

# **Kanya Maha Vidyalaya, Jalandhar City** **(An Autonomous College)**



**Minutes of 7<sup>th</sup> Meeting of Board of Studies**  
**Department of Bio-Technology**  
**Via Zoom video conferencing**  
**Date: 09-04-2022**  
**Time: 12:00 PM**

**Kanya Maha Vidyalaya, Jalandhar**  
**Department of Bio-Technology**  
**Proceedings of the Meeting of Board of Studies held on 09-04-2022**

**KANYA MAHA VIDYALAYA, JALANDHAR**  
**(UGC Autonomous College)**  
**Department of Bio-Technology**

**Proceedings of the Meeting of Board of Studies held on 09-04-2022**

The Seventh meeting of the Board of Studies of Bio-Technology was held on **09-04-2022 at 12:00 pm through Zoom.**

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

<b>S.NO</b>	<b>Details of Member</b>	<b>Presence/Absence</b>
<b>1.</b>	Mrs. Sadhna Tandon, Dean, Life Sciences ( <b>Chairperson</b> )	<b>Present</b>
<b>2.</b>	Dr. Pratap Kumar Pati, Professor & Head, Department of Biotechnology, Guru Nanak Dev University, Amritsar ( <b>Parent University Nominee</b> )	<b>Present</b>
<b>3.</b>	Dr. Neena Caplash, Professor, Department of Biotechnology, Panjab University, Chandigarh ( <b>Outside University Nominee</b> )	<b>Present</b>
<b>4.</b>	Dr. Jagdeep Kaur, Professor, Department of Biotechnology, Panjab University, Chandigarh ( <b>Outside University Nominee</b> )	<b>Present</b>
<b>5.</b>	Ms. Himadri Mahajan, PhD Scholar, Guru Nanak Dev University, Amritsar ( <b>Alumni</b> )	<b>Present</b>
<b>6.</b>	Mr. Varinder Kumar, Head, Department of Bioinformatics, GGSDS College, Chandigarh (Special Invitee)	<b>Present</b>
<b>7.</b>	Dr. Kamaljit Singh, Managing Director, Green Planet Bioproducts, GP tower, 1-Amar Garden, Near Pathankot Chowk, NH-1, Jalandhar ( <b>Industry Expert</b> )	<b>Absent</b>
<b>8.</b>	Mrs. Navgeet, Head, Department of Biotechnology	<b>Present</b>

9.	Dr. Gurpreet Kaur Grewal, Assistant Professor, Department of Bio-Technology	<b>Present</b>
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The Chairperson Mrs. Sadhna Tandon welcomed and introduced the Members of Board of studies. She apprised the members about the programmes in department along with teaching and research strengths of the department. She highlighted the progress made by department in establishing sophisticated labs with high end instrumentation and glory of the department at National & International Scenario. She took up the agenda items for deliberation one by one with the permission of committee members.

### **Bio: 2022: 7: 1**

To confirm the Proceedings of sixth Board of Studies meeting held on 10-04-2021. (**Annexure-A**)

The proceedings of the previous Board of Studies meeting held on 10<sup>th</sup> April 2021 were sent 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 Bio: 2022: 7: 1**

**Bio: 2022: 7: 2** To discuss Action Taken Report of seventh Board of Studies meeting held on 10<sup>th</sup> April 2021

S.NO	Agenda Item	Decision taken in Meeting	Action Taken
<b><u>Item: Bio 6: 2021: 3</u></b>	To discuss the syllabus and course outcomes of Biochemistry-I & General Microbiology-I of <b>B.Sc. Bio-Technology semester- I</b> under continuous evaluation system for the session 2021-22. ( <b>Annexure-C</b> )	There were no changes in the syllabus.	The syllabus was approved and executed.
<b><u>Item: Bio 6: 2021: 4</u></b>	To discuss the syllabus and course outcomes of Genetics, Biochemistry-II & General Microbiology-II of <b>B.Sc. Bio-</b>	It was decided to <ul style="list-style-type: none"> <li>• Add kinetics of competitive,</li> </ul>	The changes were approved and executed.

	<b>Technology semester- II</b> under continuous evaluation system for the session 2021-22. ( <b>Annexure-C</b> )	uncompetitive and non-competitive inhibition topics in Unit-IV of Biochemistry-II	
<b>Item: Bio 6:</b> <b>2021: 5</b>	To discuss the syllabus and course outcomes of Fundamentals of Biotechnology, Immunology-I, Biochemistry-III, Skill Development in Biotechnology-A, Immunology-B & Molecular Biology of <b>B.Sc. Bio-Technology semester-III</b> under continuous evaluation system for the session 2021-22. ( <b>Annexure-C</b> )	It was decided <ul style="list-style-type: none"> <li>• To introduce new course Fundamentals of Biotechnology in semester –III.</li> <li>• To introduce practical “Isolation of genomic DNA from blood and perform agarose gel electrophoresis” in Molecular biology practical’s instead of Animal Biotechnology course of semester-VI.</li> <li>• To remove Agro and Industrial Applications of microbes-A from semester III and introduce as Industrial Biotechnology-I in semester IV</li> </ul>	The changes were approved and executed.
<b>Item: Bio 6:</b> <b>2021: 6</b>	To discuss the syllabus and course outcomes of Industrial Biotechnology-I, Immunology-II, Biochemistry-IV, Skill Development in Biotechnology-A, Fundamentals of Bioinformatics of <b>B.Sc. Bio-Technology semester-IV</b> under continuous evaluation system for the session 2021-22. ( <b>Annexure-C</b> )	It was decided <ul style="list-style-type: none"> <li>• To remove Agro and Industrial Applications of microbes-B course from semester IV and later will be introduced in semester V as Industrial Biotechnology-II.</li> <li>• To remove practical “Isolation of microbial cells by serial dilution-spread plate method, pour plate” from Industrial Biotechnology-I as it was present in practical list of General Microbiology-I</li> </ul>	The changes were approved and executed.

		<ul style="list-style-type: none"> <li>• To introduce practical in Industrial Biotechnology-I course of semester IV “To perform an AMES assay to determine the mutagenicity of a compound”</li> <li>• To introduce practical in Immunology-I course “Separation and purification of IgG antibodies from Serum using protein A column” and remove it from practical list of Animal Biotechnology</li> <li>• In 208-19, Computer fundamentals and bioinformatics with course code BBTM-1137 was in semester I and after that it was removed from there and now it has been introduced in semester IV as Fundamentals of Bioinformatics with course code BBTM-4065</li> <li>• To introduce Industrial/Institutional visit with course code BBTM-4067 in semester IV and it was removed from semester VI where it was titled as Educational Tour &amp; Written Illustrated Report with course code BBTM-6068</li> </ul>	
<p><b><u>Item: Bio 6:</u></b> <b><u>2021: 7</u></b></p>	<p>To discuss the syllabus and course outcomes of Patent laws in Biotechnology, rDNA Technology-A, Concepts of Plant Tissue Culture, Animal Tissue Culture, Bioprocess Engineering-A, Biophysical &amp; Biochemical Techniques-A of <b>B.Sc. Bio-Technology semester-V</b> under continuous</p>	<p>It was decided</p> <ul style="list-style-type: none"> <li>• To remove practical “Growing of <i>E.coli</i> bacterial culture” from rDNA Technology-A of semester V</li> <li>• To merge practical “Agarose gel</li> </ul>	<p>The changes were approved and executed.</p>

	<p>evaluation system for the session 2021-22. (Annexure-C)</p>	<p>electrophoresis” with another practical and rephrased as “To perform spectrophotometric quantification of DNA for determination of purity and agarose gel electrophoresis” in rDNA Technology-A course of semester V</p> <ul style="list-style-type: none"> <li>• To merge restriction digestion practical with agarose gel electrophoresis and rephrased as Restriction enzyme digestion of the isolated DNA with 6, 5 and 4 cutters and agarose gel electrophoresis of the digested fragments in rDNA Technology-A course of semester V.</li> <li>• To introduce new practical “To perform ligation reaction and agarose gel electrophoresis” in rDNA Technology-A course of semester V.</li> <li>• To introduce new practical “To study differential centrifugation” in Biophysical &amp; Biochemical Techniques-A course of semester V.</li> <li>• To remove practical “To study separation of bio-molecules by thin layer chromatography” and merge it with “To study separation of bio-molecules by paper and thin layer chromatography” in Biophysical &amp; Biochemical Techniques-A course of semester V</li> </ul>	
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<p><b>Item: Bio 6:</b> <b>2021: 8</b> <b>(Annexure-C)</b></p>	<p>To discuss the syllabus and course outcomes of Intellectual Property Rights &amp; Entrepreneurship, rDNA Technology-B, Applications of Plant Tissue Culture, Animal Biotechnology, Bioprocess Engineering-B, Biophysical and Biochemical Techniques-B, Educational Tour and Written Illustrated Reports of <b>B.Sc. Bio-Technology semester-VI</b> under continuous evaluation system for the session 2021-22.</p>	<p>It was decided</p> <ul style="list-style-type: none"> <li>• To specify names of new generation sequencing techniques “Roche 454 pyrosequencing, Illumina (Solexa) HiSeq and MiSeq sequencing, Sequencing by Oligonucleotide Ligation and Detection (SOLiD), Ion Torrent technology, Single-molecule real-time (SMRT) sequencing by pacific biosciences” in Unit IV of rDNA Technology-B of semester VI</li> <li>• To remove names of cell lines and include only few important one in Unit-1 of Animal Technology semester VI</li> <li>• To include topics “Organotypic and histotypic cultures: Organotypic culture: Gas and nutrient exchange, structure integrity, growth, differentiation, advantages and applications. Methods, advantages and applications of histotypic culture. Three dimensional culture and tissue engineering: Concept of tissue engineering, components of tissue engineering, cells imaging in 3D construct” in course of Animal Biotechnology in semester VI.</li> <li>• To remove two practicals “DNA</li> </ul>	<p>After incorporating the changes, the syllabus was approved and executed.</p>
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		<p>isolation from blood” and “Quantification of isolated DNA” from practical list of Animal Biotechnology in semester VI as these practical’s are part of molecular biology.</p> <ul style="list-style-type: none"> <li>• To include following practicals “Observation of adherent (Fibroblastic, epithelial) and suspension cultures (Lymphoblast)”, “To perform trypsinization of cells”, “Cell counting by haemocytometer”, “Determination of the IC50 value of a drug using MTT assay” in course of Animal Biotechnology in semester VI.</li> <li>• To remove practical “Separation and purification of IgG antibodies from Serum using protein A column” from course of Animal Biotechnology in semester VI as it was introduced in semester IV of Immunology-I</li> </ul>	
<p><b><u>Item: Bio 6:</u></b> <b><u>2021: 9</u></b></p>	<p>To discuss the syllabus and course outcomes of Basic Nutritional Biochemistry of <b>B.Sc. Home Science semester-V</b> and Applied Nutritional Biochemistry of <b>B.Sc. Home Science semester-VI</b> under continuous evaluation system for the session 2021-22. <b>(Annexure-D)</b></p>	<p>No changes were suggested.</p>	<p>So Syllabus was approved without any changes.</p>

<p><b><u>Item: Bio 6:</u></b> <b><u>2021: 10</u></b></p>	<p>To discuss the syllabus and course outcomes of Nutritional Biochemistry of <b>Bachelors in Vocational Bachelor of Vocation (Nutrition, Exercise and Health)</b> under continuous evaluation system for the session 2021-22. (<b>Annexure-E</b>)</p>	<p>No changes were suggested.</p>	<p>Syllabus was approved and executed.</p>
<p><b><u>Item:Bio 6:</u></b> <b><u>2021: 11</u></b></p>	<p>To discuss the syllabus and course outcomes of Computer Applications and Bioinformatics of <b>Masters in Botany</b> under continuous evaluation system for the session 2021-22. (<b>Annexure-E</b>)</p>	<p>No changes were suggested.</p>	<p>Syllabus was approved and executed.</p>
<p><b><u>Item: Bio 6:</u></b> <b><u>2021: 12</u></b></p>	<p>To discuss the list of proposed examiners for above stated courses. (<b>Annexure-G</b>)</p>	<p>The list of examiners was approved</p>	<p>The list of examiners was approved and sent to COE office.</p>
<p><b><u>Item: Bio 6:</u></b> <b><u>2021: 13</u></b></p>	<p>To discuss teaching methodologies adopted in the department and inputs required to upgrade the same in session 2021-22.</p>	<p>Members suggested to conduct more activities at departmental level to build confidence in students.</p>	<p>Following activities were organized:</p> <ul style="list-style-type: none"> <li>• Alumni Talk by Dr. Vasundera Gupta, Drug Safety Associate, Paraxel, Chandigarh on 29-06-2021</li> <li>• Online Poster making competition on 'Role of Biotechnology in Defense' on 18-08-2021</li> <li>• Slogan Writing competition on 'World Diabetes Day' on 13-11-2021</li> </ul>

			<ul style="list-style-type: none"><li>• Social Outreach Visit at Banarsi Das School, Transport Nagar, Jalandhar to distribute stationery items and warm socks and caps to school students on 14-12-2021</li><li>• Online Quiz competition on 'World Leprosy Day on 31-01-2022'</li><li>• Expert Talk on 'Plant Biotechnology: E Miracle for conservation of medicinal plants' by Dr. Sandeep Rawat, Scientist, G. B. Pant National Institute of Himalayan Environment, Sikkim on 05-03-2022.</li><li>• Workshop on 'The Basics of Patents' by Ms. Monika Sharma, Patent Facilitator, SIPP, Registered Patent Agent on 10-03-2022.</li><li>• Educational Visit to Shivambu Interational Limited BDM Foods, Gagret, HP on 19-03-2022.</li></ul>
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			<ul style="list-style-type: none"> <li>• Social Outreach Visit to Girls Senior Secondary Smart School, Hazara, Jalandhar Distt for “Food Adulteration Camp” on 12-04-2022.</li> <li>• Workshop on ‘Genetic Counseling and Job Opportunities in India’ by Ms. Deepika Chaudhary, Genetic Counselor, Life Cell International, North Zone on 02-05-2022</li> </ul>
<b><u>Item: Bio 6: 2021: 14</u></b>	To discuss research Research inputs and plans of department for session 2021-22	Members suggested to indulge students in research.	<ul style="list-style-type: none"> <li>• Seed Money project is being carried out by students under supervision of Dr. Gurpreet Kaur Grewal entitled “Studying the molecular basis of dysregulated glucose and cholesterol levels”. Amount sanctioned was Rs. 30,000/- on 12-12-2020</li> <li>• SERB-TARE Project submitted: In Vitro Investigation of role of Antiepileptic drug in oxidative stress and ABCC2</li> </ul>

			<p>activity and potential of alpha-lipoic acid as antioxidant, submitted on 28 March 2022</p> <ul style="list-style-type: none"> <li>Faculty members keep students engaged in number of extension practicals and small research projects.</li> </ul>
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**The house approved the Bio: 2022: 7: 2**

**Bio 2022: 7: 3**

To discuss the syllabus and course outcomes of **B.Sc. Bio-Technology semester- I to VI** under continuous evaluation system for the session 2022-23. (**Annexure-C**).

**Proceedings:**

The proposed syllabus and course outcomes of **B.Sc. Bio-Technology semester- I to 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
<b>I</b>	Biochemistry-I Course Code: BBTM-1085	<b>IV</b>		<b>Deleted</b> To remove topic A310
<b>II</b>	Biochemistry-II Course code:2086	<b>Unit IV</b>	<b>Added</b> Kinetics of competitive, uncompetitive and non-competitive inhibition	

<b>III</b>	Fundamentals of Biotechnology  Course code: BBTM- 3061		<b>New course Introduced</b>	
<b>III</b>	Biochemistry-III  Course code: BBTM- 3085	<b>Unit III &amp; IV</b>		<b>Added</b>  In Unit-3, “Lipid digestion, Absorption and transport”, “Types of lipid oxidation – Alpha, Beta and Omega was included”  In Unit-4, “regulation of Cholesterol metabolism” was included.
<b>III</b>	Molecular Biology  Course code: 3066	<b>Practical</b>	<b>Added</b>  “Isolation of genomic DNA from blood and perform agarose gel electrophoresis”	
<b>IV</b>	Industrial Biotechnology-I  Course code: BBTM-4061	<b>Unit I,II &amp; IV</b>  <b>Practical</b>	<b>New course Introduced</b>  <ul style="list-style-type: none"> <li>Removed practical “Isolation of microbial cells by serial dilution-spread plate method, pour plate” from Industrial Biotechnology-I as it was present in practical list of General Microbiology-I</li> <li>Introduced practical in</li> </ul>	<b>Added</b>  <ul style="list-style-type: none"> <li>Introduced topic “Methods and Principles of Food Processing” in Unit-1</li> <li>“Methods” with primary and screening in Unit-2</li> </ul>

			<p>Industrial Biotechnology-I course of semester IV “To perform an AMES assay to determine the mutagenicity of a compound”</p>	<ul style="list-style-type: none"> <li>• Reorganization of Unit-4 was done, some topics of Industrial Biotechnology-II was included to club similar topics.</li> <li>• <b>Added practical</b> “Isolation of Amylase producing microbes” and “Screening of cellulase producing microorganism from wood degrading soil” in Industrial Biotechnology-I practical.</li> <li>• <b>Removed practical</b> “To perform an AMES assay to determine the mutagenicity of a compound” from Industrial Biotechnology-I practical.</li> </ul>
<b>IV</b>	Immunology-II	<b>Practical</b>	<b>Added practical</b>	

	Course code: BBTM-4062		“Separation and purification of IgG antibodies from Serum using protein A column”	
IV	Fundamentals of Bioinformatics  Course code: BBTM-4065		<b>New Course added</b>	
IV	Biochemistry-IV  Course code:	<b>Unit I-IV</b>		<b>Reorganization and more detailing of topics</b> of Biochemistry-IV was done for all the units.
IV	Industrial/Institutional visit  course code: BBTM-4067		Introduced Industrial/Institutional visit with course code BBTM-4067 in semester IV and it was removed from semester VI	
V	rDNA Technology-I  Course Code: BBTM-5061	<b>Theory</b>  <b>Unit-II</b>  <b>Unit- III</b>		<ul style="list-style-type: none"> <li>• <b>Deleted</b> Antibiotic Resistance genes</li> <li>• <b>Added</b> Role of antibiotics and antibiotic resistance genes in a vector</li> <li>• <b>Added</b> Copy Number Regulation</li> <li>• <b>Deleted</b> Gene Identification: Nucleic Acid Hybridization (Southern and Northern blotting) Merits and Demerits of Nitrocellulose and Nylon membrane (N &amp; N+)</li> <li>• <b>Added</b> Gene cloning: Ligation, Transformation Efficiency, Screening of transformants by</li> </ul>

		<p style="text-align: center;"><b>Unit-IV</b></p> <p style="text-align: center;"><b>Practical</b></p>	<ul style="list-style-type: none"> <li>• Removed practical “Growing of <i>E.coli</i> bacterial culture” from rDNA Technology-A of semester V</li> <li>• Merged practical “Agarose gel electrophoresis” with another practical and rephrased as “To perform spectrophotometric quantification of DNA for determination of purity and agarose gel electrophoresis” in rDNA Technology-A course of semester V</li> <li>• Merged restriction digestion practical with agarose gel electrophoresis and rephrased as Restriction enzyme digestion of the isolated DNA with 6, 5 and 4 cutters and agarose gel electrophoresis of the digested fragments in rDNA Technology-A course of semester V.</li> <li>• Introduced new practical “To perform ligation reaction and</li> </ul>	<p>Gene Inactivation: Antibiotic inactivation and Blue White Selection</p> <ul style="list-style-type: none"> <li>• <b>Added</b> Western blotting</li> <li>• <b>Deleted</b> Detection system of labelled probes</li> </ul> <p><b>Added practical's</b> “Preparation of competent cell” and “Transformation of competent cells by CaCl<sub>2</sub> method” in practical course of rDNA Technology-I to align with theory part.</p> <ul style="list-style-type: none"> <li>• Added Confirmation of High Molecular Weight DNA on Agarose Gel.</li> <li>• Rephrased Restriction Enzyme Digestion of DNA</li> </ul>
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			<p>agarose gel electrophoresis” in rDNA Technology-A course of semester V.</p> <ul style="list-style-type: none"> <li>• Introduced new practical “To study differential centrifugation” in Biophysical &amp; Biochemical Techniques-A course of semester V.</li> <li>• Removed practical “To study separation of bio-molecules by thin layer chromatography” and merge it with “To study separation of bio-molecules by paper and thin layer chromatography” in Biophysical &amp; Biochemical Techniques-A course of semester V</li> </ul>	
V	<p>Biochemical and Biophysical Techniques-I</p> <p>Course code: BBTM-5065</p>	<b>Practical</b>	<p><b>Added</b></p> <p>To introduce new practical “To study differential centrifugation” in Biophysical &amp; Biochemical Techniques-A course of semester V.</p> <p><b>Removed</b></p> <p>Practical removed “To study separation of bio-molecules by thin layer chromatography” and merge it with “To study separation of bio-molecules by paper and thin layer chromatography”</p>	







			To remove practical “Separation and purification of IgG antibodies from Serum using protein A column” from course of Animal Biotechnology in semester VI as it was introduced in semester IV of Immunology-I	
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After incorporating the above mentioned changes, the syllabus of B.Sc. Biotechnology Semester-I, II, III, IV, V & VI was approved.

**The house approved the Bio: 2022: 7: 3**

**Bio: 2022: 7: 4**

To discuss the syllabus and course outcomes of Basic Nutritional Biochemistry-I of **B.Sc. Home Science Semester-V** and Applied Nutritional Biochemistry of **B.Sc. Home Science semester-VI** under continuous evaluation system for the session 2022-23. **(Annexure-D)**

**Proceedings:**

The Board of Study members discussed the syllabus of Basic Nutritional Biochemistry-I of **B.Sc. Home Science Semester-V** and Applied Nutritional Biochemistry of **B.Sc. Home Science semester-VI** under continuous evaluation system for the session 2022-23 and they approved it without any change.

**(Approved syllabus attached herewith as Annexure-D)**

**The house approved the Bio: 2022: 7: 4**

**Bio: 2022: 7: 5**

To discuss the syllabus and course outcomes of Nutritional Biochemistry of **Bachelors in Vocational (Nutrition, Exercise and Health)** under continuous evaluation system for the session 2022-23. **(Annexure-E)**

**Proceedings:**

The Board of Study members discussed the syllabus of Nutritional Biochemistry of **Bachelors in Vocational (Nutrition, Exercise and Health)** under continuous evaluation system for the session 2022-23 and they approved it without any change.

(Approved syllabus attached herewith as Annexure-E)

**The house approved the Bio: 2022: 7: 5**

**Bio: 2022: 7: 6**

To discuss the syllabus and course outcomes of Computer Applications and Bioinformatics of **Masters of Science (Botany)** under credit based evaluation system for the session 2022-23. (Annexure-F)

**Proceedings:**

Chairperson discussed in detail the introduction of credit based continuous evaluation grading system (CBCEGS) for syllabus of Computer Applications and Bioinformatics of **Masters of Science (Botany)** for the session 2022-23 and they approved it.

(Approved syllabus attached herewith as Annexure-F)

**The house approved the Bio: 2022: 7: 6**

Course Code	Course Title	Course Type	Hours /Week	Credits L-T-P	Total Credits	Marks				Examination time (in Hours)
						Total	Th	P	CA	
MBTL-1046	Computer Applications and Bioinformatics	IC	3	2-1-0	3	50	40	-	10	3

**Bio: 2022: 7: 7**

To discuss the list of proposed Examiners and Evaluators for above stated courses. (Annexure-G)

**Proceedings:**

The Chairperson discussed the list of Examiners and Evaluators for above stated courses with Board of Study members and they approved it.

(Lists attached herewith as **Annexure-G**)

**The house approved the Bio: 2022: 7: 7**

**Bio: 2022: 7:8**

To discuss teaching methodologies adopted in the department and inputs required to upgrade the same for the session 2022-23.

**The house approved the (Bio: 2021: 7: 8) teaching methodologies and various activities held in the department to enhance teaching learning process. (Attached as Annexure-B)**

**Bio: 2022: 7: 9**

To discuss research inputs and plans of department for session 2022-23.

**The house highly appreciated that the faculty members are actively involved in research and said their input reflects from their publications. They have also encouraged the faculty members to indulge themselves more in research and writing papers.**

**The house approved the Bio: 2022: 7: 9**

**(Chairperson)**

**Mrs. Sadhna Tandon,  
Dean, Life Sciences.**

**FACULTY OF LIFE SCIENCES**

**SYLLABUS**

**Of**

**Bachelor of Science Bio-Technology (Semester: I-VI)**

**(Under Continuous Evaluation System)**

**Session: 2022-23**



**The Heritage Institution  
KANYA MAHA VIDYALAYA  
JALANDHAR  
(Autonomous)**

Upon successful completion of this course, students will be able to:

**PSO1.** gain and apply knowledge of Biotechnology and Science concepts to solve problems related to field of Biotechnology.

**PSO2:** design, perform experiments, analyze and interpret data for investigating complex problems in the field of biotechnology.

**PSO3:** apply ethical principles and commit to professional ethics and responsibilities and norms of the Biotechnological practices.

**PSO4:** design and develop solution to Biotechnology problems by applying appropriate tools while keeping in mind safety factor for environment & society.

**PSO5:** to undertake any responsibility as an individual and as a team in a multidisciplinary environment.

**PSO6:** contribute to the field of biotechnology and allied industries designing, developing and providing solutions for product/processes/technology development.

**PSO7:** able to justify societal, health, safety and legal issues and understand his responsibilities in biotechnological engineering practices.

**Kanya Maha Vidyalaya, Jalandhar (Autonomous)**

**SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAMME**

**Bachelor of Science (Bio-Technology)**

**Session: 2022-23**

<b>Bachelor of Science (Bio-Technology) Semester-I</b>							
<b>Course Code</b>	<b>Course Name</b>	<b>Course Type</b>	<b>Marks</b>				<b>Examination time (in Hours)</b>
			<b>Total</b>	<b>Ext.</b>		<b>CA</b>	
				<b>L</b>	<b>P</b>		
BBTL -1421	Punjabi (Compulsory)	C	50	40	-	10	3
BBTL -1031	<sup>1</sup> Basic Punjabi						
BBTL -1431	<sup>2</sup> Punjab History and Culture						
BBTL-1102	Communication Skills in English	C	50	40	-	10	3
BBTM-1483	Cell Biology	C	60	30	18	12	3+3
BBTM-1074	Botany-I	C	60	30	18	12	3+3
BBTM-1085	Biochemistry-I	C	60	30	18	12	3+3
BBTM-1346	General Microbiology-I	C	60	30	18	12	3+3
BBTM-1087	Chemistry-I	C	60	30	18	12	3+3
AECD-1161	*Drug Abuse: Problem Management and Prevention (Compulsory)	AC	50	40	-	10	3
SECF-1492	*Foundation Course	AC	25	20	-	5	1
<b>Total</b>			<b>400</b>				

<sup>1</sup> Special Course in lieu of Punjabi (Compulsory)

<sup>2</sup> Special Course in lieu of Punjabi (Compulsory) for those students who are not domicile of Punjab

\*Marks of these papers will not be added in total marks and only grades will be provided.

**C-Compulsory**

**AC- Audit course**

**Kanya Maha Vidyalaya, Jalandhar (Autonomous)**  
**SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAMME**  
**Bachelor of Science (Bio-Technology)**

**Session: 2022-23**

<b>Bachelor of Science (Bio-Technology) Semester II</b>							
<b>Course Code</b>	<b>Course Name</b>	<b>Course Type</b>	<b>Marks</b>				<b>Examination time (in Hours)</b>
			<b>Total</b>	<b>Ext.</b>		<b>CA</b>	
				<b>L</b>	<b>P</b>		
BBTL -2421	Punjabi (Compulsory)	C	50	40	-	10	3
BBTL -2031	<sup>1</sup> Basic Punjabi						
BBTL -2431	<sup>2</sup> Punjab History and Culture						
BBTM-2102	Communication Skills in English	C	50	25	15	10	3+3
BBTL-2333	Biostatistics	C	40	32	-	8	3
BBTM-2484	Zoology-I	C	60	30	18	12	3+3
BBTM-2065	Genetics	C	60	30	18	12	3+3
BBTM-2086	Biochemistry-II	C	60	30	18	12	3+3
BBTM-2347	General Microbiology-II	C	60	30	18	12	3+3
AECD-2161	*Drug Abuse: Problem Management and Prevention (Compulsory)	AC	50	40	-	10	3
SECM-2492	*Moral Education	AC	25	20	-	5	-
<b>Total</b>			<b>380</b>				

<sup>1</sup> Special Course in lieu of Punjabi (Compulsory)

<sup>2</sup> Special Course in lieu of Punjabi (Compulsory) for those students who are not domicile of Punjab

\*Marks of these papers will not be added in total marks and only grades will be provided.

**C-Compulsory**

**AC- Audit course**

**Kanya Maha Vidyalaya, Jalandhar (Autonomous)**  
**SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAMME**  
**Bachelor of Science (Bio-Technology)**  
**Session: 2022-23**

<b>Bachelor of Science (Bio-Technology) Semester-III</b>							
<b>Course Code</b>	<b>Course Name</b>	<b>Course Type</b>	<b>Marks</b>				<b>Examination Time (in Hours)</b>
			<b>Total</b>	<b>Ext.</b>		<b>CA</b>	
				<b>L</b>	<b>P</b>		
BBTM-3061	Fundamentals of Biotechnology	C	60	30	18	12	3+3
BBTM-3062	Immunology-I	C	60	30	18	12	3+3
BBTM-3083	Chemistry-II	C	60	30	18	12	3+3
BBTM-3074	Botany-II	C	60	30	18	12	3+3
BBTM-3085	Biochemistry-III	C	60	30	18	12	3+3
BBTM-3066	Molecular Biology	C	60	30	18	12	3+3
AECE-3221	*Environmental Studies (Compulsory Paper)	AC	100	60	20	20	3
SECP-3512	*Personality Development	AC	25	20	-	5	-
<b>Total</b>			<b>360</b>				

\*Marks of these papers will not be added in total marks and only grades will be provided.

**C-Compulsory**

**AC- Audit Course**

**Kanya Maha Vidyalaya, Jalandhar (Autonomous)**  
**SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAMME**  
**Bachelor of Science (Bio-Technology)**  
**Session: 2022-23**

<b>Bachelor of Science (Bio-Technology) Semester-IV</b>							
<b>Course Code</b>	<b>Course Name</b>	<b>Course Type</b>	<b>Marks</b>				<b>Examination Time (in Hours)</b>
			<b>Total</b>	<b>Ext.</b>		<b>CA</b>	
				<b>L</b>	<b>P</b>		
BBTM-4061	Industrial Biotechnology-I	C	60	30	18	12	3+3
BBTM-4062	Immunology-II	C	60	30	18	12	3+3
BBTM-4083	Biochemistry-IV	C	60	30	18	12	3+3
BBTM-4064	Skill Development in Biotechnology	C	60	30	18	12	3+3
BBTM-4065	Fundamentals of Bioinformatics	C	60	30	18	12	3+3
BBTM-4486	Zoology-II	C	60	30	18	12	3+3
BBTT-4067	Industrial/ Institutional Visit	C	20	-	20	-	-
SECS-4522	*Social Outreach	AC	25	20	-	5	-
<b>Total</b>			<b>380</b>				

\*Marks of these papers will not be added in total marks and only grades will be provided.

**C-Compulsory**

**AC- Audit Course**

**Kanya Maha Vidyalaya, Jalandhar (Autonomous)**

**SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAMME**

**Bachelor of Science (Bio-Technology)**

**Session: 2022-23**

<b>Bachelor of Science (Bio-Technology) Semester-V</b>							
<b>Course Code</b>	<b>Course Name</b>	<b>Course Type</b>	<b>Marks</b>				<b>Examination Time (in Hours)</b>
			<b>Total</b>	<b>Ext.</b>		<b>CA</b>	
				<b>L</b>	<b>P</b>		
BBTM-5061	rDNA Technology-I	C	60	30	18	12	3+3
BBTM-5062	Plant Biotechnology-I	C	60	30	18	12	3+3
BBTM-5063	Animal Biotechnology-I	C	60	30	18	12	3+3
BBTM-5064	Bioprocess Engineering-I	C	60	30	18	12	3+3
BBTM-5065	Biochemical and Biophysical Techniques-I	C	60	30	18	12	3+3
BBTM-5066	Industrial Biotechnology-II	C	60	30	18	12	3+3
SECJ-5551	*Job Readiness course	AC	25	20	-	5	-
<b>Total</b>			<b>360</b>				

**\*Marks of these papers will not be added in total marks and only grades will be provided.**

**C-Compulsory**

**AC- Audit course**

**Kanya Maha Vidyalaya, Jalandhar (Autonomous)**  
**SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAMME**  
**Bachelor of Science (Bio-Technology)**  
**Session: 2022-23**

<b>Bachelor of Science (Bio-Technology) Semester-VI</b>							
<b>Course Code</b>	<b>Course Name</b>	<b>Course Type</b>	<b>Marks</b>				<b>Examination Time (in Hours)</b>
			<b>Total</b>	<b>Ext.</b>		<b>CA</b>	
				<b>L</b>	<b>P</b>		
BBTM-6061	rDNA Technology-II	C	60	30	18	12	3+3
BBTM-6062	Animal Biotechnology-II	C	60	30	18	12	3+3
BBTM-6063	Plant Biotechnology-II	C	60	30	18	12	3+3
BBTM-6064	Bioprocess Engineering-II	C	60	30	18	12	3+3
BBTM-6085	Chemistry-III	C	60	30	18	12	3+3
BBTM-6066	Biochemical and Biophysical Techniques-II	C	60	30	18	12	3+3
BBTS-6087	Term Paper	C	20	-	20	-	-
<b>Total</b>			<b>380</b>				

**C-Compulsory**

# **B.Sc. Bio-Technology Semester-I**

**Bachelor of Science (Bio-Technology) Semester-I**  
**Session: 2022-23**  
**Course Code: BBTM-1085**  
**Biochemistry-I**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Gain basic knowledge about water and pH.

**CO2:** Acquire the knowledge of Carbohydrates, their classification, biological functions that can relate in day to day life

**CO3:** Understand the definition, structure and Biological function of lipids and their subclasses.

**CO4:** Understand the definition, structure, biological function and classification of proteins.

**CO5:** Apply the knowledge of biomolecules in the research of molecular biology

**Bachelor of Science (Bio-Technology) Semester-I**

**Session: 2022-23**

**Course Code: BBTM-1085**

**Biochemistry-I**

**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setters:**

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

**Unit-I**

Water and its Properties: Role of water in life, Structure of water molecules, Physico-chemical properties of water, Dissociation and association constants, pH and buffers.  $pI$ ,  $pK_a$ , Hasselbach Hendersson equation and its implications.

**Unit-II**

Carbohydrates: Introduction, Monosaccharides: Families of monosaccharides: aldoses and ketoses, trioses, tetroses, pentoses, and hexoses, epimers, and anomers of glucose. Furanose and pyranose forms of glucose and fructose, Mutarotation, Structure and functions of monosaccharide derivatives, Disaccharides; concept of reducing and non-reducing sugars, Haworth projections of Maltose, lactose, and sucrose, Structural and functional properties of Polysaccharides: storage polysaccharides - starch and glycogen; Structural Polysaccharides - cellulose, and chitin; Heteropolysaccharides: Peptidoglycan, Proteoglycan, glycoproteins

**Unit-III**

Lipids: Classification of lipids and fatty acids. General structure and function of major lipid subclasses, acylglycerols, phosphoglycerides, Sphingolipids, glycosphingolipids and terpenes, sterols, steroids: Prostaglandins.

## Unit-IV

Proteins: Structure of amino acids, non-protein and rare amino acids and their chemical reactions. Structural organization of proteins (Primary, Secondary, Tertiary, Quaternary and domain structure, protein classification and function. Forces stabilizing Primary, Secondary and Tertiary protein structures

### Books Recommended:

1. Voet, D., Voet, J.G. and Prait, C.W. (2018). Principles of Biochemistry, 5<sup>th</sup> Edition, Wiley.
2. Stryer, L. (2015). Biochemistry, 8<sup>th</sup> Edition, W.H. Freeman and Company, New York
3. Berg, J.M., Tymoczko, J. L. And Stryer, L. (2019). Biochemistry, 9<sup>th</sup> Edition, Freeman.
4. Mathew, C.K., Van, K.E. and Anther, K.G. (2012). Biochemistry 4<sup>th</sup> Edition, Addison Wesley.
5. Lehninger, A.L., Nelson, D.L. and Lox, M.M. (2017). Principles of Biochemistry, 7<sup>th</sup> Edition, CBS Publishers and Distributors, New Delhi.

**Bachelor of Science (Bio-Technology) Semester-I**  
**Session: 2022-23**  
**Course Code: BBTM-1085 (P)**  
**Biochemistry-I**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Perform Beer Lamberts Law

**CO2:** Determine pKa value while performing practical

**CO3:** Estimate carbohydrates and sugars in the given sample

**CO4:** Estimate proteins and fats in the sample by different methods

**Bachelor of Science (Bio-Technology) Semester-I**  
**Session: 2022-23**  
**Course Code: BBTM-1085(P)**  
**Biochemistry-I**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**Instructions for the practical Examiner:** 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. Verification of Beer Lamberts Law for p-nitrophenol or cobalt chloride.
2. Determination of pKA value of p-nitrophenol.
3. Estimation of carbohydrate in given solution by anthrone method.
4. Study the presence of reducing/ non-reducing sugar in biological samples.
5. Protein estimation by Lowry's method.
6. Protein estimation by Bradford method.
7. Protein estimation by Biuret method.
8. The determination of acid value of a fat.
9. The determination of saponification value of a fat

**Books Recommended:**

1. Plummer D.T. (2017). An Introduction to Practical Biochemistry, 3<sup>rd</sup> Edition Tata McGraw Hill Education.
2. Sawhney, S.K. and Singh, R. (2014). Introductory Practical Biochemistry, Narosa Publishing House.
3. Wilson, K. And Walker, J. (2018). Principles and Techniques of Biochemistry, 8<sup>th</sup> Edition, McGraw Hill Education.

**Bachelor of Science (Bio-Technology) Semester-I**  
**Session: 2022-23**  
**Course Code: BBTM-1346**  
**General Microbiology-I**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Know the contribution of microbiologists, the principle and application of various types of microscopic techniques.

**CO2:** Apply the concept, principle and types of sterilization techniques while performing microbiological experiments

**CO3:** Apply the concept and characteristics of antiseptics, disinfectants & their mode of action in day to day life

**CO4:** Perform microbial preservation methods.

**Bachelor of Science (Bio-Technology) Semester-I**  
**Session: 2022-23**  
**Course Code: BBTM-1346**  
**General Microbiology-I**  
**(Theory)**

**Time: 3 Hours**

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

**Instructions for the Paper Setters:**

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of 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**

Introduction to Microbiology- Historical Perspective and Important discoveries related to Microbiology. Relationship between Microbiology and Biotechnology- The Microbial Biotechnology. General Features-Bacteria, Fungi, Neurospora, Yeast and Viruses. Microbes in extreme environments- the thermophiles, halophiles, acidophiles, psychrophiles and alkalophiles.

**Unit-II**

Basic concept of Microbial growth & culture media and its components, Sterilization-Basic concept, physical and chemical methods of sterilization. Bacterial Nutrition-Introduction, Nutritional forms of bacteria, Basic concept of Transport mechanisms of nutrients across microbial cell membranes: Facilitated diffusion, Active transport and Group translocation

**Unit-III**

Principles and application of bright field, dark field, phase contrast, fluorescence & immunofluorescence, electron microscopy (Scanning electron microscopy & transmission electron microscopy). Gram positive and Gram negative bacteria: Introduction, Structure and anatomy of bacterial cell walls and Nature of the Microbial Cell Surface. Types of bacterial flagella. Different types of bacterial staining.

## Unit-IV

Bacterial Classification: Bacterial classification and taxonomy based on Bergey's Manual of Determinative bacteriology– General outline only. An introduction to Bacterial Serotypes. Microbial culture collection centres, Methods of Microbial preservation: Refrigeration, Cryopreservation, lyophilization, Paraffin method

### **Books Recommended:**

1. Davis, B.D., Dulbecco. R., Eisen, H.N. and Ginsberg, H.S. (1990). Microbiology: 4th Edition, Harper & Row, Publishers, Singapore.
2. Stanier, R.Y. (1999). General microbiology, MacMillan Press, London.
3. Tortora, G.J., Funke, B.R. and Case, C.L. (2015). Microbiology: An introduction, 12th Edition, Pearson College Div.
4. Willey, J., Sherwood, L. And Wooverton, C. J. (2017). Prescott's Microbiology, 10th Edition, McGraw-Hill Education/ Asia
5. Pelczar, M.J., Chan, E.C.S. and Krieg, N.R. (2010). Microbiology: An application based approach, Tata McGraw Hill.
6. Purohit, S.S. (2006). Microbiology: Fundamentals and Applications, 7th Edition, Agrobios (India).

**Bachelor of Science (Bio-Technology) Semester-I**  
**Session: 2022-23**  
**Course Code: BBTM-1346(P)**  
**General Microbiology-I**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Sterilize glassware & plastic ware while performing microbiological experiments.

**CO2:** Learn and do basics of microbiological experiments like to make cotton plugs

**CO3:** Cultivate various bacteria, fungi, yeast etc. by different methods

**CO4:** Study motility of microbes.

**Bachelor of Science (Bio-Technology) Semester-I**  
**Session: 2022-23**  
**Course Code: BBTM-1346(P)**  
**General Microbiology-I**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**Instructions for the practical Examiner:** 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. Aseptic techniques of sterilization.
2. Cleaning of glassware.
3. Preparation of media, cotton plugging and sterilization
4. Isolation of micro-organism from air, water and soil samples. Dilution, spread plating and pour plating, Colony purification.
5. Identification of bacteria by simple staining, negative staining and Gram staining.
6. Detection of specific bacteria by Wet mount preparation method and Hanging drop mount method.
7. To preserve bacteria by short term preservation methods like direct transfer to subculture, Immersion in oil, cryopreservation.

**Books Recommended:**

1. Cappuccino, J.G. and Sherman, N. (2014). Microbiology: A Laboratory Manual 10<sup>th</sup> Edition, Pearson Education India.
2. Dubey R.C. and Maheshwari (2012). Practical Microbiology 5<sup>th</sup> edition: S. Chand and company ltd. New Delhi.
3. Leooffee, M.J. and Pierce, B.E. (2015). Microbiology: Laboratory Theory and Application, 3<sup>rd</sup> Edition, Morton Pub. Co.
4. Sastry, A.S. and Bhat, S. (2018). Essentials of Practical microbiology. Jaypee Brothers Medical Publishers.

# **B.Sc. Bio-Technology Semester-II**

**Bachelor of Science (Bio-Technology) Semester-II**

**Session: 2022-23**

**Course Code: BBTM-2065**

**Genetics**

**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setter**

Eight questions of equal marks 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. Each question carries 6 marks.

**Unit - I**

**Mendel's Laws of Inheritance:** Principle of segregation and Independent assortment, Monohybrid, dihybrid and trihybrid crosses, Back cross and test cross, concept of probability

**Interaction of Genes:** Incomplete inheritance and co-dominance, pleiotropism, modification of F<sub>2</sub> ratios: epistasis, complementary genes, supplementary genes, inhibitory genes, duplicate genes, lethality and collaborators genes. Multiple allelism.

**Unit – II**

**Linkage:** Coupling and repulsion hypothesis, chromosomal theory of linkage, complete and incomplete linkage, linkage groups and significance of linkage.

**Crossing Over:** Introduction, mechanism of meiotic crossing over, types of crossing over, factors affecting it and its significance.

**Unit – III**

**Mutation:** Spontaneous versus induced mutations, types of mutations, mutations rate and frequency, Mutagens: Physical and Chemical, the molecular basis of mutations. Significance & Practical applications of Mutation

**Basic Microbial Genetics:** Conjugation, transduction, transformation

#### **Unit – IV**

**Organization of Chromosomes:** The structure of prokaryotic and eukaryotic chromosome, centromere and telomere structure, euchromatin and heterochromatin, Special chromosomes: Polytene chromosomes and Lampbrush chromosomes, satellite DNA, the supercoiling of DNA.

**Human Genetics:** Population genetics, Hardy Weinberg law, Pedigree analysis, Karyotyping, genetic disorders.

#### **Books Recommended:**

1. Gupta, P.K. (2018). Genetics, 5<sup>th</sup> Revised Edition, Rastogi Publications.
2. Hartl, D.L., Cochrane, B. (2017). Genetics: Analysis of Genes & Genomes 9<sup>th</sup> Edition. Jones & Bartlett Publishers.
3. Brooker, R.J. (2017). Genetics: Analysis and Principles, McGraw-Hill Education.
4. Pierce, B. (2016). Genetics: A conceptual approach, 6<sup>th</sup> Edition, WH Freeman.
5. Snustad and Simmons (2015). Principles of Genetics, 7<sup>th</sup> Edition, John Wiley & Sons.

**Bachelor of Science (Bio-Technology) Semester-II**

**Session: 2022-23**

**Course Code: BBTM-2065 (P)**

**Genetics  
(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Understand Mendelian laws.

**CO2:** Solve Paternity disputes.

**CO3:** Demonstrate segregation in preserved material.

**CO4:** Study polytene chromosomes and dermatoglyphics.

**CO5:** Study mitosis from onion root tips.

**Bachelor of Science (Bio-Technology) Semester-II**

**Session: 2022-23**

**Course Code: BBTM-2065 (P)**

**Genetics  
(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**Instructions for the practical Examiner:** 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. Demonstration of Law of segregation and Independent assortment (use of coloured beads, capsules etc.).
2. Numerical problems on Mendelism and on modified F<sub>2</sub> ratios.
3. Numerical problems on Paternity disputes (Blood groups)
4. Segregation demonstration in preserved material
5. Study of polytene chromosomes from permanent slides.
6. Dermatographics: Palm print taking and fingertip patterns.
7. Preparation and study of mitosis slides from onion root tips by squash method.

**Bachelor of Science (Bio-Technology) Semester-II**

**Session: 2022-23**

**Course Code: BBTM-2086**

**Biochemistry – II**

**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Familiarize with biomolecules, enzymes and related Metabolic pathways

**CO2:** Know the importance & metabolic role of ATP and other energy rich metabolites

**CO3:** Familiarize with enzymes and related mechanism through which they work

**CO4:** Get acquainted with the concept of bioenergetics and various metabolic processes

**CO5:** Differentiate between equilibrium and steady state kinetics and analysed simple kinetic data and estimate important parameter ( $K_m$ ,  $V_{max}$ )

**Bachelor of Science (Bio-Technology) Semester-II**

**Session: 2022-23**

**Course Code: BBTM-2086**

**Biochemistry – II  
(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setters:**

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of 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. Each question carries 6 marks.

**Unit-I**

Introduction to metabolism, catabolism, anabolism, Laws of Thermodynamics and living system, Free energy change and direction of metabolism, Characteristics of Metabolic pathways, Compartmentation and Inter-organ metabolism, Regulation & evolution of metabolic pathways

**Unit-II**

ATP: Structure, Free energy change, energy coupling with ATP (Creatinine phosphokinase, NDP kinase, Adenylate kinase), metabolic roles of ATP; Experimental methods for studying metabolism, Energy rich metabolites, biological oxidation – Reduction reactions

**Unit-III**

**Introduction to Enzymes:** Nomenclature, Classification and Characteristics of enzymes, Cofactors, Co-enzyme and Prosthetic group, Mechanism of Enzyme Action: Nature of active site, enzyme substrate complex, Factors responsible for catalytic efficiency of enzymes., Covalent catalysis, Acid base catalysis, Strain and distortion theory, Induced fit hypothesis.

**Unit-IV**

**Enzyme Kinetics:** A brief overview of enzyme energetics, Michaelis Menten equation. Derivation of Michaelis Menten equation and determination of  $K_m$  and  $V_{max}$  values

Enzyme inhibition: Reversible and Irreversible inhibition, Kinetics of competitive, uncompetitive and non-competitive inhibition. Regulation of enzyme activity, Isozymes and their importance

**Books Recommended:**

1. Voet, D., Voet, J.G. and Prait, C.W. (2018). Principles of Biochemistry, 5<sup>th</sup> Edition, Wiley.
2. Stryer, L. (2015). Biochemistry, 8<sup>th</sup> Edition, W.H. Freeman and Company, New York
3. Berg, J.M., Tymoczko, J. L. And Stryer, L. (2011). Biochemistry, 7<sup>th</sup> Edition, Freeman.
4. Nelson, D.L. and Cox, M.M. (2013). Principles of Biochemistry, 7<sup>th</sup> Edition, Freeman
5. Mathew, C.K., Van, K.E. and Anther, K.G. (2012). Biochemistry 4<sup>th</sup> Edition, Addison Wesley.
6. Lehninger, A.L., Nelson, D.L. and Lox, M.M. (2017). Principles of Biochemistry, 7<sup>th</sup> Edition, CBS Publishers and Distributors, New Delhi.

**Bachelor of Science (Bio-Technology) Semester-II**

**Session: 2022-23**

**Course Code: BBTM-2086(P)**

**Biochemistry – II  
(Practical)**

Upon completion of this course, the student will be able to:

**CO1:** Estimate salivary amylase and acid phosphatase activity.

**CO2:** Know the Effect of temperature and pH on enzyme activity.

**CO3:** Determine  $K_m$  value for the activity of acid phosphatase

**CO4:** Perform and analyse Competitive and non-competitive inhibition

**Bachelor of Science (Bio-Technology) Semester-II**

**Session: 2022-23**

**Course Code: BBTM-2086(P)**

**Biochemistry – II  
(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**Instructions for the practical Examiner:** 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 Alpha-amylase activity from saliva.
2. Assay of acid phosphatase activity.
3. Effect of temperature on enzyme activity.
4. Effect of pH on enzyme activity
5. Determination of  $K_m$  for acid phosphatase.
6. Competitive and non-competitive inhibition.

**Books Recommended:**

1. Plummer D.T. (2017) An Introduction to Practical Biochemistry, 3<sup>rd</sup> Edition Tata McGraw Hill Education.
2. Sawhney, S.K. and Randhir singh (2001). Introductory Practical Biochemistry, Narosa Publishing House.
3. Wilson, K. and Walker, J. (2018). Principles and Techniques of Biochemistry, 8<sup>th</sup> Edition, McGraw Hill Education.

**Bachelor of Science (Bio-Technology) Semester-II**

**Session: 2022-23**

**Course Code: BBTM-2347**

**General Microbiology-II**

**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Know the concept of microbial growth in batch and continuous system.

**CO2:** Know the whole process of Natural resistance and Non-specific defense mechanism against microorganisms occurs in the human body

**CO3:** Have the full knowledge of mechanism of action, its diagnosis and treatment for different Viral, Bacterial & Fungal diseases

**CO4:** Acquire the best knowledge of Industrial Microbiology

**CO5:** Describe how biotechnology is used to understand and protect the environment, treat sewage and Domestic waste water treatment

**Bachelor of Science (Bio-Technology) Semester-II**

**Session: 2022-23**

**Course Code: BBTM-2347**

**General Microbiology-II**

**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setters:**

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of 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. Each question carries 6 marks.

**UNIT-I**

Factors affecting Microbial Growth: Temperature, pH, provision of gases. Introduction to concept of microbial growth in batch and continuous system. Bacterial generation, doubling time and specific growth rate. Monoauxic, diauxic and synchronised growth curve. Sporulation and regeneration of bacteria.

**UNIT-II**

Viruses-Introduction, Plant and animal viruses-structure and composition, Classification based on differences in their transcription process. Cultivation of plant and animal viruses. Life cycle Tobacco Mosaic Virus, Herpes simplex and Bacteriophages (Lysogenic and Lytic cycle).

**UNIT-III**

Pathogenic microorganisms- Factors contributing towards microbial pathogenicity (Adhesion, Invasiveness and toxigenicity), Natural resistance and Non-specific defense mechanism against microorganisms. Introduction, mechanism of action, diagnosis and treatment for viral diseases- Influenza, AIDS and Hepatitis. Bacterial Diseases-Diphtheria, Tuberculosis, Typhoid, Streptococcus, Klebsiella infection. Fungal diseases-Aspergillosis and Candidiasis.

## UNIT-IV

Introduction to roles of microbes in environment, Bio-mining, Bioconversion, Bioremediation, and Municipal solid waste transformations.

### **Books Recommended:**

1. Davis, B.D., Dulbecco. R., Eisen, H.N. and Ginsberg, H.S. (1990). Microbiology: 4th Edition, Harper & Row, Publishers, Singapore.
2. Tortora, G.J., Funke, B.R. and Case, C.L. (1994). Microbiology: An Introduction: 5th Edition, The Benjamin / Cummings Publishing Company, Inc.
3. Stanier, R.Y. (1995). General microbiology, MacMillan Press, London.
4. Pelczar, M.T. (1995). Microbiology, Tata McGraw Hill Publication, New Delhi.
5. Schlegel, H. G., (1995). General Microbiology 7th Edition, Cambridge Univ. Press.
6. Jain, S.K. (1999). Prescott and Dunn's Industrial Microbiology 4th Edition, CBS Publishers & Distributors.
7. Chander, M. and Puri, P (2008). A Concise Course in Microbiology, Krishna Brothers Publishers, Old Railway Road, Jalandhar.
8. Postgate. J. (2000). Microbes & Man, 4th Edition, Cambridge Univ. Press.
9. Tortora. G.J., Funke. B.R. (2001). Microbiology: An Introduction, Benjamin Cummings.

**Bachelor of Science (Bio-Technology) Semester-II**

**Session: 2022-23**

**Course Code: BBTM-2347(P)**

**General Microbiology-II  
(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Enumerate the microorganisms by different methods while performing microbiological practices

**CO2:** Know the real importance of Personal hygiene.

**CO3:** Identify different fungus by lactophenol staining

**CO4:** Apply basic knowledge of nutrients to study the Growth curve of different microorganisms

**CO5:** Acquire skills and competency in microbiological laboratory practices applicable to microbiological research

**Bachelor of Science (Bio-Technology) Semester-II**

**Session: 2022-23**

**Course Code: BBTM-2347(P)**

**General Microbiology-II**

**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**Instructions for the practical Examiner:** 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. Enumeration of microorganism. Total vs viable counts.
2. Personal Hygiene-Microbes from hands, tooth-scum and other body parts.
3. Monoauxic and diauxic growth curve of micro-organisms.
4. Identification of fungus by and lactophenol staining.
5. Identification of formation of germ tube by *Candida albicans*.
6. Visualization of Streptococcus
7. Waste water management test

**Books Recommended:**

1. Cappuccino, J.G. and Sherman, N. (2014). Microbiology: A Laboratory Manual 10<sup>th</sup> Edition, Harlow, Addition-Wesley.
2. Sambrook, J. and Russel, D.W. (2012). Molecular Cloning: A laboratory manual 4<sup>th</sup> Edition, Cold Spring Harbor Laboratory Press, New York.
3. Dubey, R.C. and Maheshwari (2012) Practical Microbiology 5<sup>th</sup> Edition, S. Chand and company Ltd, New Delhi

# **B.Sc. Bio-Technology Semester-III**

**Bachelor of Science (Bio-Technology) Semester-III**  
**Session: 2022-23**  
**Course Code: BBTM-3061**  
**Fundamentals of Biotechnology**  
**(Theory)**

**COURSE OUTCOMES**

After passing this course the student will be able to:

**CO1:** Know Basic Concept of Biotechnology and recombinant technology

**CO2:** Understand applications of biotechnology in health care and agriculture

**CO3:** Know how biotechnology can impact the research and development in industry and food technology.

**CO4:** Know different Ethical issues pertaining to biotechnology

**CO5:** Understand the concept of biodegradation, bioremediation and biotransformation

**Bachelor of Science (Bio-Technology) Semester-III**

**Session: 2022-23**

**Course Code: BBTM-3061**

**Fundamentals of Biotechnology  
(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setter**

Eight questions of equal marks 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**

**Emergence, scope and basics of biotechnology**

Historical perspective, Appraise the interplay of science & technology in the development of biotechnology, Definition and areas of Biotechnology, Overview - DNA, gene, gene expression, Recombinant DNA technology. Role of Bacteria (*E.coli*), Yeast, Viruses (bacteriophages), *Drosophila melanogaster*, *Caenorhabditis elegans*, *Arabidopsis thaliana* as workhorses of biotechnology. Biotechnology Research in India. Biotechnology Institutions in India (Public and Private Sector), Biotech Success Stories, Biotech Policy Initiatives.

**UNIT-II**

**Applications of Biotechnology: An Overview**

Applying Biotechnology to Modern life styles: Healthcare – Biopharma : Recombinant human insulin, Recombinant hepatitis B Vaccine; molecular diagnostics : PCR for infectious disease (viral / bacterial), blood screening and genetic testing, Gene therapy (for Alzheimer's disease), genetic counseling); Agriculture & food production (Genetically engineered food, Seed banks, aquaculture); Green biotechnology (Bioremediation, Biofuels, Conservation); Forensics & biodefense; Evo Devo (The development of life and human family tree); careers and employment opportunities in biotechnology.

**UNIT-III**

**Bio business and IPRs in Biotechnology**

Commercialization of Biotechnology: Concerns and Consequences, Biotechnology Industry Practices & Government regulations, Concept and market potential of Bio business, Requirements and Objectives of Patent, Patentable and non-patentable inventions, process of writing and filing a patent, patenting genes/

gene fragments /SNPs/ proteins / stem cells. Patents related to bacteria, viruses, fungi and medicinal plants, Plant Breeder's Right. IPR: Introduction, types (Trade secret, Copyright, trademark)

## UNIT-IV

### Biotechnology & Society

Ethical Issues & Regulating the use of Biotechnology: Human cloning, GM microorganisms, Food & Food ingredients, stem cells; Public Perception of Biotechnology: Consuming GM foods, GMOs and environment, antibiotic resistance; The future of Biotechnology.

#### Books Recommended:

1. David P Clark & Nanette J. Pazdernik (2017) Biotechnology – Applying the Genetic Revolution, Elsevier Academic Press.
2. Bernard R Glick, Jack J Pasternak and Cheryl L Patten (2010) Molecular Biotechnology: Principles and applications of Recombinant DNA, ASM Press.
3. Singh, B.D. (2018). Biotechnology expanding horizons, Kalyani Publishers, New Delhi.
4. Singh, I. and Kaur, B (2010) Patent law and Entrepreneurship, 3rd Edition, Kalyani Publishers.

**Bachelor of Science (Bio-Technology) Semester-III**

**Session: 2022-23**

**Course Code: BBTM-3061(P)**

**Fundamentals of Biotechnology  
(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Learn Good lab practices in Biotechnology Laboratory

**CO2:** Apply principle, working and applications of instruments viz., laminar air flow, autoclave, hot air oven etc.

**CO3:** Know the Handling and disposal procedure regarding hazardous reagents

**CO4:** Know different steps in Patent writing

**Bachelor of Science (Bio-Technology) Semester-III**

**Session: 2022-23**

**Course Code: BBTM-3061(P)**

**Fundamentals of Biotechnology  
(Practical)**

**Time: 3 Hrs.**

**Max. Marks: 18**

**Instructions for the practical Examiner:**

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. Good laboratory practices followed in biotechnology laboratory
2. Introduction, use and maintenance of basic equipments in a biotechnology laboratory (Auto-pipettes, weighing balance, pH meter, Water bath, dry bath, Spectrophotometer, centrifuges, light microscope, electrophoretic apparatus, vortex mixer, magnetic stirrer, rocker, laminar hoods, autoclave, sonicator, UV transilluminator, hot air oven, BOD incubator)
3. Handling and disposal of hazardous reagents (acids, carcinogenic chemicals like acrylamide, ethidium bromide) and concept of chemical hoods.
4. Different steps for patent with the help of example.

**Bachelor of Science (Bio-Technology) Semester-III**

**Session: 2022-23**

**Course Code: BBTM-3062**

**Immunology-I  
(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Familiarize with the Immune system

**CO2:** Know about different immune cells providing immunity

**CO3:** Inculcate the knowledge of immune response towards microorganisms.

**CO4:** Have understanding of Major Histocompatibility system in relation to disease susceptibility

**CO5:** Explain immune system, properties of immune system, types of immunity, different pathways of complement systems

**CO6:** Understand immunoglobulin structure, types and functions

**Bachelor of Science (Bio-Technology) Semester-III**

**Session: 2022-23**

**Course Code: BBTM-3062**

**Immunology-I  
(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setter**

Eight questions of equal marks 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**

Types of immunity-innate and adaptive. Features of immune response-memory. Specificity and recognition of self and non-self. Terminology used in the study of immune system. Active and Passive immunization

**Unit-II**

Lymphoid cells, heterogeneity of lymphoid cells; T-cells, B-cells, Null cells; Monocytes, Polymorphs, primary and secondary lymphoid organs-thymus, Bursa of fabricius, spleen, lymph nodes, lymphatic system, Mucosa Associated Lymphoid Tissue (MALT), Lymphocyte traffic.

**Unit-III**

Introduction of Antigen and Antibody, Epitope (B cell & T Cell epitope), Introduction to Immunogen, Molecular basis of immunogenicity and antigenicity, Factors influencing immunogenicity. Immunoglobulins: classes and structure, affinity and avidity. Antigen-Antibody Interaction. Complement fixing antibodies and complement cascade: Classical, Alternative and Lectin Pathway.

**Unit-IV**

MHC class I and class II molecules, structure and function of class I and class II MHC molecules. Organization of Major Histocompatibility complex (MHC) and inheritance, regulation of MHC expression and disease susceptibility. T & B Cells and their response, Structure of T-cell antigen receptors: TCR-CD3 complex.

**Books Recommended:**

1. Punt, J., Stranford, S., Johns, P. And Owen, J.A (2018). Kuby Immunology, 8<sup>th</sup> Edition. W.H. Freeman and Company, New York.
2. Delves, P. J., Martin, S. J., Burton, D. R. and Roitt, I.M. (2017). Roitt's Essential Immunology, Wiley Blackwell Publishers.
3. Paul, W.E. (2012). Fundamental Immunology, 7<sup>th</sup> Edition, LWW Publishers.

4. Kanfmann, S.H.E., Sher A. and Ahmed, R. (2002). Immunology of Infectious Diseases, ASM Press, Washington, D.C.
5. Roitt, I.M. Brostoff, J. and Male, D.K. (2012). Immunology, 8<sup>th</sup> Edition, Mosby publishers.

**Bachelor of Science (Bio-Technology) Semester-III**  
**Session: 2022-23**  
**Course Code: BBTM-3062(P)**  
**Immunology-I**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Collect blood sample by different methods.

**CO2:** Calculate Differential leucocyte count, Total leucocytes and RBC count in the given blood sample

**CO3:** Perform Blood group testing in day to day life

**CO4:** Perform dye exclusion method to isolate mononuclear cells from peripheral blood

**CO5:** Perform various immunological techniques.

**Bachelor of Science (Bio-Technology) Semester-III**

**Session: 2022-23**

**Course Code: BBTM-3062 (P)**

**Immunology-I  
(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**Instructions for the practical Examiner:**

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. Blood Group testing.
2. Differential leucocytes count.
3. Total Leucocytes count.
4. Total RBC count
5. Separation of serum & Plasma from blood.
6. Isolation of mononuclear cells from peripheral blood and to check their viability by dye exclusion method.
7. Collection of blood sample by different method.
8. To perform Double immune diffusion.

**Books Recommended:**

1. Celis, J.E., Hunter, T. and Carter, N (2005). Cell Biology: A laboratory handbook. 3<sup>rd</sup> Edition, Vol-III, Academic Press, U.K.
2. Stevans, C.D. (2017). Clinical Immunology and Serology: A Laboratory Perspective 4<sup>th</sup> Edition, F.A Davis Company, Philadelphia.
3. Hay, F.C. and Westwood O.M.R. (2002). Practical Immunology, 4<sup>th</sup> Edition, Wiley Blackwell.

**Bachelor of Science (Bio-Technology) Semester-III**  
**Session: 2022-23**  
**Course Code: BBTM-3085**  
**Biochemistry-III**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Develop an understanding of Carbohydrates metabolisms in cell

**CO2:** Understand the Amphibolic nature of Kreb's cycle

**CO3:** Know Electron transport chain and ATP synthesis occurring inside cell

**CO4:** Know the concept of bioenergetics, various terminologies related to it and concept of high energy molecules and bonds

**CO5:** Understand the lipid metabolism occurring inside the cell

**Bachelor of Science (Bio-Technology) Semester-III**

**Session: 2022-23**

**Course Code: BBTM-3085**

**Biochemistry-III**

**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setter**

Eight questions of equal marks 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-1**

Carbohydrate metabolism: - Biosynthesis and degradation of carbohydrates, Glycolysis, gluconeogenesis, feeder's pathways for glycolysis, regulation of carbohydrates metabolism.

**UNIT-II**

Kreb's cycle: - Amphibolic nature of kreb's cycle, regulation and enzymes of kreb's cycle, glyoxylate pathway. Electron transport chain: - Mitochondrial electron chain, oxidative phosphorylation, chemiosmotic hypothesis, ATP synthase and regulation of ATP synthesis

**UNIT-III**

Lipid digestion, Absorption and transport. Lipid Catabolism: Oxidation of fatty acids (Alpha, Beta, Omega oxidation), degradation of triacylglycerol, phosphoglycerides, sphingolipids, regulation of lipid metabolism.

**UNIT-IV**

Lipid Anabolism: Synthesis of fatty acids, triacylglycerol, phosphoglycerides, sphingolipids, cholesterol and regulation of Cholesterol metabolism.

**Books Recommended:**

1. Voet, D., Voet, J.G. and Prait, C.W. (2018). Principles of Biochemistry, 5<sup>th</sup> Edition, Wiley.
2. Stryer, L. (2015). Biochemistry, 8<sup>th</sup> Edition, W.H. Freeman and Company, New York
3. Berg, J.M., Tymoczko, J. L. And Stryer, L. (2011). Biochemistry, 7<sup>th</sup> Edition, Freeman.

4. Nelson, D.L. and Cox, M.M. (2013). Principles of Biochemistry, 7<sup>th</sup> Edition, Freeman
5. Mathew, C.K., Van, K.E. and Anther, K.G. (2012). Biochemistry 4<sup>th</sup> Edition, Addison Wesley.
6. Lehninger, A.L., Nelson, D.L. and Lox, M.M. (2017). Principles of Biochemistry, 7<sup>th</sup> Edition, CBS Publishers and Distributors, New Delhi.

**Bachelor of Science (Bio-Technology) Semester-III**  
**Session: 2022-23**  
**Course Code: BBTM-3085 (P)**  
**Biochemistry-III**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Understand the importance of absorbance maxima

**CO2:** Determine reducing sugar in the given sample

**CO3:** Perform spectral analysis of plant pigments

**CO4:** Separate lipids from wheat grains sample

**CO5:** Perform thin layer chromatography to separate macromolecules

**Bachelor of Science (Bio-Technology) Semester-III**  
**Session: 2022-23**  
**Course Code: BBTM-3085 (P)**  
**Biochemistry-III**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**Instructions for the practical Examiner:**

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. Carbohydrate estimation by Dubois method.
2. Determination of reducing sugar using 3,5 dinitrosalicylic acid.
3. (a) Absorbance curve of two dyes  
(b) Spectral analysis of various plant pigments
4. Separation of lipids from wheat grains.
5. Separation of macromolecules using thin layer chromatography.

**Books Recommended:**

1. Celis, J.E., Hunter, T. and Carter, N (2005). Cell Biology: A laboratory handbook. 3<sup>rd</sup> Edition, Vol-III, Academic Press, U.K.
2. Stevans, C.D. (2017). Clinical Immunology and Serology: A Laboratory Perspective 4<sup>th</sup> Edition, F.A Davis Company, Philadelphia.
3. Hay, F.C. and Westwood O.M.R. (2002). Practical Immunology, 4<sup>th</sup> Edition, Wiley Blackwell.

**Bachelor of Science (Bio-Technology) Semester-III**

**Session: 2022-23**

**Course Code: BBTM-3066**

**Molecular Biology  
(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Study Molecular aspects of genetics.

**CO2:** Have full understanding of basic mechanism and essential component required for DNA replication in prokaryotic & eukaryotic organisms

**CO3:** Explain the concept of genetic code, decoding system, codon-anticodon interactions, selection of initiation codons, initiation, elongation, termination and also regulation of translation.

**CO4:** Know how different genes are expressed and regulated in a cell by using different operon model.

**Bachelor of Science (Bio-Technology) Semester-III**

**Session: 2022-23**

**Course Code: BBTM-3066**

**Molecular Biology  
(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setter**

Eight questions of equal marks 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. Each question carries 6 marks.

**Unit-I**

DNA as genetic material, Structure of DNA, Types of DNA, Modes of Replication of DNA in prokaryotes and eukaryotes, DNA polymerases, the replication complex: Pre-priming proteins, Fidelity of replication. Mechanism of replication.

**Unit - II**

DNA recombination in prokaryotes and eukaryotes: molecular mechanisms, Holiday Junction model, DNA damage and repair: causes and types of DNA damage, mechanism of DNA repair, Insertion elements and transposons: Bacterial and eukaryotic transposons.

**Unit-III**

**Transcription and RNA processing**

RNA structure and types of RNA, Transcription in prokaryotes: Prokaryotic RNA polymerase, role of sigma factor, promoter, Initiation, elongation and termination of RNA chains, Transcription in eukaryotes: Eukaryotic RNA polymerases, transcription factors, promoters, enhancers, mechanism of transcription initiation, promoter clearance and elongation RNA splicing and processing: processing of pre-mRNA: 5' cap formation, polyadenylation, splicing, rRNA and tRNA splicing.

**UNIT IV**

**Regulation of gene expression and translation**

Regulation of gene expression in prokaryotes: Operon concept (inducible and repressible system): lac, his, trp operons, Genetic code and its characteristics, Prokaryotic and eukaryotic translation: ribosome structure and assembly, Charging of tRNA, aminoacyl tRNA synthetases, Mechanism of initiation, elongation and termination of polypeptides, Fidelity of translation, Inhibitors of translation, Regulation, Posttranslational modifications of proteins

### **Books Recommended:**

1. Adams, R. L. P., Knowler, J. T., and Leader, D. P. (1992). *The Biochemistry of Nucleic acids*, 11<sup>th</sup> Edition, Chapman and Hall, The New York/London/Tokyo/Melbourne/Madras.
2. Bolsover, S. R., Hyams, J. S., S. Shephard, E. A. and White H. A. (1997). *From Genes to Cells.*, John Wiley and Sons.
3. Krebs, J E, Goldstein, ES, Kilpatrick, ST (2017). *Lewin's Gene XII*, Jones and Bartlett publishers, Inc.
4. Maulik, S. and Patel, S. D. (1997). *Molecular Biotechnology Therapeutic Application and Strategies*, John Wiley & Sons.
5. Primrose, SB and Twyman, R. (2010). *Principles of Gene Manipulation and genomics*, 8<sup>th</sup> Edition, Wiley Blackwell.
6. Strachan, T. and Read, A. (2010). *Human Molecular Genetics*, Garland Science
7. Pierce, B. (2016). *Genetics: A conceptual approach*, 6<sup>th</sup> Edition, WH Freeman.

**Bachelor of Science (Bio-Technology) Semester-III**  
**Session: 2022-23**  
**Course Code: BBTM-3066(P)**  
**Molecular Biology**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Isolate genomic DNA and RNA from plants

**CO2:** Perform agarose gel electrophoresis.

**CO3:** Quantify DNA.

**CO4:** Do SDS-PAGE electrophoresis of different protein samples.

**Bachelor of Science (Bio-Technology) Semester-III**

**Session: 2022-23**

**Course Code: BBTM-3066(P)**

**Molecular Biology  
(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**Instructions for the practical Examiner:** 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. Isolation of genomic DNA from plants by CTAB method.
2. Isolation of genomic DNA from blood and perform agarose gel electrophoresis.
3. Quantification and determination of purity of DNA.
4. To perform RNA Isolation from plants.
5. Quantification and determination of purity of RNA.
6. SDS-Page electrophoresis of different protein samples.

**Books Recommended:**

1. Primrose, SB and Twyman, R. (2010). Principles of Gene Manipulation and genomics, 8<sup>th</sup> Edition, Wiley Blackwell
2. Sambrook J. and Green M. R. (2013). Molecular Cloning: A Laboratory Manual, 4<sup>th</sup> Edition, CSHL.
3. Brown T.A (2017). Genomes, 3<sup>rd</sup> Edition, Garland Science.

# **B.Sc. Bio-Technology Semester-IV**

**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2022-23**  
**Course Code: BBTM-4061**  
**Industrial Biotechnology-I**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Understand the basics of microbial industrial process

**CO2:** Know about different fermenters, isolation of industrially important microbes and their screening methods

**CO3:** Understand different Strain Improvement method required for industrial important microbes

**CO4:** Understand Primary and secondary metabolite production at industrial level, Know about Microbial production of fermented foods and enzymes

**Bachelor of Science (Bio-Technology) Semester-IV**

**Session: 2022-23**

**Course Code: BBTM-4061**

**Industrial Biotechnology-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 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. Each question carries 6 marks.

**Unit-I**

Introduction: Basic concept of agriculture and food processing as industry, Methods and Principles of Food Processing, Differences between microbial industrial processes and chemical industrial processes.

**Unit-II**

Industrially important microbes, screening (primary and secondary methods), selection and identification. Maintenance and preservation of industrially important microbial cultures.

**Unit-III**

Strain improvement of industrial important microbes: by using mutational programme and recombination systems (parasexual cycle, protoplast fusion and recombinant DNA techniques), Isolation of mutants (induced, auxotrophic, resistant and revertant mutants), Inoculums Development, media formulation and process optimization of Industrial and agro industrial microbes.

**Unit-IV**

Introduction to primary and secondary metabolites production. Dairy products like curd, yoghurt, Cheese, bread. Fermented foods-Pickles, Saurkraut, Enzyme production-Amylases, cellulases, proteases in leather industries.

**Books Recommended:**

1. Wittmann, C. and Liao, J. (2017). Industrial Biotechnology:Products and Processes (Advanced Biotechnology), Vol. 4 Wiley-VCH.
2. Singh B.D. (2016). Biotechnology:Expanding horizons, Kalyani Publishers / Lyall Bk Depot
3. Chakraborty, P.K. (2013). Agro and Industrial Biotechnology, Black Prints
4. Tyagi, N. (2012). Industrial Microbiology and Biotechnology, Agrotech Press.
5. Casida, L.E.J.R. (2007). Industrial Microbiology, New Age International Publishers
6. Okafor N, Okeke B.C. (2018). Modern Industrial Microbiology and Biotechnology, 2<sup>nd</sup> edition, CRC Press.

**Bachelor of Science (Bio-Technology) Semester-IV**

**Session: 2022-23**

**Course Code: BBTM-4061(P)**

**Industrial Biotechnology-I  
(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Measure any bacterial size

**CO2:** Perform IMVIC test for metabolic characterization of bacteria

**CO3:** Isolation of enzyme producing microbes

**CO4:** Starter culture preparation

**Bachelor of Science (Bio-Technology) Semester-IV**

**Session: 2022-23**

**Course Code: BBTM-4061(P)**

**Industrial Biotechnology-I  
(Practical)**

**Time: 3 Hrs.**

**Max. Marks: 18**

**Instructions for the practical Examiner:** 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. Measurement of bacterial size.
2. Metabolic Characterization by IMVIC test
3. Isolation of Amylase producing microbes.
4. Starter culture preparation, evaluation and application.
5. Screening of cellulase producing microorganism from wood degrading soil.

**Books Recommended:**

1. Cappuccino J.G., Sherman N. (2007). Microbiology: A laboratory (Pearson Benjamin Cummings).
2. Plummer D.T. (2004). An introduction to practical biochemistry (Tata McGraw Hill Publishers Co. Ltd., New Delhi).
3. Bansal, D.D., K Hardori, R., Gupta, M.M. (1985). Practical biochemistry (Standard Publication Chandigarh).
4. Dubey R.C. and Maheshwari (2012) Practical Microbiology 5th edition: S. Chand and company ltd. New Delhi.

**Bachelor of Science (Bio-Technology) Semester-IV**

**Session: 2022-23**

**Course Code: BBTM-4062**

**Immunology-II**

**(Theory)**

**COURSE OUTCOMES:**

After passing this course, student will be able to

**CO1:** Familiarize with immune effector mechanisms, hybridoma technology and vaccination

**CO2:** Have sound knowledge of how immune system deals with various pathogens, different processes and different cell types involved in the prevention of disease.

**CO3:** Become aware about concept, synthesis and action mechanism of vaccines.

**CO4:** Perform various immune-diagnostic techniques.

**Bachelor of Science (Bio-Technology) Semester-IV**

**Session: 2022-23**

**Course Code: BBTM-4062**

**Immunology-II**

**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setter**

Eight questions of equal marks 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. Each question carries 6 marks.

**Unit-I**

T-cell subsets and surface markers, T-dependent and T-independent antigens, Adjuvants, Monoclonal antibodies: its production and uses.

**Unit-II**

Various types of immunodiffusion and immunoelectrophoretic procedures. Immunoblot, ELISA, RIA, Agglutination of pathogenic bacteria, Haemagglutination and haemagglutination inhibition.

**Unit-III**

Immune invasion: mechanism used by parasites, regulation of immune invasion, Immunity to viruses, intracellular and extracellular bacteria, immunopathological consequences of parasitic infections.

**Unit-IV**

Whole organism vaccine, Types of vaccines: purified macromolecules as vaccine, recombinant antigen vaccine, recombinant vector vaccine, synthetic peptide vaccine, multivalent subunit vaccine, DNA Vaccine, RNA Vaccine.

**Books Recommended:**

1. Abbas, A.K. Litchman, A.H. and Pillai, S. (2017). Cellular and Molecular Immunology, 9<sup>th</sup> Edition, Elsevier.
2. Benjamni, E., Coico, R. and Sunshine, G. (2015). Immunology: A short course, 7<sup>th</sup> Edition, New York, Wiley- Wiley-Blackwell.

3. Delves, P. J., Martin, S. J., Burton, D. R. and Roitt, I.M. (2017). *Roitt's Essential Immunology*, Wiley Blackwell Publishers.
4. Roitt, I., Brostoff, J. and Male, D. (2001). *Immunology*, 6<sup>th</sup> Edition, Mosby.
5. Kanfmann S.H.E., Sher, A., Ahmed, R. (2002). *Immunology of infectious Diseases*, ASM Press, Washington D.C.
6. Butler, M. (2004). *Animal Cell culture and Technology*, 2<sup>nd</sup> Edition, Garland Science.
7. Punt, J., Stranford, S., Johns, P. And Owen, J.A (2018). *Kuby Immunology*, 8<sup>th</sup> Edition, W.H. Freeman and Company, New York.

**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2022-23**  
**Course Code: BBTM-4062(P)**  
**Immunology-II**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Prepare Vaccine chart of child.

**CO2:** Study Haemagglutination & Haemagglutination inhibition assay.

**CO3:** Perform Direct and indirect ELISA.

**CO4:** Perform Double immunodiffusion test.

**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2022-23**  
**Course Code: BBTM-4062(P)**  
**Immunology-II**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**Instructions for the practical Examiner:** 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. Preparation of vaccine chart of child, highlighting optional vaccines
2. Haemagglutination assay
3. Haemagglutination inhibition assay
4. Double immunodiffusion test using specific antibody and antigen Line of identity, partial identity and non-identity
5. Single immunodiffusion test using specific antibody and antigen
6. Direct and indirect ELISA
7. To perform Immunoelectrophoresis.
8. Separation and purification of IgG antibodies from Serum using protein A column.

**Books Recommended:**

1. Stevans, C.D. (2003). Clinical Immunology and Serology: A Laboratory Perspective 2<sup>nd</sup> Edition, F.A Davis Company, Philadelphia.
2. Celis, J.E., Hunter, T. and Carter, N. (2005). Cell Biology: A laboratory handbook. 3<sup>rd</sup> Edition, Vol-III, Academic Press, U.K.
3. Hay, F.C. and Westwood O.M.R. (2002). Practical Immunology, 4<sup>th</sup> Edition, Wiley Blackwell.

**Bachelor of Science (Bio-Technology) Semester-IV**

**Session: 2022-23**

**Course Code: BBTM-4083**

**Biochemistry-IV**

**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Know the main objective of amino acid metabolism and urea cycle

**CO2:** Have knowledge of importance of essential amino acids, its biosynthesis and their regulation.

**CO3:** Explain the Biosynthetic pathways of purines and pyrimidines nucleotides

**CO4:** Explain the Degradative pathways of purines and pyrimidines

**Bachelor of Science (Bio-Technology) Semester-IV**

**Session: 2022-23**

**Course Code: BBTM-4083**

**Biochemistry-IV**

**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setters:**

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of 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. Each question carries 6 marks.

**UNIT-I**

Amino Acid Metabolism: Overview of amino acid metabolism. Glucogenic and ketogenic amino acids. Biosynthesis of essential amino acids, Regulation of amino acid biosynthesis by feedback inhibition

**UNIT-II**

Amino Acid Metabolism: Transamination reactions of amino acids, Deamination and decarboxylation reactions. Role of pyridoxal phosphate, Urea cycle and inherited defects of urea cycle. catabolism of essential amino acids, Disorders of amino acids metabolism, phenylketonuria, alkaptonuria, maple syrup urine disease, methylmalonic academia (MMA), homocystinuria

**UNIT-III**

Nucleic Acid Metabolism: Structure of purine and pyrimidine bases. Nucleosides and nucleotides. Biologically important nucleotides. Biosynthesis of purines and pyrimidines nucleotides Clinical significance of purine biosynthetic pathway.

**UNIT-IV**

Nucleic Acid Metabolism: Degradation of purines and pyrimidines, nucleotides, salvage pathway. regulation of nucleotide biosynthesis.

**Books Recommended:**

1. Jain, J. L., Jain, S. and Jain. N. (2016). Fundamentals of Biochemistry, S. Chand & Company Ltd., New Delhi.
2. Rawn, J.D. (1989). Biochemistry, Niel Patterson Publications, North Carolina.
3. Berg, J.M., Tymoczko, J.L., Gatto, G.L., Stryer, L. (2015). Biochemistry, 4<sup>th</sup> Edition., W.H. Freeman & Co., San Francisco.
4. Voet, D., Voet, J.G. (2012). Fundamentals of Biochemistry, John Wiley and Sons, New York.
5. Nelson, D.L. and Cox, M.M. (2017). Lehninger's Principles of Biochemistry, 7<sup>th</sup> Edition., WH Freeman, New York.

**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2022-23**  
**Course Code: BBTM-4083(P)**  
**Biochemistry-IV**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Quantitatively estimate amino acids by using Ninhydrin reaction

**CO2:** Acquire skills to perform protein purification by using salt precipitation

**CO3:** Isolate casein from milk to determine isoelectric pH of casein

**CO4:** Check fat content in milk sample

**Bachelor of Science (Bio-Technology) Semester-IV**

**Session: 2022-23**

**Course Code: BBTM-4083(P)**

**Biochemistry-IV**

**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Perform quantitative estimation of amino acids using Ninhydrin reaction

**CO2:** Perform purification of protein using salt precipitation

**CO3:** Isolate casein of milk and determine isoelectric pH of casein

**CO4:** Determine fat content in milk

**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2022-23**  
**Course Code: BBTM-4083(P)**  
**Biochemistry-IV**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**Instructions for the practical Examiner:** 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. Quantitative estimation of amino acids using the Ninhydrin reaction.
2. Purification of protein using salt precipitation.
3. Isolation of Casein from milk and Isoelectric pH of casein.
4. Determination of fat content in milk.
5. Estimation of blood cholesterol.

**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2022-23**  
**Course Code: BBTM-4064**  
**Skill Development in Biotechnology**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Detect different food borne infections by different methods

**CO2:** Test food adulterants Biochemically/ microbiologically.

**CO3:** Learn all the nutritional aspects of the carbohydrates, lipids & proteins.

**CO4:** Study the advanced techniques used to determine for food borne pathogens

**CO5:** Know the potential effects of food spoilage by food borne infectious agents

**CO6:** Describe the role of biotechnologies in food production and food processing

**Bachelor of Science (Bio-Technology) Semester-IV**

**Session: 2022-23**

**Course Code: BBTM-4064**

**Skill Development in Biotechnology  
(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setters:**

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of 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. Each question carries 6 marks.

**Food Biotechnology**

**Unit-I**

Commercial potential of food fermentation industry; Novel food ingredients: Low calorie sweetener, Plant tissue culture and naturally produced flavor modifiers, natural food coloring agents; Nutraceuticals: Probiotics, Food spoilage: Detection and mechanism of food borne infections (*Clostridium*, *Salmonella*, *Staphylococcus*, *Aspergillus* sp.)

**Unit-II**

Introduction to HACCP plan, Preservation: thermal processing, cold preservation, chemical preservatives, food dehydration, food irradiation, biological control; Quality assurance: Biochemical/ microbial testing of food adulterants: milk, butter, oil, jams, jellies, Government regulatory practices and policies (FSSAI, FDA etc.), Food packaging: need and ways (glass, metal, plastics, moulded pulp and aluminium foil).

**Dietetics and Nutrition Management**

**Unit III**

Energy value of biomolecules: carbohydrates, fats and proteins, basal metabolic rate definition and its measurement, factors affecting BMR, energy requirements of human beings, Energy requirements in different age groups and special conditions (pregnant ladies and lactating mothers), different dietary types, requirements, utilization and functions.

**Unit-IV**

Methods of protein determination, amino acid imbalance, protein requirements, utilization and functions, nutritional aspects of vitamins and minerals, food processing and loss of nutrients during processing and cooking, naturally occurring antinutrients, balanced diet, recommended dietary allowances for different categories of human beings, disorders related to nutrition-protein energy malnutrition, starvation and obesity.

**Books Recommended:**

1. Frazier, W.C. and Westhoff, D.C. (2013). Food microbiology (Tata McGraw-Hill publishing Co. Ltd).
2. Admas, M.R. and Moss, M.O. (2015). Food microbiology, 4<sup>th</sup> Edition, Royal Society of Chemistry).
3. SriLakshmi B. (2018). Food science, 7<sup>th</sup> Edition, New Age International Publishers, India.
4. Jay J.M., Loessner M.J. and Golden D.A. (2006). Modern Food Microbiology, 7<sup>th</sup> Edition, Springer India.
5. Sivasankar B. (2004). Food processing and preservation, 1<sup>st</sup> Edition, Prentice-Hall of India Pvt. Ltd, New Delhi.
6. Michael P. Doyle, Larry R. Beuchat (2007). Food Microbiology: Fundamentals and Frontiers, 3<sup>rd</sup> Edition, ASM Press.

**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2022-23**  
**Course Code: BBTM-4064(P)**  
**Skill Development in Biotechnology**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Check different food adulterants in the given products.

**CO2:** Determine Gluten content in wheat flour.

**CO3:** Give quality index of fats content in different food products

**CO4:** Calculate BMR

**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2022-23**  
**Course Code: BBTM-4064(P)**  
**Skill Development in Biotechnology**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**Instructions for the practical Examiner:** 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. Detection of Adulteration in food (oil, butter).
2. Determination of crude fibre content in wheat and chickpea.
3. Determination of Gluten content in wheat flour.
4. Isolation of protein concentrates.
5. Determination of fat content in different food products.
6. Determine the BMR.

**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2022-23**  
**Course Code: BBTM-4065**  
**Fundamentals of Bioinformatics**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Understand basics of computer and data storage devices

**CO2:** Understand basics of bioinformatics and sequence alignment

**CO3:** Know about scoring matrices and database searching

**CO4:** Know about primary and secondary databases

**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2022-23**  
**Course Code: BBTM-4065**  
**Fundamentals of Bioinformatics**  
**(Theory)**

**Time: 3 Hours**

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

**Instructions for the Paper Setters:**

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of 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. Each question carries 6 marks.

**UNIT-I**

Computers: General introduction to computers, organization of computers, Computer hardware and software. Data Storage Devices: Primary and secondary Storage devices. Input/Output Device: Key-tape/diskette devices, light pen mouse and joystick. Printed Output: Serial, line, page, printers; plotters, visual output; voice response units.

**UNIT-II**

Introduction to bioinformatics: History, Milestones and Applications, Local and Global alignments, Gap Penalties, Pairwise sequence alignments (Needleman-Wunsch, Smith-Watermann Algorithms), Significance of Sequence Alignment.

**UNIT-III**

**Scoring Matrices:** PAM, BLOSUM,

**Multiple Sequence Alignment:** Progressive Alignment, Iterative Alignment Methods,

**Database Searching:** BLAST and its types

**UNIT-IV**

Primary and Secondary databases, Online resources of Bioinformatics: Introduction about: NCBI, EBI, DDBJ, Expasy, PUBMED, PDB, UNIPROT, Pfam, Prosite.

**Books Recommended:**

1. Norton's P. (2017). Introduction to Computing Fundamental, 7<sup>th</sup> Edition, McGraw Hill Education, New Delhi.
2. Sinha P.K. (2010). Fundamental of Computers, 8<sup>th</sup> Edition, BPB Publication, New Delhi.
3. Jin Xiong. (2006) Essential Bioinformatics. Cambridge University Press.
4. Baxevais B.F. and Quellette F. (2004). Bioinformatics a Practical Guide to the Analysis of Genes and Proteins, 3<sup>rd</sup> Edition, Wiley-Interscience

**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2022-23**  
**Course Code: BBTM-4065 (P)**  
**Fundamentals of Bioinformatics**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Use and perform MS -office

**CO2:** Know and use various databases

**CO3:** Perform Sequence alignment

**CO4:** Perform prediction of protein functional domain

**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2022-23**  
**Course Code: BBTM-4065 (P)**  
**Fundamentals of Bioinformatics**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**Instructions for the practical Examiner:** 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. Ms-Office: word, Excel, Power-point
2. Introduction about Various Databases: NCBI, EMBL, UNIPROT, PUBMED
3. GenBank Format, FASTA format etc
4. Basic Local Alignment Search tools (BLAST)
5. Multiple Sequence Alignment using Clustal Omega
6. Prediction of Protein functional domain using PFAM/PROSITE

**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2022-23**  
**Course Code: BBTT-4067**  
**Industrial/ Institutional Visit**

**Time: 3 Hours**

**Max. Marks: 20**

**Note:**

Students will go for a visit to industry/institute and the students will be required to submit written report for the same which will be evaluated.

# **B.Sc. Bio-Technology Semester-V**

**Bachelor of Science (Bio-Technology) Semester-V**

**Session: 2022-23**

**Course Code: BBTM-5061**

**rDNA Technology-I**

**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Understand the concept of rDNA technology and their application in advanced research.

**CO2:** Know about different DNA Modifying enzymes in rDNA technology

**CO3:** Know how plasmids can be developed as vector.

**CO4:** Study different methods of Transformation.

**CO5:** Study how labelling of DNA and RNA is done

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2022-23**  
**Course Code: BBTM-5061**  
**rDNA Technology-I**  
**(Theory)**

**Time: 3 Hours**

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

**Instructions for the Paper Setters:**

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of 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**

Introduction to genetic engineering. Why gene cloning and DNA analysis is important. What is clone, how to clone a gene: Overview of the procedure.

Tools in Recombinant DNA Technology: Restriction and modifying enzymes, Type I, Type II and Type III enzymes and their characteristic features; restriction sequences, isoschizomers, rare cutting enzymes, enzyme cutting similar sequence in different manner

DNA Modifying enzymes: Characteristics and applications of Nucleases – DNase and RNase, DNA-Pol I, Klenow fragment, T4DNA polymerase, T7 DNA polymerase, T4 Polynucleotide kinase, Phosphatase, Reverse transcriptase, Taq polymerase and Ligase. Terminal deoxynucleotidyl transferase, reverse transcriptase. RNase-H, DNase-I, Nuclease S-I

**Unit-II**

Cloning vectors: Basic features of plasmids, role of antibiotics and resistance genes in a vector, multiple cloning site, copy number regulation, pBR 322, pUC 8, Bacteriophage  $\lambda$  based vectors: insertional and replacement vectors, phagemid, cosmid, fosmid. Isolation and purification of DNA from bacteria, plants, animals and soil.

**Unit-III**

Gene Cloning: Ligation, Methods of Transformation:  $\text{CaCl}_2$ , electroporation, transfection, micro projectile. Transformation efficiency, Screening of transformants by gene inactivation: antibiotic inactivation and blue white selection.

## Unit-IV

Labelling of DNA and RNA- Radioactive labelling (Nick Translation, Random Priming, End Labelling), Non-Radioactive labelling (Direct & Indirect non isotopic labelling), Gene identification: Nucleic acid hybridization (Southern & Northern blotting), Western blotting.

### **Books Recommended:**

1. Primrose, SB and Twyman, R. (2013). Principles of Gene Manipulation and genomics, 8<sup>th</sup> Edition, Wiley Blackwell.
2. Sambrook, J and Green MR (2012) Molecular Cloning: A Laboratory Manual, 4<sup>th</sup> Edition, CSHL.
3. Brown TA. (2017) Genomes, 4<sup>th</sup> Edition, Garland Science.
4. Glick, B. R., & Pasternak, J. J (2010). Molecular biotechnology- principles and applications of recombinant DNA. Washington: ASM Press.
5. Clark, D. P. & Pazdernik, N. J. (2009). Biotechnology- applying the genetic revolution. USA: Elsevier Academic Press.

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2022-23**  
**Course Code: BBTM-5061(P)**  
**rDNA Technology-I**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Isolate genomic DNA from bacteria.

**CO2:** Quantify DNA using Spectrophotometer and determine their purity.

**CO3:** Perform and understand concept of restriction digestion

**CO4:** Perform and understand concept of transformation

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2022-23**  
**Course Code: BBTM-5061(P)**  
**rDNA Technology-I**  
**(Practical)**

**Time: 3 Hrs.**

**Max. Marks: 18**

**Instructions for the practical Examiner:**

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. Isolation of genomic DNA from bacteria.
2. Confirmation of high molecular weight DNA on agarose gel.
3. To perform spectrophotometric quantification of DNA for determination of purity.
4. Restriction enzyme digestion of isolated DNA.
5. Preparation of competent cells
6. Transformation of competent cells by  $\text{CaCl}_2$  method.

**Books Recommended:**

1. Primrose, SB and Twyman, R. (2013). Principles of Gene Manipulation and genomics, 8<sup>th</sup> Edition, Wiley Blackwell.
2. Sambrook, J and Green MR (2012) Molecular Cloning: A Laboratory Manual, 4<sup>th</sup> Edition, CSHL.
3. Brown TA. (2017) Genomes, 4<sup>th</sup> Edition, Garland Science

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2022-23**  
**Course Code: BBTM-5062**  
**Plant Biotechnology-I**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Study the macronutrients and micronutrients and their deficiency symptoms in plants.

**CO2:** Know about the different physiological functions & biosynthesis of major plant growth regulators.

**CO3:** Understand the concept of Totipotency.

**CO4:** Understand the different methods of gene transfer in plants.

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2022-23**  
**Course Code: BBTM-5062**  
**Plant Biotechnology-I**  
**(Theory)**

**Time: 3 Hours**

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

**Instructions for the Paper Setters:**

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of 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**

Introduction to Plant Tissue Culture and its Historical Background, Plant nutrition: macronutrients and micronutrients and their deficiency symptoms. Plant tissue culture media: types, components and their role.

**Unit-II**

Physiological functions and biosynthesis of major plant growth regulators such as auxins, cytokinins, gibberellins and abscisic acid.

**Unit-III**

Totipotency, factors affecting cellular totipotency, Cell differentiation, Dedifferentiation and redifferentiation of cells. Tissue competency, plant-explant-plant concept. Factors influencing plant tissue culture: Genotypic, physiological, biochemical and other extrinsic factors.

**Unit IV**

Transgenic Plant Biotechnology: Methods of gene transfer - Direct (Electroporation, Microprojectile, Microinjection, PEG mediated, DEAE Dextran mediated methods) and indirect (agrobacterium mediated gene transfer).

**Books Recommended:**

1. Taiz, L and Zeiger, E. (2014). Plant Physiology, 6th Edition, Sinauer Associates.
2. Razdan, MK. (2019) Introduction to Plant tissue culture, Science Publishers
3. Bhojwani, SS and Razdan, MK. (2004). Plant Tissue Culture. Theory and Practice, Elsevier.
4. Smith, RH. (2012) Plant tissue culture: techniques and experiments, Gulf professional publishing

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2022-23**  
**Course Code: BBTM-5062 (P)**  
**Plant Biotechnology-I**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Get acquainted with functions and operations of various instruments used in plant tissue culture laboratory.

**CO2:** Prepare cotton plugs.

**CO3:** Prepare stock solutions of Murashige & Skoog (1962) medium.

**CO4:** Clean glassware, plasticware and contaminated cultures.

**CO5:** Prepare, sterilize and inoculate the explants.

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2022-23**  
**Course Code: BBTM-5062 (P)**  
**Plant Biotechnology-I**  
**(Practical)**

**Time: 3 Hrs.**

**Max. Marks: 18**

**Instructions for the practical Examiner:**

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.To study functions and operations of various instruments required for plant tissue culture (pH meter, autoclave, laminar air-flow, incubators, oven, distillation unit etc).
- 2.Laboratory design set up for a PTC Laboratory.
- 3.Cleaning of glassware, plasticware and contaminated cultures.
- 4.Different types of enclosure used in plant tissue culture. Preparation of cotton plugs.
- 5.Preparation of stock solutions of Murashige & Skoog (1962) medium.
- 6.Preparation of Murashige & Skoog's medium from stock solutions.
- 7.Different sterilization process (Instruments, glassware and thermolabile and thermostable components)
- 8.Selection, preparation, sterilization and inoculation of explants.

**Books Recommended:**

- 1.Taiz, L and Zeiger, E. (2014). Plant Physiology, 6th Edition, Sinauer Associates.
- 2.Razdan, MK. (2019) Introduction to Plant tissue culture, Science Publishers
- 3.Bhojwani, SS and Razdan, MK. (2004). Plant Tissue Culture. Theory and Practice, Elsevier.
- 4.Smith, RH. (2012) Plant tissue culture: techniques and experiments, Gulf professional publishing

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2022-23**  
**Course Code: BBTM-5063**  
**Animal Biotechnology-I**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Learn about the different aseptic techniques used in Animal Tissue Culture (ATC).

**CO2:** Know about the different sources, types and eradication of contamination.

**CO3:** Study the different culture media and reagents used in ATC.

**CO4:** Study different safety considerations in ATC laboratory.

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2022-23**  
**Course Code: BBTM-5063**  
**Animal Biotechnology-I**  
**(Theory)**

**Time: 3 Hours**

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

**Instructions for the Paper Setters:**

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of 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**

Historical background, Advantages & Disadvantages of animal tissue culture, Design and layout of ATC Lab, Equipments used in ATC Lab, Aseptic Techniques in ATC- Sterilization of culture media, glassware & tissue culture laboratory. Growth and viability of cells in culture, cryopreservation and retrieval of cells from frozen storage, transportation of cells. Characteristics of normal and transformed cells.

**Unit- II**

Contamination- sources, Types, monitoring and eradication of contamination, Cross Contamination. Safety considerations in ATC laboratory, Clean Environment – P1, P2, P3, P4 facility and their applications.

**Unit-III**

Culture Media and Reagents-Types of cell culture media, physiochemical properties, balanced salt solution, constituents of serum, serum free media (SFM), design of SFM, Advantages and disadvantages of serum supplemented and serum free media, conditioned media

**Unit-IV**

Primary culture and Established cell line Culture (Finite & continuous cell lines), Isolation of Cells-Enzyme digestion, perfusion and mechanical disaggregation. Culture of attached cells and cells in suspension, phases of cell growth and determination of cell growth data (calculation of *in vitro* age, multiplication rate, population doubling time, cell counting, phases of cell cycle)

**Books Recommended**

1. Gareth, EJ. (2016). Human Cell Culture Protocols, Humara Press.
2. Butler, M. (2004). The Animal Cell Culture and Technology, IRL Oxford Univ. Press.
3. Julio, E., Celis (2006). Cell Biology-A laboratory hand book, Vol. I-IV, Academic Press, New York.

4. Freshney, RT. (2016), Culture of Animal Cells 7<sup>th</sup> Edition, John Wiley and Sons, New York.

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2022-23**  
**Course Code: BBTM-5063(P)**  
**Animal Biotechnology-I**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Perform different Sterilization techniques.

**CO2:** Prepare Hanks Balanced salt solution.

**CO3:** Prepare Minimal Essential Growth medium.

**CO4:** Isolate lymphocytes for culturing.

**CO5:** Isolate macrophages from blood for culturing.

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2022-23**  
**Course Code: BBTM-5063(P)**  
**Animal Biotechnology-I**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**Instructions for the practical Examiner:**

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. Sterilization techniques: Theory and Practical -Glass ware sterilization -Media sterilization  
-Laboratory Sterilization
2. Sources of contamination and decontamination measures.
3. Preparation of Hanks Balanced salt solution
4. Preparation of Minimal Essential Growth medium.
5. Isolation of lymphocytes for culturing and perform cell viability test.
6. Isolation of macrophages from blood for culturing

**Book Recommended:**

1. Freshney, RT. (2016), Culture of Animal Cells. 7<sup>th</sup> Edition, John Wiley and Sons, New Delhi.
2. Butler, M. (2004). The Animal Cell Culture and Technology, IRL Oxford Univ. Press.

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2022-23**  
**Course Code: BBTM-5064**  
**Bioprocess Engineering-I**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

- CO1:** Understand the fundamental principles of chemical Engineering and biochemical engineering.
  - CO2:** Perform assay of various enzymes according to their properties and can analyse their kinetics data.
  - CO3:** Learn about different types of microbial culture
  - CO4:** Know the effect of temperature, pH and inducer on the product synthesis.
- .

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2022-23**  
**Course Code: BBTM-5064**  
**Bioprocess Engineering-I**  
**(Theory)**

**Time: 3 Hours**

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

**Instructions for the Paper Setters:**

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of 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**

**Introduction:** Fundamental principles of Chemical Engineering and biochemical engineering. Fourier's Laws of heat transfer, Molecular diffusion, Diffusion theory, role of diffusion in bioprocessing, Oxygen transfer methodology in bioreactors and factors affecting oxygen transfer, Types of microbial culture: Batch, Fed batch and continuous culture.

**Unit-II**

**Microbial Growth Kinetics:** Simple kinetics of microbial growth, yield coefficient, doubling time, specific growth rate, substrate inhibition kinetics, product inhibition kinetics, metabolic and biomass productivities.

**Unit-III**

Introduction to multistage feedback systems: Internal & external feedback systems, effector molecules (Enzyme inhibitors and enzyme activators) and their kinetics, Effect of temperature, pH and inducer on product synthesis.

**Unit-IV**

**Sterilization:** Introduction, air and media sterilizations, design of batch sterilization process, Methods of batch sterilization, Del factor, sterilization cycle, continuous sterilization of feeds and liquid wastes, Filter sterilization, sterilization of fermenters.

**Books Recommended:**

1. Stanbury, PF, Whitaker, A. and Hall, SJ. (2016). Principles of Fermentation Technology 2<sup>nd</sup> Edition., Pergamon Press, Oxford.
2. Young, MY. (2000). Comprehensive Biotechnology (Vol. 1-4), Pergamon Press, Oxford.
3. Young, MY. (1996). Environmental Biotechnology, Principles & Applications, Kluwer Academic Publications, New Delhi.
4. Bailary, JE. and Ollis, DF. (1986). Biochemical Engineering Fundamentals, McGraw Hills, New York.



**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2022-23**  
**Course Code: BBTM-5064 (P)**  
**Bioprocess Engineering-I**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

- CO1:** Study growth curve of microorganisms while growing them in different media under optimal conditions.
- CO2:** Determine the specific growth rate and generation time of a bacterium during fermentation.
- CO3:** Study the effect of temperature, pH and aeration on microbial growth
- CO4:** Know about the production of an enzyme in a Bioreactor/shaking flask.

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2022-23**  
**Course Code: BBTM-5064(P)**  
**Bioprocess Engineering-I**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**Instructions for the practical Examiner:**

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. To study the growth curve of microorganism.
2. To determine the specific growth rate and generation time of a bacterium during submerged fermentation.
3. Demonstration of sterilization of fermenter and other accessories.
4. To study the effect of temperature, pH and aeration on growth of microbes.
5. Production and assay of an enzyme in a Bioreactor/shaking flask along with method of validation.

**Books Recommended:**

1. Cappuccino JG., Sherman N. (2007). Microbiology: A laboratory, Pearson Benjamin Cummings.
2. Plummer DT. (2004). An introduction to practical biochemistry, Tata McGraw Hill Publishers Co. Ltd., New Delhi.
3. Bansal, DD., K Hardori, R., Gupta, MM. (1985). Practical biochemistry, Standard Publication Chandigarh.

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2022-23**  
**Course Code: BBTM-5065**  
**Biochemical and Biophysical Techniques-I**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Gain fundamental knowledge about the basic principles of sedimentation.

**CO2:** Study the different types of centrifugation machines and rotors.

**CO3:** Understand the principles of different types of chromatography (Paper, column, ion-exchange etc).

**CO4:** Understand the principles of single and double beam UV/Visible spectroscopy.

**CO5:** Understand the basic principle and instrumentation of NMR and ESR.

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2022-23**  
**Course Code: BBTM-5065**  
**Biochemical and Biophysical Techniques-I**  
**(Theory)**

**Time: 3 Hours**

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

**Instructions for the Paper Setters:**

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of 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**

Centrifugation: Basic principles of sedimentation, theory and applications of preparative and analytical centrifugation, Differential and density gradient centrifugation, Types of centrifugation machines and rotors, Sedimentation co-efficient, Factors affecting sedimentation coefficient, care of rotors.

**Unit - II**

Chromatography: Partition Coefficient, Theory and Principle of Paper and column chromatography, Two dimensional chromatography, gel exclusion chromatography, Principle and applications of paper, thin layer, ion-exchange and affinity chromatography.

**Unit III**

Gas Liquid Chromatography, High Performance Liquid chromatography, Fast Protein Liquid chromatography.

**Unit IV**

Spectroscopy: Basic Principle, Lambert Beer's law, Absorption spectrum, theory & principles of single and double beam UV/Visible spectroscopy, Basic Principle and instrumentation of NMR and ESR

**Books Recommended:**

1. Upadhyay, A., Upadhyay, K. and Nath N. (2016) Biophysical chemistry: Principles and Techniques. Himalaya Publishing House, India.
2. Wilson K. and Walker J. (Eds.) (2010). Practical Biochemistry: Principles and Techniques, Cambridge University Press, U.K.
3. Sheehan, D. (2009). Physical Biochemistry: Principles and Applications, John Wiley and Sons Ltd., Chichester, England.
4. Freifelder, D. (1982). Physical Biochemistry. Applications to Biochemistry & Molecular Biology, W.H. Freeman.
5. Mousumi, D. (2011). Tools and techniques of biotechnology. Jaipur, India: Pointer Publisher.

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2022-23**  
**Course Code: BBTM-5065**  
**Biochemical and Biophysical Techniques-I**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Understand the concept of differential centrifugation.

**CO2:** Separate bio-molecules by paper chromatography and thin layer chromatography.

**CO3:** Separate proteins by ion-exchange column chromatography.

**CO4:** Separate proteins by affinity column chromatography.

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2022-23**  
**Course Code: BBTM-5065(P)**  
**Biochemical and Biophysical Techniques-I**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**Instructions for the practical Examiner:**

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. To study sedimentation using Swing Bucket Rotor and Angle Rotor.
2. To study differential centrifugation.
3. To study separation of bio-molecules by paper and thin layer chromatography.
4. Separation of proteins by ion-exchange column chromatography
5. Separation of proteins by affinity column chromatography.

**Books Recommended:**

1. Upadhyay, A., Upadhyay, K. and Nath N. (2016) Biophysical chemistry: Principles and Techniques. Himalaya Publishing House, India.
2. Wilson K. and Walker J. (Eds.) (2010). Practical Biochemistry: Principles and Techniques, Cambridge University Press, U.K.
3. Sheehan, D. (2000). Physical Biochemistry: Principles and Applications, John Wiley and Sons Ltd., Chichester, England.
4. Freifelder, D. (1982). Physical Biochemistry. Applications to Biochemistry & Molecular Biology, W.H. Freeman & Co.

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2022-23**  
**Course Code: BBTM-5066**  
**Industrial Biotechnology-II**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Know about production of antibiotics, enzymes and solvents from industrial microbes

**CO2:** Know about Biofertilizers, vermicomposting, fermented foods

**CO3:** Understand concept of Biotransformation, microbial production of organic acids, Vitamins and amino acids

**CO4:** Know about Single cell proteins and alcohol production

**CO5:** Gain understanding of concept of Fuel Biotechnology and Biodegradation of xenobiotic

**CO6:** Importance of Biological Nitrogen Fixation

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2022-23**  
**Course Code: BBTM-5066**  
**Industrial Biotechnology-II**  
**(Theory)**

**Time: 3 Hours**

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

**Instructions for the Paper Setters:**

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of 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**

Antibiotics production: Penicillin and Streptomycin, pharmaceutical drugs, solvent production: Acetone, butanol and ethanol. Biodegradation of xenobiotic compound. Fuel Biotechnology: Types of Biofuels and Feedstocks for Production of Biofuel, Biogas production, Industrial alcohol production

**Unit-II**

Biotransformation, organic acids: production of citric Acid and acetic acid, microbial production of vitamin B12 and vitamin C, amino acids: Glutamic acid and lysine production, Alcoholic Beverages: wine, beers.

**Unit-III**

Introduction to BT gene, transgenic crops (BT cotton and maize) and their potentials in agro industry, SCP: Spirulina production (Yeast, Bacteria), soil treatment with microbes, Vermicomposting, production of bacterial biofertilizers, Biocontrol agent and their significance. Mycorrhizal fungi,

**Unit-IV**

BNF and its significance, diazotrophes and their characterization, Microbial association and their interaction with plants, nitrogen cycle and role of Nitrogen fixing microbes in sustainable agriculture.

**Books Recommended:**

1. Wittmann, C. and Liao, J. (2017). Industrial Biotechnology: Products and Processes (Advanced Biotechnology), Vol. 4 Wiley-VCH.
2. Singh B.D. (2016). Biotechnology: Expanding horizons, Kalyani Publishers / Lyall Bk Depot
3. Chakraborty, P.K. (2013). Agro and Industrial Biotechnology, Black Prints

4. Tyagi, N. (2012). *Industrial Microbiology and Biotechnology*, Agrotech Press.
5. Casida, L.E.J.R. (2007). *Industrial Microbiology*, New Age International Publishers
6. Okafor N, Okeke B.C. (2018). *Modern Industrial Microbiology and Biotechnology*, 2<sup>nd</sup> edition, CRC Press.

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2022-23**  
**Course Code: BBTM-5066(P)**  
**Industrial Biotechnology-II**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Understand the concept of additive and synergistic effect of antibiotics

**CO2: Perform** different types of Fermentation

**CO3:** Isolate nitrate reducing bacteria from the environment

**CO4:** Learn about wine production

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2022-23**  
**Course Code: BBTM-5066(P)**  
**Industrial Biotechnology-II**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**Instructions for the practical Examiner:**

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. Alcoholic and Mixed–Acid Fermentation.
2. Additive and Synergistic effect of two antibiotics on the above microorganism.
3. Minimum inhibitory concentration of an antibiotics for the above microorganism.
4. Demonstration of wine production by using grape juice.
5. Determination of nitrate reduction by bacteria.

**Books Recommended:**

1. Cappuccino J.G., Sherman N. (2007). Microbiology : A Laboratory (Pearson Benjamin Cummings).
2. Plummer D.T. (2004). An introduction to Practical Biochemistry (Tata McGraw Hill Publishers Co. Ltd., New Delhi).
3. Bansal, D.D., K. Hardori, R., Gupta, M.M. (1985). Practical Biochemistry (Standard Publication Chandigarh).
4. Dubey R.C. and Maheshwari (2012) Practical Microbiology 5th Edition : S. Chand and Company Ltd., New Delhi.

# **B. Sc. Bio-Technology Semester-VI**

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2022-23**  
**Course Code: BBTM-6061**  
**rDNA Technology-II**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Understand basics of cloning and expression vectors.

**CO2:** Understand the concept of gene amplification.

**CO3:** Understand different generations of sequencing.

**Bachelor of Science (Bio-Technology) Semester-VI**

**Session: 2022-23**

**Course Code: BBTM-6061**

**rDNA Technology-II**

**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setter**

Eight questions of equal marks 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. Each question carries 6 marks.

**UNIT-I**

Cloning vectors: Shuttle vectors and BAC, Overview of cloning, genomic cloning in Lambda vector, screening of recombinants, calculating number of clones that have to be screened, Linker, Adapters, Different strategies for cDNA cloning- self priming and adaptor/linker methods. Cloning vectors for Eukaryotes (yeast vectors, YAC, viral vectors, Ti & Ri plasmids)

**UNIT-II**

Gene expression: expression vectors with respect to different promoters (lac, tac, T5, T7, lamda) and their induction system, signal sequences (omp), tags (His, GST, MBP and IMPACT), selection of host with respect to promoter, Processing of recombinant proteins: soluble proteins, inclusion body, Protein refolding

**UNIT-III**

Basics of PCR, primer designing, Various types of PCR, applications of PCR, PCR based methods of site directed mutagenesis (overlap extension and cassette mutagenesis), random mutagenesis and gene cloning

**UNIT-IV**

DNA Sequencing: Sanger-Coulson method (chain termination method), Maxam- Gilbert method (chemical degradation of DNA), New generation sequencing (Illumina (Solexa) HiSeq, pyrosequencing), Ion Torrent

technology, Single-molecule real-time (SMRT) sequencing, Fundamental concepts & applications of microarray, Phage display and selection of mutant peptides, yeast two hybrid assay.

**Books Recommended:**

1. Primrose, S.B. and Twyman, R. (2013). Principles of Gene Manipulation and genomics, 8<sup>th</sup> Edition, Wiley Blackwell.
2. Sambrook, J. and Green M.R. (2012) Molecular Cloning: A Laboratory Manual, 4<sup>th</sup> Edition, CSHL.
3. Brown, T.A. (2017) Genomes, 4<sup>th</sup> Edition, Garland Science.
4. Glick, B. R., and Pasternak, J. J (2003). Molecular biotechnology- Principles and applications of recombinant DNA, ASM Press, Washington.
5. Clark, D. P. and Pazdernik, N. J. (2009). Biotechnology- applying the genetic revolution, Elsevier Academic Press.

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2022-23**  
**Course Code: BBTM-6061(P)**  
**rDNA Technology-II**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Understand the role of restriction digestion in cloning

**CO2:** Understand the concept of transformation

**CO3:** Learn about ligation

**CO4:** Amplify genes.

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2022-23**  
**Course Code: BBTM-6061(P)**  
**rDNA Technology-II**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**Instructions for the practical Examiner:**

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. Isolation of plasmid DNA
2. Digestion of plasmid with three different restriction enzymes.
3. To perform Ligation reaction
4. Transformation of cells & Confirmation of the transformants for the presence of plasmid by blue white selection
5. To perform Polymerase chain reaction

**Books Recommended:**

1. Primrose, SB and Twyman, R. (2013). Principles of Gene Manipulation and genomics, 8<sup>th</sup> Edition, Wiley Blackwell.
2. Sambrook, J and Green MR (2012) Molecular Cloning: A Laboratory Manual, 4<sup>th</sup> Edition, CSHL.
3. Brown TA. (2017) Genomes, 4<sup>th</sup> Edition, Garland Science

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2022-23**  
**Course Code: BBTM-6062**  
**Animal Biotechnology-II**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Understand the basics of animal cell culture.

**CO2:** Understand about Transfection methods and expression vectors

**CO3:** Know about Stem cells and their benefit for human benefit.

**CO4:** Understand the role of genetic engineering in the improvement of animal cell for human welfare.

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2022-23**  
**Course Code: BBTM-6062**  
**Animal Biotechnology-II**  
**(Theory)**

**Time: 3 Hours**

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

**Instructions for the Paper Setter**

Eight questions of equal marks 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. Each question carries 6 marks.

**Unit- I**

Commonly used animal cell line, their origin and characteristics (WI-38, MRC-5, IMR-90, HEK-293, HeLa, A 549), Differentiation of cells, Organotypic and histotypic cultures: Organotypic culture: Gas and nutrient exchange, structure integrity, growth, differentiation, advantages and applications. Methods, advantages and applications of histotypic culture. Three dimensional culture and tissue engineering: Concept of tissue engineering, components of tissue engineering, cells imaging in 3D construct.

**Unit- II**

Transfection methods (calcium phosphate precipitation, DEAE-Dextran- mediated transfection, Lipofection, electroporation, Retroviral infection, Microinjection), Promoters, Expression vectors and detection of transgenics, need to express proteins in animal cells.

**Unit- III**

Applications: Cell fusion and production of monoclonal antibodies; scale up methods for propagation of anchorage dependent and suspension cell culture; Bioreactors for large scale culture of cells; micro carrier cultures; Stem cells- Basics, embryonic & adult stem cells & their applications, Transdifferentiation.

**Unit-IV**

Genetic Engineering in Animal Cells: Methodology for Transgenic animals (Mice, rabbit, Cattle, goat, sheep, pigs, Fish) production of regulatory proteins, blood products, vaccines and hormones, Transgenic

animal as bioreactor, Animal cloning- IVF & embryo transfer, Benefits and Concerns surrounding the use of animal biotechnology

### **Books Recommended**

1. Gareth, EJ. (1996). Human Cell Culture Protocols, Humara Press.
2. Butler, M. (2004). The Animal Cell Culture and Technology, IRL Oxford Univ. Press.
3. Julio, E., Celis (1998). Cell Biology-A laboratory hand book, Vol. I-IV, 2<sup>nd</sup> Edition, Academic Press, New York.
4. Freshney, RT. (2016), Culture of Animal Cells 7<sup>th</sup> Edition, John Wiley and Sons, New York.

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2022-23**  
**Course Code: BBTM-6062(P)**  
**Animal Biotechnology-II**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Maintain cultures of animal cells and established cell lines with good viability, minimal contamination and appropriate documentation.

**CO2:** Perform supportive tasks relevant to cell culture, including preparation and evaluation of media, cryopreservation and recovery, and assessment of cell growth and health.

**CO3:** Recognise and troubleshoot problems common to routine cell culture.

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2022-23**  
**Course Code: BBTM-6062(P)**  
**Animal Biotechnology-II**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**Instructions for the practical Examiner:**

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. Seeding of cell line.
2. Maintenance of a cell line and check doubling time.
3. Isolation of RNA from blood.
4. Observation of adherent (Fibroblastic, epithelial) and suspension cultures (Lymphoblast).
5. To perform trypsinization of cells.
6. Cell counting by haemocytometer
7. Determination of the IC<sub>50</sub> value of a drug using MTT assay

**Book Recommended:**

1. Freshney, RT. (2016), Culture of Animal Cells. 7<sup>th</sup> Edition, John Wiley and Sons, New Delhi.
2. Butler, M. (2004). The Animal Cell Culture and Technology, IRL Oxford Univ. Press.

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2022-23**  
**Course Code: BBTM-6063**  
**Plant Biotechnology-II**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Understand basic concepts of Micropropagation.

**CO2:** Understand the concept of generation of variations in plants.

**CO3:** Learn important milestones in plant tissue culture.

**CO4:** Understand the concept of protoplast fusion and somatic cell hybridization and secondary metabolite production

**Bachelor of Science (Bio-Technology) Semester-VI**

**Session: 2022-23**

**Course Code: BBTM-6063**

**Plant Biotechnology-II**

**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setter**

Eight questions of equal marks 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. Each question carries 6 marks.

**Unit I**

Micropropagation methods (axillary bud, shoot-tip and meristem culture), Stages of micropropagation, Factors affecting micropropagation and technical problems, Applications of micropropagation, Acclimatization of tissue culture raised plants. Modes of regeneration, Somatic embryogenesis and organogenesis, Types of somatic embryogenesis, Applications of somatic embryogenesis.

**Unit II**

Haploid and triploid plant production through tissue culture; ovary and ovule culture; embryo culture and rescuing hybrid embryos; somaclonal variations, selection of variant cell lines and its applications.

**Unit-III**

Protoplast isolation and culture, viability of protoplasts, protoplast fusion, selection of somatic hybrids and cybrids, applications of somatic cell hybridization.

**Unit-IV**

Cell suspension culture, production of secondary metabolites by plant tissue culture, immobilized plant cell culture, use of bioreactors in secondary metabolite production, transgenic approaches in secondary metabolite production.

**Books Recommended:**

1. Bhojwani, S.S, and Razdan, M.K. (2004). Plant Tissue Culture. Theory and Practice, Elsevier.
2. Razdan, M.K. (2019) Introduction to Plant tissue culture, Science Publishers.

3. Singh, B.D. (2021) *Biotechnology expanding horizons*, Kalyani Publishers, New Delhi.

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2022-23**  
**Course Code: BBTM-6063(P)**  
**Plant Biotechnology-II**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Perform micropropagation techniques.

**CO2:** Learn different pathways of plant regeneration under in vitro conditions.

**CO3:** Understand techniques of establishing cell suspension cultures

**CO4:** Carry out culture experiments with different explants.

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2022-23**  
**Course Code: BBTM-6063(P)**  
**Plant Biotechnology-II**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**Instructions for the practical Examiner:**

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. Micropropagation and its different steps.
2. Significance of growth hormones in culture medium.
3. Induction of callus from different explants.
4. To study regeneration of shoots/embryos.
5. Raising of cell suspension cultures.
6. Anther culture, ovary culture and embryo rescue.

**Books Recommended:**

1. Taiz, L and Zeiger, E. (2014). Plant Physiology, 6th Edition, Sinauer Associates.
2. Razdan, MK. (2019) Introduction to Plant tissue culture, Science Publishers
3. Bhojwani, SS and Razdan, MK. (2004). Plant Tissue Culture. Theory and Practice, Elsevier.
4. Smith, RH. (2000) Plant tissue culture: techniques and experiments, Gulf professional publishing

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2022-23**  
**Course Code: BBTM-6064**  
**Bioprocess Engineering-II**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Learn about the Design of a Fermenter and how to use it.

**CO2:** Study about all the parameters to be considered while operating a fermenter.

**CO3:** Study about different techniques of Downstream Processing.

**CO4:** Learn about Effluent treatment and fermentation Economics.

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2022-23**  
**Course Code: BBTM-6064**  
**Bioprocess Engineering-II**  
**(Theory)**

**Time: 3 Hours**

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

**Instructions for the Paper Setter**

Eight questions of equal marks 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. Each question carries 6 marks.

**Unit-1**

Design of a Fermenter: Introduction, fermenter for microbial, animal & plant cell culture, Aseptic operation of fermenter, impeller and spargers, batch, fed batch, C.S.T.B.R, plug flow and air loop bioreactors and its kinetics.

**Unit-II**

Control and measurement equipments of fermenter (Temperature & pH control system, Flow measurement, foam sensing, pressure control & D.O. probes, Operation and agitation and its kinetics.

**Unit-III**

Down Stream Processing: Introduction, removal of microbial cells and other solid matters. Foam separation, filtration, industrial filters and its principles, centrifugation and industrial centrifuges, cell disruption, aqueous two phase extraction system, Basics concept of super critical fluid extraction and whole broth processing.

**Unit-IV**

Effluent treatment- Primary, Secondary and Tertiary treatment, aerobic and anaerobic slug treatment process, fermentation economics.

**Books Recommended:**

1. Stanbury, PF, Whitaker, A. and Hall, SJ. (2016). Principles of Fermentation Technology 2<sup>nd</sup> Edition., Pergamon Press, Oxford.
2. Young, MY. (2000). Comprehensive Biotechnology (Vol. 1-4), Pergamon Press, Oxford.
3. Young, MY. (1996). Environmental Biotechnology, Principles & Applications, Kluwer Academic Publications, New Delhi.
4. Bailary, JE. and Ollis, DF. (1986). Biochemical Engineering Fundamentals, McGraw Hills, New York.

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2022-23**  
**Course Code: BBTM-6064(P)**  
**Bioprocess Engineering-II**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Undergo two-week training in fermentation technology in industry/institute and learn practical aspects of fermentation technology

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2022-23**  
**Course Code: BBTM-6064(P)**  
**Bioprocess Engineering-II**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**Note:**

Students will go for at least two-week training in industry/institute and the students will be required to submit written report of their training which will be evaluated by the teacher who has taught theory course.

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2022-23**  
**Course Code: BBTM-6066**  
**Biochemical and Biophysical Techniques-II**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Illustrate the working principles electrophoresis techniques and their role in science.

**CO2:** How to measure radioactivity, instruments used for detecting and measuring radiations.

**CO3:** Understand the concepts of spectrophotometry and applications of different types of spectrophotometry.

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2022-23**  
**Course Code: BBTM-6066**  
**Biochemical and Biophysical Techniques-II**  
**(Theory)**

**Time: 3 Hours**

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

**Instructions for the Paper Setter**

Eight questions of equal marks 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. Each question carries 6 Marks.

**UNIT-I**

Electrophoresis: Factors affecting electrophoretic mobility, Types of electrophoresis, Basic principle, theory and application of native, SDS-PAGE and Agarose Gel electrophoresis, Use of solubilizers in electrophoresis.

**UNIT-II**

Introduction to IEF (Iso-electric focusing), Two dimensional gel electrophoresis and capillary electrophoresis, Applications of electrophoresis in biology for isolation of biomolecules based on charge and molecular weight.

**UNIT III**

Mass spectroscopy: Ionization methods and Analyzers, MALDI TOF and MALDI Q, Applications of mass spectroscopy in biology for qualitative and quantitative determination of bio-molecules, Introduction to fluorescence spectroscopy

**UNIT-IV**

Radioisotopic Techniques: Basic concepts of radioisotopy, theory and applications of Geiger- Muller tube, solid and liquid scintillation counters, primary and secondary flours. Safety rules for radioisotopic studies. Introduction to concept of biosafety and biosecurity

**Books Recommended:**

1. Upadhyay, A., Upadhyay, K. and Nath N. (2016) Biophysical chemistry: Principles and Techniques. Himalaya Publishing House, India.
2. Wilson K. and Walker J. (Eds.) (2010). Practical Biochemistry: Principles and Techniques, Cambridge University Press, U.K.
3. Sheehan, D. (2009). Physical Biochemistry: Principles and Applications, John Wiley and Sons Ltd., Chichester, England.
4. Freifelder, D. (1982). Physical Biochemistry. Applications to Biochemistry & Molecular Biology, W.H. Freeman.
5. Mousumi, D. (2011). Tools and techniques of biotechnology. Jaipur, India: Pointer Publisher.

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2022-23**  
**Course Code: BBTM-6066(P)**  
**Biochemical and Biophysical Techniques-II**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Learn about the qualitative and quantitative analysis of DNA sample

**CO2:** Prepare standard curve of protein

**CO3:** Prepare standard curve of DNA

**CO4:** Separation of bio-molecules by vertical and horizontal gel electrophoresis

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2022-23**  
**Course Code: BBTM-6066(P)**  
**Biochemical and Biophysical Techniques-II**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**Instructions for the practical Examiner:**

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. Preparation of standard curve of protein
2. Preparation of standard curve of DNA.
3. Casting of horizontal gel and Separation of bio-molecules by electrophoresis
4. Casting of Native-PAGE gel and Separation of bio-molecules by electrophoresis.
5. Casting of discontinuous PAGE gel and Separation of bio-molecules by electrophoresis.

**Books Recommended:**

1. Upadhyay, A., Upadhyay, K. and Nath N. (2016) Biophysical chemistry: Principles and Techniques. Himalaya Publishing House, India.
2. Wilson K. and Walker J. (Eds.) (2010). Practical Biochemistry: Principles and Techniques, Cambridge University Press, U.K.
3. Sheehan, D. (2000). Physical Biochemistry: Principles and Applications, John Wiley and Sons Ltd., Chichester, England.
4. Freifelder, D. (1982). Physical Biochemistry. Applications to Biochemistry & Molecular Biology, W.H. Freeman & Co.

**Bachelor of Science (Bio-Technology) Semester-VI**

**Session: 2022-23**

**Course Code: BBTS-6067**

**Term Paper**

**(Seminar)**

**Time: 3 Hrs.**

**Max. Marks: 20**

**Instructions:**

Term paper on recent advances in Life Sciences using Internet and Library based resources. To be presented as hard copy/ CD. Viva/ Seminar to be conducted by a panel of three internal examiners.

Annexure-D

**FACULTY OF LIFE SCIENCES**

**SYLLABUS**

**Of**

**B. Sc. Home Science (Semester-V & VI)**

**Session: 2022-23**



**The Heritage Institution**

**KANYA MAHA VIDYALAYA, JALANDHAR**

**(Autonomous)**

**Kanya Maha Vidyalaya, Jalandhar (Autonomous)**

**SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAMME**

**Bachelor of Science (Home Science)**

**Session: 2022-23**

**Semester V**

Course Code	Course Name	Course Type	Marks				Examination time (in Hours)
			Total	Ext.		CA	
				L	P		
BHSL-5063	Basic Nutritional Biochemistry	C	50	40	-	10	3

**C-Compulsory**

**Bachelor of Science (Home Science) Semester-V**  
**Session: 2022-23**  
**Course Code: BHSL-5063**  
**Basic Nutritional Biochemistry-I**  
**(Theory)**

**Time: 3 Hrs.**

**Max. Marks: 50**  
**Theory: 40**  
**CA: 10**

**Course Outcomes:**

After completing this course, student will be able to

**CO1:** Understand the concept of carbohydrates.

**CO2:** Understand metabolism of carbohydrates.

**CO3:** Understand basic concepts of fats.

**CO4:** Understand basics of inorganic elements and their dietary sources.

**Bachelor of Science (Home Science) Semester-V**  
**Session: 2022-23**  
**Course Code: BHSL-5063**  
**Basic Nutritional Biochemistry-I**  
**(Theory)**

**Time: 3 Hrs.**

**Max. Marks: 50**  
**Theory: 40**  
**CA: 10**

**Instructions for the Paper Setters:**

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of 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. Each question carries 8 marks.

**Unit-I**

Carbohydrates: Introduction, Monosaccharides: Families of monosaccharides: aldoses and ketoses, trioses, tetroses, pentoses, and hexoses, disaccharides and polysaccharides: storage polysaccharides - starch and glycogen; Structural Polysaccharides - cellulose, and chitin; Heteropolysaccharides: Peptidoglycan, Proteoglycan, glycoproteins.

**Unit-II**

Intermediary Metabolism of Carbohydrates: Biosynthesis and degradation of carbohydrates, Glycolysis, TCA Cycle, Gluconeogenesis. Structural formula of fatty acids, triglycerides and phospholipids. Rancidity of fats & its prevention.

**Unit-III**

Acid value and saponification value of fat. Essential fatty acid. Study of intermediary metabolism of fat oxidation and biosynthesis of fatty acids.

**Unit-IV**

Inorganic elements (calcium, phosphorus, magnesium and iron): Dietary source, Daily requirement, Biochemical function and Metabolism.

**Books Recommended:**

1. Jain, J. L., Jain, S. and Jain. N. (2016). Fundamentals of Biochemistry, S. Chand & Company Ltd., New Delhi.
2. Sharma, D. C. (2017). Nutritional Biochemistry, CBS Nursing Publishers.
3. Voet, D., Voet, J.G. (2012). Fundamentals of Biochemistry, John Wiley and Sons, New York.
4. Nelson, D.L. and Cox, M.M. (2017), Lehninger Principles of Biochemistry, 7<sup>th</sup> Edition, WH Freeman, New York.

**Kanya Maha Vidyalaya, Jalandhar (Autonomous)**

**SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAMME**

**Bachelor of Science (Home Science)**

**Session: 2022-23**

<b>Bachelor of Science (Home Science) Semester-VI</b>							
<b>Course Code</b>	<b>Course Name</b>	<b>Course Type</b>	<b>Marks</b>				<b>Examination Time (in Hours)</b>
			<b>Total</b>	<b>Ext.</b>		<b>CA</b>	
				<b>L</b>	<b>P</b>		
BHSM-6066	Applied Nutritional Biochemistry	C	50	25	15	10	3+3
<b>Total</b>			<b>420</b>				

<sup>3</sup>Marks of these papers will not be added in total marks and only grades will be provided.

**C-Compulsory**

**AC- Audit course**

**Bachelor of Science (Home Science) Semester-VI**

**Session: 2022-23**

**Course Code: BHSM-6066**  
**Applied Nutritional Biochemistry**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Study about general metabolism of protein

**CO2:** Have knowledge about B.M.R. and factors affecting B.M.R.

**CO3:** Get knowledge about the Urine composition and their normal and abnormal constituents

**CO4:** Study the Water and electrolyte balance

**Bachelor of Science (Home Science) Semester-VI**

**Session: 2022-23**

**Course Code: BHSM-6066**

**Applied Nutritional Biochemistry  
(Theory)**

**Time: 3Hrs**

**Max. Marks: 50**

**Theory: 25**

**Practical: 15**

**CA: 10**

**Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). 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. Each question carries 5 Marks.

**SECTION-A**

Structural formulae of amino acids peptide bonds.

- Hydrolytic breakdown of protein & essential amino acids.
- Nitrogen balance
- Protein efficiency ratio and biological value of protein.
- Elementary study of general metabolism of protein, building up of amino acid pool. General reaction of amino acid metabolism.
- Urea Cycle
- Essential amino acids

**SECTION-B**

B.M.R. – Meaning and factors affecting B.M.R. specific dynamic action of good stuffs.

**SECTION-C**

- Enzymes – definition, classification and specificity of enzymes.
- Factors affecting enzyme activity.

**SECTION-D**

- Urine composition, normal and abnormal constituents of urine
- Water and electrolyte balance, water and electrolyte losses and their replenishment effect of dehydration.



**Bachelor of Science (Home Science) Semester-VI**

**Session: 2022-23**

**Course Code: BHSM-6066(P)**  
**Applied Nutritional Biochemistry**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Perform Qualitative analysis of monosaccharide, disaccharide and polysaccharide.

**CO2:** Estimate Glucose Quantitatively

**CO3:** Test the reaction of protein fats and carbohydrate in bread, milk and egg.

**Bachelor of Science (Home Science) Semester-VI**

**Session: 2022-23**

**Course Code: BHSM-6066(P)**  
**Applied Nutritional Biochemistry**  
**(Practical)**

**Time: 3 Hrs.**

**Marks: 15**

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

1. Qualitative analysis of monosaccharide, disaccharide and polysaccharide.
2. Quantitative estimation of Glucose.
3. To test the reaction of protein fats and carbohydrate in bread, milk and egg.
4. Biochemical analysis of Urine Sample.

**Annexure-E**

**Kanya Maha Vidyalaya, Jalandhar (Autonomous)**

**SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAMME  
Bachelor of Vocation (Nutrition, Exercise and Health)  
(Session 2022-2023)  
(Credit Based Continuous Evaluation Grading System)**

<b>Semester IV</b>								
<b>Course code</b>	<b>Course type</b>	<b>Course Titles</b>	<b>Credits L-T-P</b>	<b>Max Marks</b>				<b>Examination time (in Hours)</b>
				<b>Total</b>	<b>Ext.</b>		<b>CA</b>	
					<b>L</b>	<b>P</b>		
BVNM- 4285	S	Nutritional Biochemistry	2-0-2	100	60	20	20	3+3

**Bachelor of Vocation (Nutrition, Exercise and Health) (Semester– IV)**

**Session 2022-2023**

**COURSE CODE: BVNM -4285**

**Nutritional Biochemistry**

**(Theory)**

**Course Outcome:**

CO (1): To Understand the knowledge of Classification and properties of bio molecules.

CO (2): To Understand the concept of Intermediary Metabolism of Carbohydrates, Proteins and lipids

CO (3): To review the knowledge of Enzymes, Hormones and Inborn errors of metabolism

CO (4): to Understand the Concept of Vitamins, Minerals and Antioxidants

**Bachelor of Vocation (Nutrition, Exercise and Health) (Semester– IV)**

**Session 2022-2023**

**COURSE CODE: BVNM -4285**

**Nutritional Biochemistry  
(Theory)**

**Time: 3 Hours**

**Max. Marks: 100**

**L-T-P**

**Theory: 60**

**2-0-2**

**Practical: 20**

**CA: 20**

**Instructions for the Paper Setter**

- Eight questions of equal marks 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). Each question carry 12 marks.
- Candidates are required to attempt five questions, selecting at least one question from each section.
- The fifth question may be attempted from any Section.

**UNIT - I**

1. Classification and properties of biomolecules:
  - Carbohydrates- Classification and importance of Monosaccharide, Disaccharides and Polysaccharides (without structures)
  - Classification of lipids (without structures)
  - Classification of amino acids and proteins- Essential and non-essential amino acids (without structures)

**UNIT- II**

2. Intermediary Metabolism: Overview (no structures)
  - Carbohydrates- Glycolysis, Gluconeogenesis, TCA cycle.
  - Proteins- Urea cycle.
  - Lipids-  $\beta$ -oxidation and de novo synthesis of fatty acids, ketone bodies.

**UNIT-III**

3. Enzymes:
  - Definition and classification of enzymes; Coenzymes.
  - Factors affecting enzyme catalysis.
4. Hormones:
  - Introduction to hormones.
  - Mechanism of hormone action; Biological role of Insulin and Glucagon.

**UNIT- IV**

5. Vitamins: Vitamins- Biochemical role
  - Fat soluble vitamins – A, D, E & K
  - Water soluble vitamins– (B1 and B2 only) and C

6. Minerals (elementary aspects):

- Macrominerals– Calcium, Sodium, Potassium, Magnesium
- Microminerals– Iron, Copper, Zinc, Iodine.

References:

- Berg JM, Tymoczko JL and Stryer L. (2002) Biochemistry 5th ed. W.H. Freeman.
- West ES, Todd WR, Mason HS and Van Bruggen JT: Textbook of Biochemistry, 4th Ed. Amerind Publishing Co. Pvt. Ltd.
- Murray RK, Granner DK, Mayes PA and Rodwell VW, (2003) Harper's Illustrated Biochemistry, 26th ed. McGraw-Hill (Asia).
- Nelson DL and Cox MM. (2005) Principles of Biochemistry, 4th ed. Freeman and Company.
- Voet D and Voet JG. (2004) Biochemistry 3rd ed. John Wiley and Sons.

**Bachelor of Vocation (Nutrition, Exercise and Health) (Semester– IV)**

**Session 2022-2023**

**COURSE CODE: BVNM -4285**

**Nutritional Biochemistry**

**(Practical)**

**Course Outcome:**

CO (1): To knowledge about Qualitative analysis of monosaccharide, disaccharide and polysaccharide.

CO (2): To knowledge about Quantitative estimation of glucose.

CO (3): To knowledge about test the reaction of protein fats and carbohydrate in bread, milk and egg

**Bachelor of Vocation (Nutrition, Exercise and Health) (Semester– IV)**

**Session 2022-2023**

**COURSE CODE: BVNM -4285**

**Nutritional Biochemistry  
(Practical)**

**Time: 3hrs**

**Marks: 20**

**CONTENTS:**

1. Qualitative analysis of monosaccharide, disaccharide and polysaccharide.
2. Quantitative estimation of glucose.
3. To test the reaction of protein fats and carbohydrate in bread, milk and egg

Annexure-F

**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-1046	Computer Applications and Bioinformatics	IC	3	2-1-0	3	50	40	-	10	3

**Session: 2022-24**  
**Master of Science (Botany) Semester-I**  
**Course Title: Computer Applications and Bioinformatics**  
**Course Code: MBTL-1046**

**Course outcomes:**

A student completing this paper shall be able to apply:

CO: 1 Understand the concept, applications, basic and advanced skills of MS-Word.

CO: 2 Learn problem-solving skills, including the ability to develop new algorithms and analysis methods in Microsoft-Excel.

CO: 3 Understand working with MS-Powerpoint and basic concepts of Bioinformatics.

CO: 4 An understanding of the intersection of life and information sciences, the core of shared concepts, language and skills the ability to speak the language of structure-function relationships, information theory, gene expression, and database queries.

**Session: 2022-24**  
**Master of Science (Botany) Semester-I**  
**Course Title: Computer Applications and Bioinformatics**  
**Course Code: MBTL-1046**

**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 (08 marks each) are to be set, two in each of the four Sections (A-D). 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.

**SECTION-A**

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

**SECTION-B**

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

Working with Formulae: cell referencing, use of formulae, auto sum, copying formulae, absolute & relative addressing, working with ranges- creating, editing and selecting ranges, Previewing & Printing Worksheet: page setting, print titles, adjusting margins, page break, headers and footers. Graphs and Charts: using wizards, various charts type, formatting grid lines & legends, previewing & printing charts.

**SECTION-C**

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

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

**SECTION-D**

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

**Reference Books:**

- 1.) Baxevas B.F. and Quellette F. (2004). Bioinformatics A Practical Guide to the Analysis of Genes and Proteins. Wiley-Interscience.
- 2.) Bourhe P. E. and Weissig H. (2003). Structural Bioinformatics (Methods of Structural Analysis). Wiley-Liss.
- 3.) Eidhammer I., Jonassen I. and Taylor W. R. (2004). Protein Bioinformatics: An Algorithmic Approach to Sequence and Structure Analysis. Mathematics.
- 4) Mount D. W. (2004). Bioinformatics & Genome Analysis. Cold Spring Harbor Laboratory Press.
- 5) Orengo C.A., Jones D.T. and Thornton J.M. (2003). Bioinformatics: Genes Proteins and Computers. Bios Scientific Pub.
- 6) Peter Norton's (1998). Introduction to computers, Tata McGraw-Hill Publishing Company Limited, New Delhi
- 7) Sinha, P.K. (1998). Computer Fundamentals. BPB Publications, New Delhi.