

**MAR IVANIOS COLLEGE
(AUTONOMOUS)**



Affiliated with the University of Kerala

Thiruvananthapuram

Kerala

**SCHEME AND SYLLABUS FOR THE
FOUR YEAR UNDERGRADUATE PROGRAMME (FYUGP)**

BIOCHEMISTRY- Complimentary/ Minor

for

INTERDISCIPLINARY

BOTANY AND BIOTECHNOLOGY

(With effect from 2024 Admissions)

Approved by the Board of Studies in Biotechnology

LIST OF COURSES OFFERED IN BIOCHEMISTRY

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SEMESTER WISE DISTRIBUTION

Course code	Course Title	Course category	Credit	Hour distribution per week		
				L	T	P
SEMESTER – I Academic Level 100-149						
MIUK1DSCBCH100.1	Fundamentals of Biochemistry	DSC	4	3		2
MIUK1DSCBCH102.1	Food and nutritional Biochemistry	DSC	4	4		
MIUK1MDCBCH100.1	Life style diseases and management	MDC	3	3		
SEMESTER – II Academic Level 150-199						
MIUK2DSCBCH100.1	Biomolecule	DSC	4	3		2
MIUK2DSCBCH102.1	Clinical Biochemistry	DSC	4	4		
SEMESTER – III Academic Level 200-249						
MIUK3DSCBCH200.1	Metabolism	DSC	4	4		
MIUK3DSCBCH202.1	Enzymes and enzyme kinetics	DSC	4	3		2
SEMESTER – IV Academic Level 250-299						
MIUK4VACBCH200.1	Good laboratory Practices	VAC	3	3		
SEMESTER – VI Academic Level 350-399						
MIUK6SECBCH300.1	Methodologies in research and scientific writing	SEC	3	3		

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 Biotechnology 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 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, designed based on the Outcome Based Education (OBE) approach, follows the Choice-Based Credit System (CBCS), allowing students to select courses from a prescribed list and requiring a specified number of credits to earn a degree. It adheres to the basic framework and minimum/maximum course and program credits set by the University of Kerala for the Four Year Undergraduate Programme (FYUGP), complying with the mandatory principles of the UoK-FYUGP Regulations, 2024.

The Bachelor of Science Honours program in Botany and Biotechnology, where students' journeys are not just about learning but about preparing them for impactful careers and groundbreaking research in the field. Throughout this program, students will be equipped with the knowledge, skills, and hands-on experience necessary to excel in both professional roles and research endeavors within the biotechnology sector. Our curriculum is designed to provide a strong foundation in fundamental biotechnological concepts while also delving into the latest innovations and advancements shaping the industry. As students progress through the program, they will gain practical experience with state-of-the-art laboratory techniques, data analysis methods, and scientific communication skills. This hands-on approach ensures that students are not only familiar with theoretical concepts but also adept at applying them in real-world settings.

Moreover, our emphasis on interdisciplinary learning and integration of industry-relevant topics such as quality control and entrepreneurship development ensures that students are well-prepared to navigate the dynamic landscape of biotechnological careers. Whether students aspire to work in healthcare, agriculture, environmental conservation, or industrial biotechnology, our program equips them with the tools and knowledge to succeed. Furthermore, for those inclined towards research, our program offers opportunities to engage in meaningful research projects, collaborate with industry partners, and contribute to scientific advancements. Students will learn research methodology, scientific writing, and critical analysis skills that are essential for conducting impactful research studies. By the time students graduate from our program, they will not only have a solid foundation in biotechnology but also be ready to embark on rewarding careers or pursue further studies in research.

Adequate Discipline Specific Elective (DSE) specialisation courses will be provided in Molecular diagnostics and hence the students will be able to acquire 3 Year/4 Year (Honours) UG degree majoring in Botany and Biotechnology with specialisation in Molecular diagnostics.

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'être*, 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”.

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:

Programme Outcomes (PO)

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: <ul style="list-style-type: none">• 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: <ul style="list-style-type: none">• solve different kinds of problems in familiar and non-familiar contexts

	<p>both within and outside their disciplinary/ multidisciplinary areas of learning;</p> <ul style="list-style-type: none"> • 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.
<p>PO 3</p>	<p>Develop a profound environmental dedication by fostering ecological awareness and engaging in actions that promote sustainable development by achieving the ability to</p> <ul style="list-style-type: none"> • 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.
<p>PO 4</p>	<p>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:</p> <ul style="list-style-type: none"> • 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	<p>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:</p> <ul style="list-style-type: none"> • 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	<p>Develop research-related skills including the ability to conceptualize research hypotheses/projects and adopt suitable tools and methodologies for analysis with:</p> <ul style="list-style-type: none"> • 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;

	<ul style="list-style-type: none"> • 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
<p>PO7</p>	<p>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:</p> <ul style="list-style-type: none"> • 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 (PSO)

PSO 1: Deep Understanding of Biotechnological Principles: Graduates will demonstrate a comprehensive knowledge and understanding of fundamental principles and concepts in biotechnology including genetics, molecular biology, biochemistry, and microbiology.

PSO 2: Advanced Laboratory Skills: Graduates will possess advanced laboratory skills, including proficiency in molecular techniques, cell culture, bioinformatics, and bioprocessing, enabling them to conduct experiments, analyze data, and interpret results effectively.

PSO 3: Application of Biotechnological Solutions: Graduates will be able to apply biotechnological solutions to address real-world challenges in areas such as healthcare (e.g., disease diagnosis, drug development), agriculture (e.g., crop improvement, biofertilizers), environment (e.g., bioremediation, waste management), and industry (e.g., biopharmaceutical production, biofuel development).

PSO 4: Critical Thinking and Problem-Solving: Graduates will demonstrate critical thinking, analytical reasoning, and problem-solving skills, allowing them to assess complex biotechnological problems, propose innovative solutions, and make informed decisions based on scientific evidence.

PSO 5: Effective Communication and Collaboration: Graduates will effectively communicate scientific concepts, experimental findings, and research outcomes through written reports, oral presentations, and scientific publications. They will also demonstrate the ability to collaborate with multidisciplinary teams, engage in scientific discussions, and contribute to collaborative research projects.

PSO 6: Ethical and Professional Conduct: Graduates will adhere to ethical and professional standards in biotechnological research and practice, demonstrating integrity, respect for intellectual property rights, awareness of safety protocols, and responsibility towards societal and environmental impacts of biotechnology.

PSO 7: Graduates will analyse complex botanical problems, evaluate evidence, and formulate well-reasoned conclusions while upholding integrity and professionalism, acquiring plant knowledge for human health and wellness, addressing environmental challenges through sustainable practices, and demonstrating proficiency in plant practices.

Course and Credit Structure of FYUGP

The pathway preferably followed by the department will be interdisciplinary

INTERDISCIPLINARY MAJOR STRUCTURE FOR DOUBLE MAIN (CORE AND VOCATIONAL PROGRAMMES).

INTERDISCIPLINARY DOUBLE MAJOR STRUCTURE									
SEM	DSC (Credit 4)	DSE (Credit 4)	AEC (Credit 3)	SEC (Credit 3)	MDC (Credit 3)	VAC (Credit 3)	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 C-2		AEC (Eng)-3 AEC(OL)- 4		MDC-2			6	21
III	A-3 B-3 C-3	DSE A - 1			MDC (Kerala Studies)- 3	VAC-1		6	22
IV	A-4 B-4	DSE B- 2		SEC-1		VAC-2 VAC-3	Internship	6	23
V	A-5 A-6 B-5	DSE B- 3 DSE A- 4		SEC-2				6	23
VI	A-7 B-6 B-7	DSE A- 5 DSE B - 6		SEC-3				6	23
Total		6	4	3	3	3	1*	36	133
EXIT OPTION AVAILABLE AND STUDENTS WILL BE AWARDED UG DEGREE WITH A MAJOR IN A and B									
VII	A-8 B-8 A/B- A/B A/B	DSE -7 A/B						6	24
VIII	MOOC courses A -9 B -9						Research Project/ Internship /Project or 03 courses -12C	2+1**/3***	20
Total		7	4	3	3	3	1*+1**/ 3***	44+1* + 1**/3***	177

A – Major Discipline ,B – Major Discipline,C – Complementary

* - 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 (Formative) - 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 (Formative) - 5 % of the total
 - Discipline specific formative assessment - 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	CCA (40%)	ESE		

3 credit courses	e	l	e	l	SA (50%)	FA (50%)	(70%)	SA (50%)	FA (50%)	(60%)
	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
<i>P (Pass)*</i>	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 j^{th} semester,

C_{ij} is the number of credits for the i^{th} course in the j^{th} semester, and

G_{ij} is the the grade point scored by the student in the i^{th} course in the j^{th} semester.

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 i^{th} semester and

$\sum C_i$ is the total number of credits in the i^{th} 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, a 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 for rounding off numbers may be adopted as per decisions of the Academic Council.

Dr. Lini N
Chairman
BoS (Biotechnology)
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(Autonomous),
Thiruvananthapuram

Thiruvananthapuram
19-05-2024



Mar Ivanios College (Autonomous)

Discipline	BIOCHEMISTRY				
Course Code	MIUK1DSCBCH100.1				
Course Title	FUNDAMENTALS OF BIOCHEMISTRY				
Type of Course	DSC1				
Semester	1				
Academic Level	100-149				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	Students should have a basic understanding of Biology and Chemistry.				
Course Summary	This course is designed to provide students with basic awareness about the concepts and physical aspects in biochemistry and to develop analytical skills in students in order to prepare them to use instruments.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I	Dissociation of water, weak acids and buffer action		8
		Structural features of water molecule, dissociation of water, ionic product of water, acids and bases, concepts of pH, pOH, theoretical calculations of pH and pOH, dissociation of weak acids ,	
		buffers buffer action and buffer capacity, buffers in biological	

	system,	
	Henderson – Hasselbalch equation, titration curve of weak acids, simple numerical problems involving application of this equation.	
II	NORMALITY, MOLARITY, MOLALITY, DIFFUSION, OSMOSIS AND TONICITY	8
	Solutions: Meaning of normality, molality, molarity, percentage solution, mole fraction, parts per million, simple numerical problems from the above.	
	Fundamental principles of diffusion, osmosis, osmotic pressure, Vant Hoff's laws of osmotic pressure, simple numerical problems	
	Definition of isotonic, hypotonic and hypertonic solutions, biological importance of osmosis, surface tension, viscosity.	
III	Colloids and Emulsions	8
	Colloids: Definition of true solutions, suspensions, colloids and crystalloids, distinction between lyophilic and lyophobic colloids, properties of colloids, biological significance of colloids	
	Emulsions and emulsifying agents, Donnan membrane equilibrium, Donnan equation and its significance.	
IV	Energetics	8
	Thermodynamics: Laws of conservation of energy _ first and second laws and its relevance in biological system, entropy and enthalpy, Gibbs free energy.	
	Bioenergetics- endothermic and exothermic reactions of biological systems. Energy change in biochemical reactions. Sources of heat limits of temperature, heat dissipation and conservation.	
V	Photosynthesis	5
	Primary events in photosynthesis- light-harvesting pigments, resonance energy transfer in photosynthetic pigments	
	Fluorescence and phosphorescence, absorption spectra and action spectra of photosynthetic pigments.	
	Intra and intermolecular interactions in biomolecules	8
VI	Bio-organic chemistry: (Common functional groups and their significance in biomolecules – OH, -SH, -CHO, -C=O, -COOH, -NH ₂ , -NH.	

		Intra and Intermolecular interactions in biological system: Hydrogen bond, Covalent bond, hydrophobic interaction, disulphide bond, Peptide bonds, glycosidic bond, Phosphodiester linkage, Watson-Crick base pairings, Vander Wall's force.	
		Practicum	30
VII		Weighing in Chemical balance •Preparation of solutions -percentage, molar & normal solutions, dilution from stock solution etc. Demonstration of dialysis Demonstration of PAGE Demonstration of Paper Chromatography Demonstration of Thin Layer Chromatography Colorimetry and Spectrophotometry techniques Verification of Beer Lambert's law Verification of molar extinction coefficient of any known compound	

References:

1. Physical Biochemistry by David Freifelder Publisher: W.H. Freeman & Co Ltd (September 1976)
2. A Biologist's Guide to Principles and Techniques of Practical Biochemistry by Bryan L. Williams, Keith Wilson Hodder Education,
3. Principles and Techniques of Practical Biochemistry by Keith M. Wilson, John M. Walker Cambridge University Press.
4. The Tools of Biochemistry by Cooper, T. G. 1977. Publisher: John Wiley & Sons
5. Biophysical Chemistry Principles & Techniques Handbook (2003) by Avinash Upadhyay, Kakoli Upadhyay, Nirmalendu Nath Publisher: Himalaya Publishing House.
6. Hawk's Physiological Chemistry, Bernard L. Oser (ed) TATA McGraw Hill Publishing Company LTD, New Delhi p 10- 15.
7. Experimental Biochemistry: A Student Companion, Beedu Sasidhar Rao & Vijay Deshpande, I.K International Pvt. LTD, New Delhi.
8. Introductory Practical biochemistry, S. K. Sawhney & Randhir Singh (eds) Narosa Publishing House, New Delhi.
9. Fundamentals of Biochemistry by J. L. Jain, Sunjay Jain and Nitin Jain (2008) Publishers: S. Chand & Co Ltd.
10. Text Book of Medical Biochemistry by MN Chatterjea and R Shinde, 3rd edition, JAYPEE Publishers, New Delhi.
11. Introduction to Biophysics by Pranab Kumar Banerjee (2008) Publishers: S. Chand & Company ltd ISBN: 81-219-3016-2.
12. Biochemistry: A Students survival Guide by Hiram. F. Gilbert (2002) Publishers:

Course Outcomes

No.	Upon completion of the course, the graduate will be able to	Cognitive Level	PO/PSO addressed
CO-1	Understand the dissociation of water, weak acids and action of buffers.	U, An	PSO-1 PO-1,2
CO-2	Differentiate Normality, molarity and molality, Diffusion and Osmosis, Isotonic, hypotonic and hypertonic solutions.	U, An	PSO-1,4 PO-1,2
CO-3	Compare colloids, emulsions and their significance	U, An	PSO-1,4 PO-1,2
CO-4	Discuss laws of thermodynamics and compare reactions of biological systems.	R, U, An	PSO-1,4 PO-1,2
CO-5	Describe the events in photosynthesis and contrast fluorescence and phosphorescence	R, U, An	PSO-1,4 PO-1,2
CO-6	Identify the intra and intermolecular interactions in biomolecules	U, An	PSO-1,4 PO-1,2
CO-7	Hands on training in using chemical balance, preparation of solutions, measurement of absorption using spectrophotometry techniques and familiarization of dialysis technique, PAGE and chromatographic technique.	U, Ap	PSO-1,2,3 PO-1,2,5,6

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

Note: 1 or 2 COs/module

Name of the Course: Credits: 4:0:0 (Lecture: Tutorial: Practical)

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

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

Mapping of COs with PSOs and POs:

CO's	Programme Specific Outcomes (PSO)					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	-	-	1	-	-
CO2	2	-	-	1	-	-
CO3	2	-	-	1	-	-
CO4	2	-	-	1	-	-
CO5	2	-	-	1	-	-
CO6	2	-	-	1	-	-
CO7	2	2	1	-	-	-
Average	2	2	1	1	-	-

CO's	Programme Outcomes						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	2	1	-	-	-	-	-
CO2	2	1	-	-	-	-	-
CO3	2	1	-	-	-	-	-
CO4	2	1	-	-	-	-	-
CO5	2	1	-	-	-	-	-
CO6	2	1	-	-	-	-	-
CO7	2	1	-	-	1	3	-
Average	2	1	-	0	1	3	-

Correlation Levels:

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

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final 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	BIOTECHNOLOGY				
Course Code	MIUK1DSCBCH102.1				
Course Title	FOOD AND NUTRITIONAL BIOCHEMISTRY				
Type of Course	DSC 2				
Semester	11				
Academic Level	100 -149				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4			
Pre-requisites	A basic understanding of human biology and a fundamental knowledge of nutrition concepts are recommended as prerequisites for this course.				
Course Summary	This course delves into the essential nutrients required for human health, covering macronutrients, micronutrients, and their dietary sources. Additionally, it explores the role of food in preventing lifestyle disorders, the impact of nutrition on mental health, and public health issues related to nutrition and social health problems. Practical sessions will reinforce theoretical concepts through hands-on experiences in nutritional assessment and analysis.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I	Introduction to Nutrients and Health		15
	1.	Nutrients - Definition, Types and Functions.	
	2.	Macronutrients and Micronutrients - Basis of Classification and their Significance.	
	3.	List of Nutrient-rich foods and their corresponding calories.	
	4.	Recommended Dietary Allowance (RDA) and Body Mass Index (BMI) - definition and calculation.	
	5.	Diet- healthy diet, Low carbohydrate diet, Balanced Diet- Food plate/ Eat well plate.	
	6.	Impact of Vegetarian and Non-vegetarian diet on health.	
	7.	Protein-rich foods - Sources, Benefits and Side effects.	

	8.	Minerals - Sources and Functions.	
	9.	Vitamins - Sources and Functions.	
	10	Water and Dietary Fibres - Functions, Impact on health.	
II	Food as Functional Medicines - Nutraceuticals		15
	11	Nutraceuticals - Definition, Examples, New Concepts - an overview.	
	12	Definitions of Prebiotics, Probiotics and Synbiotics and their Significance in human and animal health.	
	13	The Giants of Functional Foods - Soy, Nuts, Seeds and Mushrooms.	
	14	Phytochemicals - Definition and Importance; Conventional foods & Organic foods.	
	15	Role of Coffee, Chocolate, Tea on Health - advantages and disadvantages.	
	16	Effect of Nutrient pigments - Carotenoids, Lycopene and Curcumin on health.	
	17	Food Quality Assurance in Nutraceuticals.	
	III	Nutritional effects on Life Style Disorders and Mental Health	
18		Obesity - causes, consequences and management.	
19		Diabetes and Cardiovascular Disorders – Nutritional Strategies for the prevention and management of Type II Diabetes.	
20		Recent approaches to prevent heart diseases: Factors to maintain a Healthy Heart; Nutritional effects on Blood Pressure.	
21		Nutritional influences on Mental Health- General Concepts.	
22		Dietary interventions for mood disorders - Omega 3 fatty acids and antioxidants.	
23		Effect of Diet and Nutrition in Children with Autism Spectrum Disorders (ASD).	
24		Impact of Aging on eating behaviours and nutrition.	
IV	Nutrition and Public Health		10
	25	Social Health Problems & its impact on nutrition - Smoking, Alcoholism and Drug Addiction – A brief overview.	
	26	Nutritional deficiency Diseases - Vitamin deficiencies, Mineral deficiencies, and Protein deficiencies (brief outline study only).	
	27	Food Safety- basic concepts of HACCP, Food additives-types and effects on health, Food security-concepts and factors affecting food security, Standards and Regulatory authorities (PFA, FPO, MPO, FSSAI, ISI, BIS, AGMARK)	
V	Nutritional Profiling of Principal Foods		5
	28	Nutritional profiling of plant foods such as Cereals, Rice, Wheat, Maize, Millets, Pulses, Vegetables, Nuts, Sugar, and Jaggery; Animal foods: Milk and milk products, Egg,	

	Fish and Meat.	
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References:

1. Vidya, C. and D. Bhaskara Rao: *A text book of Nutrition*, Discovery publishing house, New Delhi- 110 002.
2. S. R. Thimmaiah: *Standard methods of biochemical analysis*, Kalyani publisher, New Delhi.
3. M. Swami Nathan: *Handbook of food and nutrition*, The Bangalore printing and publishing Co. Ltd., Bangalore.
4. Sumati R. Mudambi and M.V. Rajgopal: *Fundamentals of Foods, Nutrition and Diet Therapy*, New Age International Publication.
5. B Srilakshmi: *Nutrition Science*, New Age International Publication.
6. B Srilakshmi: *Dietetics*, New Age International Publication.
7. Sunetra Roday: *Food Science and Nutrition*.
8. Kumud Khanna, Sharda Gupta, Santosh Jain Passi, Rama Seth, Ranjana Mahna and Seema Puri : *Textbook of Nutrition and Dietetics*.
9. Pooja Verma: *Food and Nutritional Science*.
10. Sumati R. Mudambi, Shalini M. Rao and M. V. Rajgopal: *Food Science*, New Age International Publication
11. Gopalan, C., Ramasastri, B.V. and Balasubramanian, S.C. (1982) *Nutritive Value of Indian Foods: National Institute of Nutrition. Indian Council of Medical Research, Hyderabad.*
12. Mills, C.D. (2020). *Food: Nutrition, packaging, waste and safety*. Nova Science Publishers, Inc.
13. National Institute of Mental Health. (2020). The Teen brain: 7 things to know. <https://www.nimh.nih.gov/health/publications/the-teen-brain-7-things-to-know>
14. Rolfes, S. R., Pinna, K., & Whitney, E. N. (2012). *Understanding normal and clinical nutrition*. 9th ed. Belmont, CA, Wadsworth, Cengage Learning.
15. Joshi, S. A. (2002). *Nutrition and dietetics*. McGraw-Hill Education.
16. Mohan, S., Abdollahi, S., & Pathak, Y. (Eds.). (2023). *Applications of Functional Foods and Nutraceuticals for Chronic Diseases: Volume I*. CRC Press.
17. Anish, T. S., & Sreelakshmi, P. R. (2013). *Revisiting public health challenges in the new millennium*. *Annals of medical and health sciences research*, 3(3), 299-305.
18. Saini, A., Malik, A., Kumar, M., & Bhatt, S. (2020). *Nutraceuticals are for healthy life*. *International Journal of Scientific & Technology Research*, 9(2), 150-162

No.	Upon completion of the course, the graduate will be able to	Cognitive Level	PO/ PSO Addressed
CO-1	Analyze the classification, functions, and dietary sources of essential nutrients, including macronutrients, micronutrients, vitamins, minerals, and water, to develop personalized	U	PO 1 PSO 1

	dietary recommendations.		
CO-2	Evaluate the impact of different dietary patterns, such as vegetarian and non-vegetarian diets, on overall health and well-being, considering factors like protein intake, nutrient balance, and potential side effects.	U, E	PO 1 PSO 1, 3
CO-3	Examine the role of functional foods and nutraceuticals in promoting health, including the definitions and significance of prebiotics, probiotics, synbiotics, and phytochemicals found in conventional and organic foods.	U, E	PO 1 PSO 1, PSO 4
CO-4	Investigate the relationship between nutrition and lifestyle disorders like obesity, diabetes, and cardiovascular diseases, developing strategies for prevention and management through dietary interventions and healthy eating habits.	U, Ap	PO 1,2 PSO 1, PSO 3
CO-5	Assess the influence of diet and nutrition on mental health, exploring the impact of nutrients like omega-3 fatty acids and antioxidants on mood disorders and cognitive function.	U	PO 1,2 PSO 1
CO-6	Critically analyze public health issues related to nutrition, including nutritional deficiencies, social health problems like smoking, alcoholism, and drug addiction, and the importance of food quality assurance in promoting overall well-being and disease prevention.	Ap	PO 1,2 PSO3

Course Outcomes

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

Note: 1 or 2 COs/module

Name of the Course: Credits: 4:0:0 (Lecture:Tutorial:Practical)

CO No.	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	PO 1, PSO 1	U, An	C	L	
CO-2	PO 1 PSO 1, 3	U, E	F, C	L	

CO-3	PO 1 PSO 1, 3, 4	U, Ap	C	L	
CO-4	PO 1, 2 PSO 1, 3	U	C	L	
CO-5	PO 1, 2 PSO 1, 2	U, Ap	C	L	
CO-6	PO 1, 2 PSO1, 2, 4	Ap	P	L	

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

Mapping of COs with PSOs and POs:

CO's	Programme Specific Outcomes (PSO)					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	1	-	-	-	-
CO2	3	3	-	-	-	-
CO3	3	-	1	1	-	-
CO4	3	-	2	-	-	-
CO5	1	1	-	-	-	-
CO6	1	1	-	3	-	-
Average	2.3	1.5	1.5	2	0	0

CO's	Programme Outcomes						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	1	-	-	-	-	-	-
CO2	1	-	-	-	-	-	-
CO3	1	-	-	-	-	-	-
CO4	1	2	-	-	-	-	-
CO5	1	2	-	-	-	-	-
CO6	1	2	-	-	-	-	-
Average	1	2	-	-	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low

2	Moderate Medium	/
3	Substantial High	/

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final 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	BIOTECHNOLOGY				
Course Code	MIUK1MDCBCH100.1				
Course Title	LIFE STYLE DISEASE AND MANAGEMENT				
Type of Course	MDC 1				
Semester	I				
Academic Level	100-149				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 hours			3
Pre-requisites	Basic knowledge of human anatomy, physiology, and public health principles				
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		9
	1	Concept of lifestyle diseases, Non Communicable diseases and different types.	
	2	Importance of lifestyle factors in preventing disease development.	
	3	Medical, Physical, nutritional, Psycho-social and behavioural aspects of health.	
	4	Healthy habits- diet, Yoga & meditation, exercise and unhealthy habits- smoking, alcohol, Addiction to technology (Brief description only).	
II	Major life style diseases		9
	5	Diabetes- Type 1 and Type2, characteristics, causes, diagnosis, prevention and management (diet, exercise, drugs)	
	6	Obesity - Body mass index, - factors leading to obesity, prevention and management.	
	7	Atherosclerosis and cardiovascular diseases- Myocardial infarction, congestive heart failure, ischemic diseases-Causes, diagnosis and management	
	8	Mental health and happy hormones. Methods to improve mental wellbeing.	
III	Cancer as lifestyle disease		9

	9	Cancer: Characteristics, types, Causes, Diagnosis -screening, blood test, Xray, CT Scan & endoscopy brief description	
	10	Prevention-dietary , medication, vaccination, screening-outline only	
	11	Management- surgery, chemotherapy, radiation, palliative care-brief outline	
IV	Physical Activity and Public Health Approaches		9
	12	Benefits of exercise for health, Exercise prescription for different populations, Incorporating physical activity into daily life	
	13	Public Health Approaches to Lifestyle Diseases,Population-based interventions Health promotion campaigns ,Policy initiatives and advocacy	
V	Lifestyle Modification Techniques		9
	14	Motivational interviewing, Behavior change theories and models Goal setting and action planning	

Suggested Readings

1. Lifestyle Diseases., By Surendra G Gattani., 2017., Publisher: NiraliPrakashan.
2. Guide to Prevention of Lifestyle Diseases., M. Kumar and R. Kumar., 2005., Deep & Deep publications Pvt.Ltd.

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-1
CO-2	List and define various life style associated diseases.	R, U	PSO-1
CO3	Understand cancer as a life style disease and can create an awareness on its prevention and management	U, C	PSO-1,4
CO 4	Discuss the significance of physical activity in daily life and public health approaches to life style diseases.	U, E	PSO 1,4
CO5	Build and Practice healthy habits. Develop skills for the management of life style diseases.	Ap, C	PSO- 1,4

3. A Lifetime of Health Lifestyle Diseases., Holt, Rinehart and Winston Staff., 2004., Publisher: Holt McDougal.
4. Preventing Insidious Lifestyle Diseases. 2022., K V RAMANI HEMLATHA RAMANI, GUNJAN Y TRIVEDI VISHWANATHAN P, LAKSHMI M and ANITA VERMA., Publisher: BOOKVENTURE.
5. Yoga for Lifestyle Diseases., 2017., Dr. A. Banerjee., Publisher: Sports Publication.

Course Outcomes

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create
 Note: 1 or 2 COs/module

Name of the Course: Credits: 4:0:0 (Lecture:Tutorial:Practical)

CO No.	CO	PO/P SO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Create an awareness on global health issue.	PO-1 PSO-1	U, E	C, M	L	
CO-2	List and define various life style associated diseases.	PO-1 PSO-1	R, U	F, C	L	
CO3	Understand cancer as a life style disease and can create an awareness on its prevention and management	PO-1, 2 PSO-1,4	U, C	C, M	L	
CO 4	Discuss the significance of physical activity in daily life and public health approaches to life style diseases	PO-1, 2 PSO- ,4	U, E	F,C	L	
CO5	Build and Practice healthy habits and develop skills for the management of life style diseases.	PO-1, 2 PSO-1,4	Ap, C	C,M	L	

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

Mapping of COs with PSOs and POs:

CO's	Programme Specific Outcomes (PSO)
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	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	-	-	-	-	-
CO2	2	-	-	-	-	-
CO3	2	-	-	1	-	-
CO4	2	-	-	1	-	-
CO5	2	-	-	1	-	-
Average	2	-	-	1	0	0

CO's	Programme Outcomes						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	2	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-
CO4	2	2	-	-	-	-	-
CO 5	2	2					
Average	2	2	-	-	-	-	-

Correlation Levels:

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

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final 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	BIOTECHNOLOGY				
Course Code	MIUK2DSCBCH100.1				
Course Title	BIOMOLECULES				
Type of Course	DSC 3				
Semester	II				
Academic Level	150 -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 in Biology and Chemistry				
Course Summary	This course on Biomolecules provides a comprehensive study of carbohydrates, lipids, amino acids and proteins, nucleic acids, and enzymes. Students will explore the structures, properties, classifications, and functions of biomolecules, along with their qualitative analysis techniques. Practical sessions will reinforce theoretical concepts through experiments related to biomolecular analysis.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I	Carbohydrates		10
	1.	Definition and Classification of Carbohydrates	
	2.	Optical isomerism, D- and L- series, Epimers	
	3.	Aldoses and Ketoses, Structural relationships of Aldoses, Structure of Reference Carbohydrate	

	4.	Ring Structure of Monosaccharides, Anomers, Mutarotation	
	5.	Disaccharides, structure and important properties of sucrose, maltose, isomaltose, lactose and trisaccharide (examples only). Inversion of Sugar.	
	6.	Polysaccharides- Definition and Classification of Polysaccharides. Properties, Structure and Functions of Starch, glycogen, cellulose, and chitin.	
	7.	Qualitative test for carbohydrates-brief study.	
II	Lipids		10
	8.	Definition and Classification of Lipids	
	9.	Fatty acids- Properties and Structure, Sources and effects of Saturated and Unsaturated Fatty acid intakes; Essential Fatty acids	
	10.	Triglycerides- general structure and properties of triglycerides, glycerol- acrolein test	
	11.	Phospholipids- structure and function of phosphatidyl choline and phosphatidyl ethanolamine	
	12.	Sphingolipids- function of cerebrosides and gangliosides	
	13.	Steroids- structure of cholesterol and ergosterol. Colour reactions of sterols- brief study	
III	Amino Acids and Proteins		15
	14.	Definition of Amino acids and proteins, classification & properties of Amino acids-optical activity, UV absorption, Zwitterions	
	15.	Ninhydrin reactions of Amino acids and Colour reactions for specific Amino acids	
	16.	Classification of Proteins- Fibrous, Globular and Conjugated proteins	
	17.	Biological Significance of Proteins, Properties of proteins- Solubility, Isoelectric points, Denaturation of Proteins	
	18.	Elementary Study of Primary, Secondary, Tertiary, Quaternary structure of Proteins; Oligopeptides- Glutathione; Structure and Functions of Hemoglobin	
	19.	Qualitative reactions and colour reactions of Proteins	

IV	Nucleic Acids and Enzymes	10
	20. Nucleic acids- Base compositions, Structure of Purines and Pyrimidines, Ribose and Deoxyribose: Nucleoside and Nucleotide – structure	
	21. Polynucleotide- Structure of DNA (Watson and Crick double helix model); RNA – types, properties and primary structure	
	22. Enzymes- Definition and Classification, Units of enzyme activity, progress curve, effect of enzyme	
V	Practicum	30
	23. Qualitative analysis of Amino acids and Proteins Amino acids (Any 4 amino acids) .T Tests for amino acids: Solubility, ninhydrin reaction, xanthoproteic reaction, Millons test, Morners test, glyoxalic acid test, Ehrlich’s test, nitroprusside test, lead acetate, test for methionine, aldehyde test, Sakaguchi reaction and isatin test.	
	24. Tests for proteins: Solubility, Ninhydrin reaction, Xanthoproteic reaction, Folin’s test, Lowry’s test, Biuret test, Heat denaturation, TCA precipitation, Alcohol precipitation.	
	25. Demonstration of 1. Urease/Trypsin 2. Kinetics of Urease / Trypsin (Effect of pH, substrate Concentration, enzyme concentration and temperature) 3. Progress curve of Urease/Trypsin 4. Digestion of carbohydrates –action of salivary amylase	

References:

1. Beedu Sasidhar Rao & VijayDeshpande, Experimental Biochemistry: A Student Companion, I.K International Pvt. LTD, New Delhi.
2. S. K. Sawhney & Randhir Singh 2001, Introductory Practical biochemistry, (eds) Narosa Publishing House, New Delhi.
3. S. K. Thimmaiah, Standard Methods of Biochemical Analysis, (ed), Kalyani Publishers, Ludhiana ISBN 81-7663-067-5.

Course Outcomes

No.	Upon completion of the course, the graduate will be able to	Cognitive Level	PSO Addressed
CO-1	Analyze the structural diversity and classification of carbohydrates, lipids, amino acids, proteins, nucleic acids, and enzymes	U, An	PSO 1
CO-2	Apply qualitative analysis techniques to identify biomolecules such as amino acids and proteins	U, Ap, E	PSO 1,3
CO-3	Evaluate the biological significance and properties of biomolecules, including solubility, optical activity, and specific reactions	U, E	PSO1, 4
CO-4	Demonstrate an understanding of the primary, secondary, tertiary, and quaternary structures of proteins, along with the structure of nucleic acids and enzymes	U, Ap	PSO1
CO-5	Utilize practical skills to conduct qualitative tests, interpret experimental results, and apply biochemical principles in laboratory settings	Ap, E	PSO1, 2,3

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

Note: 1 or 2 COs/module

Name of the Course: Credits: 4:0:0 (Lecture:Tutorial:Practical)

CO No.	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	PO 1,2,5,6 PSO 1	U, An	C	L	
CO-2	PO 1,2,3,5,6,7, PSO 1,3,	U, E	F, C	L	
CO-3	PO 1,2,3,5,6,7 PSO1, 4	U, Ap	C	L	

CO-4	PO 1,2,3,4,5,6,7 PSO1	U,	C	L	
CO-5	PO 3,4,7 PSO-1,2,3	Ap	P, M		P

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

Mapping of COs with PSOs and POs:

CO's	Programme Specific Outcomes (PSO)					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	-	-	-	-	-
CO2	2	-	1	-	-	-
CO3	2	-	-	1	-	-
CO4	2	-	-	-	-	-
CO5	2	3	1	-	-	-
Average	2	3	1	1	0	0

CO's	Programme Outcomes						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	2	1	-	-	2	1	-
CO2	2	1	2	-	2	1	2
CO3	2	1	2	-	2	1	2
CO4	2	1	2	1	2	1	2
CO5	-	-	2	1	-	-	2
Weighted Average	2	1	2	1	2	1	2

Correlation Levels:

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

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final 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	BIOTECHNOLOGY				
Course Code	MIUK2DSCBCH102.1				
Course Title	CLINICAL BIOCHEMISTRY				
Type of Course	DSC4				
Semester	11				
Academic Level	150-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-		4
Pre-requisites	Students should have a basic understanding of biology and chemistry, including knowledge of biological fluids and their constituents, laboratory procedures, safety measures, and clinical sample handling.				
Course Summary	This course covers the fundamental aspects of Clinical Biochemistry, including the definition and scope, collection and preservation of biological fluids, normal ranges of important constituents, and safety measures in clinical laboratories. It delves into the clinical significance of biomolecules such as carbohydrates, lipids, and proteins, as well as paediatric clinical biochemistry focusing on neonatal diseases, therapeutics, and health management. Additionally, it includes pharmaceutical biochemistry topics like pharmacology principles, drug discovery, drug receptors, molecular docking, targeted drug delivery, and drug toxicity testing.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I	Clinical Biochemistry		15
	1.	Definition and Scope of Clinical Biochemistry in medical diagnosis	
	2.	Biological fluids - Blood, Urine and CSF - Collection and Preservation	
	3.	Normal range of important constituents in biological fluids	
	4.	Basics of setting up a Clinical Laboratory - collection of samples, preservation and handling of clinical samples	
	5.	Safety Measures in Clinical Laboratory	
II	Clinical Significance of Biomolecules		15
	6.	Carbohydrates- Glucose- Estimation- Fasting and Random Glucose, Glycosuria, GTT- Hyper & Hypoglycemia, Blood Glucose Regulation, Diabetic coma	
	7.	Lipids – Lipid Profile Estimation, Risk factors and Disorders related to Abnormal Lipid levels	
	8.	Proteins-Blood proteins, Abnormal levels of Protein and Disease conditions, Bence Jones Protein, Proteins in CSF and their estimations	
	9.	Brief study (only two disorders in each case) on Electrolyte and Respiratory disorders, disorders of Hepatobiliary system, Kidney function disorders, Cardiovascular disorders	
III	Paediatric Clinical Biochemistry		15
	10.	Neonatology-definition, features; Therapeutics- Principles of Paediatric therapeutics- drug doses, specific choice of antibiotics; Neonatal diseases and genes- Cystic fibrosis, Down Syndrome, Werner syndrome, Fragile X syndrome, Zellweger syndrome	
	11.	Special problems in paediatrics- Respiratory distress syndrome, neonatal hyperbilirubinemia, cystic fibrosis, neuroblastoma (VMA, HVA); Neonatal health management; Vaccination in new born babies; Recommended Immunization schedule.	
IV	Pharmaceutical Biochemistry		15

12.	Introduction to Pharmacology- General principles, Drug discovery and developmental process; Pharmacokinetic principles and pharmacodynamic principles (brief study)
13.	Structural effects on Biological action, Targeted drug delivery ; Role and types of chemical bonding interactions between drug and target, chirality of drugs, outline study of metabolic pathways of selected common drugs (maximum –four drugs only)
14.	Drug toxicity testing- <i>in vitro</i> and <i>in vivo</i> –a brief introduction to clinical trial types

References:

1. William, J., & Marshall, L. (2014). *Clinical Biochemistry: Metabolic and Clinical Aspects*. Elsevier Health Sciences UK.
2. Walsh, G. (2013). *Biopharmaceuticals: biochemistry and biotechnology*. John Wiley & Sons.
3. Meisel, H. (1997). Biochemical properties of bioactive peptides derived from milk proteins: potential nutraceuticals for food and pharmaceutical applications. *Livestock Production Science*, 50(1-2), 125-138.
4. Ahmed, N. (Ed.). (2017). *Clinical biochemistry*. Oxford University Press.
5. Burtis, C. A., & Bruns, D. E. (2014). *Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics-E-Book: Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics-E-Book*. Elsevier Health Sciences.
6. Rifai, N. (2017). *Tietz Textbook of Clinical Chemistry and Molecular Diagnostics: Tietz Textbook of Clinical Chemistry and Molecular Diagnostics-E-Book*. Elsevier Health Sciences.
7. Gaw, A., Murphy, M., Srivastava, R., Cowan, R. A., & O'Reilly, D. S. J. (2013). *Clinical Biochemistry E-Book: An Illustrated Colour Text*. Elsevier Health Sciences.
8. Gibaldi, M. (1991). *Biopharmaceutics and clinical pharmacokinetics. (No Title)*.
9. Notari, R. E. (1971). *Biopharmaceutics and pharmacokinetics*.
10. Katzung, B. G., Masters, S. B., & Trevor, A. J. (Eds.). (2004). *Basic & clinical pharmacology*.

Course Outcomes

No.	Upon completion of the course, the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand the definition and significance of clinical biochemistry in medical diagnosis.	F,U	PSO1
CO-2	Analyze the clinical relevance of biomolecules like carbohydrates, lipids, and proteins, including their normal ranges and estimation methods.	U,An	PSO1, 4
CO-3	Evaluate pediatric clinical biochemistry concepts, focusing on neonatal diseases, genetic disorders, and therapeutic principles.	R, U,An, E	PSO1, 4
CO-4	Comprehend fundamental pharmacology principles, drug discovery processes, and pharmacokinetic/pharmacodynamic principles.	R, Ap,E	PSO1, 4
CO-5	Analyze drug-receptor interactions, targeted drug delivery techniques, and chemical bonding interactions in drug action.	U,An,	PSO1, 4

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

Note: 1 or 2 COs/module

Name of the Course: Credits: 4:0:0 (Lecture:Tutorial:Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Understand the definition and significance of clinical biochemistry in medical diagnosis.	PO 1 PSO 1	U	C	L	
CO-2	Analyze the clinical relevance of biomolecules like carbohydrates, lipids, and	PO 1,2 PSO 1,4	U, An, E	F, C	L	

	proteins, including their normal ranges and estimation methods.					
CO-3	Evaluate paediatric clinical biochemistry concepts, focusing on neonatal diseases, genetic disorders, and therapeutic principles.	PO 1,2 PSO 1, 4	U, Ap	C	L	
CO-4	Comprehend fundamental pharmacology principles, drug discovery processes, and pharmacokinetic/ pharmacodynamic principles.	PO 1,2 PSO 1, 4	U,	C	L	
CO-5	Analyze drug-receptor interactions, targeted drug delivery techniques, and chemical bonding interactions in	PO 1,2 PSO 1,4	U, Ap	C	L	

	drug action.					
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F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

CO's	Programme Specific Outcomes (PSO)					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	-	-	-	-	-
CO2	2	-	-	2	-	-
CO3	2	-	-	2	-	-
CO4	3	-	-	2	-	-
CO5	3	-	-	2	-	-
Average	2.6	0	-	2	0	0

Mapping of COs with PSOs and POs:

CO's	Programme Outcomes						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	-	-	-	-	-	-
CO 2	2	2	-	-	-	-	-
CO 3	2	2	-	-	-	-	-
CO 4	3	2	-	-	-	-	-
CO 5	3	2					

Average	2	2	-	-	-	-	-
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Correlation Levels:

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

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final 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	BIOTECHNOLOGY				
Course Code	MIUK3DSCBCH200.1				
Course Title	METABOLISM				
Type of Course	DSC5				
Semester	III				
Academic Level	300-349				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-		4
Pre-requisites	Basic knowledge in Biology and Chemistry				
Course Summary	The course aims at providing an overview of energy production by explaining the general principles of cellular energy metabolism and schematizing the different metabolic pathways.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I	Metabolism of Carbohydrates		15
	1.	Glycolysis- Reactions, fate of pyruvate, regulation of glycolysis.	
	2.	Gluconeogenesis-reaction pathway, reciprocal regulation of gluconeogenesis and glycolysis.	
	3.	Citric acid cycle, Cori's cycle. Pentose Phosphate Pathway- reactions, biological significance regulation of pathway.	

	4.	Glycogen metabolism- glycogenesis, glycogenolysis, Regulation of glycogen metabolism- allosteric and hormonal regulation. (Only pathway outlines, structures not required).	
	5.	Outline study of all metabolic pathway associated with diabetes	
II	Metabolism of Lipids		15
	6.	Composition and Functions of Bile, Enterohepatic circulation (outline study).	
	7.	Scheme of β - oxidation, ATP yield in β oxidation (stearate & palmitate as examples) regulation. Basics of α - and ω -oxidation, ketone body formation.	
	8.	Cytoplasmic system of fatty acid biosynthesis and regulation of the pathway.	
	9.	Outline study of the biosynthesis of cholesterol and bile acids (structure not required).	
	10.	Elementary study of hypercholesterolemia, atherosclerosis and obesity.	
III	Metabolism of Amino acids and Proteins ; Bioenergetics		15
	11.	Zymogen activation of proteolytic enzymes of GI tract, digestion of proteins and absorption of amino acids-role of glutathione cycle.	
	12.	Reactions involved in the metabolism of amino acids- deamination, transamination and decarboxylation, coenzymes involved in these reactions. Urea cycle (structure not required).	
	13.	Redox reactions, redox potential and free energy, mitochondrial electron transport chain, coenzymes and prosthetic groups of respiratory chain enzymes- sites of ATP production, P/O ratio, inhibitors of electron transport chain, oxidative phosphorylation- chemiosmotic hypothesis (outlines only), uncouplers of oxidative phosphorylation. Formation of ATP- oxidative and substrate level phosphorylation. High energy compounds with structures (ATP, ADP, Creatine phosphate, 1, 3-bisphosphoglycerate, PEP), role of high energy phosphate groups.	
IV	Microbial metabolism		15
	14.	Metabolic diversity among microbes-autotrophs and	

		heterotrophs; Nutritional classification of bacteria.	
	15.	Photosynthesis in bacteria - photosynthetic pigments of bacteria- chlorophyll a and bacterio chlorophyll, carotenoids, phycobiliproteins, leghaemoglobin, mechanism of photosynthesis in bacteria (purple nonsulphur bacteria, green sulphur bacteria) and cyanobacteria.	
	16.	Respiration in bacteria- aerobic respiration, Glycolysis and tricarboxylic acid cycle, Electron transport and oxidative phosphorylation in Bacteria	
	17.	Anaerobic respiration- Fermentation- lactic acid and alcohol fermentation	

References:

1. Biochemistry – U. Satyanarayana, U. Chakrapani, 3rd edition, ISBN 81-87134-80.
2. Biochemistry by Lubert Stryer, W.H Freeman and Company, New York ISBN 0-7167-2009-4, 4th Edition.
3. Lehninger Principles of Biochemistry, 7th Edition by David L. Nelson David L. Nelson
4. Michael M. ox Michael M. Cox (Author), Publisher: W. H. Freeman; Fourth Edition (2004)
5. E.S. West, W.R. Todd, H.S. Mason and J.T. van Bruggen, A Text Book of Biochemistry 4th Edition, Oxford and IBH Publishing Co., New Delhi.
6. Biochemistry 4th Edition (2010) by Donald Voet, Judith G. Voet Publisher: John Wiley & Sons Inc
7. Principles Of Biochemistry 5 th Edition (2017) by Geoffrey L Zubay, William W Parson, Dennis E Vance Publisher: McGraw-Hill Book Company – Koga
8. Principles Of Biochemistry, 5 th Edition (2011) by Robert Horton H , Laurence AMoran, Gray Scrimgeour K Publisher: Pearsarson
9. Biochemistry (2008) by Rastogi Publisher: McGraw Hill.

Course Outcomes

No.	Upon completion of the course, the graduate will be able to	Cognitive Level	PO/PSO addressed
CO-1	Understand the different metabolic pathways of carbohydrates analyse each of the pathways and	U, An	PO1,2 PSO1,4

	outline the pathways, differentiating each pathways.		
CO-2	Understand the lipid metabolism by outlining each pathway, studying the relationship between regulation and the disease conditions	U, An, E	PO 1 PSO 1, 4
CO-3	Analyze the classification of amino acids and understand the relationship between amino acid and protein	An, E	PO 1,2 PSO 1,4
CO-4	Comprehend redox reactions, mitochondrial electron transport, ATP production, and the chemiosmotic hypothesis, including oxidative and substrate-level phosphorylation, and the role of high-energy phosphate compounds, and discuss the metabolic diversity among microbes, classify bacteria nutritionally, explain the mechanisms of photosynthesis in various bacteria, and describe aerobic and anaerobic respiration in bacteria.	U, An,E	PO 1,2 PSO 1, 4

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

Create

Note: 1 or 2 COs/module

Name of the Course: Credits: 4:0:0 (Lecture: Tutorial: Practical)

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

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

Mapping of COs with PSOs and POs:

CO's	Programme Specific Outcomes (PSO)					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6

CO1	3	-	-	1	-	-
CO2	3	-	-	1	-	-
CO3	3	-	-	1	-	-
CO4	3	-	-	1	-	-
Average	3	-	-	1	-	-

CO's	Programme Outcomes						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	3	1	-	-	-	-	-
CO2	3	1	-	-	-	-	-
CO3	3	1	-	-	-	-	-
CO4	3	1	-	-	-	-	-
Weighted Average	3	1	0	0	0	0	0

Correlation Levels:

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

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final 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	BIOCHEMISTRY					
Course Code	MIUK3DSCBCH102.1					
Course Title	Enzymes and Enzyme Kinetics					
Type of Course	DSC 6					
Semester	III					
Academic Level	200-249					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week	
	4	3 hours	-	2 hours	5	
Pre-requisites						
Course Summary	<p>This course offers an understanding of basic concepts of enzymes and its role in various biochemical processes. This course also envisages to give students the critical analytical ability of the scientific phenomena involving enzymes and proficiently work with enzyme systems in both academia and industry.</p>					

Detailed Syllabus: Enzymes and Enzyme Kinetics

Module	Unit	Content	Hrs
		Introduction to Enzymes	9
	1	Models of enzyme substrate complex formation: Induced fit, Lock and key, transition state models. Enzyme specificity.	

I	2	Enzyme classification and nomenclature. (Class and subclass with one example).	
	3	Units of enzyme activity- IU, Specific activity Katal, and Turnover number.	
	4	Coenzymes and their biochemical roles (CoA, TPP, PLP, NAD/NADP, FAD, FMN, Biotin, folic acid, Vitamin B12)	
	5	Concept of ES complex and features of active site	
Enzyme Kinetics			9
II	6	Factors affecting the velocity of enzyme catalyzed reaction - enzyme concentration, substrate concentration, temperature, pH, inhibitors and activators (explanation with graphical representation)	
	7	Michaelis Menten equation; Km and Vmax values and their significance	
	8	Lineweaver-Burk plot, derivation of LB equation and its importance.	
	9	Allosteric enzymes: Regulation, mechanism and examples (ATCase and Glycogen phosphorylase)	
III	Enzyme Inhibition and Regulations		9
	10	Enzyme inhibition – competitive, non-competitive, uncompetitive and feedback inhibitions.	
	11	Allosteric inhibition, suicide inhibition, role in drug design	
	12	Zymogens and their activation, Multi enzyme systems: FAS as example	
IV	Industrial Enzymology		9
	13	Isolation and purification of enzymes and criteria of purity.	
	14	Enzyme technology: Methods for large scale production of enzymes, immobilized enzymes and their comparison with soluble enzymes	
	15	Application of immobilized and soluble enzymes in health and industry	
V	Clinical Enzymology		9
	16	Diagnostic enzymes in different diseases: Liver, pancreatic and muscle enzymes in diagnosis	
	17	Isoenzymes definition, clinical applications	
	18	Enzymes as reagents, analytical agents and therapeutic agents.	
VI	Practicals		30
		<ul style="list-style-type: none"> ● Demonstration of factors affecting enzyme activity. <ul style="list-style-type: none"> ○ pH ○ temperature ○ substrate concentration ○ enzyme concentration ● Estimation of AST and ALT <p>Extraction and assay of urease, acid phosphatase & beta</p>	

amylase.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Describe the fundamental concepts of enzymes, catalytic mechanisms, specificity	R,U	1,4
CO-2	Differentiate types of enzyme inhibitions and regulations	R, U, E	1,4
CO-3	Understand and analyse industrial applications of enzymology	R,U, Ap	1, 3, 4
CO-4	Understand and analyse clinical applications of enzymology	R, U, Ap	1, 3, 4
CO-5	Develop basic skills in isolation of enzymes, assays, and related experimental techniques	R, U, An, E	1,2

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

Note: 1 or 2 COs/module

Name of the Course: Credits: 4:0:0 (Lecture:Tutorial:Practical)

CO No.	CO	PO/PS O	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Describe the fundamental concepts of enzymes, catalytic mechanisms, specificity	PO 1,2 PSO 1, 4	R,U	F, C	L/T	
CO-2	Differentiate types of enzyme inhibitions and regulations	PO 1,2 PSO 1, 4	R, U, E	F, C	L/T	

CO-3	Understand and analyse industrial applications of enzymology	PO 1,2,5 PSO 1,3, 4	R,U, Ap	C, M	L/T	
CO-4	Understand and analyse clinical applications of enzymology	PO 1,2,5 PSO 1, 3, 4	R, U, Ap	C, M	L/T	
CO-5	Develop basic skills in isolation of enzymes, assays, and related experimental techniques	PO 1,2,5,6 PSO 1,2	R, U, An, E	P		P

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

Mapping of COs with PSOs and POs:

CO's	Programme Specific Outcomes (PSO)					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	-	-	1	-	-
CO2	2	-	-	1	-	-
CO3	2	-	2	1	-	-
CO4	2	-	2	1	-	-
CO5	2	3	-	-	-	-
Average	2	3	2	1	-	-

CO's	Programme Outcomes						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	2	1	-	-	-	-	-

CO2	2	1	-	-	-	-	-
CO3	2	1	-	-	1	-	-
CO4	2	1	-	-	1	-	-
CO5	2	1	-	-	1	2	-
Average	2	1	0	0	1	2	0

Correlation Levels:

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

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final 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	Biotechnology				
Course Code	MIUK4VACBCH200.1				
Course Title	Good Laboratory Practices and Quality Control in Biotechnology				
Type of Course	VAC1				
Semester	IV				
Academic Level	250 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 hours	-		3
Pre-requisites	Essentials of Biotechnology, Microbiology				
Course Summary	This course provides students with a comprehensive understanding of good laboratory practices (GLP) and quality control (QC) in the field of biotechnology where students will learn the importance of adhering to GLP guidelines and implementing QC measures to ensure the reliability, reproducibility, and accuracy of experimental results in biotechnological research and industry.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I	Introduction to Good Laboratory Practices (GLP)		9
	1	Historical perspective, Definition, purpose, Principles	
	2	Lab rules for best lab practices, aseptic lab procedures, Facility design, equipment calibration and maintenance, personnel training, and responsibilities.	
	3	Documentation and Record Keeping -maintenance of records and log books, Equipment Calibration and Maintenance.	
	4	Handling, sampling, storage and SOP.	
II	Biosafety, hazards, risks and management		9
	5	Types of hazards – Biological hazards, physical hazards, chemical hazards, Symbols in biohazards.	
	6	Risk assessment and management- containment facility, biosafety	

		level and its classification. Assessment of biological hazards, Risk assessment process examples and tools, Biosafety measures and Guidelines.	
	7	Types of laboratory wastes and methods of disposal of laboratory wastes-Chemical, Physical and Biological.	
	8	Classification of chemicals and hazard levels.	
III	Regulations in QC and validation		9
	9	Overview of GLP and QC regulations, guidelines, and standards applicable in biotechnology. Government regulations and amendments and national and international standards – FDA, ISI, Codex , ISO,OECD.Role of FDA in India.	
	10	Hazard analysis and quality control analysis – HACCP- Significance, Seven Principles– Significance GLP.	
	11	Activities – Design qualification (DQ), Installation qualification (IQ), Operational qualification (OQ), Performance qualification (PQ)	
IV	Quality control in biotechnology industry		9
	12	Implementation of QA/QC systems to monitor and ensure the quality of processes, products, and data. Quality management and quality assurance in BI	
	13	Identification, assessment, and mitigation of potential risks to quality and compliance. GMP as an element in QC- Importance of QC in BI	
	14	Principles and procedures for validating and verifying analytical methods used in biotechnology. Sampling, inspection, testing, of raw and packaging materials,product, release and rejection of batches.	
V	Assesment		9
	15	Write an overview of quality management in a Pharmaceutical/Food industry/Beverage industry after visiting one of your choice. Case Studies and Best Practices: Examination of real-world case studies and best practices in GLP and QC implementation within the biotechnology industry.	

References

- "Good Laboratory Practice Regulations" by CRC Press
- "Quality Control in the Pharmaceutical Industry" by CRC Press
- "Laboratory Quality Management System: Handbook" by WHO
- "Statistical Methods for Quality Control" by John Wiley & Sons
- "Good Clinical, Laboratory and Manufacturing Practices: Techniques for the QA Professional" by CRC Press
- International Conference on Harmonization of Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH) guidelines
- United States Pharmacopeia (USP) standards
- Food and Drug Administration (FDA) regulations

- World Health Organization (WHO) guidelines on GLP and QC in biotechnology
- "Good Clinical, Laboratory and Manufacturing Practices: Techniques for the QA Professional" by CRC Press

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Explain the significance of adhering to good laboratory practices (GLP) in biotechnological research and industry and understand the principles and methods of GLP	U	PSO1
CO-2	Classify the different types of hazards, biosafety levels, wastes, assess the risks and evaluate the various biosafety levels in handling the same.	An, A	PSO 1,4
CO3	Understand the various regulation at national and international levels in QC and validation and identify the principles of HACCP	R, U	PSO 1,4
CO 4	Describe the significance and methods of QC in biotechnology industry	U	PSO1, 3,4

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

Note: 1 or 2 COs/module

Name of the Course: Credits: 3:0:0 (Lecture:Tutorial:Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Understood principles of good Lab Practices	PO 1 PSO1	U	F	L	
CO-2	Understood about Biohazards and different Biosafety levels	PO 1,2 PSO1,4	An, A	F	L	
CO3	Understand the various regulation at national and international levels in QC	PO 1,2 PSO 1,4	R, U	F	L	
CO4	Describe the significance of QC in Biological research	PO 1,2,5 PSO 1,3,4	U	C	L	

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

Mapping of COs with PSOs and POs:

CO's	Programme Specific Outcomes (PSO)					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	-	-	1	-	-
CO2	2	-	-	1	-	-
CO3	2	-	-	1	-	-
CO4	2	-	2	1	-	-
Average	2	-	2	1	-	-

CO's	Programme Outcomes						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	2	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-
CO3	2	1	-	-	-	-	-
CO4	2	1	-	-	2	-	-
Average	2	1	0	0	2	0	0

Correlation Levels:

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

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

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

Discipline	BIOTECHNOLOGY				
Course Code	MIUK6SECBCH300.1				
Course Title	METHODOLOGIES IN RESEARCH AND SCIENTIFIC WRITING				
Type of Course	SEC 1				
Semester	VI				
Academic Level	350-399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 hours	-	-	3
Pre-requisites	Students should have a basic understanding of scientific principles and terminology, including familiarity with research terminology such as hypothesis, experimentation, and ethics. Proficiency in written communication and citation methods is recommended.				
Course Summary	Introduction to Research Methodology covers fundamental concepts such as types of research, research methods, and components of research like problem identification and hypothesis formulation. Additionally, students will gain insight into research ethics, plagiarism prevention, and various indices used in scientific communication.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I	Introduction to Research Methodology		15
	1.	Fundamental concepts of Research. Research- meaning, characteristics and objectives.	
	2.	Types of research. Different methods of Research: Experimental, Descriptive, Historical, Qualitative and Quantitative methods.	
II	Components of research		15
	3.	Identification, design and & formulation of the research problem. Hypothesis, Null Hypothesis & Alternative Hypothesis. Hypothesis Testing.	
III	Scientific Writing and Manuscript Preparation		15
	4.	Scientific communication- formats of writing research articles. Methods and styles of referencing.	
	5.	Research Ethics. Plagiarism. Impact factor and other indices of articles and journals	
	6.	Scientific communication, Communicating research findings to diverse audiences	
	7.	Proposal writing	
IV	Academic Writing & Presentation		15
	8.	Proposal submission to funding agencies, Elements of Style. Organization of proposals, Basic knowledge of funding agencies	

	9.	Communication skills, Tailoring the presentation to the target audience – Oral presentations, Poster preparations, Elements of excellent presentation: Preparation, Visual and Delivery..	
	10	Submission of research/review articles for Publication to Reputed journals, Thesis writing, and Research report writing.	

Reference

1. Thomas, C. G. (2021). Research Methodology and Scientific Writing. Springer
2. <https://dokumen.pub/research-methodology-and-scientific-writing-2nd-edition-3030648648-9783030648640-9783030648657.html>

Course Outcome

No.	Upon completion of the course, the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Demonstrate a comprehensive understanding of fundamental research concepts, including the meaning, characteristics, and objectives of research, as well as the different types and methods such as experimental, descriptive, historical, qualitative, and quantitative methods.	U	PSO 1, 4
CO-2	Apply critical thinking skills to identify, design, and formulate research problems effectively, develop clear hypotheses (including null and alternative hypotheses), and employ hypothesis testing techniques to analyze data and draw meaningful conclusions.	Ap	PSO 3, 4
CO-3	Acquire proficiency in scientific writing and manuscript preparation, including knowledge of various formats for writing research articles, methods, and styles of referencing, and the ability to communicate complex ideas clearly and concisely.	Ap	PSO 5, 6
CO-4	Understand and adhere to research ethics principles, demonstrating awareness of issues related to plagiarism prevention, the responsible conduct of research, and the importance of maintaining integrity in all aspects of the research process.	U	PSO 1, 3
CO-5	Evaluate the impact factor and other indices used to assess the quality and relevance of articles and journals in scientific communication, and effectively communicate research findings to diverse audiences using appropriate strategies and techniques.	E	PSO 4, 5

CO-6	Apply theoretical knowledge and practical skills acquired throughout the module to complete a project proposal, oral/poster presentation, prepare a review paper.	Ap	PSO 2, 3
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R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: Credits: 4:0:0 (Lecture:Tutorial:Practical)

CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	PO 5,6 PSO 1, 4	U	C	L	
CO-2	PO 2,5,6, PSO 3, 4	Ap	P	L	
CO-3	PO 5,6 PSO 5, 6	Ap	P	L	
CO-4	PO 5,6,7 PSO 1, 3	U	F	L	
CO-5	PO 2,5 PSO 4, 5	E	C	L	
CO-6	PO 5,6 PSO 2, 3	Ap	P	L	

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

Mapping of COs with PSOs and POs:

CO's	Programme Specific Outcomes (PSO)					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	-	-	3	-	-
CO2	-	-	3	2	-	-
CO3	-	-	-	-	3	3
CO4	2	-	2	-	-	-
CO5	-	-	-	3	2	-
CO6	-	2	2	-	-	-
Average	2	2	2.3	2.6	2.5	3

CO's	Programme Outcomes						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	-	-	-	-	2	3	-
CO2		3	-	-	2	3	-

CO3	-	-	-	-	2	2	-
CO4	-	-	-	-	2	2	3
CO5	2	-	-	-	2	-	-
CO6	-	-	-	-	2	3	-
Average	2	3	0	0	2	2.6	3

Correlation Levels:

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

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm 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	✓	✓		✓
CO 6	✓	✓		

BOARD OF STUDIES MEMBERS IN BIOTECHNOLOGY(2023-2026)

No.	Name	Designation/Office with phone no. and E-mail id	Category and Guidelines
1.	(Chairman) Dr. Lini.N	Dr. Lini.N Assistant professor Department of Biotechnology lini.n@mic.ac.in Ph.8129172238	Head of the Department concerned
2.	Dr. Deepthy Alex	Dr. Deepthy Alex Assistant professor Department of Biotechnology deepthy.alex@mic.ac.in Ph.9847172375	Faculty member of the Department
3.	Dr. Santhi Krishnan	Dr. Santhi Krishnan Guest faculty Department of Biotechnology Ph.9645240146 Email. santhi.krishnan@mic.ac.in	Special invitee to BoS
4.	Dr. Preetha S. S.	Dr. Preetha S. S. Assistant Professor Email: preetha.ss@mic.ac.in Phone : +91 8281915797	Subject expert Botany
5.	Dr. Mary Sheeba A.	Dr. Mary Sheeba A. Assistant Professor Email: mary.sheeba@mic.ac.in Phone : +91 9746512803	Subject expert Botany
6.	Dr. Boban PT	Dr Boban PT Associate Professor Department of Biochemistry Government College Kariavattom Thiruvananthapuram 695581 ptboban@gmail.com Ph:9495903242	Subject expert Biochemistry

7.	Dr. Saja K.	Dr. Saja K. Assistant Professor Department of Biochemistry Email : sajaboban@gmail.com Ph. 9447343980	Subject expert Biochemistry
8.	Dr. Ragaseema V	Dr. Ragaseema V M Assistant Professor Dept of Biotechnology Govt arts college, Trivandrum Email.ragaseema7@gmail.com	Subject expert Biotechnology
9.	Dr Shiburaj Sugathan	Dr Shiburaj Sugathan Professor Department of Botany University of Kerala Email. drshiburaj@gmail.com	Subject expert (special invitee)
10.	Dr Raghul Subin	Dr Raghul Subin Assistant Professor Department of Zoology Govt. College Kariavattom Email. raghulzubin@gmail.com	Subject expert (Special invitee)
11.	Dr. Radhakrishnan E.K.	Dr.Radhakrishnan E.K. Assistant Professor School of Biosciences Mahatma Gandhi University, PD Hills (PO) Kottayam, Kerala – 686 560 Email: radhakrishnanek@gmail.com Ph: 9847901149	Subject expert from outside the parent University nominated by the Academic Council

12.	Dr. Bhavya B C	Dr. Bhavya B C Assistant professor Department of Biotechnology Cochin University of Science and Technology, Cochi Email. bhavya@cusat.ac.in Ph. 8157025337	Subject expert from outside the parent University nominated by the Academic Council
13.	Dr EA Siril	Dr EA Siril Professor and Head Department of Botany University of Kerala Kariavattom Email: easiril@keralauniversity.ac.in	Expert nominated by the Vice-Chancellor
14.	Dr. Santhosh R.S.	Dr. Santhosh R.S. CEO, Phytocon Pharmaceuticals (P) Ltd. KRIBS-BIONEST KINFRA-HighTech Park Kochi E-mail: mail@phytocon.co.in Mob.: 8281555274	Representative from industry nominated by the principal
15.	Dr. Swapna Alex	Dr. Swapna Alex Professor Department of Biotechnology College of Agriculture, Vellayani Ph: 9847067220 Email: swapna.alex@kau.in	Representative from allied areas nominated by the principal

16.	C. Padmakumar	<p>C. Padmakumar Special Officer Kerala Medical Technology Consortium Thiruvananthapuram Taluk, Kerala, India. Director The Kerala Life Sciences Parks private Limited Thiruvananthapuram, Kerala, India Email.chandrapadmakumar@gmail.com</p>	Representative from corporate sector nominated by the principal
17.	Dr. Roshin Elizabeth George	<p>Dr. Roshin Elizabeth George Research Director Biovent, KU-TBSC start-up Department of Biotechnology Karyavattom Thiruvananthapuram – 695581 E-mail: ifo@biovent.co.in Mob.: 9946793797</p>	One member of the college alumni nominated by the principal.
18.	Dr. Prakash.G. Williams	<p>Dr. Prakash.G. Williams Assistant Professor Department of Biotechnology Bishop Moore College,</p>	Expert from outside the College nominated by the principal.
19.	Dr. Jairani P S	<p>Dr. Jairani P S Assistant Professor & Head Department of Biotechnology Govt. College, Karyawattom Thiruvananthapuram E-mail: jairanips@gmail.com Mobile: 8547491638</p>	Expert from outside the College nominated by the principal.
20.	Dr. Sajeeb Khan A	<p>Dr. Sajeeb Khan A. Assistant Professor Department of Zoology University College Thiruvananthapuram – 695034 E-mail: khansajeeb@gmail.com Mobile: 9995566343</p>	Expert from outside the College nominated by the principal.

