MAR IVANIOS COLLEGE (AUTONOMOUS)

Affiliated to the University of Kerala,

Thiruvananthapuram

Kerala

SCHEME AND SYLLABUS FOR THE

FOUR YEAR UNDERGRADUATE PROGRAMME (FYUGP)

MAJOR DISCIPLINE
ZOOLOGY

(With effect from 2024 Admissions)

Approved by the Board of Studies in

Zoology

CONTENTS

PREAMBLE

National Education Policy (NEP 2020) envisions 'higher education as playing an extremely important role in promoting human as well as societal wellbeing and in developing India as envisioned in its Constitution - a democratic, just, socially conscious, cultured, and humane nation upholding liberty, equality, fraternity, and justice for all' (Section 9.1). NEP also expects higher education 'to develop good, thoughtful, well-rounded, and creative individuals, enabling an individual to study one or more specialized areas of interest at a deep level, and also develop character, ethical and Constitutional values, intellectual curiosity, scientific temper, creativity, spirit of service, and 21st century capabilities across a range of disciplines including sciences, social sciences, arts, humanities, languages, as well as professional, technical, and vocational subjects' (Section 9.1.1). Hence, more than the creation of greater opportunities for individual employment, higher education represents the key to more vibrant, socially engaged, cooperative communities and a happier, cohesive, cultured, productive, innovative, progressive, and prosperous nation. (Section 9.1.3). NEP also identifies some of the major problems currently faced by the higher education system in India (Section 9.2) and envisions a complete overhaul and re-energizing of the higher education system to overcome these challenges and thereby deliver high-quality higher education, with equity and inclusion (Section 9.3). One of the major changes which the policy proposes is moving towards a more multidisciplinary undergraduate education (Section 9.3(b)) which develops all capacities of human beings -intellectual, aesthetic, social, physical, emotional, and moral in an integrated manner (Section 11.3). In order to achieve this in its full potential, NEP visions the adjusting of the structure and lengths of degree programmes accordingly. "The undergraduate degree will be of either 3 or 4-year duration, with multiple exit options within this period, with appropriate certifications, e.g., a certificate after completing 1 year in a discipline or field including vocational and professional areas, or a diploma after 2 years of study, or a Bachelor 's degree after a 3-year programme. The 4-year multidisciplinary Bachelor's programme, however, shall be the preferred option since it allows the opportunity to experience the full range of holistic and multidisciplinary education in addition to a focus on the chosen major and minors as per the choices of the student." (Section 11.9)

In accordance with the NEP 2020, the UGC formulated a new student-centric "Curriculum and Credit Framework for Undergraduate Programmes (CCFUP)" incorporating a flexible choice-based credit system, multidisciplinary approach, and multiple entry and exit options and establishing three Broad Pathways,

(a) 3-year UG Degree,

(b) 4-year UG Degree (Honours), and

(c) 4-year UG Degree (Honours) with Research)

Accordingly, the Kerala Higher Education Reforms Commission 2022, headed by Prof Shyam B. Menon, has recommended a comprehensive reform in the undergraduate curriculum with the adoption of the 4-year undergraduate Programmes, which will bring undergraduate education in Kerala at par with the universities abroad. Consequently, Kerala State Curriculum Committee for Higher Education 2023 has been constituted, with Dr Suresh

Das as Chairman, and they have proposed a model Kerala State Higher Education Curriculum framework for undergraduate education.

The University of Kerala has decided to introduce the Four Year Under Graduate Programmes (FYUGP) from the academic year 2024-2025 onwards in its teaching departments and all affiliated colleges, and has issued many draft documents and conducted college level awareness programmes about the same.

Mar Ivanios College, by virtue of its autonomy status, conferred in 2014 and extended in 2022, vide University Grants Commission (Conferment of Autonomous Status Upon Colleges and Measures for Maintenance of Standards in Autonomous Colleges) Regulations, 2023, has the power to review existing courses/programmes and, restructure, redesign and prescribe its own courses/programmes of study and syllabi and to formulate new courses/programmes within the nomenclature specified by UGC as per the Specification of Degrees 2014 as amended from time to time. Accordingly, the Board of Studies in Zoology of Mar Ivanios College (Autonomous) proposed the implementation of the FYUGP scheme with effect from 2024 admission onwards and prepared the scheme and syllabi through many of the meetings and discussions. The Academic Council of the college which met on 30th April have discussed the proposal and syllabi in detail and approved the same to be implemented from 2024 admission onwards, subject to the final directions of the University of Kerala.

The salient features of the syllabus prepared and presented by the Board of Studies include the following:

- The curriculum is designed based on Outcome Based Education (OBE) approach.
- The curriculum follows Choice-Based Credit System (CBCS): This system allows students to select courses from a prescribed list. A specified number of credits must be earned to award the degree
- The curriculum follows the basic framework, course wise/programme-wise minimum/maximum credits set by the University of Kerala for FYUGP and abides by the basic mandatory principles of **Four Year Under Graduate Programmes (UoK-FYUGP) Regulations, 2024.**

- The FYUGP in Zoology is designed to offer students a holistic understanding of the diverse facets of Zoology, ranging from classical to contemporary concepts.
- Through a blend of lectures, laboratory sessions, fieldwork and research projects, students are exposed to the intricacies of zoological phenomena and are encouraged to develop critical thinking and analytical skills.
- Field studies in various ecological habitats and hands-on experiences not only deepen their understanding of zoological concepts but also cultivate a sense of stewardship towards biodiversity conservation.
- Under the mentorship of faculty members, students are encouraged to undertake independent research projects on topics of their interest ranging from Ecology to Cancer Biology.
- By offering a rigorous curriculum, hands-on learning experiences, and opportunities for research and innovation, the program aims to nurture the next generation of

zoologists who will contribute to the advancement of knowledge and uphold the values of sustainable development.

Graduate Attributes and Programme Outcomes (POs)

The National Higher Education Qualification Framework (NHEQF) envisages that students on completion of a programme of study must possess and demonstrate the expected graduate profile/attributes acquired through one or more modes of learning. The graduate profile/attributes indicate the quality and feature or characteristics of the graduate of a programme of study, including learning outcomes relating to the disciplinary area(s) relating to the chosen field(s) of learning and generic learning outcomes that are expected to be acquired by a graduate on completion of the programme(s) of study. The graduate profile/attributes include capabilities that help widen the current knowledge base and skills, gain and apply new knowledge and skills, undertake future studies independently, perform well in a chosen career, and play a constructive role as a responsible citizen in the society. The graduate profile/attributes are acquired incrementally and describe a set of competencies that are transferable beyond the study of a particular subject/disciplinary area and programme contexts in which they have been developed. Graduate profile/attributes are fostered through meaningful learning experiences made available through the curriculum and learning experience, the total college/university experience, and a process of critical and reflective thinking. Mar Ivanios College (Autonomous) is fully committed to ensuring the attainment of the necessary graduation attributes by the students. The college has clearly defined its raison de'tre, the philosophy of its existence, through the Motto "Truth Shall Liberate You" (*Veritas Vos Liberabit*) which refers to the ultimate enlightenment which can emerge only at the intersection of sharp intellect, sound physique, strong mind, staunch ethics, and profound spirituality. This is further made explicit through its Vision, Mission and Goals and the same expect all students who graduate from the college to:

- Have inculcated "the values of truth and charity for the protection and promotion of human dignity and of a cultural heritage, through teaching, research, and extension activities dedicated to society";
- Be co-creators of a vibrant academic community known for its innovation, intellectual rigour and social commitment;
- Be "intellectually trained, morally upright, socially committed, spiritually inspired and ecologically conscious young men and women who would be dedicated to working for the good of society, the nation and the world";
- Have acquired "global competencies and skills";
- Have inculcated a sense of harmony, equality and fraternity among youth, transcending religious, linguistic, regional or sectional diversities; and
- Have developed "scientific temper, humanism and the spirit of inquiry and reform".

Programme Outcomes are the expected student attributes achieved by a student after the student completes the FYUGP from any of the streams/pathways.

The Programme Outcomes (POs) for the FYUGP programmes across all streams and pathways, based on the above core philosophy, and in consonance with the National Higher Education Qualifications Framework (NHEQF) are given below:

By the end of the Four-Year Under-Graduate Programme, students will:

PO 1	**Demonstrate the acquisition of all necessary knowledge and skills within their disciplinary/ multi-disciplinary areas of learning. These include the acquisition of:** • **comprehensive knowledge and coherent understanding of their chosen disciplinary/ interdisciplinary areas of study, their linkages with related fields, and the awareness of current trends in their chosen area of study;** • **essential knowledge for skilled work in chosen field(s), including self-employment and entrepreneurship skills;** • **proficiency in specialized areas within chosen fields of study, encompassing diverse practical skills applicable to different situations within those fields;** • **the ability to apply learned knowledge to novel situations, solve problems, and relate concepts to real-world scenarios rather than just memorizing curriculum content.**
PO 2	**Acquire problem-solving, critical thinking, analytical reasoning skills and demonstrate creativity in their thought processes** by demonstrating the ability to: • solve different kinds of problems in familiar and non-familiar contexts both within and outside their disciplinary/ multidisciplinary areas of learning; • apply analytic thought to a body of knowledge, including the analysis and evaluation of policies, and practices, as well as evidence, arguments, claims, and beliefs; • analyse and synthesize data from a variety of sources and draw valid conclusions and support them with evidence and examples. • the ability to plan, execute and report the results of an experiment or investigation; • adhere to scientific temper and ethics in their thought process; • adopt innovative, imaginative, lateral thinking, interpersonal skills and emotional intelligence; and • incubate entrepreneurial and start-up ideas.
PO 3	**Develop a profound environmental dedication by fostering ecological awareness and engaging in actions that promote sustainable development** by achieving the ability to • recognize environmental and sustainability issues, and participate in actions to promote sustainable development as well as mitigate the effects of environmental degradation, climate change, and pollution; • contribute to effective waste management, conservation of biological diversity, management of biological resources and biodiversity, forest and wildlife conservation, sustainable development and living, and the preservation of life in all forms.

	• participate in community-engaged services/ developmental activities and thus exemplify the ideals of community engagement and service learning and deep social commitment.
PO 4	**Accomplish perfect communication, teamwork, and leadership skills, particularly in academic and professional settings, while demonstrating nuance and attention to etiquette in all communicative contexts.** This will enable them to: • listen carefully, and read texts and research documents, and present complex information with clarity and precision to different audiences; • express thoughts and ideas and communicate effectively through speech and writing using appropriate media; • communicate using language which is respectful of gender and minority orientations; • act together as a group or a team in the interests of a common cause and working efficiently as a member of a team; • inspire the team with a vision to achieve a stated goal, and use management skills to guide the team in the right direction.
PO5	**Acquire the necessary skills, including 'learning to learn' skills, and foster innovative ideas to improve competence and employability, keeping pace with the evolving global landscape and technological advancements** by demonstrating the ability to: • pursue 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/reskilling; • work independently, identify appropriate resources required for further learning; • acquire organizational and time management skills to set self-defined goals and targets with timelines; • be a proactive life-long learner. • 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; • navigate cyberspaces by following appropriate ethical principles and cyber etiquette. • use cutting edge AI tools with equal commitment to efficiency and ethics. • think 'out of the box' and generate solutions to complex problems in unfamiliar contexts;
PO6	**Develop research-related skills including the ability to conceptualize research hypotheses/projects and adopt suitable tools and methodologies for analysis** with:

	• a keen sense of observation, inquiry, and capability for asking relevant/ appropriate research 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 the field of study
PO7	**Assimilate a sound value system, a sense of autonomy, multicultural competence, social commitment, and the spirit of inclusivity and empathy by imbibing the spirit and the holistic ethos of the 'Multi-Dimensional Ivanian' (MDI) approach.** This will enable them to: • embrace and practice constitutional, humanistic, ethical, and moral values in life, including universal human values of integrity, truth, righteous conduct, peace, love, nonviolence, scientific temper, citizenship values; • identify ethical issues related to work, follow ethical practices and be objective, unbiased, and truthful actions in all aspects of work, including avoiding unethical behaviour such as fabrication, falsification or misrepresentation of data, or committing plagiarism, and adhering to intellectual property rights; • 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; • 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; • effectively engage in a multicultural group/society and interact respectfully with diverse groups; • identify with or understand the perspective, experiences, or points of view and emotions of another individual or group. • demonstrate gender sensitivity and adopt a gender-neutral approach, as also empathy for the less advantaged and the differently-abled including

	those with learning disabilities; • demonstrate proficiency in arts/ sports/ games, physical, mental and emotional fitness, entrepreneurial /organizational /pubic speaking/environmental/ community-oriented areas by actively participating in the wide range of co-curricular activities that are available to the students of Mar Ivanios College.

Programme Specific Outcomes (PSOs)

In conformity with the POs, the Programme Specific Outcomes (PSOs) of the Major in Zoology are drafted as given below:

PSO-1	**Gain in-depth understanding of the great diversity of organisms that occupy different ecological niches on Earth and the intricacy of the different life systems that these organisms adopt.**
PSO-2	Appreciate the value of conservation and promote the development of practical solutions to today's conservation challenges over sustainable development.
PSO-3	Acquire a thorough understanding of foundational concepts of Zoology, with evolution serving as the overarching framework that connects all of the topics.
PSO-4	Establish interest and competence with scientific equipment introduced, ensuring overall development.
PSO-5	Possess the skill sets required in biology and have a solid foundation in the principles of current biological trends and applied domains.
PSO-6	To build a solid conceptual foundation in biology to support your critical thinking abilities.
PSO-7	Establish the groundwork for innovative thinking by studying application-based fields, which will provide improved future chances for self-sustenance in academia or industry.
PSO-8	Perform fundamental research, develop your abilities in experimental design, scientific writing, and the necessary statistical analysis to defend your findings.

Course and Credit Structure of FYUGP

The pathway preferably followed by the department will be Major with Minor or Major with multiple disciplines of study.

The Course and Credit Structure of FYUGP is given below:

Sem	DSC (4 Cr)	DSE (4 Cr)	AEC (3 Cr)	SEC (3 Cr)	MDC (3 Cr)	VAC (3 Cr)	Internship (credit-2)/ Project/ Additional Courses (credit-12)	Total courses	Total credits
I	A-1 B-1 C-1		AEC (Eng)-1 AEC(OL)-2		MDC-1			6	21
II	A-2 B-2		AEC (Eng)-3 AEC(OL)-4		MDC-2			6	21

	C-2								
III	A-2 B-2 C-2	DSE A -1			MDC (Kerala Studies)-3	VAC-1		6	22
IV	A-4 A-5	DSE A-2		SEC-1		VAC-2 VAC-3	Internship	6	23
V	A-6 A-7 A-8	DSE -3 DSE -4		SEC-2				6	23
VI	A-9 A-10 A-11	DSE -5 DSE -6		SEC-3				6	23
Total	A (11) B (3) C (3)	6	4	3	3	3	1*	36	133
EXIT OPTION AVAILABLE AND STUDENTS WILL BE AWARDED UG DEGREE WITH MAJOR IN A									
VII	A-12 A-13 B/C-4 B/C-5 B/C-6	DSE -7						6	24
VIII	MOOC courses A -14, A -15						Research Project/ Internship /Project or 03 courses -12Cr	2+1**/ 3***	20
Total	A (15) B(3) C (3) B/C(3)	7	4	3	3	3	1*+1**/ 3***	44+ 1* + 1**/ 3***	177

A – Major Discipline

B/C-Minor/Multiple discipline

* - Mandatory Internship at the end of Semester 4

** - Research Project/ Internship /Project as part of Honours with Research

*** - Additional courses of 4 credits each.

Cr - Credits

- **Research group project for students exiting after UG 3 years:** Students who propose to exit after 3 Year UG programme can do a group project with an extra two credits to obtain research experience in discipline-specific areas of the program. The BoS can decide the number of students for the group and the evaluation criteria.
- Students will be able to take other pathways permissible under **University of Kerala Four Year Under Graduate Programmes (UoK-FYUGP) Regulations, 2024,** subject to the availability of courses/ faculty/infrastructure of the college.

- The Board of Studies shall prepare and publish a list of online courses at different levels before the commencement of classes in the respective semester offered in various online educational platforms recognised by the academic council of the college, which can be opted by the students for acquiring additional credits.

Course Participation/Attendance-

1. A student shall be permitted to register for the end-semester evaluation of a specific course to acquire the credits only if the student has completed 75% of the prescribed classroom activities in physical, online, or blended modes, as stipulated by the BoS, including any makeup activities as specified by the faculty of that particular course.
2. The reasons/cases of permissible authorised leave shall be specified by the college, with the approval of the Academic Council, ratified by the Governing Body.
3. The condonation facility shall be availed as per the existing University/college norms.

Assessment and Evaluation

1. The assessment of a course shall combine a Continuous Comprehensive Assessment (CCA) and an End Semester Evaluation (ESE).
2. For courses without practical/lab modules, 30% weightage shall be given for CCA and the remaining 70% of the weight shall be for the ESE.
3. CCA will have two sub-components: Formative Assessment (FA) and Summative Assessment (SA).
4. The CCA subcomponents will be given marks as per the following proportions:
    - Discipline specific summative assessment – 15 % of the total
    - Course attendance - 5 % of the total.
    - Discipline specific formative assessment - 10 % of the total.
5. The details of summative and formative assessment criteria, including that of attendance, will be specified by each course coordinator at the beginning of the semester, with the approval of the respective Head of the Department/BoS Chairperson and the Principal, and will be published on the college website.
6. For courses with practical/lab modules, 40% weightage shall be given for CCA and the remaining 60% of the weight shall be for the ESE.
7. In such cases specified in the item above, the CCA subcomponents will be given marks as per the following proportions:
    - Discipline specific summative assessment - 10 % of the total
    - Course attendance - 5 % of the total.
    - Discipline specific formative assessment (Class room activities, observation of skills, viva voce, quiz, interview, oral presentations, in class discussions, computerized adaptive testing, group tutorial work, reflection writing assignments, field study reports, self and peer assessments, service-learning activities, etc.) - 15 % of the total.
    - Summative Assessment (Practical Record, Practical test, skill, etc). – 10 % of the total.
8. The Course Coordinator shall be responsible for evaluating all the components of CCA for the course in question. Any grievances regarding the same shall be submitted

to the Course Coordinator within 5 days of the publication of the same on the department notice board or official class group. If the grievance is not settled at the Course Coordinator level, the student is free to appeal to the Head of the Department, within the next 3 days, who will discuss the same in the Department Level Monitoring Committee (DLMC). If still needed, students can further appeal to the College Level Monitoring Committee (CLMC) or in essential situations the University Level Monitoring Committee (ULMC) in a time period as specified by these bodies.

9. Regarding evaluation, one credit will be evaluated for 20 marks in a semester; thus, a 4-credit course will be evaluated for 80 marks, and 3-credit courses for 60 marks. However, any changes to this if brought by the University will be followed.
10. The duration of the end semester examination of a course with 4 credits will be 2 hours and the same for a course with 3 credits may be 1.5 hours/2 hours.

Mark Distribution Table

Course	Credit		Marks		Lecture			Practical		
	Lecture	**Practical**	**Lecture**	**Practical**	**CCA (30%)**		**ESE (70%)**	**CCA (40%)**		**ESE (60%)**
					SA (50%)	**FA (50%)**		**SA (50%)**	**FA (50%)**	
4 credit courses	4	0	80	0	12	12	56	0	0	0
	3	1	60	20	9	9	42	4	4	12
	2	2	40	40	6	6	28	8	8	24
	1	3	20	60	3	3	14	12	12	36
	0	4	0	80	0	0	0	16	16	48
	Credits		**Marks**		**Lecture**			**Practical**		
	Lecture	**Practical**	**Lecture**	**Practical**	**CCA (30%)**		**ESE (70%)**	**CCA (40%)**		**ESE (60%)**
3 credit courses					**SA (50%)**	**FA (50%)**		**SA (50%)**	**FA (50%)**	
	3	0	60	0	9	9	42	0	0	0
	2	1	40	20	6	6	28	4	4	12
	1	2	20	40	3	3	14	8	8	24
	0	3	0	60	0	0	0	12	12	36

Letter Grades and Grade Point

1. A mark system is followed to evaluate each question. For each course in the semester, letter grades and grade points are introduced in a 10-point indirect grading system as per the guidelines given below.
2. The Semester Grade Point Average (SGPA) is computed from the grades to measure the student's performance in a given semester. The SGPA is based on the current term's grades, while the Cumulative Grade Point Average (CGPA) is based on the grades in all courses taken after joining the programme of study.
3. The weighted grade point will be mentioned in the student's final grade cards, issued by the college, based on the marks obtained.

4. **The grades and grade points will be given as per the following format:**

Letter Grade	Grade Point	Percentage of marks (X) (CCA + ESE together)	Class
O (Outstanding)	10	$X \geq 95\%$	FIRST CLASS WITH DISTINCTION
A+ (Excellent)	9	$85\% \leq X < 95\%$	
A (Very Good)	8	$75\% \leq X < 85\%$	
B+ (Good)	7	$65\% \leq X < 75\%$	FIRST CLASS
B (Above Average)	6	$55\% \leq X < 65\%$	
C (Average)	5	$45\% \leq X < 55\%$	SECOND CLASS
$P\ (Pass)^{*}$	4	$35\% \leq X < 45\%$	THIRD CLASS
F (Fail)	0	$X < 35\%$	FAIL
Ab (Absent)	0		FAIL

- For a course PASS, separate minimum of 35% is needed for CCA and ESE.
- Less than 35% in either ESE or CCA is FAIL.

Computation of SGPA and CGPA

SGPA (Semester Grade Point Average) and CGPA (cumulative Grade Point Average) will be computed as follows:

1. The SGPA is the ratio of the sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student in the semester. That is,

   $$S_j = \frac{\sum(C_{ij} \times G_{ij})}{\sum C_{ij}}$$

   where S_j is the SGPA in the jthsemester,
   C_{ij} is the number of credits for the ith course in the jthsemester, and
   G_{ij} is the the grade point scored by the student in the ith course in the jthsemester.

2. The CGPA is also calculated in the same manner considering all the courses undergone by a student over all the semesters of a programme. That is,

   $$CGPA = \frac{\sum(C_i \times S_i)}{\sum C_i}$$

   where $S_i$is the SGPA in the ithsemester and
   $\sum C_i$ is the total number of credits in the ith semester.

3. The SGPA and CGPA shall be rounded to 2 decimal points and reported in the transcripts.

4. **Requirement for the successful completion of a Semester:**

SGPA of 4 or above and a PASS in all the courses, that is, minimum total of 35% mark in each course (CCA + ESE), with a separate minimum of 35% mark for both CCA and ESE. Appropriate and permissible rules of rounding off numbers may be adopted as per decisions of the Academic Council.

5. **Minimum Eligibility Criteria for 4 Year UG (Honours with Research)**
    - Students satisfactorily finishing all courses up to the 6th semester in the Department, with a CGPA of 7.5/10 or equivalent to 75% marks and above, will qualify to select the Honours programme with a Research Degree during the upcoming 7th and 8th semesters.
    - A relaxation of 0.5 score, i.e. CGPA of 7/10 or an equivalent relaxation of grade, will be allowed for those who belong to SC/ST/OBC (non-creamy layer)/Differently Abled, Economically Weaker Section (EWS) and other categories as per the UGC norms from time to time.

Field trip/study tour:

Field visits and study tours are essential components of the undergraduate Zoology curriculum, providing students with invaluable hands-on experience and real-world exposure to diverse ecosystems and animal behaviour. These excursions offer students the opportunity to observe and interact with animals in their natural habitats, fostering a deeper understanding of ecological principles, biodiversity, and conservation issues. By engaging in fieldwork, students develop practical skills such as data collection, specimen identification, and field observation techniques, which are integral to a career in Zoology or related fields. Additionally, these experiences inspire curiosity, critical thinking, and a passion for wildlife conservation, ultimately enriching the learning experience and preparing students for future endeavors in the field of zoological sciences. Hence, field trip/study tour will be part of the 3 Year/4 Year UG Programme majoring in Zoology offered by the Department of Zoology, Mar Ivanios College (Autonomous). The number of days for the field trip/study tour will be decided by the Principal in consultation with the BoS and the College Council.

Dr. Meera George
Chairman
BoS (Zoology)
Mar Ivanios College (Autonomous),
Thiruvananthapuram

Thiruvananthapuram

10-05-2024

LIST OF COURSES OFFERED BY THE DEPARTMENT OF ZOOLOGY

Course code	Course Title	Course category	Credit	Hour distribution per week		
				L	T	P
SEMESTER – I Academic Level 100-199						
MIUK1DSCZOO100.1	Animal diversity and Ecological Interactions I	Core	4	3		2
MIUK1DSCZOO101.1	Wildlife Biology	Core (B/C)	4	3		2
MIUK1MDCZOO100.1	Lifestyle Diseases and Management	Multidisciplinary	3	3		
SEMESTER – II Academic Level 100-199						
MIUK2DSCZOO102.1	Animal Diversity and Ecological Interactions II	Core	4	3		2
MIUK2DSCZOO103.1	Forest Ecosystem and Management	Core (B/C)	4	3		2
MIUK2MDCZOO101.1	Scientific Insights into Sex Education	Multi-Disciplinary	3	3		
SEMESTER – III Academic Level 200-299						
MIUK3DSCZOO200.1	Chordata	Core	4	3		2
MIUK3DSCZOO201.1	Ecotoxicology: Chemical Impacts on Ecosystems and Health	Core (B/C)	4	3		2
MIUK3DSEZOO200.1	Basic Human Anatomy	Elective	4	3		2
MIUK3VACZOO200.1	Public Health and Management	Value added	3	3		
SEMESTER – IV Academic Level 200-299						
MIUK4DSCZOO202.1	Systematics, Biodiversity and Conservation Biology	Core	4	3		2
MIUK4DSCZOO203.1	Comparative Anatomy of Vertebrates	Core	4	3		2
MIUK4DSEZOO201.1	Toxicology and Disaster Management	Elective	4	3		2
MIUK4SECZOO200.1	Basic Instrumentation Techniques in Life Science	Skill enhancement	3	2		2
SEMESTER – V Academic Level 300-399						
MIUK5DSCZOO300.1	Cell Biology	Core	4	3		2

MIUK5DSCZOO301.1	Genetics	Core	4	3		2
MIUK5DSCZOO302.1	Molecular Biology	Core	4	3		2
MIUK5DSEZOO300.1	Microbiology and Infectious Diseases	Elective	4	3		2
MIUK5DSEZOO301.1	Genetic Engineering	Elective	4	3		2
MIUK5SECZOO300.1	Basic Laboratory Animal Practices	Skill enhancement	3	2		2
MIUK5SECZOO301.1	Vermiculture	Skill enhancement	3	2		2
SEMESTER – VI Academic Level 300-399						
MIUK6DSCZOO303.1	Human Physiology	Core	4	3		2
MIUK6DSCZOO304.1	Developmental Biology	Core	4	3		2
MIUK6DSCZOO305.1	Evolution, Ethology and Zoogeography	Core	4	3		2
MIUK6DSEZOO302.1	Immunology	Elective	4	3		2
MIUK6DSEZOO303.1	Biomolecules	Elective	4	3		2
MIUK6SECZOO302.1	Animal Cell Culture Techniques	Skill enhancement	3	2		2
SEMESTER – VII Academic Level 400-499						
MIUK7DSCZOO400.1	Biochemistry	Core	4	3		2
MIUK7DSCZOO401.1	Bioanalytical Techniques	Core	4	3		2
SEMESTER – VIII Academic Level 400-499						
MIUK8DSEZOO400.1	Genomics and Proteomics	Elective	4	3		2
MIUK8DSEZOO401.1	Biology Of Cancer	Elective	4	3		2
MIUK8DSEZOO402.1	Tumour Immunology and Microenvironment	Elective	4	3		2

SEMESTER - I

Mar Ivanios College (Autonomous)

Discipline	**ZOOLOGY**				
Course Code	MIUK1DSCZOO100.1				
Course Title	**ANIMAL DIVERSITY AND ECOLOGICAL INTERACTIONS I**				
Type of Course	**DSC**				
Semester	I				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	Basic knowledge on Two-kingdom and Five Kingdom classifications. General characteristics of invertebrates.				
Course Summary	The course on animal diversity and ecological interactions explores the fascinating world of animals and their interactions within ecosystems. The principles of taxonomy and classification, highlights the evolutionary relationships among different animal groups.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**INTRODUCTION TO INVERTEBRATES**	**14**
	1	Introduction, Two kingdom classification and Whittaker's five kingdom classification. Advantages and disadvantages of five kingdom classification. Modern classification (Brief account)	3
	2	**Taxonomy**-Definition, history, new trends and importance, mention molecular taxonomy. Components of classification, Taxonomic hierarchy- taxon, category and rank. Linnaean hierarchy, nomenclature, principles of nomenclature. International Code of Zoological Nomenclature (ICZN), rules of nomenclature, requisites – uni, bi and trinomialism. Species, species concept and approach, taxonomic aids.	3
	3	**Introduction to Protozoa** **Kingdom Protista**: Structure and zoological importance and systematic position of *Actinophrys, Noctiluca, Paramecium* and *Opalina*- mention the symbiotic association. Ecological interactions of Parasitic protozoans- parasitic adaptations, morphology, life history, pathogenicity and prophylaxis of *Entameoba histolytica*, *Trypanosoma gambiense* and *Plasmodium vivax.*	8
II		**MESOZOA AND PARAZOA**	**10**

	4	Classifications (Subkingdom Mesozoa, Subkingdom Parazoa, Sub kingdom Eumetazoa.) Levels of organization– cellular, tissue, organ. Divisions of Eumetazoa- Radiata, Bilateria. Protostomia, Deuterostomia. Coelom, metamerism, cephalisation.	4
	7	**Sub kingdom Mesozoa**- Salient features, eg. *Rhopalura.*	1
	8	**Sub kingdom Parazoa**- Salient features **Phylum Porifera:** Classifications- Calcispongia, eg. *Sycon*; Hydrospongia, eg. *Euplectella;* Demospongia, eg. *Spongilla.* Canal system and skeletal system in sponges.	5
III	**INTRODUCTION TO EUMETAZOA**		**7**
	9	**Phylum Cnidaria**: Salient features, classifications- Class: Hydrozoa eg. *Physalia, Obelia* (structural organisation and life cycle*),* mention metagenesis. Class: Scyphozoa eg. *Aurelia, Rhizostoma*; Class: Anthozoa eg. Sea anemone, (symbiotic relationship), *Madrepora*, Polymorphism in coelenterates. Corals and Coral Reefs: Types of coral reefs (Mention the ecological interactions).	7
IV	**HELMINTHS**		**14**
	10	**Phylum Platyhelminthes**: Salient features, classifications. Class: Turbellaria eg. *Planaria*; mention regeneration, Class: Trematoda eg. *Fasciola* (life cycle and pathogenicity); Class: Cestoda, eg. *Teania solium* (life cycle and pathogenicity).	8
	11	**Phylum Nematoda**: Salient features, classifications. eg. *Ascaris, Enterobius, Wuchereria, Coenorhabditis elegans* (Mention the pathogenicity, Parasitic adaptations in helminths, host-parasitic interactions).	6
V	**PRACTICUM**		30
	12	Identification and classification of the following specimens Protista – *Actinophrys, Noctiluca, Paramecium, Opalina* Phylum Porifera – *Euplectella, Spongilla* Phylum Cnidaria – *Hydra, Obelia, Physalia, Aurelia,* Sea anemone, Madrepora Phylum Nematoda – *Ascaris* male and female (entire) Phylum Platyhelminthes – *Bipalium, Fasciola, Taenia solium* **Specimen Collection** Students shall collect any 2 invertebrates/parasites/pests specimens and prepare a brief note including taxonomy and submit for evaluation. *Study the diversity of Zooplankton/Protists in the water samples collected-Any two*	

References

1. Barnes, R.D. (1987). Invertebrate Zoology. W. B. Sunders. New Delhi.

2. Ekambaranatha Ayyar M. (1990). A Manual of Zoology. Vol. 1. Invertebrata- Part 1 & Part11. S. Viswanathan Printers and Publishers.Pvt. Ltd.
3. Hickman, C.P and Roberts, L.S. (1994). Animal Diversity. Wm. C. Brown, Dubuque, IA.
4. Hyman, L. H. (1942). The invertebrate volumes. Mc Gew - Hill.
5. Jorden, E.L and Verma, P.S. (2000). Invertebrate Zoology. S. Chand andCo Ltd. New Delhi.
6. Kapoor, V.C. (1994).Theory and Practice of animal taxonomy. Oxford & IBH Publishing Co, New Delhi.
7. Kotpal, R.L, Agarwal, S.K. and R.P. Khetarpal. (2002). Modern text book of Zoology Invertebrates.
8. Mayer, E. (1980). Principles of Systematic Zoology. Tata Mc Graw Hill Publishing Co, New Delhi.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Identify and classify invertebrate Taxa based on key morphological characteristics	U,R,	PSO-1,2
CO-2	Apply taxonomic keys and techniques for identification of unknown invertebrate specimens.	R, U, Ap	PSO-1,2,3
CO-3	Develop skills in invertebrate collection and preservation for scientific study.	R,U, An	PSO-1,2
CO-4	Describe invertebrate morphology and features on functional adaptations of different invertebrate groups.	U, Ap, C	PSO-1,2
CO-5	Take measures to prevent the pathogenicity of helminth parasites.	Ap,U	PSO-7
CO-6	Identify and list out the economic importance of the lower invertebrates.	U, Ap	PSO-1,2
CO-7	Identify the biological significance of organisms and their role in our day-today-life.	U, Ap	PSO-1,2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: ANIMAL DIVERSITY AND ECOLOGICAL INTERACTIONS-I

Credits: 3:1 (Lecture : Practical)

CO No.	CO	POs	PSOs	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Identify and classify invertebrate Taxa based on key morphological characteristics	1	PSO-1,2	U,R,	F, C	L	
2	Apply taxonomic keys and techniques for identification of unknown	1,2	PSO-1,2,3	R, U, Ap	F,P	L	P

	invertebrate specimens.						
3	Develop skills in invertebrate collection and preservation for scientific study.	1	PSO-1,2	R,U, An	F, P.	L	P
4	Describe invertebrate morphology and features on functional adaptations of different invertebrate groups.	1	PSO-1,2	U, Ap, C	F	L	
5	Take measures to prevent the pathogenicity of helminth parasites.	7	PSO-7	Ap,U	F	L	
6	Identify and list out the economic importance of the lower invertebrates.	1	PSO-1,2	U, Ap	F	L	P
7	Identify the biological significance of organisms and their role in our day-today-life.	1	PSO-1,2	U, Ap	F,C	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs: Animal Diversity & Ecological Interactions-I

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	3	2	-	-		-	-	
CO 2	3	3	-	-			-	
CO 3	3	3	-	-			-	
CO 4	3	1	-	-			-	
CO 5		-	-	-		-	2	
CO6	3	3						
CO7	3	2						

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-
CO3	3	-	-	-	-	-	-

CO4	3	-	-	-	-	-	-
CO5	-	-	-	-	-	-	3
CO6	3	-	-	-	-	-	-
CO7	3	-	-	-	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓	✓	✓	✓
CO 3		✓	✓	
CO 4	✓	✓	✓	✓
CO 5	✓	✓		✓
CO 6	✓		✓	✓
CO 7	✓	✓	✓	✓

Mar Ivanios College (Autonomous)

Discipline	ZOOLOGY				
Course Code	MIUK1DSCZOO101.1				
Course Title	**WILDLIFE BIOLOGY**				
Type of Course	**DSC (B/C)**				
Semester	I				
Academic Level	100 – 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3		2	5
Pre-requisites	Basic knowledge of animal diversity and wildlife.				
Course Summary	This paper deals with varied aspects of wildlife conservation, including its importance, major threats, management of their habitats and populations. This paper mainly emphasis on developing interest and invoking a sense of responsibility among students towards wildlife conservation. The course also explores different techniques, perspectives, and approaches to both identify and achieve wildlife management goals. This course will motivate students to pursue career in the field of wildlife conservation and management.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I	**SCOPE AND IMPORTANCE OF WILDLIFE BIOLOGY**		**10**
	1	Definition of Wildlife. Economic importance of wildlife. India as a mega wildlife diversity country.	3
	2	Conservation ethics and importance of conservation of wildlife	2
	3	Wildlife resources in Kerala -Brief account of mammals, birds, herpetofauna, fishes, invertebrates of Kerala, IUCN status (brief account)	5
II	**WILDLIFE ESTIMATION AND HEALTH MANAGEMENT**		**15**
	4	Capture- recapture method, Capturing and marking techniques– entrapping, darting, tagging and banding.	5
	5	Faecal analysis of ungulates and carnivores: Faecal samples, slide preparation and Hair identification; Pug marks and Census methods	5
	6	Common diseases of wild animals: Zoonosis (Ebola and Salmonellosis), Rabies, Foot and Mouth Disease, Mycobacterium TB, Bovine and Avian Flu	5
III	**WILDLIFE CONSERVATION AND MANAGEMENT**		**12**
	7	Traditional conservation Practice: Ecological knowledge and local	5

		biodiversity documentation.	
	9	Wildlife Conservation: Definition, In-situ and ex-situ conservation. Wildlife (Protection) Act, 1972, IUCN CITES, NBA, IBA. Project Tiger, Project Elephant – Project Crocodile, Wildlife trade and regulations	5
	10	Application of GIS and remote sensing in wildlife management.	2
IV		**HUMAN WILDLIFE INTERACTIONS**	**8**
	11	Human –wildlife coexistence. Ecotourism. Wild life tourism in forests	3
	12	Man- animal conflict in India- discussion of case studies.	5
V		**PRACTICUM**	**30**
	13	Identification of faunal diversity through direct and indirect evidences seen on a field trip to a wildlife conservation site and report submission	
	14	Submission of a report based on a visit to National Park/Wildlife Sanctuary or any other wildlife conservation site.	
	15	Discussion and evaluation of various wildlife conservation project done by government and submission of report	
	16	Bird watching and identification of resident and migratory birds and submission of reports	

References

1. Goutam Kumar Saha & Subhendu Mazumdar (2017). Wildlife Biology: An Indian Perspective, PHI Learning.
2. Singh SK (2020). Textbook of Wildlife Management 3ed. CBS Publishers.
3. Beatrice Frank & Jenny A. Glikman (2019). Human–Wildlife Interactions: Turning Conflict into Coexistence. Cambridge University Press
4. Stephanie Schuttler (2020). Getting a Job in Wildlife Biology: What It's Like and What You Need to Know. ISBN-13 : .Independent publication.8675375127-979

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand diverse wildlife fauna	U	1
CO-2	Define various wildlife management strategies.	R	2
CO-3	Explain various diseases and management of common diseases affecting wildlife.	U	3
CO-4	Analyze the issue of human wildlife conflict.	An	6
CO-5	Evaluate the efficacy of wildlife conservation project conducted by the government.	E	6

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: Wildlife Biology

Credits: 3:1 (Lecture:Practical)

CO No.	CO	PO	PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)

1	Understand diverse wildlife fauna	1	1	U	F, C,P	L/T	P
2	Define various wildlife management strategies	1, 3	2	R	F,C	L/T	
3	Explain various diseases and management of common diseases affecting wildlife.	1	3	U	F,C	L/T	
4	Analyze the issue of human wildlife conflict	3	6	An	F,C,P	L/T	p
5	Evaluate the efficacy of wildlife conservation project conducted by the government	3	6	E	F,P	L/T	p

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	3	-	-	-	-	-	-	-
CO 2	-	3	-	-	-	-	-	-
CO 3	-	-	2	-	-	-	-	-
CO 4	-	-	-	-	-	3	-	-
CO 5	-	-	-	-	-	3	-	-

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	-	-	-
CO2	3	-	3	-	-	-	-
CO3	3	-	-	-	-	-	-
CO4	-	-	3	-	-	-	-
CO5	-	-	3	-	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓		✓
CO 4	✓	✓	✓	✓
CO 5	✓	✓	✓	✓

Mar Ivanios College (Autonomous)

Discipline	ZOOLOGY				
Course Code	MIUK1MDCZOO100.1				
Course Title	**LIFESTYLE DISEASES AND MANAGEMENT**				
Type of Course	**MDC**				
Semester	I				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	2 hours		2 hours	4 hours
Pre-requisites	Students should have an interest in health and wellness.				
Course Summary	There is a significant increase in life style disease due to faulty diet and sedentary life style. This course will enhance knowledge and skills towards management of life style by addressing risk factors such as unhealthy diet, physical inactivity and stress towards achieving healthy approach to life.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**INTRODUCTION TO LIFE STYLE DISEASES**	**13**
	1	Concept of lifestyle diseases, Non Communicable diseases and types.	2
	2	Importance of lifestyle in preventing disease development.	2
	3	Medical, Physical, Nutritional, Psycho-Social and behavioural aspects of health.	5
	4	Healthy habits: Diet, Yoga & meditation, Exercise Unhealthy habits: Substance abuse (smoking, alcohol), addiction to technology. Brief description only.	4
II		**MAJOR LIFE STYLE DISEASES**	**12**
	5	Diabetes- Type-1 and Type-2: Characteristics, Causes, Diagnosis, Prevention and Management (Diet, Exercise, Drugs).	2
	6	Obesity: Body mass index, Factors leading to obesity, Prevention and Management.	3
	7	Atherosclerosis and Cardiovascular diseases: Myocardial infraction, congestive heart failure, Ischemic diseases-Causes, Diagnosis and Management	5
	8	Mental health and happy hormones. Methods to improve mental wellbeing.	2
III		**CANCER AS A LIFESTYLE DISEASE**	**20**
	9	Smoking, Physical activity, Obesity, Diagnosis -screening, blood test,	3

		Xray, CT Scan & endoscopy brief description	
	10	Prevention: Dietary , Medication, Vaccination, Screening.	3
	11	Management - Surgery, Chemotherapy, Radiation, Palliative care-brief outline	4
		ACTIVITIES	10
	12	Blood glucose monitoring using Glucometer.	
	13	Blood pressure monitoring at home.	
	14	Community awareness program for life style diseases.	
	15	Diet management practices.	
	16	Debate/Discussions/Seminars.	

Suggested Readings:

1. Surendra G Gattani., (2017). Lifestyle Diseases. Nirali Prakashan.
2. M. Kumar and R. Kumar., (2005). Guide to Prevention of Lifestyle Diseases. Deep & Deep publications Pvt. Ltd.
3. Holt, Rinehart and Winston Staff., (2004). A Lifetime of Health Lifestyle Diseases. Holt McDougal.
4. K V Ramani, Hemlatha Ramani, Gunjan y Trivedi, Vishwanathan p, Lakshmi m and Anita Verma (2022). Preventing insidious lifestyle diseases. Book venture.
5. Dr. A. Banerjee., (2017). Yoga for Lifestyle Diseases. Sports Publication.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Create an awareness on lifestyle associated health issue.	U, E	PSO-5,6
CO-2	List and define various life style associated diseases.	R, U	PSO-5,6
CO3	Demonstrate the symptoms and method of diagnosis of lifestyle diseases.	R, U	PSO-5, 6
CO4	Build and Practice healthy habits. Develop skills for the management of life style diseases.	Ap, C	PSO-5,6
CO 5	Practical approaches for life style disease management and awareness.	Ap	PSO- 5,6

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Creat

Name of the Course: Lifestyle Diseases and Management

Credits: 3:1 (Lecture: Practical)

CO No.	CO	PO	PSO	Cognitive Level	Knowledge Category	Lecture (L) /Tutorial (T)	Practical (P)
1	1	1,2	5, 6,	U, E	F, C, P	L/T	
2	2	1,2	5,6,	R, U	F, C,P	L/T	
3	3	1,2	5,6	R, U	F, C,P	L/T	
4	4	1,2	5,6	Ap, C	F, C, P	L/T	

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	-	-	-	-	3	3	-	-
CO 2	-	-	-	-	3	3	-	-
CO 3	-	-	-	-	3	3	-	-
CO 4	-	-	-	-	3	3	-	-
CO 5					2	2		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	-	-	-	-	-
CO2	3	3	-	-	-	-	-
CO3	3	3	-	-	-	-	-
CO4	3	3	-	-	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓

SEMESTER – II

Mar Ivanios College (Autonomous)

Discipline	**ZOOLOGY**				
Course Code	MIUK2DSCZOO102.1				
Course Title	**ANIMAL DIVERSITY AND ECOLOGICAL INTERACTIONS II**				
Type of Course	**DSC**				
Semester	II				
Academic Level	100 – 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	Knowledge on general characteristics of invertebrate phyla.				
Course Summary	The course on animal diversity is a solid foundation on animal biology and ecology. The structural and functional adaptation of animals and their ecological role and interactions are emphasised. The course prepares the students for further studies or careers in wildlife conservation, research, environmental consulting, education, and related fields.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**PHYLUM ANNELIDA**	**14**
	1	Salient features, classifications. Class Polychaeta eg. *Aphrodite, Arenicola*; Class: Oligochaeta eg. *Nereis*, Mention Heteroneries; Class: Hirudinaria (Parasitic adaptations) eg. Leech, Haemadipsa.	5
	2	Earthworm, Ecological interactions, Vermiculture	7
	3	**Phylum Onychophora**: Salient features. eg. *Peripatus* (Mention afinities and evolutionary significance).	2
II		**PHYLUM ARTHROPODA**	**14**
	4	Salient features, classifications. eg. Cockroach, *Limulus* (evolutionary significance), *Eupagurus, Sacculina* (Parasitic adaptations and castration), Termite, Honey bee. Ecological interactions and economic importance of arthropods. Sericultue, Apiculture	6
	5	Type Study-*Penaeus* (Mention larval stages of *penaeus*)	8
III		**PHYLUM MOLLUSCA**	**10**

	6	Salient features, classifications. Classes- Monoplacophora eg. *Neopilina;* Amphineura eg. *Chiton*; Aplacophora eg. *Neomenia*, Gastropoda eg. *Pila*; Scaphopoda eg. *Dentalium*; Pelicypoda eg. *Perna*, *Teredo*; Cephalopoda eg. *Sepia*, *Octopus*.	5
	7	Pearl Culture, Mussel Culture, Economic importance of mollusca,	5
IV		**PHYLUM ECHINODERMATA**	**7**
	8	Salient features, classifications. Classes- Asteroidea eg. *Asterias*; Ophiuroidea eg. *Ophiothrix*; Echinoidea eg. *Echinus*; Holothuroidea eg. Sea cucumber, Crinoidea, eg. Sea lily. Water vascular system. Economic importance of Echinodermata.	5
	9	**Phylum Hemichordata:** Salient features eg: *Balanoglossus*	2
V		**PRACTICUM**	**30**
	10	Identification and classification of the following specimens Phylum Annelida – Earthworm, *Nereis*, Leech, *Aphrodite*, *Arenicola* –Any 3 Phylum Onychophora – *Peripatus* Phylum Arthropoda – *Limulus*, *Eupagurus*, *Sacculina*, Honey bee, *Lepisma*, Scorpion –Any 5 Phylum Mollusca – *Chiton*, *Pila*, *Xancus*, *Dentalium*, *Perna*, *Mytilus*, *Teredo*, *Sepia*, *Octopus* -Any 5 Phylum Echinodermata – Starfish, Brittle star, Sea urchin, Sea cucumber, Sea lily **Major Dissections** Earthworm – Nervous system Prawn – Nervous system Cockroach – Nervous system - Any 2 **Minor Dissections** Earthworm – Body setae Nereis – parapodium Cockroach – mouth parts Honey bee – mouth parts / mosquito - mouth parts Prawn – appendages- Any 4	

References

1. Barnes, R.D. (1987). Invertebrate Zoology. W. B. Sunders. New Delhi.
2. Ekambaranatha Ayyar M. (1990). A Manual of Zoology. Vol. 1. Invertebrata- Part 1 & Part11. S. Viswanathan Printers and Publishers.Pvt. Ltd.
3. Hickman, C.P and Roberts, L.S. (1994). Animal Diversity. Wm. C. Brown, Dubuque, IA.
4. Hyman, L. H. (1942). The invertebrate volumes. Mc Gew - Hill.
5. Jorden, E.L and Verma, P.S. (2000). Invertebrate Zoology. S. Chand andCo Ltd. New Delhi.
6. Kapoor, V.C. (1994).Theory and Practice of animal taxonomy. Oxford & IBH Publishing Co, New Delhi.

7. Kotpal, R.L, Agarwal, S.K. and R.P. Khetarpal. (2002). Modern text book of Zoology Invertebrates.
8. Mayer, E. (1980). Principles of Systematic Zoology. Tata Mc Graw Hill Publishing Co, New Delhi.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Identify and classify invertebrate Taxa based on key morphological characteristics	**U, Ap,**	**PSO-1,2**
CO-2	List out the ecological importance of higher invertebrates in various ecosystems, including their roles as predators and prey.	**R, U**	**PSO-1,2**
CO-3	Develops skill to perform various dissections in invertebrates**.**	**An, C**	**PSO-1,5**
CO-4	Developing skills in fieldwork and laboratory techniques in taxonomic field.	**U, Ap**	**PSO-1,5,**
CO-5	Evaluate the economic impact of invertebrates on human societies and ecosystems.	**Ap,**	**PSO-1,**
CO-6	Illustrates the affinities and evolutionary significances of organisms.	**U,An**	**PSO-1,3.**
CO-7	Lists the ecological interactions and economic importance of arthropods	**An, E**	**PSO-1, 4,**

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: ANIMAL DIVERSITY & ECOLOGICAL INTERACTIONS-II

Credits: 4 3:1 (Lecture: Practical)

CO No.	CO	POs	PSOs	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Identify and classify invertebrate Taxa based on key morphological characteristics	1	**PSO-1,2**	**U, Ap**	F, C	L	P
2	List out the ecological importance of higher invertebrates in various ecosystems, including their roles as predators and prey.	1	**PSO-1,2**	**R, U**	F,P	L	
3	Develops skill to perform various dissections in	1	**PSO-1,5**	**An, C**	F, P.		P

	invertebrates.						
4	Developing skills in fieldwork and laboratory techniques in taxonomic field.	1	**PSO-1,5,**	**U, Ap**	F	L	P
5	Evaluate the economic impact of invertebrates on human societies and ecosystems.	1	**PSO-1,**	**Ap,**	F	L	P
6	Illustrates the affinities and evolutionary significances of organisms.	1	**PSO-1,3.**	**U,An**	F	L	
7	Lists the ecological interactions and economic importance of arthropods	1	**PSO-1, 4,**	**An, E**	F,C	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs: Animal Diversity & Ecological Interactions-II

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO 1	3	2	-	-	-	-	-
CO 2	3	3	-	-	-	-	-
CO 3	3	-	-	-	3	-	-
CO 4	3	-	-	-	3	-	-
CO 5	3	-	-	-	-	-	-
CO6	3	-	3	-	-	-	
CO7	3	-	-	3	-	-	-

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-

CO4	3	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-
CO6	3	-	-	-	-	-	-
CO7	3	-	-	-	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓	✓	✓	✓
CO 3		✓	✓	
CO 4	✓	✓	✓	✓
CO 5	✓	✓		✓
CO 6	✓		✓	✓
CO 7	✓	✓	✓	✓

Mar Ivanios College (Autonomous)

Discipline	**ZOOLOGY**				
Course Code	MIUK2DSCZOO103.1				
Course Title	**FOREST ECOSYSTEM AND MANAGEMENT**				
Type of Course	**DSC(B/C)**				
Semester	II				
Academic Level	100 – 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3		2	5
Pre-requisites	Basic knowledge on ecosystems.				
Course Summary	This course explores the interrelationships between forest ecosystems and their management. Students will gain a foundational understanding of forest ecology, including the biotic and abiotic factors that influence forest structure, function, and biodiversity. The course will also examine principles of forest management, focusing on sustainable practices that balance ecological health with the use of forest resources.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**INTRODUCTION TO FOREST ECOLOGY**	**15**
	1	Forest ecosystems: structure, function, and biodiversity, Characteristics of major forest types (temperate, tropical, boreal) Forest ecosystem services and values	5
	2	Biotic and abiotic factors influencing forest ecosystems.	2
	3	Succession and Species interactions and biodiversity in forests	3
	4	Brief account on silviculture. Agroforestry	2
	5	Forest entomology: Beneficial Insects and their role in forest economy: Scavenger insects, dung beetles; Pollinators, Predatory insects, and parasitic insects	3
II		**FOREST PROCESSES**	**15**
	6	Nutrient cycling in forest ecosystems. Role of decomposers and detritivores in nutrient cycling. Human impacts on nutrient cycling	5
	7	The importance of forests in maintaining water quality and preventing soil erosion. The impact of deforestation on water resources.	5
	8	Soil ecology and forest health- Soil formation. Threats to soil health, such as compaction, erosion, and acidification	
III		**FOREST MANAGEMENT**	**5**
	9	The Wildlife (Protection)Act 1972, Forest (Conservation) Act 1980, Environment (Protection)Act1986. International Treaties like CITES, CBD, RAMSAR. The BiologicalDiversity Act, 2002	5
IV		**MANGROVE ECOSYSTEM**	10

	10	Mangrove ecosystem- Types, functions and services	2
	11	Threats to the mangrove ecosystem. Mangrove conservation	2
	12	Brief account on features and adaptations of mangrove fauna	2
	13	Brief account of mangrove ecosystem of India and Kerala	4
V		**PRACTICUM**	**30**
	14	Visit to a forest research institute.	
	15	Discussion about global forest ecosystem.	
	16	Identification of faunal diversity of forest ecosystem and report submission.	
	17	Field visit to a forest ecosystem/Nature camp to familiarize the students with forest ecosystem and it ecological services	
	18	Field visit to a mangrove ecosystem and identification of faunal diversity and submission of report.	

Reference:

1. Anderson, C. W., & Miller, W. W. (2021). Watershed management: Planning for the 21st
2. century. John Wiley & Sons.
3. Bruijnzeel, L.A., Hamilton, L.S., and Asdak, C. (2011). Rainforest Hydrology, Ecology and
4. Management. Springer.
5. Manuel C. & Molles Jr. (2009) Ecology: Concepts and Applications (5th Ed).
6. McGraw-Hill International Education. pp 604. ISBN-13: 9780070171688
7. Stiling D.P. (2012). Ecology Global Insights and Investigations. McGraw-Hill Companies, pp579.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Explain the structure, function, and value of forests.	U	3
CO-2	Understand the vital processes within forests and how human activities can impact them.	U,	2
C0-3	Identify faunal diversity of forest and mangrove ecosystem	U,R	1
C0-4	Analyse the complexities of forest management in the country including policy analysis and sustainable practices.	An,Ev	1,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: Forest ecosystem and Management

Credits: 3:1 (Lecture:Practical)

CO No.	CO	PO	PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Explain the structure,	1	3	U	F, C	L/T	

	function, and value of forests.						
CO-2	Understand the vital processes within forests and how human activities can impact them.	1,3	2	U	F, C	L/T	P
CO-3	Identify faunal diversity of forest and mangrove ecosystem	6	1	Ap	F, C,P	L/T	P
CO-4	Analyse the complexities of forest management in the country including policy analysis and sustainable practices.	1,3	1,3	C	F, C,	L/T	

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	-	-	3	-	-	-	-	-
CO 2	-	3	-	-	-	-	-	-
CO 3	3	-	-	-	-	-	-	-
CO 4	3	-	2	-	-	-	-	-

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	-	-	-
CO2	3	-	3	-	-	-	-
CO3	-	-	-	-	-	3	-
CO4	1	-	3	-	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics

	Midterm Exam	Assignment	Report Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓

Mar Ivanios College (Autonomous)

Discipline	**ZOOLOGY**				
Course Code	MIUK2MDCZOO101.1				
Course Title	**SCIENTIFIC INSIGHTS INTO SEX EDUCATION**				
Type of Course	**MDC**				
Semester	II				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 hours	-	-	3
Pre-requisites	An interest and commitment to the subject matter and the maturity, receptiveness and willingness to engage in respectful constructive discussions. Foundational knowledge in Biology will be beneficial.				
Course Summary	This course aims to provide students with a holistic understanding of human sexuality, including biological, psychological, social, and cultural aspects. Through interdisciplinary perspectives, students will explore topics such as reproductive health, sexual orientation, gender identity, sexual diversity, consent, healthy relationships, and sexual health.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**BIOLOGICAL FOUNDATIONS OF SEXUALITY**	**11**
	1	Definition and scope of human sexuality. Basic terminologies.	1
	2	Anatomy and physiology of human reproductive systems. Conception, pregnancy and childbirth. Genetic sex determination in humans. Puberty and sexual development. Hormonal regulation of sexual development and behaviour.	10
II		**DIVERSITY AND DIMENSIONS OF SEXUALITY**	**6**
	3	Sexual identity, orientation, and gender identity. Psychological aspects of sexual behaviour. Sociocultural influences on sexuality. Understanding sexual diversity. LGBTQIA+ identities and issues.	6
III		**RELATIONSHIPS, VALUES AND COMMUNICATION**	**8**
	4	Characteristics of healthy relationships. Gender roles and expectations.	2
	5	Interpersonal communication and negotiation in relationships. Consent, boundaries, coercion, and marital rape.	3
	6	Respecting diverse cultural perspectives. Sexual ethics.	3
IV		**SEXUAL HEALTH AND WELLNESS**	**20**
	7	Sexual health and hygiene. Reproductive justice.	3

	8	Contraception and birth control.	3
	9	Sexually Transmitted Diseases: prevention, testing, and treatment.	4
		ACTIVITIES	10
	10	Study of functional anatomy and physiology of human reproductive systems using virtual labs/videos.	
	11	Study of the role of sex chromosomes in determining genetic sex and how variations in sex chromosome composition can result in different sex phenotypes (XX – female, XY – male).	
	12	Study of sex chromosome disorders - Turner syndrome (45,X), Klinefelter syndrome (47,XXY), and Triple X syndrome (47,XXX).	
	13	Group discussions on importance of informed decision-making regarding contraception.	
	14	Designing a public health campaign aimed at raising awareness about sexually transmitted infections (STIs) and promoting prevention methods. (posters, brochures, or social media content)	
	15	Case study – students present case studies that depict common sexual health issues/ issues specific to LGBTQIA+ individuals and communities/ issues involving consent, boundaries, and healthy relationships/ reproductive justice.	
	16	Discussions/brainstorming on inclusive approaches to sexuality education and support services.	

REFERENCES

1. Ganong, W.F. (2019), Review of Medical Physiology, 26th edition. McGraw Hill, New Delhi.
2. Hyde, J. S. & Delamater, J.D. (2013), Understanding Human Sexuality, 12th edition, McGraw-Hill Humanities Social.
3. Goerling, E & Wolfe, E. (2022), Introduction to Human Sexuality, Openoregon.pressbooks.pub (licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License)
4. Rach Cosker-Rowland, Recent Work on Gender Identity and Gender, Analysis, Volume 83, Issue 4, October 2023, Pages 801–820, https://doi.org/10.1093/analys/anad027

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Explain the biological, psychological, and social factors that influence human sexuality.	R, U	5, 6
CO-2	Apply scientific knowledge to promote sexual health, prevent sexual risks, and address common sexual concerns.	R, U, Ap, An	5, 6
CO-3	Recognize and respect diversity in sexual orientation, gender identity, and sexual expression.	R, U, Ap, An	5, 6
CO-4	Develop evidence-based strategies for effective communication, consent, and healthy relationships.	U, Ap, An, E, C	5, 6
CO-5	Demonstrate empathy, sensitivity, and professionalism in addressing sexuality-related issues	U, An, Ap, E	5, 6

	and supporting individuals with diverse needs.		

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: SCIETIFIC INSIGHTS INTO SEX EDUCATION

Credits: 3:0 (Lecture:Practical)

CO No.	CO	PO	PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Explain the biological, psychological, and social factors that influence human sexuality.	1	5,6	R, U	F, C	L	
CO-2	Apply scientific knowledge to promote sexual health, prevent sexual risks, and address common sexual concerns.	1,7	5,6	R, U, Ap, An	F, C, P	L	P
CO-3	Recognize and respect diversity in sexual orientation, gender identity, and sexual expression.	2,7	5,6	R, U, Ap, An	F, C, P	L	P
CO-4	Develop evidence-based strategies for effective communication, consent, and healthy relationships.	4,7	5,6	U, Ap, An, E, C	F, C, P,M		P
CO-5	Demonstrate empathy, sensitivity, and professionalism in addressing sexuality-related issues and supporting	2,4,7	5,6	U, An, Ap, E	F, C, P,M	L	P

	individuals with diverse needs.						

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	-	-	-	-	1	3	-	-
CO 2	-	-	-	-	1	3	-	-
CO 3	-	-	-	-	1	3	-	-
CO 4	-	-	-	-	1	3	-	-
CO 5	-	-	-	-	1	3	-	-

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	-	-	3
CO2	3	-	-	-	-	-	3
CO3	-	3	-	-	-	-	3
CO4	-	-	-	3	-	-	3
CO5	-	3	-	3	-	-	3

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓	✓		✓

CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		
CO 5	✓	✓		

SEMESTER – III

Mar Ivanios College (Autonomous)

Discipline	**ZOOLOGY**				
Course Code	MIUK3DSCZOO200.1				
Course Title	CHORDATA				
Type of Course	**DSC**				
Semester	III				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	Basic knowledge on the general characteristic of chordates				
Course Summary	The phylum Chordata represents a key evolutionary lineage that has given rise to diverse and successful animal forms. The transition from aquatic to terrestrial environments among chordates has been particularly significant, leading to the emergence of amphibians, reptiles, birds, and mammals. This course provides an in-depth study of vertebrate animals, focusing on their diversity, behaviour, and ecological roles.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**INTRODUCTION TO PHYLUM CHORDATA**	**10**
	1	Salient features, Classifications.	1
	2	**Subphylum Urochordata**- Salient features Class Larvacea eg. *Oikopleura*; Class Ascidiacea eg. *Ascidia* (Mention retrogressive metamorphosis) and Class Thaliacea eg. *Salpa.*	4
	3	**Subphylum Cephalochordata**- Salient features eg. *Amphioxus*	1
	4	**Subphylum Vertebrata**: Salient features, classifications. Division 1 Agnatha - Salient features Class Cyclostomata eg. *Petromyzo*n, Class Ostracodermi; Division 2 Gnathostomata, Salient features Classification into Super class Pisces and Tetrapoda.	4
II		**SUPER CLASS PISCES**	**10**
	5	Salient features, Classifications. Class Placodermi**,** Class Chondrichthyes.	4

	6	**Sub class Elasmobranchii** eg. *Narcine*, Sub class Holocephali eg. *Chimaera***;** Class Osteichthyes **Sub class Choanichthyes** Order1 Crossoptergii eg *Latimeria*. Order 2 Dipnoi eg. *Protopterus*, **Subclass Actinopterygii** Super order Chondrostei eg *Acipenser*. Super order Holostei eg *Lepidosteus*. Super order Teleostei eg *Anabas*, *Clarius*, *Saccobranchus*, *Ophiocephalus*, *Echeneis*. General topic: Accessory respiratory organs in fishes	6
III		**SUPER CLASS TETRAPODA**:	**15**
	7	**Class Amphibia**: Salient features, Classifications. Order Urodela eg. *Amblystoma***,** Order Anura eg. *Hyla, Bufo,Rana*, Order Apoda eg. *Ichthyophis.* General topic: Parental care in amphibia.	4
	8	**Class Reptilia**: Salient features, Classification. Subclass Anapsida Order Chelonia eg. *Chelone*; Subclass Parapsida eg. *Ichthyosaurus*; Subclass Diapsida- Order Rhynchocephalia eg. *Sphenodon*, Order Squamata- Suborder Lacertilia eg. *Calotes, Chameleon, Draco, Hemidactylus*, Suborder Ophidia eg. *Naja naja, Vipera, Bungarus, Enhydrina, Ptyas, Lycodon, Tropidonotus, Dryophis, Typhlops* and *Eryx johni*, Suborder Crocodilia eg. *Crocodilus, Alligator*; Subclass Synapsida eg *Cynognathus.* General topic: Identification of poisonous and non-poisonous snakes.	7
	9	**Class Aves**: Salient features, Classifications. Subclass Archeornithes eg .*Archeopteryx*; Subclass Neornithes- Super order Paleognathae eg. *Sruthio* and *Emu*, Super order Neognathae eg. Grey heron, Vulture, Kite, *Pavo*, Koel, Owl, Woodpecker, Crow. General topic: Flight adaptations of birds.	4
IV		**CLASS MAMMALIA**	**10**
		General characters and classification - Subclass Prototheria eg. *Tachyglossus;* Subclass Metatheria eg. *Macropus*; Subclass Eutheria - Order Insectivora eg. *Paraechinus*, Order Dermoptera eg. *Galeopithecus*, Order Chiroptera eg.*Pteropus*, Order Primates eg. *Loris*, Orangutan, Order Carnivora eg. *Leo* sps, *Felis domesticus*, *Canis familiaris*, *Herpestus*, Order Cetacea eg. *Delphinus*, Order Perissodactyla eg. *Equus*, Order Artiodactyla eg. *Camelus, Hippopotamus*, Order Proboscidia eg. *Elephas.* Order Sirenia eg. *Dugong*, Order Hyracoidea eg. *Procavia*, Order Rodentia eg. *Rattus*, Order Lagomorpha eg. *Oryctolagus*, Order Edentata eg. *Dasypus novemcinctus* (Armadillo), Order Pholidota eg. *Manis*, Order Tubilidentata eg. *Orycteropus.* Type: Rabbit (*Oryctolagus cuniculus*): External features(Self study), Digestive system, Skeletal System,	10

		Vertebral column: Atlas, Axis, Lumbar, Pectoral and Pelvic girdles, Respiratory system, Circulatory system, Heart, Arterial system and Venous system, Nervous system: Brain – Dorsal and ventral view and Urinogenital system. General topic: Aquatic adaptations in Mammals.	
V		**Practicum:** Identification and classification of the following specimens Protochordates – *Ascidia*, *Amphioxus* (entire) Pisces - 2 cartilaginous fishes, 2 fishes with accessory respiratory organs, 2 edible fishes and 2 culture fishes. Amphibia - Any 3 (representing the three orders). Reptilia - 2 poisonous and 2 non-poisonous snakes, *Draco*, *Chameleon* Mammals – Bat, Any 2 Mammals Fishes - Placoid scales of *Scoloidon* and cycloid and ctenoid scales of *Anabas* **Osteology** Rabbit limb bones, girdles, typical vertebra, atlas, axis, thoracic and lumbar vertebrae and lower jaw. Turtle - carapace and plastron **Visit to Zoo/Museum/Nature Camp- Submit Report** **Bird watching:** Prepare a field diary on campus bird watching and submit a report. Identification on different kinds of feathers	**30**

Reference

1. Bhaskaran, K. K. and Biju Kumar, A. (2003). Chordate Zoology. Manjusha Publications. Calicut.
2. Ekambaranath Iyer. (2000). A Manuel of Zoology. Vol. II S. Viswanathan and Co.
3. Jordan E. L. and P. S. Verma. (2002).Chordate Zoology. S. Chand and Co. New Delhi
4. Kotpal, R.L. (2000). Modern Textbook of Zoology: Vertebrates. Rastogi Publications,
5. Meerut.Verma, P.S. (2002). A Manual of Practical Zoology Chordates. S. chand and Co. Ltd.
6. William S. Beck, Karel, F., Liem and George Gaylord Simpson. (2000). Life: An introduction to biology. Harper Collins Publishers, New York.
7. Young J.Z. (2006). The life of Vertebrates. Oxford University

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Identify and classify invertebrate Taxa based on key morphological characteristics	U, Ap	PSO-1,2
CO-2	Outline the diversity of chordates, including vertebrates (fishes, amphibians, reptiles, birds, mammals) and selected invertebrate chordates (like tunicates and lancelets).	R, U	PSO-1,2
CO-3	Explore the evolutionary relationships within the phylum Chordata and understand how chordate characteristics have evolved over time.	U, R, An	PSO-1,3
CO-4	Illustrate the behaviour and communication strategies of different chordate groups, from complex social behaviours in mammals to unique communication methods in birds.	U, R, An	PSO-1,2,
CO-5	Identify structural similarities and differences across different chordate classes.	Ap, An	PSO-1,3
CO-6	Gain experience in conducting field surveys, sampling techniques, and observational studies of chordates in their natural habitats.	Ap, U	PSO-1,3
CO-7	Practice documenting field observations and experimental results, and effectively communicate findings through written reports and presentations.	Ap. U	PSO-1,3,5,

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: CHORDATA

Credits: 4 3:1 (Lecture: Practical)

CO No.	CO	POs	PSOs	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1	Identify and classify invertebrate Taxa based on key morphological characteristics	1	PSO-1,2	**U, Ap**	F, C	L	P
2	Outline the diversity of chordates, including vertebrates (fishes, amphibians, reptiles, birds, mammals) and selected invertebrate chordates (like tunicates and	1	PSO-1,2	**R, U**	F,P	L	

	lancelets).						
3	Explore the evolutionary relationships within the phylum Chordata and understand how chordate characteristics have evolved over time.	1	PSO-1,3	**An, C**	F, P.	L	
4	Illustrate the behaviour and communication strategies of different chordate groups, from complex social behaviours in mammals to unique communication methods in birds.	1	PSO-1,2,	**U, Ap**	F	L	P
5	Identify structural similarities and differences across different chordate classes.	6	PSO-1,3	**Ap,**	F	L	P
6	Gain experience in conducting field surveys, sampling techniques, and observational studies of chordates in their natural habitats.	1	PSO-1,3	**U,An**	F	L	P
7	Practice documenting field observations and experimental results, and effectively communicate findings through written reports and presentations.	1	PSO-1,3,5,	**An, E**	F,C		P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs: Chordata

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	3	2	-	-	-	-	-	-
CO 2	3	3	-	-	-	-	-	-
CO 3	3	3	-	-	-	-	-	-
CO 4	3	3	-	-	-	-	-	-
CO 5	3	-	3-	-	-	-	-	-
CO6	3	-	3	-	-	-		-
CO7	3	-	3	-	3	-	-	-

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-
CO5	-	-	-	-	-	3	-
CO6	3	-	-	3	-	-	-
CO7	3	-	-	-	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓
CO 5	✓	✓	✓	✓
CO 6	✓		✓	
CO 7	✓		✓	

Mar Ivanios College (Autonomous)

Discipline	**ZOOLOGY**				
Course Code	MIUK3DSCZOO201.1				
Course Title	ECOTOXICOLOGY: CHEMICAL IMPACTS ON ECOSYSTEMS AND HEALTH				
Type of Course	DSC (B/C)				
Semester	III				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	A foundational understanding of biological concepts such as cell structure and function, ecology, and organismal biology. A basic knowledge of chemistry is essential, including concepts such as chemical bonding, chemical reactions, and environmental chemistry.				
Course Summary	The course provides students with a comprehensive understanding of the impacts of chemical contaminants on the environment and human health. Through lectures, case studies, and practical exercises, students will gain knowledge of the sources, fate, and transport of environmental pollutants, mechanisms of toxicity, risk assessment, and management strategies. By the end of the course, students will be equipped with the skills and knowledge necessary to address environmental challenges and contribute to the development of sustainable solutions for environmental protection and human health.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I	**INTRODUCTION TO ECOTOXICOLOGY**		**4**
	1	Definition and scope of ecotoxicology Historical context and key concepts Interactions between pollutants and ecosystems	4
II	**ENVIRONMENTAL CONTAMINANTS AND MECHANISMS OF TOXICITY**		**13**
	2	Anthropogenic sources of environmental contaminants. Transport and dispersion of contaminants in air, water, and soil. Bioaccumulation and biomagnification of toxic substances.	6
	3	Mechanisms of Toxicity. Toxicokinetics: Absorption, distribution, metabolism, and excretion of toxicants.	5
	4	Effects of environmental contaminants on wildlife and ecosystems.	2
III	**RISK ASSESSMENT AND MANAGEMENT OF CONTAMINATED ENVIRONMENTS**		**21**

	5	Hazard identification and dose-response relationships. Dose – response curve. LC_{50}, $LD_{50,}$ sublethal concentration. Acute, subacute and chronic toxicity.	2
	6	Toxicity tests. Bioassays. OECD guidelines for testing of chemicals.	2
	7	Exposure assessment: Routes of exposure, exposure levels.	2
	8	Health effects of environmental pollutants on human populations.	2
	9	Analysis of major ecotoxicological incidents (e.g., chemical spills, industrial accidents)	3
	10	Environmental monitoring techniques - air quality monitoring, water quality monitoring, soil quality monitoring, and biodiversity monitoring	6
	11	Strategies for prevention of pollution.	2
	12	Remediation: physical, chemical and biological techniques.	2
IV	**EMERGING ISSUES IN ECOTOXICOLOGY**		**7**
	13	Emerging contaminants: Microplastics, pharmaceuticals, endocrine disruptors.	4
	14	Climate change and its impacts on ecotoxicology.	2
	15	Future directions and priorities in ecotoxicological research.	1
V		**PRACTICUM**	**30**
	16	Assessment of LC_{50} of a chemical using Brine shrimp lethality bioassay.	
	17	Water quality analysis of freshwater ecosystems.	
	18	Comet assay to evaluate DNA damage in cells on exposure to chemicals.	
	19	Field visits to industrial sites, agricultural areas, or urban environments to assess potential sources of contamination. Students will identify pollution hotspots, collect environmental samples, and document the observations.	
	20	Case study of any one ecotoxicological incident that had implications on human health.	
	21	Students will conduct a comprehensive literature review on any one contaminant of emerging concern and present their findings.	

REFERENCES

1. Newman, M. C. (2010). Ecotoxicology: A Comprehensive Treatment. CRC Press.
2. Newman, M. C. (2010). Fundamentals of Ecotoxicology: The Science of Pollution. CRC Press.
3. Hood, E. (2014). Essentials of Environmental Toxicology: The Effects of Environmentally Hazardous Substances on Human Health. Wiley.
4. Kumari, A., Rajput, V. D., Mandzhieva, S. S., Minkina, T., & van Hullebusch, E. D. (2024). Emerging Contaminants. Sustainable Agriculture and the Environment (1st ed.). Elsevier.
5. Ming-Ho Yu, Humio Tsunoda. (2000). Environmental Toxicology: Biological and Health Effects of Pollutants. CRC Press.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Explain the principles and concepts of ecotoxicology	R, U	2,7

CO-2	Explain the sources and mechanisms of toxicity of environmental contaminants and their effects on wildlife and human health.	R, U	2,7
CO-3	Prepare dose response curve for a chemical and establish the LC_{50} and sublethal concentrations of toxicants.	U, Ap, An	5,7
CO-4	Conduct bioassays using model organisms and establish the level of toxicity of a substance.	An, Ap, E	5,7,8
CO-5	Assess the level of pollution in an ecosystem using different analytical techniques.	An, Ap, E	5,7,8
CO-6	Prepare reports and present case studies and real-world examples of ecotoxicological incidents.	An, Ap, E, C	2,7,8
CO-7	Integrate the knowledge acquired through the course to predict future directions in ecotoxicological research.	An, Ap, E, C	7,8

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: ECOTOXICOLOGY: CHEMICAL IMPACTS ON ECOSYSTEMS AND HEALTH

Credits: 3:1:(Lecture:Practical)

CO No.	CO	PO	PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Explain the principles and concepts of ecotoxicology	1	2,7	R, U	F, C	L	
CO-2	Explain the sources and mechanisms of toxicity of environmental contaminants and their effects on wildlife and human health.	1,3	2,7	R, U	F, C	L	P
CO-3	Prepare dose response curve for a chemical and establish the LC_{50} and sublethal concentrations of toxicants.	1,2,6	5,7	U, Ap, An	F, C,P	L	P
CO-4	Conduct bioassays using model organisms and establish the level of toxicity of a substance.	1,2,6	5,7,8	An, Ap, E	F, C,P	L	P
CO-5	Assess the level	1,3,6	5,7,8	An, Ap, E	F, C, P		P

	of pollution in an ecosystem using different analytical techniques.						
CO-6	Prepare reports and present case studies and real-world examples of ecotoxicological incidents.	1,3,6	2,7,8	An, Ap, E, C	F, C, P		P
CO-7	Integrate the knowledge acquired through the course to predict future directions in ecotoxicological research.	1,3,6	2,7	An, Ap, E, C	F, C, P, M	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	-	3	-	-	-	-	3	-
CO 2	-	3	-	-	-	-	3	-
CO 3	-	-	-	-	3	-	3	-
CO 4	-	-	-	-	3	-	3	1
CO 5	-	-	-	-	3	-	3	1
CO 6	-	3	-	-	-	-	3	2
CO 7	-	2	-	-	-	-	2	-

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	-	-	-
CO2	3	-	3	-	-	-	-
CO3	3	2	-	-	-	3	-
CO4	3	2	-	-	-	3	-
CO5	3	-	2	-	-	3	-
CO6	3	-	2	-	-	3	-
CO7	3	-	2	-	-	3	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		
CO 6	✓	✓		
CO 7	✓	✓		

Mar Ivanios College (Autonomous)

Discipline	**ZOOLOGY**				
Course Code	MIUK3DSEZOO200.1				
Course Title	**BASIC HUMAN ANATOMY**				
Type of Course	**DSE**				
Semester	III				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	A fundamental understanding of biological concepts such as cells, tissues, organs, and organ systems is recommended.				
Course Summary	This course provides an introductory exploration of the structure and organization of the human body, focusing on key anatomical systems and their functions. Emphasis is placed on anatomical terminology, basic histology, and the gross anatomy of major organs. By the end of the course, students will be equipped with the knowledge necessary to identify and describe the anatomical structures of the human body and understand their roles in physiological processes.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I	**INTEGUMENTARY & MUSCULOSKELETAL SYSTEM**		**14**
	1	Definition and importance of anatomy. Anatomical terminology: position, planes, and body cavities. Introduction to histology: four primary types of tissues - connective tissue, epithelial tissue, muscle tissue, and nervous tissue.	2
	2	Anatomy of skin. Epidermal derivatives.	2
	3	Types of muscles – skeletal, smooth and cardiac, their location and function. Structure of skeletal muscle.	2
	4	Anatomy of Bones. Major bones of the axial and appendicular skeleton – vertebral column, ribs, sternum, pectoral and pelvic girdle, limb bones. Types of joints. Structure of a synovial joint. Cartilage, tendons, ligaments.	8
II	**CARDIOVASCULAR, RESPIRATORY & DIGESTIVE SYSTEMS**		**10**
	5	Functional anatomy of heart. Major blood vessels – arteries, veins and capillaries, their roles in circulation. Lymphatic system. Lymphoid organs.	4
	6	Basic anatomy and functions of the respiratory tract and lungs. Mechanism of breathing.	3

	7	Structure of digestive system. Functional layers of intestinal wall. Digestive glands.	3
III		**NERVOUS SYSTEM AND SENSE ORGANS**	**13**
	8	Divisions of nervous system. Anatomy of brain and spinal cord. Peripheral nervous system. Autonomic nervous system.	5
	9	Types of sense organs and receptors. Structure of eye – functional layers of retina.	4
	10	Functional anatomy of ear.	2
	11	Anatomy of taste and olfactory receptors.	2
IV		**URINARY & REPRODUCTIVE SYTEMS**	**8**
	12	Structure of kidney and nephrons.	2
	13	Anatomy of Male reproductive system – testes, accessory organs and glands.	3
	14	Female reproductive system – ovaries, accessory organs and glands.	3
V		**PRACTICUM**	**30**
	15	Study of skeletal system of man using models.	
	16	Identification of different bones based on their structure.	
	17	Study of anatomy of major organs using models/virtual lab – heart, lungs, brain, eye, ear, testes, ovary – Draw and label diagrams and identification using pictogram/modles.	
	18	Study of different types of tissues using permanent slides.	

REFERENCES

1. Scanlon, V. C., & Sanders, T. (2007). Essentials of anatomy and physiology (5th ed.). F. A. Davis Company.
2. Guyton, A.C. and Hall, J.E. (1995). Text book of Medical Physiology, 9th edition. W.B. Saunders Co.
3. Chaurasia, B.D. (2020). Handbook of General Anatomy. CBS Publishers and Distributors Pvt. Ltd.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Decribe the structure of different organs in human body.	R, U	3, 6
CO-2	Identify and explain the structural features of bones in human body.	R, U	3,6
CO-3	Explain the structure-function relationships of organ systems of human body.	R, U	3,6
CO-4	Identify different types of cells and tissues based on their structure.	U,An,E	3,6
CO-5	Integrate the knowledge about different organ systems to evaluate their functional interrelations.	U, E, Ap	3,6

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: BASIC HUMAN ANATOMY

Credits: 3:1 (Lecture:Practical)

CO	CO	PO	PSO	Cognitive	Knowledge	Lecture (L)/	Practica

No.				Level	Category	Tutorial (T)	l (P)
CO-1	Decribe the structure of different organs in human body.	1	3,6	R, U	F, C	L	
CO-2	Identify and explain the structural features of bones in human body.	1	3,6	R, U	F, C	L	
CO-3	Explain the structure-function relationships of organ systems of human body.	1	3,6	R, U	F, C	L	
CO-4	Identify different types of cells, tissues, organs and bones based on their structure.	1	3,6	U,An,E	F, C		P
CO-5	Integrate the knowledge about different organ systems to evaluate their functional interrelations.	1	3,6	U, E, Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	-	-	3	-	-	3	-	-
CO 2	-	-	3	-	-	3	-	-
CO 3	-	-	3	-	-	3	-	-
CO 4	-	-	3	-	-	3	-	-
CO 5	-	-	3	-	-	3	-	-

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-

CO3	3	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4	✓			✓
CO 5	✓	✓		

Mar Ivanios College (Autonomous)

Discipline	ZOOLOGY				
Course Code	MIUK3VACZOO200.1				
Course Title	**PUBLIC HEALTH AND MANAGEMENT**				
Type of Course	**VAC**				
Semester	III				
Academic Level	200-299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 hours	-	-	3
Pre-requisites	Basic knowledge about nutrition. Basic understanding about health and hygiene.				
Course Summary	Public health is the discipline focused on improving and protecting the health of communities and populations through education, promotion of healthy behaviours, disease prevention, and policy interventions. It addresses a wide range of issues such as infectious diseases, chronic illnesses, environmental hazards, and social inequalities to promote overall well-being on a societal level. The level of adulteration in the food that we consume is one of the factors that determine our wellbeing. This course will provide an insight to the importance of disease prevention and maintenance of hygiene.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**CONCEPT OF PUBLIC HEALTH AND HYGIENE**	**5**
	1	Scope and importance of the study, Nutrition and health- Balanced Diet, Malnutrition and Over nutrition, Obesity and weight control, Body mass index, Nutritional Deficiencies, Vitamin deficiencies.	3
	3	Common food adulterants, food additives, fortification of food	2
II		**HYGIENE**	**5**
	4	Hygiene: Definition, personal hygiene- body odour, oral hygiene, grooming, feminine hygiene, sleep hygiene. Social hygiene –clean living movements, occupational hygiene, food and cooking hygiene, medical hygiene	5
III		**DISEASES AND THEIR CONTROL MEASURES**	**20**
	5	Common food borne and water borne diseases (gastroenteritis, jaundice, cholera, salmonellosis) – causative agents, symptoms, prevention and control. Air borne: common cold, chicken pox, mumps, covid 19	7
	6	Sexually transmitted infections – AIDS, genital herpes,	8

		syphilis, gonorrhoea – causative agents, symptoms, modes of transmission and prevention.	
	7	Vector Borne : dengue, chikunguniya, malaria, rat fever and preventive measures	3
	8	Lifestyle disease Effects of smoking ,alcoholism and drug abuse. addiction, deaddiction.	2
IV		**PUBLIC HEALTH MANAGEMENT**	**15**
	9	Community health- health centres, role of health centres, vaccination and awareness programme.	2
	10	Role of government, NGO and other voluntary organizations in public health management.	2
	11	First Aid- Precautions and awareness on Personal hygiene	1
		ACTIVITIES	10
	12	Visit to Public health Centre	
	13	Outreach programs to nearby schools or Anganwadi to create awareness on public health programs and control measures of various diseases	
	14	Discussion on various disease outbreak investigations and mitigation and control measures adopted globally and in India	
	15	Evaluation of various health programs conducted by the government	
	16	Campaign against alcoholism in the campus	
	17	Campaign against drug abuse in the campus	

Reference:

1. Birkhead, G. S., Morrow, C. B., Pirani, S. (2020). Essentials of Public Health. United States: Jones & Bartlett Learning.
2. Blair, T. S. (2009). Public Hygiene. Canada: Cambridge Scholars Publishing.
3. Jatin V. Modi and Renjith S. Chawan. Essentials of Public Health and Sanitation, Part IV.Swaminathan S. Principles of Nutrition and Dietetics.
4. Murray, C. J. L. and A.D. Lopez. (1996). The Global Burden Of Disease. World Health Organization.5. Park, J.E. and Park, K. Textbook of Community Health for Nurses.
5. Park and Park, (1995) Text book of preventive and social medicine – Banarsidas Bhanot Publ. jodhpur- India.
6. Schneider, M. (2011). Introduction to Public Health. United States: Jones & Bartlett Learning.
7. Verma, S. (1998). Medical zoology, Rastogi Publ.- Meerut- India

Course Outcomes

No.	Upon completion of the course, the graduate will be able to	Cognitive Level	PSO addressed

CO-1	Practise good health and hygiene	R, U	5
CO-2	Distinguish food adulteration	R, U	5,6
CO-3	Explain the symptoms and mode of transmission of various diseases	R, U	3
CO-4	Explain the health education in India	R, U	3
CO-5	Extend awareness about public health and hygiene	U, Ap	3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: Public Health Management

Credits: 3:0 (Lecture:Practical)

CO No.	CO	PO	PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Practise good health and hygiene	1	5	U	F, C	L/T	
CO-2	Distinguish food adulteration	1	5,6	U	F, C	L/T	
CO-3	Explain the symptoms and mode of transmission of various diseases	1	3	U	F, C	L/T	
CO-4	Explain the health education in India	1	3	U	F, C, P	L/T	
CO-5	Extend awareness about public health and hygiene	7	3	U,A	F, C	L/T	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	-	-	-	-	2	-	-	-
CO 2	-	-	-	-	3	2	-	-
CO 3	-	-	3	-	-	-	-	-
CO 4	-	-	2	-	-	-	-	-
CO 5	-	-	3	-	-	-	-	-

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-

CO3	3	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment
- Seminar
- Report submission
- Midterm Exam
- Final Exam

Mapping of Cos to Assessment Rubrics

	Internal Exam	Assignment	Report Submission	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓	✓	✓

SEMESTER – IV

Mar Ivanios College (Autonomous)

Discipline	**ZOOLOGY**				
Course Code	MIUK4 DSCZOO202.1				
Course Title	**SYSTEMATICS, BIODIVERSITY AND CONSERVATION BIOLOGY**				
Type of Course	**DSC**				
Semester	IV				
Academic Level	200-299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3	-	2	5
Pre-requisites	Basic knowledge about classification of organisms, their diversity and importance of conservation.				
Course Summary	Taxonomy is the science of classifying and naming organisms, while systematic description involves organizing and categorizing species based on their characteristics, evolutionary relationships, and genetic information. It's a way to understand the diversity of life and how different species are related to each other. Systematics is one of the basic sciences that provide the fundamental foundations of preservation, practise and sustainable management of the resources.				

Detailed syllabus

Module	Unit	Content	Hrs
I	**INTRODUCTION AND BASIC CONCEPTS OF SYSTEMATICS AND TAXONOMY**		**5**
	1	Definition ad history of taxonomy	1
	2	Importance and application of systematics in biology	1
	3	Taxonomic impediments and its impact in taxonomy, Ethics in taxonomy	1
	4	Taxonomic Procedures-collection, preservation, curating and process of identification.	2
II	**TAXONOMIC TOOLS AND TECHNIQUES**		**15**
	5	Identification: Taxonomic keys:Types of taxonomic keys- Simple Dichotomous key, Bracket key, Indented Key, Serial key, Branching key, Circular key, Box key, computer key. Its merits and demerits	4
	6	Different zoological types: Holotype, Paratype, Lectotype, Syntype,	3

		Neotype, Allotype and their significance.	
	7	Systematics Publications: Different types- Short Research papers, Revision, Monograph,Faunal/Floral, Synopses and Reviews, Handbooks and Manuals, Catalogues and Checklists and Atlases	4
	8	International code of zoological nomenclature and its Law of Priority and Law of Homonymy. Scientific Nomenclature (Uninomial, Binomial Nomenclature and Trinomial Nomenclature (brief account)	4
III		**TAXONOMIC CLASSIFICATION**	**10**
	9	Kinds of classification: Natural classification,Cladistic/Phylogenetic classification, Phenetic classification, Biological classification, Omnispective classification and Hierarchical classification	3
	10	Hierarchy of classification : Linnean Hierarchy. Species category -sub species, taxon, category, rank	2
	11	Approaches in taxonomy– Morphological, Anatomical, Developmental, Biochemical (chemotaxonomy),Cytological (Cytotaxonomy), Ecological and Ethological.	3
	12	Brief account on Molecular Systematics- DNA barcoding and Phylogenetic tree	2
IV		**BIODIVERSITY AND CONSERVATION BIOLOGY**	**15**
	13	Introduction: Definition, levels of biodiversity (genetic diversity, species diversity and ecosystem diversity), Values of biodiversity. Alpha diversity, Beta diversity and Gamma diversity.	3
	14	Causes of biodiversity loss- habitat destruction, deforestation, Invasive Alien species.	2
	15	Strategic species concepts: Keystone species, Ecosystem engineer, Indicator species and umbrella species, Flagship species.	2
	16	Strategies of conservation: in situ- biospheres reserves, National parks, nature reserves, sanctuaries. Ex situ conservation-botanical gardens, zoos, aquarium. In-vitro Conservation: Gene Banks,Germ plasm bank.	3
	17	Earth summit (1992) - Rio Declaration on Environment and Development, Agenda 21, Forest Principles, Convention on Biological Diversity	3
	18	Chipko Movement, Narmada Bachao Andholan (NBA), The Silent Valley Movement, Madhav Gadgil Report, Kasturirangan committee Report.	2
V		**PRACTICUM**	**30**
		Identification of specimens using keys- fishes, Prawn, Crab, Insect using key	
		Visit to Zoological Park, National park	
		Documentation of diversity (i)Butterfly (ii) Dragonfly (iii)Ant (iv) Fishes and submission of report	
		Collection and preservation of any five (i) vertebrate (ii) invertebrate and submission of report.	

		Visit to a molecular biology lab for DNA barcoding technique	

Reference:

1. Alfred J.R.B and Ramakrishna.2004. Collection, Preservation and Identification of Animals. Zoological Survey of India Publications.
2. David, M. H, Craig Moritz and K.M. Barbara.1996. Molecular Systematics. Sinauer Associates, Inc.
3. Kapoor, V.C. 1991.Theory and Practice of Animal Taxonomy. Oxford and IBH Publishing Co., Pvt. Ltd. New Delhi.
4. Margulis,Lynn and M.J.Chapman(4th edn.). Kingdoms and Domains: An Illustrated Guide to the Phyla of Life on Earth.W.H.Freeman &Company,USA
5. Mayr, E .1969. Principles of Systematic Zoology. McGraw Hill Book Company, Inc., NY.
6. Narendran, T.C. 2008. An introduction to Taxonomy. Zoological survey of India.

Course Outcomes

No	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Define systematics and its significance	R, U	3
CO-2	Apply the tools and techniques in taxonomic identification	U, Ap	3,5
CO-3	Choose taxonomic publications for research purpose	R,U	6
CO-4	Compare different approaches in taxonomy and its recent advancements	R, U	3.5
CO-5	Compare taxonomic characters in various taxon	R, An	3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: Systematics and Conservation Biology

Credits: 3:1 (Lecture:Practical)

CO No.	CO	PO	PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Define systematics and its significance	1	3	U	F, C	L/T	
CO-2	Apply the tools and techniques in taxonomic identification	1,2 ,6	3,5	U, Ap	C,Ap	L/T	P
CO-3	Choose taxonomic publications for research purpose	1,3	6	U	F, C	L/T	

CO-4	Compare different approaches in taxonomy and its recent advancements	1	3,5	U	F, C	L/T	P
CO-5	Compare taxonomic characters in various taxon	1	3	An	F, C	L/T	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	-	-	3	-	-	-	-	-
CO 2	-	-	2	-	3		-	-
CO 3	-	-	-	-	-	3	-	-
CO 4	-	-	3	-	2	-	-	-
CO 5	-	-	3	-	-	-	-	-

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	-	-	-
CO2	3	2	-	-	-	3	-
CO3	2	-	3	-	-	-	-
CO4	3		-	-	-	-	-
CO5	3		-	-	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of Cos to Assessment Rubrics

	Internal Exam	Assignment	Project report	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓	✓	✓
CO 5	✓	✓	✓	✓

Mar Ivanios College (Autonomous)

Discipline	**Zoology**				
Course Code	MIUK4DSCZOO203.1				
Course Title	**COMPARATIVE ANATOMY OF VERTEBRATES**				
Type of Course	**DSC**				
Semester	IV				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	Basics of vertebrate diversity Basic knowledge on the structure and functions of organ systems				
Course Summary	This course explores the anatomical evolution of vertebrates. It entails compiling and analysing comparative data of anatomical aspects related to organ systems like the integumentary, digestive, respiratory, circulatory, excretory, reproductive, endocrine, and nervous systems. The course will cover anatomical adaptations of animals to their environment from both an organ system and an environmental perspective.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**INTEGUMENTARY AND SKELETAL SYSTEM**	**10**
	1	**Introduction:** Evolutionary perspectives and general concepts of comparative anatomy, Anaplasy, Homoplasy.	1
	2	**Integumentary system-** Gross anatomy of integument of vertebrates- comparative study of *Scoliodon,* frog, and rabbit. **Epidermal derivatives** - scales, feathers, beaks, hair, hoof, horns, antlers, claws, teeth, nails, hooves, and baleen **Epidermal glands** –various types of glands of vertebrates and their functions (e.g. mucous, serous, ceruminous, poison, uropygial, sweat, sebaceous and mammary glands).	4
	3	**Skeletal system-** Comparative study of vertebrae and appendicular skeleton of *Scoliodon,* frog, and rabbit	5
II		**DIGESTIVE AND RESPIRATORY SYSTEM**	**10**
	4	**Digestive system-**Origin and development of alimentary canal. Dentition of *Scoliodon,* frog, rabbit	5
	5	**Respiratory system-** Aquatic and terrestrial respiratory organs.	5
III		**CIRCULATORY SYSTEM AND URINOGENITAL SYSTEM**	**13**

	6	**Circulatory system-** Evolution of heart & aortic arches. Comparative study - *Scoliodon*, frog, and rabbit.	5
	7	**Excretory System**-Development of kidney. Evolution of kidneys in vertebrates.	4
	8	**Reproductive systems**-Development of gonads. Genital ducts in vertebrates.	4
IV		**NERVOUS SYSTEM AND SENSE ORGANS**	**12**
	9	Nervous system: Development and differentiations of various parts of brain.	6
	10	Sense organs- Comparative study of various sense organs in *Scoliodon*, frog, and rabbit.	6
V		**PRACTICUM**	**30**
	11	Comparative study of scales in fishes-Placoid, cycloid, ctenoid (Preparation of slides)	
	12	Comparative study of vertebrae (typical vertebra, atlas, axis, thoracic and lumbar vertebrae) of *Scoliodon*, frog and rabbit with the help of specimen / model / pictogram	
	13	Comparative study of pectoral and pelvic girdles of *Scoliodon*, frog and rabbit with the help of specimen / model / pictogram	
	14	Study of respiratory organ of fishes (Dissection)	
	15	Comparative study of urinogenital system of *Scoliodon,* frog and rabbit with the help of pictogram	
	16	Comparative anatomy of brain of *Scoliodon,* frog and rabbit with the help of pictogram	
	17	Comparative study of eyes of *Scoliodon,* frog and rabbit with the help of pictogram	
	18	Visit to Natural History Museum, Thiruvananthapuram	

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1. Kardong, Kenneth V. 2008. Vertebrates Comparative Anatomy, Function, Evolution. McGraw Hill Higher Education.
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5. Gupta, R.C. & Girish Chopra, 1999. Comparative anatomy of chordates. Chand & Co.
6. Saxena, R.K. & Saxena, Sumitra. 2008. Comparative Anatomy of Vertebrates. Viva Books Private Limited.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Explain the basic concepts in comparative vertebrate anatomy	R, U	1
CO-2	Compare anatomical characteristics across vertebrate species in an evolutionary context.	U, Ap	3
CO-3	Analyse the anatomical adaptations of animals to their environment	An, E	1,5
CO-4	Describe the development of various organ systems	R, U	3
CO-5	Prepare slides of different types of fish scales and compare their structure.	Ap, An	7
CO-6	Examine and compare the vertebrae and girdles in three different animals: *Scoliodon* (aquatic), frog (amphibian) and rabbit (terrestrial).	An, E	1

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: Credits: 3:1 (Lecture: Practical)

CO No.	CO	POs	PSOs	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Explain the basic concepts in comparative vertebrate anatomy	1	1	R, U	C	L	
2	Compare anatomical characteristics across vertebrate species in an evolutionary context.	1,3	3	U, Ap	F	L	P
3	Analyse the anatomical adaptations of animals to their environment	1,3	1,5	An, E	F	L	
4	Describe the development of various organ systems	1	3	R, U	F	L	P
5	Prepare slides of different types of fish scales and compare their structure.	1	6	Ap, An	P	L	P
6	Examine and compare the vertebrae and girdles in three different animals: *Scoliodon* (aquatic),	1,3	1	An, E	P	L	P

	frog (amphibian) and rabbit (terrestrial).						

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	1	-	-	-	-	-	-	-
CO 2	-	-	3	-	-	-	-	-
CO 3	1	-	-	-	1	-	-	-
CO 4	-	-	-	1	-	-	-	-
CO 5	-	-	-	-	-	1	-	-
CO 6	1	-	-	-	-	-	-	-

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	**3**	-	-	-	-	-	-
CO2	**3**	-	**3**	-	-	-	-
CO3	**3**	-	**3**	-	-	-	-
CO4	**3**	-	-	-	-	-	-
CO5	**3**	-	-	-	-	-	-
CO-6	**3**	-	**3**	-	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓			✓
CO 5	✓			
CO 6	✓			✓

Mar Ivanios College (Autonomous)

Discipline	**ZOOLOGY**				
Course Code	MIUK4DSEZOO201.1				
Course Title	**TOXICOLOGY AND DISASTER MANAGEMENT**				
Type of Course	**DSE**				
Semester	IV				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	Basic idea on different types of disasters and toxic agents				
Course Summary	This course introduces the principles and concepts of toxicology, focusing on the adverse effects of chemical, physical, and biological agents on living organisms. Moreover, it also provides an overview of disaster management principles, strategies, and practices for mitigating the impact of natural and man-made disasters.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**INTRODUCTION TO TOXICOLOGY**	**10**
	1	General Principles of Toxicology: Definition, scope of toxicology, disciplines of toxicology.	2
	2	Classification of toxic agents, natural toxins, animal toxins, plant toxins, food toxins, genetic poisons and chemical toxins.	4
	3	Factors affecting toxicity – species and strain, age, sex, nutritional status, hormones, environmental factors, circadian rhythms	4
II		**XENOBIOTIC TRANSLOCATION AND TOXICITY TESTS**	**12**
	4	Absorption, distribution, excretion, biotransformation, bioactivation.	4
	5	Toxicity tests-types and testing procedures– experimental design – selection of species.	3
	6	Dose-effect and dose-response relationship- acute toxicity, chronic toxicity reversible & irreversible effects.	2
	7	Antidotes-Classification based on the mechanism of action, antidotal procedures	3
III		**BASIC CONCEPTS OF DISASTER MANAGEMENT**	**15**
	8	Understanding of key concepts in disasters management: hazards, disasters, vulnerability, resilience, disaster management, disaster cycle, risk, prevention, mitigation, relief and response, recovery and rehabilitation	5
	9	Types of disasters: Natural disasters-earthquakes, floods drought, landside, land subsidence, cyclones, volcanoes, tsunami, avalanches, global climate extremes, pandemics.	5

		Man-made disasters-Terrorism, gas and radiations leaks, toxic waste disposal, oil spills, fire.	
	10	Disaster phenomenon and events (global, national and regional).	5
IV	**DISASTER MANAGEMENT MECHANISM**		**8**
	11	Basic principles of disasters management, disaster management cycle	4
	12	Disaster management policy, national and state bodies for disaster management	4
V		**PRACTICUM**	**30**
	13	Toxicant Bioassay – LC 50 determination in Brine shrimp using probit analysis	
	14	Study of mechanism of action of toxins using suitable databases like Toxin and Toxin Target Database (T3DB)	
	15	Analysis of dose-response using suitable software	
	16	A comprehensive literature review examining the mechanism of action of antidotes targeting specific toxins.	
	17	Case Study: COVID-19 impact and its management strategies in the Indian scenario	
	18	Mock drill for earthquake and fire	
	19	First Aid training programmes	
	20	Case study: analysis of a recent natural disaster event	

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8. Bryant Edwards (2005): Natural Hazards, Cambridge University Press, U.K.

9. Carter, Nick 1991. Disaster Management: A Disaster Manager's Handbook. Asian Development Bank, Manila Philippines.
10. Carter, W. Nick, 1991: Disaster Management, Asian Development Bank,
11. Coppola P Damon, 2007. Introduction to International Disaster Management, Butterworth-Heinemann.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Explain the fundamental principles of toxicology, including the dose-response relationship, toxicity mechanisms, and factors influencing toxicity.	R, U	4,5
CO-2	Assess the health effects of acute and chronic exposure to toxic substances.	Ap,E	5
CO-3	Critically analyze case studies and real-life examples of disaster events to extract lessons learned and implement best practices in disaster management.	An,Ap	6,8
CO-4	Design and implement disaster recovery and rehabilitation plans to facilitate the restoration of affected communities and infrastructure.	Ap	7,8
CO-5	Choose and apply antidotes against specific toxins	Ap	7

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: Toxicology and Disaster Management

Credits: 3:1 (Lecture: Practical)

CO No.	CO	POs	PSOs	Cognitive Level	Knowledge Category	Lecture (L)	Practical (P)
1	Explain the fundamental principles of toxicology, including the dose-response relationship, toxicity mechanisms, and factors influencing toxicity.	1	4,5	R, U	C	L	P
2	Assess the health effects of acute and chronic exposure to toxic substances.	1	5	Ap,E	F	L	P
3	Critically analyze case studies and real-life examples of disaster events to extract lessons learned and implement best practices in disaster	1,3	6,8	An,Ap	M	L	P

	management.						
4	Design and implement disaster recovery and rehabilitation plans to facilitate the restoration of affected communities and infrastructure.	1,4	7,8	Ap	M	L	P
5	Choose and apply antidotes against specific toxins	1,2	7	Ap	P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	-	-	-	1	2	-	-	-
CO 2	-	-	-	-	2	-	-	-
CO 3	-	-	-	-	-	3	-	3
CO 4	-	-	-	-	-	-	3	3
CO 5	-	-	-	-	-	-	2	-

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	**3**	-	-	-	-	-	-
CO2	**3**	-	-	-	-	-	-
CO3	**3**	-	**3**	-	-	-	-
CO4	**3**			**2**	-	-	-
CO5	**3**	**3**		-	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓		✓	✓
CO 2	✓			✓
CO 3	✓	✓	✓	
CO 4	✓	✓		✓
CO 5	✓	✓		

Mar Ivanios College (Autonomous)

Discipline	**ZOOLOGY**				
Course Code	MIUK4SECZOO200.1				
Course Title	**BASIC INSTRUMENTATION TECHNIQUES IN LIFE SCIENCE**				
Type of Course	**SEC**				
Semester	IV				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	2 hours	-	2 hours	4
Pre-requisites	Basic knowledge of fundamental concepts in biology, chemistry, physics. Experience with basic laboratory techniques and laboratory protocols.				
Course Summary	This course provides an introduction to the principles, techniques, and applications of instrumentation in biological research. Students will learn about various instruments used to study biological systems, including microscopy, spectroscopy, chromatography, and electrophoresis. Emphasis will be placed on understanding the underlying principles of each technique, practical applications, data analysis, and interpretation in real world situations.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**MICROSCOPY AND MICROTECHNIQUES**	**12**
	1	History and importance of microscopy in biology-principles of microscopy- Handling and care of microscope.	1
	2	Simple microscope. Compound microscope: Magnifying system, Illumination system, Image formation, Oil-immersion microscopy, Bright field, Dark field and phase contrast microscopy, Inverted microscope.	3
	3	Stereoscopic dissecting microscope (SDM). Image capture and analysis, Electron microscope- SEM, TEM and Environmental scanning electron microscope (ESEM), Fluorescence microscope, Laser scan, Confocal microscope.	4
	4	Microtome: Introduction, principle and working. Techniques for preparation of temporary and permanent slides. Histochemical techniques for detection of proteins, lipids and carbohydrates.	4
II		**CHROMATOGRAPHY**	**5**
	5	Electrochemical techniques -General principles. Buffers. Measurement of	1

		conductivity of solutions. Electrodes. pH meter.	
	6	Principle of chromatographic separation. Retention time. Chromatogram. Types of chromatography- (Brief account only) Thin layer chromatography, HPTLC, Column chromatography and ion exchange chromatography, Gas chromatography, High performance liquid chromatography (HPLC). Mention its basic principle and their applications.	4
III		**CENTRIFUGATION AND SPECTROSCOPY**	**7**
	7	Introduction. Principle of centrifugation. Basic components and types of centrifuges- Differential and density gradient centrifugation.	1
	8	Basic principles in spectroscopy- Colorimeter, Spectrophotometer principle, working and applications.	2
	9	Types-IR spectroscopy, Fluorescent spectroscopy, Atomic absorption spectroscopy, Nuclear Magnetic-resonance spectroscopy, Mass spectroscopy. (Brief account only) Mention its basic principle and their applications.	4
IV		**ELECTROPHORESIS**	**6**
	10	Introduction, Principle and techniques in electrophoretic separation of biomolecules.	1
	11	Types of electrophoresis- Native PAGE and SDS-PAGE, Agarose gel Electrophoresis, Immunoelectrophoresis. Isoelectric focusing. Radioimmunoassay, Fluorescent immunoassay, ELISA	3
	12	PCR, RT-PCR, DNA Sequencer and blotting techniques (brief account only) - Principle and applications.	2
V		**PRACTICUM**	**30**
	13	Hands-on experience with microscopic techniques.	
	14	Sketching of biological specimens using a camera lucida.	
	15	Preparation of temporary and permanent slides.	
	16	Histochemical techniques for detection of proteins, lipids and carbohydrates.	
	17	Dissection of radula under microscope.	
	18	Measurement of pH using electrodes.	
	19	Paper chromatographic separation of amino acids.	
	20	Centrifugation of biological samples.	
	21	Quantification and estimation of Na, K, Ca of the given sample with the help of flame photometer/ spectrophotometer.	
	22	Demonstration of Gel mounting and electrophoresis of DNA sample.	
	23	Demonstration of PCR and blotting techniques.	
	24	Case Studies: Analysis of real-life applications of instrumentation in biology.	
	25	Visit to Central Laboratory for Instrumentation and Facilitation, University of Kerala, will be conducted as part of the course.	

REFERENCES:

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4. Lehninger, A.L.1971. Bioenergetics. W.A. Benjamin, London
5. Narayanan, P. 2000. Essentials of Biophysics. New Age International (P) Ltd. Publishers, New Delhi

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Describe the principles behind various instrumentation techniques used in biology.	R,U	3
CO-2	Explain the significance and applications of instruments used in biology.	R,U	3
CO-3	Experience with laboratory protocols and basic laboratory techniques such as pipetting, dilutions, and safety practices.	Ap, An	3,4
CO-4	Attain practical experience and skill development in using different instruments for life science research.	An, Ap, E	4,5
CO-5	Analyse and apply the applications of instrumentation in biological research and its significance in advancing scientific knowledge.	An, Ap, E, C	5,6,7
CO-6	Analyse and present case studies in real-life applications of instrumentation in biology.	An, Ap, E, C	6,7
CO-7	Integrate the knowledge acquired through the course to predict current trends and challenges in the field of research.	An, Ap, E, C	7,8

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: BASIC INSTRUMENTATION TECHNIQUES IN LIFE SCIENCE

Credits: 2:1 (Lecture:Practical)

CO No.	CO	PSO	PO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Describe the principles behind various instrumentation techniques used in biology.	3	1	R,U	F, C	L	
CO-2	Explain the significance and applications of instruments used in biology.	3	1	R,U	F,C	L	
CO-3	Experience with laboratory protocols and basic laboratory techniques such as pipetting, dilutions, and	3,4	1,2 ,5	Ap, An	F,C		P

	safety practices.						
CO-4	Attain practical experience and skill development in using different instruments for life science research.	4,5	1,2,5,6	An, Ap, E	F,C,P		P
CO-5	Analyse and apply the applications of instrumentation in biological research and its significance in advancing scientific knowledge.	5,6,7	1,2,3,5,6	An, Ap, E, C	F,C,P,M		P
CO-6	Analyse and present case studies in real-life applications of instrumentation in biology.	6,7	1,2,3,5,6	An, Ap, E, C	F,C,P,M		P
CO-7	Integrate the knowledge acquired through the course to predict current trends and challenges in the field of research.	7,8	1,2,3,5,6	An, Ap, E, C	F,C,P,M		P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	-	-	3	-	-	-	-	-
CO 2	-	-	3	-	-	-	-	-
CO 3	-	-	3	3	-	-	-	-
CO 4	-	-	-	3	3	-	-	-
CO 5	-	-	-	-	3	3	3	-
CO 6	-	-	-	-	-	3	3	-
CO 7	-	-	-	-	-	-	3	3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-
CO3	3	3	-	-	3	-	-
CO4	3	3	-	-	3	3	-
CO5	3	3	3	-	3	3	-
CO6	3	3	3	-	3	3	-
CO7	3	3	3	-	3	3	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low

2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		
CO 5	✓	✓		
CO 6	✓	✓		
CO7	✓	✓		

SEMESTER – V

Mar Ivanios College (Autonomous)

Discipline	**ZOOLOGY**				
Course Code	MIUK5DSCZOO300.1				
Course Title	**CELL BIOLOGY**				
Type of Course	**DSC**				
Semester	V				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	Basic knowledge in prokaryotic and eukaryotic cell. Have basic knowledge in cell structure and its components.				
Course Summary	The Cell Biology course offers students an in-depth exploration of the structure, function, and physiological processes of cells. Through comprehensive lectures, laboratory sessions, and interactive discussions, students will gain a thorough understanding of the fundamental principles of cell biology, including cell structure, organelle function, cellular processes, and their relevance to human health and disease.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**CELL STRUCTURE AND FUNCTION**	**15**
	1	**History, development and scope of cell biology**- Overview of cell biology, historical perspective, discovery of cells, cell theory and its modern version, characteristics of living cells, cell and its components: basic types of cells- prokaryotic and eukaryotic, nature and comparison.	2
	2	**Overview of eukaryotic cell structure and function-** Cell membrane structure and function: Plasma membrane- ultra structure- lipid bilayer structure and function, fluid mosaic model, functions of plasma membrane. Membrane proteins: structure, function, and classification.	3
	3	**Organelle Biology**- Mention the morphology, structure and function- Mitochondria, Endoplasmic reticulum, Golgi apparatus, Lysosomes and peroxisomes, Ribosomes, Proteasomes, Cytoskeleton, Centrioles and basal bodies, Interphase nucleus, Nucleolus, Chromatin, Chromosome.	10
II		**CELL CYCLE AND CELL DIVISION**	**13**
	4	**Overview of the cell cycle phases**: G1, S, G2, and M phases, mention G0, and D0 stages and their significances, amitosis. Cell cycle checkpoints and their role in disease.	3
	5	**Mitosis:** Phases of mitosis (prophase, metaphase, anaphase, and	4

		telophase), spindle formation, and chromosome segregation. Cytokinesis: contractile ring formation, cleavage furrow formation, and completion of cell division.	
	6	**Meiosis**: Meiosis and comparison with mitosis, stages of meiosis I and II, and genetic implications. Gametogenesis, genetic recombination, and chromosome segregation.	3
	7	**Dysregulation of the Cell Cycle-**: characteristics of cancer cells, dedifferentiation of cancer cells, theories of cancer, carcinogenesis, oncogenes and tumor suppressor genes (brief account only).	3
III		**CELL SIGNALLING**	**7**
	8	**Introduction to cell signalling pathways**- types of signalling molecules and receptors, ligands, intracellular signalling cascades and intracellular second messengers.	4
	9	**Cell communication**- signal transduction, basic elements involved.	3
IV		**CELL DEATH AND SENESCENCE**	**10**
	10	**Cellular senescence**: definition, triggers, and consequences. Mechanisms of cell death and cellular senescence.	3
	11	**Aging**: cellular and other changes, causes of aging, mention free radicals and superoxide dismutase (SOD), theories of aging.	4
	12	**Environmental factors influencing aging**: lifestyle factors (diet, exercise), environmental stressors, and socioeconomic factors.	3
V		**PRACTICUM**	**30**
	13	Hands on training in handling light microscopes to observe cell structure, morphology.	
	14	Staining of prokaryotic cells: (a) *Lactobacillus* (b) *Rhizobium*	
	15	Staining of eukaryotic cells: buccal epithelial cells	
	16	Observation and study of cell organelles using permanent mount slides and simulations.	
	17	Isolation and observation of mitochondria.	
	18	Observation of Giant chromosomes in Diptera: (*Drosophila Chironomus* larvae) salivary gland cells.	
	19	Slide preparation and observation of cell cycle stages in microscopy slides. –a) Mitosis: stages in onion (*Allium cepa*) root meristem (squash preparation, b) Meiosis: stages in testis of grass hopper.	

	20	Demonstration of cell culture techniques.	
	21	Case study of practical work highlighting the impact of aging on health and disease management.	
	22	Prepare an assignment in strategies for promoting healthy aging: dietary interventions, exercise, caloric restriction, and lifestyle modifications.	
	23	Visit to a lab or research institute to familiarise the techniques in cell biology.	

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1. Beker, W. M. et. al. (2004) The World of Cell. Pearson Edn., Singapore
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Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Describe the principles and concepts of cell biology.	R,U	3
CO-2	Explain the detailed structures and functions of cell organelles	R, U,Ap	3,5
CO-3	Explain the cell cycle and stages of cell division; distinguish between mitosis and meiosis.	R,U,Ap	3,5
CO-4	Explain the mechanisms of cell death and aging.	R, U, Ap	3,5
CO-5	Perform experiments in cell biology to distinguish a prokaryotic cell from eukaryotic cell, mitosis from meiosis and know useful techniques required for further education.	An, Ap, E	3,5,7
CO-6	Analyse and present case studies and real-world examples of highlighting the impact of aging on health and disease management.	An, E, Ap, C	3,5,6
CO-7	Integrate the knowledge acquired through the course to predict future directions in cell biology research	An, E, Ap,C	3,7,8

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: CELL BIOLOGY

Credits: 3:1 (Lecture:Practical)

CO No.	CO	PSO	PO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Describe the principles and concepts of cell biology.	3	1	R,U	F, C	L	
CO-2	Explain the detailed structures and functions of cell organelles	3,5	1	R, U,Ap	F,C	L	
CO-3	Explain the cell cycle and stages of cell division; distinguish between mitosis and meiosis.	3,5	1	R,U,Ap	F,C	L	
CO-4	Explain the mechanisms of cell death and aging.	3,5	1	R, U, Ap	F,C	L	
CO-5	Perform experiments in cell biology to distinguish a prokaryotic cell from eukaryotic cell, mitosis from meiosis and know useful techniques required for further education.	3,5,7	1,2,6	An, Ap, E	F,C,P		P
CO-6	Analyse and present case studies and real-world examples of highlighting the impact of aging on health and disease management.	3,5,6	1,2,3 ,6	An, E, Ap, C	F,C,M		P
CO-7	Integrate the knowledge acquired through the course to	3,7,8	2,3.6	An, E, Ap,C	F,C,P,M		P

	predict future directions in cell biology research						

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	-	-	3	-	-	-	-	-
CO 2	-	-	3	-	2	-	-	-
CO 3	-	-	3	-	2	-	-	-
CO 4	-	-	3	-	2	-	-	-
CO 5	-	-	3	-	3	-	2	-
CO 6	-	-	3	-	3	3	-	-
CO-7	-	-	3	-	-	-	3	3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-
CO5	3	3	-	-	-	3	-
CO6	3	3	3	-	-	3	-
CO7	-	3	3	-		3	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		
CO 6	✓	✓		
CO7	✓	✓		

Mar Ivanios College (Autonomous)

Discipline	**ZOOLOGY**				
Course Code	MIUK5DSCZOO301.1				
Course Title	**GENETICS**				
Type of Course	**DSC**				
Semester	V				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	Basic Biology: students should have a foundational understanding of biological concepts such as cell structure and function, genes, DNA and RNA, structure of chromosomes. A basic knowledge in cell division and Mendelian genetics.				
Course Summary	Genetics course is designed to provide students with a comprehensive understanding of the principles and applications of genetics. The course is divided into four modules covering fundamental concepts, molecular genetics, human genetics, medical genetics and applied genetics. Practical sessions offer hands-on experience in genetic laboratory techniques and involve case studies, ethical discussions, and real-world applications of genetic principles in health and diseases.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**FUNDAMENTALS OF GENETICS**	**22**
	1	**Introduction to Genetics**- Historical overview, basic concepts and terminology in genetics. **Mendelian Genetics**- Mendel and his experiments, relevance of Mendel's principles in modern genetics.	4
	2	**Extensions to Mendelian Genetics**-Allelic, Incomplete dominance, lethal and co-dominance, Non-allelic, complementary gene action, Co-epistasis, dominant and recessive (coat colour), multiple alleles, pleiotropism and polygenic inheritance. **Cytoplasmic inheritance**: Mitochondrial DNA, kappa particles in paramecium, maternal effects in Drosophila.	6
	3	**Chromosomal Basis of Inheritance- Linkage, crossing over and recombination:** Linked genes, linkage groups, chromosome theory of linkage, factors affecting linkage, crossing over and recombination, mechanism, kinds and factors affecting crossing over and its significance. Chromosome mapping (brief account only). **Sex Linkage:** Characteristics of sex linked inheritance, sex linked	6

		inheritance of man (colour blindness and haemophilia), incomplete sex linked genes, holandric genes, sex limited genes and sex influenced genes.	
	4	**Sex Determination**-Environmental factors on sex determination, genic balance theory, chromosome theory of sex determination, chromosomal mechanism of sex determination (XXXY, XX-XO, ZZ-ZW), sex determination in man, role of Y chromosome, Barr bodies, dosage compensation and Lyon hypothesis, Chromosome mosaicism, inter sex, gynandromorph and hermaphrodite.	6
II		**MOLECULAR GENETICS**	**7**
	5	**Mutation:** Types of mutations - point mutations, insertions, deletions, chromosomal rearrangements, somatic, germinal, spontaneous, induced, autosomal, allosomal, euploidy and aneuploidy.	5
	6	Gene mutation, molecular basis of mutation - chemical, ionizing and non-ionizing.	2
III		**HUMAN GENETICS**	**8**
	7	Karyotyping, normal chromosome compliment, chromosomal anomalies in man, autosomal (eg. Down syndrome, Edwards syndrome), allosomal (eg. Klinefelters syndrome, Turner's syndrome), pedigree analysis.	4
	8	Biochemical genetics: Human biochemical genetics, biochemical pathway of phenyl alanine, tyrosine metabolism in normal man. Disorders-Phenylketonuria, Alkaptonuria, Tyrosinosis and Albinism.	4
IV		**APPLIED GENETICS AND ETHICAL CONSIDERATIONS**	**8**
	9	Medical Genetics- Genetic testing, gene therapy and genetic counselling.	2
	10	Forensic genetics-concept of DNA profiling and DNA fingerprinting.	
	11	Agricultural Genetics- Crop improvement, animal breeding and genetically modified organisms (GMOs)	2
	12	Industrial and environmental applications of Genetics-biopharmaceuticals and bioremediation.	2
	13	Ethical and Societal Issues in Genetics	2
V		**PRACTICUM**	**30**
	14	Study of monohybrid cross using coloured beads.	
	15	Observation of phenotypic variations in fruit flies (Drosophila) with different mutations.	
	16	Study of Barr body and its significance using stained buccal epithelial cells.	
	17	Study of normal chromosome compliment and karyotype of man using idiograms.	
	18	Study of genetic syndromes and abnormal karyotypes of man using idiograms (Klinefelter's syndrome, Turner's syndrome, Down syndrome and Edward syndrome).	
	19	Construction of Pedigree charts and provide students with pedigrees showing the inheritance of a particular genetic trait or disorder within a family.	
	20	Discussions on case studies illustrating real-world applications of forensic	

		genetics, such as criminal investigations, missing person's cases, or disaster victim identification.	
	21	Facilitate debate\discussions on the ethical considerations surrounding the use of DNA evidence in criminal investigations.	
	22	Visit to a research lab/Institute to familiarise the methods in applied genetics.	

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3. Peter Snustad, D. and Michael, J. (2000). Principles of Genetics. John Wiley and Sons, Inc., New York
4. Robert J. Brooker. (1999) Genetics-analysis and principles. Addison-Wesley, Menlo Park, California
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6. Strachan, I. and Read. (1999) Human molecular genetics. John Wiley and Sons, Newyork.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Describe the principles and concepts of genetics.	R,U	3
CO-2	Identify and explain the questions from Mendelian genetics.	R, U	3
CO-3	Explain the inheritance of chromosomal basis of inheritance, linkage, crossing over and recombination.	R,U,E	3
CO-4	Explain the principles of sex determination and establish the rules in sex determination.	R,U,Ap	3,5
CO-5	Explain the mechanisms of mutations, karyotyping and their effects in human health and diseases.	R,U,E	3,5
CO-6	Evaluate the karyotyping process in normal chromosomal compliment and chromosomal anomalies in man and analyse pedigree charts and genetic issues stemming from family trees.	An, Ap, E	3,5
CO-7	Analyse and present case studies illustrating real-world applications of forensic genetics, such as criminal investigations, missing person's cases, or disaster victim identification.	An, E, Ap, C	3,6,7
CO-8	Integrate the knowledge acquired through the course to predict future directions in research in applied genetics.	An, R, Ap, C	7,8

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: GENETICS

Credits: 3:1 (Lecture: Practical)

CO No.	CO	PSOs	POs	Cognitive	Knowledge Category	Lecture(L)/ Tutorial (T)	Practical (P)

				Level			
CO-1	Describe the principles and concepts of genetics.	3	1	R,U	F,C	L	
CO-2	Identify and explain the sources and pathways of Mendelian genetics	3	1	R, U	F,C	L	
CO-3	Explain the inheritance of chromosomal basis of inheritance, linkage, crossing over and recombination.	3	1	R,U,E	F,C	L	
CO-4	Explain the principles of sex determination and establish the rules in sex determination.	3	1	R,U, Ap	F,C	L	
CO-5	Explain the mechanisms of mutations and their effects in human health.	3,5	1	R,U,E	F,C	L	
CO-6	Evaluate the karyotyping process in normal chromosomal compliment and chromosomal anomalies in man.	3,5	1,2	An, Ap,E	F,C,P		P
CO-7	Analyse and present case studies illustrating real-world applications of forensic genetics, such as criminal investigations, missing person's cases, or disaster victim identification.	3,6,7	1,2,6	An, E, Ap, C	F,C,P		P

CO-8	Integrate the knowledge acquired through the course to predict future directions in research in applied genetics.	7,8	1,2,6	An, R, Ap, C	F,C,P,M		P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	-	-	3	-	-	-	-	-
CO 2	-	-	3	-	-	-	-	-
CO 3	-	-	3	-	-	-	-	-
CO 4	-	-	3	-	2	-	-	-
CO 5	-	-	3	-	2	-	-	-
CO 6	-	-	3	-	2	-	-	-
CO 7	-	-	3	-	-	2	3	-
CO 8	-	-	-	-	-	-	2	3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-
CO5	3	-	-	-		-	-
CO6	3	3	-	-		-	-
CO7	3	3	-	-	-	3	-
CO8	3	3	--	-	-	3	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6	✓	✓		
CO 7	✓	✓		
CO 8	✓	✓		

Mar Ivanios College (Autonomous)

Discipline	**ZOOLOGY**				
Course Code	MIUK5DSCZOO302.1				
Course Title	**MOLECULAR BIOLOGY**				
Type of Course	**DSC**				
Semester	V				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	A basic knowledge in general biology and molecules in biological science. Have basic knowledge in cell biology, structure and function of cell organelles, DNA and RNA, genes and chromosomes.				
Course Summary	Molecular biology course offers students a comprehensive exploration of the principles, techniques, and applications of molecular biology. This course provides an in-depth exploration of the molecular mechanisms underlying cellular processes, focusing on DNA structure and function, gene expression, regulation, and the application of molecular biology techniques in research and biotechnology. Practical sessions will provide hands-on experience with essential molecular biology techniques and data analysis. By the end of the course, students will be equipped with practical skills and theoretical knowledge necessary for further studies or careers in molecular biology, biotechnology, genetics, and related fields.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I	**INTRODUCTION TO MOLECULAR BIOLOGY**		**10**
	1	**Introduction**: Overview of molecular biology, Historical perspective and milestones, Development and scope of molecular biology.	1
	2	**Nature of genetic material**: Experiments in search for the genetic material, Griffith's experiment, transformation, contributions of Avery, Mac Leod and Mc Carty, Conrat & Stern's experiment with TMV, Hershey & Chase's experiment, and transduction.	5
	3	**Composition and structure of nucleic acids** - Watson - Crick model of DNA, clover leaf model of tRNA, different types of DNA and RNA.	4
II	**DNA REPLICATION AND REPAIR**		**14**

	4	**DNA replication in prokaryotes and eukaryotes** - Semi-conservative method, Messelson & Stahl experiment, replication machinery. Mechanism of DNA replication- semi-conservative model, DNA polymerases, replication fork, Enzymes and proteins involved in DNA replication: helicase, DNA ligase, topoisomerases. Regulation of DNA replication.	6
	5	**DNA damage and its consequences**-Types of DNA Damage-Oxidative Damage, Alkylation of Bases, Base Loss, DNA Crosslinking, DNA Strand Breaks, Cellular Stress and DNA Damage Response.	4
	6	**DNA repair mechanisms** -Mismatch Repair, Base Excision Repair, Nucleotide Excision Repair, and Repair of Double-Stranded DNA Breaks.	4
III		**GENE EXPRESSION**	**14**
	7	**Gene Expression**: contributions of Garrod, one gene – one enzyme hypothesis, one gene one polypeptide hypothesis, central dogma of Molecular Biology, central dogma reverse, colinearity of genes and gene products. Genetic code - deciphering / cracking the GC, characteristics of GC, codon assignment and wobble hypothesis. Mention contributions of Nirenberg and his associates, Khorana and his associates.	4
	8	**Transcription of RNAs** - RNA polymerases, transcription factors, mechanism of transcription, post-transcriptional modifications of mRNA, rRNA and tRNA, reverse transcription.	5
	9	**Translation** – machinery and mechanism; post translational modification of proteins; role of chaperones in protein normal folding and protection.	5
IV		**REGULATION OF GENE EXPRESSION**	**7**
	10	**Overview** of Regulation of Gene Expression, Prokaryotic versus Eukaryotic Gene Expression	1
	11	**Prokaryotic gene regulation**- inducible and repressive systems; operon concept – Lac operon and Trp operon	3
	12	**Eukaryotic gene regulation**-Epigenetic Control of Gene Expression, Transcriptional Control of Gene Expression, Post-transcriptional Control of Gene Expression, Translational Control of Gene Expression, Post-translational Control of Gene Expression.	3
V		**PRACTICUM**	**30**
	13	Study the structure and types of DNA and RNA using models and pictograms.	
	14	Isolation and purification of DNA.	
	15	Extraction of DNA from liver/spleen.	
	16	Estimation of DNA by DPA method.	
	17	Estimation of RNA by Orcinol method.	
	18	Demonstration of basic techniques in molecular biology-PCR, Electrophoresis, Blotting techniques using online tools and virtual labs.	
	19	Visit to research labs /institutes to familiarise basic molecular biology	

		techniques.	
	20	Plan, design and execute simple molecular biology-based group research projects or assignments.	

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2. Freifelder, D. Molecular Biology. Narosa Publishing House, N. D.
3. Karp G. (2005). Cell and Molecular Biology. 4 e, John Wiley & Sons, Inc.
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9. Alberts, B. et al. Molecular Biology of the Cell. Garland Pubg. Inc., New York

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Describe the principles and concepts of molecular biology	R,U	3
CO-2	Identify and describe the structure and function of DNA, RNA, and proteins, DNA repair mechanisms, the roles of enzymes involved in DNA replication, process of transcription	R, U	3
CO-3	Explain the mechanisms of gene expression, transcription and translation process.	R,U,E	3
CO-4	Explain the pathways of regulation of gene expression techniques.	R,U,Ap	3,5
CO-5	Comprehend and apply the knowledge of basic molecular biology techniques to the separation and analyses of biomolecules.	U, Ap, An	3,5
CO-6	Plan, design and execute simple molecular biology - based group research projects.	Ap, An, E, C	3,7,8
CO-7	Integrate the knowledge acquired through the course to predict future directions in molecular biology resrarch.	An, E, Ap, C	3,8

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: Molecular Biology

Credits: 3:1 (Lecture:Practical)

CO No.	CO	PSO	PO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Describe the principles and	3	1	R,U	F, C	L	

	concepts of molecular biology						
2	Identify and describe the structure and function of DNA, RNA, and proteins, DNA repair mechanisms, the roles of enzymes involved in DNA replication, process of transcription	3	1	R, U	F, C	L	
3	Explain the mechanisms of gene expression, transcription and translation process.	3	1	R,U,E	F,C	L	
4	Explain the pathways of regulation of gene expression techniques.	3,5	1	R,U,Ap	F,C	L	
5	Comprehend and apply the knowledge of basic molecular biology techniques to the separation and analyses of biomolecules.	3,5	1	U, Ap, An	F,C,P		P
6	Plan, design and execute simple molecular biology -based group research projects.	3,7,8	2,5,6	Ap, An, E, C	F,C,P		P
7	Integrate the knowledge acquired through the	3,8	1,2,5,6	An, E, Ap, C	F,C,P,M		P

	course to predict future directions in molecular biology resrarch.						

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	-	-	3	-	-	-	-	-
CO 2	-	-	3	-	-	-	-	-
CO 3	-	-	3	-	-	-	-	-
CO 4	-	-	3	-	3	-	-	-
CO 5	-	-	3	-	2	-	-	-
CO 6	-	-	3	-	-	-	2	3
CO-7	-	-	3	-	-	-	-	3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-
CO4	3	-	=	-	-	-	-
CO5	3	-	=	-	-	-	-
CO6	-	3	-	-	3	3	-
CO7	3	3	-	-	3	3	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation

- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		
CO 6	✓	✓		
CO7	✓	✓		

Mar Ivanios College (Autonomous)

Discipline	**ZOOLOGY**				
Course Code	MIUK5DSEZOO300.1				
Course Title	**MICROBIOLOGY AND INFECTIOUS DISEASES**				
Type of Course	**DSE**				
Semester	V				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	Basic knowledge on microorganisms				
Course Summary	This course provides an understanding of microbial structure and function with regards to their role in pathogenesis and infection. The biology of bacterial, viral and fungal pathogens and the diseases they cause are covered. The course explores the mechanism of pathogenicity, modes of transmission, and explores ways microbes evade host defence system. The course explores impact of various virulence factors possessed by microbes in pathogenicity and their role in establishing infection.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I	**INTRODUCTION TO MICROBIOLOGY**		**10**
	1	Introduction – Definition, scope and history of microbiology.	1
	2	Classification and characterization of bacteria, viruses, fungi and protozoa (Brief account only)	3
	3	Survey of harmful and beneficial microbes. Normal human microbiota of various organs. Microbiota replacement therapies	4
	4	Sterilization - concept of sterilization, methods of sterilization - dry heat, wet heat or steam, radiation, chemical and filtration.	2
II	**MICROBIAL CELL STRUCTURE, NUTRITION AND GROWTH**		**10**
	5	Bacterial cell- ultra structure and function of different components. Structure of Gram positive and Gram-negative bacteria	2
	6	Viruses- Structure and chemical composition of the viruses, Viral Capsid, Viral Envelope, Viral Nucleic Acids.	2
	7	Nutrition-Types of culture media- complex medium, synthetic medium, selective and non- selective medium Pure culture Methods: Direct plating, Serial dilution technique, Spread	4

		plate, Streak plate, Pour plate; Slant culture and Stab culture	
	8	Microbial growth – overview of cell growth, generation time, measurement of growth. Typical growth curve, effect of environmental factors on growth.	2
III	**MICROBIAL DISEASES IN HUMANS**		**15**
	9	Pathogenic Microorganisms (bacteria, fungi, viruses) virulence factors and mechanisms of pathogenesis.	3
	10	Host-microbe interaction – process of infection	2
	11	Bacterial diseases: Brief account on causes, symptoms and prophylaxis Airborne bacterial diseases - Streptococcal diseases, Tuberculosis. Food borne and waterborne infections - Botulism; Typhoid fever, Cholera, Shigellosis, E. coli Diarrhea (Traveller's diarrhea). Soil borne bacterial diseases- Anthrax, Tetanus, Leptospirosis.	4
	12	Viral diseases: Brief account on causes, symptoms and prophylaxis Pneumotropic viral diseases - Influenza, Adenoviral infections, Rhinoviral infections, MERS, SARS Dermatoviral diseases - Herpes simplex, chickenpox, Measles, Rubella; Viscerotropic Viral diseases - yellow fever, Dengue fever. Neurotropic viral diseases - Rabies, Polio, H1N1, Nipah.	4
	13	Fungal diseases: Brief account on causes, symptoms and prophylaxis- Aspergillosis, Candidiasis Protozoan diseases: Brief account on causes, symptoms and prophylaxis- Amoebiasis, Malaria	2
IV	**ANTIMICROBIAL CHEMOTHERAPY AND ANTIBIOTIC RESISTANCE**		**10**
	14	Main groups of antibacterial, antifungal and antiviral drugs: mechanisms of action and spectrum.	5
	15	Mechanisms of resistance to antibacterial agents: emergence and spread of antibiotic resistance	5
V		**PRACTICUM**	**30**
	16	Familiarization of laboratory instruments for microbiology- Microscope, Incubator, Autoclave, Laminar air flow	
	17	Cleaning and sterilization of glassware for microbiology.	
	18	Staining of bacteria by simple staining and Gram staining	
	19	Motility testing by hanging drop method	
	20	Techniques for isolation of bacteria – serial dilution, pour plate, spread plate techniques	
	21	Microbiological examination of water samples and enumeration of bacteria	
	22	Inhibition of microorganisms by antibacterial agents by agar well diffusion method and disc diffusion method	

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Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Explain the principles of microbial taxonomy.	R, U	1
CO-2	Develop the skill of microbial staining, culturing, isolation and characterisation of microbes.	Ap, An	5,8
CO-3	Explain the morphological features and structural components of microbes	U	5
CO-4	Gain conceptual basis for identifying pathogenic microorganisms and the mechanisms by which they cause disease in the human body.	U, E	7,8
CO-5	Analyze antimicrobial chemotherapy and antibiotic resistance	U,An	5,8

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: MICROBIOLOGY AND INFECTIOUS DISEASES

Credits: 3:1 (Lecture: Practical)

CO No.	CO	POs	PSOs	Cognitive Level	Knowledge Category	Lecture (L) /Tutorial (T)	Practical (P)
1	Explain the principles of microbial taxonomy.	1	1	R, U	C	L	P
2	Develop the skill of microbial	1,6	5,8	Ap, An	P	L	P

	staining, culturing, isolation and characterisation of microbes.						
3	Explain the morphological features and structural components of microbes	1	5	U	F	L	P
4	Gain conceptual basis for identifying pathogenic microorganisms and the mechanisms by which they cause disease in the human body.	1,2	7,8	U, E	M	L	P
5	Analyze antimicrobial chemotherapy and antibiotic resistance	1,2	5,8	U, An	M	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	2	-	-	-	-	-	-	-
CO 2	-	-	-	3	-	-	-	-
CO 3	-	-	-	-	2	-		
CO 4	-	-	-	-	-	-	2	2
CO 5	-	-	-	-	-	-	1	2

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	**3**	-	-	-	-	-	-
CO2	**3**	-	-	-	-	**3**	-
CO3	**3**	-	-	-	-	-	-
CO4	**3**	**1**	-	-	-	-	-

CO5	**3**	**2**	-	-	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓	✓	
CO 3	✓			✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓

Mar Ivanios College (Autonomous)

Discipline	ZOOLOGY				
Course Code	MIUK5DSEZOO301.1				
Course Title	**GENETIC ENGINEERING**				
Type of Course	**DSE**				
Semester	V				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	Good knowledge in cell biology and genetics.				
Course Summary	Genetic engineering is a branch of biology that studies how to use biotechnology to manipulate an organism's DNA and genes to change or modify an organism's characteristics. A new DNA strand can be inserted into an organism's existing genes or artificial synthesis can be used to modify an organism's genes to alter a particular trait or function. These species that have undergone genetic modification are subsequently employed for several objectives. For instance, an animal may undergo genetic modification to generate a desired protein. Human health and medicine have benefited greatly from the ground-breaking research that genetic engineering has produced.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**TOOLS IN GENETIC ENGINEERING**	**10**
	1	Definitions and landmarks in the history of biotechnology. Major areas of biotechnology (Brief outline only).	3
	2	Nucleases: Exonucleases and Endonucleases, Restriction Enzymes (Type I, Type II, Type III, Type IV & Type V), RNases. Methylases: CpG Methylase , Dam Methylase, Dcm Methylase.	2
	3	Polymerases: DNA Pol I, Klenow Fragments, Reverse Transcriptase, Taq & Pfu Polymerases. Ligases: T4 DNA Ligase, E.coli DNA Ligase, T4 RNA Ligase.	3
	4	Topoisomerases: Type I(A, B) & Type II(A,B). End Modifying Enzymes: Terminal Transferase, T4 Polynucleotide Kinase, Alkaline Phosphatases.	2
		VECTORS IN GENE CLONING	**5**
	5	Introduction to cloning vectors, Desirable properties of vectors, Prokaryotic & Eukaryotic Expression Systems (Constitutive & Inducible).	3

	6	Plasmid Vectors , Phage Vectors, Cosmids, Phagemids. BACs, Yeast Vectors, YACs, Lentiviral Vectors, Adenoviral Vectors, Plant Vectors, Insect Vectors.	2
III	**TECHNIQUES OF GENETIC ENGINEERING**		**15**
	7	Recombinant DNA (rDNA) techniques.	3
	8	Gene cloning: Methods of integration of DNA fragments into the vector.	2
	9	Methods of rDNA transfer in Plants and Animals: Chemical, Physical & Viral mediated DNA transfer.	2
	10	PCR and its types. Construction of Genomic & cDNA Libraries. DNA Sequencing.	2
		Protein Engineering: Site Directed Mutagenesis -- Reporter Gene Assays DNA Protein Interactions: EMSA, DNA Footprinting Protein Protein Interactions: Y2H, Y3H, B1H, B2H	2
	11	Hybridization techniques: Southern, Western, Northern Blotting.	2
	12	Animal cell, tissue and organ culture and their significance.	2
IV		**APPLICATIONS OF GENETIC ENGINEERING**	**15**
	13	Overview of the diverse applications of genetic engineering.	2
	14	Gene therapy and its potential in treating genetic disorders.	3
	15	Gene Targeting: Knock-ins & Knock-outs	3
	16	CRISPR Cas9 mediated gene editing.	1
	17	RNA interference.	1
	18	Synthetic biology.	1
	19	Diagnostic Applications: DNA fingerprinting and its applications in forensics.	2
	20	Use of genetic engineering in the development of therapeutics and vaccines. Production of biopharmaceuticals using recombinant DNA technology.	2
V		**PRACTICUM**	**30**
	21	Preparation of nutrient agar broth.	
	22	Techniques of sterilization using autoclave.	
	23	Estimation of DNA & RNA.	
	24	Estimation of Protein.	
	25	Isolation of DNA and RNA.	
	26	Electrophoresis .	

Reference:

1. Watson JD, Hopkins WH, Roberts JW, Steitz JA, Weiner AM, (2008). Molecular Biology of the Gene (6th edition).
2. Burton E. Tropp, (2011). Molecular Biology, Genes to proteins-Jones and Bartlett learning publications (4th Edition).
3. WT. Godbey, (2021). Biotechnology and its applications-Elsevier Science (2nd Edition).
4. Benjamin Lewin, (2017). Gene XII, Oxford University Press (12th edition).

5. William J. Thieman, Michael A. Palladino, (2014). Introduction to Biotechnology-Pearson
6. Michael R. Green, Joseph Sambrook Molecular Cloning: A Laboratory Manual (2012). Cold spring harbor laboratory press.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	They learn basics of biotechnology. Gain knowledge about different genetic exchange methods.	R, U	5,6,7,8
CO-2	Understand various steps involved in genetic engineering and tools involved in it.	U	5,6,7,8
CO-3	Attain knowledge about gene manipulation and gene expression which prepares them for further studies in the area of genetic engineering	U, Ap, An	5,6,7,8
CO-4	Students learn about transgenic animals, their application in the pharmaceutical industry, cloning and its importance.	U, Ap, An	5,6,7,8
CO-5	Acquaint with principles, technical requirement, scientific and commercial applications various genetic engineering tools.	Ap, An	5,6,7,8

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: Genetic engineering

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO	PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	1	1,2,5, 6	5, 6,7,8	U, An, Ap	C, P	L/T	
2	2	1,2,5, 6	5,6, 7, 8	U, An, Ap	C, P	L/T	
3	3	1,2,5, 6	5, 6, 7,8	U, An, Ap	C,P	L/T	
4	4	1,2,5, 6	5,6, 7,8	U, An, Ap	C, P	L/T	
5	5	1,2,5, 6	4,7,8	U, An, Ap	C, P		P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO4	PS O5	PSO 6	PSO 7	PSO 8
CO 1	-	-	-	-	3	3	2	3
CO 2	-	-	-	-	3	3	2	3
CO 3	-	-	-	-	3	3	2	3

CO 4	-	-	-	-	3	3	2	3
CO 5	-	-	-	3	1	1	2	3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	-	-	3	3	-
CO2	3	2	-	-	3	3	-
CO3	3	2	-	-	3	3	-
CO4	3	2	-	-	3	3	-
CO5	3	2	-	-	3	3	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		

Mar Ivanios College (Autonomous)

Discipline	**ZOOLOGY**				
Course Code	MIUK5SECZOO300.1				
Course Title	**BASIC LABORATORY ANIMAL PRACTICES**				
Type of Course	**SEC**				
Semester	V				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	2 hours	-	2	4
Pre-requisites	Those who are interested to improve their animal studies knowledge and job prospects by exploring different animal science courses.				
Course Summary	The course provides knowledge about the basic principles in laboratory animal care and management as well as the guidelines to follow during animal experimentation. Hands-on training will be provided in laboratory animal care, management and experiments. Visit to an established CCSEA-registered animal house is mandatory for the course. Specific sessions will be handled by scientists/faculties with expertise in the field.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**BASIC PRINCIPLES OF LABORATORY ANIMAL CARE AND EXPERIMENTAL TECHNIQUES**	**10**
	1	General introduction to research animals of various species.	1
	2	Biology and behaviour, Basic laboratory animal husbandry practices.	1
	3	Animal facility layout and functional units, general routine sanitation and hygiene practices, cleaning, washing and sterilization of animal cages, racks, and bedding.	3
	4	Basic experimental techniques on laboratory animals like animal handling and restraining, routes of administration, sampling techniques, autopsy techniques, anesthesia and euthanasia in animals.	5
II		**PATHOPHYSIOLOGY OF COMMONLY OCCURRING DISEASES AND THEIR PREVENTIVE MEASURES**	**10**
	5	Basic introduction to common diseases observed in animals.	3
	6	Implementation of health, monitoring program and methodologies.	5
	7	Prevention and treatment of diseases.	2
		ANIMAL NUTRITION	**5**

III	8	Nutritional requirements of laboratory animals (mice and rat), feeding frequency, antinutritional factors.	2
	9	Storage and distribution of animal feed.	3
IV	**ANIMALS ETHICS, WELFARE, RECORD KEEPING AND DOCUMENTATION**		**5**
	10	Basic concepts on animal welfare and ethics. Introduction to national and international regulations and guidelines related to animal welfare.	1
	11	Preparation and designing animal experimental protocol, Institutional Animal Ethics Committee (IAEC), its constitution and its SOPs.	2
	12	Recording and upkeep of various records related to animal breeding and receipt.	1
	13	Distribution and dispatch of animals, feed and bedding, disposal records.	1
V(P)		**PRACTICUM**	**30**
	14	Animal handling and restraining.	
	15	Routes of drug administration.	
	16	Sampling techniques.	
	17	Necropsy procedures and euthanasia.	

Reference:

1. Hatwar Bhushan P. Animal Handling Techniques & Protocol Development Strategies.
   1 st Edition. JayPee Brothers Medical Publishers, India; 2014.
2. National Research Council (US) Committee for the Update of the Guide for the Care and Use of Laboratory Animals. Guide for the Care and Use of Laboratory Animals. 8th edition. Washington (DC): National Academies Press (US); 2011. Available from: https://www.ncbi.nlm.nih.gov/books/NBK54050/ doi: 10.17226/12910.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Maintain, handle, restrain and care for small laboratory animals.	U, Ap	7,8
CO-2	Administer drugs through oral and sub-cutaneous routes.	U, Ap	7,8
CO-3	Maintain the needed documents and records according to CCSEA guidelines.	U, Ap	7,8
CO-4	Carry out experiments in small laboratory animals such as mice.	U, AP	7,8

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: Basic laboratory animal practices

Credits: 2:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO	PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)

1	1	1,5,6	7,8	U, An, Ap	C, P	L/T	
2	2	1,5,6	7, 8	U, An, Ap	C, P	L/T	
3	3	1,5,6	7,8	U, An, Ap	C, P	L/T	
4	4	5,6	7,8	An, Ap	C, P		P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	-	-	-	-	-	-	3	3
CO 2	-	-	-	-	-	-	3	3
CO 3	-	-	-	-	-	-	3	3
CO 4	-	-	-	-	-	-	3	3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	-	-	-	3	3	-
CO2	1	-	-	-	3	3	-
CO3	1	-	-	-	3	3	-
CO4	-	-	-	-	3	3	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		

Mar Ivanios College (Autonomous)

Discipline	**ZOOLOGY**				
Course Code	MIUK5SECZOO301.1				
Course Title	**VERMICULTURE**				
Type of Course	**SEC**				
Semester	V				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	2 hours	-	2 hours	4
Pre-requisites	Class XII Pass.				
Course Summary	The course provides both theoretical knowledge as well as practical skill in vermiculturing. The course offers an understanding on the variety of earthworms which are used for vermiculturing. It helps to understand the importance of vermicomposting in organic farming. It provides knowledge in solid waste management by vermicompost preparation. It also develops a skill in the management, maintenance and harvesting of vermicomposing.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**INTRODUCTION TO VERMICULTURE**	**5**
	1	Overview of vermiculture and its importance in waste manaagement. Nature and species of earthworms: Habit categories – Epigeic, endogeic and anecic,	5
II		**EARTHWORMS AND THEIR LIFE CYCLE**	**7**
	2	Indigenous and exotic species (*Eudrillus eugeniae/Eisenia foetidae/Perionyx excavatus/ Lampito mauritii*)	3
	3	Life cycle of composting worms and their role in decomposition.	4
III		**METHODOLOGY OF VERMICOMPOSTING**	**9**
	4	Step by step methodology – containers for culturing, raw materials	6

		required preparation of bed, environmental pre-requisites, feeding, harvesting, and storage of vermicompost.	
	5	Advantages of composting, precautions to be taken to prevent attack by pests and pathogens.	3
IV	**VERMICOMPOST PROFILE AND APPLIED ASPECTS**		**9**
	6	Physical, chemical and biological parameters of vermicast, vermin enrichment,	6
	7	Economic uses of vermiculture -Biofertilizer, waste disposal, vermiwash, poultry feed, vermi-remediation etc.	3
V	**PRACTICUM**		**30**
	8	Bin Setup and Maintenance Worm Selection and Care:- Monitoring Composting Process, Harvest, Storage Worm Farm Visits/Expert Talks	

References

1. Hursh, C. (2002). *Basic Composting: All the Skills and Tools You Need to Get Started*. Stackpole Books.
2. Mary Appelhof.(1982). Worms eat my Garbage.
3. Munroe, G. (2007). Manual of on-farm vermicomposting and vermiculture. *Organic Agriculture Centre of Canada*, *39*, 40.
4. Sathe, T.V. (2004). Vermiculture and Organic farming, Daya Books.
5. Vijaykumaran Nair(2019). Vermiculture and Apiculture.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO Addressed
CO-1	Promote self-employment and self-reliance among educated youth	U,Ap	PSO-1,2
CO-2	Design the basic procedure and methodology of vermiculture	R, U	PSO-1,2
CO-3	Set up and maintain vermicomposting systems effectively.	U, Ap	PSO-1,2,4
CO-4	Appreciate the environmental benefits and sustainability aspects of vermiculture.	U, Ap	PSO-1,2,7

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Credits: 2:1 (Lecture: Practical)

CO No.	CO	POs	PSOs	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Promote self-employment and self-reliance among	1,5	PSO-1,2	U	C	L	P

	educated youth						
2	Design the basic procedure and methodology of vermiculture	1,5	PSO-1,2	R, U, An	C	L	P
3	Set up and maintain vermicomposting systems effectively.	1,5	PSO-1,2,4	U, Ap	C	L	P
4	Appreciate the environmental benefits and sustainability aspects of vermiculture.	3	PSO-1,2,7	E,U	C	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	3	3	-	-	-	-	-	-
CO 2	3	3	-	-	-	-	-	-
CO 3	3	3	-	-	-	-	-	-
CO 4	3	3	-	3	-	-	-	-

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	3	-	-
CO2	3	-	-	-	3	-	-
CO3	3	-	-	-	3	-	-
CO4	-	-	3	-	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

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Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓

SEMESTER - VI

Mar Ivanios College (Autonomous)

Discipline	**ZOOLOGY**				
Course Code	MIUK6DSCZOO303.1				
Course Title	**HUMAN PHYSIOLOGY**				
Type of Course	**DSC**				
Semester	VI				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	Knowledge about the basic human anatomy.				
Course Summary	This course in human physiology provides a comprehensive overview of the fundamental principles governing the functioning of the human body. Through a combination of lectures, laboratory sessions, and interactive discussions, students will explore the intricate mechanisms underlying various physiological processes essential for human life.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**GENERAL AND CELLULAR PHYSIOLOGY**	**2**
	1	Physiology – introduction. Scope of human physiology. Brief account on types of cells and levels of organisation of human body. Homeostasis and its significance.	2
II		**PHYSIOLOGY OF NERVE, MUSCLE AND SENSORY SYSTEMS**	**19**
	2	**NERVE PHYSIOLOGY** Organisation of nervous system. Mention enteric nervous system and gut-brain axis. Cells in nervous system: neurons and glial cells.	2
	3	Types of synapses. Neurotransmitters.	1
	4	Generation and propagation of nerve impulse. Synaptic transmission. All or none law. Reflex action. Electro encephalogram. Mention nerve disorders – epilepsy, Alzheimer's disease, Parkinson's disease.	3
	5	**MUSCLE PHYSIOLOGY** Brief account on types of muscles. Ultra structure of striated muscle fibre.	2
	6	Physiological and molecular basis of muscle contraction.	2
	7	Simple muscle twitch. Summation. Rigor.	1
	8	**SENSORY PHYSIOLOGY**	4

		Types of sensory receptors and sense organs. Vision: Physiology of vision, visual pigments, photo chemistry of vision. Light and dark adaptation. Eye defects – myopia, hyperopia, presbyopia, astigmatism, cataract.	
	9	Hearing and equilibrium: Mechanism of hearing. Role of vestibular system in maintaining equilibrium. Hearing impairments – deafness, labyrinthitis.	3
	10	Smell and taste: olfactory epithelium, odorant receptors. Taste buds. Taste receptors.	1
III	**PHYSIOLOGY OF CIRCULATORY, RESPIRATORY AND GASTROINTESTINAL SYSTEMS**		**13**
	11	**CIRCULATORY PHYSIOLOGY** Conducting system of heart. Cardiac cycle. Blood pressure and pulse.	2
	12	Composition of blood. Blood groups. Structure of haemoglobin and myoglobin. Mechanism of blood clotting - intrinsic and extrinsic pathways. Anticoagulants. Lymph and its functions.	4
	13	**RESPIRATORY PHYSIOLOGY** Pulmonary ventilation. Gas exchange in lungs. Transport of respiratory gases. Mechanisms of pH and electrolyte balance in body.	2
	14	**GASTROINTESTINAL PHYSIOLOGY** Enzymatic digestion and absorption of food – mechanical and chemical changes of food in the alimentary canal.	3
	15	Nutrition – essential dietary components. Role of gut microbiota in health and disease.	2
IV	**ENDOCRINE, RENAL AND REPRODUCTIVE PHYSIOLOGY**		**11**
	16	**ENDOCRINE SYSTEM** Endocrine glands in man. Hormones and hormonal disorders. Regulation of endocrine function – feedback mechanism.	4
	17	**RENAL PHYSIOLOGY** Formation of urine. Counter-current multiplier system.	2
	18	Renal disorders – nephritis, haematuria, renal calculi, acidosis and alkalosis. Dialysis.	1
	19	**REPRODUCTIVE PHYSIOLOGY** Physiology of male reproduction, hormonal control of spermatogenesis. Physiology of female reproduction, hormonal control of menstrual cycle. Fertilization, pregnancy and childbirth.	4
V		**PRACTICUM**	**30**
	20	Study of different types of cells and tissues using permanent slides.	
	21	Preparation of stained temporary slides of cheek epithelial cells.	
	22	Demonstration of triceps reflex.	
	23	Preparation of stained temporary slides of striated muscle fibres of cockroach.	
	24	Preparation of human blood smear and observation of blood cells.	
	25	Identification of blood groups using antisera – A, B and Rh.	
	26	Testing for abnormal constituents in urine – glucose and albumin.	

	27	Study of functional anatomy & physiology of organ systems using virtual labs/videos	

REFERENCES

1. Ganong, W.F. (2019), Review of Medical Physiology, 26th edition. McGraw Hill, New Delhi.
2. Guyton, A.C. and Hall, J.E. (1995). Text book of Medical Physiology, 9th edition. W.B. Saunders Co.
3. Widmaier, E.P, Raff, H and Strang K.T. (2016). Vander's Human Physiology, 14th edition. Mc Graw Hill, NY.
4. Sembulingam, K. (2019). Essentials of Medical Physiology: With Free Review of Medical Physiology. India: Jaypee Brothers Medical Publishers Pvt. Limited.
5. Hoar, W.S.(1975). General and Comparative physiology, Prentice Hall.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Describe the structure of different types of cells and tissues in human body as well as its levels of organisation and integration.	R, U	6
CO-2	Describe how the sense organs, nervous system and muscular system function in coordination for the maintenance of equilibrium in accordance with the external environment.	R, U	6
CO-3	Explain the functioning and interactions of different organ systems for the maintenance of a healthy body.	R, U	6
CO-4	Explain the importance of gut microbiota as well as the significance of gut-brain axis in physical and mental health.	R, U	6
CO-5	Integrate the knowledge of major systems to outline the interplay between organ systems to maintain biological equilibrium.	U, An, E	5, 6
CO-6	Interpret and draw inferences from experiments regarding the physiological functions in health and disease.	An, E, Ap	5, 8

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: HUMAN PHYSIOLOGY

Credits: 3:1 (Lecture:Practical)

CO No.	CO	PO	PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Describe the	1	6	R, U	F, C	L	

	structure of different types of cells and tissues in human body as well as its levels of organisation and integration.						
CO-2	Describe how the sense organs, nervous system and muscular system function in coordination for the maintenance of equilibrium in accordance with the external environment.	1	6	R, U	F, C	L	
CO-3	Explain the functioning and interactions of different organ systems for the maintenance of a healthy body.	1	6	R, U	F, C	L	
CO-4	Explain the importance of gut microbiota as well as the significance of gut-brain axis in physical and mental health.	1	6	R, U	F, C	L	
CO-5	Integrate the knowledge of major systems to outline the interplay between organ systems to maintain biological equilibrium.	1	5, 6	R, U	F, C	L	
CO-6	Interpret and draw inferences	1,2	5,8	R, U	C, P		P

	from experiments regarding the physiological functions in health and disease.						

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	-	-	-	-	-	3	-	-
CO 2	-	-	-	-	-	3	-	-
CO 3	-	-	-	-	-	3	-	-
CO 4	-	-	-	-	-	3	-	-
CO 5	-	-	-	-	3	3	-	-
CO 6	-	-	-	-	3	-	-	2

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-
CO6	3	2	-	-	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6	✓	✓		

Mar Ivanios College (Autonomous)

Discipline	**Zoology**				
Course Code	MIUK6 DSCZOO304.1				
Course Title	**DEVELOPMENTAL BIOLOGY**				
Type of Course	**DSC**				
Semester	VI				
Academic Level	300-399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3	-	2	5
Pre-requisites	Basic knowledge of reproductive biology				
Course Summary	Developmental Biology is the discipline that provides in-depth knowledge on the embryonic and post embryonic developmental processes. The most fascinating aspect of developmental biology that a single fertilized egg can give rise to a fully developed multi cellular complex organism. This course explains the basic principles and concepts underlying the developmental processes at the cellular and molecular level. Better understanding of morphogenesis are made possible by introduced to model organisms like Sea urchin, Drosophila, Frog and Chick to study different types of eggs, cleavage patterns and various morphogenetic movements during gastrulation leading to formation of germ layers and their fate. Awareness about pre-diagnostic methods and the technique of IVF is needed for the betterment of mankind.				

DETAILED SYLLABUS

Module	Unit	Content	Hrs
I		**INTRODUCTION**	**4**
	1	Historical perspective (brief account), Theories- Preformation, Epigenesis, Recapitulation and Germplasm.	1
	2	Asexual Reprouction: brief account on Parthenogenesis: natural and artificial parthenogenesis, arrhenotoky and thelytoky, obligatory and facultative,.Significance of parthenogenesis.	3
II		**SEXUAL REPRODUCTION**	**7**
	3	Spermatogenesis and Structure of sperm	2
	4	Oogenesis structure of Graafian follicle and typical egg	3
	5	Types of eggs based on different criteria, Polarity of egg	2

III	**FERTILIZATION**		**19**
	6	Events in Fertilization-Agglutination, sperm penetration, activation of egg, amphimixis.	3
	7	Physiological and biochemical changes during and after fertilization	3
	8	Prevention of polyspermy- Primary block to polyspermy, Secondary block to polyspermy.	2
	9	Cleavage: Types of cleavage - holoblastic and meroblastic; patterns of cleavage – radial, bilateral, spiral, rotational.	3
	10	Blastulation - introduction, different types of blastula – stereo blastula, coeloblastula, discoblastula, periblastula, blastocyst.	2
	11	Gastrulation: brief account of morphogenetic movements – epiboly and emboly (invagination, involution, infiltration, ingression, delamination, convergence, divergence)	2
	12	Cell differentiation: totipotency, pleuripotency and unipotency of embryonic cells. Determination and differentiation in embryonic development	2
	13	Gene action in development of Drosophila:- Maternal effect genes; Zygotic genes- Segmental genes (gap genes, pair-rule gene and segment polarity gene) and Homeotic genes, Hox genes	2
IV	**EMBRYONIC DEVELOPMENT AND ADVANCEMENT IN DEVELOPMENTAL BIOLOGY**		**15**
	14	Frog -cleavage, blastulation, gastrulation organogeny – development of brain, eye, heart; metamorphosis - ecological, morphological and physiological changes and hormonal control	5
	15	Chick -, gastrulation, study of 24 hrs chick embryo;	2
	16	Man - implantation, pregnancy, parturition. Placentation in mammals – different types of placenta, functions	2
	17	Types of embryonic induction –Primary, Secondary and Tertiary Induction (Experiments of Spemann and Mangold)	2
	18	Assisted Reproductive Technique: IVF, GIFT, ZIFT, TET, ICSI Cloning	2
	19	Teratology: definition and causes**.** Prenatal diagnosis	2
V		**PRACTICUM**	**30**
	20	Study of different types of eggs-Amphioxus, frog, chick, man- based on models/charts.	
	21	Study of blastula- Amphioxus, frog- slide / model	
	22	Study of gastrula – frog-yolk plug stage - slide / model.	
	23	Mounting of 24hrs/48hrs chick blastoderm.	
	24	Study of placenta – any two types.	
	25	Metamorphosis in frog using pictogram	

	26	Project report on Drosophila culture/chick embryo development	

Reference:

1. Balinsky. B.I. (2004). An Introduction to Embryology. W.B. Saunders & Co.
2. Carlson.B.M. (2014) Human Embryology and Developmental Biology, Fifth Edition ISBN: 978-1-4557-2794-0
3. Berry, A.K. (2008). An Introduction to Embryology. Emkay Publications.
4. Gibbs. (2006).Practical Guide to Developmental Biology. Oxford University Press
5. Gilbert. S.F. (2000). Developmental Biology. Sinauer Associates, Inc. Publishers.

Course outcome

No	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Explain the events that lead to formation of a multicellular organism from a single fertilized egg	R,U	3
CO-2	Define the cellular processes of development and the molecular mechanisms underlying these process	R,U	3,6
CO-3	Application of latest techniques like IVF and pre natal diagnosis to be applied for human welfare.	U, AP	5
CO-4	Development of the skill to raise and maintain culture of model system; Drosophila in the laboratory	U, C	3,8
CO-5	Describe the general patterns and sequential developmental stages during embryogeneis	U,R	3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: Developmental Biology
Credits: 3:1 (Lecture:Practical)

CO No.	CO	PO	PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Explain the events that lead to formation of a multicellular organism from a single fertilized egg	1	3	U	F, C	L/T	

CO-2	Define the cellular processes of development and the molecular mechanisms underlying these process	1	3,6	U	F, C	L/T	P
CO-3	Application of latest techniques like IVF and pre natal diagnosis to be applied for human welfare.	1	5	Ap	F, C	L/T	
CO-4	Development of the skill to raise and maintain culture of model system; Drosophila in the laboratory	1	5	C	F, C, P	L/T	P
CO-5	Describe the general patterns and sequential developmental stages during embryogeneis.	1	3,5	U	F, C	L/T	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	-	-	-	3	-	-	-	-
CO 2	-	-	3	-	-	2	-	-
CO 3	-	-	-	-	3	-	-	-
CO 4	-	-	-	-	3	-	-	-
CO 5	-	-	3	-	3	-	-	-

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-

CO4	3	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓	✓	✓
CO 5	✓	✓		✓

Mar Ivanios College (Autonomous)

Discipline	**ZOOLOGY**				
Course Code	MIUK6DSCZOO305.1				
Course Title	**EVOLUTION, ETHOLOGY AND ZOOGEOGRAPHY**				
Type of Course	**DSC**				
Semester	VI				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	Basic idea on evolution and animal behavior				
Course Summary	This course delves into the fundamental concepts such as the origin of life, theories of organic evolution, and the supporting evidence. It explores the concept of speciation, its diverse types and the underlying causes that propel evolutionary change. Additionally, it elucidates the intricacies of animal behaviour from a scientific perspective, analyzing theories of learning and behavioural adaptations. Through an examination of the geological history concerning continental formation, the course investigates the factors influencing animal distribution and traverses the diverse zoogeographical realms that delineate our planet's biodiversity.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**THEORIES OF ORIGIN OF LIFE AND ORGANIC EVOLUTION**	**10**
	1	Theories of origin of life. Origin of basic biological molecules, abiotic synthesis of organic monomers and polymers, concept of Oparin - Haldane, Miller-Urey Experiments. The RNA world. The First Cell	2
	2	Theories of organic evolution: Lamarck's theory, Weisman's germplasm theory, Darwin's theory of natural selection. Mutation theory, sexual selection theory, Neo Darwinism	3
	3	Hardy –Weinberg law and the factors affecting genetic equilibrium	2
	4	Speciation- sympatric speciation and allopatric speciation. Species isolation and isolating mechanisms	3
II		**GEOLOGICAL TIME SCALE, PALAEONTOLOGY AND PRIMATE EVOLUTION**	**10**
	5	Geological time scale– eras, periods and epochs. Major events in evolutionary timescale. Mass extinction and its consequences.	3
	6	Fossils- fossilization and its significance fossil dating	2
	7	Stages in Primate Evolution - Prosimii, Anthropoidea and Hominids. Major trends in human evolution-Hominid fossils.	5
III		**ETHOLOGY**	**18**
	8	Motivation- models of motivation (Lorenz's psychohydraulic model and	3

		Deutsch's model).	
	9	Learning- types of learning (imprinting, habituation, conditioned reflex, unconditioned reflex, latent learning, insight learning)	3
	10	Neural centres (hypothalamus and limbic system) and mechanisms in behaviour: drinking, feeding, learning, memory and cognition.	3
	11	Hormones and behaviour	3
	12	Sociobiology- social groups –merits and demerits, properties of organized societies, social groups in mammals, social stress.	3
	13	Pheromones and chemical communication; human pheromones	3
IV	**ZOOGEOGRAPHY**		**7**
	14	Geographic distribution of animals-cosmopolitan distribution, discontinuous distribution, bipolar distribution and isolated distribution, factors affecting animal distribution; barriers to animal distribution-physical and biological barriers.	3
	15	Zoogeographical Realms: (brief account of each realm mention the areas included, physical features and fauna) Palaearctic region, Australian region, Ethiopian region, Nearctic region, Oriental region and Neotropical region. Biogeographical classification of India- Western Ghats, Eastern Ghats and Himalayas. Insular Fauna: Brief account of oceanic islands and continental islands (with one example each).	4
		PRACTICUM	30
	16	Mathematical problems associated with Hardy- Weinberg equilibrium.	
	17	Identification of types of fossils using pictogram	
	18	Identification of fossil ancestors of man using pictogram	
	19	Experimental setup-Alarm pheromones in ants.	
	20	Study of habituation in Pila	
	21	Maize learning experiments in mice/rats (video demonstration)	
	22	Study of different zoogeographical realms with fauna: • Palaearctic region • Australian region • Ethiopian region • Nearctic region • Oriental region • Neotropical region.	

Reference

1. Futuyma, D.J.1986. *Evolutionary Biology* (2nd edn). Sinauer Associates Inc. MA, USA
2. Gould, S,J. 2002. *The Structure of Evolutionary Theory*. Harvard University Press,
3. MA, USA
4. Hall, B.K and Hallgrimsson, B. 2008. *Strickberger's Evolution* (4th edn). Jones and Bartlett Pub.London, UK
5. Campbell.B.G.2009. Human Evolution. Transaction Publishers, NJ, USA

6. Alcock, J. (2001): Animal Behaviour- An Evolutionary Approach (7th Ed.) Sinaur Associates, Inc.
7. Manning, A. & Dawkins, M.S. (1998). An Introduction to Animal Behaviour. (5th Ed.)
8. Cambridge: Cambridge University Press.
9. George W. (1962). Animal geography, Heinemann Edl. Books Ltd., London.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Explain the concept on the origin of life, theories on organic evolution and its evidence.	R, U	3
CO-2	Describe the concept of speciation, types and causes	R, U	1
CO-3	Analyze the science of animal behavior and the concept of learning	An, E	5
CO-4	Examine the factors affecting animal distribution and zoogeographical realm	R, An	2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: Credits: 3:1 (Lecture: Practical)

CO No.	CO	POs	PSOs	Cognitive Level	Knowledge Category	Lecture (L)	Practical (P)
1	Explain the concept on the origin of life, theories on organic evolution and its evidence.	1	3	R, U	C	L	P
2	Describe the concept of speciation, types and causes	1	1	R, U	C	L	
3	Analyze the science of animal behavior and the concept of learning	1,2	5	An, E	F	L	P
4	Examine the factors affecting animal distribution and the characteristics of various zoogeographical	1	2	R, An	C	L	P

	realms						
5	Identify different zoogeographical realms	1	2	U	P		P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	-	-	2	-	-	-	-	-
CO 2	1	-	-	-	-	-	-	-
CO 3	-	-		-	1	-	-	-
CO 4	-	-	2	-	-	-	-	-
CO 5	-	1	-	-	-	-	-	-

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	**3**	-	-	-	-	-	-
CO2	**3**	-	-	-	-	-	-
CO3	**3**	**2**	-	-	-	-	-
CO4	**3**	-	-	-	-	-	-
CO5	**3**	-	-	-	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓		✓	✓
CO 4	✓	✓		✓
CO 5	✓	✓		

Mar Ivanios College (Autonomous)

Discipline	**ZOOLOGY**				
Course Code	MIUK6DSEZOO302.1				
Course Title	**IMMUNOLOGY**				
Type of Course	**DSE**				
Semester	VI				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	A fundamental understanding of biological concepts, including cell structure and function, and basic principles of physiology.				
Course Summary	This course provides students with a comprehensive understanding of the immune system and its role in defending animals against pathogens and diseases. Through lectures, discussions, laboratory exercises, and assignments, students will gain knowledge of the cellular and molecular mechanisms underlying immune responses, immunological techniques used in research and diagnostics, as well as the principles and applications of immunotherapy. By the end of the course, students will have a solid foundation in immunology that prepares them for further studies or careers in immunology				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**COMPONENTS OF IMMUNE SYSTEM**	**14**
	1	Overview of immune system. Types of immunity, innate and acquired immunity; passive and active immunity; humoral and cell-mediated immunity. Cells and organs of immune system - Primary and Secondary lymphoid organs. Immune cells: types, production and functions.	8
	2	Antigens, Immunogens, factors affecting immunogenicity, epitopes, haptens.	2
	3	Immunoglobulins: General Properties, Structure. Different classes of immunoglobulins (1gA, 1gD,1gE,1gG and 1gM) and their functions. Mention polyclonal & monoclonal antibodies	4
II		**IMMUNE RESPONSE AND ANTIGEN – ANTIBODY INTERACTIONS**	**13**
	4	Primary and secondary immune responses: characteristics, stages, immune cell activation and memory.	2
	5	Antigen – antibody interactions: precipitation, agglutination, complement fixation, neutralization, opsonisation.	2

	6	Antigen processing and presentation. Role of MHCs.	3
	7	Complement system. Pathways and biological effects of complement activation.	3
	8	Transplantation immunology. Types of grafts. Mechanism of graft rejection.	3
III	**DEFECTS OF IMMUNE SYSTEM**		**10**
	9	Immunodeficiency disorders. Congenital and acquired immunodeficiencies.	4
	10	Autoimmunity. Auto immune diseases – systemic and organ specific.	4
	11	Hypersensitivity. Types of hypersensitivity reactions.	2
IV	**IMMUNOTHERAPY**		**8**
	12	Vaccines. Types of vaccines - whole organisms, purified macromolecules, others (mRNA vaccine).	2
	13	Monoclonal antibodies. Hybridoma technology. Use of monoclonal antibodies in immunotherapy.	5
	14	Immunomodulatory drugs.	1
		PRACTICUM	**30**
	15	Observe immune cells (such as lymphocytes, macrophages, neutrophils) using light microscopy. Learn to identify different cell types based on their morphology and understand their functions.	
	16	Total and differential count of WBCs in human blood samples.	
	17	Observation of agglutination of blood cells using antisera and interpretation of antigen – antibody interactions.	
	18	Demonstration of immunological techniques – ELISA, western blot.	

REFERENCES

1. Owen, J., Punt, J., & Stranford, S. (2018). Kuby Immunology (8th ed.). WH Freeman.
2. Delves, P. J., Martin, S. J., Burton, D. R., & Roitt, I. M. (2016). Roitt's Essential Immunology (13th ed.). Wiley-Blackwell.
3. Abbas, A. K., Lichtman, A. H., & Pillai, S. (2014). Basic immunology: Functions and disorders of the immune system. Elsevier.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Explain the components of immune system and their interactions to ward off pathogens and maintain health.	R, U	6
CO-2	Compare the different types of immune mechanisms as well as antibodies and interpret their action in providing immunity.	R, U, An	5, 6
CO-3	Explain the characteristics and mechanisms of immune responses and antigen-antibody interactions.	R, U	6
CO-4	Explain the basis of altered immunological conditions and disorders and how immunotherapies can be used for managing the conditions.	U, E, Ap	6, 7
CO-5	Interpret the types of antigen and antibody present in a blood sample based on agglutination reactions.	U, An, Ap	5, 6

CO-6	Identify the immune cells based on their morphology and evaluate their counts in relation to health and diseases.	R, U, Ap, E	5, 7

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: IMMUNOLOGY

Credits: 3:1 (Lecture:Practical)

CO No.	CO	PO	PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Explain the components of immune system and their interactions to ward off pathogens and maintain health.	1	6	R, U	F, C	L	
CO-2	Compare the different types of immune mechanisms as well as antibodies and interpret their action in providing immunity.	1	5,6	R, U, An	F, C, P	L	
CO-3	Explain the characteristics and mechanisms of immune responses and antigen-antibody interactions.	1	6	R, U	F, C	L	
CO-4	Explain the basis of altered immunological conditions and disorders and how immunotherapies can be used for managing the conditions.	1	6,7	U, E, Ap	F, C	L	
CO-5	Interpret the types of antigen and antibody	1,6	5,6	U, An, Ap	F, C, P		P

	present in a blood sample based on agglutination reactions.						
CO-6	Identify the immune cells based on their morphology and evaluate their counts in relation to health and diseases.	1,6	5,7	R, U, Ap, E	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	-	-	-	-	-	3	-	-
CO 2	-	-	-	-	3	3	-	-
CO 3	-	-	-	-	-	3	-	-
CO 4	-	-	-	-	-	3	3	-
CO 5	-	-	-	-	3	3	-	-
CO 6	-	-	-	-	3	-	3	-

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-
CO5	3	-	-	-	-	2	-
CO6	3	-	-	-	-	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		
CO 6	✓	✓		

Mar Ivanios College (Autonomous)

Discipline	**ZOOLOGY**				
Course Code	MIUK6DSEZOO303.1				
Course Title	**BIOMOLECULES**				
Type of Course	**DSE**				
Semester	VI				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Basic knowledge in cell biology				
Course Summary	Biomolecules are the most essential organic molecules, which are involved in the maintenance and metabolic processes of living organisms. They range from small molecules such as primary and secondary metabolites and hormones to large macromolecules like carbohydrates, proteins, lipids and nucleic acid. The course aims to enable the learners to understand the basic processes which link the biological systems with the chemical systems and to provide them with basic knowledge and insight about the three-dimensional structure of macromolecules (carbohydrates, proteins, lipids and nucleic acid) and the relationship between their structure and function.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**PROPERTIES OF WATER, CHEMICAL BONDS, pH AND BUFFERS**	**6**
	1	Structure and properties of water. Importance of water in biological systems. Water as a universal solvent.	2
	2	Types and significance of chemical bonds.	2
	3	pH and buffers.	2
II		**CARBOHYDRATES AND LIPIDS**	**16**
	4	**Carbohydrates:** Definition and classification of carbohydrate, stereoisomeric forms of carbohydrate, structure, functions and reactions of biologically important carbohydrates.	3
	5	Monosaccharide—glucose, fructose, mannose, galactose. Disaccharides – sucrose, lactose, maltose, cellobiose.	4
	6	Polysaccharides—Storage: starch, glycogen, inulin. Structural: hemicelluloses, cellulose, lignin, chitin and peptidoglycans.	4
	7	**Lipids:** Definition, classification and functions of lipids.	4

		Occurrence, chemistry and biological functions of simple lipids (e.g. triacyclglycerols, wax) compound lipids (e.g. phospholipids, glycolipid) and derived lipids (e.g. cholesterol, prostaglandins).	
	8	Fatty acids: classification and nomenclature.	1
III		**AMINO ACIDS AND PROTEINS**	**17**
	9	**Aminoacids:** Structure and classification. Properties of amino acids: pK value and iso-electric point. Reactions of amino acids: (due to - carboxyl group, amino group and side chains); Peptide bonds and peptide formation.	4
	10	**Proteins:** Structural levels of organisation: a) Primary structure (e.g. insulin); b) Secondary structure: Alpha helix, Beta pleated sheet, Ramachandran angles and Ramachandran plot. c) Tertiary structure (e.g. Myoglobin) d) Quaternary structure (e.g. Haemoglobin) Globular proteins (e.g. Myoglobin, Haemoglobin: biological importance) and Fibrous proteins (e.g. Keratin and Collagen: biological importance).	4
	11	**Enzymes:** Classification (I.U.B. system) and nomenclature of enzymes. Enzyme kinetics: Energy of activation; Steady state enzyme kinetics: Michaelis-Menten equation. Km value and its significance. Mechanism of action of enzymes: Enzyme specificity - active site; formation of enzyme substrate complex - covalent catalysis, acid-base catalysis, metal ion catalysis, and catalysis by approximation and orientation. Lock and key model & Induced fit model	5
	12	Control of enzyme activity: a) Enzyme inhibition: Reversible inhibition - competitive, uncompetitive and mixed types. Irreversible inhibition: non-competitive and suicide inhibitions. b) Enzyme regulation: allosteric regulation, covalent modification, feedback or end product inhibition, compartmentalization, effect of regulatory molecules and cofactors.	3
	13	Co-enzymes, cofactors, iso-enzymes, ribozymes and abzymes.	1
IV		**NUCLEIC ACID, VITAMINS AND MINERALS**	**6**
	14	**Nucleic acid:** Structure of nucleotides and nucleic acids: Structural organization of DNA (Watson –Crick model). Bonds and forces found in nucleic acids.	2
	15	Types of DNA: A, B, C, Z, triplex and tetraplex DNAs Types of RNA: mRNA, tRNA, rRNA and snRNA Biological roles of nucleotides and nucleic acids. Biological importance of nucleic acids. 16s rRNA and its significance.	2
	16	**Vitamins:** Fat-soluble and water-soluble vitamins. **Minerals:** Micro and Macro minerals. Biological importance of vitamins and minerals, deficiency	2

		symptoms.	
V		**PRACTICUM**	**30**
	17	Qualitative analysis of carbohydrates (Fehling's test).	
	18	Determination of blood sugar (O-Toluidine reaction).	
	19	Qualitative analysis of urine for abnormal constituents (Fehling's test, Sulphosalicylic acid test).	
	20	Identification tests for Proteins (Biuret test).	

Reference:

1. Lehninger's Principles of Biochemistry by David L Nelson; A.L. Lehninger and Michael M. Cox, 7th edition, Macmillan Learning U.K.

2. Biochemistry, The molecular basis of life by Trudy McKEE and James R. McKEE, 7th edition, Oxford University Press.

3. Biochemistry by Donald Voet and Judith G. Voet, 4th edition, John Wiley & Sons, INC.

4. Biochemistry by Jeremy M. Berg and John L. Tymoczko, 8th edition, W.H. Freeman & Company.

Course Outcomes

No.	Upon completion of the course, the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Acquire an insight into various biomolecules which constitute living organisms.	R, U	5, 6, 7
CO-2	Learn the structure and properties of carbohydrates.	R, U	5, 6, 7
CO-3	Acquire the basic concepts of structural organization and characterization of proteins and importance of enzymes.	R, U	5, 6, 7
CO-4	Learn about structure and properties of lipids.	R, U	5, 6, 7
CO-5	Explain the structure of DNA, RNA and their types.	R, U	5, 6, 7
CO-6	Understand other accessory molecules like vitamins and minerals.	R, U	5, 6, 7
CO-7	Acquaint with principles, technical requirement, scientific understanding of biochemical assays.	U, An, Ap	5, 6, 7

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Biomolecules: Credits: 3:0: 1(Lecture: Tutorial: Practical)

CO No.	CO	PO	PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	1	1,5, 6	5, 6,7	R, U	F, C	L/T	
2	2	1,5,6	5,6, 7	R, U	F, C	L/T	
3	3	1,5,6	5, 6, 7	R, U	F, C	L/T	

4	4	1,5,6	5,6, 7	R, U	F, C	L/T	
5	5	1,5,6	5, 6, 7	R, U	F, C	L/T	
6	6	1,5,6	5, 6, 7	R, U	F,C	L/T	
7	7	1,5,6	4,7,8	U, An, Ap	C, P		P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	-	-	-	-	3	3	1	
CO 2	-	-	-	-	3	3	1	
CO 3	-	-	-	-	3	3	1	
CO 4	-	-	-	-	3	3	1	
CO 5	-	-	-	-	3	3	1	
CO6	-	-	-	-	3	3	1	
CO7	-	-	-	3	-	-	1	2

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	3	3	-
CO2	3	-	-	-	3	3	-
CO3	3	-	-	-	3	3	-
CO4	3	-	-	-	3	3	-
CO5	3	-	-	-	3	3	-
CO6	3	-	-	-	3	3	-
CO7	3	-	-	-	3	3	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 6	✓	✓		

Mar Ivanios College (Autonomous)

Discipline	**ZOOLOGY**				
Course Code	MIUK6SECZOO302.1				
Course Title	**ANIMAL CELL CULTURE TECHNIQUES**				
Type of Course	**SEC**				
Semester	VI				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	2 hours	-	2	4
Pre-requisites	Those who are interested to pursue their future studies and research as well as career in life science.				
Course Summary	The course provides theoretical knowledge as well as practical skills in animal cell culture techniques. Hands-on training in animal cell culture and maintenance will be provided. Visit to an established animal cell culture facility is mandatory for the course. Specific sessions will be handled by scientists/faculties with expertise in the field.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**INTRODUCTION TO CELL CULTURE LABORATORY AND EQUIPMENT**	**10**
	1	Laboratory safety, risk assessment, general safety, Standard Operating Procedures, safety regulations, biosafety levels, safe laboratory practices and fumigation with formaldehyde.	1
	2	Basic equipment (Incubator, microscope, sterilizer, washing up instrument, sterilizing and drying oven, centrifuge, water purification, cell freezing-storage).	1
	3	Expanded equipment (Laminar flow hood, Cell counter, vacuum pump, CO2 incubator, preparation and quality control equipment, temperature recording, bulk culture, pipette aids and automatic pipetting).	3
II		**LABORATORY PRACTICES AND ASEPTIC TECHNIQUE**	**10**
	5	Aseptic work area, cell culture hood, cell culture hood layout, incubator storage and cryogenic storage.	3
	6	Introduction, sterile work area, good personal hygiene, sterile reagents and media, sterile handling and good aseptic technique.	

III		**BIOLOGICAL CONTAMINATION**	**5**
	8	Introduction, bacteria, yeasts, molds, viruses, mycoplasma. Cell culture contamination detection, elimination and troubleshooting, appropriate usage of antibiotics.	2
	9	Storage and distribution of animal feed.	3
IV		**CELL CULTURE BASICS**	**5**
	10	Cell lines; selecting the appropriate cell line, acquiring cell lines, culture collections- NCCS, ATCC.	1
	11	Preparation culture environment, adherent *v/s* suspension culture, media, pH, CO_2, température.	2
	12	Culturing Techniques: Sub-culturing, freezing, revival of cryo-preserved cells, seeding of cells into 96-well plate and cell viability assay(MTT).	1
V(P)		**PRACTICUM**	**30**
	13	Medium preparation.	
	14	Basics steps in cell culture (Cell counting, sub culturing, freezing, thawing).	
	15	Cell viability assays.	
	16	Apoptosis assays.	

Reference:

1. Harrison, M. A., Rae, I. F. (1997). General Techniques of Cell Culture. United Kingdom: Cambridge University Press.
2. Animal Cell Culture: A Practical Approach. (2000). United Kingdom: Oxford University Press, UK.
3. Capes-Davis, A., Freshney, R. I. (2021). Freshney's Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications. United Kingdom: Wiley.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Maintain a basic cell culture laboratory aseptically, use and care the basic equipments.	U, Ap	7,8
CO-2	Maintain cell cultures by sub-culturing and cryopreservation.	U, Ap	7,8
CO-3	Carry out experiments using animal cell cultures.	U, Ap	7,8

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: Basic laboratory animal practices

Credits: 2:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO	PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	1	1,2,5,6	7,8	U, An, Ap	C, P	L/T	

2	2	1,2,5,6	7, 8	U, An, Ap	C, P	L/T	
3	3	1,2,5,6	7,8	U, An, Ap	C, P		(P)

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	-	-	-	-	-	-	3	3
CO 2	-	-	-	-	-	-	3	3
CO 3	-	-	-	-	-	-	3	3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	1	-	-	3	3	-
CO2	1	1	-	-	3	3	-
CO3	1	1	-	-	3	3	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		

SEMESTER – VII

Mar Ivanios College (Autonomous)

Discipline	**ZOOLOGY**				
Course Code	MIUK7DSCZOO400.1				
Course Title	**BIOCHEMISTRY**				
Type of Course	**DSC**				
Semester	VII				
Academic Level	400 - 499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	Sound knowledge in biology and chemistry.				
Course Summary	This course introduces students to metabolism: the collection of chemical processes by which cells derive energy from their surroundings and use this energy to make the building blocks of life. The major metabolic pathways involved in the synthesis and breakdown of important biological molecules are explored, along with the mechanisms of regulating these pathways in the body. Links between errors in metabolism and human disease are also discussed.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**CARBOHYDRATE METABOLISM**	**10**
	1	Major pathways of glucose utilization: Glycolysis, Pentose Phosphate Pathway (PPP), Glycogenesis.	3
	2	Fate of pyruvate: a) Fermentation: lactic acid fermentation and ethanol fermentation; and b) Citric acid cycle.	3
	3	Feeder pathways for glycolysis: Glycogenolysis, Gluconeogenesis and Cori cycle.	4
	4	Hormonal regulation of carbohydrate metabolism.	
II		**LIPID METABOLISM**	**15**
	5	Fatty acid metabolism: Beta oxidation, alpha oxidation and omega oxidation of fatty acids.	5
	6	Biosynthesis of fatty acids, Cholesterol: biosynthesis and regulation. Ketone bodies: formation, ketosis and keto acidosis.	7
	7	Role of liver in lipid metabolism.	3
III		**PROTEIN/ NUCLEIC ACID METABOLISM**	**15**
	8	Catabolism of amino acids: deamination, transamination and trans-deamination, decarboxylation; catabolism of glucogenic and ketogenic amino acids.	5

	9	Urea cycle: Formation and disposal of ammonia.	5
	10	Catabolism of purines and pyrimidines.	5
IV		**ENERGY METABOLISM**	**5**
	11	High energy bonds and energy rich compounds in muscle - ATP, ADP and PC. Biological oxidation: mitochondrial electron transport chain, oxidative phosphorylation, ATP synthesis, chemiosmotic theory.	5
V(P)		**PRACTICUM**	**30**
	12	Determination of the isoelectric pH of the given amino acid by titration method.	
	13	Estimation of DNA/RNA	
	14	Quantitative estimation of glycogen of a tissue	
	15	Quantitative estimation of blood glucose	
	16	Quantitative estimation of protein(tissue/ serum).	
	17	Determination of acid value of the given fat.	
	18	Determination of saponification value of the given fat.	
	19	Estimation of serum cholesterol using a standard protocol	

Reference:

1. David L Nelson, A.L. Lehninger and Michael M. Cox, (2017). Lehninger's Principles of Biochemistry- Macmillan Learning U.K (7^{th} edition).
2. Trudy McKEE and James R. McKEE, (2019). Biochemistry, The molecular basis of life- Oxford University Press (7^{th} edition).
3. Donald Voet and Judith G. Voet, (2010). Biochemistry- John Wiley & Sons, INC (4^{th} edition).
4. Jeremy M. Berg and John L. Tymoczko, (2023). Biochemistry- W.H. Freeman & Company (8^{th} edition).

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Outline the major pathways in carbohydrate metabolism.	R, U,	5,6,7,8
CO-2	Learn about lipid metabolism and its importance.	U, Ap	5,6,7,8
CO-3	Explore on basic reactions and its concepts in protein and nucleic acid metabolism.	U, Ap	5,6,7,8
CO-4	Understand the physiological importance of metabolism and energy production.	U, AP	5,6,7,8

CO-5	Acquaint with principles, technical requirement, scientific understanding of biochemical assays	U, Ap, An	7,8

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: Biochemistry

Credits: 3:0:1 (Lecture: Tutorial: Practical

CO No.	CO	PO	PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1	1	1,5,6	5, 6,7,8	U, An, Ap	F, C	L/T	
2	2	1,5,6	5,6, 7, 8	U, An, Ap	F, C	L/T	
3	3	1,5,6	5, 6, 7,8	U, An, Ap	F, C	L/T	
4	4	1,5,6	5,6, 7,8	U, An, Ap	F, C	L/T	
5	5	1,5,6	4, 7, 8	An, Ap	F, P		P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	-	-	-	-	3	3	2	3
CO 2	-	-	-	-	3	3	2	3
CO 3	-	-	-	-	3	3	2	3
CO 4	-	-	-	-	3	3	2	3
CO 5	-	-	-	3	-	-	2	3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	3	3	-
CO2	3	-	-	-	3	3	-
CO3	3	-	-	-	3	3	-
CO4	3	-	-	-	3	3	-
CO5	-	-	-	-	3	3	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low

2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	**Assignment**	**Project evaluation**	**End Semester Examinations**
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		

Mar Ivanios College (Autonomous)

Discipline	Zoology				
Course Code	MIUK7DSCZOO401.1				
Course Title	**BIOANALYTICAL TECHNIQUES**				
Type of Course	**DSC**				
Semester	VII				
Academic Level	400 - 499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3		2	5
Pre-requisites	Basic understanding of physics.				
Course Summary	Bio analytical techniques refer to a set of methods used to analyze biological samples. These techniques play a crucial role in pharmaceutical research, clinical diagnostics, and biomedical research. Some common bio analytical techniques include microscopy, chromatography, spectrometry, electrophoresis and immunoassays. These techniques can be combined or used individually to analyze various aspects of biological samples, providing valuable information for research, diagnosis, and treatment in fields such as medicine, pharmacology, and biotechnology.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**MICROSCOPY AND HISTOLOGICAL TECHNIQUES**	**15**
	1	**Microscopy-** Principle, history and importance of microscopy in biology	2
	2	**Working principle and applications:** Bright field, Dark field and phase contrast microscopy. Inverted microscope, Fluorescence microscope, Laser scan microscope, Confocal microscope, Electron microscope- SEM, TEM	5
	3	**Histological Techniques:** Techniques for preparation of temporary and permanent slides, whole mounts, smears, squashes and sections. Specimen preparation for TEM, SEM. Shadow casting, freeze fracturing, freeze etching, negative staining.	5
	4	Histochemical techniques for detection of proteins, lipids and carbohydrates	3
II		**ELECTROPHORESIS**	**5**

	5	**Working principle and applications:** Native PAGE and SDS-PAGE. Agarose gel electrophoresis. Gel documentation.	3
	6	Immunoelectrophoresis. Isoelectric focusing. Radioimmunoassay.	2
III		**CHROMATOGRAPHY AND CENTRIFUGATION**	**15**
	7	Principle and types of chromatography	3
	8	**Working principle and applications:** Thin layer chromatography, HPTLC, Column chromatography and ion exchange chromatography.	5
	9	Gas chromatography, High performance liquid chromatography (HPLC)	3
	10	**Centrifugation**: Principle of centrifugation. Basic components and types of centrifuges. Different types of rotors. Ultracentrifugation - analytical and preparative. Differential and density gradient centrifugation.	4
IV		**SPECTROSCOPY**	**10**
	11	**Working principle and applications:** IR spectroscopy, Fluorescent spectroscopy, Flame emission spectroscopy, Atomic absorption spectroscopy, Nuclear Magnetic- resonance spectroscopy, Mass spectroscopy	7
	12	Cell based assay- Flow cytometry	3
V		**PRACTICUM**	**30**
	13	Sketching of biological specimens using a camera lucida.	
	14	Dissection of radula under stereomicroscope.	
	15	Demonstration of Fluorescence microscope.	
	16	Demonstration of inverted microscope.	
	17	Gel mounting and electrophoresis of DNA sample.	
	18	Paper chromatographic separation of amino acids	
	19	Quantification estimation of Na, K, Ca of the given sample with the help of flame photometer/ spectrophotometer	
	20	Histological prepation of liver,gut and muscle.	
	21	Histochemical localization of glycogen and protein	
	22	Demonstration of flow cytometry	
	23	Visit to research labs and institutes	

Reference:

1. Ghatak K.L. 2011. Techniques and Methods in Biology. PHI Learning Pvt. Ltd. New Delhi
2. Gupta A. 2009. Instrumentation and Bio-Analytical Techniques. PragatiPrakashan, Meerut.
3. Hoope, W. et.al.1983. Biophysics. Springer Verlag, Berlin.
4. Lehninger, A.L.1971. Bioenergetics. W.A. Benjamin, London
5. Narayanan, P. 2000. Essentials of Biophysics. New Age International (P) Ltd. Publishers, New Delhi
6.

Course Outcomes

No.	Upon completion of the course, the graduate will be able to	Cognitive Level	PSO addressed

CO-1	Choose various analytical techniques to deal with biological samples.	R, U	4
CO-2	Experiment with various analytical techniques in research.	R, Ap	4,5
CO-3	Explain the basic principles of analytical techniques.	R, U	3
CO-4	Analyse research problems with appropriate techniques.	R, An	6
CO-5	Create research projects using multiple analytical techniques.	R, C	8

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: Bioanalytical Techniques

Credits: 3:1 (Lecture:Practical)

CO No.	CO	PO	PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Choose various analytical techniques to deal with biological samples	2,6	4	U	F, C	L/T	
CO-2	Experiment with various analytical techniques in research.	5,6	4,5	Ap	F, C, P	L/T	P
CO-3	Explain the basic principles of analytical techniques.	1	3	U	F, C	L/T	
CO-4	Analyse research problems with appropriate techniques.	2,6	6	An	F, C, P	L/T	P
CO-5	Create research projects using multiple analytical techniques.	2,6	8	C	C,p	L/T	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	-	-	-	3	-	-	-	-
CO 2	-	-	-	3	3	-	-	-
CO 3	-	-	2	-	-	-	-	-
CO 4	-	-	-	-	-	3	-	-
CO 5	-	-	-	-	-	-	-	3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	-	3	-	-	-	3	-
CO2	-	-	-	-	2	3	-
CO3	3	-	-	-	-	-	-
CO4	-	3	-	-	-	3	-
CO5	-	3	-	-	-	3	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics

	Internal Exam	Assignment	Report Submission	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓

SEMESTER – VIII

Mar Ivanios College (Autonomous)

Discipline	**Zoology**				
Course Code	MIUK8DSEZOO400.1				
Course Title	**GENOMICS AND PROTEOMICS**				
Type of Course	**DSE**				
Semester	VIII				
Academic Level	400 - 499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2	5
Pre-requisites	Knowledge in bio informatics, Molecular biology and genetic engineering				
Course Summary	Genomics and proteomics are two of the newest biological disciplines, and research in these areas has been driven by the application of technology to biology. Two critical technologies driving these disciplines are DNA sequencing and mass spectrometry. This course imparts advanced knowledge on the methods to study gene expression at the genome and proteome levels using traditional methods to advanced sequencing technology. The detailed analysis of the techniques involved for quantifying gene and protein expression will enable students to understand various methodologies involved in the detection of gene expression. Additionally, they would be able to study genome organization, comparison and the application of the genomic and proteomic techniques in various fields.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**INTRODUCTION TO BIOINFORMATICS**	**7**
	1	Database: Biological data, Bioinformatics databases, Classification of databases, Nucleic acid/Protein sequence, and structural databases, File formats.	2
	2	Sequence alignment: Pairwise (BLAST, FASTA), Multiple (ClustalW, Clustal Omega),Local, and global. Sequence analysis: Basic protein and nucleic acid sequence analysis, Phylogenetic analysis.	3
	3	Structure prediction: secondary and tertiary structure of proteins – *Ab initio* and Homology modelling, Ramachandran plot, 3D structure visualization, and comparison.	2
II		**GENOMICS**	**13**

	4	Genetics to genomics, Genome Sequence Acquisition and Analysis. Application of genomics. Comparative genomics, Functional genomics, Structural genomics, Clinical genomics, Pharmacogenomics and metagenomics. Biomedical Genome Research— Genomic sequences to make new vaccines, and new types of antibiotics.	3
	5	Next Generation Sequencing: Introduction, History, and Evolution of sequencing, Types, First, second, and third generation sequencing. NGS platforms: Roche 454, ABI SOLiD, Ion torrent, Illumina, PacBio, Oxford nanopore. Introduction to NGS technologies: DNA-seq, whole genome sequencing, RNA-seq, ChIP-seq, Hi-C, Metagenomics, Single-cell sequencing. Applications of NGS in transcriptome analysis, whole genome sequencing, and exome sequencing. Bioethics of sequencing – ownership of DNA sequence, storage, and security.	7
	6	Clinical genomics: Variation in the human genome – SNPs, SNVs, TRDs, CNVs, and chromosomal aberrations. Known examples of SNPs that cause diseases, Gene therapy and gene editing. Genomics in human and healthcare. Ethical consequences of genomic variations and clinical genomics.	3
III		**EXPRESSION DATA ANALYSIS**	**10**
	7	Basic introduction to - EST, SAGE/CAGE, Microarray, RNAseq; control, treated, replicates & its importance, Differential expression analysis.	4
	8	Affymetrix protocol and data generation, the spotted microarray technology, cDNA and oligo spotted arrays, microarray vs RNAseq for gene expression profiling.	3
	9	Application of Microarray and RNA seq: Biomedical applications, Plant genomics and industry.	3
IV		**PROTEOMICS**	**15**
	10	Introduction to proteome, Genomics to proteomics. Protein structure: Primary, secondary, tertiary, and quaternary structures, Proteins, and Peptides. Protein folding, Protein stability, Protein denaturation, and Physiochemical properties of protein, Protein -Protein interaction.	4
	11	Protein isolation and separation: 2-D gel electrophoresis, SDS page, Native page, Chromatography techniques. Complete proteome analysis: Mass spectrometry (LC-MS). Protein Identification: ELISA and western blot. Protein structure determination: X-ray Crystallography, NMR spectroscopy, and cryo-electron microscopy.	7
	12	Mining of protein databases, Protein sequence to function, Application of proteomics, Industrial application, Proteomics in disease diagnosis and drug discovery, plant genetics and breeding.	4
V		**PRACTICUM**	**30**
	13	NCBI - Sequence Databases & Tools	
	14	ISU Centers, Databases, Servers, Software	
	15	Sequence Alignment & Analysis	

	16	BLAST, FASTA, Gene Prediction	
	17	Structure Databases & Visualization	
	18	Protein Function Prediction, Protein Structure Prediction, Proteome Analysis	

Reference:

1. Voet D, Voet JG & Pratt CW, (2016). Fundamentals of Biochemistry: Life at the Molecular Level- Wiley (5th Edition).
2. Brown TA, (2023). Genomes- Garland Science (5th Edition)
3. Campbell AM & Heyer LJ, (2007). Discovering Genomics, Proteomics and Bioinformatics- Benjamin Cummings (2nd Edition).
4. Primrose S & Twyman R, (2006). Principles of Gene Manipulation and Genomics- Blackwell (7th Edition)
5. Glick BR & Patten CL, (2017). Molecular Biotechnology: Principles and Applications of Recombinant DNA- Wiley (5th Edition)

Course Outcomes

No.	Upon completion of the course, the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Provide students with an overview of the fundamental technological concepts of genomics, and proteomics methods .	R, U, Ap	5,6,7,8
CO-2	Genome sequencing, various types of sequencing technologies and sequencing approaches.	U, An, Ap	5,6,7,8
CO-3	Understand the significance of various expression analysis tools and its uses in various research fields.	U, Ap, An	5,6,7,8
CO-4	Understand various methods and techniques of proteome analysis, and its applications.	U, Ap, An	5,6,7,8
CO-5	Acquire hands on experience in various genomic and proteomic tools.	Ap	7,8

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: Genomics and proteomics

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO	PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	1	1,2,5,6	5, 6,7,8	U, An, Ap	C, P	L/T	
2	2	1,2,5,6	5,6, 7, 8	U, An, Ap	C, P	L/T	
3	3	1,2,5,6	5, 6, 7,8	U, An, Ap	C,P	L/T	
4	4	1,2,5,6	5,6, 7,8	U, An, Ap	C, P	L/T	
5	5	1,2,5,6	5,6,7,8	An, Ap	P		P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	-	-	-	-	3	3	2	3

CO 2	-	-	-	-	3	3	2	3
CO 3	-	-	-	-	3	3	2	3
CO 4	-	-	-	-	3	3	2	3
CO 5					3	3	2	3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	-	-	3	3	-
CO2	3	2	-	-	3	3	-
CO3	3	2	-	-	3	3	-
CO4	3	2	-	-	3	3	-
CO5	3	2	-	-			

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		

Mar Ivanios College (Autonomous)

Discipline	**ZOOLOGY**				
Course Code	MIUK8DSEZOO401.1				
Course Title	**BIOLOGY OF CANCER**				
Type of Course	**DSE**				
Semester	VIII				
Academic Level	400 - 499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	Sound understanding in Cell Biology, Molecular Biology.				
Course Summary	The course aims to provide students with a comprehensive insight into the molecular mechanisms underlying cancer development and into cancer treatment. Among the topics covered are tumor viruses, oncogenes, tumor suppressor genes, multistep tumorigenesis, cancer stem cells, tumor heterogeneity, cancer invasion, metastasis, precision medicine and drug development.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**FUNDAMENTALS OF CANCER**	**7**
	1	Introduction to cancer.	2
	2	Benign and Malignant tumours.	2
	3	Cancer epidemiology.	3
II		**ETIOLOGY OF CANCER**	**8**
	4	Viruses and cancer (RNA and DNA viruses).	3
	5	Cancer susceptibility syndromes, inflammation and Cancer.	2
	6	Chemical & physical carcinogens, carcinogenesis, types of carcinogenesis, diet and cancer.	3
II		**MASTER GUARDIANS AND EXECUTIONERS**	**20**
	7	Cellular Oncogenes, tumor suppressor genes, signaling.	5
	8	Cell cycle regulation, programmed cell death, autophagy, senescence, telomeres.	3
	9	Gene Regulation and Epigenetics in Cancer	2
	10	**Genetic Integrity and Tumourigenesis:** Cell immortalization, Multi-Step Tumorigenesis, Maintenance of Genetic Integrity.	5
	11	**Invasion and Metastasis:** Biology of Angiogenesis, Invasion	5

		and Metastasis. Models for metastasis, Cancer stem cells	
IV	**CANCER PHENOTYPES AND THERAPEUTIC APPROACHES**		**10**
	12	Tumor heterogeneity. Screen for small molecule inhibitors. Efficacy studies. Radiotherapy, Chemotherapy, Surgery and Immunotherapy.	8
	13	Aging and Cancer Risk.	2
V(P)		**PRACTICUM**	**30**
	14	Cell Viability assays (MTT).	
	15	Apoptosis Assays (Annexin V/PI staining).	
	16	Cell Migration Assays (Scratch wound).	
	17	Cell cycle analysis.	
	18	Expression analysis (RT-PCR)	

Reference:

1. Robert A. Weinberg, (2023). The Biology of Cancer-W.W. Norton.
2. Robin Hesketh, (2013). Introduction to Cancer Biology- Cambridge University Press.
3. Raymond W. Ruddon, (2007). Cancer Biology- Oxford University Press, USA.
4. The American Cancer Society, (2018). The American Cancer Society's Principles of Oncology Prevention to Survivorship-Wiley.
5. Kurt S. Zänker, Thomas Dittmar, (2016). Role of Cancer Stem Cells in Cancer Biology and Therapy-CRC Press.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Familiarize the student with the concepts that serve the foundation cancer as a genetic disease.	R, U, Ap	5,6,7,8
CO-2	Build the foundation to provide a comprehensive summary of the major signalling pathways that affect tumour development.	U, Ap, An	5,6,7,8
CO-3	Understand the cellular and molecular mechanisms involved in the transformation of normal cell into malignant cells, the invasiveness of cancer cells into host tissues, and the metastatic spread of cancer cells in the host organism.	U, Ap, An	5,6,7,8
CO-4	Learn about the most common types of cancer and symptoms that are responsible for diagnosing and treating patients with cancer.	U, Ap, An	5,6,7,8
CO-5	Learn various techniques involved in drug screening.	Ap, An	7,8

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: Biology of Cancer

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO	CO	PO	PSO	Cognitive	Knowledge	Lecture (L)	Practica

No.				Level	Category	/Tutorial (T)	l (P)
1	1	1,2,5,6	5, 6,7,8	U, An, Ap	C, P	L/T	
2	2	1,2,5,6	5,6,7, 8	U, An, Ap	C, P	L/T	
3	3	1,2,5,6	5,6,7,8	U, An, Ap	C,P	L/T	
4	4	1,2,5,6	5,6, 7,8	U, An, Ap	C, P	L/T	
5	5	1,2,5,6	4, 7,8	An, Ap	P		P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	-	-	-	-	3	3	2	3
CO 2	-	-	-	-	3	3	2	3
CO 3	-	-	-	-	3	3	2	3
CO 4	-	-	-	-	3	3	2	3
CO 5	-	-	-	3	1	1	3	3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	-	-	3	3	-
CO2	3	2	-	-	3	3	-
CO3	3	2	-	-	3	3	-
CO4	3	2	-	-	3	3	-
CO5	-	2	-	-			

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignments
- Internal Exam
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	End Semester Examinations
CO 1	✓	✓	✓
CO 2	✓	✓	✓
CO 3	✓	✓	✓
CO 4	✓	✓	✓
CO 5	✓	✓	

Mar Ivanios College (Autonomous)

Discipline	**ZOOLOGY**				
Course Code	MIUK8DSEZOO402.1				
Course Title	**TUMOUR IMMUNOLOGY AND MICROENVIRONMENT**				
Type of Course	**DSE**				
Semester	VIII				
Academic Level	400 - 499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-		4
Pre-requisites	Sound knowledge in molecular biology.				
Course Summary	This course is designed to provide students an understanding of the interplay between tumours and the immune system, as well as current therapies that use the immune system in the setting of oncology. The course will be broken up into four modules. The topics will cover basic immunology and tumor biology, will address the interplay between the immune system and tumors, and finally discuss current immunological therapies. At the conclusion of the course, participants should understand how the immune system functions, how immune system links with tumour progression.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Fundamentals of Tumor Immunology**	**10**
	1	Role of human immune system on cancer	2
	2	Mechanisms of the Immune Response to Cancer	2
	3	Adaptive immune response to cancer cells	2
	4	Role of gene rearrangement in the Immune Response	2
	5	Immunosurveillance	2
II		**Tumor Microenvironment**	**20**
	6	Immune cells in the tumor microenvironment	4
	7	Interactions between the tumor and infiltrating leukocytes	5
	8	The role of tumor cells in their local environment	5
	9	Inflammation and Cancer	3
	10	Immunomodulatory molecules of the immune system	3
III		**Mechanisms of Tumor Evasion**	**10**

	11	Introduction- Escaping the Immune Response	3
	12	Changes in Tumor Cells	3
	13	Changes in Cell Mediated Immune Response in Cancer	4
IV	**Cancer Immunotherapy**		**20**
	14	Cancer immunotherapy- Introduction, Types	**3**
	15	Cancer Vaccines	**3**
	16	Monoclonal antibody therapy of cancer	**3**
	17	Radioimmunotherapy	**3**
	18	Interferon therapy	**3**
	19	Adoptive cellular therapy for the treatment of cancer	**2**
	20	Checkpoint blockade and combinatorial immunotherapies	**2**
	21	Challenges and opportunities in immunotherapy	**1**

Reference:

1. Robert D. Schreiber (2024). Cancer Immunology Research- American Association for Cancer Research
2. Xianda Zhao and Subree Subramanian (2021). Cancer Immunology- MDPI Books
3. Lisa H. Butterfield, Howard L. Kaufman, Francesco M. Marincola (2021). Cancer Immunotherapy Principles and Practice- SITC

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand the significance of immunology in the context of cancer.	U, Ap	5,6,7,8
CO-2	Learn about interaction between various cellular components with tumour cells.	U, Ap	5,6,7,8
CO-3	Various mechanisms involved in successful evasion of tumour cells.	U, Ap	5,6,7,8
CO-4	Understand the various therapeutic approaches involved immunotherapy.	U, AP	5,6,7,8

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: Tumour immunology and Microenvironment

Credits: 4:0:0 (Lecture: Tutorial: Practical

CO No.	CO	PO	PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	1	1,2,5,6	5, 6,7,8	U,An, Ap	F, C	L/T	
2	2	1,2,5,6	5,6, 7, 8	U, An, Ap	F, C	L/T	
3	3	1,2,5,6	5, 6, 7,8	U, An, Ap	F, C	L/T	
4	4	1,2,5,6	5,6, 7,8	U, An, Ap	F, C	L/T	

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1	-	-	-	-	3	3	2	3
CO 2	-	-	-	-	3	3	2	3
CO 3	-	-	-	-	3	3	2	3
CO 4	-	-	-	-	3	3	2	3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	-	-	3	3	-
CO2	3	2	-	-	3	3	-
CO3	3	2	-	-	3	3	-
CO4	3	2	-	-	3	3	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/discussion/quiz/seminar/presentation
- Project Evaluation
- Internal Exam
- End semester exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓

MAR IVANIOS COLLEGE (AUTONOMOUS), THIRUVANANTHAPURAM
BOARD OF STUDIES IN ZOOLOGY, 2023 – 2026

No	Name	Designation
1.	Dr. MEERA GEORGE (Chairperson)	Assistant Professor & Head Dept. of Zoology, Mar Ivanios College, Thiruvananthapuram
2.	Dr. G. PRASAD (University Nominee)	Professor & Head Department of Zoology, University of Kerala
3.	Dr. K. G. MANJU	Professor, Dept. of Zoology, Mar Ivanios College, Thiruvananthapuram
4.	Dr. SUBOJ BABYKUTTY	Assistant Professor, Dept. of Zoology, Mar Ivanios College, Thiruvananthapuram
5.	Dr SUSAN KURIAN	Assistant Professor, Dept. of Zoology, Mar Ivanios College, Thiruvananthapuram
6.	Dr. LIJA L RAJU	Assistant Professor, Dept. of Zoology, Mar Ivanios College, Thiruvananthapuram
7.	Dr. ANUPRIYA SAMUEL	Assistant Professor, Dept. of Zoology, Mar Ivanios College, Thiruvananthapuram
8.	Dr. SNEHA CHANDRAN B K	Assistant Professor, Dept. of Zoology, Mar Ivanios College, Thiruvananthapuram
9.	Prof. Dr. SAJEEVAN T.P	Professor in Marine Biology, Department of Marine Biology, Microbiology and Biochemistry, Lakeside Campus, Cochin University of Science
10.	Dr. R. HARIKUMARAN NAIR	Professor, School of Biosciences Mahatma Gandhi University Kottayam, Kerala
11.	Dr. F. G. BENNO PEREIRA	Assistant Professor Department of Zoology University of Kerala Thiruvananthapuram
12.	Dr. MADHUSOODANAN U K	Associate Professor Department of Biochemistry Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST) Thiruvananthapuram
13.	Dr. RENJITH P. NAIR	Scientist C Department of Applied Biology Division of Thrombosis Research Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST) Thiruvananthapuram

14.	Mr. JAIDEEP KUMAR	Aquaculture consultant in Bapatla District, Andhra Pradesh. Aquaculture Outlook, Flat No. A3, Plot No. 1 Third Floor, Nahar Mathura Apartments, Sri Aadhi Varagha Puri, Thiruvidandhai, Chengalpattu District Chennai – 603112