



GU/Acad –PG/BoS - GU-ART /2025-26/606

Date: 04.12.2025

CIRCULAR

The syllabus of the Goa University–Admission Ranking Test (GU-ART) for **Master of Science in Biotechnology** and **B.Ed. in Biotechnology** Programmes, approved by the Academic Council in its meeting held on 7th November 2025 is attached.

The Dean/Vice-Dean (Academic) of the School of Biological Sciences and Biotechnology and the Principals of all the affiliated Colleges are requested to take note of the above and bring the contents of this Circular to the notice of all concerned, including students aspiring to pursue the Master's and B.Ed. Programmes.

(Ashwin V. Lawande)
Deputy Registrar – Academic

To,

1. The Dean, School of Biological Sciences and Biotechnology, Goa University.
2. The Vice-Dean (Academic), School of Biological Sciences and Biotechnology, Goa University.
3. Principals of all the affiliated Colleges.

Copy to:

1. Controller of Examinations, Goa University.
2. Assistant Registrar (Admissions), Goa University.
3. Assistant Registrar Examinations (UG/PG), Goa University.
4. Director, Directorate of Internal Quality Assurance, Goa University for uploading the Syllabus on the University website.



GOA UNIVERSITY

**SYLLABUS FOR GOA UNIVERSITY-ADMISSIONS RANKING TEST (GU-ART)
FOR MASTER'S & B.Ed. IN BIOTECHNOLOGY PROGRAMMES**

Effective from AY: 2026-27

Modules	Content
Module 1:	Basic Biomolecules
	<ul style="list-style-type: none">• Carbohydrates: Classification, structure, roles; simple sugars, polysaccharides (homo- & heteropolysaccharides), glycoconjugates, and lectin interactions.• Amino acids & proteins: Structures, properties, peptide bond and synthesis, protein classification, purification, structure (Ramachandran plot), and denaturation.• Lipids: Types (phospholipids, sphingolipids, fatty acids, sterols/steroids), properties, biological roles, and signalling molecules (eicosanoids).• Nucleic acids: Bases, nucleotides, DNA & RNA structures, DNA supercoiling, synthetic analogues, and nucleotide functions.
Module 2:	Enzymes and Metabolism
	<ul style="list-style-type: none">• General terminology: Catabolism, anabolism, amphibolic pathways, regulation modes.• Enzymes: Structure, activity, kinetics (Michaelis–Menten), specificity, inhibition types, regulation (feedback).• Carbohydrate metabolism: Glycolysis, Kreb's cycle, oxidative phosphorylation, alternate pathways (HMP shunt, gluconeogenesis, glyoxylate cycle, glycogenesis).• Protein metabolism: Transamination, deamination, urea cycle.• Lipid metabolism: Fatty acid biosynthesis and beta-oxidation.• Nucleotide metabolism: Purine and pyrimidine biosynthesis, degradation, and recycling.
Module 3:	Cell Biology
	<ul style="list-style-type: none">• Cell basics: Discovery, cell theory, prokaryotic vs. eukaryotic ultrastructure.• Membranes: Fluid mosaic model, transport mechanisms, cell wall, cytoskeleton, extracellular matrix.

	<ul style="list-style-type: none"> • Organelles: Mitochondria, chloroplast, ribosomes, Golgi, ER, lysosomes, nucleus, vacuoles. • Processes: Cell cycle (mitosis, meiosis, checkpoints), protein trafficking, signal transduction (receptors, pathways, quorum sensing). • Cell interactions: Adhesion molecules, cell-cell and cell-matrix connections.
Module 4:	Microbiology <ul style="list-style-type: none"> • Foundations: Origins of microbiology, taxonomy, evolution, structure of bacteria, archaea, fungi, protozoa, viruses, prions. • Ecology & interactions: Metabolic diversity, symbiosis, nitrogen fixation, biofilms, biogeochemical cycles. • Methods: Cultivation, preservation, culture media, enumeration, microbial control (chemotherapeutics). • Genetics: Transformation, conjugation, transduction.
Module 5:	Plant Biology <ul style="list-style-type: none"> • Transport: Water potential, ascent of sap (cohesion-tension), transpiration, stomatal regulation, phloem transport (source–sink). • Mineral nutrition: Essential elements, uptake mechanisms, deficiencies. • Growth regulators: Auxins, gibberellins, cytokinins, abscisic acid, ethylene, brassinosteroids, jasmonates. • Responses: Tropisms, photoperiodism, photomorphogenesis. • Photosynthesis: Pigments, photosystems & electron transport, C3, C4, CAM pathways, photorespiration.
Module 6:	Animal Physiology <ul style="list-style-type: none"> • Digestion & absorption: Enzymes and hormones. • Respiration: Pulmonary ventilation, gases, pigments, dissociation curves, control mechanisms. • Circulation: Blood composition, haemopoiesis, cardiac cycle, heart conduction. • Muscle physiology: Types, contraction mechanisms (isotonic vs. isometric). • Excretion/osmoregulation: Kidney, urine formation, ornithine cycle. • Nervous system: Synapses, neurotransmission, impulse conduction. • Endocrine system: Hormones, glands, regulation. • Reproduction: Male/female anatomy, cycles, menopause, fertility control.
Module 7:	Ecology and Evolution <ul style="list-style-type: none"> • Ecology basics: Ecosystems, biomes, populations, niches, trophic levels. • Community interactions: Predator–prey dynamics, succession, climax community, island biogeography.

	<ul style="list-style-type: none"> • Evolution: Darwinism, Neo-Darwinism, adaptation, speciation, coevolution, origin of life theories. • Paleobiology: Fossils, stratigraphy, living fossils, molecular phylogeny.
Module 8:	Biotechnology <ul style="list-style-type: none"> • Ancient & classical: Domestication, fermentation, penicillin, genetics. • Modern: DNA technologies, cloning, sequencing, gene editing, Human Genome Project. • Indian contributions: Green Revolution, GM crops, food security initiatives. • Applied areas: <ul style="list-style-type: none"> ○ Medical: Vaccines, diagnostics, gene/stem-cell therapy, nanomedicine, IoT in health. ○ Environmental: Bioremediation, engineered microbes, AI applications. ○ Food & agriculture: GMOs, probiotics, biofertilizers, biopesticides, SCP, nutraceuticals. ○ Industrial: Biofuels, bioplastics, enzymes, wastewater treatment. ○ Frontiers: Biomimetics, bioinformatics, bioterrorism.
Module 9:	Entrepreneurship in Biotechnology <ul style="list-style-type: none"> • Core aspects: Meaning, importance, and traits of successful entrepreneurship. • Business planning: Business model canvas, project identification, funding sources, regulatory compliance. • Applications: Diagnostic labs, incubators, eco-farms, aquaponics/aquaculture, herbal industries. • Services: Bioinformatics, clinical data management, consultancy.
Module 10:	Basic Concepts of Chemistry <ul style="list-style-type: none"> • Atomic structure • Chemical bonding and molecular structure • Classification of elements and periodicity • Properties of liquids and gaseous state
Module 11:	Physical Chemistry <ul style="list-style-type: none"> • Solutions and equilibrium • Electrochemistry • Chemical kinetics • Thermodynamics and bioenergetics
Module 12:	Analytical Techniques <ul style="list-style-type: none"> • Principles of chromatography (ion exchange, gel filtration, HPLC, GC) • Principles of spectroscopy (UV-VIS, IR, NMR, Raman) • Electrophoresis, pH meter, colorimetry

Module 13:	Organic Chemistry
	<ul style="list-style-type: none"> • Basic concepts of organic compounds • Functional groups and their reactions • Stereochemistry • Polymers
Module 14:	Mechanics and Properties of Matter
	<ul style="list-style-type: none"> • Units, dimensions, and measurements • Kinematics, Newton's laws, work, energy, and power • Laws of motion, systems of particles, rotational motion • Elasticity, viscosity, surface tension, properties of liquids and solids
Module 15:	Thermodynamics and Heat
	<ul style="list-style-type: none"> • Thermal properties of matter • Laws of thermodynamics, heat transfer mechanisms • Kinetic theory of gases
Module 16:	Waves and Oscillations
	<ul style="list-style-type: none"> • Simple harmonic motion, mechanical waves, Doppler effect, resonance • Sound waves
Module 17:	Electricity, Magnetism, and Electromagnetism
	<ul style="list-style-type: none"> • Electrostatics, Coulomb's law, electric potential, capacitors • Current electricity, Ohm's law, Kirchhoff's laws • Magnetic effects of current, electromagnetism, electromagnetic induction, alternating current, magnetic properties of matter
Module 18:	Optics
	<ul style="list-style-type: none"> • Reflection, refraction, lenses and mirrors, total internal reflection • Wave optics: interference, diffraction, polarization
Module 19:	Modern Physics
	<ul style="list-style-type: none"> • Atomic structure and spectra, photoelectric effect, properties of nuclei, radioactivity, dual nature of matter and radiation • Semiconductors and basic digital electronics
Module 20:	Human Anatomy and Physiology
	<ul style="list-style-type: none"> • Basic structure and functions of human organ systems (e.g., circulatory, respiratory, nervous, digestive, endocrine, reproductive) • Cell structure and tissue organization • Organ functions and homeostasis mechanisms
Module 21:	Microbiology and Immunology
	<ul style="list-style-type: none"> • Human microbiota and pathogens

	<ul style="list-style-type: none"> • Immune system components and functions (innate and adaptive immunity) • Vaccines and immunological techniques
Module 22:	Molecular Medicine and Genetics <ul style="list-style-type: none"> • Molecular basis of diseases (genetic, infectious, metabolic) • Gene regulation and molecular genetics in medicine • Basics of genetic disorders and inheritance patterns
Module 23:	Clinical Laboratory Techniques <ul style="list-style-type: none"> • Diagnostic methods and biochemical assays • Blood composition and haematology basics • Basic pharmacology and drug action principles
References/ Readings:	<ol style="list-style-type: none"> 1. D.L. Nelson & Cox. M. (2017) Lehninger Principles of Biochemistry. W.H. Freeman & Co. 7th edition. 2. Berg, J. M., Tymoczko, J. L. and Stryer, L., (2019) Biochemistry. IXth Edition. W.H Freeman and Co. 3. Alberts, B., Bray, D., Hopkin, K., Johnson, A. D., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2015). Essential cell biology. Garland Science. 4. Alberts, B. (2017). Molecular biology of the cell. Garland science. 3. 5. Cooper, G.M. and Hausman, R.E. (2019). The Cell: A Molecular Approach. 7th edition. Oxford University Press. 6. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. 8th edition. Lippincott, Williams and Wilkins, Philadelphia. 7. Willey, J.M., Sherwood, L.M., and C.J. Woolverton, (2021) Prescott's Microbiology (11th ed.). McGraw-Hill Education. 8. Ananthnarayan, R. and Jeyaram Panicker, C. K. (2010). Textbooks of Microbiology. 17th edition. Orient Longman. 9. Hopkins, W.G. and Huner, A. (2008). Introduction to Plant Physiology. John Wiley and Sons. U.S.A. 4th edition. 10. Pandey, B. P., & Sinha, S. (2017). Plant Physiology. Vikas Publishing House. 11. Salisbury, F. B., & Ross, C. W. (1991). Plant Physiology. Wadsworth Publishing. 12. Taiz, L., Zeiger, E., Moller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition. 13. V.K. Jain, (2018), Fundamentals of plant physiology S.Chand publications. 19th edition. 14. Agarwal R A, Anil K Srivastava & Kaushal Kumar (2022). Animal Physiology and Biochemistry. S Chand Publication. 15. Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Harcourt Asia PTE Ltd. /W.B. Saunders Company. 16. Nagabhushanam, (2008), Textbook of Animal Physiology, Oxford and IBH.

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