MAR IVANIOS COLLEGE (AUTONOMOUS)

Affiliated to the

University of Kerala Thiruvananthapuram

Kerala

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

DISCIPLINE

MATHEMATICS (SF)

(With effect from 2024 Admissions)

Approved by the Board of Studies in

Mathematics and Statistics

CONTENTS

PREAMBLE

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

In accordance with the NEP 2020, the UGC formulated a new student-centric "Curriculum

and Credit Framework for Undergraduate Programmes (CCFUP)" incorporating a flexible choice-based credit system, multidisciplinary approach, and multiple entry and exit options and establishing three Broad Pathways,

(a) 3-year UG Degree,

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

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

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

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

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

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

- The curriculum is designed based on Outcome Based Education (OBE) approach.

- The curriculum follows Choice-Based Credit System (CBCS): This system allows students to select courses from a prescribed list. A specified number of credits must be earned to award the degree

- The curriculum follows the basic framework, course wise/programme-wise minimum/maximum credits set by the University of Kerala for FYUGP and abides by the basic mandatory principles of **Four Year Under Graduate Programmes (UoK-FYUGP) Regulations, 2024.**

- Comprehensive Coverage: The syllabus covers a broad range of mathematical topics beyond the core curriculum, providing students with a deeper understanding and appreciation of mathematics.

- Applications and Problem-Solving: Emphasis is placed on real-world applications of mathematics and problem-solving skills, allowing students to see the practical relevance of the concepts they learn.

- Multidisciplinary Connections: The syllabus includes connections to other disciplines such as physics, computer science, engineering, economics, etc., demonstrating how mathematics is used across various fields.

- Depth and Rigor: It focuses on depth and rigor in mathematical reasoning, encouraging students to engage with complex proofs and mathematical structures.

- Flexibility and Adaptability: The syllabus is flexible enough to accommodate different learning styles and interests, allowing students to pursue areas of mathematics that align with their interests and career goals

Graduate Attributes and Programme Outcomes (POs):

The National Higher Education Qualification Framework (NHEQF) envisages that students on completion of a programme of study must possess and demonstrate the expected graduate profile/attributes acquired through one or more modes of learning. The graduate profile/attributes indicate the quality and feature or characteristics of the graduate of a programme of study, including learning outcomes relating to the disciplinary area(s) relating to the chosen field(s) of learning and generic learning outcomes that are expected to be acquired by a graduate on completion of the programme(s) of study. The graduate profile/attributes include capabilities that help widen the current knowledge base and skills, gain and apply new knowledge and skills, undertake future studies independently, perform well in a chosen career, and play a constructive role as a responsible citizen in the society. The graduate profile/attributes are

acquired incrementally and describe a set of competencies that are transferable beyond the study of a particular subject/disciplinary area and programme contexts in which they have been developed. Graduate profile/attributes are fostered through meaningful learning experiences made available through the curriculum and learning experience, the total college/university experience, and a process of critical and reflective thinking. Mar Ivanios College (Autonomous) is fully committed to ensuring the attainment of the necessary graduation attributes by the students. The college has clearly defined its raison de'tre, the philosophy of its existence, through the Motto "Truth Shall Liberate You" (Veritas Vos Liberabit) which refers to the ultimate enlightenment which can emerge only at the intersection of sharp intellect, sound physique, strong mind, staunch ethics, and profound spirituality. This is further made explicit through its Vision, Mission and Goals and the same expect all students who graduate from the college to:

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

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

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

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

PO 1	Demonstrate the acquisition of all necessary knowledge and skills within their disciplinary/ multi-disciplinary areas of learning. **These include the acquisition of:**
	• **comprehensive knowledge and coherent understanding of their chosen disciplinary/ interdisciplinary areas of study, their linkages with related fields, and the awareness of current trends in their chosen area of study;**
	• **essential knowledge for skilled work in chosen field(s), including self-employment and entrepreneurship skills;**
	• **proficiency in specialized areas within chosen fields of study, encompassing diverse practical skills applicable to different situations within those fields;**
	• **the ability to apply learned knowledge to novel situations, solve problems, and relate concepts to real-world scenarios rather than just memorizing curriculum content.**
PO 2	**Acquire problem-solving, critical thinking, analytical reasoning skills and demonstrate creativity in their thought processes** by demonstrating the ability to:
	• solve different kinds of problems in familiar and non-familiar contexts both within and outside their disciplinary/ multidisciplinary areas of learning;
	• apply analytic thought to a body of knowledge, including the analysis and evaluation of policies, and practices, as well as evidence, arguments, claims, and beliefs;
	• analyse and synthesize data from a variety of sources and draw valid conclusions and support them with evidence and examples.
	• the ability to plan, execute and report the results of an experiment or investigation;
	• adhere to scientific temper and ethics in their thought process;
	• adopt innovative, imaginative, lateral thinking, interpersonal skills and emotional intelligence; and

	• incubate entrepreneurial and start-up ideas.
PO 3	**Develop a profound environmental dedication by fostering ecological awareness and engaging in actions that promote sustainable development** by achieving the ability to • recognize environmental and sustainability issues, and participate in actions to promote sustainable development as well as mitigate the effects of environmental degradation, climate change, and pollution; • contribute to effective waste management, conservation of biological diversity, management of biological resources and biodiversity, forest and wildlife conservation, sustainable development and living, and the preservation of life in all forms. • participate in community-engaged services/ developmental activities and thus exemplify the ideals of community engagement and service learning and deep social commitment.
PO 4	**Accomplish perfect communication, teamwork, and leadership skills, particularly in academic and professional settings, while demonstrating nuance and attention to etiquette in all communicative contexts.** This will enable them to: • listen carefully, and read texts and research documents, and present complex information with clarity and precision to different audiences; • express thoughts and ideas and communicate effectively through speech and writing using appropriate media; • communicate using language which is respectful of gender and minority orientations; • act together as a group or a team in the interests of a common cause and working efficiently as a member of a team; • inspire the team with a vision to achieve a stated goal, and use management skills to guide the team in the right direction.
PO5	**Acquire the necessary skills, including 'learning to learn' skills, and foster innovative ideas to improve competence and employability, keeping pace with the evolving global landscape and technological advancements** by

demonstrating the ability to:

- pursue learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social, and cultural objectives, and adapting to changing trades and demands of the workplace, including adapting to the changes in work processes in the context of the fourth industrial revolution, through knowledge/ skill development/reskilling;
- work independently, identify appropriate resources required for further learning;
- acquire organizational and time management skills to set self-defined goals and targets with timelines;
- be a proactive life-long learner.
- use ICT in a variety of learning and work situations;
- access, evaluate, and use a variety of relevant information sources, and use appropriate software for analysis of data;
- navigate cyberspaces by following appropriate ethical principles and cyber etiquette.
- use cutting edge AI tools with equal commitment to efficiency and ethics.
- think 'out of the box' and generate solutions to complex problems in unfamiliar contexts;

PO6	**Develop research-related skills including the ability to conceptualize research hypotheses/projects and adopt suitable tools and methodologies for analysis** with: • a keen sense of observation, inquiry, and capability for asking relevant/ appropriate research questions; • the ability to problematize, synthesize, and articulate issues and design research proposals; • the ability to define problems, formulate appropriate and relevant research questions, formulate hypotheses, test hypotheses using quantitative and qualitative data, establish hypotheses, make inferences based on the analysis and interpretation of data, and predict cause-and-effect relationships;

	• the capacity to develop appropriate methodology and tools for data collection; • the appropriate use of statistical and other analytical tools and techniques; • the ability to plan, execute and report the results of an experiment or investigation; • the ability to acquire the understanding of basic research ethics and skills in practicing/doing ethics in the field/ in personal research work, regardless of the funding authority or the field of study
PO7	**Assimilate a sound value system, a sense of autonomy, multicultural competence, social commitment, and the spirit of inclusivity and empathy by imbibing the spirit and the holistic ethos of the 'Multi-Dimensional Ivanian' (MDI) approach.** This will enable them to: • embrace and practice constitutional, humanistic, ethical, and moral values in life, including universal human values of integrity, truth, righteous conduct, peace, love, nonviolence, scientific temper, citizenship values; • identify ethical issues related to work, follow ethical practices and be objective, unbiased, and truthful actions in all aspects of work, including avoiding unethical behaviour such as fabrication, falsification or misrepresentation of data, or committing plagiarism, and adhering to intellectual property rights; • exercise responsibility and demonstrate accountability in applying knowledge and/or skills in work and/or learning contexts appropriate for the level of the qualification, including ensuring safety and security at workplaces; • practice responsible global citizenship required for responding to contemporary global challenges, enabling learners to become aware of and understand global issues and to become active promoters of more peaceful, tolerant, inclusive, secure, and sustainable societies; • effectively engage in a multicultural group/society and interact respectfully with diverse groups; • identify with or understand the perspective, experiences, or points of view and emotions of another individual or group.

- demonstrate gender sensitivity and adopt a gender-neutral approach, as also empathy for the less advantaged and the differently-abled including those with learning disabilities;
- demonstrate proficiency in arts/ sports/ games, physical, mental and emotional fitness, entrepreneurial /organizational /pubic speaking/environmental/ community-oriented areas by actively participating in the wide range of co-curricular activities that are available to the students of Mar Ivanios College.

Programme Specific Outcomes (PSOs)

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

PSO 1	Understand the foundational principles of mathematics in order to analyse, interpret and draw inferences from mathematical statements and data using the principles of mathematical logic and effectively communicate mathematical ideas through various means.
PSO 2	Discuss and illustrate the core mathematical concepts contained in various branches of mathematics like analysis, algebra, discrete mathematics, probability theory and earn proficiency in advanced mathematical applications through differential equations, linear algebra, operations research, graph theory, number theory, etc.
PSO 3	Apply various mathematical principles and methods to develop proficiency in problem-solving skills with regard to real-world situations in diverse fields and build critical and analytical thinking capacity and skills through mathematical inquiry and exploration.
PSO 4	Engage with current trends and developments in diverse research and applications in mathematics in order to acquire the capacity for independent learning and research and acquire skills for ongoing self-directed study and professional development in mathematics, and embrace opportunities for

		intellectual growth and exploration beyond the classroom.
PSO 5		Identify the diverse cultural perspectives and experiences within the mathematical community and society and improve collaboration and teamwork skills through group exercises, discussions, problem-solving activities, lab works, projects, mathematical outreach activities, etc.
PSO 6		Develop expertise and skills in the use of various mathematical software and computational tools and applying them in different fields and disciplines of knowledge.
PSO 7		Practise self-discipline and persistence in life through focused mathematical pursuits, overcoming challenges and setbacks through perseverance, resilience, and mastery.
PSO 8		Formulate ethical awareness and responsibility in the use and application of mathematical knowledge for sustainable development and proficiency in analyzing environmental data using mathematical modelling and statistical techniques.

Course and Credit Structure of FYUGP

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

The Course and Credit Structure of FYUGP is given below:

Sem	DSC (4 Cr)	DSE (4 Cr)	AEC (3 Cr)	SEC (3 Cr)	MDC (3 Cr)	VAC (3 Cr)	Internship (credit-2)/ Project/ Additional Courses (credit-	Total courses	Total credits

						12)			
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-2 B-2 C-2	DSE A -1			MDC (Kerala Studies) -3	VAC -1		6	22
IV	A-4 A-5	DSE A-2		SEC-1		VAC -2 VAC -3	Internship	6	21
V	A-6 A-7 A-8	DSE -3 DSE -4		SEC-2				6	23
VI	A-9 A-10 A-11	DSE -5 DSE -6		SEC-3				6	23
Total	A (11) B (3) C (3)	6	4	3	3	3	1*	36	133
EXIT OPTION AVAILABLE AND STUDENTS WILL BE AWARDED UG DEGREE WITH MAJOR IN A									

VII	A-12 A-13 B/C-4 B/C-5 B/C-6	DSE -7						6	24
VIII	MOOC courses A -14, A -15						Research Project/ Internship /Project or 03 courses - 12Cr	2+1**/ 3***	20
Total	A (15) B(3) C (3) B/C(3)	7	4	3	3	3	1*+1**/ 3***	44+ 1* + 1** / 3***	177

A – Major Discipline

B/C-Minor/Multiple discipline

* - Mandatory Internship at the end of Semester 4

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

*** - Additional courses of 4 credits each.

Cr - Credits

- **Research group project for students exiting after UG 3 years:** Students who propose to exit after 3 Year UG programme can do a group project with an extra two credits to obtain research experience in discipline-specific areas of the program. The BoS can decide the number of students for the group and the evaluation criteria.

- Students will be able to take other pathways permissible under **University of Kerala Four Year Under Graduate Programmes (UoK-FYUGP) Regulations, 2024,** subject to the availability of courses/ faculty/infrastructure of the college.

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

- **Field trip/study tour**: A study tour to places of interest in India focusing on secularism and oneness promotes intercultural understanding, tolerance, and the appreciation of diversity, fostering the values of secularism and unity in a multicultural society. Field visits provide students with practical, hands-on experiences that enhance their understanding of theoretical concepts taught in the classroom. By seeing and experiencing real-world applications of what they learn, students are better equipped to grasp and retain knowledge. This engagement can lead to improved academic performance and a deeper comprehension of the subject matter. Hence, field trip/study tour will be part of the 3 Year/4 Year UG Programme majoring in Mathematics offered by the Department of Mathematics and Statistics, Mar Ivanios College (Autonomous). The number of days for the field trip/study tour will be decided by the Principal in consultation with the BoS and the College Council.

Course Participation/Attendance-

1. A student shall be permitted to register for the end-semester evaluation of a specific course to acquire the credits only if the student has completed 75% of the

prescribed classroom activities in physical, online, or blended modes, as stipulated by the BoS, including any makeup activities as specified by the faculty of that particular course.

2. The reasons/cases of permissible authorised leave shall be specified by the college, with the approval of the Academic Council, ratified by the Governing Body.

3. The condonation facility shall be availed as per the existing University/college norms.

Assessment and Evaluation

1. The assessment of a course shall combine a Continuous Comprehensive Assessment (CCA) and an End Semester Evaluation (ESE).

2. For courses without practical/lab modules, 30% weightage shall be given for CCA and the remaining 70% of the weight shall be for the ESE.

3. CCA will have two sub-components: Formative Assessment (FA) and Summative Assessment (SA).

4. The CCA subcomponents will be given marks as per the following proportions:
    *   Discipline specific summative assessment   – 15% of the total
    *   Course attendance   - 5 % of the total.
    *   Discipline specific formative assessment   - 10% of the total.

5. The details of summative and formative assessment criteria, including that of attendance, will be specified by each course coordinator at the beginning of the semester, with the approval of the respective Head of the Department/BoS Chairperson and the Principal, and will be published on the college website.

6. For courses with practical/lab modules, 40% weightage shall be given for CCA and the remaining 60% of the weight shall be for the ESE.

7. In such cases specified in the item above, the CCA subcomponents will be given marks as per the following proportions:
    *   Discipline specific summative assessment   – 10% of the total
    *   Course attendance (Formative)   - 5 % of the total.
    *   Discipline specific formative assessment   - 15% of the total.
    *   Practical record/skill/practical test, etc.   – 10% of the total.

- The above is given in detailed tabular form as follows:

Sl. No.	Activity	Percentage (%) of the total	
		Theory courses	Courses with practical
1.	Summative Assessment (written Test or any other discipline specific assessment tools like Open book test, Lab reports, problem-based assignments, individual or team project report, case study report, literature survey, book reviews, video/film/documentary productions, etc)	15	10
2.	Summative Assessment (Practical Record, Practical test, skill, etc)	------------	10
3.	Formative Assessment (Attendance)	5	5
4.	Formative Assessment (Class room activities, observation of skills, viva voce, quiz, interview, oral presentations, in class discussions, computerized adaptive testing, group tutorial work, reflection writing assignments, field study reports, self and peer assessments, service-learning activities, etc.)	10	15
	Total	30	40

8. The Course Coordinator shall be responsible for evaluating all the components of CCA for the course in question. Any grievances regarding the same shall be submitted to the Course Coordinator within 5 days of the publication of the same on the department notice board or official class group. If the grievance is not settled at the Course Coordinator level, the student is free to appeal to the Head of the Department, within the next 3 days, who will discuss the same in the Department Level Monitoring Committee (DLMC). If still needed, students can further appeal to the College Level Monitoring Committee (CLMC) or in essential

situations the University Level Monitoring Committee (ULMC) in a time period as specified by these bodies.

9. Regarding evaluation, one credit will be evaluated for 20 marks in a semester; thus, a 4-credit course will be evaluated for 80 marks, and 3-credit courses for 60 marks. However, any changes to this if brought by the University will be followed.

10. The duration of the end semester examination of a course with 4 credits will be 2 hours and the same for a course with 3 credits may be 1.5 hours/2 hours.

Mark Distribution Table

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

Letter Grades and Grade Point

1. A mark system is followed to evaluate each question. For each course in the semester, letter grades and grade points are introduced in a 10-point indirect grading system as per the guidelines given below.

2. The Semester Grade Point Average (SGPA) is computed from the grades to measure the student's performance in a given semester. The SGPA is based on the current term's grades, while the Cumulative Grade Point Average (CGPA) is based on the grades in all courses taken after joining the programme of study.

3. The weighted grade point will be mentioned in the student's final grade cards, issued by the college, based on the marks obtained.

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

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

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

Computation of SGPA and CGPA

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

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

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

where S_j is the SGPA in the jth semester,

C_{ij} is the number of credits for the ith course in the jth and

G_{ij} is the the grade point scored by the student in the ith course in the jth 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 ith semester and

$\sum C_i$ is the total number of credits in the ith semester.

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

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

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Mr Sumesh S S

Chairman BoS

Assistant Professor and Head

Department of Mathematics and Statistics

Mar Ivanios College (Autonomous),

Thiruvananthapuram

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10-05-2024

LIST OF COURSES

Course Code	Course Title	Course Category	Credits	Hour distribution per week		
				L	T	P
SEMESTER I | Academic Level 100-199						
MIUK1DSCMAT110.1	Mathematics for Computer Science-I	DSC	4	4		
MIUK1DSCMAT111.1	Mathematics for Statistics - I	DSC	4	4		
MIUK1DSCMAT103.1	Mathematics for Humanities and Commerce – I	DSC	4	4		
MIUK1DSCMAT104.1	Mathematics for Economics - I	DSC	4	4		
MIUK1MDCMAT112.1	Business Mathematics	MDC	3	3		
MIUK1MDCMAT106.1	Quantitative Techniques and Aptitude (Basic Mathematics for Competitive Examinations)	MDC	3	3		
SEMESTER II | Academic Level 100-199						
MIUK2DSCMAT160.1	Mathematics for Computer Science-II	DSC	4	4		
MIUK2DSCMAT161.1	Mathematics for Statistics - II	DSC	4	4		
MIUK2DSCMAT153.1	Mathematics for Humanities and Commerce – II	DSC	4	4		
MIUK2DSCMAT154.1	Mathematics for Economics - II	DSC	4	4		
MIUK2MDCMAT156.1	Data Interpretation and Logical Reasoning	MDC	3	3		
SEMESTER III | Academic Level 200-299						
MIUK3DSCMAT210.1	Mathematics for Computer Science –III	DSC	4	4		
MIUK3DSCMAT211.1	Mathematics for Statistics – III	DSC	4	4		
MIUK3DSCMAT203.1	Mathematics for Humanities, Commerce and Economics (Operations Research)	DSC	4	4		
SEMESTER IV | Academic Level 200-299						
MIUK4SECMAT253.1	Python Programming and LaTeX	SEC	3	3		

Mar Ivanios College (Autonomous)

SEMESTER - I

COURSES OFFERING – SEMESTER I

COURSE TYPE	MAJOR (STUDENTS)	COURSE TITLE	CREDITS
DSC	ALL SCIENCES INCLUDING COMPUTER SCIENCE	Mathematics for Computer Science-I	4
DSC	ALL SCIENCES INCLUDING STATISTICS	Mathematics for Statistics - I	4
DSC	HUMANITIES AND COMMERCE	Mathematics for Humanities and Commerce – I	4
DSC	ECONOMICS	Mathematics for Economics - I	4
MDC	COMMERCE	Business Mathematics	3
MDC	COMMON TO ALL DISCIPLINES	Quantitative Techniques and Aptitude (Basic Mathematics for Competitive Examinations)	3

Mar Ivanios College (Autonomous)

Discipline	Mathematics				
Course Code	MIUK1DSCMAT110.1				
Course Title	**Mathematics for Computer Science-I**				
Type of Course	DSC				
Semester	I				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4
Pre-requisites	High School Level Basic Mathematics				
Course Summary	The course introduces fundamental mathematical concepts crucial for various disciplines. Set Theory explores the properties and relationships of sets, including operations such as union, intersection, and complementation, laying the groundwork for understanding mathematical structures. Vector Algebra focuses on the manipulation and properties of vectors in multi-dimensional spaces, essential for modelling physical quantities and geometric transformations. Matrix Algebra extends these concepts to matrices, providing tools for solving systems of linear equations, representing transformations, and analyzing data. Number Theory investigates the properties of integers and their relationships, including divisibility, prime numbers, and modular arithmetic, forming the basis for cryptographic algorithms and computational methods. Together, these topics provide a comprehensive understanding of foundational mathematical structures and techniques applicable across diverse fields such as physics, engineering, computer science, and cryptography, empowering learners to tackle complex problems and analyze real-world phenomena with mathematical rigor.				
Texts	**1.** Higher Engineering mathematics, 42th edition, Dr. BS Grewal 2. Calculus, edition 10,Anton 3.Discrete Mathematics with graph theory and combinotrics, T. Veerarajan				
References	**1.** T S Blyth and E F Robertson, *Linear Algebra,* 2nd Edition, Springer 2. Erwin Kreyszig, *Advanced Engineering Mathematics,* 10th				

	Edition, Wiley-India.
	3. Peter O'Neil, *Advanced Engineering Mathematics,* Thompson Publications

Detailed Syllabus:

Module	Unit	Content	Hrs
		SET THEORY	**15**
	1	Basic concepts and notations	1
		Universal set, Null set, Subset, Singleton set, Finite and Infinite sets, Cardinality of a finite set, Subset, Equal sets	2
		Ordered pairs and Cartesian product	2
I	2	Relations	1
		Types of relations	2
		Properties of relations	3
	3	Equivalence classes	2
		Representation of relations by graphs	2
		The topics in this module can be found in chapters 2 of text [3]	
		VECTOR ALGEBRA	**15**
	1	Scalars and vectors	1
		Vectors viewed geometrically and vectors in coordinate system using ICT tools	1
		Arithmetic operations on vectors, Rules of arithmetic operations	2
		Norm of a vector, Unit vectors, Normalising a vector	2
II	2	Definition of Dot products	2
		Angle between vectors	1
		Cross products, Arithmetic properties of cross products	2
	3	Lines determined by a point and a vector	2
		Vector equations of lines	2
		ICT tools can be used to enhance effective learning. *The topics in this module can be found in chapters 11 sections 11.2 - 11.5 of text [2]*	
		LINEAR ALGEBRA	**15**
	1	Definition of Determinants	1
		Properties of determinants(excluding factor theorem)	3
III	2	Matrices, Special matrices	2
		Matrix operations	3
		Elementary transformations, Rank of a matrix	3

		Cramer's rule for solving system of equations	3
		ICT tools can be used to enhance effective learning. *The topics in this module can be found in chapter 2 sections 2.1-2.5,2.7,2.9,2.10 of text [1]*	
IV		**NUMBER THEORY**	**15**
	1	Divisibility	1
		The Fundamental Theorem of Arithmetic	2
		Sieve of Erotosthenes	2
		Division procedure, Greatest Common Divisor	1
		The Euclidean Algorithm for finding gcd(a, b)	2
		Congruences	2
		Congruence class modulo m	1
		Wilson's Theorem, Fermat's Little Theorem (Proof of theorems may be omitted. Emphasis should be given for statements/definitions, applications and problems using the concepts)	4
		The topics in this module can be found in chapter 3 sections of text [3]	

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand the foundational concepts of set theory and apply set notation and terminology to describe mathematical relationships and structures.	U, Ap	PSO-1,5
CO-2	Understand the fundamental concepts of vector algebra and apply vector algebra techniques to solve problems in geometry, physics, engineering, and computer graphics.	U, Ap	PSO-1,2,4
CO-3	Understand and apply the fundamental concepts of matrix algebra, including matrix and determinants, and Solve systems of linear equations using matrix method.	U, Ap	PSO-1,2,5
CO-4	Understand the fundamental concepts of number theory and Investigate modular arithmetic and its applications in cryptography, coding theory, and computer science.	U, Ap, An	PSO-2,3,4,8

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

Name of the Course: Mathematics for Computer Science-I
Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture(L)/ Tutorial(T)	Practical(P)
1	Understand the foundational concepts of set theory and apply set notation and terminology to describe mathematical relationships and structures.	PO-1,2 PSO-1,5	U, Ap	F, C, P	L	
2	Understand the fundamental concepts of vector algebra and apply vector algebra techniques to solve problems in geometry, physics, engineering, and computer graphics.	PO-1,2 PSO-1,2,4	U, Ap	C, P	L	
3	Understand and apply the fundamental concepts of matrix algebra, including matrix and determinants, and Solve systems of linear equations using matrix method.	PO-1,2 PSO-1,2,5	U, Ap	C,P	L	
4	Understand the fundamental concepts of number theory and Investigate modular arithmetic and its applications in cryptography, coding theory, and computer science.	PO-1,2 PSO-2,3,4,8	U, Ap, An	F, C, P	L	

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

Mapping of COs with PSOs and POs:

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	3	3	-	1	-	-	-	3	3	-	-	-	-	-
CO 2	3	3	3	1	-	-	-	-	3	3	1	-	1	-	-
CO 3	3	3	3	-	1	-	-	-	3	3	-	-	-	-	-
CO 4	3	3	3	1	-	-	-	1	3	3	-	1	1	-	-

Correlation Levels:

Level	Correlation
-	Nil

1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics:

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

Mar Ivanios College (Autonomous)

Discipline	Mathematics				
Course Code	MIUK1DSCMAT111.1				
Course Title	**Mathematics for Statistics - I**				
Type of Course	DSC				
Semester	I				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-		4
Pre-requisites	1. Elementary Matrix Theory				
Course Summary	The course covers a comprehensive range of topics in linear algebra and its applications. It begins with the study of elementary row operations and how they are used to manipulate matrices, leading to the understanding of echelon forms and the computation of inverses using these operations. The course delves into the characterization of invertible matrices and their significance in solving systems of linear equations. Vectors are introduced, along with concepts of linear independence, dependence, and their role in forming vector spaces. The course emphasizes the importance of bases, dimension, and rank in understanding the structure of vector spaces and linear transformations. Gram-Schmidt process is introduced to obtain orthonormal vectors from a set of vectors. Eigenvalues and eigenvectors are introduced, leading to discussions on diagonalization. Quadratic forms are also discussed. The course also covers some numerical methods of solving linear simultaneous equations, interpolation methods, and numerical integration. As this course is designed as a minor course, we may avoid all the proofs of theorems.				
Texts	**1. David C Lay,** *Linear Algebra and its Applications*, **3**rd **Edition** **2. B S Grewal,** *Higher Engineering Mathematics*, **42**nd **Edition, Khanna Publishers.**				
References	**1.** T S Blyth and E F Robertson, *Linear Algebra,* 2nd Edition, Springer 2. Erwin Kreyszig, *Advanced Engineering Mathematics,* 10th Edition,				

		Wiley-India. 3. Peter O'Neil, *Advanced Engineering Mathematics,* Thompson Publications

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Linear Equations in Linear Algebra**	**15**
	1	Elementary row operations	2
		Echelon form	3
		Inverse of a matrix using elementary operations	2
	2	Systems of Linear equations and its solutions	4
		Matrix of a system of linear equations	1
		Cramer's rule	3
		Topics can be found in sections 1.2 - 1.5, 2.2 and 3.3 of text 1	
II		**Vector Spaces**	**15**
	1	Vector spaces and subspaces	3
		Null spaces, column spaces and linear transformations	2
		Subspaces of $\mathbb{R}^n$	1
	2	Linear independent sets; Bases	2
		The dimension of a vector space	1
		Rank	1
	3	Inner product, length and orthogonality	2
		Orthogonal sets	1
		The Gram – Schmidt Process	2
		Topics can be found in sections 4.1, 4.2, 2.8, 4.3, 4.5, 4.6, 6.1, 6.2, 6.4 of text 1	
III		**Diagonalization and Quadratic Forms**	**15**
	1	Characteristic equation	1
		Eigenvalues and eigenvectors	3
	2	Diagonalization	3
		Eigenvectors and linear transformations	1
	3	Diagonalization of symmetric matrices	3
		Quadratic forms	4
		Topics can be found in sections 5.1-5.4, 7.1, 7.2 of text 1	
IV		**Numerical Solutions**	**15**
	1	Newton-Raphson formula	2
	2	Gauss elimination method	2
		Gauss Jordan method	1
		Jacobi's iteration method	1
		Gauss-Seidel iteration method	1
	3	Newtons interpolation formula	2

		Lagrange's interpolation formula	2
	4	Trapezoidal rule	1
		Simpson's one-third rule	1
		Simpson's three-eighth rule	1
		Weddles rule	1
Topics can be found in sections 28.2, 28.5 to 28.7, 29.6, 29.10, 30.6 to 30.8, 30.10 of Text 2			

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Learn matrix algebra and hence solve linear equations using matrices.	R, U, Ap	PSO- 1, 2, 3
CO-2	Get acquainted with basic concepts such as vector spaces, linear dependence or independence of vectors, basis and linear maps.	Ap, An, E	PSO-1, 2, 3, 4
CO-3	Analyze and calculate eigenvalues and eigenvectors and diagonalize matrices, if possible.	U, Ap, An, E, C	PSO-1, 2, 3, 4, 8
CO-4	Learn some numerical methods for solving linear simultaneous equations, some interpolation methods, and numerical integration	R, U, Ap	PSO-1, 3, 7

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

Name of the Course: Mathematics for Statistics - I
Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture(L/ Tutorial(T)	Practical (P)
1.	Learn matrix algebra and hence solve linear equations using matrices.	PO-1, 2 PSO- 1, 2, 3	R, U, Ap	F, C, P	L	
2.	Get acquainted with basic concepts such as vector spaces, linear dependence or independence of vectors, basis and linear maps.	PO-1, 2 PSO-1, 2, 3, 4	Ap, An, E	F, C	L	
3.	Analyze and calculate eigenvalues and eigenvectors and diagonalize matrices, if possible.	PO- 1, 2,6 PSO-1, 2, 3, 4, 8	U, Ap, An, E, C	C, P, M	L	
4.	Learn some numerical methods for solving linear simultaneous equations, some interpolation methods, and numerical	PO-1, 2 PSO-1, 3, 7	R, U, Ap	P	L	

integration					

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

Mapping of COs with PSOs and POs:

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	3	3	2	2	1	1	1	3	3	-	1	1	2	1
CO 2	3	3	3	3	1	1	2	1	3	3	-	1	1	2	1
CO 3	3	3	3	3	2	1	2	3	3	3	-	2	2	3	2
CO 4	3	2	3	2	2	1	3	1	3	3	-	2	1	1	-

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics:

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

MAR IVANIOS COLLEGE (AUTONOMOUS)

Discipline	Mathematics				
Course Code	MIUK1DSCMAT103.1				
Course Title	**Mathematics for Humanities and Commerce – I**				
Type of Course	DSC				
Semester	I				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4
Pre-requisites	1. Equations 2. Basic arithmetical operations				
Course Summary	This course typically covers fundamental mathematical concepts like set theory, different functions, permutations and combinations and techniques essential for various business applications. It includes the manipulation of algebraic expressions, solving linear equations and inequalities, and understanding basic algebraic concepts. It also covers the matrix algebra and its applications in Business. This course is mainly intended for first semester undergraduate students with Commerce as their major discipline.				
Prescribed Texts	1 B M Aggarwal – Business Mathematics and Statistics, Ane Books Pvt Ltd, 2023. 2. D.C. Sancheti, V.K. Kapoor Business Mathematics, Sultan Chand & SonsPublications, 2006.				
Reference Books	1. **"Business Mathematics" by Gary Clendenen and Stanley A. Salzman, 13th Edition, Pearson Publishers** 2. **"Business Mathematics" by Cheryl Cleaves, Margie Hobbs, and Jeffrey Noble, 9th Edition, Pearson Publishers** 3. **"Essential Mathematics for Economics and Business" by Teresa Bradley:**2nd Edition, Wiley India Private Limited				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Set Theory, Fractions, Permutations and Combinations**	**15**
	1	Set theory: definition-Null set- Subset-Power set-Equal set-Union, Intersection [The topics to be discussed in this module can be found in	4

		Chapter 2 of Text 2]	
	2	Fractions, adding and Subtracting fractions adding and multiplying fractions decimal and fraction conversions	5
		[The topics to be discussed in this module can be found in Chapter 2,3 of the Reference text 2]	
	3	Basic concepts of permutations and combinations-Introduction-Factorial-permutation results- Circular permutations with restrictions-Combinations with standard results	6
		[The topics to be discussed in this module can be found in Chapter 9 of the text 2]	
II		**Equations**	**15**
	4	Linear equation- simultaneous linear equations Quadratic equations, quadratic equation by factoring,	15
		[The topics to be discussed in this module can be found in Chapter 8 of text 2]	
III		**Differentiation**	**15**
	5	Functions, Limits, Continuity, derivatives, rules of differentiation, differentiation of implicit functions.	15
		[The topics to be discussed in this module can be found in Chapter 3 and Chapter 4 of text 1]	
IV		**Matrix Algebra**	**15**
	6	Matrices– Matrix operations (addition, subtraction, constant multiplication and multiplication) - Determinants-Minors and cofactors-ad joint -Inverse of a Matrix, solving linear equation with matrix using Cramer's Rule. Application of Matrices and determinants to Business	15
		[The topics to be discussed in this module can be found in Chapter 1,Chapter 2 of text 1]	
		[Wherever possible, ICT enabled tools should be used]	

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand the concepts of set theory, permutations and combinations, analyse and solve mathematical problems related to these concepts	U, Ap, An	PSO-1,2,3

CO-2	Identify and practice problems related to linear equations and quadratic equations	R, U, Ap, An	PSO-1,2,3,6
CO-3	Determine the concept of functions, derivatives, and evaluate the problems using the rules of differentiation	Ap, An, E	PSO-1,2,3,4
CO-4	Perform different matrix operations and solve problems using different techniques of matrices	Ap, An	PSO-1,2,3

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

Name of the Course: Mathematics for Humanities and Commerce – I
Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture(L/Tutorial(T)	Practical (P)
1	Understand the concepts of set theory, permutations and combinations, analyse and solve mathematical problems related to these concepts	PO 1,2 PSO-1,2,3	U, Ap, An	F, C	L	
2	Identify and practice problems related to linear equations and quadratic equations	PO 1,2 PSO-1,2,3,6	R, U, Ap, An	C	L	
3	Determine the concept of functions, derivatives, and evaluate the problems using the rules of differentiation	PO 1,2 PSO-1,2,3,4	Ap, An, E	C	L	
4	Perform different matrix operations and solve problems using different techniques of matrices	PO 1,2 PSO-1,2,3	Ap, An	C, P	L	

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

Mapping of COs with PSOs and POs:

	PSO	PSO	PSO	PSO	PSO	PSO	PSO	PSO	PO	PO	PO	PO	PO	PO	PO

	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7
CO 1	3	3	3	2	-	-	1	2	3	3	-	-	-	2	1
CO 2	3	3	3	2	1	2	-	1	3	3	-	2	-	1	-
CO 3	3	3	3	2	1	-	-	1	3	3	-	-	-	-	1
CO 4	3	3	3	-	-	-	2	2	3	3	-	2	1	-	-

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics:

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

	MAR IVANIOS COLLEGE (AUTONOMOUS)

Discipline	Mathematics
Course Code	MIUK1DSCMAT104.1
Course Title	**Mathematics for Economics - I**
Type of Course	DSC
Semester	I
Academic Level	100-199

Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4

Pre-requisites	Set Theory
Course Summary	This course at the undergraduate level typically provides students with the mathematical tools and techniques necessary for understanding and analysing economic concepts and models. It explains the differential Calculus, application of differentiation focusing on single variable optimization and Matrix Algebra. This course is designed for first semester undergraduate level economics students.
Prescribed Text	Knut Sydsaeter, Peter J. Hammond: *Mathematics for Economic Analysis*, Pearson, 1995.
Reference Textbooks	1 G D Allen, Mathematical Analysis for Economics, AITBS Publishers, D-2/15. Krishnan Nagar, New Delhi 3. Taro Yamane, Mathematics for Economists, An Elementary Survey, PHI, New Delhi. 4. Chiang A.C. and K.Wainwright, Fundamental Methods of Mathematical Economics, 4th Edition, McGraw-Hill, New York, 2005.(cw) 5. Dowling E.T, Introduction to Mathematical Economics, 2nd Edition, Schaum's Series, McGraw- Hill, New York, 2003(ETD)

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Functions, Limits and Continuity**	**15**

	1	**Functions of one variable**: Introduction, Functions of one real variable, graphs, graphs of functions, linear functions.	8
	2	Limits, dash of limits, continuity	7
		Chapter 2 , Section 6.1, 4.4, 6.2,6.3	
II		**Differentiation**	**15**
	3	Slopes of curves, the slope of the tangent and the derivative, rates of change and their economic significance, simple rules for differentiation, differentiation of sums, products and quotients, second and higher order derivatives. The generalized power rule, composite functions and the chain rule, implicit differentiation, linear approximations and differentials, polynomial approximation, elasticities.	15
		Chapter 4 and 5	
III		**Application of Differentiation to Economics**	**15**
	4	The intermediate-value theorem, the extreme value theorem, the mean value theorem, Taylor's formula, intermediate forms and L' Hopital's rule, inverse functions. **Single-Variable Optimization**: Some basic definitions, a first-derivative test for extreme points, alternative ways of finding maxima and minima, local maxima and minima, convex and concave functions and inflection points.	15
		Chapter 7, Chapter 9 Sections 1-5	
IV		**Linear Algebra and Its applications**	**15**
	5	**Linear Algebra - Vectors and Matrices:** Systems of linear equations, vectors, matrices and matrix operations, matrix multiplication, rules for matrix multiplication, the transpose. **Determinants and Matrix Inversion:** Determinants of order 2, determinants of order 3, expansion by cofactors, inverse of a matrix, Cramer's rule. Linear independence, The rank of a matrix, Eigen values. Cayley Hamilton theorem and its applications. Chapter 12,13,14	15
		[Wherever possible, ICT enabled tools should be used]	

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Sketch the graph of different functions and analyse the continuity of functions	U, Ap,An	PSO-1,2,3
CO-2	Apply the simple rules of differentiation to solve problems	Ap	PSO-1,2,3,6

	like linear approximation, polynomial approximation and elasticities		
CO-3	Explore, identify and determine the application of differentiation in various topics like Intermediate value theorem, the extremities of a function etc	Ap, An, E	PSO-1,2,3,4
CO-4	Construct matrices and solve various problems related to matrices like finding out inverse of a matrix, eigen values of a matrix etc	Ap, E,C	PSO-1,2,3

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

Name of the Course: Mathematics for Economics - I
Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture(L/ Tutorial(T)	Practical (P)
1	Sketch the graph of different functions and analyse the continuity of functions	PO 1,2 PSO-1,2,3	U, Ap,An	F, C, P, M	L	
2	Apply the simple rules of differentiation to solve problems like linear approximation, polynomial approximation and elasticities	PO 1,2 PSO-1,2,3,6	Ap	F, C	L	
3	Explore, identify and determine the application of differentiation in various topics like Intermediate value theorem, the extremities of a function etc	PO 1,2 5 PSO-1,2,3,4	Ap, An, E	C	L	
4	Construct matrices and solve various problems related to matrices like finding out inverse of a matrix, eigen values of a matrix etc	PO 1,2,6 PSO-1,2,3	Ap, E,C	C, M	L	

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

Mapping of COs with PSOs and POs:

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	3	3	-	-	-	-	-	3	3	-	2	-	-	1
CO 2	3	3	3	-	-	3	-	-	3	3	-	-	-	1	2
CO 3	3	3	3	3	-	-	-	-	3	3	2	1	3	-	-
CO 4	3	3	3	-	-	-	1	2	3	3	2	-	-	3	1

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics:

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

Mar Ivanios College (Autonomous)

Discipline	Mathematics				
Course Code	MIUK1MDCMAT112.1				
Course Title	**Business Mathematics**				
Type of Course	MDC				
Semester	I				
Academic Level	100 – 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 hours	-		3
Pre-requisites	1. Equations 2. Basic arithmetical operations				
Course Summary	This course typically covers fundamental mathematical concepts like ratio and proportion, permutations and combinations and techniques essential for various business applications. It includes the manipulation of algebraic expressions, solving linear equations and inequalities, and understanding basic algebraic concepts. This course is mainly intended for first semester undergraduate students with Commerce as their major discipline.				
References	1.B M Aggarwal – *Business Mathematics and Statistics*, Ane Books Pvt Ltd, 2023. 2. D.C. Sancheti, V.K. Kapoor- *Business Mathematics*, Sultan Chand & Sons Publications, 2006. 3. CA materials				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Ratio and Proportion, Indices and logarithms**	**8**
	1	Ratio and Proportion and its applications	3
	2	Laws of indices	3
	3	Exponents, Logarithms and Anti-Logarithms	2
II		**Linear Equations**	**10**
	4	Simultaneous linear equations up to three variables	4
	5	Quadratic and cubic equations in one variable	2
	6	Applications in business related problems	4

III		**Linear Inequalities**	**8**
	7	Meaning of linear inequalities, Objective function, Constraints, Feasible region	1
	8	Linear inequalities in one variable	2
	9	Linear inequalities in two variables	2
	10	Shading the solution space and identification of vertices	3
IV		**Mathematics for Finance**	**9**
	11	Simple interest	1
	12	Compound interest	1
	13	Effective rate of interest	1
	14	Present Value	1
	15	Net Present Value	1
	16	Future Value	1
	17	Annuities	1
	18	Perpetuity	1
	19	Compound Annual Growth Rate	1
V		**Permutation and Combination**	**10**
	20	Basic concepts of permutations and combinations	4
	21	Factorial	1
	22	Permutation results	2
	23	Circular permutations with restrictions	1
	24	Combinations with standard results	2

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Explain the concepts of ratio, proportions, indices, logarithms and its applications in business.	R, U, Ap	PSO-1, 3
CO-2	Find solutions of linear equations using different methods	Ap, An, C	PSO-1, 2, 3
CO-3	Solve equations with inequalities	Ap, An, E	PSO-1, 2, 3
CO-4	Calculate interest, related terms and computation thereof	U, Ap, C	PSO-1, 2, 3
CO-5	Differentiate between permutations and combinations in arranging objects	R, U, Ap, E	PSO-1, 2, 3, 4

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

Name of the Course: Business Mathematics

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

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture(L)/ Tutorial(T)	Practical(P)
CO-1	Explain the concepts of ratio, proportions, indices, logarithms and its applications in business.	PO-1,2 PSO-1, 3	R, U, Ap	F, C	L	
CO-2	Find solutions of linear equations using different methods	PO-1,2 PSO-1,2,3	Ap, An, C	C, P	L	
CO-3	Solve equations with inequalities	PO-1,2 PSO-1,2,3	Ap, An, E	F, C, P	L	
CO-4	Calculate interest, related terms and computation thereof	PO-1,2 PSO-1,2,3	U, Ap, C	P, M	L	
CO-5	Differentiate between permutations and combinations in arranging objects	PO-1,2 PSO-1,2,3,4	R, U, Ap, E	F, C, P	L	

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

Mapping of COs with PSOs and POs:

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	2	3	2	1	1	2	2	3	3	1	2	1	2	1
CO 2	3	3	3	2	2	2	2	2	3	3	-	2	1	2	1
CO 3	3	3	3	2	2	2	2	2	3	3	1	2	1	2	1
CO 4	3	3	3	2	2	2	1	1	3	3	1	1	-	1	1
CO 5	3	3	3	3	1	1	2	2	3	3	-	1	1	2	1

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low

2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz/ Assignment
- Discussion / Seminar
- Midterm Exam
- End Semester Examinations

Mapping of COs to Assessment Rubrics:

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

Mar Ivanios College (Autonomous)

Discipline	Mathematics				
Course Code	MIUK1MDCMAT106.1				
Course Title	**Quantitative Techniques and Aptitude** **(Basic Mathematics for Competitive Examinations)**				
Type of Course	MDC				
Semester	I				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 hours	-	-	3
Pre-requisites	Basic High School Mathematics.				
References	1. R. S. Aggarwal, *Quantitative Aptitude*, S. Chand, New Delhi, 2017. 2. M Tyra and K. Kundan, *Practice Book of Quicker Maths*, BSC Publishing Company Pvt Ltd, New Delhi, 2015. 3. Rajesh Verma, *Fast Track Obective Arithmetic*, Arihant Publications (India) Ltd., New Delhi.				
Course Summary	The course discusses basic mathematics and quantitative techniques essential for competitive examinations. The course covers basic arithmetic techniques, percentage, profit and loss, time related problems etc. It also introduces the mensuration, probability and mathematics related to bank and market. The syllabus is aligned with the requirements of any standard competitive examination.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Basic Number Problems**	**15**
	1	Number system, Basic arithmetic operations, BODMAS rule, HCF and LCM, Decimal Fractions, Simplification, Word problems based on numbers, Square roots and Cube roots, Average, Problems on Ages, Surds and Indices, Logarithms.	
II		**Percentage and Proportion**	**15**
	2	Percentage, Profit and Loss, Ratio and Proportion, Partnership, Pipes and Cisterns, Time, Work and Wages, Time and Distance, Boats and Streams, Problems on Trains, Alligation or Mixture, Simple Interest, Compound Interest, Area and Volume, Races and Games of skill.	
III		**Elementary Mensurations and Probability**	**15**
	3	Elementary Mensuration, Calendar, Clocks, Permutations and Combinations, Probability, True Discount, Banker's Discount,	

	Heights and Distances, Stocks and Shares, Odd man out and series.	

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand the basic arithmetic and acquire ability to solve number related problems.	R, U, Ap, E	1,2,3
CO-2	Understand concepts of percentage and proportion, different types of work and time related problems and acquire ability to solve them.	R, U, Ap, E	1,2,3,
CO-3	Understand the basic mensuration, probability, mathematics related dicounts and acquire ability to solve related problems.	R, U, Ap, E	1,2,3
CO-4	Acquire expertise to perform successfully in the mathematical/quantitative part of competitive examinations.	Ap, E	1,2,3

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

Name of the Course: Quantitative Techniques and Aptitude
(Basic Mathematics for Competitive Examinations)
Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture(L)/ Tutorial(T)	Practical(P)
1.	Understand the basic arithmetic and acquire ability to solve number related problems.	PO-1,2 PSO-1,2,3	R, U, Ap, E	F, C	L	
2.	Understand concepts of percentage and proportion, different types of work and time related problems and acquire ability to solve them.	PO-1,2 PSO-1,2,3	R, U, Ap, E	P	L	
3.	Understand the basic mensuration, probability, mathematics related dicounts and acquire ability to solve related problems.	PO-1,2 PSO-1,2,3	R, U, Ap, E	C, P	L	
4.	Acquire expertise to perform successfully in the mathematical/quantitative part of competitive examinations.	PO-1,2 PSO-1,2,3	Ap, E	P, M	L	

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

Mapping of COs with PSOs and POs:

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	3	3	2	2	1	1	1	3	3	-	1	1	2	1
CO 2	3	3	3	1	1	1	2	1	3	3	-	1	1	2	1
CO 3	3	3	3	1	2	1	2	3	3	3	-	2	2	-	2
CO 4	3	2	3	2	2	1	1	1	3	3	-	2	1	1	-

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics:

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

Mar Ivanios College (Autonomous)

SEMESTER - II

COURSES OFFERING – SEMESTER II

COURSE TYPE	MAJOR (STUDENTS)	COURSE TITLE	CREDITS
DSC	ALL SCIENCES INCLUDING COMPUTER SCIENCE	Mathematics for Computer Science-II	4
DSC	ALL SCIENCES INCLUDING STATISTICS	Mathematics for Statistics - II	4
DSC	HUMANITIES AND COMMERCE	Mathematics for Humanities and Commerce - II	4
DSC	ECONOMICS	Mathematics for Economics - II	4
MDC	COMMON TO ALL DISCIPLINES	Data Interpretation and Logical Reasoning	3

Mar Ivanios College (Autonomous)

Discipline	Mathematics				
Course Code	MIUK2DSCMAT160.1				
Course Title	**Mathematics for Computer Science-II**				
Type of Course	DSC				
Semester	II				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4
Course Summary	Discrete mathematics is a branch of mathematics that deals with distinct and finite objects rather than continuous ones. It encompasses a wide range of topics, including logic, combinatorics, and graph theory. Combinatorics focuses on counting and arranging objects, while graph theory studies the properties of networks represented by vertices and edges. Logic forms the basis for rigorous reasoning and proofs, essential for establishing the validity of mathematical arguments. Discrete mathematics finds applications in computer science, cryptography, network design, and algorithm analysis, providing essential tools for solving problems in various domains. Mastery of discrete mathematics equips learners with fundamental analytical skills and problem-solving techniques crucial for both theoretical investigations and practical applications.				
Texts	Discrete Mathematics with graph theory and combinatorics, T. Veerarajan				
References	1. Discrete Mathematics: An Open Introduction" by Oscar Levin 2. Higher Engineering Mathematics, B S Grewal, , 42nd Edition, Khanna Publishers 3. "Introduction to Graph Theory" by Douglas B. West 4. "Discrete Mathematics and Its Applications" by Kenneth H. Rosen				

Detailed Syllabus:

Module	Unit	Content	Hrs
		Mathematical Logic	**15**
	1	Introduction-Propositions	1
		Connectives, Order of Precedence for Logical Connectives	1
		Conditional and Biconditional Propositions,	1
I	2	Tautology and Contradiction	2
		Equivalence of Propositions	2
		Algebra of Propositions	3
		Tautological Implication	3
	3	Theory of Inference-Introduction, Truth Table Technique	2
		The topics in this module can be found in chapters 1 of the text	
		Coding Theory	**15**
	1	Encoders and Decoders	2
		Group Code	1
		Hamming Codes (Proof of theorems may be omitted.)	2
II	2	Basic notations of error corrections using matrices	4
		Error Correction in Group Codes	3
		Step by Step Procedure for Decoding Group Codes.	3
		The topics in this module can be found in chapters 5 of the text	
		Combinatorics	**15**
		Permutations and Combinations	2
		Permutations with Repetition, Circular permutation(Proofs maybe omitted)	3
III		Recurrence relations	2
		Solving recurrence relations	3
		Particular solutions	2
		Solution of recurrence relations by generating functions	3
		The topics in this module can be found in chapters 5 of the text	
		Introduction to Graphs	**15**
	1	Basic definitions	2
		Degree of a vertex	1
	2	Complete graph	2
		Bipartite graph	2
IV		Subgraphs	2

		Isomorphic graphs	2
	3	The adjacency matrix	2
		The incidence matrix	2
	The topics in this module can be found in chapters 7 of the text		

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand the fundamental concepts of mathematical logic and Explore the relationships between logical statements, truth values, and logical connectives	U, Ap	PSO-1,2
CO-2	Understand the fundamental concepts of coding theory, including error detection, error correction, and encoding techniques and Analyze the performance of error-correcting codes using metrics such as Hamming distance, code rate, and minimum distance.	U, An	PSO-2,3,4
CO-3	Understand the fundamental concepts of combinatorics and Explore advanced topics in combinatorics, such as generating functions, recurrence relations, and inclusion-exclusion principle.	U, Ap, An	PSO-1,2,8
CO-4	Understand and apply the fundamental concepts of graph theory, including graphs, vertices, edges, and basic graph properties.	U, Ap	PSO-2,3,5

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

Name of the Course: Mathematics for Computer Science-II
Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture(L)/ Tutorial(T)	Practical P)
1.	Understand the fundamental concepts of mathematical logic and Explore the relationships between logical statements, truth values, and logical connectives	PO-1, 2 PSO-1,2	U, Ap	F, C, P	L	
2.	Understand the fundamental concepts of coding theory, including error detection, error	PO-1,2 PSO-	U, An	F, C, M	L	

	correction, and encoding techniques and Analyze the performance of error-correcting codes using metrics such as Hamming distance, code rate, and minimum distance.	2,3,4				
3.	Understand the fundamental concepts of combinatorics and Explore advanced topics in combinatorics, such as generating functions, recurrence relations, and inclusion-exclusion principle.	PO-1,2 PSO-1,2,8	U, Ap, An	F, C, M	L	
4.	Understand and apply the fundamental concepts of graph theory, including graphs, vertices, edges, and basic graph properties.	PO-1,2 PSO-2,3,5	U, Ap	F, C	L	

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

Mapping of COs with PSOs and POs:

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	3	3	-	-	-	-	-	3	3	-	1	-	-	-
CO 2	3	3	3	2	-	-	-	-	3	3	1	-	1	-	-
CO 3	3	3	3	-	-	-	-	1	3	3	-	-	-	-	-
CO 4	3	3	3	-	1	-	-	-	3	3	1	1	1	-	-

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics:

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

Mar Ivanios College (Autonomous)

Discipline	Mathematics				
Course Code	MIUK2DSCMAT161.1				
Course Title	**Mathematics for Statistics - II**				
Type of Course	DSC				
Semester	II				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-		4
Pre-requisites	1. Concepts of functions, limit, continuity and differentiability				
Course Summary	This course is designed to get a fairly descent coverage of differential calculus of one or more variables. A short section on sequences and series is also included. This course is mainly intended for first semester undergraduate students with Statistics as their major discipline. As this course is designed as a minor course, we may avoid all the proofs of theorems.				
Texts	**H Anton, I Bivens, S Davis, *Calculus*, 10th Edition, John Wiley & Sons**				
References	1. G. B. Thomas, R. L. Finney, *Calculus*, 9th Edition, Addison-Weseley Publishing Company 2. K F Riley, M P Hobson, S J Bence, *Mathematical Methods for Physics and Engineering,* 3rd Edition, Cambridge University Press 3. Mary L Boas, *Mathematic Methods in the Physical Sciences,* 3rd Edition, Wiley 4. Erwin Kreyszig, *Advanced Engineering Mathematics,* 10th Edition, Wiley-India				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Differential Calculus of One Variable**	**15**
	1	The derivative function	1
		Introduction to techniques of differentiation	1
		The product and quotient rules	1
		Derivatives of trigonometric functions	1
		The chain rule	2

		Implicit differentiation	1
	2	Derivatives involving logarithmic functions	3
		Derivatives of inverse functions	1
	3	L'Hopital's rule	4
Topics can be found in sections 2.2-2.7, 6.2, 6.3 and 6.5 of the text			
II		**Applications of Derivatives**	**15**
	1	Increase, decrease and concavity	3
		Relative extrema	3
		Graphing polynomials	3
	2	Absolute maxima and minima	3
	3	Rolle's theorem and Mean-Value theorem	3
Topics can be found in sections 3.1, 3.2, 3.4 and and 3.8 of the text			
III		**Differential Calculus of Functions of Two or More Variables**	**15**
	1	Functions of two or more variables-their domains, graph and level curves	3
		Partial derivatives	2
		Implicit partial differentiation	1
		Higher-order partial derivatives	1
		The chain rule	2
	2	Maxima and minima of functions of two variables	3
		Lagrange multipliers	3
Topics can be found in sections 13.1, 13.3, 13.5, 13.8 and 13.9 of text			
IV		**Sequences and Series**	**15**
	1	Sequences	2
	2	Infinite series	2
		Convergence tests	4
		The comparison, ratio and root tests	4
		Alternating series; absolute and conditional convergence	3
Topics can be found in sections 9.1, 9.3-9.6 of text			

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Compute derivatives of functions.	U, Ap	PSO-1, 3
CO-2	Find limits of rational functions.	Ap, An, E	PSO-1, 3
CO-3	Use derivatives to explore the behavior of a given function. This includes locating and classifying its extrema, and graphing polynomial functions.	Ap, An, E, C	PSO- 1, 2, 3, 4, 7
CO-4	Compare and contrast functions of one variable and more than one variable.	R, U	PSO- 1, 3

| CO-5 | Learn and perform differentiation of functions of more than one variable and find its extremas. | U, Ap, An | PSO- 1, 2, 3 |
| CO-6 | Comfortable with sequences and series, understanding when they add up to a definite value or go to infinity using different tests to decide, and understanding the behaviour of alternating series. | R, U, Ap, An | PSO- 1, 2, 3, 4 |

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

Name of the Course: Mathematics for Statistics - II
Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture(L)/ Tutorial(T)	Practical P)
1.	Compute derivatives of functions.	PO-1, 2 PSO-1, 3	U, Ap	F, C, P	L	
2.	Find limits of rational functions.	PO-1, 2 PSO-1, 3	Ap, An, E	P	L	
3	Use derivatives to explore the behavior of a given function. This includes locating and classifying its extrema, and graphing polynomial functions.	PO-1, 2, 6 PSO- 1, 2, 3, 4, 7	Ap, An, E, C	C, P, M	L	
4.	Compare and contrast functions of one variable and more than one variable.	PO-1, 2 PSO- 1, 3	R, U	F, C	L	
5.	Learn and perform differentiation of functions of more than one variable and find its extremas.	PO-1, 2 PSO- 1, 2, 3	U, Ap, An	C, P	L	
6	Comfortable with sequences and series, understanding when they add up to a definite value or go to infinity using different tests to decide, and understanding the behaviour of alternating series.	PO-1, 2 PSO- 1, 2, 3, 4	R, U, Ap, An	F, C, P	L	

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

Mapping of COs with PSOs and POs:

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	2	3	2	1	1	2	1	3	3	-	1	1	1	-

CO 2	3	2	3	2	1	-	1	1	3	3	-	1	1	-	-
CO 3	3	3	3	3	2	2	3	2	3	3	-	2	2	3	1
CO 4	3	2	3	1	-	-	1	-	3	3	-	-	-	-	-
CO 5	3	3	3	2	1	2	2	2	3	3	-	1	2	2	1
CO 6	3	3	3	3	2	2	2	1	3	3	-	1	1	1	-

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics:

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

	MAR IVANIOS COLLEGE (AUTONOMOUS)

Discipline	Mathematics
Course Code	MIUK2DSCMAT153.1
Course Title	**Mathematics for Humanities and Commerce -II**
Type of Course	DSC
Semester	II
Academic Level	100-199

Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4

Pre-requisites	1. Functions 2. Differentiation
Course Summary	The emphasis of this courses is on computational skills on Business Mathematics and their practical application, with practical application being predominant. It covers several topics such as interpolation, extrapolation, integration techniques, application of Mathematics in finance and index numbers. This course is mainly intended for second semester undergraduate students with Commerce as their major discipline.
Prescribed Texts	1. B M Aggarwal – Business Mathematics and Statistics, Ane Books Pvt Ltd, 2023. 2. D.C. Sancheti, V.K. Kapoor Business Mathematics, Sultan Chand & SonsPublications, 2006.
Reference Books	4. **"Business Mathematics" by Gary Clendenen and Stanley A. Salzman, 13th Edition, Pearson Publishers** 5. **"Business Mathematics" by Cheryl Cleaves, Margie Hobbs, and Jeffrey Noble, 9th Edition, Pearson Publishers** 6. **"Essential Mathematics for Economics and Business" by Teresa Bradley:**2nd Edition, Wiley India Private Limited

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Interpolation and Extrapolation**	**12**
	1	Introduction, Importance, methods of interpolation – Newtons Forward and Backward method, Lagrange's method of	12

		Extrapolation	
II		**Integral Calculus**	**12**
	3	Introduction, General Rules, Some Standard results, Method of substitution, Partial fractions, Some standard substitutions, Integration by parts [The topics to be discussed in this module can be found in Chapter 6 of Text 1]	12
III		**Mathematical Application in Business**	**12**
	4	-Depreciation- methods of depreciation, partial year depreciation and changes in estimates, accelerated depreciation methods. Payroll cost calculations, Property tax calculations, exchange rates and currency conversion. [The topics to be discussed in this module can be found in Chapter 17 of Reference Text 2]	12
IV		**Basic Mathematics of Finance**	**12**
	5	Simple interest-Compound Interest-Effective rate of interest-Present Value-Net Present Value-Future Value-Perpetuity-Annuities-Sinking Funds-Calculations of EMI-Calculation of returns under normal rate of return, effective rate of return and Compound Annual Growth Rate (CAGR) [The topics to be discussed in this module can be found in Chapter 14 of Reference Text 2]	12
V		**Title of the Module: Index Numbers**	**12**
	6	Index Numbers: Definition, Simple and composite index numbers, types of index numbers, methods of construction of price index numbers, Laspeyer's price index number, Paasche's price index number, Fisher ideal index number, construction of cost living index, consumer price index, whole sale index, share price index. [The topics to be discussed in this module can be found in Chapter 6 of Text 1]	12
		[Wherever possible, ICT enabled tools should be used]	

Course Outcomes

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

CO-1	Compute the problems involving interpolation and extrapolation	Ap	PSO-1,2,3
CO-2	Integrate different functions and apply integration techniques to solve various problems related to it	Ap, E	PSO-1,2,3
CO-3	Estimate property tax , exchange rates and determine currency conversion	An, E	PSO-1,2,3
CO-4	Classify different annuinities , sinking funds and compute mathematical problems related to it	Ap, An, E, C	PSO-1,2,3
CO-5	Construct cost living index and compute problems related to index numbers	C, Ap, An, E	PSO-1,2,3

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

Name of the Course: Mathematics for Humanities and Commerce -II
Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture(L)/ Tutorial(T)	Practical P)
1	Compute the problems involving interpolation and extrapolation	PO 1,2 PSO-1,2,3	Ap	F, C	L	
2	Integrate different functions and apply integration techniques to solve various problems related to it	PO 1,2 PSO-1,2,3	Ap, E	F, C, P	L	
3	Estimate property tax, exchange rates and determine currency conversion	PO 1,2 PSO-1,2,3	An, E	C	L	
4	Classify different annuities, sinking funds and compute mathematical problems related to it	PO 1,2 PSO-1,2,3	Ap, An, E, C	C, P	L	
5	Construct cost living index and compute problems related to index numbers	PO 1,2 PSO-1,2,3	C, Ap, An, E	F, C	L	

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

Mapping of COs with PSOs and POs:

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	3	3	-	-	2	1	1	3	3	-	1	-	2	1
CO 2	3	3	3	-	-	-	1	1	3	3	2	-	-	1	-
CO 3	3	3	3	-	-	-	1	1	3	3	-	1	-	2	-
CO 4	3	3	3	2	-	-	1	1	3	3	-	2	1	-	-
CO 5	3	3	3	-	-	2	1	2	3	3	-	2	1	-	-

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics:

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

MAR IVANIOS COLLEGE (AUTONOMOUS)

Discipline	Mathematics				
Course Code	MIUK2DSCMAT154.1				
Course Title	**Mathematics for Economics-II**				
Type of Course	DSC				
Semester	II				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	0	0	4
Pre-requisites	1. Functions of one variable 2. Differentiation				
Course Summary	This course at the undergraduate level typically provides students with the mathematical tools and techniques necessary for understanding and analysing economic concepts and models. It talks about Exponential and logarithmic functions, multivariable functions and its application, Integral Calculus, differential equations and difference equations. This course is designed for second semester undergraduate level economics students.				
Prescribed Text	Knut Sydsaeter, Peter J. Hammond: *Mathematics for Economic Analysis*, Pearson, 1995.				
Reference Textbooks	1. G D Allen, Mathematical Analysis for Economics, AITBS Publishers, D-2/15. Krishnan Nagar, New Delhi 2. Taro Yamane, Mathematics for Economists, An Elementary Survey, PHI, New Delhi. 3. Chiang A.C. and K.Wainwright, Fundamental Methods of Mathematical Economics, 4th Edition, McGraw-Hill, New York, 2005.(cw) 4. Dowling E.T, Introduction to Mathematical Economics, 2nd Edition, Schaum's Series, McGraw- Hill, New York, 2003(ETD)				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Functions of Several variables and its Applications**	**12**
	1	**Functions of Several Variables:** Functions of two or more variables, geometric representations of functions of several variables, partial derivatives with two variables, partial derivatives and tangent planes, partial derivatives with many variables, partial derivatives in Economics.	7
	2	The chain rule, more general chain rules, derivatives of functions defined implicitly, partial elasticities, homogeneous functions of two variables, linear approximations and differentials.	5
		Chapter 15 Section 1-7, **Chapter 16 Sections 1-5, 8, 9**	
II		**Integration**	**12**
	3	**Integration:** Areas under curves, indefinite integrals, the definite integral, economic application of integration. **Further Topics in Integration:** Integration by parts, integration by substitution, extending the concept of the integral, a note on income distribution.	12
		Chapter 10 and 11	
III		**Difference Equations**	**12**
	4	**Difference Equations:** First order difference equations, compound interest and present discounted values, linear equations with a variable coefficient, second order equations, second order equations with constant coefficients.	12
		Chapter 20	
IV		**Differential Equations**	**12**
	5	**Differential Equations:** First order differential equations, the direction is given – find the path, separable differential equations-I, separable differential equations-II, first order linear differential equations-I, first order linear differential equations-II, second order differential equations, second order differential equations with constant coefficients.	12
		Chapter 21	
V		**Exponential and Logarithmic Functions**	**12**
	6	**Exponential and Logarithmic Functions**: The natural exponential function, the natural logarithmic function, generalizations, applications of exponentials and logarithms.	
		Chapter 14 Sections 1-4	
		[Wherever possible, ICT enabled tools should be used]	

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Apply the concept of partial derivatives and evaluate partial elasticities, and differentials	Ap,An,E	PSO-1,2,3
CO-2	Explore the ideas of Integral calculus in evaluating income distribution and apply different techniques of integration	Ap,An,E	PSO-1,2,3
CO-3	Discuss and illustrate various problems related to difference equations	Ap,E An	PSO-1,2,3
CO-4	Evaluate first order and second order differential equations	Ap,E	PSO-1,2,3
CO-5	Apply the concept of exponential and logarithmic functions in Economic models	Ap	PSO-1,2,3

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

Name of the Course: Mathematics for Economics-II
Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture(L)/Tutorial(T)	Practical P)
1	Apply the concept of partial derivatives and evaluate partial elasticities, and differentials	PO 1,2 PSO-1,2,3	Ap, An, E	F, C	L	
2	Explore the ideas of Integral calculus in evaluating income distribution and apply different techniques of integration	PO 1,2 PSO-1,2,3	Ap, An, E	F, C, M	L	
3	Discuss and illustrate various problems related to difference equations	PO 1,2 PSO-1,2,3	Ap, An, E	C, M	L	
4	Evaluate first order and second order differential equations	PO 1,2 PSO-1,2,3	Ap, E	C, M	L	
5	Apply the concept of exponential and logarithmic functions in Economic models	PO 1,2 PSO-1,2,3	Ap	C	L	

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

Mapping of COs with PSOs and POs:

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	3	3	-	2	1	-	-	3	3	-	-	-	-	-
CO	3	3	3	-	2	2	2	1	3	3	-	-	1	-	2

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

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics:

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

Mar Ivanios College (Autonomous)

Discipline	Mathematics				
Course Code	MIUK2MDCMAT156.1				
Course Title	**Data Interpretation and Logical Reasoning**				
Type of Course	MDC				
Semester	II				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 hours	-	-	3
Pre-requisites	Basic High School Mathematics.				
References	1. Nishit K Sinha, Data Interpretation for CAT, Pearson, Noida, 2023. 2. Nishit K Sinha, Logical Reasoning for CAT, Pearson, Noida, 2023.				
Course Summary					

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Data Interpretation**	**15**
	1	Introduction to Data Interpretation, Developing the skills, Data sufficiency, Logical Venn diagrams, Tabulation, Bar Graphs, Pie Chart, Line Graphs, Radar Graphs, Mixed Graphs, Caselets. Practising and Mastering Data Interpretation through exercises. (Foundation/Moderate/Advanced Exercises)	
II		**Logical Reasoning**	**10**
	2	Logical Reasoning: Linear Arrangement, Circular Arrangement, Tabular Arrangement, Logical links, Group formation, syllogism, coding-decoding, logic and data-based reasoning. Practical Exercises.	
III		**Analytical and Verbal Reasoning**	**20**
	3	Analytical Reasoning: Blood relation, Directions decision making, Input-output, cubes and dice, Series (letter, number and mixed), Boolean logic. Verbal Reasoning: Statement and Assumptions, Statement and Conclusions, Statement and Arguments, Statement Course of action, Cause and Effect, Theme detection.	

		Practical Exercises.	

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand different methods to represent data and acquire skills to classify and interpret them and solve the related problems.	R, U, Ap, E	PSO-1,2,3
CO-2	Understand the different types of logical reasoning problems and acquire ability to solve them.	U, Ap, E	PSO 1,2,3
CO-3	Understand the analytical reasoning and verbal reasoning problems and acquire ability to solve them.	U, Ap, E	PSO 1,2,3
CO-4	Acquire expertise to perform successfully well in data interpretation and reasoning part of competitive examinations.	Ap, E	PSO 1,2,3

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

Name of the Course: Data Interpretation and Logical Reasoning
            (Basic Mathematics for Competitive Examinations)
Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture(L)/ Tutorial(T)	Practical (P)
1.	Understand different methods to represent data and acquire skills to classify and interpret them and solve the related problems.	PO-1,2 PSO-1,2,3	R, U, Ap, E	F, C, P	L	
2.	Understand the different types of logical reasoning problems and acquire ability to solve them.	PO-1,2 PSO-1,2,3	U, Ap, E	F, C, P	L	
3.	Understand the analytical reasoning and verbal reasoning problems and acquire ability to solve them.	PO-1,2 PSO-1,2,3	U, Ap, E	C, P, M	L	
4.	Acquire expertise to perform successfully well in data interpretation and reasoning part of competitive examinations.	PO-1,2 PSO-1,2,3	Ap, E	P, M	L	

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

Mapping of COs with PSOs and POs:

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	3	3	2	2	1	1	1	3	3	-	1	1	2	1
CO 2	3	3	3	1	1	1	2	1	3	3	-	1	1	2	1
CO 3	3	3	3	1	2	1	2	-	3	3	-	2	2	1	2
CO 4	3	2	3	2	2	1	2	1	3	3	-	2	1	2	-

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics:

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

Mar Ivanios College (Autonomous)

SEMESTER - III

COURSES OFFERING – SEMESTER III

COURSE TYPE	MAJOR (STUDENTS)	COURSE TITLE	CREDITS
DSC	ALL SCIENCES INCLUDING COMPUTER SCIENCE	Mathematics for Computer Science –III	4
DSC	ALL SCIENCES INCLUDING STATISTICS	Mathematics for Statistics – III	4
DSC	COMMON TO ALL DISCIPLINES	Mathematics for Humanities, Commerce and Economics (Operations Research)	4

Mar Ivanios College (Autonomous)

Discipline	Mathematics				
Course Code	MIUK3DSCMAT210.1				
Course Title	**Mathematics for Computer Science –III**				
Type of Course	DSC				
Semester	III				
Academic Level	200-299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4
Pre requisites	1. Concepts of functions, limits and continuity 2. Basic arithmetical operations				
Course Summary	The course covers fundamental concepts in calculus, numerical methods, and discrete probability theory. Basic Differentiation explores the principles of finding derivatives of functions, essential for analyzing rates of change and optimization problems. Basic Integration delves into techniques for finding antiderivatives and definite integrals, enabling the calculation of areas under curves and solving problems involving accumulation. Numerical Methods introduces algorithms for approximating solutions to mathematical problems that are difficult or impossible to solve analytically, including root-finding, interpolation, and numerical integration techniques. Discrete Probability examines the principles of probability theory applied to discrete events and random variables, covering topics such as probability distributions, expected values, and counting methods. Together, these topics provide a solid foundation in mathematical techniques essential for various fields, including engineering, computer science, finance, and statistics, equipping learners with the tools to tackle both theoretical and practical challenges in quantitative analysis and decision-making.				
Texts	**1.** B S Grewal, *Higher Engineering Mathematics*, 42nd Edition, Khanna Publishers. **2**. H Anton, I Bivens, S Davis, *Calculus*, 10th Edition, John Wiley & Sons.				
References	1. George B. Thomas, Ross L. Finney, Calculus and analytic geometry, 9th Edition, Addison-wesley publishingCompany 2. Tom M. Apostol. Calculus, Volume 1, 2nd Edition, John Wiley & Sons				

		3. Tom M. Apostol. Calculus, Volume 2, John Wiley & Sons	

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Differentiation**	**15**
	1	The derivative function(definition only)	1
		Techniques of differentiation	2
		Product rule	2
		Quotient rule	3
	2	Derivatives of trigonometric function	2
		The chain rule	3
	3	Derivatives of logarithmic functions	
		The topics in this module can be found in chapter 2 sections 2.2-2.6, 6.2 of text [2]	
II		**Integration**	**15**
	1	Area Problem	1
		Indefinite integral	2
	2	Integration by substitution	5
		Definite integral	2
		Integration by parts	5
		ICT tools can be used to enhance effective learning. *The topics in this module can be found in chapter 2 sections 4.1, 4.2, 4.3, 4.5, 7.2 of text [2]*	
III		**Numerical Methods**	**15**
	1	Solution of Algebraic and transcendental equation-Bisection method	2
		Newton Raphson method	3
	2	Solution of linear simultaneous equation - Gauss elimination method	3
		Iterative methods of solution-Gauss Seidel iteration method	3
	3	Numerical integration-Simpson's $1/3^{rd}$ rule	3
		The topics in this module can be found in chapter 28.1, 28.2, 28.6, 28.7, 30.7 of text [1]	
		Basic Probability	**15**
	1	Basic Terminology	2
		Probability and set notation	4

IV	2	addition law of probability		3
		Independent events,		4
		Bayes' Theorem		2
		The topics in this module can be found in chapter 26.1 to 26.6 of text [1]		

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Apply the concept of differentiation in real life situation.	U, Ap, An	PSO-1,3,8
CO-2	Perform various operations on Integration, including substitution, integration by parts	U, Ap, An	PSO-3,4
CO-3	Understand the fundamental principles of numerical methods for solving mathematical problems and Demonstrate proficiency in applying numerical techniques to solve equations	U, Ap, An	PSO-1,5
CO-4	Understand the concept of probability theory and gain the idea of set notations, understanding independent events and study Bayes theorem.	U, Ap	PSO-1,3,7

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

Name of the Course: Mathematics for Computer Science –III
Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture(L)/ Tutorial(T)	Practical(P)
1	Apply the concept of differentiation in real life situation.	PO-1,2 PSO-1,3,8	U, Ap, An	C, P, M	L	
2	Perform various operations on Integration, including substitution, integration by parts	PO-1, 2 PSO-3,4	U, Ap, An	C, P, M	L	
3	Understand the fundamental principles of numerical methods for solving mathematical problems and Demonstrate proficiency in applying numerical techniques to solve equations	PO-1, 2 PSO-1,5	U, Ap, An	C, P, M	L	

| 4 | Understand the concept of probability theory and gain the idea of set notations, understanding independent events and study Bayes theorem. | PO-1, 2 PSO-1,3,7 | U, Ap | F, C, P | L | |

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

Mapping of COs with PSOs and POs:

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	2	3	-	-	-	-	2	3	3	-	-	-	-	1
CO 2	2	2	3	2	-	-	-	-	3	3	-	-	1	-	1
CO 3	3	3	3	-	1	-	-	-	3	3	1	-	-	-	-
CO 4	3	2	3	-	-	-	1	-	3	3	-	1	1	-	-

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics:

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

Mar Ivanios College (Autonomous)

Discipline	Mathematics				
Course Code	MIUK3DSCMAT211.1				
Course Title	**Mathematics for Statistics – III**				
Type of Course	DSC				
Semester	III				
Academic Level	200-299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-		4
Pre-requisites	1. Basics of integration 2. Differentiation				
Course Summary	The course covers a wide range of topics of integration of functions of one variable, some basic methods of integration of one or more variables. A short section on some basic forms of differential equations is also included. As this course is designed as a minor course, we may avoid all the proofs of theorems.				
Texts	1. H Anton, I Bivens, S Davis, *Calculus*, 10th Edition, John Wiley & Sons. 2. B S Grewal, *Higher Engineering Mathematics,* 42nd Edition, Khanna Publishers.				
References	1. G. B. Thomas, R. L. Finney, *Calculus*, 9th Edition, Addison-Weseley Publishing Company 2. K F Riley, M P Hobson, S J Bence, *Mathematical Methods for Physics and Engineering,* 3rd Edition, Cambridge University Press 3. Mary L Boas, *Mathematic Methods in the Physical Sciences,* 3rd Edition, Wiley 4. Erwin Kreyszig, *Advanced Engineering Mathematics,* 10th Edition, Wiley-India				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Integral Calculus of One Variable**	**15**
	1	An overview of integration methods	1
		Integration by substitution	2

		Evaluating definite integrals by substitution	1
	2	Integration by parts	2
		Integrating trigonometric functions	3
		Trigonometric substitutions	2
	3	Integrating rational functions by partial fractions	3
Topics can be found in sections 7.1, 4.3, 4.9, 7.2-7.5 of text 1			
II		**Applications of Integration**	**15**
	1	Average value of a function	2
	2	Area between two curves	3
		Volumes by slicing; disks and washers	3
		Volumes by cylindrical shells	3
	3	Length of a plane curve	2
		Area of a surface of revolution	2
Topics can be found in sections 4.8, 5.1-5.5 0f text 1			
III		**Multiple Integrals**	**15**
	1	Defining and evaluating double integrals	3
		Double integrals over nonrectangular regions	3
		Reversing the order of integration	1
		Area calculated as a double integral	1
	2	Double integrals in polar coordinates	3
	3	Triple integrals	3
		Jacobian (definition only)	1
Topics can be found in sections 14.1-14.3, 14.5, 14.7 of text 1			
IV		**Ordinary Differential Equations**	**15**
	1	Definition, order, degree	1
	2	Variable separable	2
		Homogeneous equations	2
		Linear equations	2
		Bernoulli's equation	1
		Exact equations	2
	3	Solving homogeneous linear equations with constant coefficients	2
		Finding particular integral of non-homogeneous linear equations with constant coefficients and its solution.	3
Topics can be found in sections 11.1, 11.6, 11.7, 11.9, 11.10, 11.11, 13.4, 13.6 of text 2			

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Learn various integration techniques and integrate	U, Ap	PSO- 1, 3

	functions.		
CO-2	Apply integrals to geometric applications	Ap, An, C	PSO-1, 2, 3, 4, 7
CO-3	Understand the integration of functions of more than one variable	U, Ap	PSO-1, 2, 3
CO-4	Develop methods to solve differential equations	R, U, Ap, An, E	PSO-1, 2, 3, 4, 7, 8

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

Name of the Course: Mathematics for Statistics – III
Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture(L)/ Tutorial (T)	Practical (P)
1.	Learn various integration techniques and integrate functions.	PO-1, 2 PSO- 1, 3	U, Ap	F, C, P	L	
2	Apply integrals to geometric applications	PO-1, 2, 6 PSO-1, 2, 3, 4, 7	Ap, An, C	P, M	L	
3.	Understand the integration of functions of more than one variable	PO-1, 2 PSO-1, 2, 3	U, Ap	F, C, P	L	
4	Develop methods to solve differential equations	PO-1, 2 PSO-1, 2, 3, 4, 7, 8	R, U, Ap, An, E	F, C, P, M	L	

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

Mapping of COs with PSOs and POs:

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	2	3	2	1	1	2	1	3	3	-	1	1	1	-
CO 2	3	3	3	3	2	2	3	2	3	3	-	2	2	3	1
CO 3	3	3	3	2	1	2	2	2	3	3	-	1	2	2	1
CO 4	3	3	3	3	2	1	3	3	3	3	-	1	2	2	1

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics:

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

Mar Ivanios College (Autonomous)

Discipline	Mathematics				
Course Code	MIUK3DSCMAT203.1				
Course Title	**Mathematics for Humanities, Commerce and Economics (Operations Research)**				
Type of Course	DSC				
Semester	III				
Academic Level	200-299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4
Pre-requisites	1. Linear Equations 2. Inequalities				
Course Summary	This course at the undergraduate level typically covers mathematical modelling, optimization techniques, and decision-making methods to solve complex problems in operations and decision sciences. It covers formulation of LPP, methods of transportation, assignment problems and project management techniques like CPM and PERT. This course equips students with quantitative problem-solving skills and analytical tools necessary for optimizing processes, making informed decisions, and improving efficiency in various organizational settings and preparing students for careers in operations research, management consulting, and related fields.				
Prescribed Text	Ravindran - Philips - Solberg: Operations Research- Principles and Practice				
Reference Textbooks	1. Hamdy A Taha: Operations Research: An Introduction (10th Edition) 2. Kanti Swarup, P. K. Gupta, Man Mohan: Operations Research 3. J K Sharma: Operations Research - Theory and Applications				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Title of the Module: Linear Programming**	**15**
	1	Formulation of Linear Programming models	5
	2	Graphical solution of Linear Programs in two variables	5

	3	Linear Programs in standard form - basic variable - basic solution- basic feasible solution-feasible solution	5
		[The topics to be discussed in this module can be found in Chapter 2 of the prescribed text]	
II		**Title of the Module: Simplex method**	**15**
	4	Solution of a Linear Programming problem using simplex method (Since Big- M method is not included in the syllabus, avoid questions in simplex method with constraints of ≥ or = type).	15
		[The topics to be discussed in this module can be found in Chapter 2 of the prescribed text]	
III		**Title of the Module: Transportation Problems**	**15**
	5	Linear programming formulation - Initial basic feasible solution (Vogel's approximation method/ North-west corner rule)	6
	6	– Degeneracy in basic feasible solution - Modified distribution method – optimality test.	4
		Standard assignment problems - Hungarian method for solving an assignment problem.	5
		[The topics to be discussed in this module can be found in Chapter 3 of the prescribed text]	
IV		**Title of the Module: Project Management**	**15**
	7	Activity -dummy activity - event - project network, CPM (solution by network analysis only),	9
	8	PERT.	6
		[The topics to be discussed in this module can be found in Chapter 3 Section 7 of the prescribed text]	
		Use CAS wherever possible	

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Formulate LPP and Solve LPP using Graphical method	Ap, An, E, C	PSO 1,2,3
CO-2	Determine the solution of LPP using Simplex method	Ap, An, E	PSO 1,2,3
CO-3	Use Vogel's Approximation method and North West corner method to solve the transportation problem and Hungarian method to solve assignment problems	An, Ap,E	PSO 1,2,3
CO-4	Apply the techniques of CPM and PERT to solve the real-life problems	Ap, An, E, C	PSO 1,2,3

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

Name of the Course: Mathematics for Humanities, Commerce and Economics
(Operations Research)

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

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Formulate LPP and Solve LPP using Graphical method	PO 1,2 PSO 1,2,3	Ap, An, E, C	F, C	L	
2	Determine the solution of LPP using Simplex method	PO 1,2 PSO 1,2,3	Ap, An, E	F, C	L	
3	Use Vogel's Approximation method and North West corner method to solve the transportation problem and Hungarian method to solve assignment problems	PO 1,2 PSO 1,2,3	An, Ap,E	F, C	L	
4	Apply the techniques of CPM and PERT to solve the real life problems	PO 1,2 PSO 1,2,3,4,5	Ap, An, E, C	F, C	L	

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

Mapping of COs with PSOs and POs:

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	3	3	2	2	1	1	1	3	3	-	2	2	1	2
CO 2	3	3	3	2	2	1	1	1	3	3	1	-	2	1	1
CO 3	3	3	3	3	1	1	1	2	3	3	-	-	1	2	2
CO 4	3	3	3	3	3	2	1	1	3	3	1	1	2	2	3

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics:

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

Mar Ivanios College (Autonomous)

<u>SEMESTER - IV</u>

<u>COURSES OFFERING – SEMESTER IV</u>

COURSE TYPE	MAJOR (STUDENTS)	COURSE TITLE	CREDITS
SEC	COMMON TO ALL DISCIPLINES	Python Programming and LaTeX	3

Mar Ivanios College (Autonomous)

Discipline	Mathematics
Course Code	MIUK4SECMAT253.1
Course Title	**Python Programming and LaTeX**
Type of Course	SEC
Semester	IV
Academic Level	200 - 299

Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 hours	-	-	3

Pre-requisites	1. Basic knowledge of computer 2. Mathematical logic
Text Book	1. Vernon L. Ceder, *The Quick Python Book*, Second Edition, Manning. 2. Indian TeX Users Group, *LaTeX Tutorials - A Primer*, available online at https://www.tug.org/twg/mactex/tutorials/ltxprimer-1.0.pdf
Course summary	In this course we introduce a high-level, general-purpose programming language programming language Python and a mathematical typesetting tool LaTeX. We discuss the basics of python through examples from mathematics as a tool to solve mathematical problems. The core part of LaTeX program is included in the course.

Detailed Syllabus:

Module	Unit	Content	Hrs

I		**Python Programming**	20
	1	We begin the discussion by introducing the basics of python. The feature of using python as a calculator, the supporting data types, variables, assignments, expressions, operations, indentation and comments etc. are to be discussed in detail. Then introduces list, tuple, set etc and their features and attributes. The strings, string operations, formatting of strings and related topics are to be discussed in detail. Then we introduce dictionaries too. The control flow elements including if, if- else, if-elif-else and for, while loops etc are discussed with more examples. We introduce the functions and related topics too.	
		The topics are to be discussed based on chapters 3 to 9 of Text1. In chapter 9, only sections 9.1 to 9.5 need to be discussed.	
II		**Typesetting using LaTeX**	25
	2	The main topics in this module are following: Typesetting a simple article and compiling it. How spaces are treated in the document. Document layout: various options to be included in the documentclass command, page styles, splitting files into smaller files, breaking line and page, using boxes (like, mbox) to keep text unbroken across lines, dividing document in to parts like frontmatter, mainmatter, backmatter, chapters, sections, etc, cross referencing with and without page number, adding footnotes. Emphasizing words with \emph,\texttt, \textsl, \textit, \underline etc. Basic environments like enumerate, itemize, description, flushleft, flusuright, center, quote, quotation. Controlling enumeration via the enumerate package. Tables: preparing a table and floating it, the longtable environment. Typesetting mathematics: basic symbols, equations, operators, the equation environment and reference to it, the displaymath environment, exponents, arrows, basic functions, limits, fractions, spacing in the mathematics environments, matrices, aligning various objects, multi-equation environments, suppressing numbering for one or more equations, handling long equations, phantoms, using normal text in math mode, controlling font size, typesetting theorems, definitions, lemmas, etc, making text bold in math mode, inserting symbols and environments (array, pmatrix, etc) using the support of GUIs. Figures: Including JPG, PNG graphics with graphicx package, controlling width, height etc., floating figures, adding captions, the wrapfig package. Adding references/bibliography and citing them, using the package hyperref to add and control hypertext links, creating presentations with pdfscreen, creating new	

| | | commands. Fonts: changing font size, various fonts, math fonts. Spacing: changing line spacing, controlling horizontal, vertical spacing, controlling the margins using the geometry package, fullpage package. Preparing a dummy project with titlepage, acknowledgement, certificates, table of contents (using \tableofcontents), list of tables, table of figures, chapters, sections, bibliography (using the thebibliography environment). This dummy project should contain atleast one example from each of the topic in the syllabus, and should be submitted for internal evaluation before the end semester practical examination. |
| | | The topics are to be discussed based on Text2. |

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Typeset a report containing Mathematics using LaTeX.	U, Ap	PSO-1,2,3,6
CO-2	Acquire basic programming skill.	U, Ap	PSO-1,3,6,7
CO-3	Understand basics of python programming and use to solve related problems.	U, Ap, C	PSO-1,2,5,6,7

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

Name of the Course: Python Programming and LaTeX
Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1.	Typeset a report containing Mathematics using LaTeX.	PO-1,2,6 PSO-1,2,3,6	U, Ap	P, M	L	P
2.	Acquire basic programming skill.	PO-1,2,5 PSO-1,3,6,7	U, Ap	F, C, P	L	P
3.	Understand basics of python programming and use to solve related problems.	PO-2,5,6/ PSO-1,2,5,6,7	U, Ap, C	F, C, P,M	L	P

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

Mapping of COs with PSOs and POs:

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	3	3	-	2	3	2	1	3	3	2	-	1	3	-
CO 2	3	2	3	-	2	3	3	1	3	3	2	1	3	2	-
CO 3	3	3	2	1	3	3	3	1	2	3	2	-	3	3	1

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Seminar	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓

MAR IVANIOS COLLEGE (AUTONOMOUS), THIRUVANANTHAPURAM
BOARD OF STUDIES IN MATHEMATICS AND STATISTICS 2023 – 2026

No	Name	Designation
1.	Mr. Sumesh S S (Chairman)	Assistant Professor and Head, Dept. of Mathematics, Mar Ivanios College
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3.	Fr. Dr. Gigi Thomas	Dean, Mar Ivanios College
4.	Ms. Tiji Thomas	Faculty member of the Department
5.	Dr. Jill K Mathew	Faculty member of the Department
6.	Dr. Linda J P	Faculty member of the Department
7.	Dr. Neeradha C K	Faculty member of the Department
8.	Dr. Anusha Edwin	Faculty member of the Department
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11.	Dr. Viji Z. Thomas	Associate Professor, Department of Mathematics, IISER Trivandrum
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13.	Ms. Jyothi Ramaswamy	Tata Consultancy Services (TCS), Technopark Campus, Karyavattom, Trivandrum
14.	Ms. Indu L	Assistant Professor, Department of Mathematics, College of Engineering Trivandrum, Thiruvananthapuram

15.	Dr. C. Satheesh Kumar	Professor of Statistics, Director School of Physical and Mathematical Sciences, University of Kerala
16.	Dr. A. Riyaz	Assistant Professor, Department of Statistics, University of Kerala
17.	Dr. Subha R. Nair	Associate Professor, Department of Statistics, HHMSPB NSS College for Women, Thiruvananthapuram