GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)

(Deemed to be University)

VISAKHAPATNAM * HYDERABAD * BENGALURU

Accredited by NAAC with A^{++} Grade

GITAM School of Science

CURRICULUM AND SYLLABUS

4 Year Undergraduate Programme
UBTSC04: B.Sc. Biotechnology

w.e.f. 2023-24 admitted batch

(Updated on 31st July 2023)

Academic Regulations

Applicable for the Undergraduate Programmes offered:

School of Humanities and Social Sciences
School of Business
and
School of Science

Vision

To become a global leader in higher education.

Mission

To impart futuristic and comprehensive education of global standards with a high sense of discipline and social relevance in a serene and invigorating environment.

Quality Policy

To achieve global standards and excellence in teaching, research, and consultancy by creating an environment in which the faculty and students share a passion for creating, sharing and applying knowledge to continuously improve the quality of education.

GITAM School of Science

Vision

To nurture outstanding Science Education and build a vibrant world-class research and innovation ecosystem.

Mission

1. To provide a flexible, responsive, and adaptive curriculum that emphasizes experiential learning and allows students to realize their full potential.
2. To develop high-impact research knowledge and solutions to improve the communities in which we live.
3. To promote a culture of high curiosity, enterprising mindset and keen desire to contribute to society.
4. To inculcate empathy, integrity, and trust in the GITAM fraternity with a strong commitment towards society and environment.

UBTSC04: B.Sc. Biotechnology

(w.e.f.2023-24 Admitted Batch)

Programme Educational Objectives (PEOs)

PEO 1: To update and enhance the knowledge of students in Biotechnology

PEO 2: To help the students explore their academic and other forms of their talent with exposing them areas of interdisciplinary subjects that relate to Biotechnology

PEO 3: To enrich the students with the comprehensive knowledge on frontier research areas of Biotechnology

PEO 4: To make the students as highly valuable human resources for medical, pharma and other industrial sectors by enhancing and fine tuning their skills.

PEO 5: To foster a scientific temper in students.

PEO 6: To build research capabilities among the students.

PEO Articulation

	PEO1	PEO2	PEO3	PEO4	PEO5	PEO6
M1	3	3	3	3	3	3
M2	1	2	2	3	2	3
M3	1	1	1	2	2	2
M4	1	1	1	1	1	1

3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

UBTSC04: B.Sc. Biotechnology

Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

At the end of the Programme the students would be able to demonstrate:

PO1: Complex problem-solving:
- To solve different kinds of problems in familiar and non-familiar contexts and apply the learning to real-life situations.

PO2: Critical thinking:
- Apply analytic thought to a body of knowledge, including the analysis and evaluation of policies, and practices, as well as evidence, arguments, claims, beliefs, and the reliability and relevance of evidence.
- Identify relevant assumptions or implications and formulate coherent arguments.
- Identify logical flaws and holes in the arguments of others.
- Analyze and synthesize data from a variety of sources and draw valid conclusions and support them with evidence and examples.

PO3: Creativity:
- Create, perform, or think in different and diverse ways about the same objects or scenarios.
- Deal with problems and situations that do not have simple solutions.
- Innovate and perform tasks in a better manner.
- View a problem or a situation from multiple perspectives.
- Think 'out of the box' and generate solutions to complex problems in unfamiliar contexts.
- Adopt innovative, imaginative, lateral thinking, interpersonal skills and emotional intelligence.

PO4: Communication Skills:
- Listen carefully, read texts and research papers analytically and present complex information in a clear and concise manner to different groups / audiences.
- Express thoughts and ideas effectively in writing and orally and communicate with others using appropriate media.
- Confidently share views and express herself / himself.
- Construct logical arguments using correct technical language related to a field of learning, work/vocation, or an area of professional practice, and convey ideas, thoughts, and arguments using language that is respectful and sensitive to gender and other minority groups.

PO5: Analytical reasoning/thinking:
- Evaluate the reliability and relevance of evidence.
- Identify logical flaws in the arguments of others.
- Analyze and synthesize data from a variety of sources-draw valid conclusions and support them with evidence and examples, and address opposing viewpoints.

PO6: Research-related skills:
- A keen sense of observation, inquiry, and capability for asking relevant/ appropriate questions.
- The ability to problematize, synthesize, and articulate issues and design research proposals.
- The ability to define problems, formulate appropriate and relevant research questions, formulate hypotheses, test hypotheses using quantitative and qualitative data, establish hypotheses, make inferences based on the analysis and interpretation of data, and predict cause-and-effect relationships.

- The capacity to develop appropriate methodology and tools for data collection.
- The appropriate use of statistical and other analytical tools and techniques.
- The ability to plan, execute and report the results of an experiment or investigation, the ability to acquire the understanding of basic research ethics and skills in practicing/doing ethics in the field/ in personal research work, regardless of the funding authority or field of study.

PO7: Coordinating/collaborating with others:

- Work effectively and respectfully with diverse teams.
- Facilitate cooperative or coordinated effort on the part of a group.
- Act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.

PO8: Leadership readiness/qualities:

- Mapping out the tasks of a team or an organization and setting direction.
- Formulating an inspiring vision and building a team that can help achieve the vision, motivating and inspiring team members to engage with that vision.
- Using management skills to guide people to the right destination.

PO9: Learning how to learn skills:

- Acquire new knowledge and skills, including 'learning how to learn skills, that are necessary for pursuing learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social, and cultural objectives, and adapting to changing trades and demands of the workplace, including adapting to the changes in work processes in the context of the fourth industrial revolution, through knowledge / skill development / re-skilling.
- Work independently; identify appropriate resources required for further learning.
- Acquire organizational skills and time management to set self-defined goals and targets with timelines.
- Inculcate a healthy attitude to be a lifelong learner.

PO10: Digital and technological skills:

- Use ICT in a variety of learning and work situations.
- Access, evaluate, and use a variety of relevant information sources, and use appropriate software for analysis of data.

PO11: Multicultural competence and inclusive spirit:

- The acquisition of knowledge of the values and beliefs of multiple cultures and a global perspective to honour diversity.
- Capability to effectively engage in a multicultural group/society and interact respectfully with diverse groups.
- Capability to lead a diverse team to accomplish common group tasks and goals.
- Gender sensitivity and adopting a gender-neutral approach, as also empathy for the less advantaged and the differently-abled including those with learning disabilities.

PO12: Value inculcation:

- Embrace and practice constitutional, humanistic, ethical, and moral values in life, including universal human values of truth, righteous conduct, peace, love, non-violence, scientific temper, citizenship values.
- Practice responsible global citizenship required for responding to contemporary global challenges, enabling learners to become aware of and understand global issues and to become active promoters of more peaceful, tolerant, inclusive, secure, and sustainable societies.
- Formulate a position/argument about an ethical issue from multiple perspectives.
- Identify ethical issues related to work, and follow ethical practices, including avoiding unethical behavior such as fabrication, falsification or misrepresentation of data, or committing plagiarism, and adhering to intellectual property rights.
- Recognize environmental and sustainability issues and participate in actions to promote sustainable development.
- Adopt an objective, unbiased, and truthful actions in all aspects of work.

- Instill integrity and identify ethical issues related to work, and follow ethical practices.

PO13: Autonomy, responsibility, and accountability:

- Apply knowledge, understanding, and/or skills with an appropriate degree of independence relevant to the level of the qualification.
- Work independently, identify appropriate resources required for a project, and manage a project through to completion.
- Exercise responsibility and demonstrate accountability in applying knowledge and/or skills in work and/or learning contexts appropriate for the level of the qualification, including ensuring safety and security at workplaces.

PO14: Environmental awareness and action:

- Ability to apply the knowledge, skills, attitudes, and values required to take appropriate actions for.
- Mitigating the effects of environmental degradation, climate change, and pollution.
- Effective waste management, conservation of biological diversity, management of biological resources and biodiversity, forest and wildlife conservation, and sustainable development and living.

PO15: Community engagement and service:

- To participate in community-engaged services/ activities for promoting the wellbeing of society.

PO16: Empathy:

- To identify with or understand the perspective, experiences, or points of view of another individual or group, and to identify and understand other people's emotions.

PSO1: To conceptualize and apply the basic principles of biological sciences and chemical sciences to provides an essential platform to understand the modern biotechnological processes designed according to the current needs of the society

PSO2: To understand and evaluate the various cellular processes and underlying mechanisms along with development of a diverse technologies

PSO3: To provide a platform for encompassing research with proficient and ethical responsibilities towards meeting societal needs

PSO4: To acquaint with various biological processes and explore their therapeutic, agriculture and industrial applications

Curriculum Structure

(Flexible Credit System)

Minimum Credit Requirements to Award Degree Under Each Category

S.No.	Course Category and Category Code		Minimum Credit Requirement					
			3 Year Undergraduate		4 Year Undergraduate (Hons.)		4 Year Undergraduate (Hons.) with Research	
			Credits	(%)	Credits	(%)	Credits	(%)
1	Multidisciplinary Core Courses	MDC	12	10	12	7.5	12	7.5
2	Major Core	MC	44	36.66	76	47.5	64	40
3	Major Electives	ME	16	13.33	16	10.00	16	10
4	Minor	MI	24	20	32	20	32	20
5	Internship	INT	04	3.40	04	2.50	04	2.50
6	Ability Enhancement Courses – University Core	UC	08	6.60	08	05	08	05
7	Skill Enhancement Courses – University Core	UC	08	6.60	08	05	08	05
8	Value Added Courses – University Core	UC	04	3.40	04	2.50	04	2.50
9	Research Project / Dissertation	PROJ	--	00	--	00	12	7.50
	Total		**120**	**100**	**160**	**100**	**160**	**100**

Multi-disciplinary Core Courses (MDC)

Course Code	Level	Course Title	L	T	P	S	J	C
HRMG1012	100	Principles of Management	2	0	0	0	0	2
VEDC1001	100	Venture Development	2	0	0	0	0	2
SOCY1031	100	Humans, Humanity and Humanities	2	0	0	0	0	2
SOCY1041	100	Humans and their World	2	0	0	0	0	2
PHYS1251	100	Introduction to Physical Sciences	2	0	0	0	0	2
BCBI1041	100	Introduction to Chemical and Life Sciences	2	0	0	0	0	2
		Total Credits						**12**

Major Core (MC)

Course Code	Level	Course Title	L	T	P	S	J	C
BTSC2131	200	Enzymology and Metabolism	3	0	0	0	0	3
BTSC2141	200	Enzymology and Metabolism Laboratory	0	0	2	0	0	1
BTSC2151	200	Molecular Biology	3	0	0	0	0	3
BTSC2161	200	Molecular Biology Laboratory	0	0	2	0	0	1
BTSC2171	200	Genetic Engineering	3	0	0	0	0	3
BTSC2181	200	Genetic Engineering Laboratory	0	0	2	0	0	1
BTSC3111	300	Genetics and Evolution	3	0	0	0	0	3
BTSC3121	300	Genetics Laboratory	0	0	2	0	0	1
BTSC3131	300	Plant Biotechnology	3	0	0	0	0	3
BTSC3141	300	Plant Biotechnology Laboratory	0	0	2	0	0	1
BTSC3151	300	Fundamentals of Biostatistics	3	0	0	0	0	3
BTSC3161	300	Basics in Immunology	3	0	0	0	0	3
BTSC3171	300	Animal Biotechnology	3	0	0	0	0	3
BTSC3181	300	Animal Biotechnology Laboratory	0	0	2	0	0	1
BCBI1101	100	Cell Biology	3	0	0	0	0	3
BCBI1111	100	Chemistry of Biomolecules	3	0	0	0	0	3
MFST2391	200	General Microbiology	3	0	0	0	0	3
MFST2401	200	General Microbiology Laboratory	0	0	2	0	0	1
MFST2551	200	Biochemical and Biophysical Techniques	3	0	0	0	0	3
MFST2561	200	Biochemical and Biophysical Techniques Laboratory	0	0	2	0	0	1
		Total Credits						**44**

Major Electives (ME)

Minimum number of credits to be earned: 16.

Course Code	Level	Course Title	L	T	P	S	J	C
BTSC2191	200	Plant Physiology	3	0	0	0	0	3
BTSC2201	200	Fundamentals of Human Physiology	3	0	0	0	0	3
BTSC2211	200	Plant Physiology Laboratory	0	0	2	0	0	1
BTSC2221	200	Fundamentals of Human Physiology Laboratory	0	0	2	0	0	1
BTSC3191	300	Ecological Diversity	3	0	0	0	0	3
BTSC3201	300	Ecological Diversity Laboratory	0	0	2	0	0	1
BTSC3211	300	Bioprocess Engineering and Technology	3	0	0	0	0	3
BTSC3221	300	Bioprocess Engineering and Technology Laboratory	0	0	2	0	0	1
BTSC3231	300	Bioinformatics	3	0	0	0	0	3
BTSC3241	300	Bioinformatics Laboratory	0	0	2	0	0	1
BTSC3251	300	Genomics	3	0	0	0	0	3
BTSC3261	300	Genomics Laboratory	0	0	2	0	0	1
BTSC3271	300	Tumor Biology	3	0	0	0	0	3
BTSC3281	300	Tumor Biology Laboratory	0	0	2	0	0	1
BTSC3291	300	Protein Engineering	3	0	0	0	0	3
BTSC3301	300	Protein Engineering Laboratory	0	0	2	0	0	1

Internship (INT)

Course code	Level	Course Title	L	T	P	S	J	C
BTSC3444	300	Internship	0	0	0	0	8	4

University Core (UC)

Course code	Level	Course Title	L	T	P	S	J	C
Ability Enhancement Courses								
LANG1042	100	Academic Writing	2	0	0	0	0	2
LANG1201	100	Critical Thinking	2	0	0	0	0	2
LANG1012	100	Communication Skills in English – Intermediate	0	0	4	0	0	2
LANG1022	100	Communication Skills in English – Advanced	0	0	4	0	0	2
Skill Enhancement Courses								
CSCI1301	100	Introduction to Programming	0	0	4	0	0	2
CSCI1311	100	Introduction to Data Science	0	0	4	0	0	2
CLAD1002	100	Emotional Intelligence & Reasoning Skills	0	0	2	0	0	1
CLAD1012	100	Leadership Skills & Quantitative Aptitude	0	0	2	0	0	1
CLAD1022	100	Verbal Ability & Quantitative Ability	0	0	2	0	0	1
CLAD1032	100	Practicing Verbal Ability & Quantitative Aptitude	0	0	2	0	0	1
Value Added Courses								
ENVS1002	100	Environmental Studies *	3	0	0	0	0	3
POLS1051	100	The Indian Constitution *	1	0	0	0	0	1
Pass / Fail Courses (Mandatory)								
FINA1081	100	Personal Financial Planning *	1	0	0	0	0	0
PHPY1011	100	Gandhi and the Contemporary World * / UHV	1	0	0	0	0	0
Pass / Fail Courses (Any one course to be chosen)								
DOSP1122	100	Yoga	0	0	2	0	0	0
MFST1002	100	Health and Wellbeing *	0	0	2	0	0	0
Club Activities								
DOSL1002	100	Club Activity (Participant)	0	0	2	0	0	0
DOSL1012	100	Club Activity (Member of the Club)	0	0	2	0	0	0
DOSL1022	100	Club Activity (Leader of the Club)	0	0	2	0	0	0
DOSL1032	100	Club Activity (Competitor)	0	0	2	0	0	0
Community Service								
DOSL1042	100	Community Services – Volunteer	0	0	2	0	0	0
DOSL1052	100	Community Services – Mobilizer	0	0	2	0	0	0
Sports								
DOSP1002	100	Badminton	0	0	2	0	0	0
DOSP1012	100	Chess	0	0	2	0	0	0
DOSP1022	100	Carrom	0	0	2	0	0	0
DOSP1032	100	Football	0	0	2	0	0	0
DOSP1042	100	Volleyball	0	0	2	0	0	0
DOSP1052	100	Kabaddi	0	0	2	0	0	0
DOSP1062	100	Kho- Kho	0	0	2	0	0	0
DOSP1072	100	Table Tennis	0	0	2	0	0	0
DOSP1082	100	Handball	0	0	2	0	0	0
DOSP1092	100	Basketball	0	0	2	0	0	0
DOSP1102	100	Tennis	0	0	2	0	0	0
DOSP1112	100	Throw ball	0	0	2	0	0	0

* Massive Open Online Course (MOOC)

Students pursuing 4th year of the Programme need to choose the courses from the respective basket of Honours or Honours with Research

Honours Courses

Minimum number of credits to be earned: 32.

Course Code	Level	Course Title	L	T	P	S	J	C
BTSC4001	400	Medical Biotechnology	3	0	0	0	0	3
BTSC4011	400	Medical Biotechnology Laboratory	0	0	2	0	0	1
BTSC4021	400	Advanced Immunology	3	0	0	0	0	3
BTSC4031	400	Advanced Immunology Laboratory	0	0	2	0	0	1
BTSC4041	400	Food Biotechnology	3	0	0	0	0	3
BTSC4051	400	Food Biotechnology Laboratory	0	0	2	0	0	1
BTSC4061	400	Nanobiotechnology	3	0	0	0	0	3
BTSC4071	400	Nanobiotechnology Laboratory	0	0	2	0	0	1
BTSC4081	400	Industrial Biotechnology	3	0	0	0	0	3
BTSC4091	400	Industrial Biotechnology Laboratory	0	0	2	0	0	1
BTSC4101	400	Neurobiology	3	0	0	0	0	3
BTSC4111	400	Neurobiology Laboratory	0	0	2	0	0	1
BTSC4121	400	Human Infectious diseases	3	0	0	0	0	3
BTSC4131	400	Human Infectious Diseases Laboratory	0	0	2	0	0	1
BTSC4141	400	Marine Biotechnology	3	0	0	0	0	3
BTSC4151	400	Marine Biotechnology Laboratory	0	0	2	0	0	1

Honours with Research Courses

Minimum number of credits to be earned is 32 out of which 12 credits must be earned through Research Project / Dissertation

Course Code	Level	Course Title	L	T	P	S	J	C
BTSC4001	400	Medical Biotechnology	3	0	0	0	0	3
BTSC4011	400	Medical Biotechnology Laboratory	0	0	2	0	0	1
BTSC4021	400	Advanced Immunology	3	0	0	0	0	3
BTSC4031	400	Advanced Immunology Laboratory	0	0	2	0	0	1
BTSC4081	400	Industrial Biotechnology	3	0	0	0	0	3
BTSC4091	400	Industrial Biotechnology Laboratory	0	0	2	0	0	1
BTSC4101	400	Neurobiology	3	0	0	0	0	3
BTSC4111	400	Neurobiology Laboratory	0	0	2	0	0	1
BTSC4141	400	Marine Biotechnology	3	0	0	0	0	3
BTSC4151	400	Marine Biotechnology Laboratory	0	0	2	0	0	1
Research Project / Dissertation (PROJ)								
BTSC4888	400	Dissertation - I (Review of Literature & Research Proposal)	0	0	0	0	8	4
BTSC4999	400	Dissertation – II	0	0	0	0	16	8

Minor Courses

One Minor is to be chosen from the following list of Minors.

The minimum number of credits to be earned up to 3 years of the programme is 24.

The minimum number of credits to be earned for the 4 year programme is 32.

Minors List

S.No.	Minor	Credits Required	
		3-Year UG	4-Year UG
1	Biochemistry	24	32
2	Bioinformatics	24	32
3	Biotechnology	24	32
4	Chemistry	24	32
5	Environmental Science	24	32
6	Mathematics	24	32
7	Statistics	24	32
8	Microbiology	24	32
9	Food Science and Technology	24	32
10	Physics	24	32
11	Electronics	24	32
12	Data Science	24	32
13	English	24	32
14	History	24	32
15	Political Science	24	32
16	Psychology	24	32
17	Sociology	24	32
18	Economics	24	32
19	Mass communication	24	32
20	Visual Communication	24	32
21	Bharatanatyam	24	32
22	Carnatic Vocal	24	32
23	Kuchipudi	24	32
24	Mohiniyattam	24	32
25	Mridangam	24	32
26	Theatre Arts	24	32
27	Business Administration	24	32

GITAM School of Science

GITAM (Deemed to be University)

Visakhapatnam | Hyderabad | Bengaluru