTL-1046	Computer Applications and Bioinformatics

MBTP-1077	Botany Practicals I		MBTP-1077	Botany Practicals I
MBTP-1078	Botany Practicals II		MBTP-1078	Botany Practicals II

5.2 The proposed syllabus and Course outcomes of class **M.Sc Botany (Semester II)** was passed by the members of the board in the meeting. Theoretical Biology (MBTL-2336) from Sem I was swaped with Bryology (MBTL-1073) from Sem II. The new scheme is given below. The syllabus and course outcomes were same as that for the session 2020-21 **(Annexure-L).**

Old Scheme			New Scheme	
Course Code	Course Title		**Course Code**	Course Title
MBTL-2071	Bryology		MBTL-2071	Pteridology
MBTL-2072	Pteridology		MBTL-2072	Diversity and Biology of Gymnosperms
MBTL-2073	Diversity and Biology of Gymnosperms		MBTL-2073	General Microbiology
MBTL-2074	General Microbiology		MBTL-2074	Cell Biology
MBTL-2075	Cell Biology		MBTL-2075	Ecological Modelling and Forest Ecology
MBTL-2076	Ecological Modelling and Forest Ecology		MBTL-2336	Theoretical Biology
MBTP-2077	Botany Practicals I		MBTP-2077	Botany Practicals I
MBTP-2078	Botany PracticalsII		MBTP-2078	Botany PracticalsII
MBTV-2079	On Job Training or Assignment		MBTV-2079	On Job Training or Assignment

5.3 The proposed syllabus and Course outcomes of class **M.Sc Botany (Semester III)** was passed by the members of the board in the meeting. **The syllabus for Applied**

Botany (MBTL- 3075) was revised and changes are listed below. The syllabus and course outcomes for the rest of the syllabus were same as that for the session 2020-21 **(Annexure-M).**

Changes in Syllabus:

Course Title: Applied Botany (MBTL 3075):

- Vegetable oils and fats topic moved to Unit III from Unit I.
- Gum and Resins, Rubber moved to Unit IV from Unit II.
- Essential oil yielding plants of India, their use in perfumery moved to Unit III from Unit II.
- Fibre yielding plants moved under title fibres in Unit III.
- Tanning and Dyeing material, rubber and other latex yielding products, gums and resins were shifted Unit IV.
- Topic Sugars was deleted from Unit III as they were already present in Unit I.
- Soils have been deleted from Unit III.

5.4 It was decided to add 20% internal assessment in all the papers of **M.Sc. (Botany) semester IV** for session 2021-22 under continuous evaluation system.The syllabus for Plant Tissue Culture and Biotechnology (MBTL- 4073) is revised and changes are listed below. The syllabus and course outcomes for the rest of the syllabus were same as that for the session 2020-21. **(Annexure N)**

Changes in Syllabus

Course Title: Plant Tissue Culture and Biotechnology (MBTL- 4073):

- Introduction and Historical Aspects of Tissue culture were added in Unit I.

Item: Bot 6: 2021-6: To discuss the syllabus of **B.Sc. (Hons.) Agriculture, Semester V, VI**, **VI** and **VIII** under continuous evaluation system for the session 2021-22.

Proceedings: The courses for B.Sc. (Hons.) Agriculture programme Semester V-VIII, were finalized in the light of recommendations of 5th Deans Committee, ICAR.
Furthermore, the provisions for online internship as an alternative, in the eventuality of persistence of COVID wave were also finalized unanimously and are appended at **Annexure O**.
Item: Bot 6: 2021-7: To discuss and approve list of proposed examiners for above stated courses.

Proceedings:

List of Paper setters and evaluators proposed by internal committee members for the above stated courses were approved by BOS members for the session 2021-22. **(Annexure P)**

Item: Bot 6: 2021-8: To discuss teaching methodologies adopted in the Department and inputs required to upgrade the same.

Proceedings:

BOS member appreciated the innovative teaching methodologies adopted by department like ICT based educational videos, projects & seminars- leading to critical & creative thinking. In the wake of current COVID 19 Pandemic situation, KMV continued its teaching on Learning Management System where teachers continued their online classes by uploading video lectures, assignments, power point presentations, lessons, notes, tests, quiz etc. So, the effectiveness of teaching could be well maintained and all teachers could finish their syllabi in time. Other highlights of department include student- student mentoring, group discussions, student mentoring by teachers & remedial classes for weak students. The Department is well equipped with smart class rooms, e-content and demonstrations for better understanding of concepts. The department is doing excellent work by organising virtual lab visits, competitions like powerpoint presentation competition, quiz competition and e workshops through online platforms. BOS members really appreciated the faculty for doing such activities.

Item: Bot 6: 2021-9: To discuss the outcomes of above stated courses and programmes.

Proceedings:

The course outcomes of above stated courses and programmes were discussed and approved by members of Board of studies.

Item: Bot 6: 2021-10: To discuss the course scheme and detailed syllabus for above stated programmes.

Proceedings:

The course scheme and detailed syllabus for above stated programmes were discussed and approved.

Item: Bot 6: 2021-11: To discuss and approve **ordinance for Bachelor of Science (Medical) and M.Sc. Botany** for the session 2021-22.

Proceedings:

The ordinances for Bachelor of Science (Medical) and M.Sc. Botany for the session 2021-22 were discussed and approved.

- The meeting ended with vote of thanks by Mrs. Shikha Vashist. She said that all achievements are due to excellent team work and she has full faith in her team for prospective growth of department under Autonomous status.

Annexure (B)

FACULTY OF LIFE SCIENCES

SYLLABUS

Of

Botany For

Bachelor of Science (Medical)

Semester I-VI

(Under Continuous Evaluation System)

(12+3 System of Education)

Session: 2022-23

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 2022-23)
Botany

Bachelor of Science (Medical)
Semester I

Course Name	Program Name	Course Code		Course Type	Marks				CA	Examination time (in Hours)
					Total	Paper	Ext. L	Ext. P		
Botany	Bachelor of Science (Medical)	BSMM-1075	I	E	100	Diversity of Microbes	30	-	20	3
			II			Diversity of Cryptogams	30	-		3
			P			Practical (based on Paper-I and Paper-II)	-	20		3

Bachelor of Science (Medical)
Semester II

Course Name	Program Name	Course Code		Course Type	Marks					Examination time (in Hours)
					Total	Course Title	Ext. L	Ext. P	CA	
Botany	Bachelor of Science (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

Bachelor of Science (Medical) Semester III										
Course Name	**Program Name**	**Course Code**		**Course Type**	**Marks**					**Examination time (in Hours)**
					Total	**Paper**	**Ext.**		**CA**	
							L	**P**		
Botany	Bachelor of Science (Medical)	BSMM-3075	I	E	100	Structure, Development and Reproduction in Flowering Plants-I	30	-	20	3
			II			Structure, Development and Reproduction in Flowering Plants-II	30	-		3
			P			Practical (Based on Papers–I and II)	-	20		3

Bachelor of Science (Medical) Semester IV										
Course Name	**Program Name**	**Course Code**		**Course Type**	**Marks**					**Examination time (in Hours)**
					Total	**Course Title**	**Ext.**		**CA**	
							L	**P**		
Botany	Bachelor of Science (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

Bachelor of Science (Medical) Semester VI										
Course Name	**Program Name**	**Course Code**		**Course Type**	**Marks**					**Examination time (in Hours)**
					Total	**Course Title**	**Ext.**		**CA**	
							L	**P**		
Botany	**Bachelor of Science (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**

Bachelor of Science (Medical) Semester V										
Course Name	**Program Name**	**Course Code**		**Course Type**	**Marks**					**Examination time (in Hours)**
					Total	**Paper**	**Ext.**		**CA**	
							L	**P**		
Botany	Bachelor of Science (Medical)	BSMM-5075	I	E	100	Plant physiology	30	-	20	3
			II			Biochemistry & Biotechnology	30	-		3
			P			Practical (based on Paper-I and Paper-II)	-	20		3

Bachelor of Science (Medical) Semester-I (Session 2022-23)
BOTANY

Course Code: BSMM-1075(I)

DIVERSITY OF MICROBES

(Theory)

Course outcome: -

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

CO1: Understand the classification, characteristic features, life cycle and economic value of algae.

CO2: Understand the general features of viruses especially SARS and COVID-19, mycoplasmas, bacteria and cyanobacteria.

CO3: Develop knowledge about features, classification, life cycle and economic importance of fungi.

CO4: Understand the general characteristics of lichens.

Bachelor of Science (Medical) Semester-I (Session 2022-23)
BOTANY

Course Code: BSMM-1075(I)

DIVERSITY OF MICROBES

(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

Algae: General characters, classification and economic importance, range of thallus organization, important features and life history of Chlorophyceae– *Volvox, Oedogonium, Coleochaete;* Xanthophyceae– *Vaucheria;* Phaeophyceae– *Ectocarpus, Sargassum;* Rhodophyceae– *Polysiphonia.*

UNIT-II

General account of viruses and mycoplasma with special reference to SARS and Covid-19. Bacteria–structure, nutrition, reproduction and economic importance; general account of cyanobacteria.

UNIT-III

General account, classification and economic importance of fungi. Important features and life history of Mastigomycotina– *Pythium, Phytophthora;* Zygomycotina– *Mucor*, Ascomycotina– *Saccharomyces, Eurotium, Chaetomium, Peziza*.

UNIT-IV

Basidiomycotina– *Puccinia, Agaricus;* Deuteromycotina– *Cercospora, Colletotrichum*. General account of Lichens.

Suggested Readings:

1. Dube, H.C., 2007, A Textbook of Fungi, Bacteria and Viruses (3rd edition), Scientific Publishers, India
2. Dube, H.C., 2013, An Introduction to Fungi (4th edition), Scientific Publishers., India.
3. James W. Brown. (2015). Principles of Microbial Diversity.ASM press, USA.
4. Ogunseitan, O. (2008). Microbial Diversity: Form and function in Prokaryotes. Wiley Publishers, USA.
5. Sharma, O.P., 2004, Text Book of Thallophytes. McGraw Hill Publishing Co., India.
6. Sharma, P.D., 2004, The Fungi, (2nd Edition) Rastogi Publication, India
7. Srivastava, H.N., 2018, Diversity of Microbes and Cryptogams, Vol. I, Pradeep's Publication.

Bachelor of Science (Medical) Semester-I (Session 2022-23)
BOTANY

Course Code: BSMM-1075(II)

DIVERSITY OF CRYPTOGAMS

(Theory)

Course Outcomes:

After passing this course student will be able to:

CO1: Demonstrate knowledge of similarities and differences between vascular and nonvascular plants.

CO2: Build up a sound foundation in the subject of Cryptogamic Botany in general and Bryophytes in particular so that the students may be able to apply the acquired knowledge while interacting into the other fields of Botany.

CO3: Acquaint the students about the classification, morphology, biology and economic importance of various pteridophytic plants.

CO4: Recognize different plants and flora that come under pteridophytes.

Bachelor of Science (Medical) Semester-I (Session 2022-23)
BOTANY

Course Code: BSMM-1075(II)
DIVERSITY OF CRYPTOGAMS
(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

Bryophyta: Amphibians of plants kingdom displaying alternation of generations; structure, reproduction.

UNIT-II

Classification of Hepaticopsida (e.g. *Marchantia*); Anthocerotopsida (e.g. *Anthoceros*), Bryopsida (e.g. *Funaria*).

UNIT-III

Pteridophyta: The first vascular plant; important characteristics of Psilopsida, Lycopsida, Sphenopsida and Pteropsida; Structure, reproduction in *Rhynia*

UNIT-IV

Structure and reproduction in *Lycopodium, Selaginella, Equisetum, Pteris and Marsilea.*

Suggested Readings:

- Goffinet B. (2008). Bryophyte Biology. Cambridge University Press, UK.
- Sambamurty, S.S. (2013). A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany. I K International Publishing House Pvt Ltd., India
- Sharma, O.P. (2014). Bryophyta. McGraw Hill Education Pvt Ltd., India.
- Srivastava, H.N., 2018, Diversity of Microbes and Cryptogams, Vol. I, Pradeep's Publication.
- Vashishta, P.C, Sinha, A.K, Kumar, A., (2010). Botany for Degree Students Pteridophyta (Vascular cryptogams). S.S. Chand Publications

Bachelor of Science (Medical) Semester-I (Session 2022-23)
BOTANY

Course Code: BSMM-1075(P)

PRACTICAL – RELATED TO DIVERSITY OF MICROBES&

DIVERSITY OF CRYPTOGAMS

Course Outcomes:

After passing this course student will be able to:

CO1: Ability to evaluate different sources of phylogenetic information (e.g. molecular sequence data, ultrastructure, morphology) for understanding algae and fungi.

CO2: Knowledge of the evolutionary history and time-scale of non-vascular plants, including the development of the first terrestrial plants from green algae.

CO3: Knowledge of the history and time-scale of land plant evolution, and evaluation of the principal types of evidence underlying.

CO4: Basic understanding of algal and fungal diversity (incl. morphology, cell structure and level of organization) to phylum level, and their association as lichens.

Bachelor of Science (Medical) Semester-I (Session 2022-23)
BOTANY

Course Code: BSMM-1075(P)

PRACTICAL – RELATED TO DIVERSITY OF MICROBES &

DIVERSITY OF CRYPTOGAMS

Time: 3 Hrs. **Marks: 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/institution.
1. Gram staining of bacteria.
2. Observation of disease symptoms in hosts infected by fungi, viruses and mycoplasma. Section cutting of diseased material and identification of the pathogens as per the theory syllabus.
3. Study of the genera included under algae and fungi.
4. Study of morphology, reproductive structures and anatomy of the examples cited in theory under Bryophyta and Pteridophyta.
5. Types of Bacteria to be observed from temporary /permanent slides /electron micrographs.

Suggested Readings:

- Lee, R.E. **(2018).** Phycology, Fifth Edition, Cambridge University Press, USA.
- Agrios, G.N. **(2005).** Plant Pathology, 5th edition, Academic Press, U.K.

Bachelor of Science (Medical) Semester-II (Session 2022-23)

BOTANY

Course Code: BSMM-2075 (I)

CELL BIOLOGY

(Theory)

Course outcome: -

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

CO1: Explain the structure of cell and organelles associated with it.

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

CO3: Describe chromosome organization and aberrations associated with it.

CO4: Understand cellular envelopes and their functions.

Bachelor of Science (Medical) Semester-II (Session 2022-23)

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

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

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.

Bachelor of Science (Medical) Semester-II (Session 2022-23)

BOTANY

Course Code: BSMM-2075(II)

GENETICS

(Theory)

Course outcome: -

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

CO1: Understand the chemical basis of hereditary material i.e. DNA.

CO2: Understand Mitosis, Meiosis and gene interactions.

CO3: Understand different methods of gene expression in prokaryotes and eukaryotes.

CO4: Understand various methods of genetic mutation and variations in living beings.

Bachelor of Science (Medical) Semester-II (Session 2022-23)

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; the nucleosome 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.

Bachelor of Science (Medical) Semester-II (Session 2022-23)

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.

Bachelor of Science (Medical) Semester-II (Session 2022-23)

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 And Barllett Publishers, Boston, Massachusetts.
3. Harns, N. and Oparka, K.J. 1994. Plant Cell Biology, A Practical Approach. IRL Press, at Oxford University 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.

Bachelor of Science (Medical) Semester-III (Session 2022-23)
BOTANY

Course Code: BSMM-3075(I)

STRUCTURE, DEVELOPMENT AND REPRODUCTION IN FLOWERING PLANTS-I (Theory)

Course outcome: -

After passing this course the student will develop:

CO1: Understanding of basic body plan of a flowering plant, Diversity in plant form branching pattern and canopy architecture trees.

CO2: Understanding of shoot apical meristem and its histological organization. Cambium and its function and formation of secondary xylem.

CO3: Understanding of wood in relation to water and minerals, growth rings and structure of secondary phloem and periderm.

CO4: Understanding of origin, development, arrangement and diversity in size and shape of leaf, internal structure in relation to photosynthesis and water loss, senescence and abscission.

Bachelor of Science (Medical) Semester-III (Session 2022-23)
BOTANY
Course Code: BSMM-3075(I)

STRUCTURE, DEVELOPMENT AND REPRODUCTION IN FLOWERING PLANTS-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

The basic body plan of a flowering plant-modular type of growth. Diversity in plant form in annuals, biennials and perennials; trees-largest and longest-lived, branching pattern; monopodial and sympodial growth; canopy architecture.

Unit II

The Shoot System: The shoot apical meristem and its histological organization; meristematic and permanent tissue, formation of internodes. Cambium and its functions; formation of secondary xylem.

Unit III

A general account of wood structure in relation to conduction of water and minerals; characteristics of growth rings, sapwood and heart wood; role of woody skeleton; secondary phloem-structure function relationships; periderm.

Unit IV

Leaf: Origin, development, arrangement and diversity in size and shape; internal structure in relation to photosynthesis and water loss; adaptations to water stress; senescence and abscission.

Suggested Readings:

- Beck, C.B. (2010). An Introduction to Plant Structure and Development: Plant anatomy for the Twenty First Century (2nd Edition). Cambridge University Press, UK.
- Cutler, D. F., Botha, T. and Stevenson, D. M. (2007). Plant Anatomy: An Applied Approach. Blackwell Publishing, Oxford, UK.
- Dickison, W.C. (2000). Integrative Plant Anatomy. Academic Press, California, USA.
- Mauseth, J.D. (1988). Plant Anatomy, The Benjamin/Cummings Publishing Company Inc., Menlo Park, California, USA.
- Raven, P.H., Evert, R.F. and Eichhorn, S.E. (1999). Biology of Plants, 5th edition. W.H. Freeman and Co., Worth Publishers, New York.
- Rudall, P. J. (2007). Anatomy of Flowering Plants: An Introduction to Structure and
- Development (3rd Edition). Cambridge University Press, UK.
- Thomas, P. (2000) Trees: Their Natural History, Cambridge University Press, Cambridge.
- Srivastava, H.N. (2018) Diversity of Seed Plants and Their Systematics, Vol. III, Pradeep's Publication.

Bachelor of Science (Medical) Semester-III (Session 2022-23)
BOTANY

Course Code: BSMM-3075(II)

STRUCTURE, DEVELOPMENT AND REPRODUCTION IN FLOWERING PLANTS-II (Theory)

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

CO1: Recognize the major groups of vascular plants and their phylogenetic relationships.

CO2: Know the structure and development of monocot and dicot embryos.

CO3: Understand different means of vegetative reproduction.

CO4: Understand physiology of seed germination.

Bachelor of Science (Medical) Semester-III (Session 2022-23)
BOTANY
Course Code: BSMM-3075(II)

STRUCTURE, DEVELOPMENT AND REPRODUCTION IN FLOWERING-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

The Root System: The root apical meristem; differentiation of primary and secondary tissues and their roles; structural modification for storage, respiration, reproduction and for interaction with microbes.

Unit II

Vegetative Reproduction: various methods of vegetative propagation. Detailed study and types of grafting and budding, economic aspects. Flower: A modified shoot; structure, development and varieties of flower; functions

Unit III

Structure of anther and pistil; the male and female gametophytes; types of pollination; attractions and reward for pollinators; (sucking and foraging types); pollen-pistil interaction self incompatibility.

Unit IV

Double fertilization: formation of seed endosperm and embryo: fruit development and maturation Significance of Seed: Suspended animation; ecological adaptation; unit of genetic recombination with reference to reshuffling of genes and replenishment; dispersal strategies.

Suggested readings:

- Bhojwani, S.S., Bhatnagar, S.P. and Dantu P.K. (2015). The Embryology of Angiosperms, 6th edition. Vikas Publishing House, Delhi.
- Hartmann, H.T. and Kestler, D.E. (1976). Plant Propagation: Principles and Practices, 3rd edition, Prentice Hall of India Pvt. Ltd., New Delhi.
- Mauseth, J.D. (1988). Plant Anatomy, The Benjamin/Cummings Publishing Company Inc., Menlo Park, California, USA.
- Peau, K. (1977). Anatomy of Seed Plants, 3rd edition. John Wiley & Sons, New York.
- Pegeri, K. and Vander Pijl (1979). The Principles of Pollination Biology, Pergamon Press, Oxford.
- Raven, P.H., Evert, R.F. and Eichhorn, S.E. (1999). Biology of Plants, 5th edition. W.H. Freeman and Co., Worth Publishers, New York.
- Srivastava, H.N. (2018) Diversity of Seed Plants and Their Systematics, Vol. III, Pradeep's Publication.

Bachelor of Science (Medical) Semester-III (Session 2022-23)
BOTANY
Course Code: BSMM-3075 (P)

PRACTICAL – STRUCTURE, DEVELOPMENT AND REPRODUCTION IN FLOWERING PLANTS (I & II)

Course outcome: -

After passing this course the student will be able to:

CO1: Develop knowledge about the role of herbarium techniques in plant identification.

CO2: Understand different life forms exhibited by flowering plants.

CO3: Understand anatomy of different plant parts using free hand razor technique.

CO4: Examine flower and their mode of pollination.

Bachelor of Science (Medical) Semester-III (Session 2022-23)
BOTANY
Course Code: BSMM-3075 (P)

PRACTICAL – STRUCTURE, DEVELOPMENT AND REPRODUCTION IN FLOWERING PLANTS (I & II)

TIME: 3 Hours 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. Study of any commonly occurring dicotyledonous plant (for example *Solanum nigrum* or Kalanchoe) to the body plan, organography and modular type of growth.

2. Life forms exhibited by flowering plants (by a visit to a forest or a garden, Study of tree like habit in cycads, bamboo, banana, traveller's tree (*Revenala madagascariensis*) and Yucca and comparison with true trees as exemplified by conifers and dicotyledons.

3. L.S. Shoot tip to study the cytohistological zonation and origin of leaf primordia.

4. Monopodial and sympodial types of branching in stems (especially rhizomes).

5. Anatomy of primary and secondary growth in monocots and dicots using free hand razor technique (*Solanum*, *Boerhavia*, *Helianthus*, *Mirabilis*, *Nyctanthus*, *Draceana*, Maize) hand sections (or prepared slides). Structure of secondary phloem and xylem. Growth rings in wood, microscopic study of wood in T.S., T.L.S. and R.L.S.

6. Field study of diversity in leaf shape, size, thickness, surface properties. Internal structure of leaf. Structure and development of stomata (using epidermal peels of leaf).

7. Anatomy of the root. Primary and secondary structure.

8. Examination of a wide range of flowers available in the locality and methods of their pollination.

9. Structure of anther, microsporogenesis (using slides) and pollen grains (using whole mounts). Pollen viability using in vitro pollen germination.

10. Structure of ovule and embryo sac development using serial sections from permanent slides.

11. Nuclear and cellular endosperm. Embryo development in monocots and dicots (using permanent slides/dissections).

12. Simple experiments to show vegetative propagation (leaf cuttings in *Bryophyllum*, *Sansevieria*, *Begonia*; stem cuttings in rose, *Salix*, money plant, Sugarcane and *Bougainvillea*).

13. Germination of non-dormant and dormant seeds.

Suggested Readings (for laboratory exercises):

1. Bhojwani, S.S. and Bhatnagar, P. (2000). The Embryology of Angiosperms (4th revised and enlarged edition), Vikas Publishing House, New Delhi.

2. Mauseth, J.D. (1988). Plant Anatomy, The Benjamin/Cumminas Publishing Co., Inc., Mehlo Park, California, USA.

3. Raven, P.H., Evert, R.F. and Eichhorn, S.E. (1992). Biology of Plants (5th Edition). Worth Publishers, New York.

4. Steeves, T.A. and Sussex, I.M. (1989). Patterns in Plant Development (2nd Edition). Cambridge University Press, Cambridge

Bachelor of Science (Medical) Semester-IV (Session 2022-23)

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*

Bachelor of Science (Medical) Semester-IV (Session 2022-23)

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 International 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.

Bachelor of Science (Medical) Semester-IV (Session 2022-23)

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, sclepiadaceae, Solanaceae, Lamiaceae, Chenopodiaceae, Euphorbiaceae, Liliaceae, Orchidaceae and Poaceae.

Bachelor of Science (Medical) Semester-IV (Session 2022-23)

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

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, Cambridge University 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

Bachelor of Science (Medical) Semester-IV (Session 2022-23)

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.

Bachelor of Science (Medical) Semester-IV (Session 2022-23)

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 of computers in taxonomy. The teachers should prevent students from collecting plants from the 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 show Photography), 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. Columbia University Press, New York.
3. Simpson, M.C. (2006). Plant Systematics. Elsevier, Amsterdam

Bachelor of Science (Medical) Semester-V (Session 2022-23)
BOTANY
Course Code: BSMM-5075 (I)

Course Title: Plant Physiology

(Theory)

Course outcome: -

After passing this course the student will be able to:

CO1. Understand the plant cells in relation to water and mineral nutrition.

CO2. Learn about the movement of sap & absorption of water and growth in plant.

CO3. Understand the process of photosynthesis in higher plants with particular emphasis on light and dark reactions, C3 and C4 pathways.

CO4. Understand the growth regulator in higher plants .

Bachelor of Science (Medical) Semester-V (Session 2022-23)
BOTANY
Course Code: BSMM-5075 (I)

Course Title: Plant Physiology

(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

Plant-Water Relation: Importance of water to plant life, physical properties of water, (imbibition) diffusion and osmosis, absorption, transport of water and transpiration, physiology of stomata.
Mineral Nutrition: Essential macro-and micro-elements and their role, mineral uptake, deficiency and toxicity symptoms (hydroponics).

Unit-II

Transport of Organic Substances: Mechanism of phloem transport, source-sink relationship, factors affecting translocation.

Growth and Development: Definitions, phases of growth and development, kinetics of growth, seed dormancy, seed germination and factors of their regulation, plant movements, the concept of photoperiodism, physiology of flowering, florigen concept, biological clocks, physiology of senescence, fruit ripening.

Unit-III

Photosynthesis: Significance, historical aspects, photosynthetic pigments, action and absorption spectra and enhancement effects, concept of two photosystems, z-scheme, photophosphorylation, Calvin cycle, C4 pathway, CAM plants, photorespiration.

Unit-IV

Plant growth regulators - auxins, gibberellins, cytokinins, abscissic acid and ethylene, history of their discovery, biosynthesis and mechanism of action, general account of salicylic acid, jasmonates and brassinosteroids, photomorphogenesis, phytochromes and cryptochromes, their discovery, physiological role and mechanism of action.

Suggested Readings:-

1. Bhatia, K.N. (2019). Plant Physiology I and II. Trueman Book Company. New Delhi
2. Hopkins, W.G. and Huner, A. (2008). Introduction to Plant Physiology (4th Edition). JohnWiley and Sons. U.S.A.
3. Jain, V.K. (2017). Fundamentals of Plant Physiology. S. Chand Publishing. New Delhi.
4. Mandavia, C., Patel, S. V., Mandavia, M. K., Golakiya, B. A. and Chovatia, V. P. (2009).Glimpses in Plant Physiology. International Book Distributing Co., Lucknow, India.
5. Mohr, H. and Schopfer, P. (1995). Plant Physiology. Springer-Verlag, Berlin, Germany.
6. Pandey, S.N. and Sinha, B. K. (2005). Plant Physiology. Vikas Publishing. New Delhi.
7. Salisbury, F.B. and Ross, C.W. 2006. Plant Physiology (4th Edition). Wadsworth PublishingCo.,California, USA.
8. Srivastava, H. N. (2019). Plant Physiology, Biochemistry and Biotechnology. Pradeep Publications, Jalandhar.
9. Taiz, L. and Zeiger, E. (2010). Plant Physiology (5th Edition). Sinauer Associates Inc. USA.

Bachelor of Science (Medical) Semester-V (Session 2022-23)
BOTANY
Course Code: BSMM-5075 (II)

Course Title: Biochemistry &Biotechnology

(Theory)

Course outcome: -

After passing this course the student will be able to:

CO1. Understand the properties and function of enzymes, and process of carbohydrate metabolism.

CO2. Understand the Properties of nitrogen metabolism & lipid metabolism and its significance in plants

CO3. Understand the fundamentals of Recombinant DNA Technology. Know about the Genetic Engineering.

CO4. Understand the principle and basic protocols for Plant Tissue Culture.

Bachelor of Science (Medical) Semester-V (Session 2022-23)
BOTANY
Course Code: BSMM-5075 (II)

Course Title: Biochemistry & Biotechnology

(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

Basics of Enzymology: Discovery and nomenclature, characteristics of enzymes, concept of holoenzyme, apoenzyme, coenzymes and cofactors regulation of enzyme activity, mechanism of action.

Respiration: ATP-the biological energy currency, aerobic and anaerobic respiration, Kreb's cycle, electron transport mechanism (chemiosmotic theory), redox potential, oxidative phosphorylation, pentose phosphate pathway.

Unit-II

Nitrogen and Lipid Metabolism: Biology of nitrogen fixation, importance of nitrate reductase and its regulation, ammonium assimilation, structure and function of lipids, fatty acid biosynthesis, β-oxidation, saturated and unsaturated fatty acids, storage and mobilization of fatty acids.

Unit-III

Genetic Engineering: Tools and techniques of recombinant DNA technology, cloning vectors, genomic and cDNA library, transposable elements, techniques of gene mapping.

Unit-IV

Biotechnology: Functional definition, basic aspects of plant tissue culture, cellular totipotency, differentiation and morphogenesis, biology of Agrobacterium, vectors for gene delivery and marker genes, salient achievements in crop biotechnology.

Suggested Readings: -

1. Bhojwani, S.S. (1996). Plant Tissue Culture: Applications and Limitations. Elsevier Science Publishers, New York, USA.

2. Dennis, D.T., Turpin, D.H. Lefebvre, D.D. and Layzell (eds.) (1997**).** Plant Metabolism (2nd Edition). Longman, Essex, England.

3. Galston, A.W. (1994). Life Processes in Plants. Scientific American Library, Springer-Verlag, New York, USA.

4. Glick, B.R., Pasternak, J.J. (2010). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.

5. Lea, P.J. and Leegood, R.C. (1999). Plant Biochemistry and Molecular Biology. John Wiley Sons, Chelichester, England.

6. Old, R.W. and Primrose, S.B. (2006). Principles of Gene Manipulation, Blackwell Scientific Publishers, Oxford, UK.

7. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics (5th Edition). John Wiley and Sons Inc., U.S.A.

8. Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques And Applications. John Wiley & Sons Inc. U.S.A.

9. Vasil, I.K. and Thorpe, T.A. (2012). Plant Cell and Tissue Culture. Kluwer Academic Publishers, The Netherlands

Bachelor of Science (Medical) Semester-V (Session 2022-23)
BOTANY
Course Code: BSMM-5075(P)
PRACTICAL – Plant physiology, Biochemistry &Biotechnology
(I &II)

Course outcome: -

After passing this course the student will be able:

CO 1: Determine the osmotic potential of cell sap by plasmolytic method.

CO2: Determine the Diffusion Pressure Deficit (DPD) of plant cells.

CO3: Determine the effect of time period on the rate of imbibition in different types of seeds.

CO4: Determine the relation between absorption and transpiration.

Bachelor of Science (Medical) Semester-V (Session 2022-23)
BOTANY
Course Code: BSMM-5075(P)

PRACTICAL – Plant physiology, Biochemistry &Biotechnology
(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 study the permeability of plasma membrane using different**:** concentrations of organic solvents.
2. To study the effects of temperature on permeability of plasma membrane.
3. To prepare the standard curve of protein and determine the protein content in unknown samples.
4. To study the enzyme activity of catalase and peroxidase as influenced by pH and temperature.
5. Separation of chloroplast pigments by solvent method.
6. Determining the osmotic potential of vacuolar sap by plasmolytic method.
7. Determining the water potential of any tuber.
8. Separation of amino acids in a mixture by paper chromatography and their identification by comparison with standards.
9. Bioassay of auxin, cytokinin, GA, ABA and ethylene using appropriate plant material.
10. Demonstration of the technique of micropropagation by using different explants, e.g. axillary buds, shoot meristems.
11. Demonstration of the technique of another pollen culture.
12. Demonstrate the ascent of sap using a dye.
13. Demonstration of root and shoot formation from the apical and basal portion of stem segments in liquid medium containing different hormones.
14. Demonstrate the transpiration pull by mercury method.
15. Demonstration of osmosis by potato osmoscope.
16. Comparison of loss of water from two surfaces of leaf by $CoCl_2$ method/four leaf method.
17. Demonstration of imbibition by plaster of peris method.
18. Demonstration that O2 is evolved during photosynthesis.
19. Separation of pigments by paper chromatography/TLC method.
20. Demonstration of phototropism movements.
21. Demonstration the measurements of growth by arc auxanometer.
22. Requirements for setting up the tissue culture laboratory.
23. Preparation of nutrient medium.
24. Sterilization of glassware and plant material.
25. Preparation of explant for aseptic manipulation.

Suggested Readings (For Laboratory Exercises)

1. Bajracharya D. (1999). Experiments in Plant Physiology-A Laboratory Manual. Narosa Publishing House, New Delhi.

2. Devi, P. 2000. Principles and Methods of Plant Molecular Biology, Biochemistry and Genetics. Agrobios, Jodhpur, India.

3. Dixon, R.A. (Ed.) 1994. Plant Cell Culture: A Practical Approach, IRL Press, Oxford.

4. Kochhar, S. L. and Gujral, S. K. (2016). Comprehensive Practical Plant Physiology. Macmillan Publishers India Ltd., Delhi.

5. Moore, T.C. 2012. Research Experiences in Plant Physiology: A Laboratory annual. Springer-Verlag. Berlin.

6. Plummer, D.T. (2001). An Introduction to Practical Biochemistry (3rd Edition). Tata McGraw-Hill Publishing Co. Ltd. New Delhi.

7. Roberts, J. and Tuckar, G.A. (Eds.) 2000. Plant Hormone Protocols. Human Press, NewJersey, USA.

8. Scott, R.P.W. 1995. Techniques and Practices of Chromatography. Marcel Dekker, Inc., NewYork.

9. Smith, R.H. 2000. Plant Tissue Culture: Techniques and Experiments. Academic Press,NewYork.

Bachelor of Science (Medical) Semester-VI (Session 2022-23)

BOTANY

Course Code: BSMM-6075 (I)

Ecology

(Theory)

Course outcome: -

After passing this course the student will develop:

CO1.Understand the abiotic components and relationship with living organism.

CO2.Demonstrate an understanding keys of community ecology and biodiversity

CO3.Understand the structure and function of ecosystem and growth curve

CO4. Study the biogeographical region and vegetation of India

Bachelor of Science (Medical) Semester-VI (Session 2022-23)

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.

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Unit-I

Plants and Environment: Atmosphere (gaseous compositions), water (properties of water cycle),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 and xerophytes), temperature (thermoperiodicity and vernalization), light (photoperiodism, heliophytes and sciophytes) and salinity.

Unit-II

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

Unit-III

Population Ecology: Growth curves, ecotypes, ecads.
Ecosystem: Structure, abiotic and biotic components, food chain, food web, ecological pyramids, 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.

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.

Bachelor of Science (Medical) Semester-VI (Session 2022-23)

BOTANY

Course Code: BSMM-6075(II)

Economic Botany

(Theory)

Course outcome: -

After passing this course the students will be able to:

CO1: Understand the cultivation and economic importance of various food plant crops, fibre and oil yielding plants.

CO2: Understand the economic importance of spices and condiments.

CO3: Understand economic importance of medicinal plants.

CO4: Understand the processing and economic value of beverages, rubber plant, firewood, timber and bamboos.

Bachelor of Science (Medical) Semester-VI (Session 2022-23)

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 *Chorchorus 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), *Withania somnifera* (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. Kocchar, 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 Kocchar, 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.

Bachelor of Science (Medical) Semester-VI (Session 2022-23)

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. Determination of abundance and frequency of species by quadrate method.

CO2. To 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.

Bachelor of Science (Medical) Semester-VI (Session 2022-23)

BOTANY

Course Code: BSMM-6075(P)

PRACTICAL: - Ecology and Economic botany
(I &II)

TIME: 3HrsPractical: 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 distribution with Raunkiaer's Standard Frequency Diagram.
3. To estimate Importance Value Index for grassland species on the basis of relative frequency, relative density and relative dominance in protected and grazed grassland.
4. To measure the vegetation cover of grassland through point frame method.
5. To measure the above ground plant biomass in a grassland.
6. To study the morphological anatomical features of hydrophytes (*Hydrilla, Eichhornia*) Xerophytes (*Nerium, Calotropis*).
7. To determine diversity indices (richness, Simpson, Shannon-Weaver) in grazed and protectedgrassland.
8. To estimate bulk density and porosity of grassland and woodland soils.
9. To determine moisture content and water holding capacity of grassland and woodland soil.
10. To study the vegetation structure through profile diagram.
11. To estimate transparency, pH and temperature of different water bodies.
12. To measure dissolved oxygen content in polluted and unpolluted water samples.
13. To estimate salinity of different water samples.
14. To determine the percent leaf area injury of different leaf samples collected around polluted sites.
15. To estimate dust-holding capacity of the leaves of different plant species.
16. **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).
17. **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.
18. Sectioning and staining of jute stem to show the location and development of fibers.
19. Microscopic structure.Tests for lignocelluloses.
20. **Vegetable Oils:** Study of hand sections of groundnut, mustard and coconut and staining ofoildroplets by Sudan III and Sudan Black.
21. **Field Visits:** To study sources of firewood (10 plants)/timberyielding trees (10trees)/bamboos,list to be prepared mentioning special features, collection of plant based articlesofcommonuse.

22. **Spices:** Examine black pepper, cloves, cinnamon (hand sections) and opened of cardamomanddescribe them briefly.
23. 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.
24. **Beverages:** Section boiled coffee beans and tea leaves to study the characteristic structuralfeatures.
25. 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. Kocchar, 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 8thedition. 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 C

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULLUM OF EXAMINATION OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Biotechnology)
(Session 2022-23)
Botany-I

Bachelor of Science (Biotechnology) Semester-I								
Course Name	**Program Name**	**Course Code**	**Course Type**	**Marks**				**Examination time (in Hours)**
				Total	**Ext.**		**CA**	
					L	**P**		
Botany-I	Bachelor of Science (Biotechnology)	BBTM-1074	C	60	30	18	12	3+3

Bachelor of Science (Biotechnology) Semester -III								
Course Name	**Program Name**	**Course Code**	**Course Type**	**Marks**				**Examination time (in Hours)**
				Total	**Ext.**		**CA**	
					L	**P**		
Botany-II	Bachelor of Science (Biotechnology)	BBTM-3074	C	60	30	18	12	3+3

Bachelor of Science (Bio-Technology) Semester-I
Session: 2022-23
Course Code: BBTM-1074
Botany-I

Course outcomes: After passing this course the student will be able to:

CO1: Understand the diversity of plants.

CO2: Understand the structure of meristems, permanent tissues, anatomy of root, stem and leaf in flowering plant.

CO3: Understand the reproduction and different aspects of pollination and self-incompatibility in flowering plants.

CO4: Understand the different plant classification systems, terminology related to floral descriptions and economic importance of various angiosperm families.

Bachelor of Science (Bio-Technology) Semester -I
Session: 2022-23
Course code: BBTM-1074
Botany-I
(Theory)

Time: 3 Hours **Max. Marks: 60**
Theory: 30
Practical: 18
CA: 12

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 atleast one question from each section. The fifth question may be attempted from any Section.

Unit –I

Diversity in plants: General characters of Algae, Fungi, Lichens, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms. Concepts of species, hierarchical taxa and biological nomenclature.

Unit –II

Anatomy of flowering plants: Meristems, simple and complex permanent tissues, internal structure of stem, root and leaf, secondary growth in stem and root of *Helianthus*.

Unit –III

Reproduction in flowering plants: Structure and development of anther and male gametophyte, Structure and development of ovule and female gametophyte; Pollination (self and cross) and fertilization; structure and function of endosperm and embryo (dicot and monocot), polyembryony, self-incompatibility.

Unit –IV

Taxonomy of flowering plants: Artificial (Linnaeus), natural (Bentham & Hooker) and phylogenetic (Engler and Prantl) systems of classification; Terminology pertaining to floral description, General characteristics (including economic importance) of following families of angiosperms; giving examples of few important genera: Solanaceae: *Solanum/Petunia*, Rutaceae: *Citrus, Murraya,* Cruciferae- *Brassica*, Apiaceae (Umbelliferae)- Coriander, Asteraceae - *Helianthus,* Leguminosae –*Cassia/Acacia*/Sweet pea, Poaceae (Graminae)- *Triticum*.

Suggested Readings:

1. Bhojwani, S.S. and Bhatnagar, S.P. (2000). The Embryology of Angiosperms, 4th revised and enlarged edition. Vikas Publishing House, Delhi.
2. Peau, K. (1977). Anatomy of Seed Plants, 3rd edition. John Wiley & Sons, New York.
3. Pegeri, K. And Vander Pijl (1979). The Principles of Pollination Biology, Pergamon Press, Oxford.
4. Dickinson, W.C. (2000). Integrative Plant Anatomy. Harcourt Academic Press, USA.
5. Fahn, A. (1974). Plant Anatomy. Pergmon Press, USA and UK. 6. Hopkins, W.G. and Huner, P.A. (2008). Introduction to Plant Physiology. John Wiley and Sons. 7. Taiz, L. and Zeiger, E. (2006). Plant Physiology, 4 th edition, Sinauer Associates Inc .MA, USA.

Bachelor of Science (Bio-Technology) Semester-I
Session: 2022-23
Course Code: BBTM-1074
Botany-I

Course outcomes: After passing this course the student will be able to:

CO1: Understand the anatomy of dicot root, stem and leaf.

CO2: Understand structure and development of anther, male gametophyte, ovule, female gametophyte and endosperms.

CO3: Understand the description of flowers including floral diagram, floral formula, V.S. of flower of various angiosperm families.

CO4: Understand the morphology and economic importance of different angiosperm families.

Bachelor of Science (Bio-Technology) Semester-I
Session: 2022-23
Course Code: BBTM-1074 (P)
Botany-I
(Practical)

Time: 3 Hrs. **Max. Marks: 18**

Note. The question paper will be set by the examiner based on the syllabus.

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.

Experiments:

Plant Anatomy:
Anatomical studies of stem, root and leaf in *Helianthus* and maize plant.

Embryology:
Study of the permanent slides pertaining to micro and megasporogenesis and female gametophytes and endosperms.

Taxonomy:

a) Description of flowers including floral diagram, floral formula, V.S. of flower of the representative genera of families mentioned in syllabus.
b) Identification and short morphological economic note on the specimens included in Unit IV of the theory paper.

Suggested Readings:

1. Bhojwani, S.S. and Bhatnagar, S.P. (2000). The Embryology of Angiosperms, 4th revised and enlarged edition. Vikas Publishing House, Delhi.
2. Peau, K. (1977). Anatomy of Seed Plants, 3rd edition. John Wiley & Sons, New York.
3. Pegeri, K. And Vander Pijl (1979). The Principles of Pollination Biology, Pergamon Press, Oxford.
4. Dickinson, W.C. (2000). Integrative Plant Anatomy. Harcourt Academic Press, USA.
5. Fahn, A. (1974). Plant Anatomy. Pergmon Press, USA and UK.
6. Hopkins, W.G. and Huner, P.A. (2008). Introduction to Plant Physiology. John Wiley and Sons.
7. Taiz, L. and Zeiger, E. (2006). Plant Physiology, 4 th edition, Sinauer Associates Inc .MA, USA.

Bachelor of Science (Biotechnology) Semester – III
Session 2022-23
Course Code: BBTM-3074
Botany-II (Theory)

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

CO1: Understand the nutrition, Transport and Stress responses in plants.

CO2: Understand the physiology of photosynthesis.

CO3: Know the concept of plant pathology and its effect on economy of crops.

CO4: Understand the concept of biodiversity and phytogeography.

Bachelor of Science (Bio-Technology) Semester- III
Session 2022-23
Course Code: BBTM-3074
Botany-II
(Theory)

Time: 3 Hours **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

Nutrition, Transport and Stress responses in plants: Macronutrients and micronutrients and their deficiency symptoms; Water relations, osmosis, transpiration, water potential & its components, ascent of sap and transport of organic solutes. Responses of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses.

Unit-II

Photosynthesis: Light harvesting complexes; mechanisms of electron transport; photoprotective mechanisms; CO2 fixation-C3, C4 and CAM pathways.

Unit-III

Plant Pathology & epidemiology: Definitions, classification, mode of transmission & control measures of plant diseases; host-pathogen interaction, Disease resistance, phytoalexins, PR proteins. A brief account of the following plant diseases with respect to casual agents, symptoms, epidemiology and their control measures: Black stem rust of wheat, Loose smut of wheat, Late and early blight of potato, Red rot of sugarcane, TMV of potato, Yellow vein mosaic of bhindi.

Unit-IV

Biodiversity: Physical environment; biotic environment; biotic and abiotic interactions. Concept of habitat and niche; Characteristics of a population; population growth curves; population regulation; Major terrestrial biomes; biogeographical zones of India.

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 2nd Ed. 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.

Bachelor of Science (Bio-Technology) Semester- III
Session 2022-23
Course Code: BBTM-3074
Botany-II (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: Estimate the oxygen level evolved during photosynthesis.

CO3: Understand the practical skills on separation of plant pigments.

CO4: Know the symptoms and control measures of plant diseases and its effect on economy of crops.

Bachelor of Science (Bio-Technology) Semester- III
Session 2022-23
Course Code: BBTM-3074(P)
Botany-II
(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.

Experiments:

1. Estimation of relative water content of leaf.
2. Measurement of osmotic potential of different tissues by Chardokov method.
3. Demonstrate the transpiration pull by mercury method.
4. Demonstration that O2 is evolved during photosynthesis.
5. Separation of pigments by paper chromatography/TLC method.
6. 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, Red rot of sugarcane, TMV of potato, Yellow vein mosaic of bhindi.

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.

ANNEXURE D

FACULTY OF LIFE SCIENCES

SYLLABUS

Of

Botany For

Bachelor of Science (Home Science)
Semester-V

(Under Continuous Evaluation System)
(12+3 System of Education)

Session: 2022-23

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 (Home Science) Semester -V
(Session 2022-23)
Botany

Bachelor of Science (Home Science) Semester –V								
Course Name	**Program Name**	**Course Code**	**Course Type**	**Marks**				**Examination time (in Hours)**
				Total	**Ext.**		**CA**	
					L	**P**		
Applied botany and home gardening	Bachelor of Science (Home Science)	BHSM-5077	C	100	50	30	20	3+3

Bachelor of Science (Home Science) Semester-V
(Session 2022-23)

Course Code: BHSM-5077

APPLIED BOTANY AND HOME GARDENING
(Theory)

Course outcome: -

After passing this course the student will be able to:

CO:1 Understand the art of soil preparation for gardening.

CO:2 Understand different means of plant propagation.

CO:3 Understand the concept of kitchen garden and plants propagated in it.

CO:4 Plan lawn, hedges, ornamental plants in a garden and will be able to identify algae, fungi and moulds.

Bachelor of Science (Home Science) Semester-V
(Session 2022-23)
Course Code: BHSM-5077
APPLIED BOTANY AND HOME GARDENING
(Theory)

Time: 3 Hours. **Max. Marks: 100**
Theory: 50
Practical: 30
CA: 20

Instructions for the Paper Setters:
Eight questions of equal marks (10 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

Gardening
Layout of a Garden
Soil preparation – digging, tillage, drainage, watering and weeding.
Manures and fertilizes

Unit-II

Propagation of plants
Seed propagation
Vegetative propagation by natural and artificial methods (Bulbs Rhizomes suckers Runners Tubers Budding and grafting)

Unit-III

Kitchen Garden
Principle of planning and cultivation of vegetables with reference to potato tomato radish cauliflower brinjal, pea and spinach.

Unit-IV

Lawn and Hedges
Principle of planning of lawn and hedges
Brief description of care and cultivation of ornamental plants.
Care and cultivation of seasonal flowers
Care and cultivations of common indoor plants.

General characteristics, morphology and economic importance: algae, fungi and moulds.

Suggested Readings:

1. Basic Gardening Gemmell Alam Penguin books publication.
2. B. Choudhary: Vegetables (National Book of India, New Delhi 1979)
3. Breikell C. 1993, Step by Step Gardening Technique (Royal Horticultural Society's Encyclopedia of Practical Gardening).
4. Dutta A.C. Botany for Degree Students (Oxford University Press, New Delhi 1970)
5. Gangullee H.C. Dass, K.S. Dass, K.S. Dutta C: College Botany Vol. I (New Central Book Agency Calcutta 1991)
6. Gopalaswamianger K.S. 1991 Complete Gardening in India (Messers Nagaraj and Co., Madras).
7. H.T. Harman and D Keter: Plant Propagation, Principles and Practices (Prentice Hall of India Pvt. Ltd. New Delhi 1979).
8. Hind Book of Agriculture: ICAR, New Delhi 1987.
9. J.L. Shreemali Economic Botany (Har Anand Publication, New Delhi 1995)
10. O.P. Sharma: Hill's Economic Botany 2006 Tata McGraw-Hill Publishing Co. Ltd.

Bachelor of Science (Home Science) Semester-V
(Session 2022-23)
Course Code: BHSM-5077(P)
APPLIED BOTANY AND HOME GARDENING
(Practical)

Course outcome: -

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

CO:1 Identify different tools to be used in soil preparation.

CO:2 Understand the use of different plant parts for plant propagation.

CO:3 Maintain different plants in the garden.

CO:4 Identify ornamental plants.

Bachelor of Science (Home Science) Semester-V
(Session 2022-23)
Course Code: BHSM-5077(P)
APPLIED BOTANY AND HOME GARDENING
(Practical)

Time: 3 Hrs.

Marks: 30

Note: Paper will be set on the spot by the examiner.

1. Study of garden tools and accessories.
2. Identification of different types of plants i.e. vegetable flowers, ferns and ornamental
3. Plants.
4. Preparation of soil digging tillage drainage watering and weeding.
5. To prepare and manuring a seed bed for raising seedlings.
6. To prepare a bed for sowing potatoes and cultivate them.
7. To prepare a plot for raising seedlings.
8. To prepare a pot for repotting.
9. To prepare a plot and cultivate seasonal vegetable (as in theory).
10. Plant propagation.
    a) From seeds guiding rules for seed sowing.
    b) Vegetative propagation by cutting and grafting.
    c) Maintenance of plants
    d) Use of pesticides and fungicides
    e) Identification of slides of algae fungi and moulds.

Project: Prepare Herbarium file Collection of specimen of ornamental plants flower.

Suggested Readings:

1. Basic Gardening Gemmell Alam Penguin books publication.
2. B. Choudhary: Vegetables (National Book of India, New Delhi 1979)
3. Breikell C. 1993, Step by Step Gardening Technique (Royal Horticultural Society's Encyclopedia of Practical Gardening).
4. Dutta A.C. Botany for Degree Students (Oxford University Press, New Delhi 1970)
5. Gangullee H.C. Dass, K.S. Dass, K.S. Dutta C: College Botany Vol. I (New Central Book Agency Calcutta 1991)
6. Gopalaswamianger K.S. 1991 Complete Gardening in India (Messers Nagaraj and Co., Madras).
7. H.T. Harman and D Keter: Plant Propagation, Principles and Practices (Prentice Hall of India Pvt. Ltd. New Delhi 1979).
8. Hind Book of Agriculture: ICAR, New Delhi 1987.
9. J.L. Shreemali Economic Botany (Har Anand Publication, New Delhi 1995)
10. O.P. Sharma: Hill's Economic Botany 2006 Tata McGraw-Hill Publishing Co. Ltd.

ANNEXURE E

FACULTY OF LIFE SCIENCES

SYLLABUS

Of

Botany For

Master of Science (Botany)

Semester (III – IV)

(Under Continuous Evaluation System)

Session: 2022-23

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-III
Session: 2022-23

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

Kanya Maha Vidyalaya, Jalandhar

SCHEME AND CURRICULUM OF EXAMINATIONS OF TWO-YEAR DEGREE PROGRAMME

Master of Science (Botany) Semester -IV
Session: 2022-23

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(Opt-A)	C	Hazardous Chemicals (Optional Paper)	3	50	40		10	3
MBTL-4076(Opt-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	C	Field Study	Satisfactory/ Not Satisfactory					
MBTP-4070	C	Research Techniques	3	Satisfactory/ Not Satisfactory				
		Total		**450**				

Student can opt only one paper from the two optional papers (i) MBTL-4076(Opt-A) and (ii) MBTL-4076(Opt-B)

Semester - III

Master of Science (Botany) Semester-III
(Session: 2022-23)
Developmental Botany
MBTL-3071

Course outcomes:

After passing this course the student will be able to:

CO1: Compare the function and morphology of pollen grains.

CO2: Understand various aspects related to fertilization and endosperm development.

CO3: Understand different aspects of embryo development.

CO4: Understand role of Embryology in Taxonomy and Plant Breeding.

Master of Science (Botany) Semester-III
(Session: 2022-23)
Developmental Botany
MBTL-3071

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

Instructions for the Paper Setters:

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

Unit-I

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

Unit-II

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

Unit-III

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

Master of Science (Botany) Semester-III
(Session: 2022-23)

Unit-IV

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

Books Recommended

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

Master of Science (Botany) Semester-III
(Session: 2022-23)
Plant Molecular Biology
MBTL – 3072

Course outcomes:

After passing this course the student will be able to:

CO1: Gain knowledge about RNA processing and DNA sequencing.

CO2: Understand different techniques related to molecular biology.

CO3: Understand the structures and purposes of Cloning Vehicles.

CO4: Gain knowledge about genetic cloning and genomics & proteomic techniques.

Master of Science (Botany) Semester-III
(Session: 2022-23)
Plant Molecular Biology
MBTL – 3072

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

Instructions for the Paper Setters:

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

Unit-I

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

Unit-II

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

Unit-III

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

Unit-IV

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

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

Master of Science (Botany) Semester-III
(Session: 2022-23)

Books Recommended

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

Master of Science (Botany) Semester-III
(Session: 2022-23)
Plant Breeding and IPR
MBTL –3073

Course outcomes:

After passing this course the student will be able to:
CO1: Understand sources and types of genetic variation and explain their importance for plant improvement.

CO2: Understand historical evolution of plant breeding and different centers of origin.

CO3: Describe methods that are used in plant breeding.

CO4: Understand IPR (Intellectual property right)

Master of Science (Botany) Semester-III
(Session: 2022-23)
Plant Breeding and IPR
MBTL –3073

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

Instructions for the Paper Setters:

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

Unit-I

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

Unit-II

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

Unit-III

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

Unit-IV

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

Master of Science (Botany) Semester-III
(Session: 2022-23)

Books Recommended

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

Master of Science (Botany) Semester-III
(Session: 2022-23)
Plant Biochemistry
MBTL – 3074

Course outcomes:

After passing this course the student will be able to:

CO1: Understand cellular chemistry and interactions.

CO2: Understand structure, metabolism of carbohydrates.

CO3: Describe structure, functions and metabolism of Lipids.

CO4: Understand kinetics of enzyme catalyzed reactions and enzyme inhibitory and regulatory processes.

Master of Science (Botany) Semester-III
(Session: 2022-23)
Plant Biochemistry
MBTL – 3074

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

Instructions for the Paper Setters:

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

Unit-I

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

Unit-II

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

Unit-III

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

Unit-IV

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

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

Books Recommended

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

Master of Science (Botany) Semester-III
(Session: 2022-23)
Applied Botany
MBTL – 3075

Course outcomes:

After passing this course the student will be able to:

CO1: Demonstrate knowledge of the value of plants in our everyday lives.

CO2: Understand commercial use of different forest products.

CO3: Describe various industrial plant products.

CO4: Understand chemical processing of different products in Applied Botany.

Master of Science (Botany) Semester-III
(Session: 2022-23)
Applied Botany
MBTL – 3075

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

Instructions for the Paper Setters:

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

Unit-I

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

Unit-II

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

Unit-III

Industrial Plant Products: Essential oil yielding plants of India, their use in perfumery, vegetable oils, fats and waxes, starches and other cellulose products. Manufacturing of paper and board from raw plant material. Manufacturing of crude and high-quality paper, recycled paper; bio fuel producing plants.

Fibres: Different types of fibre yielding plants, classification of fibres, physical and chemical processes involved in the manufacturing of fibre.

Unit-IV

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

Master of Science (Botany) Semester-III
(Session: 2022-23)

Books Recommended

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

Master of Science (Botany) Semester-III
(Session: 2022-23)
Plant Morphogenesis
MBTL – 3076

Course outcomes:

After passing this course the student will be able to:

CO1: Learn about morphogenesis and organogenesis in plants.

CO2: Understand differentiation in plants.

CO3: Describe plant regeneration processes and tissue relationships.

CO4: Understand different factors affecting plant morphogenesis.

Master of Science (Botany) Semester-III
(Session: 2022-23)
Plant Morphogenesis
MBTL – 3076

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

Instructions for the Paper Setters:

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

Unit-I

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

Unit-II

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

Unit-III

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

Unit-IV

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

Master of Science (Botany) Semester-III
(Session: 2022-23)

Books Recommended

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

Master of Science (Botany) Semester-III
(Session: 2022-23)
Botany Practicals I
MBTP-3077

(Based on MBTL-3071, MBTL-3072 and MBTL-3073)

Course Outcomes:

After passing this course the student will be able to:

CO1: Perform immobilization of enzymes.

CO2: Wide application of enzymes and their future potential.

CO3: Perform different experiments based on plant pollination.

CO4: Understand embryology of dicot and monocot plants.

Master of Science (Botany) Semester-III
(Session: 2022-23)
Practical-I
MBTP-3077
(Based on MBTL-3071, MBTL-3072 and MBTL-3073)

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

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

Suggested Practical's from MBTL-3071

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

Suggested Practical's from MBTL-3072

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

Suggested Practical's from MBTL-3073

1. Floral biology in self- and cross-pollinated species,

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

Master of Science (Botany) Semester-III
(Session: 2022-23)
Botany Practicals II
MBTP-3078
(Based on MBTL-3074, MBTL- 3075 and MBTL-3076)

Course outcomes:

After passing this course the student will be able to:

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

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

CO3: Exhibit clear and concise communication of scientific data.

CO4: Understand different techniques related to molecular biology.

Master of Science (Botany) Semester-III
(Session: 2022-23)
Botany Practicals II
MBTP-3078
(Based on MBTL-3074, MBTL- 3075 and MBTL-3076)

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

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

Suggested Practical's based on MBTL-3074

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

Suggested Practical's based on MBTL-3075

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

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

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

Suggested Practical's based on MBTL-3076

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

Semester - IV

Master of Science (Botany) Semester-IV
(Session: 2022-23)
Plant Anatomy
MBTL –4071

Course outcomes:

After passing this course the student will be able to:

CO1: Compare anatomy of primary and secondary growth in roots as well as shoots.

CO2: Understand anatomy of different types of wood and their commercial utilization.

CO3: Understand floral, fruit and seed anatomy.

CO4: Understand anatomy of plant parts in relation to habitat.

Master of Science (Botany) Semester-IV
(Session: 2022-23)
Plant Anatomy
MBT L –4071

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

Instructions for the Paper Setters:

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

UNIT-I

The Shoot and Root System: Primary structure and basic vasculature, the root-stem transition, secondary growth in stems and roots, the origin of cambium and its activity, anamalous secondary growth, polycyclic vasculature, secondary meristems, origin and function, the role of pericycle, phellogen, phellem, phelloderm, distribution of sclerenchyma in leaves, stem and roots.
Nodal Anatomy: Types of nodes in dicots and monocots, the node-internode transition, formation of leaf and branch traces.

UNIT-II

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

UNIT-III

Floral Anatomy: The anatomy of floral axis and the whorls, the leaf origin of carpel, evidences from anatomy of essential and accessory whorls.
Fruit and Seed Anatomy: Gross and ultrastructural surface features of the fruits and seeds, role In taxonomy, internal anatomy of dicot and monocot seeds, organ and cellular anatomy of typical monocot and dicot seeds.

UNIT-IV

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

Suggested Readings:

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

Master of Science (Botany) Semester-IV
(Session: 2022-23)
Structure and Metabolism of Plant Hormones
MBTL – 4072

Course outcomes:

After passing this course the student will be able to:

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

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

CO3: Understand biosynthesis, action and uses New class plant hormones.

CO4: Relate microbial association with the production of growth regulators.

Master of Science (Botany) Semester-IV
(Session: 2022-23)
Structure and Metabolism of Plant Hormones
MBTL – 4072

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

Instructions for the Paper Setters:

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

UNIT-I

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.

Suggested Readings:

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

Master of Science (Botany) Semester-IV
(Session: 2022-23)
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, differentiation in cell and tissue culture and mechanism, advantage and disadvantages of micro-propagation.

CO2: Understand the mechanism of production of disease resistant, herbicide resistant and pathogen free plants.

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.

Master of Science (Botany) Semester-IV
(Session: 2022-23)
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

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

Suggested Readings:

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

Master of Science (Botany) Semester-IV
(Session: 2022-23)
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: Understand working of different spectroscopic techniques.

CO4: Understand theory and practice of different blotting techniques.

Master of Science (Botany) Semester-IV
(Session: 2022-23)
Analytical Techniques
MBTL – 4074

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

Instructions for the Paper Setters:

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

Suggested Readings:

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

Master of Science (Botany) Semester-IV
(Session: 2022-23)
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, origin of angiosperms and phylogeny.

CO3: Understand the role of various fields of biology in plant taxonomy.

CO4: Understand the concept of taxonomic tools, aspects related to phytogeography and local plant diversity.

Master of Science (Botany) Semester-IV
(Session: 2022-23)
Diversity and Biology of Angiosperms
MBTL – 4075

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

Instructions for the Paper Setters:

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

UNIT-I

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 and Helobiales and their treatment in the modern systems of classification.

UNIT-III

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

UNIT-IV

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

Suggested Readings:

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

Master of Science (Botany) Semester-IV
(Session: 2022-23)
Hazardous Chemicals
(Optional Paper)
MBTL-4076 (Opt-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.

Master of Science (Botany) Semester-IV
(Session: 2022-23)
Hazardous Chemicals
(Optional Paper)
MBTL-4076 (Opt-A)

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

Instructions for the Paper Setters:

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

Master of Science (Botany) Semester-IV
(Session: 2022-23)
UNIT-IV

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

Suggested Readings:

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

Master of Science (Botany) Semester-IV
(Session: 2022-23)
Immunology
(Optional Paper)
MBTL-4076(Opt-B)

Course outcomes:

After passing this course the student will be able to:

CO1: Understand history and principles of immunology.

CO2: Conceptualize how the antigen is processed.

CO3: Understand the working of antibodies.

CO4: Understand the cells and tissues of the immune system.

Master of Science (Botany) Semester-IV
(Session: 2022-23)
Immunology
(Optional Paper)
MBTL-4076(Opt-B)

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

Instructions for the Paper Setters:

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

Books Recommended

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

Master of Science (Botany) Semester-IV
(Session: 2022-23)
Botany Practicals I
MBTP -4077

(Based on MBTL-4071, MBTL-4072 and MBTL-4073)

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

Master of Science (Botany) Semester-IV
(Session: 2022-23)
Botany Practicals I
MBTP -4077

(Based on MBTL-4071, MBTL-4072 and MBTL-4073)

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

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

Suggested Practicals based on MBTL-4071

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

Suggested Practical's based on MBTL-4072

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

Suggested Practical's based 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

Master of Science (Botany) Semester-IV
(Session: 2022-23)
Botany Practicals II
MBTP -4078

(Based on MBTL-4074 and MBTL-4075)

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: Understand role of herbarium in plant taxonomy.

CO4: Understand diagnostic features of different families.

Master of Science (Botany) Semester-IV
(Session: 2022-23)
Botany Practicals II
MBTP -4078
(Based on MBTL-4074 and MBTL-4075)

Time: 4 hrs **Max. Marks- 75**
Practical – 60
CA – 15

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

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

1. Paper Chromatography
2. Thin Layer chromatography
3. Column chromatography
4. Gel Filtration Chromatography
5. Ion Exchange Chromatography
6. Affinity Chromatography
7. Electrophoresis: 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 of locally available families. This list is indicative only

- Ranunculaceae: *Ranunculus, Delphinium,*
- Brassicaceae: *Brasssica, Iberis*
- Malvaceae: *Hibiscus*
- Rutaceae: *Murraya, Citrus*
- Fabaceae: *Lathyrus, Cassia, Acacia, Mimosa*
- Rosaceae: *Rose, Prunus*
- Asteraceae: *Helianthus, Ageratum, Sonchus*
- Apiaceae: *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*

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.

ANNEXURE: F

FACULTY OF LIFE SCIENCES

SYLLABUS

Of

Botany For

Master of Science (Botany)

Semester (I – IV)

(Under Credit Based Continuous Evaluation Grading System)

Session: 2022-24

The Heritage Institution
KANYA MAHA VIDYALAYA
JALANDHAR
(Autonomous)

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATIONS OF TWO-YEAR DEGREE PROGRAMME

Master of Science (Botany) Semester-I

Session: 2022-24

Course Code	Course Title	Course Type	Hours /Week	Credits L-T-P	Total Credits	Marks				Examination time (in Hours)
						Total	Th	P	CA	
MBTL-1071	Fungi and Plant Pathology	C	4	4-0-0	4	50	40	-	10	3
MBTL-1072	Phycology	C	4	4-0-0	4	50	40	-	10	3
MBTL-1073	Bryology	C	4	3-1-0	4	50	40	-	10	3
MBTL-1074	Plant Physiology	C	4	4-0-0	4	50	40	-	10	3
MBTL-1075	Genetics and Evolution	C	4	4-0-0	4	50	40	-	10	3
MBTL-1046	Computer Applications and Bioinformatics	IC	3	2-1-0	3	50	40	-	10	3
MBTP-1077	Botany Practicals I	C	6	0-0-6	3	75	-	60	15	3
MBTP-1078	Botany Practicals II	C	6	0-0-6	3	75	-	60	15	3
Student can opt any one of the following Interdisciplinary compulsory courses		IDE			4	100	80		20	3
Total					**29**	**450**				
IDEC-1101 IDEM-1362 IDEH-1313 IDEI-1124 IDEW-1275				Effective Communication Skills Basics of Music (Vocal) Human Rights and Constitutional Duties Basics of Computer Applications Indian Heritage: Contribution to the world (Credits of these courses will not be added to SGPA)						

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATIONS OF TWO-YEAR DEGREE PROGRAMME

Master of Science (Botany) Semester-II

Session: 2022-24

Course Code	Course Title	Course Type	Hours/ week	Credits L-T-P	Total Credits	Marks				Examination time (in Hours)
						Total	L	P	CA	
MBTL-2071	Pteridology	C	4	4-0-0	4	50	40	-	10	3
MBTL-2072	Diversity and Biology of Gymnosperms	C	4	4-0-0	4	50	40	-	10	3
MBTL-2073	General Microbiology	C	4	4-0-0	4	50	40	-	10	3
MBTL-2074	Cell Biology	C	4	4-0-0	4	50	40	-	10	3
MBTL-2075	Ecological Modelling and Forest Ecology	C	4	4-0-0	4	50	40		10	3
MBTL-2336	Theoretical Biology	IC	3	3-0-0	3	50	40	-	10	3
MBTP-2077	Botany Practicals I	C	6	0-0-3	3	75	-	60	15	3
MBTP-2078	Botany Practicals II	C	6	0-0-3	3	75	-	60	15	3
	Summer Training									
Total					**29**	**450**				

Kanya Maha Vidyalaya, Jalandhar

SCHEME AND CURRICULUM OF EXAMINATIONS OF TWO-YEAR DEGREE PROGRAMME

Master of Science (Botany) Semester-III

Session: 2022-24

Course Code	Course Title	Course Type	Hours/ week	Credits L-T-P	Total Credits	Marks				Examination time (in Hours)
						Total	L	P	CA	
MBTL-3071	Developmental Botany	C	4	4-0-0	4	50	40	-	10	3
MBTL-3072	Plant Molecular Biology	C	4	4-0-0	4	50	40	-	10	3
MBTL-3073	Plant Breeding and IPR	C	4	4-0-0	4	50	40	-	10	3
MBTL-3074	Plant Biochemistry	C	4	4-0-0	4	50	40	-	10	3
MBTL-3075	Applied Botany	C	4	4-0-0	4	50	40	-	10	3
MBTL-3076	Plant Morphogenesis	C	4	4-0-0	4	50	40		10	3
MBTP-3077	Botany Practicals I	C	6	0-0-3	3	75	-	60	15	3
MBTP-3078	Botany Practicals II	C	6	0-0-3	3	75	-	60	15	3
Student can opt any one of the following Interdisciplinary compulsory courses		IDE			4	100	80		20	3
Total					**30**	**450**				
IDEC-1101 IDEM-1362 IDEH-1313 IDEI-1124 IDEW-1275			Effective Communication Skills Basics of Music (Vocal) Human Rights and Constitutional Duties Basics of Computer Applications Indian Heritage: Contribution to the world (Credits of these courses will not be added to SGPA)							

Kanya Maha Vidyalaya, Jalandhar

SCHEME AND CURRICULUM OF EXAMINATIONS OF TWO-YEAR DEGREE PROGRAMME

Master of Science (Botany) Semester -IV

Session: 2022-24

Course Code	Course Title	Course Type	Hours/ week	Credits L-T-P	Total Credits	Marks				Examination time (in Hours)
						Total	L	P	CA	
MBTL-4071	Plant Anatomy	C	4	4-0-0	4	50	40	-	10	3
MBTL-4072	Structure and Metabolism of Plant Hormones	C	4	4-0-0	4	50	40	-	10	3
MBTL-4073	Plant Tissue Culture and Biotechnology	C	4	4-0-0	4	50	40	-	10	3
MBTL-4074	Analytical Techniques	C	4	4-0-0	4	50	40	-	10	3
MBTL-4075	Diversity and Biology of Angiosperms	C	4	4-0-0	4	50	40	-	10	3
MBTL-4076 (Opt-I/II)	Optional Paper**	IE	3	3-0-0	3	50	40		10	3
MBTP-4077	Botany Practicals I	C	6	0-0-6	3	75	-	60	15	3
MBTP-4078	Botany Practicals II	C	4	0-0-4	2	75	-	60	15	3
MBTP-4079	Field Study and Research Techniques	C		0-2-0	2	50	-	40	10	-
Total					**30**	**500**				

****Student can opt only one paper from the two optional papers.**

List of Optional Papers

4. **MBTL-4076 (I) Hazardous Chemicals**
5. **MBTL-4076 (II) Immunology**

Kanya Maha Vidyalaya, Jalandhar

SCHEME AND CURRICULUM OF EXAMINATIONS OF TWO-YEAR DEGREE PROGRAMME

Session: 2022-24

List of Interdisciplinary (ID) Courses

Name of ID Course	Course Code	Semester
Effective Communication Skills	IDEC-1101	I
	IDEC-3101	III
Basic Fundamentals of Music (Vocal)	IDEM-1362	I
	IDEM-3362	III
Human Rights and Constitutional Duties	IDEH-1313	I
	IDEH-3313	III
Basics of Computer and IT	IDEI-1124	I
	IDEI-3124	III
Indian Heritage: Contribution to the world	IDEW-1275	I
	IDEW-3275	II

Semester - I

Session: 2022-24
Master of Science (Botany) Semester-I
Program Specific Outcomes

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

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

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

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

PSO5. Identify the taxonomic position of plants, formulate the research literature, and analyze non reported plants with substantiated conclusions using first principles and methods of nomenclature and classification in Botany.

Session: 2022-24
Master of Science (Botany) Semester-I
Course Title: Fungi and Plant Pathology
Course Code: MBTL-1071

Course outcomes

After passing this course the student will be able to

CO: 1 Explain diversity in the fungal kingdom

CO: 2 Understand life cycle of major genera of fungi

CO: 3 Understand the major virulence mechanisms that phytopathogens employ to colonize plants.

CO: 4 Develop an appreciation for the strategies that can be employed to incorporate disease resistance in crop plants.

Session: 2022-24
Master of Science (Botany) Semester-I
Course Title: Fungi and Plant Pathology
Course Code: MBTL-1071

LTP: 4-0-0

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

Instructions for the Paper Setters:

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

UNIT-I

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

- **GYMNOMYCOTA**
  (i) Acrasiomycetes - a general account
  (ii) Protosteliomycetes - a general account
  (iii)Myxomycetes: *Stemonitis*
- **MASTIGOMYCOTA** 1. Haplomastigomycotina
  (i) Chytridiomycetes: *Chytriomyces, Allomyces;* (ii) Hyphochytridiomycetes: *Rhizidiomyces*
  (iii) Plasmodiophromycetes: *Plasmodiophora*

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

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

UNIT-II

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

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

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

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

Session: 2022-24
Master of Science (Botany) Semester-I

UNIT-III

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

UNIT-IV

Principles and methods for the prevention and control for plant diseases, toxins and enzymes in plant diseases, defence mechanisms of plants against pathogens, Genetics of plant pathogen interaction.
Sex hormones in fungi, Heterothallism, heterokaryosis, parasexual cycle. Mycorrhizae in agriculture and plant growth, Biological control and concept of mycoherbicides.
Important contributions of the following mycologists/microbiologists: E.J.Butler, K.C. Mehta, B.B. Mundkur, Robert Koch, Alexander Flemming, S.A. Waksman, W.M. Stanley and Christian Gram. Important mycological and plant pathological journals and institutes.

Reference Books:

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

Session: 2022-24
Master of Science (Botany) Semester-I
Course Title: Phycology
Course Code: MBTL-1072

Course Outcomes

After passing this course the student will be able to:

CO: 1 Identify and classify different species of algae.

CO: 2 Understand comparative life history of Green and Yellow Green Algae

CO: 3 Provide a comparative account on Brown and Red Algae.

CO: 4 Understand the role of algae from an ecological and economic point of view.

Session: 2022-24
Master of Science (Botany) Semester-I
Course Title: Phycology
Course Code: MBTL-1072

LTP: 4-0-0

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

Instructions for the Paper Setters:

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

Reference Books:

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

Session: 2022-24
Master of Science (Botany) Semester-I
Course Title: Bryology
Course Code: MBTL-1073

Course outcomes

After passing this course the student will be able to:

CO1: Understand the main characteristics of bryophyte.

CO2: Describe the distinguishing traits of liverworts, hornworts, and mosses.

CO3: Understand evolution in gametophyte and sporogonium in bryophytes.

CO4: Understand means of spore dispersal, peristome teeth and various methods to conserve bryophytes.

Session: 2022-24
Master of Science (Botany) Semester-I
Course Title: Bryology
Course Code: MBTL-1073

LTP: 4-0-0

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

Instructions for the Paper Setters:

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

Reference Books:

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.

Session: 2022-24
Master of Science (Botany) Semester-I
Course Title: Plant Physiology
Course Code: MBTL-1074

Course outcomes

After passing this course the student will be able to:

CO: 1 Understand the water relationship with plants and energy metabolism.

CO: 2 Understand the interaction between the cell and signaling mechanism

CO: 3 Gain an appreciation of the nitrogen metabolism

CO: 4 understands the sulfur chemistry and sulfur metabolism in plants

Session: 2022-24
Master of Science (Botany) Semester-I
Course Title: Plant Physiology
Course Code: MBTL-1074

LTP: 4-0-0

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

Instructions for the Paper Setters:

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

UNIT-I

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

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

Reference Books:

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

Session: 2022-24
Master of Science (Botany) Semester-I
Course Title: Genetics and Evolution
Course Code: MBTL-1075

Course Outcomes

After passing this course the student will be able to

CO:1 Understand the concept of genes, genetic material and Mendelian Principles.

CO:2 Understand the biochemistry and molecular biology of cancer and mutations.

CO:3 Understand transposable genetic elements and regulation of Gene expression in prokaryotes

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

Session: 2022-24
Master of Science (Botany) Semester-I
Course Title: Genetics and Evolution
Course Code: MBTL-1075

LTP: 4-0-0

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

Instructions for the Paper Setters:

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

UNIT-I

Fine structure of gene, classical versus molecular concept of gene, the cis-trans complementation for functional allelism; Mendelian Principles: Codominance, incomplete dominance, gene interactions, pleiotropy, penetrance, expressivity, fine structures of gene and "Complex loci" in eukaryotes, over-lapping genes; concept of split gene; pseudogenes, nucleotide sequences.
Genetic Material: - Properties and replication, proof that the genetic information is stored in DNA, the Watson - Crick Model, the double helix, alternate forms of double helix, DNA replication, initiation and primer problem, complex replication apparatus, rolling circle replication of phage ϕ X174.

UNIT-II

Homologous chromosomes, polytene and Lampbrush chromosomes; Oncogenes, biochemistry and molecular biology of cancer, genetic disorders, Correlation between mutagenicity and carcinogenicity.
Mutations: Definition, types, detection in bacteria, *Neurospora*, maize and *Drosophila*; molecular basis of mutations; induced mutations (radiation and chemical mutagenesis), DNA repair mechanisms, DNA recombination mechanism.

UNIT-III

Transposable Genetic Elements: introduction, transposable elements in bacteria (Is elements, Tn 3 family), transposable elements in eukaryotes "Yeast Ty elements", maize transposons, Drosophila transposons, significance of transposable elements. Somatic Crossing Over: Molecular mechanism of crossing over, gene conversion, ordered and unordered tetrad analysis, somatic cell hybridization.
Regulation of Gene Expression in Prokaryotes: The Operon model, lac, an inducible operon, trp, a repressible operon, positive control of the lac operon by CAP and CAMP, attenuation.

Session: 2022-24
Master of Science (Botany) Semester-I

UNIT-IV

Polyploids: Inheritance pattern in autopolyploids (chromosome and chromatid segregation), diplodization, role of polyploidy in evolution.
Paleontology and Evolutionary History: The evolutionary time scale; eras, periods and epoch; major events in the evolutionary time scale; origins of unicellular and multicellular organisms; major groups of plants and animals; stages in primate evolution including Homo.
Organic evolution: Review of theories of evolution. Hardy-Weinberg law, speciation, modes of speciation (gradual and abrupt).

Reference Books:

1. Brown, T.A. (2017). Genomes 4, 4th edition, Garland Science, United States.
2. Griffiths, A. J., Wessler, S. R., Lewontin, R. C., Gelbart, W. M., Suzuki, D. T., & Miller, J. H. (2005). An introduction to genetic analysis. Macmillan. Freeman and Company, USA.
3. Hawley R.S. and Walker, M. Y. (2003) Advanced Genetic Analysis-Finding meaning in Genome. Blackwell Publishing, USA.
4. Klug W. S., Cummings, M. R., Spencer, C. A. and Palladino M. A. (2015). Concepts of Genetics. 11th edition, Pearson Education, London, England.
5. Krebs, J. E., Goldstein, E. S., & Kilpatrick, S. T. (2018). Lewin's GENES XII. Jones & Bartlett Learning. Burlington, Massachusetts.
6. Simmons, M. J., & Snustad, D. P. (2006). Principles of genetics. John Wiley & Sons.
7. Smith, J.M. (1998). Evolutionary Genetics. 2nd edition, Oxford University Press.
8. Watson, J. D. (2004). Molecular biology of the gene. Pearson Education India.

Session: 2022-24
Master of Science (Botany) Semester-I
Course Title: Botany Practicals I
Course Code: MBTP-1077

(Based on MBTL-1071, MBTL-1072, MBTL-1073)

Course Outcomes:

After passing this course the student will be able to:

CO1: Characterize different disease symptoms of crop plants.
CO2: Identify pathogenic organisms responsible for plant diseases.
CO3: Know about the history and time-scale of land plant evolution, and evaluation of the principal types of evidence underlying.
CO4: Understand algal diversity (incl. morphology, cell structure and level of organization) to phylum level, and their association as lichens.
CO5: Understand diversity and morphology of bryophytes
CO6: Identify prominent members of bryophytes

Session: 2022-24
Master of Science (Botany) Semester-I
Course Title: Botany Practicals I
Course Code: MBTP-1077

(Based on MBTL-1071, MBTL-1072, MBTL-1073)

LTP: 0-0-3

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

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

Suggested Practicals

Based on MBTL-1071:

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

Based on MBTL-1072:

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

Based on MBTL-1073:

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.

Session: 2022-24
Master of Science in Botany Semester-I
Course Title: Botany Practicals II
Course Code: MBTP-1078

(Based on MBTL-1074, MBTL-1075, MBTL-1046)

Course outcomes:

After passing this course the student will be able to:

CO1: Prepare various biological reagents used in experiments

CO2: Estimate various biological activities in plants.

CO3: Understand the lab structure of cytogenetics and perform the molecular level of practicals like DNA isolation.

CO4: Perform the different types of cell division in various plants.

CO5: Understand basics of computer.

CO6: Interpret data in word and powerpoint files.

Session: 2022-24
Master of Science in Botany Semester-I
Course Title: Botany Practicals II
Course Code: MBTP-1078

(Based on MBTL-1074, MBTL-1075, MBTL-1046)

LTP: 0-0-3

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

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

Suggested Practicals

Based on MBTL-1074

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

Based on MBTL-1075:

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

Based on MBTL-1046

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

Semester - II

Session: 2022-24
Master of Science (Botany) Semester-II
Course Title: Pteridology
Course Code: MBTL-2071

Course outcomes

After passing this course the student will be able to:

CO1: Understand taxonomic and biological features of Pteridophyta.

CO2: Understand systematics and life cycles of various Pteridophytes.

CO3: Comprehend the evolutionary trends among different genera of Pteridophytes

CO4: Understand land adaptations and importance of Pteridophytes.

Session: 2022-24
Master of Science (Botany) Semester-II
Course Title: Pteridology
Course Code: MBTL-2071

LTP: 4-0-0

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

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.

Reference Books:

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.

Session: 2022-24
Master of Science (Botany) Semester-II
Course Title: Diversity and Biology of Gymnosperms
Course Code: MBTL-2072

Course outcomes

After passing this course the student will be able to:

CO1: Describe general characteristics of gymnosperms.

CO2: Understand the history of gymnosperms.

CO3: Identify and classify different gymnosperm genera and their distribution on the earth's surface.

CO4: Understand origin and evolution of gymnosperms.

Session: 2022-24
Master of Science (Botany) Semester-II
Course Title: Diversity and Biology of Gymnosperms
Course Code: MBTL-2072

LTP: 4-0-0

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

Instructions for the Paper Setters:

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

Reference Books:

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.

Session: 2022-24
Master of Science (Botany) Semester-II
Course Title: General Microbiology
Course Code: MBTL-2073

Course outcomes

After passing this course the student will be able to:

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

CO2: Know about viruses and diseases related to viruses.

CO3: understand the water treatment, bioremediation and aeromicrobiology

CO4: Gain knowledge on industrial products related to microbes and control of microbes

Session: 2022-24
Master of Science (Botany) Semester-II
Course Title: General Microbiology
Course Code: MBTL-2073

LTP: 4-0-0

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

Instructions for the Paper Setters:

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

Industrial Microbiology: The Microbe: Primary and secondary metabolites, major industrial products: foods, flavoring 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.

Reference Books:

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.

Session: 2022-24
Master of Science (Botany) Semester-II
Course Title: Cell Biology
Course Code: MBTL-2074

Course outcomes

After passing this course the student will be able to:

CO1: Learn about levels of structural organization, cellular membranes and intracellular transport.

CO2: Gain knowledge on the structural organization and function of intracellular organelles, genes and chromosomes.

CO3: Study about the cell cycle and cell division.

CO4: Gain knowledge on cellular communication & cell signaling.

Session: 2022-24
Master of Science (Botany) Semester-II
Course Title: Cell Biology
Course Code: MBTL-2074

LTP: 4-0-0

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

Instructions for the Paper Setters:

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

Reference Books:

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)

Session: 2022-24
Master of Science (Botany) Semester-II
Course Title: Ecological Modelling and Forest Ecology
Course Code: MBTL-2075

Course outcomes:

After passing this course the student will be able to:

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

CO2: Integrate information from species association and diversity.

CO3: Understand the distribution of vegetation with respect to the environment.

CO4: Understand different Environmental Law & Policy.

Session: 2022-24
Master of Science (Botany) Semester-II
Course Title: Ecological Modelling and Forest Ecology
Course Code: MBTL-2075

LTP: 4-0-0

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

Instructions for the Paper Setters:

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

Reference Books:

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

Session: 2022-24
Master of Science (Botany) Semester-II
Course Title: Botany Practicals I
Course Code: MBTP-2077
(Based on MBTL-2071, MBTL-2072 and MBTL-2073)

Course Outcomes:

After passing this course the student will be able to:

CO1: Understand Morphological, reproductive and anatomical structures of plants.

CO2: Understand wood anatomy of gymnosperms.

CO3: Perform different experiments based on microorganisms.

CO4: Culture microorganisms on different media and their future potential.

Session: 2022-24
Master of Science (Botany) Semester-II
Course Title: Botany Practicals I
Course Code: MBTP-2077
(Based on MBTL-2071, MBTL-2072 and MBTL-2073)

LTP: 0-0-3

Max. Marks- 75
Theory - 60
CA – 15
Examination Time: 6 hrs

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

Suggested Practicals

Based on MBTL-2071:

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

Based on MBTL-2072:

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

Based on MBTL-2073:

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.

Session: 2022-24
Master of Science (Botany) Semester-II
Course Title: Botany Practicals II
Course Code: MBTP-2078
(Based on MBTL-2074, MBTL-2075 and MBTL-2336)

Course Outcomes:

After passing this course the student will be able to:

CO1: Understand structures of various cell organelles.

CO2: Examine cell divisions in plant cells.

CO3: Perform different experiments based on plant ecology.

CO4: Analyze nutrients and pigment contents in plants using various techniques.

CO5: Learn application of Statistics in Life Science.

CO6: Analyze and interpret the observations Statistically

Session: 2022-24
Master of Science (Botany) Semester-II
Course Title: Botany Practicals II
Course Code: MBTP-2078
(Based on MBTL-2074, MBTL-2075 and MBTL-2336)

LTP: 0-0-3

Max. Marks- 75
Theory - 60
CA – 15
Examination Time: 6 hrs

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

Suggested Practicals

Based on MBTL-2074:

1. Understanding the cytology laboratory- components of compound/electron microscope.
2. Examination of electron micrographs of eukaryotic cells with special reference to organelles.
3. Examination of various stages of mitosis and meiosis using appropriate plants material (e.g. onion root tips, onion flower buds).
4. Calculation of Mitotic and meiotic index from dividing root tip cells and pollen grains.
5. Study on cyclosis in *Tradescantia* and *Hydrilla* leaves.
6. Observations on Barr bodies in Squamous epithelium.
7. Preparation of Feulgen stained chromosomes in root tip cells.
8. Effect of colchicine on chromosome movements during mitosis.
9. Use of fluorescent dye to visualize cell components.

Based on MBTL-2075:

1. To determine minimum size and number of quadrats required for reliable estimate of biomass in grassland.
2. To find out association between grassland species using chi square test.
3. To analyse plant communities using Bray-Curtis ordination method.
4. To determine soil moisture content, porosity, bulk density of different soil samples collected from different locations.
5. To study chlorophyll content of SO_2 fumigated and unfumigated plant leaves.
6. To determine Na, K concentration of water sample using flame photometer.
7. To determine water holding capacity of different soil samples.
8. To determine percent organic Carbon and organic matter in different soil samples.
9. To estimate chlorophyll content in SO_2 fumigated and unfumigated plant leaves.
10. To estimate rate of CO_2 evolution from different soil using soda lime or alkali absorption method.
11. To determine sulphate content of water samples.
12. To determine O_2 content of water samples.

Based on MBTL-2336:

1. To Study the Exponential Growth of Microbes with the help of Graph.
2. To Find the rate of change of Bacterial Growth w.r.t time, nutrient etc.
3. To Study the Application of Probability in Life Sciences / Genetics.
4. To Analyse the Biostatistical data using mean and Standard deviation.
5. To Find Correlation and Regression between two Variables of Biostatistical data.
6. Application of t-test as a Single mean in Life Sciences.
7. Application of χ^2-test as a Goodness of fit in Life Sciences.
8. Application of χ^2- test in association of attributes in Life Sciences.
9. Application of Z- test as test of single Mean in Life Sciences in Botany.

Semester - III

Session: 2022-24
Master of Science (Botany) Semester-III
Course Title: Developmental Botany
Course Code: MBTL-3071

Course outcomes:

After passing this course the student will be able to:

CO1: Compare the function and morphology of pollen grains.

CO2: Understand various aspects related to fertilization and endosperm development.

CO3: Understand different aspects of embryo development.

CO4: Understand the role of Embryology in Taxonomy and Plant Breeding.

Session: 2022-24
Master of Science (Botany) Semester-III
Course Title: Developmental Botany
Course Code: MBTL-3071

LTP: 4-0-0

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

Instructions for the Paper Setters:

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

Unit-I

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

Unit-II

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

Unit-III

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

Session: 2022-24
Master of Science (Botany) Semester-III

Unit-IV

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

Reference Books:

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

Session: 2022-24
Master of Science (Botany) Semester-III
Course Title: Plant Molecular Biology
Course Code: MBTL – 3072

Course outcomes:

After passing this course the student will be able to:

CO1: Gain knowledge about DNA sequencing and RNA processing.

CO2: Understand different techniques related to molecular biology.

CO3: Understand the structures and purposes of cloning vehicles.

CO4: Gain knowledge about genetic cloning and genomics & proteomic techniques.

Session: 2022-24
Master of Science (Botany) Semester-III
Course Title: Plant Molecular Biology
Course Code: MBTL – 3072

LTP: 4-0-0

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

Instructions for the Paper Setters:

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

Unit-I

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

Unit-II

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

Unit-III

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

Unit-IV

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

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

Reference Books:

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

Session: 2022-24
Master of Science (Botany) Semester-III
Course Title: Plant Breeding and IPR
Course Code: MBTL –3073

Course outcomes:

After passing this course the student will be able to:

CO1: Understand sources and types of genetic variation and explain their importance for plant improvement.

CO2: Understand historical evolution of plant breeding and different centers of origin.

CO3: Describe methods that are used in plant breeding.

CO4: Understand IPR (Intellectual property right)

Session: 2022-24
Master of Science (Botany) Semester-III
Course Title: Plant Breeding and IPR
Course Code: MBTL –3073

LTP: 4-0-0

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

Instructions for the Paper Setters:

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

Unit-I

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

Unit-II

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

Unit-III

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

Unit-IV

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

Reference Books:

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

Session: 2022-24
Master of Science (Botany) Semester-III
Course Title: Plant Biochemistry
Course Code: MBTL – 3074

Course outcomes:

After passing this course the student will be able to:

CO1: Understand cellular chemistry and interactions.

CO2: Understand the structure and metabolism of carbohydrates.

CO3: Describe structure, functions and the metabolism of lipids.

CO4: Understand kinetics of enzyme catalyzed reactions and enzyme inhibitory and regulatory processes.

Session: 2022-24
Master of Science (Botany) Semester-III
Course Title: Plant Biochemistry
Course Code: MBTL – 3074

LTP: 4-0-0

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

Instructions for the Paper Setters:

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

Unit-I

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

Unit-II

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

Unit-III

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

Unit-IV

Enzymology: Introduction to enzymology, history of enzymes, nomenclature and classification.
Specificity of enzymes: group specificity, absolute specificity, stereochemical specificity. Mechanism of enzyme catalysis: Activation energy, Nature of active sites, enzyme-substrate complex, induced fit hypothesis, strain and distortion theory.
Enzyme Kinetics: Michaelis-Menton Equation, Lineweaver-Burk plot. Regulation of enzyme activity and concentration: Brief account of enzyme induction and repression, covalent modification, isoenzymes and allosteric enzymes

Reference Books:

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

Session: 2022-24
Master of Science (Botany) Semester-III
Course Title: Applied Botany
Course Code: MBTL – 3075

Course outcomes:

After passing this course the student will be able to:

CO1: Demonstrate knowledge of the value of plants in our everyday lives.

CO2: Understand commercial use of different forest products.

CO3: Describe various industrial plant products.

CO4: Understand chemical processing of different products in applied botany.

Session: 2022-24
Master of Science (Botany) Semester-III
Course Title: Applied Botany
Course Code: MBTL – 3075

LTP: 4-0-0

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

Instructions for the Paper Setters:

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

Unit-I

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

Unit-II

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

Unit-III

Industrial Plant Products: Essential oil yielding plants of India, their use in perfumery, vegetable oils, fats and waxes, starches and other cellulose products. Manufacturing of paper and board from raw plant material. Manufacturing of crude and high-quality paper, recycled paper; bio fuel producing plants.

Fibres: Different types of fibre yielding plants, classification of fibres, physical and chemical processes involved in the manufacturing of fibre.

Unit-IV

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

Reference Books:

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

Session: 2022-24
Master of Science (Botany) Semester-III
Course Title: Plant Morphogenesis
Course Code: MBTL – 3076

Course outcomes:

After passing this course the student will be able to:

CO1: Learn about morphogenesis and organogenesis in plants.

CO2: Understand differentiation in plants.

CO3: Describe plant regeneration processes and tissue relationships.

CO4: Understand different factors affecting plant morphogenesis.

Session: 2022-24
Master of Science (Botany) Semester-III
Course Title: Plant Morphogenesis
Course Code: MBTL – 3076

LTP: 4-0-0

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

Instructions for the Paper Setters:

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

Unit-I

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

Unit-II

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

Unit-III

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

Unit-IV

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

Reference Books:

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

Session: 2022-24
Master of Science (Botany) Semester-III
Course Title: Botany Practicals I
Course Code: MBTP-3077

(Based on MBTL-3071, MBTL-3072 and MBTL-3073)

Course Outcomes:

After passing this course the student will be able to:

CO1: Perform immobilization of enzymes.

CO2: Wide application of enzymes and their future potential.

CO3: Perform different experiments based on plant pollination.

CO4: Understand embryology of dicot and monocot plants.

Session: 2022-24
Master of Science (Botany) Semester-III
Course Title: Practical-I
Course Code: MBTP-3077
(Based on MBTL-3071, MBTL-3072 and MBTL-3073)

LTP: 0-0-3

Max. Marks- 75
Theory - 60
CA – 15
Examination Time: 6 hrs

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

Suggested Practical's from MBTL-3071

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

Suggested Practical's from MBTL-3072

8. Identification of the parts of bright- field microscope and demonstration of its use and care.
9. Perform basic microbiological techniques such as sterile plating and isolation of single colonies.
10. Isolation of DNA from biological samples.
11. Characterization of isolated DNA using agarose gel electrophoresis.
12. Graph and analyze agarose gel data.
13. Genetic transformation of bacteria.
14. Screening and selection of transformants.
15. Demonstration of PCR technique.
16. Spectrophotometric estimation of DNA.
17. Demonstration of DNA sequencing technique.

Suggested Practical's from MBTL-3073

18. Floral biology in self- and cross-pollinated species,

19. Selfing and crossing techniques.
20. Numerical exercises on probability and biostatistics
21. Maintenance of experimental records;
22. Learning techniques in hybrid seed production
23. To study Breeders kit.
24. Studies on centres of origin of various useful crops.
25. To study Vegetative Propagation in – Potato, Onion bulb, Sugarcane, Ginger.
26. To perform exploration for determination of male sterility.
27. To perform Field exploration for determination of Dichogamy, Heterostyly and Dioecy.
28. To estimate Pollen viability in *Zea mays* and *Hibiscus*.

Session: 2022-24
Master of Science (Botany) Semester-III
Course Title: Botany Practicals II
Course Code: MBTP-3078
(Based on MBTL-3074, MBTL- 3075 and MBTL-3076)

Course outcomes:

After passing this course the student will be able to:

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

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

CO3: Exhibit clear and concise communication of scientific data.

CO4: Understand different techniques related to molecular biology.

Session: 2022-24
Master of Science (Botany) Semester-III
Course Title: Botany Practicals II
Course Code: MBTP-3078
(Based on MBTL-3074, MBTL- 3075 and MBTL-3076)

LTP: 0-0-3

Max. Marks- 75
Theory - 60
CA – 15
Examination Time: 6 hrs

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

Suggested Practical's based on MBTL-3074

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

Suggested Practical's based on MBTL-3075

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

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

(*Rauwolfia serpentine)*, Ashwgandha (*Withania somnifera*), Liquorice (*Glycyrrhiza glabra)*, Poppy (*Papaver somniferum*), Arjuna (*Terminalia arjuna)*

16. Study of morphology and nutrition value for pulses: Green Gram (*Phaseolus aureus)*, Black Gram (*Phaseolus mungo)*, Pigeon Pea (*Cajanas cajan)*, Kidney Bean *(Phaseolus vulgaris)*
17. Study of morphology of plants producing fruits Citrus (*Citrus sp)*, Apple (*Malus pumila)*, Mango (*Mangifera indica)*, Banana (*Musa sapientum)*, Pineapple (*Ananas comosus)*, Grapevine (*Vitis sp)*
18. Vegetables: Potato (*Solanum tuberosum*), Radish (*Rapahnus sativus*), Turnip (*Brassica rapa*)
19. Study of morphology of Beverages: Tea (*Thea sinensis*), Coffee (*Coffea arabica*) and knowledge of processing method.

Suggested Practical's based on MBTL-3076

20. Emasculation, bagging, hand pollination to study pollen germination, seed set and fruit development.
21. Study of cleistogamous flowers and their adaptations.
22. Study of nuclear and cellular endosperm through dissection and staining.
23. Isolation of zygotic globular, heart shaped, torpedo stage and mature embryos from suitable seed.
24. Study of seed dormancy and methods to break dormancy
25. Study the primitive and advanced characters of plants in angiosperms
26. Study various methods of asexual reproduction and vegetative reproduction
27. Study effects light, gravity, humidity temperature on plants
28. To study effect of bending on plant morphogenesis.

Semester - IV

Session: 2022-24
Master of Science (Botany) Semester-IV
Course Title: Plant Anatomy
Course Code: MBTL –4071

Course outcomes:

After passing this course the student will be able to:

CO1: Compare anatomy of primary and secondary growth in roots as well as shoots.

CO2: Understand anatomy of different types of wood and their commercial utilization.

CO3: Understand floral, fruit and seed anatomy.

CO4: Understand anatomy of plant parts in relation to habitat.

Session: 2022-24
Master of Science (Botany) Semester-IV
Course Title: Plant Anatomy
Course Code: MBTL –4071

LTP: 4-0-0

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

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.

Reference Books:

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

Session: 2022-24
Master of Science (Botany) Semester-IV
Course Title: Structure and Metabolism of Plant Hormones
Course Code: MBTL – 4072

Course outcomes:

After passing this course the student will be able to:

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

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

CO3: Understand biosynthesis, action and uses of New class of plant hormones.

CO4: Relate microbial association with the production of growth regulators.

Session: 2022-24
Master of Science (Botany) Semester-IV
Course Title: Structure and Metabolism of Plant Hormones
Course Code: MBTL – 4072

LTP: 4-0-0

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

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.

Reference Books:

9. 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.
10. Davies, P. J. (Ed.). (2004). Plant hormones: biosynthesis, signal transduction, action! Springer Science & Business Media.
11. Dennis, D.T., Turpin, D.H., Lefebvre, D.D., and Layzell, D.B. (eds) (1997). Plant Metabolism.Longman, Essex.
12. Galston, A.W. (1989). Life Processes in Plants. Scientific American Library, Springer-Verlag, NewYork.
13. Hooykaas, P.J.J., Hall, M.A., and Libbenga, K.R. (eds) (1999). Biochemistry and Molecular Biology of Plant Hormones. Elsevier, Amsterdam.
14. Hopkins, W. G. (2007). Introduction to plant physiology 4th edition. John Wiley & Sons, Inc., NewYork.
15. 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.
16. Taiz, L., Zeiger, E., Møller, I. M., & Murphy, A. (2015). Plant physiology and development, Sinauer Associates Inc

Session: 2022-24
Master of Science (Botany) Semester-IV
Course Title: Plant Tissue Culture and Biotechnology
Course Code: MBTL – 4073

Course outcomes:

After passing this course the student will be able to:

CO1: Understand the concept of cytogenetics, differentiation in cell and tissue culture and mechanism, advantage and disadvantages of micro-propagation.

CO2: Understand the mechanism of production of disease resistant, herbicide resistant and pathogen free plants.

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

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

Session: 2022-24
Master of Science (Botany) Semester-IV
Course Title: Plant Tissue Culture and Biotechnology
Course Code: MBTL – 4073

LTP: 4-0-0

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

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

Introduction and Historical aspects of Tissue Culture, Micropropagation: Stages, Types, Cytogenetics and differentiation in cell and tissue culture, plant regeneration from callus, shoot apex culture and anthers. 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.

Reference Books:

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

Session: 2022-24
Master of Science (Botany) Semester-IV
Course Title: Analytical Techniques
Course Code: 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: Understand working of different spectroscopy techniques.

CO4: Understand theory and practice of different blotting techniques.

Session: 2022-24
Master of Science (Botany) Semester-IV
Course Title: Analytical Techniques
Course Code: MBTL – 4074

LTP: 4-0-0

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

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.

Reference Books:

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

Session: 2022-24
Master of Science (Botany) Semester-IV
Course Title: Diversity and Biology of Angiosperms
Course Code: 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, origin of angiosperms and phylogeny.

CO3: Understand the role of various fields of biology in plant taxonomy.

CO4: Understand the concept of taxonomic tools, aspects related to phytogeography and local plant diversity.

Session: 2022-24
Master of Science (Botany) Semester-IV
Course Title: Diversity and Biology of Angiosperms
Course Code: MBTL – 4075

LTP: 4-0-0

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

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 and Helobiales and their treatment in the modern systems of classification.

UNIT-III

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

UNIT-IV

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

Reference Books:

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

Session: 2022-24
Master of Science (Botany) Semester-IV
Course Title: Hazardous Chemicals
(Optional Paper)
Course Code: MBTL-4076 (Opt-I)

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.

Session: 2022-24
Master of Science (Botany) Semester-IV
Course Title: Hazardous Chemicals
(Optional Paper)
Course Code: MBTL-4076 (Opt-I)

LTP: 3-0-0

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

Instructions for the Paper Setters:

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

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

Reference Books:

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

Session: 2022-24
Master of Science (Botany) Semester-IV
Course Title: Immunology
(Optional Paper)
Course Code: MBTL-4076(Opt-II)

Course outcomes:

After passing this course the student will be able to:

CO1: Understand history and principles of immunology.

CO2: Conceptualize how the antigen is processed.

CO3: Understand the working of Antibodies.

CO4: Understand the cells and tissues of the immune system.

Session: 2022-24
Master of Science (Botany) Semester-IV
Course Title: Immunology
(Optional Paper)
Course Code: MBTL-4076(Opt-II)

LTP: 3-0-0

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

Instructions for the Paper Setters:

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

Reference Books:

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

Session: 2022-24
Master of Science (Botany) Semester-IV
Course Title: Botany Practicals I
Course Code: MBTP -4077

(Based on MBTL-4071, MBTL-4072 and MBTL-4073)

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.

Session: 2022-24
Master of Science (Botany) Semester-IV
Course Title: Botany Practicals I
Course Code: MBTP -4077

(Based on MBTL-4071, MBTL-4072 and MBTL-4073)

LTP: 0-0-3

Max. Marks- 75
Theory - 60
CA – 15
Examination Time: 6 hrs

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

Suggested Practicals based on MBTL-4071

13. Study of apical meristems with the help of dissections, whole mount preparations, sections and permanent slides.
14. Study of xylem and phloem elements using maceration, staining, light and electron micrographs (xerophytes, hydrophytes and halophytes).
15. Study of secretory structures (nectaries and laticifers).
16. Study of leguminous roots with different types of nodules.
17. Anatomical studies of young and mature stem of *Helianthus*.
18. Comparative anatomy of dicot and monocot root, stem and leaf
19. To study anomalous stem behaviour in stem (*Mirabilis jalapa, Nycthanthus, Boerhaavia diffusa, Bignonia, Dracaena.)*
20. Study of anatomical features in xerophytes e.g. (leaf of *Nerium*. stem and leaf of *Calotropis*, phyllocladode of *Ruscus*.)
21. Study of anatomical features in hydrophytes e.g. (*Nelumbo* petiole, *Hydrilla* stem and leaf, *Eichhornia* petiole, leaf lamina, *Typha*)
22. To study anatomy of storage roots of e.g. (*Raphnus sativa, Beta vulgaris*,)
23. To study anatomy of halophytes e.g. (*Chenopodium* stem)
24. To study permanent tissues slides.

Suggested Practical's based on MBTL-4072

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

Suggested Practical's based 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

Session: 2022-24
Master of Science (Botany) Semester-IV
Course Title: Botany Practicals II
Course Code: MBTP -4078

(Based on MBTL-4074 and MBTL-4075)

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: Able to understand role of herbarium in plant taxonomy.

CO4: Understand diagnostic features of different families.

Session: 2022-24
Master of Science (Botany) Semester-IV
Course Title: Botany Practicals II
Course Code: MBTP -4078
(Based on MBTL-4074 and MBTL-4075)

LTP: 0-0-2

Max. Marks- 75
Theory - 60
CA – 15
Examination Time: 4 hrs

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

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

1. Paper Chromatography
2. Thin Layer chromatography
3. Column chromatography
4. Gel Filtration Chromatography
5. Ion Exchange Chromatography
6. Affinity Chromatography
7. Electrophoresis: 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 of locally available families. This list is indicative only

- Ranunculaceae: *Ranunculus, Delphinium,*
- Brassicaceae: *Brasssica, Iberis*
- Malvaceae: *Hibiscus*
- Rutaceae: *Murraya, Citrus*
- Fabaceae: *Lathyrus, Cassia, Acacia, Mimosa*
- Rosaceae: *Rose, Prunus*
- Asteraceae: *Helianthus, Ageratum, Sonchus*
- Apiaceae: *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*

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.

Session: 2022-24
Master of Science (Botany) Semester-IV
Course Title: Field Study and Research Techniques
Course Code: MBTP -4079

Course outcomes:

After passing this course the student will be able to:

CO1: Understand plant collection, their preservation and importance in taxonomic studies

CO2: Understand a general definition of research design

CO3: Identify the overall process of designing a research study from its inception to its report.

CO4: Understand ethical issues in educational research.

Session: 2022-24
Master of Science (Botany) Semester-IV
Course Title: Field Study and Research Techniques
Course Code: MBTP -4079

LTP: 0-2-0

Max. Marks- 50
Evaluation Report - 40
CA – 10

Field Study:

1. Collection of Plants identification and preservation
   (a) from local excursion (short) (b) Major excursion (long)
2. Preparation of Herbarium.
3. Preservation of collected plant species.
4. Submission of report for every field study
5. Submission of compiled herbarium at the time of End Sem. Exam.

Research Techniques:

1. Introduction: Research design, principles, execution of work, interpretation of results.
2. Review of literature: Structure of a scientific library, journals, books, Digital library and E books
3. Layout of a Research Paper, Journals in Botanical Science, Impact factor of Journals
4. Google Scholar, Open source, bibliography management system.
5. Methods of data collection
6. Data analysis: Measures of Central tendencies (Mean, mode, median,) Standard deviation, the variance and coefficient of variation, Correlation and regression, ANOVA using SPSS
7. Ethics in research related to publishing, Plagiarism and Self-Plagiarism

Reference Books:

1. Thomas, C. G. (2021). *Research methodology and scientific writing*. Thrissur: Springer.
2. Bairagi, V., & Munot, M. V. (Eds.). (2019). *Research methodology: A practical and scientific approach*. CRC Press.
3. Jain, S. (2019). *Research methodology in arts, science and humanities*. Society Publishing.

ANNEXURE G

FACULTY OF LIFE SCIENCES

SYLLABUS

of

Certificate course

in

Nursery Development and Management (Botany)

Session: 2022-23

The Heritage Institution

KANYA MAHA VIDYALAYA JALANDHAR

(Autonomous)

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATIONS OF SIX-MONTH CERTIFICATE COURSE

Certificate course in Nursery Development and Management (Botany)
Session: 2022-23

Course Code	Course Title	Hours/ Week	Marks				Examination time (in Hours)
			Total	Ext.		CA	
				L	P		
	Nursery Development and Management	3	100	50	30	20	3

Certificate course in Nursery Development and Management (Botany)
Session: 2022-23
Program Specific Outcomes

PSO1. Understand nursery planning and development.

PSO2. Understand commercial production of nursery.

PSO3. Understand nursery management and consumer chain.

Certificate course in Nursery Development and Management (Botany)
Session: 2022-23

Course outcomes

By the end of this course, the student will be able to:

CO:1. Describe the basic resources necessary for nursery crop production

CO: 2. Explain the commercial aspects of the nursery crop industry

CO: 3. Understand properties of soil.

CO: 4. Understand different techniques involved in plant multiplication.

Certificate course in Nursery Development and Management (Botany)
Session: 2022-23

Course Title: Nursery Development and Management

(Theory) **Duration:** 6 months

Credits: 1+1 **Marks: 50**

UNIT – I

Introduction to the nursery industry, nursery techniques, Importance, Types of nurseries, Nursery standards. Establishment of Nursery: Selection of site and location, Design, Irrigation and Drainage management. Propagation: Sexual, Asexual and tissue culture, role of plant hormones and disinfectants. Seed dormancy (scarification & stratification) internal and external factors.

UNIT II

Soil and soil factors (pH, Nutrition). Growth media and potting mixers. Transplanting, Potting, pruning and in ground production. Selection and management of nursery stock, Criteria for selection, propagation material, its inspection, labelling and storage.

UNIT III

Plant breeding: Genetic improvement of plants, Mendel's principles, Plant reproduction and its phases, Genetic variations, sterility, hybrid crosses, Quantitative traits, Plant breeding programmes, Hybrid seed production, breeder's rights and trademarks.

UNIT IV

Pest and disease management – Cultural, physical, chemical and biological controls. Integrated pest management. Weed control methods.

Glasshouses, shade houses and other nursery structures, Management and marketing- packaging, retail and customer relations.

Certificate course in Nursery Development and Management (Botany)
Session: 2022-23

Course Title: Nursery Development and Management

(Practical)

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

Practical:

1. Designing nursery layout.
2. Media for propagation of plants in nursery beds and pot.
3. Preparation of nursery beds and sowing of seeds.
4. Raising of rootstock.
5. Seed treatments for breaking dormancy and inducing vigorous seedling growth.
6. Preparation of plant material for potting.
7. Hardening plants in the nursery.
8. Practicing different types of cuttings, layering, graftings and buddings.
9. Preparation of plant growth regulators for seed germination and vegetative propagation.
10. Visit to a tissue culture laboratory.
11. Maintenance of nursery records.
12. Use of different types of nursery tools and implements for general nursery and virus tested plant material in the nursery. Cost of establishment of a mist chamber, greenhouse, glasshouse, polyhouse and their uses.
13. Nursery development business planning

Suggested Reading:

1. Ray, P.K. (2012). Plant Nursery Management: How to Start and Operate a Plant Nursery. Scientific Publishers.
2. Hartmann, H.T., Kester D.E., Davis, F.T and R.L Geneve (2010) Plant Propagation: Principles and practices (8th Edition)
3. Sharma, R.R and Srivastav M (2004):Plant propagation and nursery management (First Edition) International Book Distributing Co.
4. Bose ,T.K.Sanyal, D and Sandhu, M.L.(1998) Propagation of Horticultural crops. Naya Prakash Publishers , Kolkatta .

ANNEXURE J

Workshop attended:

Name of Faculty	Title of the Workshop/online course	Name of the Institution	Organizers	Date
Mrs. Shikha Vashisht	DNA cutting and shredding: how bacteria prevent phage attacks	Deen Dayal Upadhyaya College, University of Delhi	DBT Star College (DDU) Deen Dayal Upadhyaya College,	January 3, 2022
Mrs. Shikha Vashisht	Workshop "Advancing Green Educational Campuses - A regional experience sharing"	Centre for Science and Environment, Delhi and GNDU, Amritsar	Centre for Science and Environment, Delhi and GNDU, Amritsar	10th October 2021
Mrs. Shikha Vashisht	International webinar on Higher Education During the Covid-19 Pandemic: A Global Perspective of the Challenges and Best Practices	TAYLOR'S University	TAYLOR'S University, Malaysia	4th September 2021
Mrs. Shikha Vashisht	Four Week Massive Open Online Course "Innovative Pedagogical Strategies for Gifted and slow learners"	Khalsa College of Education G.T. Road, Amritsar, Punjab.	Khalsa College of Education G.T. Road, Amritsar, Punjab.	27th May,2021 to 27th June, 2021
Mrs. Shikha Vashisht	Faculty Development Programme Managing Online Classes & Co-creating MOOCS 6.0 By	Ramanujan college, university of Delhi	Teaching learning centre, Ramanujan college, university of Delhi	05th July 2021-19th July 2021
Mrs. Shikha Vashisht	National Webinar on "Role of Polyploidy in Evolution of Plants"	Eternal University, Baru Sahib	Department of Botany, Eternal University, Baru Sahib	17th June 2021
Dr. Sandeep Kaur	National Webinar on "Conservation of Plant Biodiversity"	Guru Nanak College, Sri Mukatsar Sahib	Department of Basic Sciences	20th May 2021
Dr. Sandeep Kaur	National Webinar on "Role of Wetlands in Biodiversity Conservation"	Patel Memorial National College, Rajpura	Department of Botany and Zoology	21st May 2021

Dr. Sandeep Kaur	National Webinar on "World Environment Day"	Sri Guru Granth sahib world University, Fatehgarh Sahib	Department of Botany and Environmental Sciences	4th June 2021
Dr. Sandeep Kaur	National Webinar on "Role of Polyploidy in Evolution of Plants"	Eternal University, Baru Sahib	Department of Botany, Eternal University, Baru Sahib	17th June 2021
Dr. Sandeep Kaur	4-week-induction program for Faculties of Universities/Colleges and Institutes of Higher Education.	Ramanujan College, University of Delhi	Teaching Learning Centre, Ramanujan College, University of Delhi	21st August-19th September 2021
Dr. Sandeep Kaur	Two Day National Workshop on "Waste Management: Zero Waste College"	KLE's Society's Science and Commerce College	Department of Botany and Nature's Club	10-11 February 2022
Dr. Sandeep Kaur	Short Term Course on "Fostering Social Responsibility and Community Engagement in Higher Education Institution in India"	Kanya Maha Vidyalaya, Jalandhar	Unnat Bharat Abhiyan	22-26th March 2022
Deepika Vats	Five days inter disciplinary "Advance Teaching learning, research Methodology and innovations ,,	Saint France De sales college, Nagpur	Saint France De sales college, Nagpur	1st June to 5th June 2021
Deepika Vats	National webinar on Role of Wetlands in biodiversity conservation	Patel memorial national college, Rajpura, Punjab	Patel memorial national college, Rajpura, Punjab	21may,2021
Deepika Vats	Online TWO-WEEK interdisciplinary REFRESHER course on "Advanced research methodology,	Ramanujan college, university of Delhi	Teaching learning centre, Ramanujan college, university of Delhi	22jan -05 Feb 2022
Dr. Sandeep Singh	International webinar on Higher Education During the Covid-19 Pandemic: A Global Perspective of the Challenges and Best Practices	TAYLOR'S University	TAYLOR'S University, Malaysia	4th September 2021

DEEN DAYAL UPADHYAYA COLLEGE
UNIVERSITY OF DELHI

THE NATIONAL ACADEMY OF SCIENCES, INDIA
ALLAHABAD

Department of BioTechnology, Government of India
UNDER THE AEGIS OF
DBT STAR COLLEGE PROGRAM

Sixth Lecture Workshop (Online)

On

"Trans-disciplinary Areas of Research and Teaching by Shanti Swarup Bhatnagar (SSB) Awardee"

(January 03, 2022 – February 02, 2022)

Certificate of Completion

This is to certify that

SHIKHA VASHISHT

ASSISTANT PROFESSOR DEPARTMENT OF BOTANY KANYA MAHA VIDYALAYA, JALANDHAR ,INDIA

Has Completed One Professional Development Hour by attending Webinar held on January 03, 2022 as part of the Lecture Workshop

DNA cutting and shredding: how bacteria prevent phage attacks

Dr Kayarat Saikrishnan

Biology Division, Indian Institute of Science Education and Research, Pune 411 008

Registered Email ID of Attendee : arnavshikha2012@gmail.com
Certificate No. *2022/NASIDDUCSSB/Technical Talk/2022/01/04 3:01:22 PM GMT+5:30*

Professor. Manoj Saxena, *fNASc*
Program Coordinator-DBT Star College (DDU)
Deen Dayal Upadhyaya College, University of Delhi

CSE

CENTRE FOR SCIENCE AND ENVIRONMENT

CERTIFICATE OF PARTICIPATION

Workshop on

Advancing Green Educational Campuses – A regional experience sharing

This is to certify that **Mrs. Shikha Vashist** has participated in the workshop on **"Advancing Green Educational Campuses – A regional experience sharing"** jointly organised by Centre for Science and Environment, New Delhi and Guru Nanak Dev University, Amritsar on **December 10, 2021** at Guru Nanak Dev University, Amritsar.

With best wishes,

Mr. Rajneesh Sareen, Programme Director
Sustainable Buildings and Habitat Programme
Centre for Science and Environment

Dr. Ashwani Luthra, Co-ordinator
Centre for Sustainable Habitat
Guru Nanak Dev University Amritsar

CERTIFICATE OF COMPLETION

This is to certify that

Shikha Vashisht
Kanya Maha Vidyalaya, Jalandhar

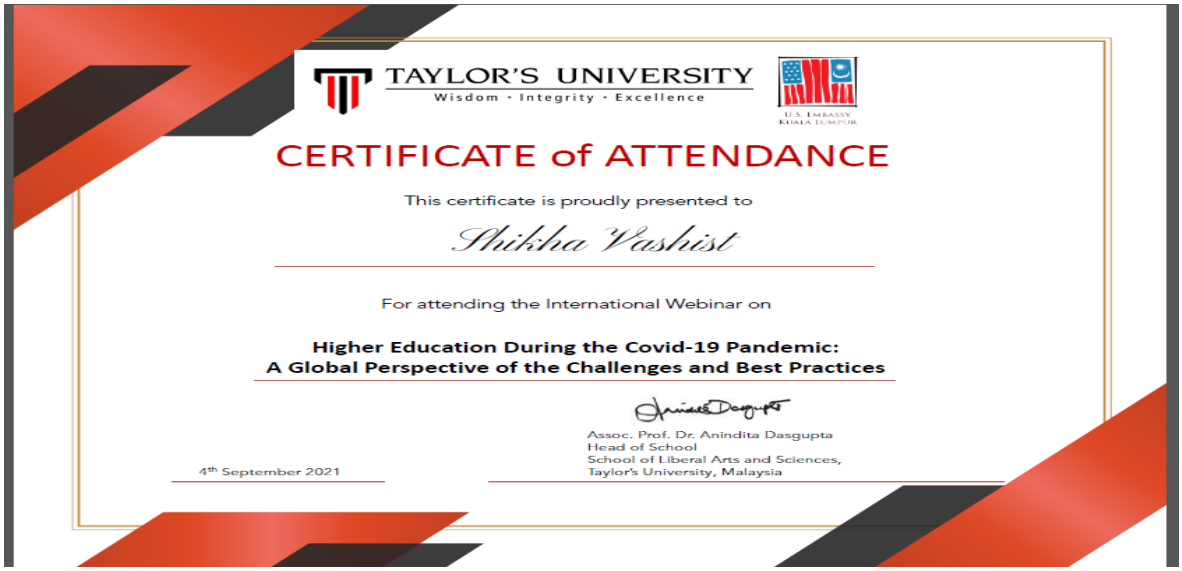
has successfully completed with 'A' grade a four- week Massive Open Online Course "Innovative Pedagogical Strategies for Gifted and Slow Learners" offered by Khalsa College of Education G.T. Road, Amritsar, Punjab, India. This course was developed as a part of the UNESCO International Online Mentoring Programme-UNESCO Chair on Open Technologies for Open Educational Resources and Open Learning-Open Education for a Better World (OE4BW) from May 27, 2021 to June 27, 2021.

OPEN EDUCATION for a BETTER WORLD

DR. DEEPIKA KOHLI
COURSE DEVELOPER & INSTRUCTOR
KHALSA COLLEGE OF EDUCATION, G.T.ROAD, AMRITSAR, PUNJAB, INDIA

DR. RAMESH CHANDRA SHARMA
COURSE MENTOR
DR.B.R.AMBEDKAR UNIVERSITY, NEW DELHI, INDIA

DR. HARPREET KAUR
PRINCIPAL
KHALSA COLLEGE OF EDUCATION, G.T.ROAD, AMRITSAR, PUNJAB, INDIA



TAYLOR'S UNIVERSITY
Wisdom · Integrity · Excellence

U.S. EMBASSY KUALA LUMPUR

CERTIFICATE of ATTENDANCE

This certificate is proudly presented to

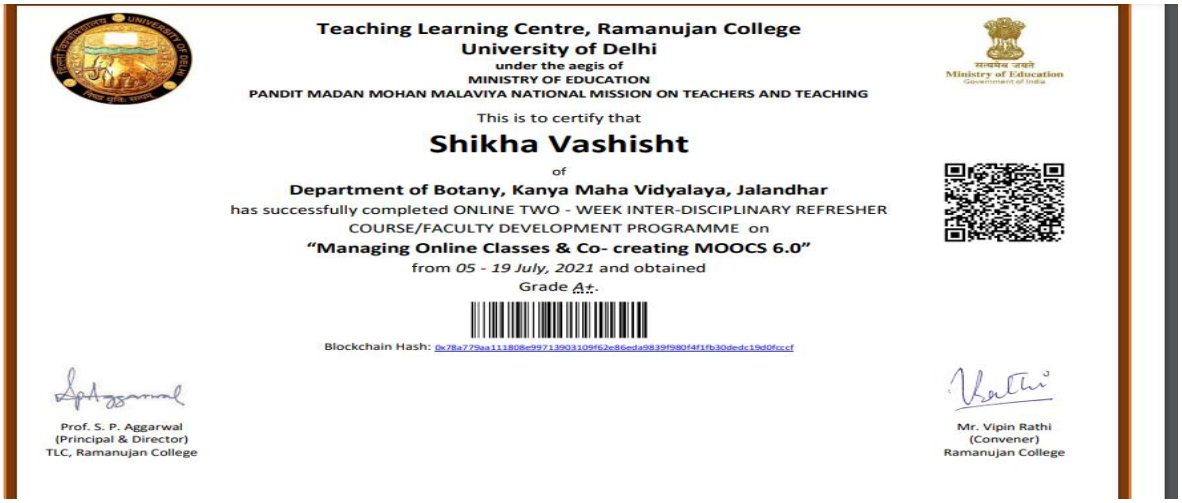
Shikha Vashist

For attending the International Webinar on

Higher Education During the Covid-19 Pandemic:
A Global Perspective of the Challenges and Best Practices

Assoc. Prof. Dr. Anindita Dasgupta
Head of School
School of Liberal Arts and Sciences,
Taylor's University, Malaysia

4th September 2021



Teaching Learning Centre, Ramanujan College
University of Delhi
under the aegis of
MINISTRY OF EDUCATION
PANDIT MADAN MOHAN MALAVIYA NATIONAL MISSION ON TEACHERS AND TEACHING

Ministry of Education
Government of India

This is to certify that

Shikha Vashisht

of

Department of Botany, Kanya Maha Vidyalaya, Jalandhar

has successfully completed ONLINE TWO - WEEK INTER-DISCIPLINARY REFRESHER COURSE/FACULTY DEVELOPMENT PROGRAMME on

"Managing Online Classes & Co- creating MOOCS 6.0"

from *05 - 19 July, 2021* and obtained

Grade A+.

Blockchain Hash: 0x78a779aa111808e99713903109f62e86eda9839f980f4f1fb30dedc19d0fcccf

Prof. S. P. Aggarwal
(Principal & Director)
TLC, Ramanujan College

Mr. Vipin Rathi
(Convener)
Ramanujan College

Certificate No. EU/BOT/eWR/2021/06/17/ 25

Eternal University, Baru-Sahib
Himachal Pradesh-173101

NATIONAL WEBINAR

on

Polyploidy and its role in evolution of plants

June 17, 2021 (Thursday)

e-Certificate

This is to certify that Dr /Prof /~~Mr~~ / Ms /Mrs Mrs. SHIKHA VASHISHT of Department of BOTANY, KANYA MAHA VIDYALAYA, JALANDHAR, PUNJAB has participated in National webinar on "Polyploidy and its role in evolution of plants", organized by Department of Botany, Eternal University, Baru-Sahib, Himachal Pradesh-173101 (India) on June 17 (Thursday), 2021.

Dr DK Srivastava
Coordinator
Department of Botany

Prof. A.S. Ahluwalia
Pro-Vice Chancellor
Eternal University

Dr Lata
Moderator
Department of Botany

NAAC Accredited 'A' Grade

GURU NANAK COLLEGE

SRI MUKTSAR SAHIB

Affiliated to Panjab University, Chandigarh
Governed by SGPC, Sri Amritsar Sahib
Covered under 'Star College Scheme' of DBT, GOI

National Webinar

on

Conservation of Plant Biodiversity

Certificate of Participation

This is to certify that *Dr. Sandeep Kaur*, Assistant Professor of *Kanya Maha Vidyalaya, Jalandhar* has participated in **National Webinar on Conservation of Plant Biodiversity** organised by Department of Basic Sciences, Guru Nanak College, Sri Muktsar Sahib held on 20 May, 2021.

(Dr. Mandeep Kaur Dhillon)
Co-coordinator

(Dr. Harpreet Kaur)
Coordinator

(Dr. Anita Rani)
Convenor

(Dr. Tejinder Kaur Dhaliwal)
Principal

Patel Memorial National College, Rajpura, Punjab

(Affiliated by Punjabi University, Patiala)

22 MAY 2021
BIODIVERSITY DAY
We're part of the solution
Biodiversity #ForNature

National Webinar

On

Role of Wetlands in Biodiversity Conservation

May 21, 2021

Certificate of Participation

This is to certify that Dr./Mr./Ms. **Dr. Sandeep Kaur** .....has participated in Webinar organized by Department of Botany and Zoology, Patel Memorial National College, Rajpura (Punjab) on May 21, 2021.

Dr. Ashwani Kumar
Principal

Dr. Dalvir Kaur
Coordinator

Dr. Jasneet Kaur
Coordinator

SRI GURU GRANTH SAHIB WORLD UNIVERSITY

FATEHGARH SAHIB, PUNJAB

REIMAGINE
RECREATE
RESTORE
#GenerationRestoration

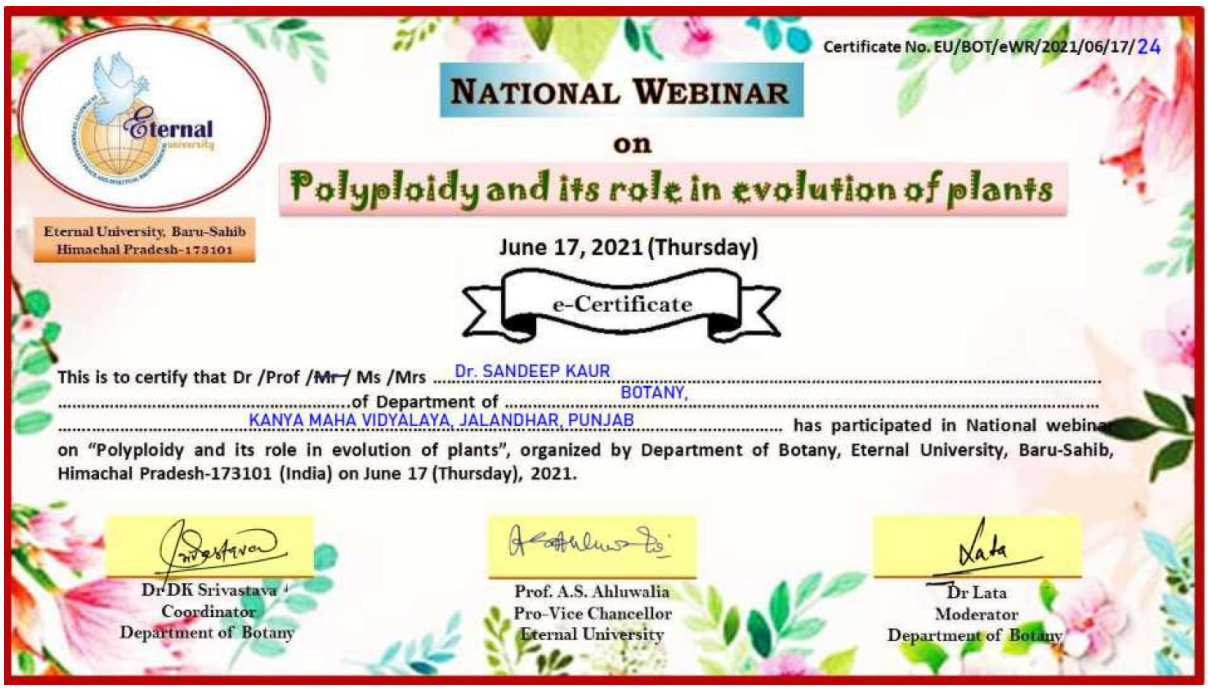
CERTIFICATE OF PARTICIPATION

This is to certify that

Dr. Sandeep Kaur

has actively participated in National Webinar organized by Department of Botany & Environmental Science on June 04, 2021 to mark World Environment Day.

Dr. Yadvinder Singh
Coordinator



Certificate No. EU/BOT/eWR/2021/06/17/24

Eternal University, Baru-Sahib
Himachal Pradesh-173101

NATIONAL WEBINAR

on

Polyploidy and its role in evolution of plants

June 17, 2021 (Thursday)

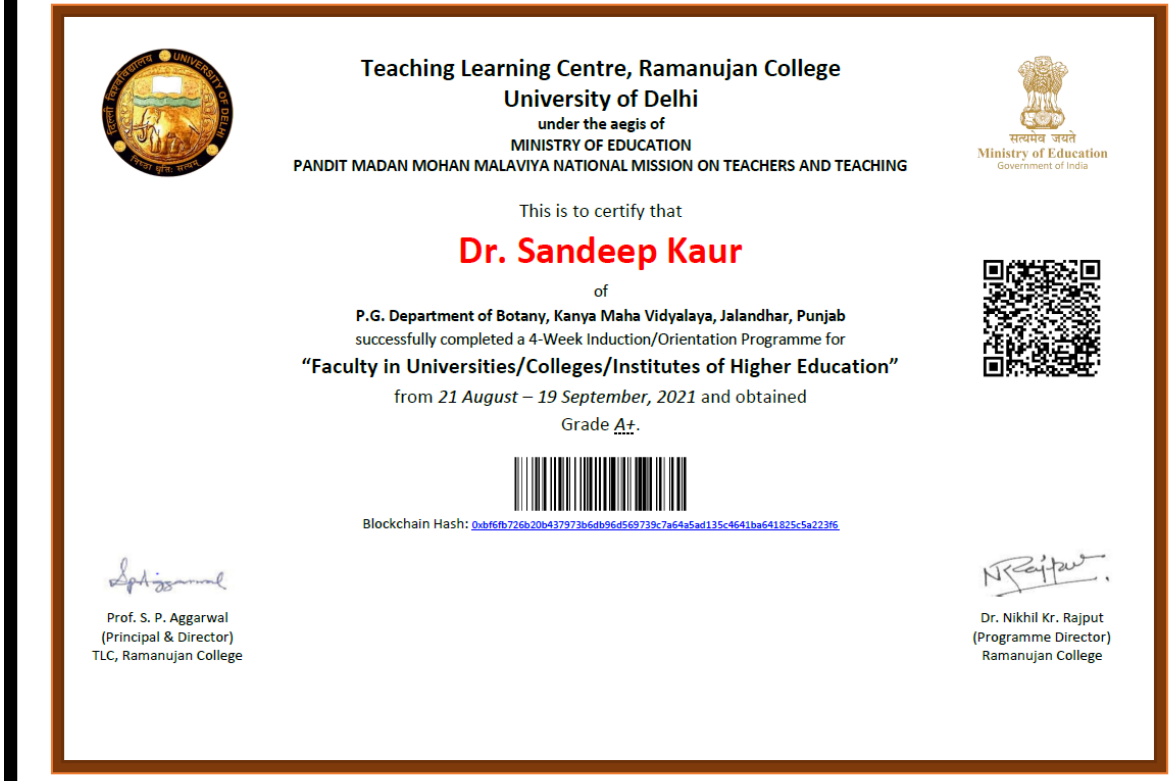
e-Certificate

This is to certify that Dr /Prof /~~Mr~~/ Ms /Mrs Dr. SANDEEP KAUR
of Department of BOTANY,
KANYA MAHA VIDYALAYA, JALANDHAR, PUNJAB has participated in National webinar on "Polyploidy and its role in evolution of plants", organized by Department of Botany, Eternal University, Baru-Sahib, Himachal Pradesh-173101 (India) on June 17 (Thursday), 2021.

Dr DK Srivastava
Coordinator
Department of Botany

Prof. A.S. Ahluwalia
Pro-Vice Chancellor
Eternal University

Dr Lata
Moderator
Department of Botany



Teaching Learning Centre, Ramanujan College
University of Delhi
under the aegis of
MINISTRY OF EDUCATION
PANDIT MADAN MOHAN MALAVIYA NATIONAL MISSION ON TEACHERS AND TEACHING

Ministry of Education
Government of India

This is to certify that

Dr. Sandeep Kaur

of
P.G. Department of Botany, Kanya Maha Vidyalaya, Jalandhar, Punjab
successfully completed a 4-Week Induction/Orientation Programme for
"Faculty in Universities/Colleges/Institutes of Higher Education"
from *21 August – 19 September, 2021* and obtained
Grade A+.

Blockchain Hash: 0xbf6fb726b20b437973b6db96d569739c7a64a5ad135c4641ba641825c5a223f6

Prof. S. P. Aggarwal
(Principal & Director)
TLC, Ramanujan College

Dr. Nikhil Kr. Rajput
(Programme Director)
Ramanujan College

KLE SOCIETY'S SCIENCE AND COMMERCE COLLEGE

(Affiliated to University of Mumbai)

Plot No. 29, Sector 1, Kalamboli,Navi Mumbai, Maharashtra - 410 218

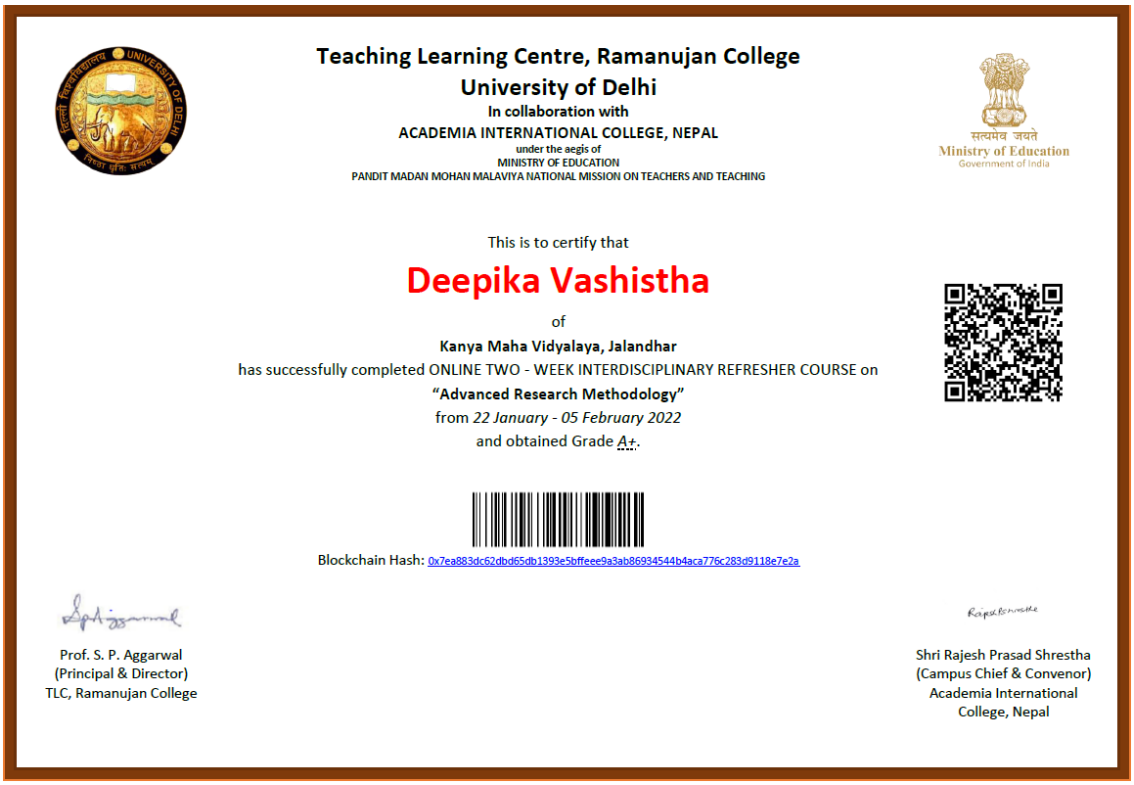
CERTIFICATE OF PARTICIPATION

This is to Certify that

Dr./Mr./Ms. Dr. SANDEEP KAUR , Kanya Maha Vidyalaya, Jalandhar has participated in the Two days National Level Workshop on **"Waste Management: Zero Waste College"** organised by Department of Botany in Collaboration with Nature Club, from **10th February to 11th February, 2022**.

Dr. Shilpi V. Teotia
HOD Botany & Chairperson of Nature Club

Dr. G.D.Giri
Principal



Teaching Learning Centre, Ramanujan College
University of Delhi
In collaboration with
ACADEMIA INTERNATIONAL COLLEGE, NEPAL
under the aegis of
MINISTRY OF EDUCATION
PANDIT MADAN MOHAN MALAVIYA NATIONAL MISSION ON TEACHERS AND TEACHING

सत्यमेव जयते
Ministry of Education
Government of India

This is to certify that

Deepika Vashistha

of

Kanya Maha Vidyalaya, Jalandhar

has successfully completed ONLINE TWO - WEEK INTERDISCIPLINARY REFRESHER COURSE on

"Advanced Research Methodology"

from *22 January - 05 February 2022*

and obtained Grade *A+*.

Blockchain Hash: 0x7ea883dc62dbd65db1393e5bffeee9a3ab86934544b4aca776c283d9118e7e2a

Prof. S. P. Aggarwal
(Principal & Director)
TLC, Ramanujan College

Shri Rajesh Prasad Shrestha
(Campus Chief & Convenor)
Academia International College, Nepal

Patel Memorial National College, Rajpura, Punjab

(Affiliated by Punjabi University, Patiala)

22 MAY 2021
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National Webinar

On

Role of Wetlands in Biodiversity Conservation

May 21, 2021

Certificate of Participation

This is to certify that Dr./Mr./Ms. **Deepika Vashistha** .....has participated in Webinar organized by Department of Botany and Zoology, Patel Memorial National College, Rajpura (Punjab) on May 21, 2021.

Dr. Ashwani Kumar
Principal

Dr. Dalvir Kaur
Coordinator

Dr. Jasneet Kaur
Coordinator

ST. FRANCIS DE SALES COLLEGE

Christian Minority Institution
Managed by Archdiocese of Nagpur
Seminary Hills, Nagpur, Maharashtra

Website: https://sfscollege.edu.in/ **Email: sfs_college@yahoo.com**

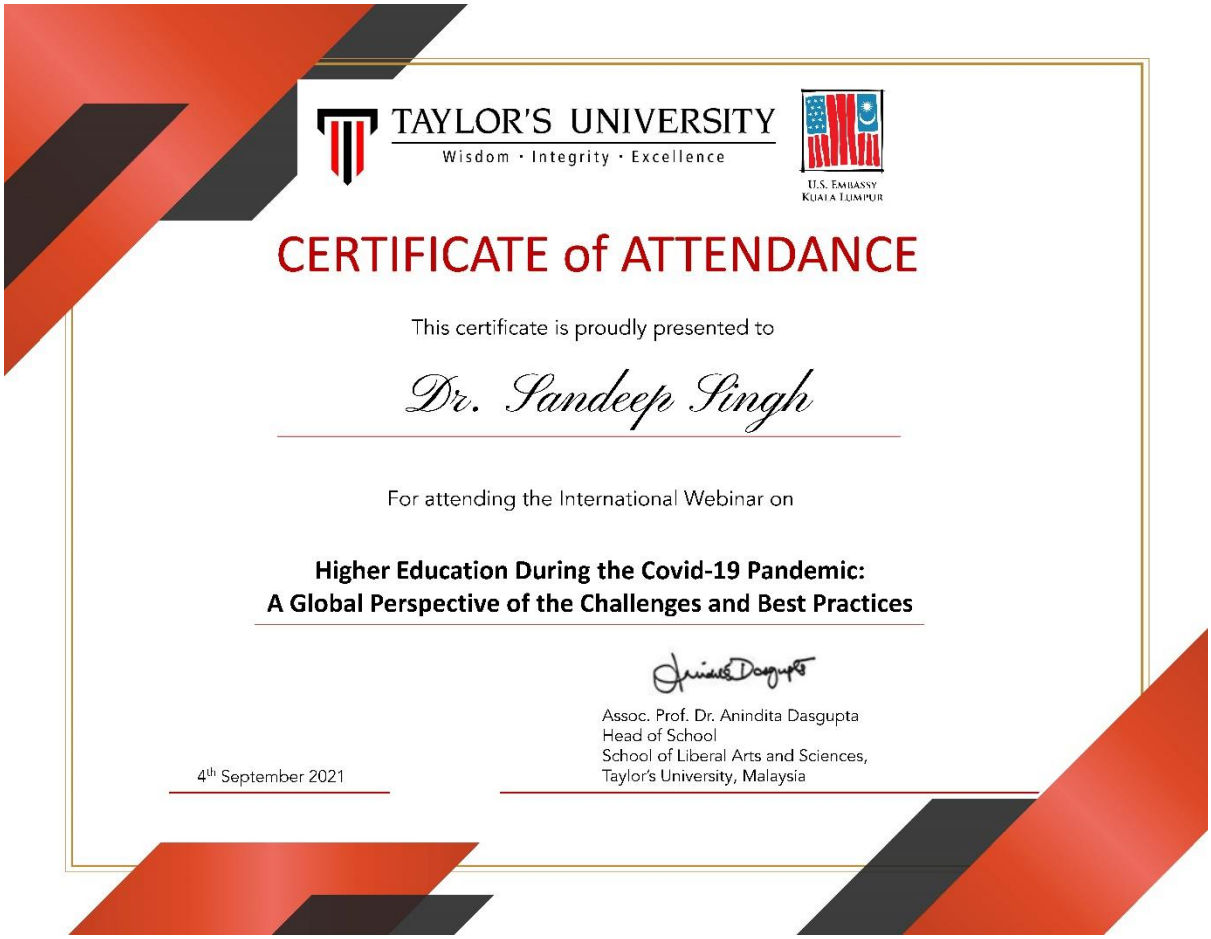
CERTIFICATE OF PARTICIPATION

Certificate ID: 429

This is to certify that Prof./Dr/Mr/Mrs/Ms **Deepika vashistha**
from **KMV Jalandhar**
has attended the Five Day Interdisciplinary Online Workshop on **"Advance Teaching, Learning, Research Methodology and Innovations"** organized by Saint Francis De Sales College, Nagpur from 1st June to 5th June, 2021.

Thomas. K.T.

Dr. K.T. Thomas
Organizing Convener & Principal
SFS College, Nagpur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Kuala Lumpur
CERTIFICATE of ATTENDANCE
This certificate is proudly presented to
Dr. Sandeep Singh
For attending the International Webinar on
Higher Education During the Covid-19 Pandemic:
A Global Perspective of the Challenges and Best Practices
Assoc. Prof. Dr. Anindita Dasgupta
Head of School
School of Liberal Arts and Sciences,
Taylor's University, Malaysia
4th September 2021