॥ सा विद्या या विमुक्तये ॥

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

'ज्ञानतीर्थ', विष्णुपुरी, नांदेड – ४३१ ६०६ (महाराष्ट्र राज्य) भारत

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

'Dnyanteerth', Vishnupuri, Nanded - 431 606 (Maharashtra State) INDIA

Established on 17th September, 1994, Recognized By the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'B++' grade

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

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विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत राष्ट्रीय शैक्षणिक धोरण २०२० नुसार पदवी द्वितीय वर्षाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२५–२६ पासून लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, दिनांक २७ मे २०२५ रोजी संपन्न झालेल्या मा. विद्यापरिषद बैठकीतील विषय क्रमांक १६/६१–२०२५ च्या ठरावानुसार विज्ञान व तंत्रज्ञान विद्याशाखेतील राष्ट्रीय शैक्षणिक धोरण–२०२० नुसारचे पदवी द्वितीय वर्षाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२५–२६ पासून लागू करण्यास मा. विद्यापरिषदेने मान्यता प्रदान केली आहे. त्यानुसार विज्ञान व तंत्रज्ञान विद्याशाखेतील बी. एस्सी द्वितीय वर्षाचे खालील विषयाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२५–२६ पासून लागू करण्यात येत आहेत.

01	B.Sc. II year Zoology
02	B.Sc. II year Chemistry (General)
03	B.Sc. II year Biotechnology (Vocational)
04	B.Sc. II year Dyes & Drugs
05	B.Sc. II year Biotechnology
06	B.Sc. II year Bioinformatics

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या **www.srtmun.ac.in** या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी, ही विनंती.

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड – ४३१ ६०६.
जा.क्र.:शै–१/एनइपी/विवत्रंविपदवी/२०२५–२६/134
दिनांक १६.०६.२०२५

सहाय्यक कुलसचिव
शैक्षणिक (१–अभ्यासमंडळ) विभाग

प्रत : माहितीस्तव तथा कार्यवाहीस्तव.

१) मा. कुलगुरू महोदयांचे कार्यलय, प्रस्तुत विद्यापीठ.
२) मा. प्र. कुलगुरू महोदयांचे कार्यलय, प्रस्तुत विद्यापीठ.
३) मा. आधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
४) मा. संचालक, परीक्षा व मुंल्यमापन मंडळ, प्रस्तुत विद्यापीठ.
५) मा. प्राचार्य, सर्व संबधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
६) सिस्टीम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ. याना देवून कळविण्यात येते की, परिपत्रक अभ्यासक्रम संकेतस्थळावर प्रसिध्द करण्यात यावेत.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

STRUCTURE AND SYLLABUS OF A FOUR-YEAR MULTIDISCIPLINARY DEGREE PROGRAM WITH MULTIPLE ENTRY AND EXIT OPTIONS

UNDER

NATIONAL EDUCATION POLICY (NEP 2020)

In

SUBJECT: Biotechnology (Vocational)

FACULTY OF SCIENCE AND TECHNOLOGY

B. Sc. Second Year
(Affiliated Colleges)

With Effect From June 2025

From the Desk of the Dean, Faculty of Science and Technology

Swami Ramanand Teerth Marathwada University, Nanded, enduring to its vision statement "***Enlightened Student: A Source of Immense Power***", is trying hard consistently to enrich the quality of science education in its jurisdiction by implementing several quality initiatives. Revision and updating curriculum to meet the standard of the courses at national and international level, implementing innovative methods of teaching-learning, improvisation in the examination and evaluation processes are some of the important measures that enabled the University to achieve ***the 3Es, the equity, the efficiency*** and ***the excellence*** in higher education of this region. To overcome the difficulty of comparing the performances of the graduating students and also to provide mobility to them to join other institutions the University has adopted the cumulative grade point average (CGPA) system in the year 2014-2015. Further, following the suggestions by the UGC and looking at the better employability, entrepreneurship possibilities and to enhance the latent skills of the stakeholders the University has adopted the Choice Based Credit System (CBCS) in the year 2018-2019 at graduate and post-graduate level. This provided flexibility to the students to choose courses of their own interests. To encourage the students to opt the world-class courses offered on the online platforms like, NPTEL, SWAYM, and other MOOCS platforms the University has implemented the credit transfer policy approved by its Academic Council and also has made a provision of reimbursing registration fees of the successful students completing such courses.

SRTM University has been producing a good number of high calibre graduates; however, it is necessary to ensure that our aspiring students are able to pursue the right education. Like the engineering students, the youngsters pursuing science education need to be equipped and trained as per the requirements of the R&D institutes and industries. This would become possible only when the students undergo studies with an updated and evolving curriculum to match global scenario.

Higher education is a dynamic process and in the present era the stakeholders need to be educated and trained in view of the self-employment and self-sustaining skills like start-ups. Revision of the curriculum alone is not the measure for bringing reforms in the higher education, but invite several other initiatives. Establishing industry-institute linkages and initiating internship, on job training for the graduates in reputed industries are some of the important steps that the University would like to take in the coming time. As a result, revision

of the curriculum was the need of the hour and such an opportunity was provided by the New Education Policy 2020. National Education Policy 2020 (NEP 2020) aims at equipping students with knowledge, skills, values, leadership qualities and initiates them for lifelong learning. As a result the students will acquire expertise in specialized areas of interest, kindle their intellectual curiosity and scientific temper, and create imaginative individuals.

The curriculum given in this document has been developed following the guidelines of NEP-2020 and is crucial as well as challenging due to the reason that it is a transition from general science based to the discipline-specific-based curriculum. All the recommendations of the ***Sukanu Samiti*** given in the **NEP Curriculum Framework-2023** have been followed, keeping the disciplinary approach with rigor and depth, appropriate to the comprehension level of learners. All the Board of Studies (BoS) under the Faculty of Science and Technology of this university have put in their tremendous efforts in making this curriculum of international standard. They have taken care of maintaining logical sequencing of the subject matter with proper placement of concepts with their linkages for better understanding of the students. We take this opportunity to congratulate the Chairman(s) and all the members of various Boards of Studies for their immense contributions in preparing the revised curriculum for the benefits of the stakeholders in line with the guidelines of the **Government of Maharashtra regarding NEP-2020**. We also acknowledge the suggestions and contributions of the academic and industry experts of various disciplines.

We are sure that the adoption of the revised curriculum will be advantageous for the students to enhance their skills and employability. Introduction of the mandatory ***On Job Training, Internship program*** for science background students is praise worthy and certainly help the students to imbibe firsthand work experience, team work management. These initiatives will also help the students to inculcate the workmanship spirit and explore the possibilities of setting up of their own enterprises.

Dr. M. K. Patil
Dean
Faculty of Science and Technology

From the Desk of the Chairman, BOS in Biotechnology and Bioinformatics:

Preamble: The National Education Policy 2020 (NEP 2020) is formulated to revamp education system and lay down road map for new India. This policy is framed based on the fundamental pillars of access, equity, quality, affordability, and accountability and seeks to transform India into a thriving knowledge society and a global knowledge superpower.

Some of the important features of National Education Policy are increasing gross enrolment ratio in higher education, holistic and multidisciplinary education with multiple entry/exit options, establishment of academic bank of credit, setting up of multidisciplinary education and research Universities and National Research Foundation, expansion of open and distance learning to increase gross enrolment ratio, internationalization of education, motivated with energized and capable faculty, online and digital education and effective governance and leadership.

As per the National Education Policy, the Government of Maharashtra has proposed a model curriculum framework and an implementation plan for the State of Maharashtra. It is to suggest and facilitate the implementation of schemes and programs, which improve not only the level of academic excellence but also improve the academic and research environment in the state. The proposed curriculum framework endeavours to empower the students and help them in their pursuit for achieving overall excellence.

In view of NEP priority and in keeping with its vision and mission, process of updating the curriculum is initiated and implemented in SRTM University at UG and PG level from the academic year 2023-2024.

Biotechnology is often considered as the technology of hope for meeting future challenges like feeding our increasing population, cleaning dangerously polluted environments and potentiating healthcare sector etc. Establishment of new IISERs, Central Universities and IITs indicate that we are already on the track of developing infrastructure and human resource. Our dream of becoming future 'superpower' will not be possible without Biotechnology and inclusive efforts. Therefore, it is necessary to attract young and bright students and train them in the field of Biotechnology.

Keeping in mind, BOS in Biotechnology and Bioinformatics prepared the curriculum to ensure up-to-date level of understanding of Vocational Biotechnology. Studying Vocational Biotechnology prepares the students for their career working either in educational institutions or industries in which they can be directly involved in the teaching, research and development. Also, to ensure uniform curriculum and its quality at UG/PG level , curriculum of different Indian Universities, syllabus of NET, SET, MPSC and UPSC and the UGC model curriculum is referred to serve as a base in updating the same.

The comments or suggestions from all teachers, students and other stakeholders are welcome for upbringing this curriculum.

Salient Features:

The syllabus of B Sc Biotechnology (Vocational) has been framed to meet the requirements of Choice Based Credit System under NEP 2020. The courses offered here will train and orient the students in the specific field of Vocational Biotechnology.

The Core Courses deal with Fundamentals of Biochemistry, Principles of Immunology and Virology, Basic Instrumentation Techniques, and Developmental Biology.

Apart from the core courses, Generic Elective Courses deal with Applications of Biotechnology and Medical Biotechnology

The Skill Enhancement Courses, like Algal Culture Technology and Biopesticide Production Technology, offered during this program are designed with the aim of imparting specific skills to the students, which will lead to their employability and the development of their own enterprises.

This would help students to lay a strong foundation in the field of Vocational Biotechnology.

Overall after completion of this course, students will also acquire fundamental knowledge and applications of Biotechnology.

Program Educational Objectives:

The Objectives of this program are:

PEO1: To offer an undergraduate program in Biotechnology (Vocational) based on the needs of industries, academic and research institutions worldwide.

PEO2: To promote and popularize Vocational Biotechnology at grass root level and attract young and budding talents.

PEO3: To expose the students to the different emerging fields of Vocational Biotechnology.

PEO4: To update the curriculum by introducing recent advances in the subject that enable the students to successfully face NET, SET, MPSC, UPSC, and other competitive examinations.

PEO5: To train and orient the students so as to develop human resources for the educational institutes and other organizations.

PEO6: To inculcate analytical and application oriented abilities to create active and frontline researchers and human resource for the industries.

PEO7: To develop specific skills amongst students for employability and for the development of their own enterprises.

Program Outcomes:

The Outcomes of this program are:

PO1: This program shall promote and popularize Vocational Biotechnology at grass root level and shall attract young and budding talents.

PO2: This program will expose the students to the different emerging fields of Vocational Biotechnology.

PO3: This will provide updated curriculum with recent advances in the subject that enable the students to successfully face NET, SET, MPSC, UPSC and other competitive examinations.

PO4: This program shall train and orient the students to develop human resource for the educational institutes and other organizations.

PO5: This program shall train and orient the students to develop active and frontline researchers and human resource for the industries.

PO6: This will also develop specific skills amongst students for employability and for the development of their own enterprises.

Prerequisite:

The students should have basic knowledge of science at 10+2 level. The optional courses are offered to students registered for undergraduate programs. Such students should have the basic knowledge of Vocational Biotechnology and are willing to gain additional knowledge in the field of Vocational Biotechnology.

The students seeking admission to this program should have cleared the 10+2 examination from any recognized Board.

Dr Sunita D Lohare

Chairman, BOS in Biotechnology and Bioinformatics,

Swami Ramanand Teerth Marathwada University,

Nanded 431606.

Details of the Board of Studies Members in the subject Biotechnology and Bioinformatics under the Faculty of Science & Technology, S.R.T.M. University, Nanded.

Sr No	Name of the Member	Designation	Sr No	Name of the Member	Designation
1	Dr Sunita Dhundiraj Lohare, Shri Havgiswami Mahavidyalaya, Udgir, Dist. Latur Mob 9284161504	Chairman	2	Dr Babasaheb S Surwase School of Life Sciences SRTM, University, Nanded 431606. Mob 9075829767	Member
3	Dr Pratap V. Deshmukh Nagnath Arts, Commerce and Science College, Aundha Nagnath, Dist. Hingoli Mob 9637202024	Member	4	Dr Komal S. Gomare Dept of Biotechnology, Dayanand Science College, Latur Mob 9284238413	Member
5	Dr Vaibhav D. Deshpande General Manager, Quality Corporate Office, Wockhardt, Mumbai Mob 9100988260	Member		--	
	Invitee Members				
6	Dr Laxmikant Kamble School of Life Sciences, SRTM University, Nanded 431606. Mob 8669695555	Member	7	Dr M M V Baig Dept of Biotechnology, Yeshwant Mahavidyalaya, Nanded. Mob 9422170641	Member
8	Dr Arun Ingale School of Life Sciences, North Maharashtra University, Umavinagar, Jalgaon Mob 9822708707	Member	9	Dr Prashant Thakare Department of Biotechnology, SGB Amravati University, Amravati. Mob 9822222822	Member
10	Dr A B Gulwe School of Technology, SRTM University Sub Campus, Latur. Mob 7387120874	Member	11	Dr Sanjog T. Thul Environmental Biotechnology and Genomics Division, National Environmental and Engineering Research Institute (CSIR-NEERI), Nagpur Mob. : 91-712-2249885	Member
12	Dr Shivraj Hariram Nile Department of Food Science and Agriculture, National Agri-Food Biotechnology Institute (NABI), Mohali, Punjab. Mob 9561740707	Member	13	Dr Sunil Hajare Department of Biotechnology, New Model Degree College, Hingoli. Mob 8378878817	Member

Swami Ramanand Teerth Marathwada University, Nanded

(Three Optional in the First Year)

Credit Framework for Four Year Multidisciplinary Degree Program with Multiple Entry and Multiple Exit

Year & Level	Semester	Optional1 *(From the same Faculty)*	Optional2 *(From the same Faculty)*	Optional3 *(From the same Faculty)*	Generic Elective (GE) (select from Basket 3 of *Faculties other than Science and Technology*)	Vocational & Skill Enhancement Course	Ability Enhancement Course (AEC) (Basket 4) Value Education Courses (VEC)/Indian Knowledge System (IKS) (Basket5) *(Common across all faculties)*	Field Work / Project/Internship/ OJT/Apprenticeship/ Case Study Or Co-curricular Courses (CCC) (Basket6 for CCC) *(Common across all faculties)*	Credits	Total Credits
1	2	3	4	5	6	7	8	9	10	11
1 (4.5)	I	Opt 11 (T 2Cr) Opt 12(P 2Cr) 4Credits	Opt 21 (T 2Cr) Opt 22(P2Cr) 4Credits	Opt 31(T 2Cr) Opt 32(P 2Cr) 4Credits	GE1 2Credits	SEC 1 2Credits	AECENG 1 (2Cr) ACEMIL1 (2Cr) IKS(2Cr) 6Credits	-	22	44
	II	Opt 13(T 2Cr) Opt 14(T 2Cr) 4Credits	Opt 23 (T 2Cr) Opt 24(P 2Cr) 4Credits	Opt 33(T 2Cr) Opt 34(P 2Cr) 4Credits	GE2 2Credits	SEC 2 2Credits	AECENG 2 (2Cr) ACEMIL2 (2Cr) CI(2Cr) 6Credits	--	22	
	Cum. Cr.	08	08	08	04	04	12	00	44	

***Exit option*: UG Certificate in Opt1, Opt2 and Opt3 on completion of 44 credits** and additional **4 credits from NSQF/Internship**

2 (5.0)	III	Major 1(T-2cr) Major 2 (T-2cr) Major 3 (P-2cr) Major 4 (P-2cr) 8 Credits	Minor 1 (T-2cr) Minor 2 (P-2cr) 4 Credits		GE 3 2Credits	VSC 1 2Credits	ACEENG3 (2Cr) ACEMIL3 (2Cr) 4Credits	CCC(2Cr) *(NCC/NSS/SPT/ CLS/ HWS/YGE/FIT)* 2Credits	22	88
	IV	Major 5 (T-2cr) Major 6 (T-2cr) Major 7 (P-2cr) Major 8 (P-2cr) 8 Credits	Minor 1 (T-2cr) Minor 2 (P-2cr) 4 Credits	—	GE 4 2Credits	VSC 2 2Credits	ACEENG4 (2Cr) ACEMIL4 (2Cr) EVS (2Cr) 6Credits	---	22	
	Cr	24	16	08	08	08	22	02	88	
***Exit option*: UG Diploma in Major and Minor on completion of 88 credits and an additional 4 credits NSQF/ Internship in Major Subject**										

3 **(5.5)**	**V**	**Major19**(T 3Cr) **Major20**(T3Cr) **Major21**(T2Cr) **Major 22** (P 2Cr) **Major 23** (P 2Cr) **12 Credits**	**Major E1** 4 Credits	-		--	**VSC3** **2 Credits**	--	**FP** **4 Credits**	**22**	
	VI	**Major24**(T3Cr) **Major25**(T 3Cr) **Major26**(T2Cr) **Major27**(P 2Cr) **Major28**(P2Cr) **12Credits**	**Major E2** **4 Credits**	--		--	**VSC4** **2Credits**	-	**OJT** **4 Credits**	**22**	**13** **2**
	Cr	**56**		**16**	**08**	**08**	**4+ 8 =12**	**22**	***04+08***		**13** **2**
***Exit option*: B.Sc. (Bachelor in Science) With a Major in DSC and a Minor in DSM**											

4 (6.0)	VII	Major29(T4Cr) Major30(T4Cr) Major31(T 2Cr) Major32(P4Cr)	Major E1 Major E2 4Cr	RM 4Cr		-	-	-	-	22	44
	VIII	Major33(T4Cr) Major34(T4Cr) Major35(T 2Cr) Major36(P4Cr)	MajorE3 Major E4 4Cr	-		-	-	-	OJT 4Credits	22	
	Cum Cr	Honours:92		16+4	08	08	VSC-8, SEC-4	AEC-8,MIL-8 VEC-4,IKS-2	16		176
Exit option: B.Sc. (Hons) with Major in DSC and Minor in DSM											
4 (6.0)	VII	Major29(T3Cr) Major30(T3Cr) Major31(T4Cr) 10Credits	MajorE1 Major E2 4Cr	RM 4 Cr		-	-	-	Research Project RP1 4Credits	22	44
	VIII	Major29(T3Cr) Major30(T3Cr) Major31(T4Cr) 10 Credits	MajorE3 Major E4 4Cr	-		-	-	-	Research Project RP2 8Credits	22	
Exit option: B.Sc. (Hons with Research) in DSC and Minor in DSM											
Total Credits		Major-92/84	Minor1–16, RM-04	Minor-2 08		GE-08	VSC-8, SEC-6 14	AEC-8,MIL-8, VEC-4, IKS-2 22	CC-2,FP/CS-4, OJT-4, RP-12 30	176	

B. Sc. Second Year Semester III (Level 5.0)

Teaching Scheme

Subject	Course Code	Course Name	Credits Assigned			Teaching Scheme	
			Theory	Practical	Total	Theory (Hrs/Week)	Practical (Hrs/ Week/ Batch)
Optional 1 Major	SBTVCT-1201	Fundamentals of Biochemistry	02	--	02	02	--
	SBTVCP-1201	Lab Course in Fundamentals of Biochemistry	--	02	02	--	04
Optional 2 Major	SBTVCT-1202	Principles of Immunology & Virology	02	--	02	02	--
	SBTVCP-1202	Lab Course in Immunology & Virology	--	02	02	--	04
Minor	SBTVMT-1201	Molecular Biology	02	--	02	02	--
	SBTVMP-1201	Lab Course in Molecular Biology		02	02	--	04
Generic Elective (From Other Faculty)	SBTVGE-1201	Applications of Biotechnology	02	--	02	02	--
Vocational & Skill Enhancement Course	SBTVVC-1201	Biopesticide Production Technology	--	02	02	--	04
Ability Enhancement Course	AECENG-1201	L1 – Compulsory English	02	--	02	02	--
Ability Enhancement Course	AECXXX-1201	L2–Second Language Marathi (MAR), Hindi (HIN), Urdu (URD), Kannada (KAN), Pali (PAL)	02	--	02	02	--
Co-curricular Courses (CCC)	CCCXXX-1201	Any one of NCC/ NSS/Sports (SPT)/ Culture Studies (CLS) /Health Wellness (HWS) /Yoga Education (YGE)/ Fitness (FIT)	--	02	02	--	04
Total Credits			**12**	**10**	**22**	**12**	**20**

B. Sc. Second Year Semester III (Level 5.0)

Examination Scheme

[20% Continuous Assessment (*CA)* and 80% End Semester Assessment (*ESA*)]

Subject	CourseCode	Course Name	Theory				Practical		Total
			Continuous Assessment(CA) Avg of			ESA			
			Test I	Test II	(T1+T2)/2	Total	CA	ESA	
Optional 1 Major	SBTVCT-1201	Fundamentals of Biochemistry	10	10	10	40	--	--	50
	SBTVCP-1201	Lab Course in Fundamentals of Biochemistry	--	--	--	--	20	30	50
Optional 2 Major	SBTVCT-1202	Principles of Immunology & Virology	10	10	10	40	--	--	50
	SBTVCP-1202	Lab Course in Principles of Immunology & Virology	--	--	--	--	20	30	50
Minor	SBTVMT-1201	Molecular Biology	10	10	10	40	--	--	50
	SBTVMP-1201	Lab Course in Molecular Biology	--	--	--	--	20	30	50
Generic Elective (From other faculty)	SBTVGE-1201	Applications of Biotechnology	10	10	10	40	--	--	50
Vocational & Skill Enhancement Course	SBTVVC-1201	Biopesticide Production Technology	--	--	--	--	20	30	50
Ability Enhancement Course	AECENG-1201	L1 – Compulsory English	10	10	10	40	--	--	50
Ability Enhancement Course	AECXXX-1201	L2–Second Language Marathi (MAR), Hindi (HIN), Urdu (URD), Kannada (KAN), Pali (PAL)	10	10	10	40	--	--	50
Co-curricular Courses (CCC)	CCCXXX-1201	Any one of NCC/ NSS/Sports (SPT)/ Culture Studies (CLS) /Health Wellness (HWS) /Yoga Education (YGE)/ Fitness (FIT)	--	--	--	--	20	30	50

B. Sc. Second Year Semester IV (Level 5.0)

Teaching Scheme

Subject	Course Code	Course Name	Credits Assigned			Teaching Scheme	
			Theory	Practical	Total	Theory (Hrs/ Week)	Practical (Hrs/ Week/Batch)
Optional 1 Major	SBTVCT-1251	Basic Instrumentation Techniques	02	--	02	02	--
	SBTVCP-1251	Lab course in Basic Instrumentation techniques	--	02	02	--	04
Optional 2 Major	SBTVCT-1252	Developmental Biology	02	--	02	02	--
	SBTVCP-1252	Lab Course in Developmental Biology	--	02	02	--	04
Minor	SBTVMT-1251	r-DNA Technology	02	--	02	02	--
	SBTVMP-1251	Lab Course in r-DNA Technology	--	02	02	--	04
Generic Elective (From Other Faculty)	SBTVGE-1251	Medical Biotechnology	02	--	02	02	--
Vocational & Skill Enhancement Course	SBTVVC-1251	Algal Cultural Technology	--	02	02	--	04
Ability Enhancement Course (AEC)	AECENG-1251	L1- Compulsory English	02	--	02	02	--
Ability Enhancement Course (MIL)	AECXXX-1251	L2–Second Language Marathi (MAR), Hindi (HIN), Urdu (URD), Kannada (KAN), Pali (PAL)	02	--	02	02	--
Value Education Course (VEC)	VECEVS-1251	Environmental Studies	02	-	02	02	--
		Total Credits	**14**	**08**	**22**	**14**	**16**

B. Sc. Second Year Semester IV (Level 5.0)

Examination Scheme

[20% Continuous Assessment (*CA)* and 80% End Semester Assessment (*ESA*)]

Subject	Course Code	Course Name	Theory				Practical		Total
			Continuous Assessment (CA)			ESA			
			Test I	Test II	(T1+T2)/2	Total	CA	ESA	
Optional 1 Major	SBTVCT-1251	Basic Instrumentation Techniques	10	10	10	40	--	--	50
	SBTVCP-1251	Lab course in Basic Instrumentation techniques	--	--	--	--	20	30	50
Optional 2 Major 1	SBTVCT-1252	Developmental Biology	10	10	10	40	--	--	50
	SBTVCP-1252	Lab Course in Developmental Biology	--	--	--	--	20	30	50
Minor	SBTVMT-1251	r-DNA Technology	10	10	10	40	--	--	50
	SBTVMP-1251	Lab Course in r-DNA Technology	--	--	--	--	20	30	50
Generic Elective (GE) (From Other Faculty)	SBTVGE-1251	Medical biotechnology	10	10	10	40	--	--	50
Vocational &Skill EnhancementCourse	SBTVVC-1251	Algal Cultural Technology	--	--	--	--	20	30	50
Ability EnhancementCourse (AEC)	AECENG-1251	L1- Compulsory English	10	10	10	40	--	--	50
Ability Enhancement Course (MIL)	AECXXX-1251	L2–Second Language Marathi (MAR), Hindi (HIN), Urdu (URD), Kannada (KAN), Pali (PAL)	10	10	10	40	--	--	50
Value Education Course (VEC)	VECEVS-1251	Environmental Studies	10	10	10	40	--	--	50

SBTVCT-1201: Fundamentals of Biochemistry

Marks: 50 **B. Sc. Biotechnology** **Hours: 30**

Course pre-requisite:

- The candidate should have basic knowledge in Biochemistry.

Course Objectives:

- To understand a general introduction to the basic concepts of Biomolecules.
- To understand the structure, behaviour and importance of biomolecules.

Course Outcomes:

- Students will be able to describe the molecular basis of life and role of energy rich compounds in biological system.
- Students will be able to describe structure, properties and roles of biomolecules.

Module No.	Unit No.	Topic	Hrs.
1.0	**01**	**Carbohydrates**	08
	1.1	Introduction: Basics of carbohydrates.	
	1.2	Classification, Structure and properties of carbohydrates.	
	1.3	Chemical Properties of Monosaccharide.	
	1.4	Introduction to disaccharide (lactose maltose sucrose) and polysaccharide (heparin starch and glycogen). Biological function/ roles of carbohydrates.	
2.0	**2.0**	**Proteins**	08
	2.1	Protein: Concepts and classification of amino acids.	
	2.2	Classification of protein based on solubility, shape, composition, and function.	
	2.3	Primary structure of proteins: Amino acids, Building blocks of proteins.	
	2.4	Structure, classification of protein based on polarity, Peptide bond formation, Properties (physical, chemical), titration of amino acid.	
3.0	**3.0**	**Lipids and Vitamins**	08
	3.1	Introduction: Biological function of lipids, Occurrence, properties and classification of lipids.	
	3.2	Importance of phospholipid, sphingolipid and glycerolipid.	
	3.3	Definition Vitamin: classification and functions Fat and water-soluble vitamins.	
	3.4	Introduction to minerals: Sources and functions of minerals (calcium, phosphorus, iodine, chlorine, magnesium, sodium).	
4.0	**4.0**	**Nucleic Acids and Enzymes**	06
	4.1	Structure of nucleic acid – Nitrogenous bases, pentose, nucleotides, nucleosides, nucleoside di and triphosphate.	
	4.2	Physicochemical properties and biological function of nucleic acids.	

	4.3	Basic structure of DNA & RNA: Forms of DNA, Types of RNA.	
	4.4	**Enzymes-**Nomenclature, Classification and Role of Enzymes.	
		Total	30

Reference Books

1. Nelson, D.L. and Cox, M.M, Lehninger: Principles of Biochemistry, 6thedition, W.H. Freeman, and Company (New York), 2013.
2. Devlin, T.M., Textbook of Biochemistry with Clinical Correlations, 7th edition, John Wiley & Sons, Inc. (New York), 2011.
3. Berg, J.M., Tymoczko, J.L. and Stryer L., Biochemistry, 7thedition., W.H. Freeman, and Company (New York), 2012.
4. Voet and Voet, Biochemistry, 4th edition, John Wiley, and Sons, 2021.
5. U. Satyanarayana, U. Chakrapani, Biochemistry, 6thedition, Elsevier, 2021.
6. Prasad Manjeshwar, Textbook of Biochemistry, 5th edition, Sheetal distributors, 2022.

SBTVCP-1201: Lab Course based on Fundamentals of Biochemistry

Marks: 50 **B. Sc. Biotechnology** **Hours: 30**

Sr. No.	List of Experiments: Fundamentals of Biochemistry
1	Preparation of Standard solutions – Molar, Molal, Normal, Percent.
2	Preparation of Buffers Solutions.
3	Identification of Bio molecules by Spot test.
4	Estimation of Carbohydrate by DNS Reagent.
5	Estimation of Protein by Biuret method.
6	Qualitative estimation of DNA by Diphenylamine method.
7	Estimation of vitamin by DNPH/Iodometric method.

SBTVCT-1202: Principles of Immunology & Virology

Marks: 50 **B. Sc. Biotechnology** **Hours: 30**

Course pre-requisite:

- The candidate should have basic knowledge of Immune system.

Course Objectives:

- The objective of this course is to provide the detail understanding of different cells & Organs of the immune system and their role in immune protection.
- Application of immunological techniques in diseases diagnosis.
- The course will provide knowledge about the basics of virology.
- The course will provide knowledge of vaccines and antivirals in controlling viral diseases.

Course Outcomes:

- Students will be able to describe the Cells and organs involve in immune reactions.
- Students will be able to describe structure, mode of transmission and control measures for viral infections.

Module No.	Unit No.	Topic	Hrs.
1.0	**01**	**Unit I: Basics of Immunology**	**08**
	1.1	General concept of Immunity, Innate and Acquired Immunity.	
	1.2	Humoral and cellular Immunity. Hematopoiesis.	
	1.3	Types and role of Primary and Secondary lymphoid organs.	
	1.4	Cells of Immune system.	
2.0		**Unit-II - Antigen and Antibody**	08
	2.1	Antigen and Antibody: Immunogenicity and factors that influence Immunogenicity & Antigenicity.	
	2.2	Adjuvants, Epitopes, Haptens.	
	2.3	Structure, types and functions of Immunoglobulins.	
	2.4	Antigen- Antibody interactions: Precipitation and Agglutination Reactions, Complement fixation.	
3.0		**Unit-III: Basics of Virology**	08
	3.1	Brief introduction / outline on discovery of viruses.	
	3.2	Nomenclature & classification of Viruses (ICTV, LHT, Baltimore).	
	3.3	Ultra-structure, viral nucleic acid, nucleo-capsid structure and Envelope.	
	3.4	Viroids, Prions, Cultivation of viruses.	
4.0		**Unit-IV Life Cycle of Viruses**	06
	4.1	Life cycle and replication of RNA and DNA Viruses. Bacteriophages-Lambda, T, M13.	
	4.2	Animal Viruses- Adenovirus, Retrovirus. Plant Viruses- TMV, CaMV.	
	4.3	Brief outline of Vaccines, Antivirals, Interferon.	

	4.4	Detailed account on Corona and Ebola Viruses. Detailed account on COVID-2019.	
		Total	30

Reference Books & Text:

1. Immunology – Kuby- W.H. Freeman. 2018.
2. Essentials of Immunology- Roitt I. M.- Blackwell. 2011.
3. Immunology- Nandini Shetty- New Age International. 2021.
4. Textbook of Microbiology – Anantnarayan and Panikar-Orient Longman. 2017.
5. Immunology- A.K. Abbas- Elsevier. 2021.
6. An Introduction to Viruses- Amita Biswas- Vikas Publication. 1984.
7. Bacterial and Bacteriophage Genetics– Edward Birge- Springer. 2020.
8. Microbial Genetics-David Freifelder- Narosa. 2013.
9. Virology Principles and Applications- John Carter, Venetia A. Saunders-Wiley. 2013.
10. Introduction to Modern Virology IV l edition- Dimmock, Primrose. 2001.
11. Plant Virus- M.V. Nayudu- Tata McGraw Hill. 2008.

SBTVCP-1202: Lab Course based on Principles of Immunology & Virology

Marks: 50 **B. Sc. Biotechnology** **Hours: 30**

Sr. No.	List of Experiments: Principles of Immunology & Virology
1	Immunodiagnostics (demonstration using Kits- Widal, VDRL, Blood Group etc).
2	Immunodiffusion, Immuno-Electrophoresis, Western Blotting, Differential Leukocyte Count.
3	Lymphoid organ, Cell and their microscopic observation.
4	Immunization, collection of Serum.
5	Purification of Ig G from Serum.
6	Isolation of bacteriophage from sewage/Titration / one-step growth curve of bacteriophage.
7	Enumeration of Bacteriophage by PFU method.
8	Cultivation of Virus in Embryonated egg, Heamagglutination test.
9	ELISA study and demonstration.
10	Isolation and study of plant virus.

SBTVMT-1201: Molecular Biology

Marks: 50 **B. Sc. Biotechnology** **Hours: 30**

Course pre-requisite

- The candidate should have been basic knowledge Molecular Biology

Course objectives:

- To understand gene regulation in prokaryotes & eukaryotes
- To understand DNA repair mechanism

Course Outcomes:

- Students will acquire the laboratory skills for the isolation if genetic material.
- Students will learn the mutation & repair mechanism.

Curriculum Details:

Module No.	Unit No.	Topic	Hrs.
1.0		**Unit: I – DNA Replication**	08
	1.1	DNA replication: experimental evidence for semiconservative DNA Replication in *E.coli*, Meselson and Stahl's experiment.	
	1.2	Replication in prokaryotic.	
	1.3	Replication in Eukaryotic Cells. Mechanism of Replications and Enzymes involved in it.	
	1.4	DNA Repair- Direct repair – Photo Reactivation, Excision, Mismatch, SOS, Base excision, Nucleotide excision.	
2.0		**Unit:II - Transcription of Prokaryotes and Eukaryotes**	08
	2.1	Transcription of Prokaryotes: Initiation, Elongation & Termination. Structure of RNA polymerase, Role of sigma factor.	
	2.2	Transcription in Eukaryotes: Initiation, Elongation & Termination.	
	2.3	Upstream & downstream Promoters.	
	2.4	Post transcriptional modification.	
3.0		**Unit: III –**Translation in Prokaryotes and Eukaryotes	08
	3.1	Introduction to translation	
	3.2	Translation Prokaryotes: Initiation, elongation, termination.	
	3.3	Translation Eukaryotes: Initiation, elongation, termination.	
	3.4	Post translational modifications.	
4.0		**Unit- IV: Gene regulation and operon concept:**	06
	4.1	Regulation of gene expression	
	4.2	Regulation of transcription in Prokaryotes.	
	4.3	Operon concept: Trp-operon & Lac- operon.	
	4.4	Operon concept: Arabinose & Histidine operon.	
		Total	30

Reference Books:

1. Kakoli and Upadhya- Molecular Biology- Himalaya. 2023.
2. Watson – Molecular biology of gene- Pearson. 2004.
3. David Freifelder - Microbial Genetics – Narosa. 1997.

4. David Freifelder – Molecular Biology – Jones and Bartlett /Narosa. 1983.
5. Gardner – Principals of Genetics – Wiley international pub. 2006.
6. Simmonds &Snustad – Principles of Genetics IV ed- Wiley international. 2005.
7. T.A. Brown – Genomes – Garland Science. 2006.
8. Albert Bruce- Molecular biology of the cell- Garland Science. 2017.
9. Loddish - Molecular cell biology – W-H. Freeman. 2016.
10. B. Lewin – Genes- IX- Oxford. 2019.

SBTVMP-1201: Lab Course in Molecular Biology

Marks: 50 **B.Sc. Biotechnology** **Hours: 30**

Sr. No.	List of Experiments:
1	Isolation of genomic DNA from bacteria.
2	Isolation of genomic DNA, animal cells.
3	Isolation of genomic DNA from plant cells.
4	Isolation of plasmid DNA.
5	Spectroscopic analysis of DNA/ RNA.
6	Study of Agarose gel electrophoresis.
7	Study of Photoreactivation.
8	Effect of UV on growth of bacteria.
9	Isolation of Lac mutants by using Replica plate method.
10	Study of Ames test.

Generic Elective

SBTVGE-1201: Applications of Biotechnology

Marks: 50 **B.Sc. Biotechnology SY** **Hours: 30**

Course pre-requisite:

- The candidate should have basic knowledge of types of Biotechnology and their applications.

Course Objectives:

- To have overview and understanding of world of Biotechnology with applications.
- To understand the major groups of microorganism's tools in Biotechnology.

Course Outcomes:

- Students become able to understand the applications of Biotechnology in different fields.
- Student would gain insight in agriculture, PTC, Environment, and Biofuel.

Module No.	Unit No.	Topic	Hrs.
1.0	**1.0**	**Introduction of Biotechnology**	08
	1.1	Introduction: Definition, Historical overview of Biotechnology.	
	1.2	Recent discoveries from Cell biology to Biotechnology.	
	1.3	Application of Biotechnology in Agriculture: Plant tissue culture, Seed Technology.	
	1.4	Transgenic plants and their applications, Bio-fertilizers, Bio-pesticide with examples. etc.	
2.0	**2.0**	**Biotechnology in Health & Biopharmaceuticals**	08
	2.1	Biotechnology in Health and Biopharmaceuticals: Diagnostics-Ag-Ab interactions and other types of diagnosis.	
	2.2	Concept of Stem Cells.	
	2.3	Hybridoma Technology.	
	2.4	Genetic Counselling. Transgenic Animals and their applications.	
3.0	**3.0**	**Biotechnology in Industry**	08
	3.1	Beverage-Winery, Distillery.	
	3.2	Dairy industry and their applications.	
	3.3	Food Processing and packaging.	
	3.4	Enzymes and therapeutic uses, Paper & Pulp etc.	
4.0	**4.0**	**Application of Biotechnology in Environment & Biodiversity**	06
	4.1	Composting, Wastewater treatment, Solid waste management.	
	4.2	Biodegradation, Bioremediation.	
	4.3	Biofuel- Biodiesel, Biogas, Ethanol.	
	4.4	Biodiversity: in situ, ex situ conservation of endangered species. Ethical, Legal (IPR, Patent) and social impact of Biotechnology.	

		Total	30

Reference Books and text:

1. 1.Introduction to Biotechnology- Brown, C Publications Campbell F.G., Priest-Panima Publications, 2002.
2. Biotechnology-U Satyanarayana- New Age Publications, 2017.
3. Biotechnology - B.D. Singh, Kalyani Publications, 2010.
4. Biotechnology: Expanding Horizon- B.D. Singh- Kalyani Publications, 2012.
5. Elements of Biotechnology - P.K. Gupta, Rastogi Publications, 1994.
6. A Text book of Biotechnology - R.C. Dubey- S. Chand, 1993.
7. Advances in Biotechnology- S.N. Jogdand- Himalaya Publication, 2007.
8. 8.Concepts in Biotechnology-Balasubranian- University Press, 2004.
9. Biotechnology - Purohit- Agrobios Publication, 2005.
10. Modern concepts of Biotechnology, H.D. Kumar, Vikas Publications, 1998.

Sr No	List of Experiments: Applications of Biotechnology
1	Students field Trip to Biotech Companies
2	Survey and report on commercial dairy products and packaged food products available in market
3	Survey and report on vaccination programme in India and vaccines in market.
4	Survey and report on use of Biofuel (Biodiesel and biogas)
5	Visit and report on local drinking and waste water treatment, bio composting, biogas units.
6	Report on government agencies- DBT, CSIR, ICMR, ICAR, TIFR, IISER, IIT, DRDO
7	Report on Top 10 Biotech companies in India and World
8	Visit and report on Biotech Research Institute, Forensic Laboratory and Biotech Industry.

SBTVVC-1201: Biopesticide Production technology

Marks: 50 **B. Sc. Biotechnology** **Hours: 30**

Course pre-requisite:

- The candidate should have basic knowledge in Agricultural practices and Biopesticides.

Course Objectives:

- To understand a general introduction to the basic concepts of Biopestiside.
- To understand the importance of Biopesticide over chemical pesticide.

Course Outcomes:

- Students will be able to describe the role of biopestiside in agriculture.
- Students will be able to understand preparation of biopestiside.

Module No.	Unit No.	Topic	Hrs.
1.0	**1**	**Unit-I Bio pesticides**	08
	1.1	Introduction to bio-pesticides.	
	1.2	Types of biopesticides.	
	1.3	Applications of bio-pesticides.	
	1.4	Advantages and disadvantages of biopesticides.	
2.0	**2**	**Unit-II**	08
	2.1	*B.thuringiensis* as Biopesticide.	
	2.2	*Trichoderma* as Biopesticide.	
	2.3	Biological pest control.	
	2.4	Integrated pest management.	
3.0	**3**	**Unit -III**	08
	3.1	Introduction to Bioinsecticide, Biofungicide and Bioherbicide.	
		Bioinsecticide types and applications.	
	3.2	Biofungicide types and applications.	
	3.3	Bioherbicide types and applications.	
4.0	**4.0**	**Unit-IV**	06
	4.1	Isolation and characterization of *Pseudomonas fluorescens* as Biocontrol agent.	
	4.2	*Pseudomonas fluorescens* as biocontrol agent.	
		Present status bio-pesticides.	
	4.3	Future needs of bio-pesticides.	
		Total	30

Reference Books & Text

1. Biotechnology: R.C. Dubey, S. Chand publications. 1993.

2. Biotechnology: B.D.Singh, Kalyani Publishers, 2015.

3. Elements of Biotechnology: P.K. Gupta, Rastogi Publications. 2010.

4. Microbiology: R. C. Dubey, S. Chand publications. 2012.

Sr. No.	List of Experiments: Biopesticide Production technology
1	Isolation of *B. thuringiensis*
2	Isolation of *Trichoderma harzianum*
3	Inoculum preparation of *Trichoderma harzianum*
4	Isolation of *Pseudomonas fluorescens*
5	Inoculum preparation of *Pseudomonas fluorescens*

SEMESTER – IV

SBTVCT-1251: Basic Instrumentation Techniques

Marks: 50 **Hours: 30**

Pre requisite:

- Basic knowledge of Instruments used in the laboratory.

Course Objectives:

- The objectives of this course is to provide the Students with the understanding of various analytical techniques used in biotechnology based research and industry.
- To understand the principle and working of instrumentation used in Biotechnology.

Course Outcomes:

- Students will be able to acquire the knowledge about the Principle & working of Instruments
- Students will be able to handle instruments in the laboratory.

Curriculum Details

Module No.	Unit No.	Topic	Hrs.
1. 0		**Unit 1: Microscopy & Spectroscopy**	08
	1.1	Light Microscopy: Simple & Compound Microscope, Phase contract Microscope ,Electron Microscope, TEM/SEM.	
	1.2	Spectroscopy, General principle Electromagnetic Spectrum radiation.	
	1.3	Energy & Atomic structure, Types of spectra, Basic law of absorption.	
	1.4	Visible & Ultraviolet Spectroscopy, applications in biology.	
2.0		**Unit 2: Chromatography Techniques**	08
	2.1	Chromatography principle, working & applications.	
	2.2	Adsorption chromatography, Partition chromatography. ,	
	2.3	Paper Chromatography, TLC.	
	2.4	Column Chromatography, Ion exchange chromatography & GC.	
3.0		**Unit 3: Centrifuges**	08
	3.1	Centripetal Force, Centrifugal force, basic Principle of centrifugation.	
	3.2	Centrifuge type, types of rotor.	
	3.3	Density gradient centrifugation, Nature of density gradient.	
	3.4	Preparative centrifugation, Differentials centrifugation & applications.	
4.0		**Unit 4: Electrophoresis**	06
	4.1	General Principles, Low voltage electrophoresis, High voltage electrophoresis.	
	4.2	Agarose Gel electrophoresis and PAGE.	
	4.3	IEF, PFGE.	
	4.4	Factors affecting on Electrophoretic Mobility.	
		Total	30

References Books & Text:

1. Biophysical Chemistry- Upadhyay, Upadhyay and Nath-Himalaya. 2023.

2. Practical Biochemistry- Wilson & Walker –Cambridge. 2002.
3. Practical Biochemistry- David Plummer- Tata McGraw Hill. 2017.
4. Principles of Biochemistry- Lehninger –Kalyani Publications. 2013.
5. Light Microscopy in Biology-A.J. Laccy. 1999.
6. Instrumental Methods of Chemical Analysis- Chatwal Anand- Himalaya. 2024.
7. Instrumental Methods of Chemical Analysis –B.K. Sharma-Goel. 2011.
8. Physical Biochemistry-D. Friefilder. 1976.

SBTVCP-1251: Lab Course based on Basic Instrumentation techniques

Marks: 50 **B. Sc. Biotechnology** **Hours: 30**

Sr No	List of Experiments
1	Study and Care of Microscope, Observation of Microscopic samples
2	Study of Colorimeter and determination of Lambda Max.
3	Study of UV-Visible Spectrophotometer
4	Study of Paper Chromatography/ TLC.
5	Separation of Pigments/ Biomolecules by Chromatography.
6	Separation of pigments by column chromatography
7	Demonstraion of GC/ HPLC/ HPTLC
8	Principals and working of different centrifuges.
9	UV Spectroscopic Analysis of DNA, RNA & Proteins
10	Study of Paper/PAGE/ SDS-PAGE/ Agarose Gel Electrophoresis

SBTVCT-1252: Developmental Biology

Marks : 50 **Hours : 30**

Pre requisite:

- Basic knowledge about plant gametogenesis & fertilization, basic embryogenesis.

Course Objectives:

- To provide an understanding of basics of gametogenesis, fertilization, stem cells, cloning & embryogenesis.
- Developmental biology aspects in plants & animals.

Course Outcomes:

- Students will be able to acquire the knowledge stem cell technology.
- Students will be able to understand developmental pattern of plants and animals.
- Students will able to learn skills of cloning & test tube baby.

Curriculum Details

Module No.	Unit No.	Topic	Hrs.
1. 0		**Unit -I: Animal Development**	08
	1.1	Development: Concept of Gametogenesis and Fertilization Types and Patterns of cleavage.	
	1.2	Blastulation, Gastrulation, Neurulation, Organogenesis and Growth in Frog and chick.	
	1.3	Concepts of competence, determination, commitment and Differentiation.	
	1.4	Dedifferentiation, re-differentiation, trans-differentiation.	
2.0		**Unit-II: Animal Development & Stem Cell**	08
	2.1	Role of gene/s in patterning and development in drosophila Concept of Stem cells stem cell technology.	
	2.2	Progenitor cells, cell lineages in plants and animals. Ageing and Apoptosis, abnormal.	
	2.3	Development and terato-genesis in plants and animals.	
	2.4	Cancer biology.	
3.0		**Unit -III: Plant Development**	06
	3.1	Seedling development: Photo-morphogenesis.	
	3.2	Meristem structure and activity, Organ development.	
	3.3	Shoot and root patterning.	
	3.4	Floral patterning in Arabidopsis.	
4.0		**Unit –IV :Methods in Development Biology**	08
	4.1	Developmental plasticity in plant and animal development. Embryo Culture and preservation.	
	4.2	sperm bank, Cloning in mammals: Dolly and other mammals.*in vitro* Fertilization, concept of test tube baby.	
	4.3	Transgenic technology and applications in plants and animals.	
	4.4	Conservation, Hybrids and GMOs.	
		Total	30

Reference Books & Text:

1. An Introduction to Embryology - B.I. Balinsky. 2019.
2. Development Biology - S.F. Gillbert- Sinauer Associates. 2000.
3. Developmental Biology-Shastri and Shukla- Rastogi Publication. 2018.
4. Developmental Genetics- G.S. Miglani- IK International. 2006.
5. Chordate Embryology- Varma and Agarwar- S.Chand. 2010.
6. Chordate Zoology- Jordan Varma- S.Chand. 2013.
7. Plant Anatomy- B.P. Pande- S.Chand. 2001.
8. Text book of Angiosperms- B.P. Pande- S.Chand. 1981.
9. Developmental Biology - S.C. Goel. 1984.
10. Developmental Biology – Wolpert. 2011.
11. Embryology of Angiosperms – S.S. Bhojwani and S.P. Bhatnagar. 2018.
12. An Introduction to Plant Cell Development – J. Burgess. 1985.

SBTVCP-1252: Lab Course based on Developmental Biology

Marks: 50 **B. Sc. Biotechnology** **Hours: 30**

Sr No	List of Experiments
1	Study of different types of animal eggs
2	Study of staging & staining of Chick embryos
3	Study of frog development, observation of frog embryo different development stages
4	Study of different types of sperms by smear preparation.
5	Frequency of genetic traits in human
6	Study of Sex-linked inheritance, Multiple allelism
7	Study of plant development and role of hormones in plant development 8. Development of male and female gametophytes
8	Developmental stages during plant Embryogenesis
9	Analysis of histochemical changes during transition of vegetative shoot to reproductive apex
10	Histochemical analysis of the activity of cambium
11	Visit to Sperm bank/ IVF centre

SBTVMT-1251: r-DNA Technology

Marks: 50 **B. Sc. Biotechnology** **Hours: 30**

Pre requisite:

- Basic knowledge Gene transformation technology.

Course Objectives:

- To acquaint the students with modern techniques used for manipulation of DNA, RNA and Proteins
- Techniques used for Isolation and identification of gene of interest
- Applications of gene cloning in industry, medicine, agriculture.

Course Outcomes:

- The students will have knowledge of tools and strategies used in r-DNA Technology.
- The students will understand the applications from academic and industrial perspective.
- The students will able to use and apply the knowledge of r-DNA Technology in problem solving and in practice

Curriculum Details

Module No.	Unit No.	Topic	Hrs.
1. 0		**Unit-I: Tools of gene cloning**	08
	1.1	Restriction enzymes: Types and properties, ligases, polymerases, alkaline phosphatase	
	1.2	Vectors: Plasmids (pBR322, pUC18/19), Bacteriophages (λ Phage, M 13 Phage),	
	1.3	Phagmids Cosmids, BAC, YAC, SV 40 and Retrovirus	
	1.4	Ti and Ri plasmids	
2.0		**Unit-II: Techniques used in cloning**	08
	2.1	Blotting techniques: Southern, Northern, Western Blotting and applications.	
	2.2	PCR: Mechanism, Types and Application.	
	2.3	Probes and its applications	
	2.4	Preparation of Genomic and cDNA library,	
3.0		**Unit -III: Identification & modification of genes**	06
	3.1	Screening of recombinants, DNA fingerprinting, DNA foot printing	
	3.2	DNA Sequencing: Sanger and Maxam-Gilbert method	
	3.3	Protein engineering methods and its applications	
	3.4	Chemical synthesis of gene	
4.0		**Unit-IV: Applications of Cloning**	08
	4.1	Production of Recombinant insulin, Recombinant vaccine, Recombinant growth hormone, Blood Clotting factor VIII	
	4.2	Production and applications of Transgenic plants	
	4.3	Production and applications of transgenic animals.	
	4.4	Gene therapy.	
		Total	30

Reference Books & Text:

1. Gene Cloning & Manipulation – Christopher Howe. 2007
2. From Genes to Clones- Ernst L. Winnacker. 2018
3. Molecular Biotechnology – Bernard Glick. 2022
4. ABC of Gene cloing- Dominic W.S Wong. 2008
5. Genomes 3 - T.A.Brown . 2006
6. Gene cloning and DNA Analysis- T.A. Brown. 2016
7. Text book of Biotechnology – U Satyanarayana. 2020
8. Gene Biotechnology - Jogdand S.N. 2016
9. Genetic Engineering and its applications - Joshi P 2002
10. Genetic Engineering, -Mitra Sandhya. 2006

SBTVMP-1251: Lab Course based on r-DNA Technology

Marks: 50 **B. Sc. Biotechnology** **Hours: 30**

Sr No	List of Experiments
1	Isolation of genomic DNA
2	Isolation of Plasmid DNA
3	Effect of UV radiation on yeast / bacteria
4	Study of DNA repair mechanism by photo reactivation.
5	Agarose gel electrophoresis of genomic DNA & plasmid DNA.
6	Restriction digestion of DNA
7	Preparation of Competent Cells and transformation
8	Blotting Techniques- Southern, Western
9	Principle and study of PCR based experiments

Generic Elective

SBTVGE-1251: Medical Biotechnology

Marks: 50 **B.Sc. Biotechnology SY** **Hours: 30**

Course pre-requisite:

- Technical understanding of Microbiology, immunology and basics of cancer biology.

Course Objectives:

- To improve the knowledge on medical techniques used to identify the diseases.
- To enables the students to understand the role of antigen antibody reactions and Role of carcinogenic agents.

Course Outcomes:

- Will prepare students to understand the role of different immunization techniques of diseases.
- It will also help students to learn the application of stem cell technology.
- It will help students for the preparation of Vaccines.

Curriculum Details

Module No.	Unit No.	Topic	Hrs.
1. 0		**Unit-I : Vaccine Technology**	08
	1.1	Immunization, live, killed, attenuated, Sub unit vaccines.	
	1.2	Recombinant DNA and protein based vaccines, plant-based vaccines and reverse vaccinology; Peptide vaccines.	
	1.3	Conjugate vaccines; Passive Immunization; Antibody, Transfusion of Immuno-competent.	
	1.4	Cells, Stem cell therapy; Cell based vaccines.	
2.0		**Unit-II : Diagnostic methods**	08
	2.1	Antibody based diagnosis; Monoclonal antibodies as diagnostic Reagents.	
	2.2	Production and screening of monoclonal antibodies.	
	2.3	Monoclonal antibodies for Diagnosis of bacterial and viral diseases.	
	2.4	Detection of parasitic diseases by using; ELISA and Western blot.	
3.0		**Unit-III: Stem cell technology**	06
	3.1	Cellular therapy; Stem cells: definition, properties and potency of stem Cells.	
	3.2	Embryonic and adult stem cells with applications Role of scaffolds; Role of Growth factors.	
	3.3	Concept of tissue engineering.	
	3.4	Clinical applications and Ethical issues.	
4.0		**Unit-IV : Cancer Biology**	08
	4.1	Oncogenes, tumour suppressor genes, cancer and the cell cycle.	
	4.2	Virus-induced cancer, metastasis.	
	4.3	Interaction of cancer cells with normal cells, apoptosis.	
	4.4	Therapeutic interventions of uncontrolled cell growth.	

		Total	30

Reference Books & Text

1. Kuby Immunology- Goldsby, Kindt, Osborne.-W,H Freeman. 2007.
2. Cellular & Molecular Immunology- Abbas, Lichtman, Pillai.-Elsevier publications. 2021.
3. Roitt‟s Essential Immunology- Deives, Martin, Burton, Roitt-Blackwell publications. 2016.
4. Cellular interactions &Immuno-biology- Butterwort & Heinemann. 2024.
5. Review of Medical Microbiology & Immunology- Warren Levinson.-McGraw Hill. 2018.
6. Cell and Molecular biology, David Sadava; Jones & Bartlett Publishers. 2020.
7. Cell & Molecular Biology - Gerald Karp, John Wills. 2018.
8. Developmental biology- SF Gilbert Sinauer associates. 2010.
9. Genomes, T.A. Brown, Garland Science. 2006.

Sr. No.	List of Experiments: Medical Biotechnology
1	SDS PAGE.
2	2D Gel electrophoresis capillary.
3	ELISA, Immunoblotting.
4	Study of Ag-Ab reactions Widal, VDRL.
5	Immuno electrophoresis and Rocket immuno electrophoresis.
6	Latex agglutination.
7	ELISA.
8	Western Blotting.

SBTVVC-1251: Algal Cultural Technology

Marks: 50 **B. Sc. Biotechnology** **Hours: 30**

Course pre-requisite:

- The candidate should have basic knowledge of Algae.

Course Objectives:

- To enable Students to develop basic skills such as culturing of algae.
- To understand the economic importance of Algae.
- To understand role of algae as a biofertilizer.

Course Outcomes:

- Students will be able to acquire the knowledge about the Algal culturing techniques in the laboratory, Lab. organization & nutritional importance of algae.
- Students will be able to understand preparation of SCP from algae.

Curriculum Details

Module No.	Unit No.	Topic	Hrs.
1. 0		**Unit-I Introduction of Algae**	08
	1.1	Introduction to the Algae (Habitat, cell structure and reproduction).	
	1.2	Roles of Algae in Biogeochemistry.	
	1.3	Role of Algae in Food Webs.	
	1.4	Role of algae in other biotic Associations.	
2.0		**Unit-II Culturing of Algae**	08
	2.1	Algal culturing techniques in the laboratory.	
	2.2	Introduction of Photo bioreactor	
	2.3	Raceway ponds.	
	2.4	Indoor and mass culture methods of economically important algae.	
3.0		**Unit-III Algal Products**	06
	3.1	Products of Algae: SCP.	
	3.2	Products of Algae: Vitamins.	
	3.3	Production of Essential fatty acids.	
	3.4	Algae as a bio fertilizer.	
4.0		**Unit-IV Algal Biofuels**	08
	4.1	Recent developments and future of algal biotechnology: Algal biofuels and algal biodiesel.	
	4.2	Algal bioethanol.	
	4.3	Biological hydrogen production.	
	4.4	Role of Algae in global warming.	
		Total	30

Reference Books & Text:

1. Algal Culturing Techniques (First Edition) Elsevier Publication. 2004.

2. Handbook of Microalgal Culture: Applied Phycology and Biotechnology, (Second Edition) Authors: Amos Richmond, Qiang Hu (Wiley Publication). 2013.

Sr. No.	List of Experiments: Algal cultural technology
1	Collection and microscopic observation of algae.
2	Quantification of cultured algae.
3	Isolation, identification of economically important algae.
4	Inoculum development and pilot scale production of any one economically important algae.
5	Quantitative estimation proteins from algae.
6	Chromatographic separation of essential biomolecules from algal extract.
7	Visit to nearby industry actively engaged in algal technology.
8	Project on algal biotechnology.

**********13.06.2025**********