MAHATMA GANDHI UNIVERSITY, KERALA

Abstract

Bachelor of Science (Honours) Zoology - Fifth Semester - Modifications to the Course Outcomes, Course Content and Mode of Assessment - Approved - Orders Issued.

ACA 16

No. 5275/ACA 16/2026/MGU Priyadarsini Hills,Dated: 26.05.2026

Read:-1. U.O.No.5797/AC A16/2024/MGU, dated.27.06.2024.

2. Minutes of the meeting of the Expert Committee on Zoology (UG)

4. Orders of the Vice Chancellor under Section 10 (17), Chapter III of the Mahatma Gandhi University Act 1985, dated 23.05.2026.

ORDER

The syllabi of various Honours Under Graduate Programmes coming under The MGU-UGP (Honours) Regulations, 2024, have been approved vide paper read as (1) above and published on the website of the University.

The Expert Committee on Zoology (UG), deliberated on modifying the **Course Outcomes, Course Content and Mode of Assessment of the DSC, DSE and SEC** type courses in the **Fifth Semester** syllabus of **Bachelor of Science (Honours) Zoology** programme and has submitted recommendations, vide paper read as (2) above. **(Recommendations are attached as Annexure).**

Considering the urgency of the matter, sanction has been accorded by the Vice Chancellor, in exercise of the powers of the Academic Council vested upon him under Section 10(17), Chapter III of the Mahatma Gandhi University Act 1985, vide paper read as (3) above, to approve the aforementioned recommendations.

Hence, the **Course Outcomes**, **Course Content and Mode of Assessment** of the said courses in the **Fifth Semester** syllabus of **Bachelor of Science (Honours) Zoology** programme stands modified to this extent.

Orders are issued accordingly.

SUDHA MENON J

ASSISTANT REGISTRAR III
(ACADEMIC)
For REGISTRAR

Copy To

1. PS to VC
2. PA to Registrar/CE
3. Convenor, Expert Committee, Zoology(UG)
4. JR 2 (Admin)/DR 2, AR 3 (Academic)
5. JR/DR/AR (Exam)
6. Tabulation/Academic Sections concerned
7. AC C1/AC C2 Sections
8. IT Cell 3/OQPM1Sections
9. PRO/IQAC/Records Sections
10. Stock File/File Copy

File No. 26554/AC A16-1/2026/AC A16.

Forwarded / By Order

Section Officer

The document is digitally approved. Hence signature is not needed.

ANNEXURE

SEMESTER V

ALL COURSES

Course Level	300-399 (Modified)

Course Name : Animal Diversity Chordata - II

Course Code : MG5DSCZGY300

Course Outcomes (CO)

CO.No	Expected Course Outcome	Learning Domains (Modified)	PO.No	Page No.
1	No Change	No Change	No Change	114
2		An		
3	Explain flight adaptation in birds, endemic birds of the Western Ghats and aquatic mammals.	U		
4	Identify the specimen, dissect the pecten and hyoid of a bird.	A,S		
5	Removed			

Course Content

Content for Classroom transaction (Units)

Module	Units (Modified)	Course Description (Modified)	Hours	CO.No (Modified)	Page No.
1	1.1	No Change	No Change	1	115-117
	1.2			No Change	
	1.3			3	
2	2.1	No Change	No Change	1	
	2.2			No Change	
	2.3			3	
3	3.1	Type Specimens (Euphlyctis, Pigeon and Rabbit – Brief study only) Integumentary System, Skeletal System: Axial Skeleton (skull excluded), Appendicular skeleton,	No Change	No Change	

		Digestive System, Circulatory System, Respiratory system, Sense organs, Urinogenital system.			
4	4.1	No Change	No Change	4	
	4.2				
	4.3	Prepare and write in record, the list of the common names and scientific names of smallest/ biggest/tallest/ heaviest/ other peculiarities/ animals of different states /national animal etc. from Aves and Mammals	No Change		
	4.4	No Change	No Change		
	4.5				
	4.6				
		Activity	No Change	1	
5		**Teacher Specific Content**			

Mode of Assessment

<table>
<tr><td rowspan="2">Assessment Type</td><td>B. End Semester Evaluation (Modified)</td><td>Page No.</td></tr>
<tr><td>
Theory
Total Marks = 50 Duration- 1.5 hrs
<table>
<tr><th>Type of Questions</th><th>No. of Questions to be Answered</th><th>Total Marks</th></tr>
<tr><td>Short Essay</td><td>4 out of 6</td><td>4 x 5 = 20</td></tr>
<tr><td>Short Answer</td><td>6 out of 8</td><td>6 x 3 = 18</td></tr>
<tr><td>Multiple Choice Questions</td><td>12 out of 12</td><td>12 x 1=12</td></tr>
</table>
Practical
Total Marks= 35
Record- 10 marks
Minor Dissection-8 marks
</td><td>117</td></tr>
</table>

	Osteology- 5 marks Spotter Identification- 6 marks Identify the labelled parts and write notes on-6 marks	

Course Name : Cell Biology and Molecular Biology
Course Code : MG5DSCZGY301

Course Outcomes (CO)

CO.No	Expected Course Outcome (Modified)	Learning Domains (Modified)	PO.No.	Page No.
1	Explain cell theory, cellular diversity and cell communication.	No Change	No Change	119
2	Explain the structure and functions of the cell organelles.	U		
3	Describe the cell cycle and types of cancer, diagnosis and treatment.	U		
4	No Change	U		
5	Conduct experiments to demonstrate cell and molecular biology concepts.	S		

Course Content

Content for Classroom transaction (Units)

Module	Units (Modified)	Course Description (Modified)	Hours	CO.No (Modified)	Page No.
1		**Overview of cells and cellular dynamics**			120-121
	1.1	No Change	No Change	No change	
	1.2	Prokaryotes - Bacteria in detail and Mycoplasma Eukaryotic cell (Brief account) Difference Between Prokaryotes and Eukaryotes Virus, Virions and Viroids, Prions; Origin of Eukaryotic cell - Endosymbiotic theory			
	1.3	Structure and functions of:		2	

		Cytoskeleton, Endoplasmic reticulum, Ribosomes (Prokaryotic and Eukaryotic), Golgi complex, Lysosomes, Mitochondria	No Change		
	1.4	No Change		3	
	1.5			3	
2		**Plasma membrane**			
	2.1	No Change	No Change	2	
	2.2			1,2	
	2.3			No Change	
	2.4			2	
3		**Nature of Genetic material and Expression of Gene**			
	3.1	No Change	No Change	No Change	
	3.2				
	3.3	Prokaryotic Gene expression and regulation: Central Dogma of molecular biology and characteristics of genetic code DNA replication. Gene Expression: Transcription, Translation and Reverse transcription. Prokaryotic Gene regulation: (inducible and repressible systems) Operon concept - Lac operon and Tryptophan operon.			
4		**Cell Biology**			
	4.1	No Change	No Change	5	
	4.2				
	4.3				
	4.4				
	4.5				
		Molecular Biology			
	4.6	No Change	No Change	5	
	4.7				
	4.8	Extraction of DNA from			

		plant/ tissue samples. (Demonstration only)			
		Activity		5	
5		**Teacher Specific Content**			

Teaching and Learning Approach (Modified)	**Classroom Procedure (Mode of Transaction)**	Page No. 122
	Lectures, Flipped classroom, Participative Learning, Interactive Sessions, Practical based learning, Peer teaching.	

Mode of Assessment

Assessment Type	**B. End Semester Evaluation (Modified)**	**Page No.**

Theory

Total Marks = 50 **Duration- 1.5 hrs**

Type of Questions	**No. of Questions to be Answered**	**Total Marks**
Short Essay	4 out of 6	4 x 5 = 20
Short Answer	6 out of 8	6 x 3 = 18
Multiple Choice Questions	12 out of 12	12 x 1 = 12

Practical

Total Marks : 35

Record- 10 marks **Practical Examination: 25 marks**

Squash preparation of onion root tip for mitotic stages/ Preparation of Human blood smear and identification of leukocytes. – 10 marks

Barr body from human buccal epithelium-4 Marks

Extraction of DNA- 3 marks (Procedure only)

Spotter identification from Cell Biology – 4 marks

Spotter Identification from Molecular Biology – 4marks

122

Course Name : Fundamentals of Genetics
Course Code : MG5DSCZGY302

Course Outcomes (CO)

CO.No	Expected Course Outcome (Modified)	Learning Domains (Modified)	PO.No.	Page No.
1	Discuss Mendelian principles of inheritance and gene interactions.	U,A	No Change	123
2	Understand and analyze genetic recombination, linkage and sex determination.	U,A		
3	Discuss the mechanism of mutation.	U		
4	Comprehend the organization of genetic material and pedigree analysis.	U		
5	Familiarize with genetic diseases.	No Change		

Course Content

Content for Classroom transaction (Units)

Module	Units	Course Description (Modified)	Hours (Modified)	CO.No (Modified)	Page No.
1	No Change				124-125
2	No Change				
3	No Change				
4		**Cytogenetics and Genetic disorders**			
	4.1	No Change	No Change	No Change	
	4.2	Pedigree Analysis (Brief account only) – Pedigree symbols and construction of Pedigree.	2	4	
	4.3	Human chromosomal anomalies: Autosomal (Down syndrome, Edward's syndrome and Cri du chat syndrome). Sex chromosomal anomalies (Klinefelter syndrome, and Turners syndrome), Single gene disorders - Sickle cell	5	No Change	

		anemia, cystic fibrosis¸Tay Sachs disease. ACTIVITY: Study of syndromes and karyotypes using photograph			
	4.4	Inborn errors of metabolism: Genetic basis of Phenyl ketonuria, Alkaptonuria, Albinism.	3	No Change	
	4.5	Multifactorial disorders - Cleft lip and cleft palate.	1	No Change	
	4.6	No Change	No Change	No Change	
5		**Teacher Specific Content**			

Teaching and Learning Approach (Modified)	**Classroom Procedure (Mode of Transaction)**	Page No. 125
	Lectures, Flipped classroom, Participative Learning, Interactive Sessions, Practical based learning, Peer teaching.	

Mode of Assessment

Assessment Type	**B. End Semester Evaluation (Modified)** **Theory** **Total Marks = 70** **Duration- 2 hrs**	**Page No.**
	Type of Questions / **No. of Questions to be Answered** / **Total Marks** Multiple Choice Questions: 10 out of 10: 10 x 1 = 10 Short Answer: 10 out of 12: 10 x 3 = 30 Short Essays: 6 out of 8: 6 x 5 = 30	125

Course Name : Biotechnology- Principles and Practices
Course Code : MG5DSEZGY300

Course Outcomes (CO)

CO.No	Expected Course Outcome (Modified)	Learning Domains (Modified)	PO.No.	Page No.
1	No Change	U	No Change	127

2	No Change	No Change	No Change	
3				
4	Describe biosafety concerns in biotechnology and the protection of intellectual property rights.	No Change		
5	Removed			

Course Content

Content for Classroom transaction (Units)

Module	Units	Course Description	Hours	CO.No (Modified)	Page No.
1	No Change				128-130
2	No Change				
3	No Change				
4		**A.Biosafety concerns B.Intellectual Property Protection**	No Change	No Change	
	4.1	No Change			
	4.2			4	
5		**Teacher Specific Content**			

Mode of Assessment

Assessment Type	B. End Semester Evaluation (Modified)			Page No.
	Theory			130
	Total Marks = 70		**Duration- 2 hrs**	
	Type of Questions	**No. of Questions to be Answered**	**Total Marks**	
	Multiple Choice Questions	10 out of 10	10 x 1 = 10	
	Short Answer	10 out of 12	10 x 3 = 30	
	Short Essay	6 out of 8	6 x 5 = 30	

Course Name : Wildlife Management
Course Code : MG5DSEZGY301

Course Outcomes (CO)

CO.No	Expected Course Outcome (Modified)	Learning Domains (Modified)	PO.No.	Page No.
1	No Change	No Change	No Change	132
2	Describe primate biology, ecology and wildlife, with special reference to mammals, birds and reptiles.	No Change	No Change	
3	Discuss the man-wildlife conflict, its consequences and remedial measures.	U	No Change	
4	No Change	U	No Change	
5	No Change	No Change	No Change	

Course Content

Content for Classroom transaction (Units)

<table>
<tr><th>Module</th><th>Units</th><th>Course Description</th><th>Hours</th><th>CO.No (Modified)</th><th>Page No.</th></tr>
<tr><td>1</td><td colspan="4">No Change</td><td rowspan="9">133-134</td></tr>
<tr><td rowspan="6">2</td><td></td><td>Introduction to wildlife & Man wildlife conflict</td><td rowspan="5">No Change</td><td rowspan="4">No Change</td></tr>
<tr><td>2.1</td><td rowspan="4">No Change</td></tr>
<tr><td>2.2</td></tr>
<tr><td>2.3</td></tr>
<tr><td>2.4</td><td rowspan="2">3</td></tr>
<tr><td></td><td>Activity</td><td></td></tr>
<tr><td>3</td><td colspan="4">No Change</td></tr>
<tr><td>4</td><td colspan="4">No Change</td></tr>
<tr><td>5</td><td></td><td colspan="3">Teacher Specific Content</td></tr>
</table>

Mode of Assessment

Assessment Type	B. End Semester Evaluation (Modified) Theory Total Marks = 70 Duration- 2 hrs	Page No.
	Type of Questions / **No. of Questions to be Answered** / **Total Marks** Multiple Choice Questions / 10 out of 10 / 10 x 1 = 10 Short Answer / 10 out of 12 / 10 x 3 = 30 Short Essay / 6 out of 8 / 6 x 5 = 30	134

Course Name : Climate Change and Disaster Risk Reduction
Course Code : MG5DSEZGY302

Course Outcomes (CO)

CO.No	Expected Course Outcome (Modified)	Learning Domains (Modified)	PO.No.	Page No.
1	No Change	U	No Change	136
2	Recognize the challenges and impacts in urban, rural, and industrial disaster risk management in the context of climate change.	U		
3	Comprehend basic concepts, approaches and tools of Disaster Risk Management and appropriate mitigation measures.	No Change		
4	Apply preparedness measures and natural resources management strategies for disaster risk reduction and climate change adaptation.	A		
5	Understand national and international climate change policies and risk assessment methods for effective disaster resilience.	U, A		

Course Content

Content for Classroom transaction (Units)

Module	Units (Modified)	Course Description (Modified)	Hours	CO.No (Modified)	Page No.
1		**Climate Change & Disasters**	No Change		137
	1.1	No Change		No Change	
	1.2			1	
	1.3			1	
	1.4 (Added)	Carbon to Climate Control: A Path to Disaster Reduction: Carbon trading, carbon credit; Carbon footprint, carbon sequestration. Carbon neutral, alternate sources of energy, ecological footprint, Polluter Pays Principle, 3'R Principle, Green auditing.	4	1	
2		**Disaster Risk Reduction (DRR)**	No Change		137-138
	2.1	Issues in Urban, Rural and Industrial disaster risks management with respect to climate change. Resilient agriculture, Disaster Resilience-Infrastructure, Industry, Livelihoods, Schools, Hospitals. Issues of special needs - gender, aged, children, Disabled; psycho-social Impact of climate change in India/Kerala.	No Change	No Change	
	2.2	Psycho-social Impact of climate change in India/Kerala:Extreme Heat, changing rainfall patterns, increased droughts, depletion of ground water, melting	No Change	No Change	

		of glaciers, rise of sea level, faunal decline.			
	2.3	Climate change- Impact on Agriculture & Food Security, Energy Security, Water Security. Health, Migration & Conflict **ACTIVITY** 1. Energy audit of your house/college. 2. Survey in your locality regarding measures adopted for energy utilisation, rainwater harvesting etc. and conducting awareness programs.	4	2	
	2.4	Removed			
	2.5				
3		**Adaptation strategies**	No Change		138-139
	3.1	**Basic concepts and terminologies:** Hazard, Risk, vulnerability, Disaster, Mitigation, DRR and its evolution, Disaster Risk Management (DRM), Emergency, Response, Relief; Resilience, Reconstruction, Recovery	4	3	
	3.2	**Disaster Risk Mitigation** Disaster management journey and paradigm shift; Approaches in disaster management– Engineering-centric, Community-Based Disaster Preparedness (CBDP), Indent management, Ecosystem-based Disaster Risk Reduction (ecoDRR). Land Use	5	3	

		Planning and Development Regulations, Disaster Safe Designs and Constructions - Structural and Non-Structural measures of mitigation, International and national policy frameworks and guidelines.			
	3.3	**Disaster Risk Management** Tools and Methods in Disaster Risk Management: Hazard, risk and vulnerability analysis; legislations, Codes & Standards, Risk sensitive land use planning, Safety auditing, Role of Strategic Environmental Assessment (SEA)/ Environmental Impact Assessment (EIA), situation analysis, Incident response system, Post-Disaster Needs Assessments (PDNA), Environmental economics & DRR, Recovery framework. DM Planning for Government at national/ sub- national, Ministry/ departments, organization/establishm -ents and at local levels.	5	3	
	3.4 (added)	**Applications of science and technology for DRR & Climate Change Adaptation (CCA)** Geo-informatics in	3	4	

		Disaster Management (RS, GIS, GPS and RS) Disaster Communication System (Early Warning and Its Dissemination), S&T; Institutions for Disaster Management in India.			
	3.5 (added)	**Disaster Preparedness** Crisis management, Early warning and communication, Emergency response, Local preparedness, Relief management-Shelter, & quot; water, sanitation and hygiene & quot; (Watsan), environmental health, trauma care; Role of agencies, technology and coordination; Issues of green relief, sustainable recovery, built back better; Climate Change Adaptation - Disaster Risk Reduction (CCA-DRR) and sustainability integration into post-disaster/post-conflict development, International response.	3	4	
4		**Challenges, issues & impact of Climate change**	No Change		139
	4.1	Natural Resource Management-Disaster Risk Management (NRM-DRM) integration, ecosystem-based adaptation and eco DRR; Role of Green growth, sustainable NRM – WRM (Natural Resource management -	5	No Change	

		Integrated Water Resources Management), Watershed, River basin, Integrated Coastal Zone Management Plan: (ICZM), Socioeconomic resilience, Capacity building.			
	4.2	**Policies/treaties to combat Climate change:** International - Montreal protocol, Kyoto Protocol, Earth summit, Paris Agreement 2005, IPCC, & UNFCCC; National - Disaster management Act, 2005, NAPCC - National Action Plan on Climate Change; Role of government, NGOs, and communities.	4	5	
	4.3	**Methods of risk assessment in the Kerala context:**GIS and remote sensing applications for risk mapping role of local government in disaster management Case studies on policy implementation Early warning systems and their implementation Community-based disaster preparedness Infrastructure planning for disaster resilience Analyzing successful disaster management cases in Kerala Data analytics for predicting and managing disasters	No Change	5	

		Activity: 1. Case studies; Field work at areas with history of natural disasters in Kerala – Report submission and Presentation. 2. Visit to disaster prone areas & report.			
5		**Teacher Specific Content**			

Mode of Assessment

Assessment Type	**B. End Semester Evaluation (Modified)** **Theory** **Total Marks = 70** **Duration- 2 hrs**	**Page No.**
	Type of Questions / **No. of Questions to be Answered** / **Total Marks** Multiple Choice Questions: 10 out of 10: 10 x 1 = 10 Short Answer: 10 out of 12: 10 x 3 = 30 Short Essay: 6 out of 8: 6 x 5 = 30	140

Course Name : Food and Water Quality Management
Course Code : MG5SECZGY300

Course Outcomes (CO)

CO.No	Expected Course Outcome (Modified)	Learning Domains (Modified)	PO.No.	Page No.
1	Understand various food adulterants, food additives, their detection methods and health impacts.	No Change	No Change	142
2	Discuss food laws, regulations, quality management systems, and the role of agencies in ensuring food safety.			
3	Identify food spoilage, methods for analysis of	U		

	spoiled foods, and assessment of water quality.			
4	Explain principles and methods of food preservation and modern food packaging techniques to maintain food safety.	No Change		
5	**Removed**			

Course Content

Content for Classroom transaction (Units)

Module	Units	Course Description (Modified)	Hours (Modified)	CO.No (Modified)	Page No.
1					143
	1.1	No Change	No Change	No Change	
	1.2			No Change	
	1.3			2	
	1.4			2	
2					144
	2.1	No Change	No Change	3	
	2.2			3	
	2.3			No Change	
	2.4			3	
	2.5			3	
3					144
	3.1	Principles and methods of food preservation. Temperature-Based Methods of Food Preservation High Temperature Preservation (Thermal Methods): Principle, process, advantages, and limitations of blanching, Pasteurization, Ultra-High temperature (UHT) Sterilization, canning; spoilage of canned foods. Low temperature preservation; Processing and Preservation by low-temperature refrigeration	No Change	4	

		and cold storage, chilling, freezing, cryogenic freezing, freeze drying. Effect of freezing on constituents of foods; chilling injury, freezer burn.			
	3.2	Different techniques of Food Preservation: Drying, dehydration and concentration:Factors affecting rate of drying and dehydration; water activity and relative humidity, drying methods. Methods of concentration;preservation using sugar, salt and acids. Effect of drying, dehydration and concentration on quality of foods. Hurdle technology.	5	4	
	3.3	Recent advances in food packaging: Active packaging, intelligent packaging, modified atmosphere packaging (MAP), controlled atmosphere packaging (CAP, biodegradable plastics, edible gums and Coatings. Retort pouches, Aseptic and shrink packaging.	5	4	
	3.4	Removed			
4		**Teacher Specific Content**			

Mode of Assessment

<table>
<tr><td rowspan="2">Assessment Type</td><td>B. End Semester Evaluation (Modified)
Theory
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</table></td><td>Page No.
145</td></tr>
</table>

Course Name : Aquarium Fabrication and Setting
Course Code : MG5SECZGY301

Course Summary (Modified)	By the end of this course, students will be equipped with the knowledge and practical skills needed to design, set up, and manage both standard and speciality aquariums, ensuring the health and well-being of the aquatic life they care for. They will be prepared to address the challenges of aquarium maintenance and contribute to the growing field of aquarium design and management. The course is aimed at imparting skill in the preparation of varieties of aquaria using the latest materials and techniques available.	**Page No. 146**

Course Outcomes (CO)

CO.No	Expected Course Outcome (Modified)	Learning Domains (Modified)	PO.No.	Page No.
1	Describe the fundamentals of designing diverse aquariums, management & maintenance with cost-effective solutions.	No Change	No Change	146
2	Explain essential aquarium accessories, water quality parameters, and filtration systems to ensure a healthy aquatic environment.			

3	Describe the methods of setting up freshwater and marine aquariums, aquarium plants & their significance, types of feed, feed preparation for aquarium fishes.	U,S		
4	Investigate common challenges in aquarium management, safe transport of ornamental fishes and the marketing strategies to support sustainable business opportunities.	U,A		
5	Removed			

Course Content

Content for Classroom transaction (Units)

Module	Units	Course Description (Modified)	Hours (Modified)	CO.No (Modified)	Page No.
1		**Aquarium- The Fundamentals**	**11**		**147**
	1.1	Aquarium: Benefits of keeping an aquarium. Factors to be considered for tank construction. Location, Size, Shape of aquarium (rectangular, triangular, trapezoid, global, hexagonal, blowfront, cube and custom-shaped), Water volume, Choice material (glass, acrylic and other material), Purpose, Budget, and Aesthetic preferences.	No Change	No Change	
	1.2	**Types of Aquariums-** Freshwater Aquariums (Community Tanks, Species- Specific Tanks and Planted Aquariums), Saltwater (Marine) Aquariums (Fish-Only (FO) Tanks, Fish-Only with Live Rock (FOWLR) Tanks and Reef Tanks), Brackish Aquariums	4	No Change	
	1.3	Specialty Aquariums-	5	No Change	

		Biotope Aquariums, Planted aquariums, Reef tanks, Coldwater Aquariums, Nano aquariums, Paludariums, jelly fish aquariums, Public Display Aquariums, Experimental or Research Aquariums, Breeding Tanks, Quarantine Tanks, Furniture integrated aquariums (Coffee table aquariums) Wall mounted aquariums (Wall Niches, Room Dividers, Office space), floor-integrated tanks, etc.			
	1.4	Removed			
2		**Aquarium Accessories and Water Quality Management**	**16**		
	2.1	**Aquarium accessories-** **Essential accessories-** Heater(Submersible, inline, or preset heaters), Thermometer (Stick-on, submersible, or digital thermometers), Lighting System (LED, fluorescent, or metal halide lights), Air Pump and Air stones, Water Testing Kits and Filter. **Decoration and Aesthetic Accessories-** Aquarium Substrate, Aquarium Plants, Driftwood and Rocks, Ornaments and Backgrounds. **Feeding Accessories** (Automatic Fish Feeder, Feeding Ring and Target Feeding Tools). **Maintenance accessories** (Substrate Cleaners, Sand Sifters, Algae Removal Tools, Water Change Tools, Glass and Acrylic Cleaning Tools, Protein Skimmer Cleaning Tools (Marine	7	No Change	

		Aquariums). **Safety Accessories** (Surge Protector, Aquarium Lid or Hood, Temperature Controller, Battery Backup or Generator.			
	2.2	**Water Quality Parameters-** pH, salinity, oxygen, carbondioxide, COD, BOD, chlorine, ammonia, nitrites, nitrates, and water hardness. Water testing techniques. The nitrogen cycle and its importance in aquariums.	4	No Change	
	2.3	**Water filtration system-** Types of filtrations; Mechanical, biological and chemical filters. Types of Filtration Systems- Internal Filters, Hang-On-Back (HOB) Filters, Canister Filters, Sponge Filters, Under Gravel Filters (UGF), Sump Filters, Fluidized Bed Filters, Wet/Dry Filters (Trickle Filters), Protein Skimmers (Marine Tanks). Filter Media- Mechanical, Biological and Chemical Media. Aerators, Power air-pump, Spray bar)	5	No Change	
	2.4	Removed			
	2.5	Removed			
3		**Setting Up the Aquarium**	**11**		
	3.1	Setting up, maintenance and routine management of fresh water aquarium (planning of tank size, aquarium type,location, gathering of equipment, setting up of tank by cleaning, adding substrate, testing leaks, installing of equipment, arranging decorations, tank filling, cycling the tank, adding fish and maintenance)	4	3	

		Setting up maintenance and routine management of a marine aquarium (planning of tank size, aquarium type, location, installing of equipment, prepare the substrate, add live rock (for reef tanks), water setup (RO/DI water, marine salt mix, cycle the tank), Routine Maintenance). Salt Buildup in Marine Aquariums Aqua-scaping. Process of introduction of fish in newly constructed aquarium Activity: Construction of a Freshwater Aquarium			
	3.2	**Aquarium plants and their culture:** Importance, Uses of Aquatic plants, Types of Freshwater Aquatic plants. Most common aquarium plants in the aquarium industry. Types of aquarium plants based on their placement in aquarium. Conditions needed for aquarium plant growth. Role of aquarium plants in nitrogen cycle. Propagation of aquarium Plants. **Food and feeding:** Different feed used in aquarium with feeding management. Types of Feed: Dry feeds, non-dry feeds (Moist feeds, Wet or paste feeds), Feeds for colour enhancement. feeding of young ones (fry), Feeds of fry. Live feed culture and application of live feed in aquarium. Live food organisms- Collection and culture of Infusoria, Culture of daphnia, Moina culture and Brachionus	7	3	

		culture, Culture of tubifex, Culture of blood worms. Feeding rate and management- Feeding frequency			
	3.3	Removed			
	3.4				
	3.5				
	3.6				
	3.7				
4 (added)		**Challenges and Solutions**	**7**		
	4.1 (added)	Water quality issues (ammonia, nitrite, and nitrate levels, pH fluctuations, high salinity) and solutions (regular water testing, water changes, proper filtration and maintain biological filtration). Common diseases and their control measures- Common diseases of aquarium fishes-Bacterial diseases, Protozoan diseases, Fungal diseases, Parasitic diseases (pathogen, symptom, treatment). Disease management of aquarium fish	2	4	
	4.2 (added)	Control of excessive growth of algae (Control Nutrient Levels, Lighting Management, Algae Scrubbers or Cleaners, Use Phosphate Removers). Overfeeding and Waste Management. Equipment Malfunctions and solutions. Fish compatibility and overcrowding.	3	4	

	4.3 (added)	Transport of ornamental fishes; Fish packaging system, Steps to be taken while transporting fish, Conditioning of fish for packaging. Marketing and prospect of aquariums.	2	4	
5		**Teacher Specific Content**			

Teaching and Learning Approach (Modified)	**Classroom Procedure (Mode of Transaction)**	Page No. 148
	Lecture, activities, Videos,Group discussions and presentation, Demonstration on Set up a Freshwater Home Aquarium	

Mode of Assessment (Modified)

Assessment Type

A. Continuous Comprehensive Assessment (CCA)

Theory

Total Marks: 25

- Written Exams/Quizzes, Oral/Viva Assessments
- Assignment advantages of different tank materials (glass vs. acrylic) or comparing freshwater and marine aquarium setups on activities
- Practical Evaluation-Assess the student's ability to set up freshwater aquarium, including selecting and installing accessories, managing water parameters, and integrating species.
- Field Visits and Reports.

B. End Semester Evaluation

Theory

Total Marks = 50 **Duration- 1.5 hrs**

Type of Questions	**No. of Questions to be Answered**	**Total Marks**
Multiple Choice Questions	12 out of 12	12 x 1 = 12
Short Answer	6 out of 8	6 x 3 = 18
Short Essay	4 out of 6	4 x 5 = 20

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