MAR IVANIOS COLLEGE (AUTONOMOUS)

Affiliated to the

University of Kerala
Thiruvananthapuram

Kerala

SCHEME AND SYLLABUS FOR THE

FOUR YEAR UNDERGRADUATE PROGRAMME (FYUGP)

DISCIPLINE:
STATISTICS (Aided Stream)

(With effect from 2024 Admissions)

Approved by the Board of Studies in

Mathematics and Statistics

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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 and Statistics 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.**
- Serve as a bridge between academic knowledge and real-world application, promoting research, lifelong learning and meaningful contributions.
- Encouraging students to engage with the local community through mathematics outreach programs, tutoring initiatives, or collaborative projects with schools or community organizations.
- Incorporating elements of other disciplines like computer science, physics and economics to showcase the diverse applications and connections of mathematics

- Structuring the course around project-based learning modules where students tackle open-ended mathematical problems, fostering independence, creativity, and teamwork.
- Integrating the use of mathematical software and tools into the curriculum, such as R, Python, and powerpoint to enhance computational skills and problem-solving abilities.
- Emphasize problem-solving skills over memorization by presenting students with challenging problems that demand critical thinking and creativity.
- Partnering with industry players to offer real-world case studies, internships, or projects, giving students practical experience and exposure to potential career paths
- prepares students for a wide range of jobs and keeps up with current trends to ensure graduates are ready for today's workforce.
- Study tours offer unique chances to delve into real-world applications of mathematical concepts, enhancing their understanding and honing practical problem-solving skills across diverse industries and research environments.
- Guide students in developing these attributes uniquely, fostering personal growth and success in various aspects of life.

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:

On successful completion of the Four-Year Under-Graduate Programme with Mathematics major, students will be able to:

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.
PSO5	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.
PSO6	Develop expertise and skills in the use of various mathematical software and computational tools and applying them in different fields and disciplines of knowledge.
PSO7	Practise self-discipline and persistence in life through focused mathematical pursuits, overcoming challenges and setbacks through perseverance, resilience, and mastery.

PSO8	Formulate ethical awareness and responsibility in the use and application of mathematical knowledge for sustainable development and proficiency in analysing environmental data using mathematical modelling and statistical techniques.

Course and Credit Strcuture 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 Strcuture of FYUGP is given below:

Sem	DSC (4 Cr)	DSE (4 Cr)	AEC (3 Cr)	SEC (3 Cr)	MDC (3 Cr)	VAC (3 Cr)	Internship (credit-2)/ Project/ Additional Courses (credit-12)	Total courses	Total credits
I	A-1 B-1 C-1		AEC (Eng)-1 AEC(OL)-2		MDC-1			6	21
II	A-2 B-2 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 (formative assessment) - 5 % of the total.
- Discipline specific formative assessment - 10% of the total.

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

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

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

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

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

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

Mark Distribution Table

Course	Credit		Marks		Lecture			Practical		
	Lecture	Practical	Lecture	Practical	CCA (30%)		ESE (70%)	CCA (40%)		ESE (60%)
					SA (50%)	FA (50%)		SA (50%)	FA (50%)	
4 credit	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

	Credits		Marks		Lecture			Practical		
					CCA (30%)		ESE (70%)	CCA (40%)		ESE (60%)
	Lecture	Practical	Lecture	Practical	SA (50%)	FA (50%)		SA (50%)	FA (50%)	
courses	0	4	0	80	0	0	0	16	16	48
3 credit courses	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 semester, 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.

Sumesh S S
Chairman BoS
Assistant Professor and Head
Department of Mathematics and Statistics
Mar Ivanios College (Autonomous),
Thiruvananthapuram

Thiruvananthapuram

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						
MIUK1DSCSTA100.1	Basic Statistics	DSC	4	4		
MIUK1MDCSTA101.1	Elementary Statistics	MDC	3	3		
SEMESTER II - Academic Level 100-199						
MIUK2DSCSTA150.1	Random Variables and Probability Distributions	DSC	4	4		
MIUK2MDCSTA151.1	Elementary probability	MDC	3	3		
SEMESTER III - Academic Level 200-299						
MIUK3DSCSTA200.1	Statistical Analysis	DSC	4	3		2
SEMESTER IV - Academic Level 200-299						
MIUK4SECSTA250.1	Statistical computation using R	SEC	3	1		4
SEMESTER V - Academic Level 300-399						
MIUK5SECSTA300.1	R Basics for Data Science	SEC	3	1		4
SEMESTER VI - Academic Level 300-399						
MIUK6SECSTA350.1	Introduction to Machine Learning using Python	SEC	3	1		4

SEMESTER - I

Mar Ivanios College (Autonomous)

Discipline	STATISTICS
Course Code	MIUK1DSCSTA100.1
Course Title	**Basic Statistics**
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. Foundations of Mathematics 2. Basic Calculus
Course Summary	The course aims that students will understand data and will learn to summarize data, create and interpret simple graphs and compute appropriate summary statistics. They also will gain the elementary idea of probability and how to solve simple numerical problems.
Textbooks	1. S.C. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics,, 12th Edition, Sultan Chand & Sons, New Delhi 2. Prem S Mann, Introductory Statistics, 2nd Edition, Wiley 3. S. P. Gupta, Statistical Methods, 4th Edition, Sultan Chand and Sons, New Delhi 4. C. H. Brase and C. P. Brase, Understanding Basic Statistics, 9th Edition, Cengage

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Data**	**10**
	1	Define data and various scales of data	2

	2	Construct various frequency distribution tables – ungrouped, grouped, cumulative and relative	3
	3	Discuss various graphical representations - histogram, frequency polygon, frequency curve, ogives	3
	4	Explain bar diagram and pie diagram.	2
II		**Measure of central tendency and dispersion**	**20**
	5	Calculate various measures of central tendency:-arithmetic mean, median, mode, geometric mean, harmonic mean. (definitions and numerical problems only)	8
	6	Calculate various measures of dispersion:-range, quartile deviation, mean deviation, standard deviation, percentiles, deciles (definitions and numerical problems only)	8
	7	Calculate relative measures of dispersion - coefficient of variation. Compare absolute and relative measures of dispersion. (definitions and numerical problems only)	4
III		**Elementary probability theory**	**30**
	8	Explain random experiment, sample space, events, types of events(mutually exclusive, exhaustive, equally likely)	6
	9	Define sigma field of events, probability space	4
	10	Define classical approach to probability, axiomatic approach to probability (axioms only), (simple numerical problems)	4
	11	Explain addition and multiplication theorems, (proof of theorems not needed)	4
	12	Determine the conditional probability (simple numerical problems)	4
	13	Explain the concepts of independence of two or three events	4
	14	Bayes theorem and its applications, , (proof of theorems not needed)	4

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand characteristics of statistical data and	R, U, Ap	PSO1

	describing data through illustrating examples using charts and diagram			
CO-2	Summarize data using various measures of central tendency and dispersion	U, Ap	PSO1	
CO-3	Understand the elementary ideas of random experiment, sample space, events, sigma field of events, probability space	R	PSO1	
CO-4	Evaluate the probabilities of events using classical and axiomatic approaches	U, Ap	PSO3	
CO-5	Assess the independence of events and application of Bayes theorem	U, Ap	PSO3	

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

Note: 1 or 2 COs/module

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

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1	CO1	PO1/PSO1	R, U, Ap	F, C	L	
2	CO2	PO1/PSO1	U, Ap	C	L	
3	CO3	PO1/ PSO2	R	F	L	
4	CO4	PO2/ PSO3	U, Ap	F,C	T	
5	CO5	PO2/ PSO3	U, Ap	F,C	T	

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

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	2	1	-	-	1	-	1	3	2	-	-	2	1	-
CO 2	3	1	2	-	1	1	-	1	3	1	-	-	-	-	-
CO 3	3	1	-	1	-	-	-	1	3	1	-	-	-	-	1
CO 4	3	3	1	-	-	-	-	2	3	3	-	1	1	1	2
CO 5	3	3	2	1	1	-	1	3	3	3	1	1	1	1	1

3Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

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

Mar Ivanios College (Autonomous)

Discipline	STATISTICS				
Course Code	MIUK1MDCSTA101.1				
Course Title	**Elementary Statistics**				
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. Basic Mathematics				
Course Summary	This course gives basic idea of statistics and develops the computing ability of students who have no mathematical background				
Textbooks	1.Gupta S.C and Kapoor V.K, "Mathematical Statistics", Sultan Chand &Sons, New Delhi 2. Agarwal, B.L, "Basic Statistics",4th Edition New Age International(P) Ltd, New Delhi 3. Gupta S.C, "Fundamentals of Statistics", Himalaya Publishing House, Mumbai				

Detailed Syllabus:

Module	Unit	Content	Hours
I		**Data and measures of central tendency**	**15 hrs**
	1	Data, types of data, scaling of data	3 hrs
	2	Measures of central tendency-arithmetic mean, median, mode	6 hrs

	3	simple numerical problems of Measures of central tendency	6 hrs
II		**Measures of dispersion**	**15 hrs**
	4	Measures of dispersion- range, mean deviation, standard deviation	6 hrs
	5	simple numerical problems of measures of dispersion	9 hrs
III		**Correlation and regression**	**15 hrs**
	6	Bivariate data, correlation – scatter diagram, types of correlation.. Pearson's correlation coefficient	6 hrs
	7	linear regression, equation of two regression lines	3 hrs
	8	Simple numerical problems based on Pearson's correlation coefficient and equation of two regression lines	6 hrs

Course Outcomes

Sl .no	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Define data and carry out classification of data	R,U	PSO1
CO-2	Calculation of measures of central tendency	Ap	PSO1
CO-3	Calculation of measures of dispersion	Ap	PSO1
CO-4	Explain the concepts of correlation	U	PSO1
CO-5	Calculation of correlation coefficient through Pearson's method.	Ap	PSO3
CO-6	Identify and construct regression lines for data sets	Ap	PSO2

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

Note: 1 or 2 COs/module

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

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1	CO1	PO1/PSO1	R,U	F	L	
2	CO2	PO1/PSO1	Ap	C	L	
3	CO3	PO1/PSO1	Ap	C	L	
4	CO4	PO1/PSO1	U	C	L	
5	CO5	PO2/PSO3	Ap	P	T	
6	CO6	PO2/PSO2	Ap	P	T	

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

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	3	2	2	-	-	-	-	3	3	-	-	2	1	-
CO 2	3	2	2	1	-	-	-	-	3	2	-	-	1	1	-
CO 3	3	2	2	1	-	-	-	-	3	2	-	-	1	1	-
CO 4	3	2	2	1	-	-	-	-	3	2	-	-	1	1	-

CO 5	3	1	2	2	-	-	-	-	3	2	-	-	1	2	-
CO6	3	1	2	2	-	-	-	-	3	2	-	-	1	2	-

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

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

SEMESTER - II

Discipline	STATISTICS
Course Code	MIUK2DSCSTA150.1
Course Title	**Random Variables and Probability Distributions**
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. Elementary Statistics 2. Elementary Probability
Course Summary	This course introduces the concept of random variables and their probability distributions. Students will also gain an understanding of standard probability distributions and learn how to solve numerical problems.
Textbooks	5. S.C. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics,, 12th Edition, Sultan Chand & Sons, New Delhi 6. C. H. Brase and C. P. Brase, Understanding Basic Statistics, 9th Edition, Cengage 7. Prem S Mann, Introductory Statistics, 2nd Edition, Wiley 8. S. P. Gupta, Statistical Methods, 4th Edition, Sultan Chand and Sons, New Delhi

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Random Variables**	**20**
	1	Explain the concept of random variables–Discrete and	3

		Continuous	
	2	Define probability density functions and distribution function, numerical problems	7
	3	Define bivariate random variables. Evaluate joint, marginal, and conditional distributions, numerical problems	7
	4	Independence of random variables, numerical problems	3
II		**Expectation of random variable**	**15**
	5	Definition and properties of expectation (without proof), numerical problems	4
	6	Conditional expectation, numerical problems	3
	7	Probability generating function, numerical problems	3
	8	Moments and moment generating function – properties (without proof) and uses, numerical problems	5
III		**Probability distributions**	**25**
	11	Binomial distribution – definition, mean and variance (without proof). Numerical problems	5
	12	Poisson distribution – definition, mean and variance (without proof). Numerical problems	5
	13	Fitting of distribution (binomial and Poisson)	4
	14	Normal distribution – definition, mean and variance (without proof). Numerical problems	5
	15	Importance of normal distribution and standard normal distribution. Simple problems using standard normal tables.	5
	16	Central Limit Theorem – lindberg levy form (statement only)	1

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Introduction of elementary ideas of random variables and probability distributions.	U, Ap	PSO1

CO-2	Introduction of bivariate random variables, joint, marginal, and conditional distributions. Independence of random variables	U, Ap, An	PSO2
CO-3	Determine the expectation, conditional mean and variance of a random variable.	U, Ap	PSO3
CO-4	Calculate moments, moment generating function and probability generating function	U, Ap	PSO3
CO-5	Introduces the basic probability models binomial, Poisson and normal. Solve numerical problems.	U, Ap	PSO2
CO-6	Understand the use of standard normal tables and apply for solving problems.	U, Ap	PSO8
CO-7	Central limit theorem	U	PSO8

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

Note: 1 or 2 COs/module

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

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1	CO1	PSO1	U, Ap	F,C	L	
2	CO2	PSO2	U, Ap, An	F,C	L	
3	CO3	PSO3	U, Ap	F,C	L	
4	CO4	PSO3	U, Ap	F,C	L	
5	CO5	PSO2	U, Ap	F,C	L	
6	CO6	PSO8	U, Ap	F,C	L	

7	CO7	PSO8	U	F,C	L		

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

Mapping of COs with PSOs and POs :

	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PS O8	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	3	3	2	1	-	-	-	-	3	3	-	-	2	2	-
CO 2	3	3	2	2	-	-	-	-	3	3	-	-	2	2	-
CO 3	3	3	2	2	1	-	-	-	3	3	-	2	1	1	-
CO 4	3	3	3	2	1	-	-	-	3	3	-	1	2	2	-
CO 5	3	3	1	1	-	-	-	-	3	3	-	1	2	1	-
CO6	3	3	2	2	-	-	-	-	3	2	-	1	2	1	-
CO7	3	3	2	2	2	1	1	1	3	3	-	1	2	2	-

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

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

Mar Ivanios College (Autonomous)

Discipline	STATISTICS				
Course Code	MIUK2MDCSTA151.1				
Course Title	**Elementary probability**				
Type of Course	**MDC**				
Semester	II				
Academic Level	150-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 hours	-	-	3
Pre-requisites	1. Basics of mathematics 2.. Basics of statistics				
Course Summary	This course gives a basic idea of probability and develops the computing skill on probability of students in any discipline				
Textbooks	1. S.C. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics,, 12th Edition, Sultan Chand & Sons, New Delhi 2. Agarwal, B.L, "Basic Statistics",4th Edition New Age International(P) Ltd, New Delhi 3. Gupta S.C, "Fundamentals of Statistics", Himalaya Publishing House, Mumbai				

Detailed Syllabus:

Module	Unit	Content	Hours
I		**Random experiments, events and sample space**	**15 hrs**

	1	Permutations and combinations	2 hrs
	2	Random algebra of events-union, intersection, complement, types of events-disjoint and exhaustive events experiment, sample space, events,	8 hrs
	3	simple numerical problems	5 hrs
II		**classical approach to probability**	**15 hrs**
	4	Equally likely events, classical approach to probability (definition only)	4 hrs
	5	Addition theorem of probability(without proof).	1 hr
	6	simple numerical problems	10 hrs
III		**Conditional probability**	**15 hrs**
	7	Independent events, multiplication theorem of probability and conditional probability. (definitions only)	9 hrs
	8	simple numerical problems	6 hrs

Course Outcomes

Sl .no	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Remember permutations and combinations through illustrated examples	R,U	PSO1
CO-2	Understanding the concepts of random experiments,events	U	PSO2
CO-3	Calculation of algebra of events	Ap	PSO3
CO-4	Identify the concepts of equally likely events and calculation of probability based on classical definition	U,Ap	PSO1
CO-5	Apply the concept of addition theorem in probability.	Ap	PSO3

| CO-6 | Explain concepts of independent events and multiplication theorem | An | PSO2 |
| CO-7 | Calculation of conditional probability | Ap | PSO3 |

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

Note: 1 or 2 COs/module

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

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1	CO1	PSO1	R,U	F,C	L	
2	CO2	PSO2	U	F,C	L	
3	CO3	PSO3	Ap	F,C	L	
4	CO4	PSO1	U,Ap	F,C	L	
5	CO5	PSO3	Ap	F,C	L	
6	CO6	PSO2	An	F,C	L	
7	CO7	PSO3	Ap	F,C	L	

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

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	3	2	1	-	-	-	-	3	3	-	-	2	2	-

CO 2	3	3	2	2	-	-	-	-	3	3	-	-	2	2	-
CO 3	3	3	2	2	1	-	-	-	3	3	-	2	1	1	-
CO 4	3	3	3	2	1	-	-	-	3	3	-	1	2	2	-
CO 5	3	3	1	1	-	-	-	-	3	3	-	1	2	1	-
CO6	3	3	2	2	-	-	-	-	3	2	-	1	2	1	-
CO7	3	3	2	2	2	1	1	1	3	3	-	1	2	2	-

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

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

SEMESTER III

Mar Ivanios College (Autonomous)

Discipline	STATISTICS
Course Code	MIUK3DSCSTA200.1
Course Title	**Statistical Analysis**
Type of Course	**DSC**
Semester	III
Academic Level	200-299

Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5

Pre-requisites	1. Elementary Statistics 2. Probability Distributions
Course Summary	This course aims that the student will get an understanding of sampling distributions and statistics following these distributions. Student also will learn to compute confidence intervals and solve numerical problems of testing of statistical hypothesis.
Textbooks	1. S.C. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics,, 12th Edition, Sultan Chand & Sons, New Delhi 2. Moore DS, Notz W, Fligner MA. The Basic Practice of Statistics. 6th ed. W.H. Freeman and Co. 3. Prem S Mann, Introductory Statistics, 2nd Edition, Wiley 4. S. P. Gupta, Statistical Methods, 4th Edition, Sultan Chand and Sons, New Delhi 5. C. H. Brase and C. P. Brase, Understanding Basic Statistics, 9th Edition, Cengage

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Sampling Distributions**	15
	1	normal, chi square, t and F distributions (definitions only)	4
	2	Statistics following these distributions	4
	3	Use of tables and simple problems	7
II		**Interval Estimation and Hypothesis Testing**	20
	4	Statistical inference	3
	5	Interval estimation for mean and variance of a normal distribution (problems only)	7
	6	Statistical hypothesis - Null and Alternate hypothesis, Type I and Type II errors, Critical Region, Size and power of the test, P value. (Definition only)	10
III		**Large Sample and Small Sample Tests**	25
	7	Large sample tests - test of a single mean, equality of two means, test of a single proportion, and equality of two proportions. (Numerical problems only)	10
	8	Small sample tests - test of a single mean, paired and unpaired t-test. (Numerical problems only)	10
	9	Chi-square test of goodness of fit, test of independence of attributes, test of homogeneity. (Numerical problems only)	5
IV		**Practical**	15
	10	Practical illustration of concepts studied using R programming	15

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Introduction to sampling distributions	R, U	PSO4

CO-2	Getting familiarity of statistical tables and simple problems using it	U, Ap	PSO3
CO-3	Getting an idea on statistical inference and interval estimation	U, Ap, E	PSO4
CO-4	Getting awareness on the testing of hypothesis using various distributions	U, Ap, An, E	PSO4
CO-5	Practical problems based on concepts studied using R programming	U, Ap, An, E, C	PSO6

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

Note: 1 or 2 COs/module

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

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1	CO1	PSO4	R, U	F,C	L	
2	CO2	PSO3	U, Ap	F,C	L	
3	CO3	PSO4	U, Ap, E	F,C	L	
4	CO4	PSO4	U, Ap, An, E	F,C	L	
5	CO5	PSO6	U, Ap, An, E, C	F,C		P

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

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	3	2	1	1	-	-	1	3	3	-	1	2	2	-
CO 2	3	3	2	1	2	-	-	1	3	3	-	2	2	2	-
CO 3	3	3	3	2	1	-	-	2	3	3	-	2	3	3	-
CO 4	3	3	3	3	1	1	-	2	3	3	-	2	3	3	1
CO 5	1	3	2	2	3	3	1	3	3	3	-	2	3	3	1

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

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

SEMESTER IV

Mar Ivanios College (Autonomous)

Discipline	STATISTICS
Course Code	MIUK4SECSTA250.1
Course Title	**Statistical computation using R**
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	1 hour	-	4 hours	5

Pre-requisites	1. Basic Statistics 2. Basic Computer knowledge
Course Summary	This course will review basic statistical tools through the study and practice of data analysis and graphical interpretation using 'R'.
References	1. Purohit, S. G., Gore S. D., Deshmukh S. R. (2008). Statistics Using R, Narosa Publishing House, NewDelhi. 2. Braun, W. J., & Murdoch, D. J. (2021). A first course in statistical programming with R. Cambridge University Press. 3. Crawley, M. J. (2012). The R book. John Wiley & Sons. 4. Dalgaard, P. Introductory Statistics with R [electronic resource].

Detailed Syllabus:

Module	Content	Hrs
I	Import data, Plotting graphs by means of Box plots, stem-leaf, frequency polygon, pie charts, and graphical summaries of data.	15
II	Generate automated reports giving detailed descriptive statistics. Correlation and lines of regression.	15

III	Basics of statistical inference in order to understand hypothesis testing. Compute p-values, Confidence intervals and their interpretation.	15

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Learn how to load data.	U, Ap	PSO3
CO-2	Summarise data using some important graphical tools using R.	U, Ap	PSO1
CO-3	Perform descriptive analysis of data.	U, Ap	PSO5
CO-4	Deal with analysis of bivariate data using correlation and regression	U, Ap, An	PSO6
CO-5	Interpret the results based on the analysis of data.	U, Ap, An	PSO8

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

Note: 1 or 2 COs/module

Name of the Course: Credits: 1:0:2 (Lecture:Tutorial:Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1	CO1	PO1/ PSO3	U, Ap	F,P		P
2	CO2	PO2/ PSO1	U, Ap	C,P		P
3	CO3	PO5/	U, Ap	C,P	T	P

		PSO5						43
4	C04	PO5/ PSO6	U, Ap, An	F,C,P			P	
5	CO5	PO6/ PSO8	U, Ap, An	P,M			P	

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

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	1	1	1	2	2	3	1	3	1	2	-	2	3	3	-
CO 2	1	1	1	2	2	3	1	3	1	2	1	2	3	3	-
CO 3	2	2	2	2	3	3	1	3	2	2	-	2	3	3	-
CO 4	2	2	2	2	3	3	1	3	2	2	-	3	3	3	-
CO 5	3	3	3	3	3	3	2	3	2	3	1	3	3	3	1

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

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

SEMESTER V

Mar Ivanios College (Autonomous)

Discipline	STATISTICS				
Course Code	MIUK5SECSTA300.1				
Course Title	**R Basics for Data Science**				
Type of Course	**SEC**				
Semester	V				
Academic Level	300-399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	1	-	4	5
Pre-requisites	1. Basic Statistics 2. Basic R				
Course Summary	This course will review some basic statistical tools for data science and graphical interpretation using 'R'.				
References	1. Purohit, S. G., Gore S. D., Deshmukh S. R. (2008). Statistics Using R, Narosa Publishing House, NewDelhi. 2. Wickham, H., Çetinkaya-Rundel, M., & Grolemund, G. (2023). R for data science. " O'Reilly Media, Inc.". 3. Braun, W. J., & Murdoch, D. J. (2021). A first course in statistical programming with R. Cambridge University Press. 4. Crawley, M. J. (2012). The R book. John Wiley & Sons. 5. Dalgaard, P. Introductory Statistics with R [electronic resource].				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Introduction to R**	**15**

	1	Introduction	1
	2	Data types and objects in R	3
	3	Control structures	3
	4	Common R libraries for data science	5
	5	Importing, and exporting	3
II		**Data Analysis using R**	**15**
	6	Data cleaning	2
	6	Descriptive statistics	4
	7	Correlation	4
	8	Regression- linear and logistic regression	5
III		**Data Visualization using R**	**15**
	9	Scatter plot	2
	10	Line plot	2
	11	Bar plot	3
	12	Histogram	3
	13	Box plot	3
	14	Q-Q plot	2

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand and acquire basic knowledge of R.	U, Ap	PSO1
CO-2	Create simple programs by using basic tools for data science.	U,Ap,C	PSO6
CO-3	Perform descriptive analysis of data.	U, Ap	PSO3

| CO-4 | Deal with analysis of bivariate data using correlation and regression | U,Ap,An | PSO3 |
| CO-5 | Analyze information about outputs and create graphics. | Ap, An, C | PSO8 |

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

Note: 1 or 2 COs/module

Name of the Course: Credits: 1:0:2 (Lecture:Tutorial:Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1	CO1	PO1/PSO1	U, Ap	F,C	L	
2	CO2	PO5 /PSO6	U,Ap,C	C,P		P
3	CO3	PO2/ PSO3	U, Ap	F,C,P		P
4	CO4	PO5/ PSO3	U,Ap,An	C,P	T	P
5	CO5	PO6/ PSO8	Ap, An, C	C,P,M		P

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

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	1	-	2	3	3	1	3	3	3	-	2	3	3	-

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

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

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

SEMESTER VI

Mar Ivanios College (Autonomous)

Discipline	STATISTICS
Course Code	MIUK6SECSTA350.1
Course Title	**Introduction to Machine Learning using Python**
Type of Course	**SEC**
Semester	VI
Academic Level	300-399

Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	1	-	4 hours	5

Pre-requisites	1. Basics of Python Programming 2. Advanced Statistical techniques for machine learning
Course Summary	This course will provide a solid foundation in the fundamentals of machine learning with Python.
References	1. Müller, A. C., & Guido, S. (2016). Introduction to machine learning with Python: a guide for data scientists. " O'Reilly Media, Inc.". 2. Zollanvari, A. (2023). Machine Learning with Python: Theory and Implementation. Springer Nature. 3. Sarkar, D., Bali, R., & Sharma, T. (2018). Practical machine learning with Python. Book".

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Basic Python for Machine Learning**	**15**
	1	Introduction to machine learning	3

	2	Python's role in machine learning	3
	3	Important libraries in Python for machine learning.	9
II		**Supervised Learning Techniques**	**15**
	4	Classification – Support Vector Machine, Naïve Bayes.	7
	5	Regression- Linear, Polynomial and logistic regression.	8
III		**Unsupervised Learning Techniques**	**15**
	6	Clustering-k means clustering, k-nearest neighbor, hierarchical.	8
	7	Association- Principle Component Analysis, apriori.	7

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand the importance of machine learning.	U	PSO1
CO-2	Create simple programs in Python using the libraries used for machine learning techniques.	U,Ap, C	PSO6
CO-3	Acquire knowledge of supervised learning techniques	U	PSO1
CO-4	Deal with classification and regression problems in real data.	U, Ap, An	PSO6
CO-5	Understand unsupervised learning procedures and identify which method to be used.	U, Ap, An, E	PSO4
CO-6	Implement the appropriate algorithms based on the studied techniques.	An, E,C	PSO8

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

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

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1	CO1	PO1/PSO1	U	F,C	L	
2	CO2	PO5/PSO6	U,Ap, C	C,P		P
3	CO3	PO2/PSO1	U	F,C	L	
4	CO4	PO6/PSO6	U, Ap, An	C,P		P
5	CO5	PO5/PSO4	U, Ap, An, E	P		P
6	CO6	PO6/PSO8	An, E,C	P,M		P

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

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	-	-	2	1	3	-	3	3	3	-	-	3	2	-
CO 2	2	1	1	2	1	3	1	3	2	3	-	1	3	2	-
CO 3	3	1	2	2	1	3	1	3	3	3	-	1	3	3	-
CO 4	3	2	3	3	2	3	1	3	3	3	-	-	3	3	-

CO 5	2	2	3	3	1	3	1	3	2	2	-	-	3	3	-
CO6	2	2	3	2	1	3	1	3	2	3	-	-	3	3	-

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

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

MAR IVANIOS COLLEGE (AUTONOMOUS), THIRUVANANTHAPURAM
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6.	Dr. Linda J P	Faculty member of the Department
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10.	Dr Subrahamanian Moosath K. S.	Professor, Department of Mathematics, IIST Trivandrum
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