MAR IVANIOS COLLEGE
(AUTONOMOUS)

Affiliated to the

University of Kerala, Thiruvananthapuram

Kerala

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

MAJOR DISCIPLINE

PHYSICS

(With effect from 2024 Admissions)

Approved by the Board of Studies in Physics

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 Physics 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.**

- The FYUGP in Physics is designed to offer students a holistic understanding of the diversity of Physics from the Newtonian physics contemporary concepts.

- Through a blend of lectures, laboratory sessions, internships and research projects, students are exposed to the unresolved truths of the physical world and are encouraged to develop critical thinking and analytical skills.
- From basic understanding of the theoretical concepts to hands-on experiences from the state of the art laboratories, the course could cultivate enthusiasm among students to search for the ultimate truth about the universe the way it is today.
- Under the mentorship of experienced faculty members, students are encouraged to undertake independent research projects on topics of their interest ranging from theoretical physics to nano materials.
- By offering a rigorous curriculum, hands-on learning experiences, and opportunities for research and innovation, the program aims to nurture the next generation of Physicist who will contribute to the advancement of knowledge and uphold the values of sustainability.

2. 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.

<table>
<tr><td>PO 2</td><td>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.
</td></tr>
<tr><td>PO 3</td><td>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.
</td></tr>
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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.

3. **Programme Specific Outcomes (PSOs)**

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

PSO No.	Programme Specific Outcomes (PSO)	POs addressed
PSO-1	Discuss the fundamental laws, basic concepts in physics and prioritise the core knowledge in the major premises of Physics and their interconnections	PO-1
PSO-2	Apply the principles of Physics and mathematical tools to analyse and solve numerical and conceptual problems in various domains, as well as formulate equations and models for describing different physical theories and phenomena.	PO-2
PSO-3	Analyse concepts in space science, nanoscience and nanotechnology, atmospheric science, electronics, forensic science, energy physics, and medical physics to establish a seamless integration with industry, research and academic institutions	PO-2, PO-5
PSO-4	Create a multidisciplinary perspective to recognise synergies between disciplines such as arts and sports, environmental science, history, economics, data analysis, artificial intelligence, archeophysics, geology, archaeology, history, and collaboration with peers in multidisciplinary research	PO-3, PO-5
PSO-5	Create general awareness and skills in programming, operating systems, computer hardware and software, scientific writing, optical fibre technology, PCB making and design, photographic optics, electrical device knowledge, and devise and troubleshoot basic household appliances for fostering self-employability.	PO-5
PSO-6	Evaluate the effectiveness and weaknesses of modern electronics, communication systems and address global concerns such as the energy crisis and natural disasters, to provide innovative solutions	PO-2
PSO-7	Apply theoretical knowledge and practical skills to real-world challenges in scientific research and industrial environments and practise ethical standards in scientific research and practice.	PO-6

4. **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.

Course Category Codes

Sl. No.	Name of Course	Course Category Code
1	Ability Enhancement Course	**AEC**
2	Multi-Disciplinary Course	**MDC**
3	Discipline Specific Core	**DSC**
4	Discipline Specific Elective	**DSE**
5	Value Addition Course	**VAC**
6	Skill Enhancement Course	**SEC**

The Course and Credit Structure of FYUGP is given below:

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

5. **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.

6. **Assessment and Evaluation**

1. The assessment of a course shall combine a Continuous Comprehensive Assessment (CCA) and an End Semester Evaluation (ESE).
2. For courses without practical/lab modules, 30% weightage shall be given for CCA and the remaining 70% of the weight shall be for the ESE.
3. CCA will have two sub-components: Formative Assessment (FA) and Summative Assessment (SA).
4. The CCA subcomponents will be given marks as per the following proportions:
   - Discipline specific summative assessment - 15% of the total
   - Course attendance - 5 % of the total.
   - Discipline specific formative assessment - 10% of the total.
5. The details of summative and formative assessment criteria, including that of attendance, will be specified by each course coordinator at the beginning of the semester, with the approval of the respective Head of the Department/BoS Chairperson and the Principal, and will be published on the college website.
6. For courses with practical/lab modules, 40% weightage shall be given for CCA and the remaining 60% of the weight shall be for the ESE.
7. In such cases specified in the item above, the CCA subcomponents will be given marks as per the following proportions:
   - Discipline specific summative assessment - 10% of the total
   - Course attendance - 5 % of the total.
   - Discipline specific formative assessment - 15% of the total.
   - Summative Assessment (Practical Record, Practical test, skill, etc). - 10% of the total.
8. The Course Coordinator shall be responsible for evaluating all the components of CCA for the course in question. Any grievances regarding the same shall be submitted to the Course Coordinator within 5 days of the publication of the same on the department notice board or official class group. If the grievance is not

settled at the Course Coordinator level, the student is free to appeal to the Head of the Department, within the next 3 days, who will discuss the same in the Department Level Monitoring Committee (DLMC). If still needed, students can further appeal to the College Level Monitoring Committee (CLMC) or in essential situations the University Level Monitoring Committee (ULMC) in a time period as specified by these bodies.

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

Mark Distribution Table

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

Letter Grades and Grade Point

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

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

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

8. Computation of SGPA and CGPA

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

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

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

where S_j is the SGPA in the j^{th} semester,

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

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

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

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

where S_i is the SGPA in the i^{th} semester and

$\sum C_i$ is the total number of credits in the i^{th} semester.

3. The SGPA and CGPA shall be rounded to 2 decimal points and reported in the transcripts.
4. **Requirement for the successful completion of a Semester:** SGPA of 4 or above and a PASS in all the courses, that is, minimum total of 35% mark in each course (CCA + ESE), with a separate minimum of 35% mark for both CCA and ESE. Appropriate and permissible rules of rounding off numbers may be adopted as per decisions of the Academic Council.
5. **Minimum Eligibility Criteria for 4 Year UG (Honours with Research):**
   - Students satisfactorily finishing all courses up to the 6th semester in the Department, with a CGPA of 7.5/10 or equivalent to 75% marks and above, will qualify to select the Honours programme with a Research Degree during the upcoming 7th and 8th semesters.
   - A relaxation of 0.5 score, i.e., CGPA of 7/10 or an equivalent relaxation of grade, will be allowed for those who belong to SC/ST/OBC (non-creamy layer)/Differently Abled, Economically Weaker Section (EWS) and other categories as per the UGC norms from time to time

9. 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 Physics offered by the Department of Physics, 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.

10. Specialization Streams

Physics offers specialisation streams in elective (DSE) courses. Out of the trial required DSE courses a student is studying, if the students take any four courses from a particular stream the student is eligible to get specialisation title in their degree. Department of Physics is offering a specialization in Electronics and its course codes and the respective semesters are given below

Semester	Course Code
3	MIUK3DSEPHY101.1
4	MIUK4DSEPHY201.1
5	MIUK5DSEPHY301.1
6	MIUK6DSEPHY301.1

Dr. John Jacob
Chairman
BoS (Physics)
Mar Ivanios College
(Autonomous),
Thiruvananthapuram

Thiruvananthapuram

10-05-2024

LIST OF COURSES OFFERED BY THE DEPARTMENT OF PHYSICS

SEMESTER I								
Course Type	Course Code	Course Title	Credit	Hours /Week	Hours Distribution/Week			Page No.
					L	T	P	
DSC1	MIUK1DSCPHY101.1	Foundation Course in Physics-I	4	5	3	0	2	26
DSC2	MIUK1DSCPHY102.1	Introductory Mechanics	4	5	3	0	2	31
DSC3	MIUK1DSCPHY103.1	Properties of solids	4	5	3	0	2	37
MDC1	MIUK1MDCPHY101.1	Elementary Data analysis	3	3	3	0	0	44
MDC2	MIUK1MDCPHY102.1	Green Energy Resources	3	3	3	0	0	49
MDC3	MIUK1MDCPHY103.1	Environmental Physics	3	3	3	0	0	55
MDC4	MIUK1MDCPHY104.1	Physics in arts and Sports	3	3	3	0	0	60
MDC5	MIUK1MDCPHY105.1	Basics of artificial intelligence	3	3	3	0	0	64
SEMESTER II								
Course Type	Course Code	Course Title	Credit	Hours /Week	Hours Distribution/Week			Page No.
					L	T	P	
DSC1	MIUK2DSCPHY151.1	Foundation Course in Physics- II	4	5	3	0	2	70
DSC2	MIUK2DSCPHY152.1	Electricity, Magnetism and Acoustics	4	5	3	0	2	75
DSC3	MIUK2DSCPHY153.1	Optics and Thermodynamics	4	5	3	0	2	82
MDC1	MIUK2MDCPHY151.1	Archeophysics	3	3	3	0	0	88
MDC2	MIUK2MDCPHY152.1	Beyond the Sky	3	3	3	0	0	93
MDC3	MIUK2MDCPHY153.1	Foundations in Forensic Science	3	3	3	0	0	97
MDC4	MIUK2MDCPHY154.1	Medical Physics	3	3	3	0	0	102
SEMESTER III								
Course Type	Course Code	Course Title	Credit	Hours /Week	Hours Distribution/Week			Page No.
					L	T	P	

DSC1	MIUK3DSCPHY201.1	Basic Electronics	4	5	3	0	2	106
DSC2	MIUK3DSCPHY202.1	Digital Electronics and Data Science	4	5	3	0	2	111
DSC3	MIUK3DSCPHY203.1	Solid State Physics & Spectroscopy	4	5	3	0	2	117
DSE1	MIUK3DSEPHY201.1	Circuit Elements and Network Theorem	4	4	4	0	0	122
DSE2	MIUK3DSEPHY202.1	Mathematical tools for Physics	4	4	4	0	0	126
DSE3	MIUK3DSEPHY203.1	Basics of Nanoscience and Nanotechnology	4	4	4	0	0	132
VAC1	MIUK3VACPHY201.1	History of Physics and It's Role in Society	3	3	3	0	0	137
VAC2	MIUK3VACPHY202.1	Introduction to laboratory safety measurements	3	3	3	0	0	143
SEMESTER IV								
Course Type	Course Code	Course Title	Credit	Hours /Week	Hours Distribution/Week			Page No.
					L	T	P	
DSC1	MIUK4DSCPHY251.1	Electromagnetics and Transient Current	4	5	3	0	2	148
DSC2	MIUK4DSCPHY252.1	Classical Mechanics	4	5	3	0	2	154
DSE1	MIUK4DSEPHY251.1	Basic Digital Principles and Applications	4	5	3	0	2	160
DSE2	MIUK4DSEPHY252.1	Object Oriented Programming	4	5	3	0	2	165
DSE3	MIUK4DSEPHY253.1	Fiber Optic Communication	4	5	3	0	2	169
VAC1	MIUK4VACPHY251.1	Disaster Management	3	3	3	0	0	175
VAC2	MIUK4VACPHY252.1	Research and Publication Ethics	3	3	3	0	0	180
SEC1	MIUK4SECPHY251.1	Physics for Everyday Appliances	3	3	3	0	0	185
SEC2	M IUK4SECPHY252.1	Basic Instrumentation skills	3	4	2	0	2	190
SEMESTER V								
Course Type	Course Code	Course Title	Credit	Hours /Week	Hours Distribution/Week			Page

					L	T	P	No.
DSC1	MIUK5DSCPHY301.1	Optics	4	5	3	0	2	195
DSC2	MIUK5DSCPHY302.1	Quantum Mechanics-I	4	4	4	0	0	200
DSC3	MIUK5DSCPHY303.1	Thermodynamics & Statistical Mechanics	4	5	3	0	2	205
DSE1	MIUK5DSEPHY301.1	Transistor Amplifier Circuits and Oscillators	4	4	4	0	0	212
DSE2	MIUK5DSEPHY302.1	Research Methodology	4	4	4	0	0	216
DSE3	MIUK5DSEPHY303.1	Python for Physics	4	5	3	0	2	221
DSE4	MIUK5DSEPHY304.1	Forensic Science	4	4	4	0	0	228
SEC1	MIUK5SECPHY301.1	Programming in Java	3	3	3	0	0	233
SEC2	MIUK5SECPHY302.1	Optics in Photography Holography	3	3	3	0	0	240
SEMESTER VI								
Course Type	Course Code	Course Title	Credit	Hours /Week	Hours Distribution/Week			Page No.
					L	T	P	
DSC1	MIUK6DSCPHY351.1	Atomic and Molecular Physics	4	4	4	0	0	245
DSC2	MIUK6DSCPHY352.1	Nuclear and Particle Physics	4	4	4	0	0	251
DSC3	MIUK6DSCPHY353.1	Solid State Physics	4	4	4	0	0	256
DSE1	MIUK6DSEPHY351.1	Operational Amplifiers and Applications	4	5	3	0	2	261
DSE2	MIUK6DSEPHY352.1	Applied Optics	4	5	3	0	2	266
DSE3	MIUK6DSEPHY353.1	Numerical Methods in Physics	4	5	3	0	2	271
SEC1	MIUK6SECPHY351.1	Scientific Writing	3	3	3	0	0	276
SEC2	MIUK6SECPHY352.1	Fibre Optic Technology	3	3	3	0	0	281
SEC3	MIUK6SECPHY353.1	PCB Making and Designing	3	3	3	0	0	286
SEMESTER VII								
Course Type	Course Code	Course Title	Credit	Hours /Week	Hours Distribution/Week			Page

					L	T	P	No.
DSC1	MIUK7DSCPHY401.1	Advanced Mathematical Physics	4	4	4	0	0	291
DSC2	MIUK7DSCPHY402.1	Quantum Mechanics – II	4	4	4	0	0	296
DSE1	MIUK7DSEPHY401.1	Semiconductor Physics and Nanoelectronics	4	4	4	0	0	300
DSE2	MIUK7DSEPHY402.1	Environmental Sustainability of Nanomaterials	4	4	4	0	0	305
SEMESTER VIII								
Course Type	Course Code	Course Title	Credit	Hours /Week	Hours Distribution/Week			.
					L	T	P	
CIP	MIUK8CIPPHY450.1	CAPSTONE INTERNSHIP	12	-	-	-	-	-
RPH	MIUK8RPHPHY450.1	RESEARCH BASED PROJECT	12	-	-	-	-	-

SEMESTER I

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK1DSCPHY101.1				
Course Title	**Foundation Course in Physics-I**				
Type of Course	**DSC**				
Semester	I				
Academic Level	100 – 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites					
Course Summary	This course discusses basic foundation concepts in Physics. Simple mathematical tools required for understanding Physical concepts are discussed in the first module. Motion of objects is explained on the basis of Newton's laws followed by the discussion on work and energy. Study on rotational dynamics reveals the concept of angular momentum and its significance in rigid bodies. The discussion on oscillations will help to understand simple harmonic motion and its applications in pendulum.				

Detailed Syllabus

Module	Unit	Content	Hrs	COs
I		**LANGUAGE OF PHYSICS (Book 1: Chapter 1)**	**9**	
	1	Vectors algebra - vector operations, component form, triple products,	3	4, 5
	2	Gradient, the operator ∇, the divergence, the curl, product rules	4	4, 5
	3	Integral calculus: line, surface and volume integrals	1	4, 5
	4	Gauss's divergence theorem and Stokes's theorem (statements only)	1	4, 5
II		**LAWS OF MOTION (Book 2: Chapter 4 &8)**	**9**	
	5	Newton's first law, law of inertia - Inertial frame of reference	2	1
	6	Newton's second law- Mass and Force	1	1
	7	Mass and weight- Variation of g with location, measuring mass and weight	2	2,4
	8	Newton's third law	1	1
	9	Momentum and impulse - Newton's second law in terms of Momentum, The impulse-momentum theorem	2	1
III		**DYNAMICS OF MOTION- WORK AND ENERGY**	**9**	

	(BOOK2: Chapter 6 & 7)			
	10	Work, Kinetic energy and work - energy theorem	1	1, 4
	11	Work and energy with varying forces- Straight line motion, Motion along a curve, Power	2	2, 4
	12	Gravitational Potential energy, elastic Potential energy	3	1
	13	Conservative and non-conservative forces, Law of Conservation of energy	2	2, 4
	14	Force and potential energy	1	2, 4
IV	**DYNAMICS OF ROTATION AND ANGULAR MOMENTUM (Book 2, Book 3 and Book 4)**		**9**	
	15	Torque, Angular acceleration, Rigid body rotation about a moving axis Combined translation and rotation-energy relations, rolling without slipping. Rolling friction, work and power in rotational motion (Book2: Chapter 10)	4	1
	16	Angular momentum of a particle, fixed axis rotation-Moment of Inertia (ring, Disc, Stick), The Parallel axis theorem, dynamics of fixed axis rotation (Book3: Chapter 7)	4	3, 4
	17	Determination of MI. of a flywheel (Theory only) (Book 4, Chapter 8)	3	3, 4
V	**UNDERSTANDING OSCILLATIONS (Book 6, Book 2)**		**9**	
	18	Simple Harmonic motion, Energy in Simple Harmonic motion(Book6, Chapter 15)	3	6
	19	mass on a spring - oscillation of two particles connected by a spring- (Book 2, Chapter 9)	2	6
	20	compound pendulum - interchange ability of suspension and oscillation points-collinear points-conditions for maximum and minimum periods (Book 2, Chapter 9)	4	6

Books for study

1. Introduction to Electrodynamics, David J Griffiths, Prentice Hall
2. Sear and Zemansky's University Physics With Modern Physics, Hugh D Young, Roger A Freedman, Addison -Wesley, 13TH EDITION, 2012.
3. Introduction to Mechanics, Daniel Kleppner and Robert Kolenkow Second Edition, Mc Graw Hill Education, 2017.
4. Mechanics by Upadyaya
5. Principles Of Physics 10th Edition, Robert Resnick Jearl Walker, David Halliday, Wiley, 2014.

BOOKS FOR REFERENCES

1. Mechanics: J. C. Upadhyaya and Ram Prasad, S. Chand Publications, 2017
2. Mechanics: H. S. Hans and S. P. Puri, TMH, 2ndEdn.
3. Properties of matter: Brijlal and Subramaniam, S. Chand & Co.,2004

4. Principles of Physics: P.V. Naik, PHI, 2010

PRACTICALS- A (At least five experiments to be performed from the following list)

Sl No.	Description	CO
1	Compound Bar Pendulum – Symmetric	6
2	Compound Bar Pendulum – Asymmetric.	6
3	Determination of moment of inertia of fly wheel	4, 6
4	Helical spring- Spring constant	2, 6
5	Show that the period of oscillation of a simple pendulum is independent of the mass of the bob used.	6
6	Establish the relationship between length and period of a simple pendulum.	6

PRACTICALS- B (Any One experiment to be performed from the following list)

Sl No.	Description	CO
1	Inclined plane - determine the downward force, along an inclined plane	1, 2
2	Concurrent forces - determination of unknown mass	1, 2
3	Concurrent forces - parallelogram law verification	1, 2

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Discuss the basic mathematical tools used to manipulate vectors and associated problems	U, Ap	PSO – 1, 2
CO-2	Remember Newton's laws of motion and understand basic concepts related to objects in motion like momentum, inertia, work, energy and simple harmonic motion.	R, U	PSO – 1, 2
CO-3	Apply the basic ideas of Newtonian mechanics to evaluate dynamics of objects in detail.	R, U	PSO – 1, 2
CO-4	Understand the concept of moment of inertia and apply it to objects having different shapes	R, U, Ap	PSO – 1, 2,7
CO-5	Solve numerical problems related to motion of objects	U, Ap	PSO – 1, 2
CO-6	Apply the concept of simple harmonic motion to understand periodic movement of objects	U, Ap	PSO – 1, 2,7

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

Name of the Course: FOUNDATION COURSE IN PHYSICS-I

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

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Discuss the basic mathematical tools used to manipulate vectors and associated problems	PSO – 1, 2	U, Ap	F, C	L	
CO-2	Remember Newton's laws of motion and understand basic	PSO – 1, 2	R, U	F, C	L	P

	concepts related to objects in motion like momentum, inertia, work, energy and simple harmonic motion.					
CO-3	Apply the basic ideas of Newtonian mechanics to evaluate dynamics of objects in detail.	PSO – 1, 2	R, U	F, C	L	
CO-4	Understand the concept of moment of inertia and apply it to objects having different shapes	PSO – 1, 2,7	R, U, Ap	F, C, P	L	
CO-5	Solve numerical problems related to motion of objects	PSO – 1, 2	U, Ap	F, C	L	
CO-6	Apply the concept of simple harmonic motion to understand periodic movement of objects	PSO – 1, 2,7	U, Ap	F, C, P	L	P

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

Mapping of COs with PSOs and POs :

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

Correlation Levels:

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

Assessment Rubrics:

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

- Final Exam

Mapping of COs to Assessment Rubrics :

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

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK1DSCPHY102.1				
Course Title	**Introductory Mechanics**				
Type of Course	**DSC**				
Semester	1				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	• The students should have undergone a course in physics during their higher secondary curriculum • The students should have a basics understanding of motion • The students should have basic ideas physical quantities and units				
Course Summary	This course aims to present the basics of mechanics in an easily understandable way. The course begins with an introduction to kinematics which includes the properties of vectors, motions and Newton's laws. The second module comprises the basic ideas of momentum and collisions and discusses the concept of conservation. The basic ideas of circular motion are explained with a few examples in the third module. The work, energy, force and the concept of angular momentum are introduced in the fourth module. The last module includes the elementary ideas of central force.				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I	**INTRODUCTION TO KINEMATICS (Book :1 - Chapter: 2, 3,4; Book : 2- Chapter: 2,3,4; Book : 3; Chapter: 1-5)**		**9**	
		Vectors,Properties of vectors - cross product and dot product, scalar product and Vector product, Divergence and Curl	3	1
		Motion in One Dimension - Position, Velocity and speed, acceleration, freely falling objects	2	2
		Motion in two Dimension - position, velocity and acceleration vectors, projectile motion, circular motion	2	2
		Newton's laws of motion, Application of Newton's laws - Particles in equilibrium, Dynamics of particles, Frictional Force	2	2
II	**LINEAR MOMENTUM, IMPULSE AND COLLISIONS (Book**		**9**	

	:1 - Chapter: 9; Book : 2- Chapter: 8)			
		Linear momentum, Conservation of linear momentum	2	3
		Impulse - momentum theorem	2	3
		Collisions, Collisions in one dimension and two dimensions,	2	3
		Elastic and inelastic collisions, concept of centre of mass, rocket propulsion	3	3
III	**CIRCULAR MOTION (Book 1, Chapter 4, Chapter 6)**		**9**	
		The Particle in Uniform Circular Motion	2	4
		Tangential and Radial Acceleration	1	4
		Newton’s Second Law for Particle in Uniform Circular Motion	3	4
		Non Uniform Circular Motion	3	4
IV	**ANGULAR MOMENTUM (Book :1 - Chapter: 8, 11; Book : 2- Chapter: 10, Book:3 - Chapter 9,10)**		**9**	
		Work done by a constant force and varying force, work–kinetic energy theorem, potential energy	2	4
		Conservative and non-conservative forces, conservative forces and potential energy	2	4
		Angular Momentum, Conservation of Angular Momentum, Torque	2	4
		Angular momentum of rotating rigid object	1	4
		Gyroscopic Effects: Vector Aspects of Angular Momentum	2	4
V	**CENTRAL FORCE (Book 4, Chapter 10)**		**9**	
		Central Force Motion as a One- body Problem	2	5
		Consequences of Conservation of Angular Momentum	2	5
		Consequences of Conservation of Energy	1	5
		The Effective Potential	1	5
		The Formal Solution for Central Force Motion	3	5

Practicals - Part A (CO-6)

1. Least Count of instruments - Screw Gauge, Vernier Calipers, Spectrometer, traveling microscope
2. Screw Gauge - To find the thickness of a scale and radius of wire
3. Vernier Calipers - To find the breadth of a scale and the diameter of a small spherical/cylindrical body
4. The moment bar - To determine the weight of a bar/scale
5. Concurrent Forces - To find the weight of a body using parallelogram law of vectors
6. Viscosity - To find the Coefficient of viscosity- Continuous flow method using constant pressure head.
7. Viscosity- To find the Coefficient of viscosity- using Variable pressure head arrangement

8. To locate the points to given coordinates in space, measure the distance between two points in space and then to verify the distance using distance formula.
9. To find the distance of given point (in space) from a plane (passing through three non-collinear points) by actual measurement and also analytically
10. To study the third law of motion using two spring balances

Practicals - Part B (CO-6)

1. Surface Tension - To find the surface tension of water by capillary rise method
2. The force of Friction - To determine the relationship between force of limiting friction and normal reaction and to find the coefficient of friction between a block and a horizontal surface
3. The inclined plane - To determine the downward force along the inclined plane acting on a trolly/roller

Book for study

1. Physics for scientists and engineers with Modern Physics, 7th Edition, Serway & Jewett,
2. College Physics 2e, OpenStax
3. University Physics, 13 th Edition, Hugh D. Young, Roger A. Freedmann, A. Lewis Ford, Pearson 2012.
4. An Introduction to Mechanics, D. Kleppner & R. Kolenkow, 2/e, Cambridge University Press.

Book for reference

1. Principles of Physics, 10/e, Walker, Halliday & Resnick, International Student Version, Wiley
2. Basic Physics, Kenneth W Ford, World Scientific Publishing Co. Pvt. Ltd., 2016

Web Resources

- https://archive.org/details/basicph_current/mode/2up (Basic Physics: Principles and Concepts, Avijit Lahiri)

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Remember the basics of vectors and their properties	R	PSO-1
CO-2	Compare the motions in one and two dimensions and explain the newton’s laws of motion and its applications	R, U	PSO-1
CO-3	Learn the physical and mathematical concepts of linear momentum, Impulse and Collisions	R, U	PSO-1

CO-4	Review the fundamental idea of work energy and force and recognize the concept of angular momentum	R, U	PSO-1
CO-5	Discuss the elementary ideas of central force	R, U	PSO-1
CO-6	Identify the methods to measure the radius of various objects and interpret the nature of various forces	U,Ap	PSO-2

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

Note: 1 or 2 COs/module

Name of the Course: INTRODUCTORY MECHANICS

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

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Remember the basics of vectors and their properties	PO 1/PSO-1	R	F	L	-
CO-2	Compare the motions in one and two dimensions and explain the newton's laws of motion and its applications	PO 2/PSO-1	R, U	F,C	L	P
CO-3	Learn the physical and mathematical concepts of linear momentum, Impulse and Collisions	PO 1/PSO-1	R, U	F,C	L	-
CO-4	Remember the fundamental idea of work energy and force and recognize the concept of angular momentum	PO 1/PSO-1	R, U	F,C	L	-
CO-5	Discuss the elementary ideas of central force	PO 1/PSO-1	R, U	F,C	L	-
CO-6	Identify the methods to measure the radius of various objects and interpret the nature of	PO2/ PSO-2	U,Ap	C,P	-	P

	various forces					

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

Mapping of COs with PSOs and POs :

	PSO 1	PS O2	PSO 3	PSO 4	PS O5	PS O7	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO-1	1	-	-	-	-	-	2						
CO-2	2	-	-	-	-	-	2	1					
CO-3	1	-	-	-	-	-	2	2					
CO-4	2	-	-	-	-	-	2	1					
CO-5	2	-	-	-	-	-	1						
CO-6	-	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	✓			

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK1DSCPHY103.1				
Course Title	**Properties of Solids**				
Type of Course	**DSC**				
Semester	I				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	1.				
Course Summary	This course explores the fundamental properties of solids and their applications in semiconductor devices. Topics covered include magnetic properties, superconductivity, thermal properties, dielectric properties and semiconductor devices. Emphasis is placed on understanding the underlying concepts of physics governing these properties and their technological significance.				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**MOLECULES AND SOLIDS (Book 1)**	**9**	
	1	Bonding in molecules, Potential Energy diagrams for molecules, Weak (Van der Waals) bonds – Protein synthesis,	2	1
	2	Bonding in solids	1	1
	3	Free electron theory of metals	1	1
	4	Band theory of solids, Semiconductors and doping, Semiconductor Diodes, LEDs, OLEDs, Transistors: Bipolar and MOSFETs, Integrated Circuits, 22-nm Technology	5	1,6
II		**MAGNETIC PROPERTIES (Book 2)**	**9**	
	1	Permeability and Susceptibility	1	2
	2	Origin of Magnetic Moment	1	1,6
	3	Classification of magnetic materials	2	2
	4	Curie Temperature, Weiss theory of Ferromagnetism	1	2
	5	Hysteresis loop	2	2
	6	Antiferromagnetism, Ferrimagnetism, Ferrites, Magnetic materials for information storage	2	2
III		**SUPERCONDUCTIVITY (Book 2)**	**8**	
	1	Introduction, Magnetic Properties, Meissner Effect	2	3
	2	Type I and type II superconductors – London Penetration depth	2	3
	3	Isotope Effect, BCS Theory, Cooper Pairs	2	3

	4	High temperature superconductivity, Applications	2	3
IV	**THERMAL PROPERTIES (Book 3)**		**10**	
	1	Coefficient of Thermal Conductivity, Thermometric Conductivity	1	4
	2	Thermal conductivity – Radial flow of heat, cylindrical flow	2	4,6
	3	Wiedemann – Franz Law	1	4
	4	Latent Heat of Fusion	1	4
	5	Laws of Fusion - Practical Applications	1	4
	6	Effect of Pressure and impurities on Freezing point,	1	4
	7	Thermoelectric effects – Seebeck, Peltier, Thomson effect and Thermo electric power	3	4
V	**DIELECTRIC PROPERTIES (Book 2)**		9	
	1	Electric Dipole, Polarizability, Polarisation vector, Dielectric constant, Dielectric Susceptibility	2	5
	2	Dielectric polarisation- Electronic Polarisation, Ionic Polarisation, Orientation Polarisation, Space Charge Polarization, Total Polarisation	3	5
	3	Frequency dependence of Polarisation, Dielectric loss	2	5
	4	Ferroelectric Crystals, Piezoelectric Crystals- Applications	1	5
	5	Applications of dielectric materials	1	5

PRACTICALS

(15 Weeks with 2 hours of laboratory session per week)

Sl No	Experiment	CO
Part A At least **FIVE** experiments to be performed		
1	Diode Characteristics (for Ge and Si diodes)	6
2	Zener diode characteristics: To (i) trace and construct the circuit (ii) to plot the V-I characteristic under reverse biased condition and (iii) to calculate the dynamic resistance of the diode under reverse bias when conducting	6
3	LED and photo diode characteristics: To (i) study the variations in resistance with varying current and (ii) to study the output characteristics of a photo diode	6
4	Half wave rectifier-Measurement of ripple factor with and without filter capacitor	6
5	Full wave rectifier- Measurement of ripple factor with and without filter capacitor	6
6	Phase transition-determination of M.P of wax	6
7	Determination of thermal conductivity of rubber	6
8	Lee’s disc-determination of thermal conductivity of a bad conductor	6
9	LED circuit design	6

10	Circular coil- magnetization of a magnet	6
11	Absolute determination of m and Bh using box type and Searle's type vibration magnetometers	6
12	Searle's vibration magnetometer-comparison of magnetic moments	6
13	To determine the Planck's constant using LEDs of at least 4 different colours	6
Part B At least **ONE** experiment to be performed		
1	Thermo emf-measurement of emf using digital multimeter	6
2	Potentiometer – Resistivity	6
3	Carey Foster's Bridge-Resistivity	6
4	Design and construction of variable dc power supply (0-12V) using diodes, capacitors and IC 7812)	

BOOKS FOR STUDY:

1. Physics, Principles with Applications, Douglas C. Giancoli, Pearson Education Limited, 7^{th} Edition (2016).
2. Engineering Physics, G Aruldhas, PHI Learning Private Limited, New Delhi(2012).
3. Heat and Thermodynamics: Brijlal and Subramaniam, S. Chand &Co.

BOOKS FOR REFERENCES

1. Concepts of Modern Physics, Arthur Beiser, Shobhit Mahajan, S Rai Choudhury, McGraw Hill Education (India) Private Limited (2017).
2. Solid State physics and Electronics, R K Puri, V K Babbar, S Chand & Company Ltd, (2008).
3. Solid State Physics, Dr R Asokamani, Eswar Press, Chennai, (2015).
4. Applied Solid State Physics, Rajnikant, Wiely India Pvt. Ltd. 92011)
5. Heat and Thermodynamics: M. Zeemansky, McGraw Hill, New Delhi (2007).
6. Heat and Thermodynamics: Rose C. McCarthy, The Rosen Publishing Group, Inc. NY, (2005)
7. Thermodynamics Kinetic Theory and Statistical Thermodynamics: F. W. Sears and G.
8. L. Salinger, Addison-Wesley Publishing Company, 3rd Edn. (1975).

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO - 1	Differentiate various types of bonding in solids,	U, An, Ap	1,2

	describe the relationship between band structure and electrical properties and apply the principles of doping in the fabrication of semiconductor devices		
CO - 2	Illustrate and interpret the magnetic properties of materials and their theoretical underpinnings crucial for different applications	Ap	1,2
CO - 3	Explain the principles of superconductivity, describe the properties of superconducting materials, and evaluate the wide range of applications of superconductivity	U, An, E	1,2
CO - 4	Describe and apply the thermal conductivity principles of solids, analyse the latent heat of fusion and evaluate its applications and analyse the thermoelectric properties of solids	U, Ap, An, E	1,2
CO - 5	Describe the principles governing dielectric materials and categorise different types of dielectric crystals and appraise their application.	U, An, E	1,2
CO - 6	Experiment and infer conductivity and magnetic property measurements as well as semiconductor device characterization.	Ap, An	1,7

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

Note: 1 or 2 COs/module

Name of the Course: PROPERTIES OF SOLIDS

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

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO - 1	Differentiate various types of bonding in solids, describe the relationship between band structure and electrical properties and apply the principles of doping in the fabrication of semiconductor devices	PSO -	U, An, Ap	C	L	P
CO - 2	Illustrate and interpret the magnetic properties of materials and	PSO-	Ap	C	L	

	their theoretical underpinnings crucial for different applications					
CO - 3	Explain the principles of superconductivity, describe the properties of superconducting materials, and evaluate the wide range of applications of superconductivity	PSO -	U, An, E	C	L	
CO - 4	Describe and apply the thermal conductivity principles of solids, analyse the latent heat of fusion and evaluate its applications and analyse the thermoelectric properties of solids	PSO –	U, Ap, An, E	C	L	P
CO -5	Describe the principles governing dielectric materials and categorise different types of dielectric crystals and appraise their application.	PSO	U, An, E			
CO -6	Experiment and infer conductivity and magnetic property measurements as well as semiconductor		Ap, An	P		P

	device characterization.					

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

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO 7	PO 1	PO2	PO 3	PO 4	PO 5	PO6	PO 7
CO 1	3	2	-	-	-	-	-	3	3	2	1	1	-	-
CO 2	3	3	-	-	-	-	-	3	3	2	1	-	1	-
CO 3	3	3	-	-	-	-	-	3	3	3	1	-	-	-
CO 4	3	3	-	-	-	-	-	3	3	3	1	1	-	-
CO 5	3	3	-	-	-	-	-	3	3	3	2	-	-	-
CO 6	3	-	-	-	-	-	3	3	3	3	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/Practical Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓			✓
CO 4	✓	✓		✓

CO 5	✓			
CO 6	✓		✓	

Mar Ivanios College (Autonomous)

Discipline	PHYSICS
Course Code	MIUK1MDCPHY101.1
Course Title	**Elementary Data Analysis**
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 hours

Pre-requisites	
Course Summary	By the end of the course, students will have gained proficiency in collecting, analysing, and interpreting experimental data in Physics, preparing them for further studies or careers in scientific research or related fields. The course emphasizes hands-on experience with real-world datasets and practical applications, aiming to equip students with the ability to extract meaningful insights from experimental measurements.

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**PRESENTATION OF DATA (Book:01, 04)**	**10**	
	1	Data: Quantitative and Qualitative, Attributes, Variables, Scales of Measurement- Nominal, Ordinal, Interval and Ratio.	2	1
	2	Presentation of Data by Tables and Diagrams- Tabular and Graphical, Including Bar Diagram, Histogram, Pie Chart, Frequency Polygon and Ogives.	3	1
	3	Bivariate data: Definition, Scatter Diagram	2	1
	4	Frequency Distributions for Discrete and Continuous Variables, Graphical Representation of a Frequency Distribution by Histogram and Frequency Polygon, Cumulative Frequency Distributions.	3	1
II		**PROBABILITY (Book: 02, 05)**	**10**	
	5	Introduction, Random Experiments, Sample Space, Events and Algebra of Events	3	2
	6	Definitions of Probability – Classical, Statistical, and Axiomatic.	2	2
	7	Conditional Probability, Laws of Addition and Multiplication, Independent Events	2	2
	8	Theorem of Total Probability, Bayes' Theorem and its Applications.	3	2

III	**STATISTICAL METHODS (Book: 01,03)**		**10**	
	9	Statistical Methods: Definition and Scope of Statistics, Concepts of Statistical Population and Sample.	2	1
	10	Central Tendency and its Measures: Arithmetic Mean, Median, Mode, Geometric Mean and Harmonic Mean, Quartile and Percentiles.	3	3
	11	Measures of Dispersion: Range, Skewness, Mean Deviation, Standard Deviation, Moments, Coefficient of Variation	3	3
	12	Standard Probability Distributions: Normal, Binomial and Poisson.	2	3
IV	**INTRODUCTION TO SPREADSHEET (Book: 06)**		**6**	
	13	Cell Reference – Entering Data, Formatting, Editing Data	1	4
	14	Using Formulas – Filters ,Sorting, Data Analysis, Pivot Tables	2	4
	15	Mathematical and Statistical Functions, Creating Charts (Pie Chart, Column Chart and Line Chart)	3	4
V	**HANDS ON TRAINING (Book: 06) Any Five.**		**09**	
	16	Using Spreadsheet, calculate the mean, median, and mode.	9	5
	17	Using Spreadsheet, calculate the range and standard deviation.		
	18	Using Spreadsheet, compute standard deviation, range and skewness of the data.		
	19	Using Spreadsheet, organize data in a list alphabetically, numerically or chronologically.		
	20	Using Spreadsheet, plot Ohm's law.		
	21	Using Spreadsheet, create a formula to find the Income tax of an individual that contains nested functions.		
	22	A worksheet contains names and marks in 3 subjects. Calculate total marks and construct 3D Pie chart for total marks.		
	23	Using Spreadsheet, Construct 2D line chart for a given set of data.		
	24	Using Spreadsheet, Construct 2D column chart for a given set of data.		
	25	From the data given, using the most appropriate formulas and functions, (i). Calculate the total rainfall for the week and the year respectively. (ii). Find the lowest rainfall for the week and the year respectively. (iii). Find the highest rainfall for the week and the year respectively. (iv). Find the mean rainfall for the week and the year respectively.		

BOOKS FOR STUDY

1. Goon A. M., Gupta M. K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I& II, 8th Edn. The World Press, Kolkata.
2. Hogg, R.V., Tanis, E. A. and Rao J. M. (2009): Probability and Statistical Inference, Seventh Ed, Pearson Education, New Delhi.

3. Mood, A. M. Graybill, F. A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.
4. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
5. Vijay K. Rohatgi, A. K. Md. Ehsanes Saleh · 2011,An Introduction to Probability and Statistics, Wiley.
6. Curtis Frye, Microsoft Excel 2019 Step by Step- 250 Ways to a Calmer You ,2019, Microsoft.

References

1. K. F. Riley, M. P. Hobson and S. J. Bence, 2006, Mathematical Methods for Physics and Engineering Third Edition, Cambridge University Press.

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO1	Understand of data, bi-variate data, scales of measurement, presentation of data with the help of diagrams and the knowledge of quantitative techniques in the area of statistics .	U	4
CO2	Understanding of probability theory and its applications, enabling them to analyse uncertain situations, make informed decisions, and solve problems in diverse contexts.	U	4
CO3	Understand of data through its central value, variability, shape and their distributions.	U	4
CO4	Develope the proficiency in utilizing formulas to conduct calculations and streamline tasks through automation.	U, Ap	2,4
CO5	Interpret, apply and visualize data using Spreadsheet software, enabling them to make informed decisions and solve real-world problems efficiently.	U, Ap	2,4

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

Note: 1 or 2 COs/module

Name of the Course: Elementary Data Analysis

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

CO No.	**CO**	**PO/PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture (L)/Tutorial (T)**	**Practical (P)**
CO1	Understand of data, bi-variate data, scales of measurement, presentation of data with the help of diagrams and the knowledge of quantitative techniques	3,5/4	U	F,C	L	

	in the area of statistics .					
CO2	Understanding of probability theory and its applications, enabling them to analyse uncertain situations, make informed decisions, and solve problems in diverse contexts.	3,5/4	U	F,C	L	
CO3	Understand of data through its central value, variability, shape and their distributions.	3,5/4	U	F,C	L	
CO4	Competence in using formulas to perform calculations and automate tasks	2, 3,5/2,4	U, Ap	F,C,P	L	
CO5	Aim to equip participants with the necessary skills to effectively apply , interpret, and visualize data using Spreadsheet software, enabling them to make informed decisions and solve real-world problems efficiently.	2, 3,5/2,4	U, AP	F,C,P	L/T	

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

Mapping of COs with PSOs and POs :

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

Correlation Levels:

Level	Correlation
-	Nil

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

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

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK1MDCPHY102.1				
Course Title	**Green Energy Resources**				
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	NIL				
Course Summary	The course provides a comprehensive understanding of work, energy, and power fundamentals. It includes various forms of energy such as renewable and conventional systems like coal, oil and natural gas. It explores the impact of non-conventional energy sources on global warming and examines approaches to energy conservation and governmental policies. Moreover, this course also covers specific renewable energy sources like solar, wind, hydro, tidal, and wave energy. The course touches upon other energy sources, storage methods and provides a broad overview of energy systems and technologies.				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I	**INTRODUCTION (Book 1 Ch 2, Book 2 Ch 1, Book 3, Ch 1)**		**9**	
	1	Fundamentals of Work, Energy and Power	1	1
	2	Various Forms of Energy - Renewable and Conventional energy Systems - Comparison - Coal, Oil and Natural Gas – Availability - Applications – Merits and demerits	2	1

	3	Impact Due to Non-Conventional Energy Sources – Global Warming	3	1
	4	Approaches to Energy Conservation - Energy Conservation Policies of Different Governmental Bodies	3	1
II	**SOLAR ENERGY (Book 1 Ch 4, Book 3 Ch 2)**		**9**	
	5	Solar Radiation Measurements (qualitative only), Solar Energy Collector, Principles of the Conversion of Solar Radiation into Heat	3	2
	6	Classification of Different Types of Solar Energy Collectors (qualitative ideas only) - Merits and Demerits	3	2
	7	Solar Energy Storage, Solar Heaters, Solar Cookers, Solar Green Houses	1	2
	8	Merits and Demerits of Solar Energy, Solar Cell Technology (basic principle only)	2	2
III	**WIND ENERGY (Book 1 Ch 8,9, Book 2 Ch 8, Book 3 Ch 3)**		**9**	
	9	Basic Principles of Wind Energy Conversion, Merits and Demerits	3	3
	10	Basic Components of Wind Energy Conversion System	3	3
	11	Policies Related to Wind Energy in India, Applications of Wind Energy.	3	3
IV	**HYDRO, TIDAL AND WAVE ENERGY (Book 1 Ch 18, Book 3 Ch 5)**		**9**	
	12	Hydro-Resources, Hydro-Project- Types and Hydro-Conversion Technologies	2	4
	13	Tidal Resource, Tidal Power Conversion	3	4
	14	Wave Resource, Wave Energy Conversion	3	4
	15	Challenges to Sustainability	1	4
V	**OTHER SOURCES OF ENERGY AND STORAGE (Book 1 Ch 19, 20, Book 2 Ch 12)**		**9**	
	16	Piezoelectric Energy Harvesting – Physics and Characteristics of Piezoelectric Effect, Piezoelectric Energy Applications	2	5

	17	Electromagnetic Energy Harvesting	2	5
	18	Oceans and Chemical Energy Resources	2	5
	19	Energy Storages - Primary and Secondary Cells –Fuel Cells (basics)	3	5

Books for Study:

1. Energy Technology: S. Rao and Dr. B.B. Parulekar, Third edition, 2009.
2. Alternative Energy Resources, Green Energy and Technology, Efstathios E. (Stathis) Michaelides, Springer, 2012, DOI 10.1007/978-3-642-20951-2.
3. Non-Conventional Energy Sources, Sri. Shali Habibulla, State Institute of Vocational Education Directorate of Intermediate Education Govt. of Andhra Pradesh, Hyderabad, 2005.
4. Non-Conventional Energy Resources: G. D. Rai, Khanna Publishers, 2008.
5. Solar Energy Fundamentals and application: H.P. Garg and J. Prakash, Tata McGraw - Hill Publishing company Ltd., 1997.

Books for Reference:

1. Power Plant Technology: A. K. Wahil. 1993.
2. Solar energy: S. P. Sukhatme, Tata McGraw- Hill Publishing company Ltd.,1997.
3. Renewable Energy, Power for a sustainable future, Godfrey Boyle, 2004, Oxford University Press, in association with The Open University.
4. Solar Energy: Resource Assessment Handbook, Dr. P Jayakumar, 2009.
5. Wave and Tidal Energy Editor(s): Deborah Greaves, Gregorio Iglesias, First published:23 March 2018, DOI:10.1002/9781119014492, 2018 John Wiley & Sons Ltd.
6. Renewable Energy Resources: John Twidell and Tony Weir, Routledge Publishers ISBN: 978-1138782841.
7. Solar energy: G.D. Rai, Fifth edition, 1995.
8. Renewable Energy: Sources and Methods, Anne Elizabeth Maczulak, 2010.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand the Energy Systems	R, U	PSO-1,2
CO-2	Understand Solar Energy Technologies and Applications	U	PSO-2
CO-3	Understand Wind Energy Conversion Systems and Policies	U	PSO-2
CO-4	Understand the fundamental principles of hydro resources	R, U	PSO-1,2
CO-5	Understand the fundamental principles behind piezoelectric and electromagnetic energy harvesting as well as energy storages	U	PSO-1,2

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

Name of the Course: Green Energy Resources

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

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Understand of Energy Systems	1,2/1,2	R, U	F, C	L	-
CO-2	Understand Solar Energy Technologies and Applications	2/2	U	C	L	-
CO-3	Understand Wind Energy Conversion Systems and Policies	2/2	U	C	L	-

CO-4	Understand the fundamental principles of hydro resources	1,2/ 1,2	R, U	F, C	L	-
CO-5	Understand the fundamental principles behind piezoelectric and electromagnetic energy harvesting as well as energy storages	1,2/ 1,2	U	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	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	1						1	-	-	-			
CO 2	-	2						1	-	-	1			
CO 3	-	2						1	-	-	2			
CO 4	2	1						1	-	-	2			
CO 5	2	1						2	-	-	-			

Correlation Levels:

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

Assessment Rubrics:

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

- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

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

Mar Ivanios College (Autonomous)

Discipline	PHYSICS
Course Code	MIUK1MDCPHY103.1
Course Title	**Environmental Physics**
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. 2.
Course Summary	Foster environmental consciousness among students by fostering an understanding of environmental issues and the interconnectedness of humanity and the environment, advocating for nature preservation and conservation, and promoting awareness of environmental laws and policies.

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**ENVIRONMENT: A BASIC INTRODUCTION (Refer Book 1 Chapter 1, 4; Book 2, Chapter 1)**	**9**	
	1	Overview of Environment	3	1
	2	Impact of Population on Environment- Water, Food, Waste, Pollution, Ozone Layer	3	1,2
	3	Radioactive Waste, Types of Contaminants in Electronic Waste.	3	1,2
II		**PHYSICS OF CLIMATE CHANGE (Refer Book 3 Chapter 1, 13; Book 4, Chapter 1)**	**9**	
	4	Composition of the Atmosphere- Primary Gases - Greenhouse Gases- Reactive Gas Species-Aerosols	2	3
	5	Weather and Climate- Layers of the Atmosphere	1	3
	6	Global Circulation of the Atmosphere-Ocean Currents	2	3
	7	Global Warming and the Ocean- Warming Oceans- Phytoplankton- Acidifying Oceans	2	2
	8	The Global Energy Balance- The Greenhouse Effect	1	2
	9	Environmental Impacts of Climate Change- Sea Level- Snow and Ice	1	2
III		**ENVIRONMENTAL POLLUTION (Refer Book 5 Unit 5)**	**9**	
	10	Pollution	1	1

	11	Air Pollution-Types and Sources of Air Pollution-Pollutants in the Atmosphere-Effects of Air Pollution on Living Organisms-Effects of Air Pollution on the Stratosphere-Ozone Depletion and its Effects	2	1,2
	12	Air Pollution in India-Air Quality Monitoring	1	1
	13	Water Pollution-Water Availability on the Planet-Point Sources of Pollution-Causes of Water Pollution-Groundwater Pollution	3	1,2
	14	Noise Pollution-Effects of Noise Pollution on Physical Health-Effects of Noise Pollution on Mental Health-Noise Control Techniques	2	1,2
IV	**ENVIRONMENTAL DEGRADATION (Refer Book 5 Unit 4, 5)**		9	
	15	Soil Pollution-Causes of Soil Degradation-Problems with Pesticide Use-Excess Salts and Water	2	1,4
	16	Thermal Pollution-Sources-Effects	1	1
	17	Biodiversity-Genetic Diversity-Species Diversity-Ecosystem Diversity-Biogeographic Classification of India	3	4
	18	Threats to Biodiversity: Habitat Loss, Poaching of Wildlife, Man-Wildlife Conflicts	1	4
	19	Conservation of Biodiversity	2	4
V	**WASTE MANAGEMENT AND ENVIRONMENTAL ACTS (Refer Book 5 Unit 5, 6; Book 2 Chapter 1)**		**9**	
	20	Solid Waste Management: Causes, Effects, and Control Measures of Urban and Industrial Waste - Incineration-Vermi - Composting	2	5
	21	Treatment Strategies of E-waste – Recycling - Landfill Disposal - Biological Treatment - Advanced Methods	2	5
	22	Role of an Individual in Prevention of Pollution	1	5
	23	Environmental Laws and Constitutional Provisions to Control Pollutions in India-The Environment (Protection) Act- The Air (prevention and Control of Pollution) act- The Water (Prevention and Control of Pollution) Act- The Wildlife Protection Act- The Forest Conservation Act of 1980	4	5

BOOKS FOR STUDY

1. Foundations of Environmental Physics : Understanding Energy Use and Human Impacts : Kyle Forinash, Island Press; 1st edition (2010)
2. Handbook of Electronic Waste Management: International Best Practices and Case Studies: Edited by Majeti Narasimha Vara Prasad, Sri Jayewardenepura, and Anwesha Borthakur, Butterworth-Heinemann 2020
3. Atmosphere, Weather and Climate:R.G. Barry, R. J. Chorley ;Routledge 8th edition (2003)
4. Climate Change: What The Science Tells Us: C. Fletcher; Wiley 1st edition

5. A textbook of Environmental Studies- E Bharucha - University Grants Commission, 2004

BOOKS FOR REFERENCE

1. Environmental Science: Principles and Practice- R.C. Das and D.K. Behera - PHI Learning Pvt. Ltd (2008)
2. A textbook of Environmental Studies- S.Satyanarayan, S.Zade, S.Sitre and P.Meshram - Allied Publishers, New Delhi, 2009
3. The Physics of Monsoon: R. N. Kesavamoorthy and N. Sankar Rao, Allied Publications (1992)
4. The Physics of Atmosphere: J. T. Houghton, Cambridge University, 3rd Edition (2002)

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand the environment and identify, realize, and enlist the causes of environmental pollution	U	PSO-2
CO-2	Become aware of environmental issues and their effects on man and other living beings.	U	PSO-2
CO-3	Understand the basics of atmospheric composition and weather	U	PSO-1, PSO-2
CO-4	Understand biodiversity and examine major environmental degradation and propose control and prevention measures	R, U	PSO-1, PSO-7, PSO-8
CO-5	Understand various waste management methods and aware of policies and standards related to waste management and environmental protection	R,U	PSO-8,10

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

Note: 1 or 2 COs/module

Name of the Course: Environmental Physics

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

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Understand the environment and identify, realize, and enlist the causes of environmental pollution	2/2	R, U	F, C	L	-
CO-2	Become aware of environmental issues and their effects on man	2/2	U	F	L	-

	and other living beings.					
CO-3	Understand the basics of atmospheric composition and weather	1,2/1,2	U	F,C	L	-
CO-4	Understand biodiversity and examine major environmental degradation and propose control and prevention measures	1,7,/1,7	R, U	F,C	L	-
CO-5	Understand various waste management methods and aware of policies and standards related to waste management and environmental protection	7/7	R,U	F	L	-

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

Mapping of COs with PSOs and POs :

	PSO 1	PSO2	PSO3	PSO4	PSO 5	PSO 6	PSO 7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	-	1	-	-	-			-	1	-	-	-		
CO 2	-	2	-	-	-			-	2	-	-	-		
CO 3	1	2	-	-	-			1	1	-	-	-		
CO 4	1	-	-	-	-		2	1	-	-	-	-		1
CO 5	-	-	-	-	-		1	-	-	-	-	-		2

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

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

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK1MDCPHY104.1				
Course Title	**Physics in Arts and Sports**				
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					
Course Summary	Focusses on the physical principles behind arts and sports, with the purpose of enabling the student to develop and optimize ideas on arts/music/photography and sports				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**INTRODUCTION (Book 1 Ch 1, Ch 2 & Ch 4) (Ref 1 & 2)**	**9**	
	1	Electromagnetic Spectrum, Refraction and Total Internal Reflection in Diamonds, Polarization	2	1
	2	Geometry in Architecture, Developments from Brunelleschi to Leonardo	2	2
	3	Light and Shadow in Nature, Fibonacci Series, Golden Ratio and Symmetry in Nature.	4	
	4	Human Visual System	1	2
II		**PHYSICS OF PAINTING & PHOTOGRAPHY (Book 1 Ch 6, Ch 7, Ch 8 & Ch 9)**	**9**	
	5	Primary Colours, Colour Triangle, Colour Sensitivity of the Eye	3	1
	6	Colour: Saturation, Brightness in Painting and Photography. Additive Color Mixing in Painting, Subtractive Primary Colors	3	1
	7	Camera - Focusing the Camera	1	3
	8	Parameters Affecting Quality of Photos: Exposure Time, Aperture, Depth of Field, *f* Number, Rule of Third	2	3
III		**PHYSICS OF MUSIC (Book 1 Ch 10, Ch 11 & Ch 13)**	**9**	
	9	Periodic Oscillations, Simple Harmonic Motion, Damped Oscillations (qualitative) and Resonance.	3	1
	10	Build-up and Decay of Musical Tones, Resonators in Musical Instruments	2	2

	11	Beats and Harmony, Principle of Superposition, Sound Perception: Pitch, Loudness and Timbre, Loudness and Amplitude, Loudness and Frequency	4	3
IV	**PHYSICS IN SPORTS – I (Book 2 Ch 1, Ch 2 & Ch 3)**		9	
	12	Newton's Laws of Motion, Concept of Velocity, Momentum, Force, Action and Reaction, Conservation of Momentum and Energy, Torque	4	1
	13	Damping, Friction, Rotation, Circular Motion, Gravitation, Projectile, Range of Projectile	3	2
	14	Catches, Throws, Thrust, Pressure	2	2
V	**PHYSICS IN SPORTS - II (Book 2 Ch 8, Ch 9 & Ch 10)**		**9**	
	15	Science Behind Various Sports -Basketball, Football, Javelin, Discus, Cricket Batting, Kicking of Football, Badminton, Swimming	2	4
	16	Science Behind the Design of Bats - Table Tennis, Cricket, Tennis	1	4
	17	Cricket Bowling- Magnus Effect, Spin Motion, Reverse Swing	2	4
	18	Throw- Shot Put Throw, Discus Throw and Javelin Throw	1	4
	19	Athletics - Physics of Running, Long jump, High Jump & Gymnastics	3	4

Book for Study

1. Physics in the Arts P. U. P. A. Gilbert and W. Haeberli (Elsevier) Revised Edition
2. The Physics of Sports A Textbook by David R. Heskett
3. Concepts in physics by H C Verma

References

1. Phyllotaxis, anthotaxis and semataxis Acta Biotheoretica Vol 14, 1961, pages 1-28. (Fibonacci series)
2. https://www.mathnasium.com/blog/14-interesting-examples-of-the-golden-ratio-in-nature (Fibonacci series)
3. https://science.howstuffworks.com/engineering/architecture/brunelleschis-dome.htm

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand basic concepts in physics and interpret relation connecting with arts/sports/music/photography	U, R	1, 2
CO-2	Realize the concept and its application on arts/sports /music/photography	U, R	1,2
CO-3	Demonstrate the ability to think critically and to use appropriate mathematical techniques and concepts to obtain quantitative solutions to performance of arts/sports /music/photography their equipment using physics.	U, R	2,3
CO-4	Develop the ability to read, evaluate, and interpret	U, R	2,3

	numerical and general arts/sports /music/photography data and apply physical principles to real-world sporting situations		

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

Note: 1 or 2 COs/module

Name of the Course: PHYSICS IN ARTS AND SPORTS

Credits: 3:0:0 (Lecture:/Tutorial)

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Understand basic concepts in physics and interpret relation connecting with arts/sports/music/photography	1/1	U	F, C	L	--
CO-2	Realize the concept and its application on arts/sports /music/photography	1/1	U	F, C	L	-
CO-3	Demonstrate the ability to think critically and to use appropriate mathematical techniques and concepts to obtain quantitative solutions to performance of arts/sports /music/photography their equipment using physics.	1, 2/1, 2,	U, R	F, C	L	-
CO-4	Develop the ability to read, evaluate, and interpret numerical and general sports data and apply physical principles to real-world sporting situations	1,2/ 1,2	U, R	F, C	L, T	-

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

Mapping of COs with PSOs and POs :

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

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

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

Mar Ivanios College (Autonomous)

Discipline	**PHYSICS**				
Course Code	MIUK1MDCPHY105.1				
Course Title	**Basics of Artificial Intelligence**				
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 hours
Pre-requisites					
Course Summary	This course provides a foundational introduction to Artificial Intelligence (AI) tailored for students with minimal or no background in information technology. The aim is to introduce key concepts, applications, and implications of AI in a user-friendly manner, making it accessible to non-IT students.				

Module	Unit	Content	Hrs	CO
I	**INTRODUCTION TO ARTIFICIAL INTELLIGENCE (Book : 1, 4)**		8	
	1	Concept of AI, History, Current Status and Scope	1	1
	2	Intelligent Agents and Environments	1	1
	3	Problem Formulations	1	1
	4	Review of Tree and Graph Structures	1	1
	5	State Space Representation	1	1
	6	Search Graph	1	1
	7	Search Tree	2	1
II	**KNOWLEDGE REPRESENTATIONS AND SEARCH ALGORITHMS** (Book : 2, 3)		9	
	8	Definition of Knowledge	1	3
	9	Representation and Organization of Knowledge	1	3
	10	Random Search, Search with Closed and Open List	1	3
	11	Depth First Search	1	3
	12	Breadth First Search	1	3
	13	Heuristic Search, A* Algorithm	2	3
	14	Concepts of Game Playing, Expert Systems	2	3
III	**MACHINE LEARNING (Book : 2, 3)**		10	

	15	History of Machine Learning, Types of Problems in Machine Learning	1	1
	16	Machine Learning Paradigms- Supervised learning	2	1
	17	Semi-Supervised and Unsupervised Learning Methods	2	2
	18	Reinforcement Learning	1	2
	19	Association Learning and Market Basket Analysis	2	2
	20	Concepts of Computer Vision and Nature Inspired Computing	2	2
IV	**PERFORMANCE MEASURES (Book : 01)**		09	
	21	Classification of Performance Measures	1	4
	22	Precision and Recall	2	4
	23	Accuracy, F-Measure and Receiver Operating Characteristic Curve (ROC)	2	4
	24	Area Under Curve (AUC)	1	4
	25	Bootstrapping	1	4
	26	Cross Validation and Ensemble Methods	2	4
V	**ETHICAL CONSIDERATIONS AND APPLICATIONS IN AI (Online Resource : 5, 6)**		09	
	27	Discussion on Bias, Fairness, and Transparency in AI	1	5
	28	Privacy Concerns and Responsible AI Practices	2	5
	29	Exploring AI Applications in Non-Technical Domains Like AI in Healthcare, Finance and Education	2	5
	30	Showcasing User-Friendly AI Tools and Platforms	2	5
	31	Case studies: Weather Predictions, Self-driving cars.	2	5

BOOKS FOR STUDY

1. Russell, Stuart Jonathan, Norvig, Peter, Davis, Ernest. Artificial Intelligence: A Modern Approach. United Kingdom: Pearson, 2010.
2. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems, PHI Learning ,2014
3. Vinod Chandra S. S. and Anand Hareendran S. Artificial Intelligence and Machine Learning, PHI Learning Private Limited,2014.
4. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill
5. https://nptel.ac.in/courses/106105077
6. https://nptel.ac.in/courses/106106126

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand Machine learning concepts	R, U	4
CO-2	Understand supervised, unsupervised and reinforcement learning concepts	R, U	4
CO-3	Understand various search algorithms, such as uninformed search (breadth-first search, depth-first search) and informed search (heuristic search, A* algorithm), to solve problems in artificial intelligence and other related fields	R, U	2,4
CO-4	Understand real life problems using appropriate machine learning models and evaluate the performance measures	R, U	2,4
CO-5	Understand the ethical implications of various AI technologies and applications across diverse domains such as healthcare, finance, autonomous vehicles, and social media.	R, U	4,7

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

Note: 1 or 2 COs/module

Name of the Course: BASICS OF ARTIFICIAL INTELLIGENCE

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

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Understand Machine learning concepts	1,6/4	R, U	F,C	L	-
CO-2	Understand supervised, unsupervised and reinforcement learning concepts	1,6/4	R, U	F,C	L	-
CO-3	Understand various search algorithms, such as uninformed search (breadth-first	6,7/2,4	R, U	F,C	L	-

	search, depth-first search) and informed search (heuristic search, A* algorithm), to solve problems in artificial intelligence and other related fields					
CO-4	Understand real life problems using appropriate machine learning models and evaluate the performance measures	3,6,7 /2,4	R, U	C,P	L	-
CO-5	Understand the ethical implications of various AI technologies and applications across diverse domains such as healthcare, finance, autonomous vehicles, and social media.	6,7,8 /4,7	R, U	C, P	L/T	-

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

Mapping of COs with PSOs and POs :

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

SEMESTER II

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK2DSCPHY151.1				
Course Title	**Foundation Course in Physics-II**				
Type of Course	**DSC**				
Semester	II				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites					
Course Summary	This course discusses the basic concepts required to learn advanced physics courses. The concept of error and precision emphasises the importance of numbers when expressing the magnitude of a quantity. Discussion on waves basic features of waves and its expression. Basic concepts of fluids helps us to understand application level problems like venturimeter and aeroplane wings. The discussion on elasticity gives an idea about different elastic moduli.				

Detailed Syllabus:

Module	Unit	Content	Hrs	COs
I		**PRECISION IN PRACTICE (Book 1)**	**9**	
	1	Significant figures	1	1
	2	Basic ideas of error measurement	1	1
	3	Uncertainties of measurement	1	1
	4	Importance of estimating errors	1	1
	5	Dominant errors, random errors, systematic errors	2	1
	6	Estimating and reporting of errors, errors with reading scales, absolute and relative errors, and standard deviation, Variance in measurements	2	1
	7	Error bars and graphical representation	1	1
II		**PHYSICAL WORLD OF WAVES (Book2: Chapter 16)**	**9**	
	8	Types of waves – Mechanical, Electromagnetic and matter waves, Transverse and longitudinal waves	1	2
	9	Amplitude, phase, wavelength, wave number, period , frequency, angular frequency, phase constant, Speed of a travelling wave	2	2
	10	Wave Speed on a stretched string, energy and power of a	2	2

		wave travelling along a string		
	11	Wave equation	1	2
	12	The principle of Superposition of waves	1	2
	13	Standing waves and resonance(qualitative idea)	2	2
III	**FLUID STATICS (Book 4: Chapter 11)**		**6**	
	14	Cohesion and adhesion of liquids, surface tension - pressure inside a bubble, capillary action	4	3
	15	Pressure in the body: Blood pressure, pressure in eye, Pressure Associated with the Lungs, Other Pressures in the Body: Spinal Column and Skull- Bladder Pressure- Pressures in the Skeletal System	2	3
IV	**FLUID DYNAMICS (Book 3: Chapter 12 and Book 4: Chapter 12)**		**12**	
	16	Fluid flow-streamline and turbulent flow, continuity equation (Book 3: Chapter 12)	2	3
	17	Bernoulli's equation -derivation, venturimeter, lift on an aeroplane wing (Book 3: Chapter 12)	4	3
	18	Viscosity and Laminar Flow; Poiseuille's Law, Motion of an Object in a Viscous Fluid (Book 4: Chapter 12)	4	3
	19	Molecular Transport Phenomena: Diffusion, rate and direction of diffusion, Osmosis and Dialysis - Diffusion across Membranes (Book 4: Chapter 12)	2	3
V	**BEAUTY OF DEFORMATION AND RESTORATION (Book2, Book5)**		**9**	
	20	Condition for equilibrium, Centre of Gravity (Book2: Chapter 11)	1	4
	21	Stress, Strain, and Elastic Moduli- Hook's law, Tensile stress and strain, Bulk Stress and Strain, Shear Stress and Strain (Book2: Chapter 11)	2	4
	22	bending of beams, bending moment, cantilever, Beams supported at its ends and loaded in the middle (Book 5: Chapter 12)	3	4
	23	twisting couple on a cylindrical rod or wire, work done in twisting a wire, torsion pendulum (Book 5: Chapter 12)	3	4

BOOKS FOR STUDY:

1. ERROR ANALYSIS TEXT BOOK
2. Principles Of Physics 10th Edition, Robert Resnick Jearl Walker, David Halliday, Wiley, 2014.
3. Sear and Zemansky's University Physics With Modern Physics, Hugh D Young, Roger A Freedman, Addison -Wesley, 13TH EDITION, 2012.
4. College Physics 2e, PAUL PETER URONE, ROGER HINRICHS, Openstax, 2022
5. Elements of Properties of Matter: D.S. Mathur, S. Chand Publications,2014

BOOKS FOR REFERENCES

1. Mechanics: J. C. Upadhyaya and Ram Prasad, S. Chand Publications, 2017
2. Mechanics: H. S. Hans and S. P. Puri, TMH, 2ndEdn.
3. Properties of matter: Brijlal and Subramaniam, S. Chand & Co.,2004
4. Principles of Physics: P.V. Naik, PHI, 2010
5. Principles Of Physics 10th Edition, Robert Resnick Jearl Walker, David Halliday, Wiley, 2014.

PRACTICALS

(15 Weeks with 2 hours of laboratory session per week)

At least **four** experiments to be performed from the following list

Part A - Any 5

1. Uniform bending—Y- optic lever method
2. Non-uniform bending-Y-Optic lever & telescope
3. Rigidity modulus –Static torsion
4. Torsion pendulum I- By Torsional oscillations.
5. Torsion pendulum I- By Equal masses.
6. Viscosity-Continuous flow method using constant pressure head.
7. Viscosity-Variable pressure head arrangement
8. Surface tension-Capillary rise.

Part B - Any one of the following

1. Evaluation of errors in simple experiments.
2. Experiment to demonstrate random error, by taking dimensions of a small rectangular object using vernier caliper and evaluate the volume of the object
3. Comparison of least counts of measuring instruments.
4. Uniform Bending- determination of Y using pin and Microscope
5. Determination of the viscosity of fluid using Stoke's method.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Discuss the basics of error analysis and use it in expressing physical quantities.	U, Ap	1.2.7
CO-2	Identify the basic concepts of waves and its mathematical expression to understand periodic wave motion	R, U	1,2
CO-3	Observe physical concepts of fluids in rest and	R, U	1.2.7

	motion, to relate them with real world examples		
CO-4	Understand Hook's law and apply it to calculate the elastic moduli of beams and rods.	U, Ap	1.2.7

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

Note: 1 or 2 COs/module

Name of the Course: FOUNDATION COURSE IN PHYSICS-II

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

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Discuss the basics of error analysis and use it in expressing physical quantities.	PSO 1, 2, 7/ PO 1, 2	U, Ap	F, C, P	L	P
CO-2	Identify the basic concepts of waves and its mathematical expression to understand periodic wave motion	PSO 1, 2, 7/ PO 1, 2	R, U	F, C	L	P
CO-3	Observe physical concepts of fluids in rest and motion, to relate them with real world examples	PSO 1, 2, 7/ PO 1, 2	R, U	F, C, P	L	P
CO-4	Cite Hook's law and apply it to calculate the elastic moduli of beams and rods.	PSO 1, 2, 7/ PO 1, 2	U, Ap	F, C, P	L	P

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

Mapping of COs with PSOs and POs :

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

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

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

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK2DSCPHY152.1				
Course Title	**Electricity, Magnetism and Acoustics**				
Type of Course	**DSC**				
Semester	II				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hrs	5 hours
Pre-requisites					
Course Summary	This course provides a comprehensive understanding of fundamental principles and Phenomenon of electricity, magnetism, and acoustics. This course enables to identify and explain chemical, thermal and magnetic effect of electric current, analyses and solves electrical circuits with dc and ac source.				

Module	**Unit**	**Content**	**Hrs**	**CO**
I	**ELECTRICITY (Book: 1,2)**		11	
	1	Electric charge and its properties	1	1
	2	Coulomb's Law -Electric intensity	1	1
	3	Electric field and electric field lines	1	1
	4	Gauss law- Electric field intensity due to a Uniformly charged sphere.	1	1
	5	Electrical potential–Equipotential surfaces	1	1
	6	Ohms law- Current density, Electric resistivity and Conductivity	1	1
	7	Kirchoff law of circuit analysis – Maxwell Bridge	2	1
	8	Carey–Foster Bridge – theory – temperature coefficient of resistance, Potentiometer – theory	3	1
II	**MAGNETIC EFFECT OF ELECTRIC CURRENT (Book: 1,2)**		10	
	9	Magnetic flux and magnetic induction ,Relation connecting B.M and H, Magnetic susceptibility and permeability	2	2
	10	Biot Savart law- magnetic induction at a point due to a straight conductor carrying current	2	2
	11	magnetic induction at a point on the axis of a circular coil	2	2

		carrying current		
	12	Amperes circuital law-magnetic field inside a long solenoid	2	2
	13	Lorentz force on a moving charge- direction of force	1	2
	14	Torque on a current loop in a uniform magnetic field.	1	2
III	**THERMAL AND CHEMICAL EFFECTS OF ELECTRIC CURRENT (Book: 1,2)**		06	
	15	Thermoelectricity – Seebeck effect- laws of thermo e.m.f	2	3
	16	measurement of thermo e.m.f. using potentiometer	1	3
	17	Peltier effect and Peltier coefficient	1	3
	18	Thomson effect and Thomson coefficient	1	3
	19	Faraday's laws of electrolysis	1	3
IV	**AC AND DC CIRCUITS (Book: 1,2)**		09	
	20	EMF induced in a coil rotating in a magnetic field	1	4
	21	Peak, average and RMS values of AC voltage and current	1	4
	22	j operator method –use of j operator in the study of AC circuits	1	4
	23	Resistance in an AC Circuit-Inductance in an AC circuit. Capacitance in an AC circuit-	2	4
	24	AC through an inductance and capacitance in series	1	4
	25	AC through an capacitance and resistance in series	1	4
	26	Growth and decay of current in LC and CR circuits with d.c.voltages	2	4
V	**ULTRASONICS AND ACOUSTICS (Book: 3,4)**		09	
	27	Ultrasonics	0.5	5
	28	Production – Piezoelectric crystal method - Magnetostriction method	2	5
	29	Properties and Applications of Ultrasonics	1.5	5
	30	Acoustics of building – Reverberation- Sabine's Reverberation formula	2	5
	31	Factors affecting acoustics of building- Sound distribution in an auditorium-	2	5
	32	Requisites for good acoustics.	1	5

Practicals (Books: 5,6)		**Hrs**	**CO**
Table A (Any Five)			
1	Deflection and vibration magnetometer- M and Bh	2	2,6
2	Circular coil- magnetization of a magnet	2	2,6
3	Searle's vibration magnetometer-comparison of magnetic moments	2	2,6
4	Potentiometer-Resistivity	2	1,6
5	Thermo-emf-measurement of emf using Potentiometer	2	5,6

6	Carey Foster‟s bridge – Measurement of unknown resistance of wire	2	1,6
7	Carey Foster's Bridge-Temperature coefficient of resistance	2	1,6
8	To study the frequency response of a series RC circuit	2	4,6
9	Sonometer-frequency of A.C	2	4,6
10	Melde's string-Frequency of fork	2	6
Table B (Any one as recommended by tutor)			
11	Verification of Ohms Law	2	1,6
12	Circular coil-dipole moment	2	2,6
13	Potentiometer – EMF of a thermocouple	2	3,6
14	To study the frequency response of a series LC circuit	2	4,6
15	Kundt's tube-determination of velocity of sound.	2	6

Books for Study

1. Brijlal and Subramaniam, Electricity and Magnetism, S. Chand & Co, New Delhi (2016)

2. R. Murugeshan, Electricity and Magnetism, S. Chand & Co, New Delhi (2016)

3. Textbook of Sound, D.R.Khanna and R.S. Bedi, Atmaram and sons, 1969.

4. A Text Book of Sound, N.Subrahmanyam and BrijLal, Vikas Publishing House - Second revised edition,1995.

5. Yarwood and Wittle; Experimental Physics for Students, Chapman & Hall Publishers.

6. A text book of practical physics, S. Viswanathan & Co., Chennai.

Reference

1. David J Griffith,1997, Introduction to electrodynamics,2ND EDITION, New Delhi, Prentice Hall of India Pvt.Ltd.
2. Electricity and Magnetism -E.M.Pourcel, Berkley Physics Cource, Vol.2 (Mc Grraw-Hill)
3. Hugh D. Young and Roger A. Freedman, Sears & Zemansky's University Physics with Modern Physics,14th Edition (2015)
4. Fundamentals of Acoustics" by Lawrence E. Kinsler, Austin R. Frey, Alan B. Coppens

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 electric charge and electric fields. Apply and solve basic electric circuit problems using Ohm's Law and Kirchhoff's Laws.	U, Ap	PSO-1,2

CO-2	Understand Biot and Savart's law and Ampere's circuital law to describe and explain the generation of magnetic fields by electrical currents.	U, Ap	PSO-1,2
CO-3	Understand the basics Thermocouple effects	U	PSO-1,2
CO-4	Understand the concepts of AC and DC circuits and solves electrical circuits with dc and ac source.	U, Ap	PSO-1,2
CO-5	To know the different methods of producing ultrasonic waves and better understanding of the theories used in building acoustics.	U	PSO-1,2
CO6	Develope practical skills and understanding experimental setups in the context of the relevant physical principles of Electricity, Magnetism and Acoustics.	U,Ap	PSO - 1,3

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

Note: 1 or 2 COs/module

Name of the Course : ELECTRICITY, MAGNETISM AND ACOUSTICS

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

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Understand the fundamental concepts of electric charge and electric fields. Apply and solve basic electric circuit problems using Ohm's Law and Kirchhoff's Laws.	PO-1/PSO-1,2	U, Ap	C	L	-
CO-2	Understand Biot and Savart's law and Ampere's circuital law to describe and explain the generation of magnetic fields by	PO-1/PSO-1,2	U, Ap	C	L	-

	electrical currents.					
CO-3	Understand the basics Thermocouple effects	PO-1/PSO-1,2	U	F,C	L	-
CO-4	Understand the concepts of AC and DC circuits and solves electrical circuits with dc and ac source.	PO-1/PSO-/1,2	U, Ap	C	L	-
CO-5	To know the different methods of producing ultrasonic waves and better understanding of the theories used in building acoustics.	PO-1/PSO-1,2	U	F,C	L	-
CO-6	Develope practical skills and understanding experimental setups in the context of the relevant physical principles of Electricity, Magnetism and Acoustics.	PO-1,6/ PSO - 1,3	U,Ap	C,P	-	P

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

Mapping of COs with PSOs and POs :

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

CO 4	2	2	-	-	-	-	-	2	-	-	-	-		
CO 5	2	2	-	-	-	-	-	2	-	-	-	-		
CO 6	2	-	2	-	-	-	-	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	✓	✓		

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK2DSCPHY153.1				
Course Title	**Optics and Thermodynamics**				
Type of Course	**DSC**				
Semester	II				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites					
Course Summary	Introduces theory of different optical phenomena. Aims to provide the basic concepts of thermodynamics, the first and the second law of thermodynamics, heat engine, entropy, and the change in entropy during reversible and irreversible processes. Gain the basic knowledge about the fundamentals of Statistcal Mechanics. Provides a platform to observe and analyse different optical phenomena through practical sessions.				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**GEOMETRIC OPTICS (Book 1)**	**7**	
	1	Light – Electromagnetic theory and Quantum theory, Dual nature	1	2
	2	Reflection – Laws, Refraction – Laws	2	1
	3	Refractive index, optical path,	1	2
	4	Dispersion	1	2
	5	Fermat's principle, Rectilinear propagation of light	2	1,2
II		**WAVE OPTICS (Book 1)**	**15**	
	6	Interference - Principle of superposition.	2	1
	7	Young's double slit experiment, bright and dark fringes, fringe width	2	2
	8	Interference in thin films – due to reflected light, Colours in thin films, Applications.	2	2
	9	Newtons rings	2	2
	10	Diffraction - Fresnel and Fraunhofer Diffraction	1	2
	11	Diffraction from a Single slit, Double slit (Qualitative), Plane transmission grating (Qualitative).	3	2
	12	Polarisation – polarised and unpolarised light	1	2
	13	Types of Polarisations	2	2
III		**THERMODYNAMICS (Book 2)**	**9**	
	14	Thermodynamic Systems, Thermodynamic Equilibrium,	2	1,3

		Work done during volume changes, Internal energy and first law of Thermodynamics		
	15	Thermodynamic processes –Quasistatic, Isothermal, Adiabatic, reversible, and irreversible, Cyclic process, Isobaric and Isochoric (Basic ideas)	3	3
	16	Carnot's Ideal Heat engine	2	3
	17	Second law of thermodynamics – Clausius and Kelvin - Planck statements, Refrigerator	2	1,3
IV		**ENTROPY (Book 2)**	**5**	
	18	Change of entropy – Reversible process, irreversible processes and physical concept	2	3
	19	T -S diagram	2	3
	20	Principle of increase of entropy - Heat Death of universe	1	3
V		**STATISTICAL MECHANICS (Book 2)**	**9**	
	21	Statistical Basis – Probability, Principle of equal A priory	1	1,4
	22	Macrostates and Microstates, Phase space	2	4
	23	Statistical Ensembles – Microcanonical, Canonical, Grand Canonical	2	4
	24	Maxwell - Boltzmann statistics - Energy distribution – Derivation	2	4
	25	Need of Quantum statistics, Maxwell - Boltzmann statistics, Bose - Einstein statistics, Fermi - Dirac statistics – Comparative study only	2	4

PRACTICALS

(15 Weeks with 2 hours of laboratory session per week)

Sl No	Experiment	CO
	Part A At least **FIVE** experiments to be performed	
1	Liquid Lens – optical constants of given lens	5
2	Liquid lens – Refractive Index of given liquid	5
3	Spectrometer – A, D and n of a solid prism	5
4	Spectrometer – Dispersive power and Cauchy's constants	5
5	Spectrometer – Grating normal Incidence	5
6	Spectrometer – Hollow Prism Refractive Index of given liquid	5
7	Spectrometer – i-d Curve	5
8	Newton's Rings – Reflected system	5
9	To determine angular spread of He-Ne laser using plane diffraction grating	5
	Part B At least **ONE** experiment to be performed	
1	Air wedge – Diameter of a wire	5
2	To determine the wavelength of a laser source using diffraction of a	5

	single slit	
3	To determine the wavelength of a laser source using diffraction of double slits	5

BOOKS FOR STUDY:

1. Optics, Dr. N Subrahmanyam Brijlal, Dr M N Avadhanulu, S Chand and Company Ltd (2020).
2. Heat and Thermodynamics: Brijlal and Subramaniam, S. Chand &Co. (2021).

BOOKS FOR REFERENCES

1. Optics, Ajoy Ghatak, McGraw Hill, New Delhi (2020).
2. Heat and Thermodynamics: M. Zemansky, McGraw Hill, New Delhi (2007).
3. Physics, Principles with Applications, Douglas C. Giancoli, Pearson Education Limited, 7^{th} Edition (2016).
4. Concepts of Modern Physics, Arthur Beiser, Shobhit Mahajan, S Rai Choudhury, McGraw Hill Education (India) Private Limited (2017).
5. Sear and Zemansky's University Physics With Modern Physics, Hugh D Young, Roger A Freedman, Addison -Wesley, 13TH EDITION, 2012.
6. Heat and Thermodynamics: D. S. Mathur, S. Chand & Sons, New Delhi (1995)
7. College Physics 2e, Paul Peter Urone, Roger Hinrichs, Openstax, 2022.
8. Principles Of Physics 10th Edition, Robert Resnick Jearl Walker, David Halliday, Wiley, 2014.
9. Statistical Mechanics, Sathyaprakash, Kedar Nath Ram Nath, Delhi, Edn (2021).
10. Thermal and Statistical Mechanics: S. K. Roy, New Age International- 2001

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO - 1	Explain the fundamental laws of Optics, Thermodynamics and Statistical Mechanics.	U	PSO – 1,2
CO - 2	Illustrate the basic principles and describe the applications of geometric optics, wave optics, and polarization	**U, Ap**	PSO –1,2
CO - 3	Identify the basic concepts in thermodynamics and entropy, enabling them to evaluate physical processes and systems governed by these principles.	U, Ap, E	PSO – 1,2
CO - 4	Define phase space, microstate, macrostate, ensemble and describe different statistical distributions	U, Ap	PSO – 1,2
CO - 5	Inculcate experimental skills and apply optical principles to analyse and interpret experimental data through laboratory experiments	U, Ap, An	PSO – 1,7

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

Note: 1 or 2 COs/module

Name of the Course: OPTICS AND THERMODYNAMICS

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

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO - 1	Explain the fundamental laws of Optics, Thermodynamics and Statistical Mechanics.	PO1, 2/PSO – 1,2	U	F, C	L	
CO - 2	Illustrate the basic principles and describe the applications of geometric optics, wave optics, and polarization	PO1,2/ PSO – 1,2	**U, Ap**	F, C	L	
CO - 3	Identify the basic concepts in thermodynamics and entropy, enabling them to evaluate physical processes and systems governed by these principles.	PO1.2/ PSO – 1, 2	U, Ap, E	F, C	L	
CO - 4	Define phase space, microstate, macrostate, ensemble and describe different statistical distributions	PO1,2/ PSO – 1, 2	U, Ap	F, C	L	
CO - 5	Inculcate experimental skills and apply optical principles to analyse and	PO1,2/ PSO – 1,7	U, Ap, An	C, P		P

	interpret experimental data through laboratory experiments					

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

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO 7	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	3	-	-	-	-	-	3	3	1	2	-	1	-
CO 2	3	3	-	-	-	-	-	3	3	2	2	1	2	-
CO 3	3	3	-	-	-	-	-	3	2	2	1	1	2	-
CO 4	3	3	-	-	-	-	-	2	1	2	1	1	1	-
CO 5	3	-	-	-	-	-	3	3	3	3	2	2	3	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/Practical Evaluation	End Semester Examinations
CO 1	✓			✓

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

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
	MIUK2MDCPHY151.1				
Course Title	**Archaeophysics**				
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					
Course Summary	The course provides a comprehensive overview of archaeology's core elements and its relationship with physics. Students will gain insights into the nature of archaeological data and develop proficiency in various methods for analysing and interpreting this data. Furthermore, the course explores the principles governing digital tools in archaeology and their practical applications. By the end of the course, students will develop a comprehensive knowledge about archaeology, from its theoretical foundations to its real-world computational applications, facilitating a deeper appreciation of the discipline's interconnections to various other disciplines.				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**INTRODUCTION TO ARCHAEOLOGY (Book 1: Chapter1; Book 2; Book 3: Chapter 1)**	**9**	
	1.	Archaeology: Definition and Scope; Goals of Archaeology; Archaeology and Physics	2	1
	2.	Types of Archaeology	1	1
	3.	The Process of Archaeology (Excavation, Data Collection and Recording, Laboratory and Conservation, Interpretation, Publication)	2	1
	4.	Techniques and Tools (Excavation, Survey and Mapping)	2	1
	5.	Introducing the Concept of Digital Geoarchaeology	2	1
II		**BASICS OF RADIOACTIVITY (Book 4, Chapter 27, 31)**	**9**	
	6.	Introduction to the Nucleus	1	2
	7.	Natural Radioactivity-Alpha, Beta and Gamma Rays-Properties of Alpha, Beta and Gamma Rays	2	2
	8.	Soddy Fajan’s Displacement Law- Natural Radioactive Series	1	2
	9.	Law of Radioactive Disintegration-Half-Life	2	2
	10	Units of Radioactivity	1	2
	11	Radioactive Dating	2	2
III		**RADIOACTIVE DATING TECHNIQUES (Book 1:**	**9**	

		Chapter 13)		
	12	Dating Methods in Archaeology, Dating System, Relative Dating and Absolute Dating Techniques	2	3
	13	Radiocarbon Dating-Principle, Sample, Collection of Sample, Limitations	3	3
	14	Thermo-Luminescence Dating	1	3
	15	Potassium-Argon Dating; Uranium Series Dating; Fission Track Dating	2	3
	16	Archaeomagnetism, Dendrochronology	1	3
IV		**DIGITAL ARCHAEOLOGY (Book 3: Chapter 11, 14)**	**9**	
	17	LiDAR Basics	1	4
	18	LiDAR in Geo-Archaeology - Principles of Capturing 3D Geo-Data with LiDAR- Advantages and Drawbacks- Typical Workflow for LiDAR, Data Capturing and Processing	3	4
	19	Geophysical Methods	1	4
	20	Ground Penetrating Radar, Electromagnetic Induction Methods, Electrical Resistance Techniques, Magnetic Methods, Acoustic Procedures	4	4
V		**ACTIVITIES (Any five)**	**9**	
	21	Museum visits & reports	9	5
	22	Handling of artefacts		
	23	Registration and documentation of artefacts		
	24	Presentation and discussions by students		
	25	Estimate the energy loss of different ions in water and carbon, using SRIM/TRIM etc simulation		
	26	Simulation study (using SRIM/TRIM or any other software) of radiation depth in materials		
	27	Comparison of interaction of H like ions in given medium (Carbon/Water) using simulation software (SRIM etc).		
	28	Estimate the energy loss of different ions in water and carbon, using SRIM/TRIM etc simulation		
	29	Simulation study (using SRIM/TRIM or any other software) of radiation depth in materials		
	30	Comparison of interaction of H like ions in given medium (Carbon/Water) using simulation software (SRIM etc).		

BOOKS FOR STUDY:

1. Archaeology: Principles and methods K Rajan; Manoo Pathippakam (2002)
2. https://www.archaeological.org/pdfs/education/Arch101.2.pdf
3. Digital Geoarchaeology New Techniques for Interdisciplinary Human-Environmental Research; Christoph Siart, Markus Forbriger, Olaf Bubenzer (eds.); Springer (2018)
4. Modern Physics; R Murugeshan, Kiruthiga Sivaprasath, 17th Edition, S Chand & Company (2014)

BOOKS FOR REFERENCE:

1. Introducing Archaeology, Robert James Muckle and Stacey L. Camp; University of Toronto Press ,Third Edition (2021)
2. Archaeology in Practice (A Student Guide to Archaeological Analyses), Balme, Jane and Alistair Paterson ;John Wiley and Sons Inc.(2014)
3. Modern Physics, R.A. Serway, C. J. Moses, C. A. Moyer; 3rd edition, Thomson (2005)

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand the basic concepts of Archaeology, the sources, the methodology and its relations with Physics	R,U	PSO-1, 4
CO-2	Understand basics of radioactivity	R,U	PSO-1
CO-3	Understand and identify various methods of dating	U	PSO-1,2,4,7
CO- 4	Understand the principles of digital tools for archaeology	U	PSO-2,4,7
CO- 5	Understand about the Museums and the Artefacts. Familiarize with computational tools to estimate energy loss of ions in different media.	U, Ap	PSO-2,4,7

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

Note: 1 or 2 COs/module

Name of the Course: ARCHAEOPHYSICS

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

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1	Introduction to basic concepts of Archaeology, the sources, the methodology and its relations with Physics	1/2	R,U	F,C	L	-
2	Understand basics of radioactivity	1/1,2	R,U	F	L	-
3	Understand and identify various methods of dating	1,5/2,5	U	F,C	L	-
4	Understand the principles of digital tools for archaeology	5/2,5	U	C	L	-

5	Understand about the Museums and the Artefacts. Familiarize with computational tools to estimate energy loss of ions in different media.	5/5	U, Ap	F,P	-	P

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

Mapping of COs with PSOs and POs :

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

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

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

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK2MDCPHY152.1				
Course Title	**Beyond the Sky**				
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					
Course Summary	This course provides a comprehensive overview of astronomy, covering foundational concepts such as the scientific method and observational techniques. Students explore topics ranging from the formation of the solar system to the evolution of stars and galaxies. By the end of the course, students will have a deeper understanding of the cosmos and its wonders, from the smallest planets to the largest galaxies.				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**INTRODUCTION TO ASTRONOMY (Book 1 - Chapter 1,3 & 4)**	**9**	
	1	Introduction –Importance of Astronomy	1	1
	2	Methods of Astronomy and Astrophysics –The Scientific Method - Scope of Astronomy	2	1
	3	Brightness Measurement 1. Magnitude Scale 2. Measurement of Apparent Luminosity 3. Corrections for Observed Magnitudes	3	1
	4	Distance Measurement 1. Measurement of Distances Within Solar System 2. Method of Parallax 3. The Method of Luminosity Distance	3	1
II		**OBSERVATIONAL ASTRONOMY (Book 1 - Chapter 19, Web Link -1,2)**	**10**	
	5	Optical Photometry and Spectroscopy, Astronomical Instruments - Optical Telescopes, Radio Telescopes, Space Telescopes - Hubble Space Telescope	6	2
	6	Night Sky 1. Stars and Planets in Night Sky 2. Comets and Meteors 3. Familiarization with Common Constellations 4. Eclipses	4	2

		5. Phases of the Moon		
III		**SOLAR SYSTEM (Book-3, Chapter 2&3, Book-2, Chapter-5, Web Link-1,3)**	**9**	
	7	Formation of the Solar System	2	3
	8	The Sun –Photosphere - Chromosphere - Solar Corona – Prominences – Sunspots and Solar Cycle- Solar Flares	4	3
	9	The planets of the Solar System - Kuiper Belt – Oort Cloud	3	3
IV		**STELLAR EVOLUTION (Book-3, Chapter 7, Book-4, Chapter -78)**	**8**	
	10	Classification of Stars 1. Spectral Types of Stars - The Harvard Classification System 2. Hertzsprung—Russell Diagram	1	4
	11	Stellar Evolution - Low Mass Stars: 0.05–0.5 Solar Masses, Mid Mass Stars: 0.5–~8 Solar Masses, High Mass Stars in the Range 8 Solar Masses	5	4
	12	White Dwarfs - Chandrasekhar Limit, Neutron Stars, Black Holes, Supernova Explosion	2	4
V		**GALAXIES AND BEYOND (Book-2 Chapter 21, 22, Book-3 Chapter 8 & 9)**	**9**	
	13	Milky Way Galaxy - Size, Shape and Structure of the Milky Way	1	5
	14	Hubble Classification of Galaxies, Expanding Universe	2	5
	15	Big Bang Models of the Universe, The Cosmic Microwave Background	3	5
	16	Extrasolar Planetary Systems, Habitable Planets	3	5

Books for Study

1. Astrophysics: Stars and Galaxies, K. D. Abhayankar - University Press 2001
2. An Introduction to Astrophysics, Baidyanadh Basu – PHI Learning Private Limited 2010
3. Introduction to Astronomy and Cosmology – Ian Morison, Wiley 2008
4. Modern Physics, R Murugeshan and Kiruthiga Sivaprasath, S. Chand & Company Pvt. Ltd. 2014
5. From Dust to Life: The Origin and Evolution of our Solar System, John Chambers and Jacqueline Mitton, Princeton University Press 2017

Web References

1. https://science.nasa.gov/solar-system/
2. https://spaceplace.nasa.gov/
3. A brief history of the big bang theory (https://www.worldscientific.com/doi/pdf/10.1142/9789811229442_0001)

Book for Reference:

1. An Introduction to Modern Astrophysics – Carroll & Ostlie, Latest Edition
2. Weinberg, S. The First Three Minutes: A Modern View of The Origin Of The Universe (Basic Books, 1993)
3. Minding the Heavens by Leila Belkora
4. The Amateur Astronomer by Sir Patrick Moore

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Understanding the Foundations of Astronomy	R, U	PSO-1,2,3
CO-2	Exploring Observational Astronomy	U, Ap	PSO-1,2,3
CO-3	Understand the constituents and formation of the solar system	R, U	PSO-1,2,3
CO-4	Understanding Stellar Evolution	R, U	PSO-1,2,3
CO-5	Exploring Galaxies and Cosmology	R, U	PSO-1,2,3

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

Note: 1 or 2 COs/module

Name of the Course: BEYOND THE SKY

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

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1	Understanding the Foundations of Astronomy	1,2,/1,2,3	R, U	F, C	L	-
2	Exploring Observational Astronomy	1,2, /1,2,	U, Ap	F, C, P	L	-
3	Understand the constituents and formation of the solar system	2,4/1,2,3	R, U	F,C	L	-
4	Understanding Stellar Evolution	1,2/1,2,3	R,U	F,C	L	-
5	Exploring Galaxies and Cosmology	4,6/1,2,3	R,U	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	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	3	3	-	-	-	-	-	1	-	1	-	-	-
CO 2	3	3	3	-	-	-	-	1	1	-	1	-	2	-
CO 3	3	3	3	-	-	-	-	-	1	-	1	-	-	-
CO 4	3	3	3	-	-	-	-	-	-	-	1	-	-	-

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

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

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

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK2MDCPHY153.1				
Course Title	**Foundations in Forensic Science**				
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	1.				
Course Summary	The "Foundations in Forensic Science" course is a comprehensive and interdisciplinary exploration of key areas in forensic investigation. Through this course, students can delve into the fundamental principles and techniques essential to modern forensic science. Beginning with an overview of forensic science's role in crime investigation, students progress to mastering crime scene management, evidence collection, and preservation. They then explore the analysis of various types of physical evidence and their forensic significance. The course culminates in a study of firearms and their crucial role in criminal investigation.				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**SCIENCE IN CRIMINAL JUSTICE SYSTEM [sec 1,2,4,5 Book 1 Chapter 1; sec 3 Book 2, Chapter 1]**	**9**	
	1	Definition and Scope of Forensic Science	1	1
	2	History and Development of Forensic Science	1	1
	3	Basic principles of Forensic Science	2	1
	4	Services of Criminal Laboratories - Basic Services Provided by Full Service Crime laboratories, Optional Services Provided by Full Service Crime Laboratories.	2	1
	5	Functions of Forensic Scientist - Analysis of Physical Evidence, The Importance of Physical Evidence, Determining Admissibility of Evidence, Providing Expert Testimony.	3	1
II		**THE CRIME SCENE [Book 1, Chapter 2]**	**9**	
	6	Processing the Crime Scene - Securing and Isolating the Crime Scene, Recording the Crime Scene, Conducting a Systematic Search for Evidence.	5	2
	7	Collecting and Packaging of Physical Evidence - Collecting Physical Evidence, Handling Evidence, Packaging Evidence.	2	2
	8	Maintaining the Chain of Custody - Obtaining Standard/Reference Samples, Submitting Evidence to the Laboratory.	1	2

	9	Ensuring the Crime Scene Safety	1	2
III		**PHYSICAL EVIDENCE [Book 1, Chapter 3 (sec 10 & 11), Chapter 4 (sec 12)]**	**9**	
	10	Common Types of Physical Evidence	1	3
	11	The Significance of Physical Evidence -Identification, Comparison, Individual Characteristics, Class Characteristics, Assessing the Value of Physical Evidence, Cautions and Limitations in Dealing with Physical Evidence.	5	3
	12	Crime Scene Reconstruction - Principles of Crime- Scene Reconstruction, Personnel Involved in Reconstruction.	3	3
IV		**MICRO-TRACES [Book 2, Chapter 17]**	**9**	4
	13	Importance	1	4
	14	Nature -Plant Materials, Dust, Fibres, Polymers, Minerals, Glass, Paint, Soil, mMaterials of Animal Origin.	1	4
	15	Location - The Culprit, Victim, Crime Scene, Weapon, Vehicle, Location, Techniques.	1	4
	16	Collection - Handpicking, Taping, Tacuuming, Dissolving and Washing, Scraping.	1	4
	17	Forensic Problems	1	4
	18	Evaluation -Tools and Techniques, Microscopy, Micro Chemical Tests, X-ray Diffraction, Micro-FTIR Spectroscopy.	2	4
	19	Example of a Specific Trace Evidence - Glass - Importance, Nature, Location, Evaluation.	2	4
V		**FIREARMS [Book 2, Chapter 9]**	**9**	
	20	Importance	1	5
	21	Nature - Firearms, Firearm Parts, Classifications, Single Shot Firearms, Repeaters, Ammunition, The Firing Process.	5	5
	22	Location - The Victim, the Culprit, the Scene of Occurrence, the Firearm, the Ammunition.	3	5

Books for study:

(1) Criminalistics: An Introduction to Forensic Science, Richard Saferstein, (12/e), Pearson Education Inc.
(2) Forensic Science in Criminal Investigation and trials, Dr. BR.Sharma, (4/e), Universal Law Publishing Co. Pvt. Ltd.

Books for References:

(1) Crime Investigation, Paul L Kirk, Wiley
(2) Solving Crimes with Physics, Carla Miller Nozigia, Mason Crest Publishers
(3) Beginners Forensic Science, Dr. C. Hegde & Dr. R. Shekhar, Himalaya Publishing House.
(4) Crime Scene Forensics: A Scientific Method Approach, Robert C Shaler, CRC Press
(5) Fundamentals of Forensic Science, Max M. Houck & Jay A. Siegel, Elsivier Science.

Course Outcomes

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

CO-1	Describe the services of a typical comprehensive crime laboratory and forensic scientist in a criminal justice system	R, U	2, 3
CO-2	Describe the various measures taken while securing, recording and searching the crime scene as well as describe the proper techniques for packaging common types of physical evidence.	R, U	2, 3
CO-3	Summarize the common types and significance of physical evidence encountered at crime scenes as well as the principles of crime scene reconstruction.	R, U	2, 3, 6
CO-4	Demonstrate the physical evidence related to crimes involving microtraces.	R, U	2,3, 7
CO-5	Demonstrate the physical evidences related to crimes involving firearms.	R, U,	2,3, 7

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

Note: 1 or 2 COs/module

Name of the Course: FOUNDATIONS IN FORENSIC SCIENCE

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

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Describe the services of a typical comprehensive crime laboratory and forensic scientist in a criminal justice system	PO- 1 PSO - 2, 3	R, U	F, C	L/T	-
CO-2	Describe the various measures taken while securing, recording and searching the crime scene as well as describe the proper techniques for packaging common types of physical evidence	PO- 1, 3, 6 PSO - 2, 3	R, U	F, C	L/T	-
CO-3	Summarize the common types and significance of physical evidence encountered at crime scenes as well as the principles of crime	PO- 1, 2, 3, 6 PSO - 2, 3	R, U	F, C, P	L/T	-

	scene reconstruction.					
CO-4	Demonstrate the physical evidence related to crimes involving microtraces.	PO- 1, 2,3, 6 PSO - 2, 3, 7	R, U	F, C, P	L/T	-
CO-5	Demonstrate the physical evidences related to crimes involving firearms.	PO- 1, 2, 6 PSO - 2, 3, 7	R, U	F, C	L/T	-

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

Mapping of COs with PSOs and POs :

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

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations

CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓			✓
CO 4	✓			✓
CO 5	✓	✓		

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK2MDCPHY154.1				
Course Title	**Medical Physics**				
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					
Course Summary	The course deals with the physical phenomenon revolving around the biological systems				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**ORIGIN AND EVOLUTION OF LIFE (Book 1 Ch 1 & Ch 14)**	**9**	
	1	Prebiotic Earth	1	1
	2	Theories of Origin and Evolution of Life	2	1
	3	Cell Components – Proteins -Nucleic Acids	2	1
	4	Atoms and Ions, Molecules Essential for Life	2	1
	5	Heat Transfer in Biomaterials: Heat Transfer Mechanism, The Heat Equation, Joule Heating of Tissue	2	2
II		**ENERGY PATHWAYS IN BIOLOGY (Book 1 Ch 3 & Ch 11)**	**9**	
	6	Free Energy, Coupled Reactions, Group Transfer Potential, Photosynthesis Photosystem, Photophosphorylation and Carbon Fixation	3	2
	7	Oxidation, Glycolysis, The Krebs Cycle, The Respiratory Chain, Diffusion, Osmosis, Osmotic Pressure, Osmoregulation	2	2
	8	Surface Tension, Dialysis, Adsorption, Viscosity	2	1
	9	Thermal Conduction, Colloids, Sedimentation.	2	1
III		**BIOMECHANICS (Book 1 Ch 12)**	**5**	
	10	Striated Muscles, Contractile Proteins, Mechanical Properties of Muscles, Contraction mechanism, Role of Ca^{2+} ions	2	1
	11	Bio Mechanics of Cardio Vascular System Blood Pressure	1	1
	12	Electrical Activity During the Heart Beat-Electro Cardiography	2	1
IV		**PHYSICS OF RADIOTHERAPY**	**13**	

		(Book 3 Ch 2, 3,4)		
	13	Overview of Modern Radiotherapy Techniques, Need and Necessity of Quality Assurance Programme in Radiotherapy.	3	2
	14	Physical Principles of X-Ray Diagnosis - Interactions of X-Rays with Human Body, Differential Transmission of X-Ray Beam	4	3
	15	Beam Therapy and Brachytherapy	2	3
	16	Overview of Digital Subtraction Radiography and Mammography	2	3
V		**ABSORPTION AND FLUORESCENCE SPECTROSCOPY (Book 3 Ch 5, 6, 7)**	**9**	
	17	Electromagnetic Spectrum, Properties of Electromagnetic Radiations	1	4
	18	Concept and Types of Spectroscopies	1	4
	19	Absorption Spectrum, Energy Characteristics of Spectrum	1	4
	20	Fundamental Laws of Photometry: Beer’s Law	2	4
	21	Principles of fluorescence, Colorimeter, Spectrophotometer & Spectro Fluorophotometer	2	4
	22	Ultrasound, CT, MRI Scanners (Basic Ideas Only)	2	4

Books for Study:

1. Biophysics, Vasantha Pattabhi N Goutham, Kluwer Academic Publishers, Newyork, Boston
2. ‘HEAT TRANSFER APPLICATIONS IN BIOLOGICAL SYSTEMS’, Liang Zhu University of Maryland Baltimore County, Baltimore, Maryland
3. “The Physics of radiation Therapy” by Faiz M Khan, Edn 3, Lippincott Williams and Wilkins.
4. Essentials of Biophysics: P. Narayanan, 2nd Edn. New Age publishers

Books for Reference:

1. A text book of biophysics: R. N. Roy, New central book agency Kolkata.
2. Introduction to Biophysics, Pranab Kumar Banerjee, S. Chand&co, NewDelhi
3. Elementary bio physics, P. K. Srivastava, Narosa publishing house, NewDelhi

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Interpret the fundamentals of physics adds values on biological systems	R, U	PSO-1,2, 3
CO-2	Explain models of biological system dealing with transport phenomena.	R, U	PSO-1,2
CO-3	Administer experimental techniques for making correct and appropriate use of a range of scientific equipment used in biological systems	R, U, Ap	PSO-1,2,3
CO-4	Analyse the biologic system by making use of experimental techniques in physics	R, U, An	PSO-3,6,

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

Note: 1 or 2 COs/module

Name of the Course: MEDICAL PHYSICS

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

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1	Understand and interpret the fundamentals of physics adds values on biological systems	1,2/1	U	F, C	L	
2	Explain models of biological system dealing with transport phenomena.	1,2,/1	U	P	L	
3	Study experimental techniques for making correct and appropriate use of a range of scientific equipment used in biological systems	1,3/1,2	U, R	C, P	L, T	
4	Evaluate the biologic system by making use of experimental techniques in physics	2,3, /1,3	U, R	F, C, P	L, T	

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

Mapping of COs with PSOs and POs :

	PS O1	PS O2	PS O3	PS O4	PSO 5	PSO 6	PSO 6	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	1	-	-	-	-	-		2	2	--	-	-	-	
CO 2	1	-	-	-	-	-		2	2	-	-	-	-	
CO 3	1	1	-	-	-	-		2	-	2	-	-	-	
CO 4	1	-	2	-	-	-		-	2	2	-			

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium

3	Substantial / High

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics:

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

SEMESTER III

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK3DSCPHY201.1				
Course Title	**Basic Electronics**				
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					
Course Summary	This course aims to familiarise the electronic components, their characteristics and applications. It also helps to understand the linear IC 741 and its mathematical operations.				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO No
I		**DIODES AND TRANSISTORS (Book 2, Chapter 13,15,18&19)**	**9**	
	1	P-N Junction Diode - characteristics, Zener diode, Zener diode as voltage regulator	2	1
	2	Rectification: Halfwave, Full wave-Centre tap, Bridge rectifiers (Derivations not required), RC Filter circuit, Dual power supply	3	1, 6
	3	BJT-Theory of BJT operation and configurations	2	1
	4	CB and CE characteristics and gain parameters	2	2
II		**TRANSISTOR AMPLIFIERS (Book 1, Chapter 8,9,10&11)**	**9**	
	5	Need for biasing and stabilization, stability factor-Thermal Runaway (Basic ideas only)	1	2, 6
	6	Selection of operating point- ac and dc load lines	2	2
	7	Collector feedback; base resistor and potential divider methods (CE configuration only)	2	2
	8	BJT amplifiers - analysis of CE amplifier (frequency response, band width, impedance and gain)	2	2, 6
	9	Multi stage Amplifiers- RC and Transformer coupled amplifiers	2	2
III		**FEEDBACK CIRCUITS (Book 2, Chapter 25&28)**	**9**	
	10	Feedback principles – Negative feedback - advantages of	2	3

		negative feedback		
	11	Forms of negative feedback (Series and shunt)	1	3
	12	Positive feedback - Barkhausen criterion for oscillations	2	3
	13	Principle of sinusoidal oscillation	1	3
	14	Hartley Oscillator, Colpitt's Oscillator and RC phase shift oscillator (derivations not required)	3	3,6
IV	**OPERATIONAL AMPLIFIERS (Book 1, Chapter 25)**		**9**	
	15	Differential amplifier- Common mode and differential signals	2	4
	16	Voltage gain in differential amplifiers- CMRR	1	4
	17	Concept of Virtual Ground, Ideal Op Amp and its features- Familiarising IC 741 Op Amp	1	4
	18	Inverting and Non inverting Amplifiers	2	4
	19	Op Amp Applications: Voltage follower, Adder, Subtractor	2	4,6
	20	Op Amp Applications: Integrator-Differentiator	1	4, 6
V	**LOGIC GATES AND BOOLEAN ALGEBRA (Book 2, Chapter 33&34)**		**9**	
	21	Positive and Negative logic- Basic Logic gates (OR, AND and NOT)	2	5, 6
	22	De Morgan's theorem, Bubbled gates, Universal gates and XOR gates	3	5
	23	Laws of Boolean Algebra-Equivalent circuits (Solving simple circuits only)	2	5
	24	Adders and subtractors	2	5

Basic Electronics Practicals Part A (atleast 5 experiments to be performed)		**CO**
1	**PN junction Diode (Ge & Si) characteristics**-To draw the characteristic curves of a PN junction diode and to determine its ac and dc forward resistances.	6
2	**Full wave (centre tapped) rectifier**-To construct a full wave rectifier using junction diode and to calculate the ripple factor with and without shunt filter	6
3	**Bridge rectifier**-To construct a bridge rectifier using junction diodes and to calculate the ripple factor with and without shunt filter	6
4	**Zener diode as a voltage regulator**-To construct a voltage regulator using Zener diode and to study its line regulation and load regulation.	6
5	**Transistor CE characteristics**-To draw the characteristic curves of a transistor in the CE configuration and determine the current gain, input impedance and output impedance	6
6	**OP amp. IC741- Inverting amplifier**-To construct an inverting amplifier using IC741 and determine its voltage gain	6
7	**OP amp. IC741- Non-inverting amplifier** - To construct a non-inverting	6

	amplifier using IC741 and determine its voltage gain	
8	**Logic Gates** (AND, OR and NOT) using diodes and Transistor	6
PART B		
9	**Dual power supply**-To construct a dual power supply using bridge rectifier and measure the output voltages for different pair of identical load resistors	6
10	**Single stage CE amplifier**- To construct a single stage CE transistor amplifier and study its frequency response (designing not required).	6
11	**RC Phase shift oscillator** (using transistor**)**	6

BOOKS FOR STUDY:

1. Principles of Electronics: V. K. Mehta and Rohit Mehta, S. Chand Ltd.,2020 Edition
2. Basic Electronics-Solid State: B. L. Theraja, S. Chand Ltd. 2005
3. Basic Electronics: Devices, circuits and IT fundamentals: Santiram Kal, PHI, 2010

BOOKS FOR REFERENCE

1. Electronic Devices and Circuit theory: Robert Boylestad & Louis Nashelski, PHI,5th Edn.
2. Electronic Fundamentals & Applications: John D Ryder, PHI, 4thEdn.
3. Introduction to semiconductor materials and Devices, M.S Tyagi, Wiley India (2005)
4. Electronic circuits; Analysis and Design, Donald Neamen, Mc Graw Hill Education India (Third Edition)
5. Operational Amplifiers and Linear integrated circuits, R. A Gayakwad, Prentice Hall India (Fourth Edition 2015)
6. Digital Principles and Applications, Donald P Leach and Albert Paul Malvino, The Mc Graw Hill Company, Sixth Edition

COURSE OUTCOMES

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Familiarize solid-state devices for rectification	U, R, Ap	1, 5
CO-2	Understand different amplifier circuits	U, Ap	1, 5
CO-3	Understand positive and negative feedback circuits	U	1, 2
CO-4	Understand the concept and applications of operational amplifiers.	U, Ap	1, 5
CO-5	Familiarise digital electronics principles	U, R	1, 2
CO-6	Fabrication of elementary electronic circuits	Ap	5

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

Note: 1 or 2 COs/module

Name of the Course: BASIC ELECTRONICS

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

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Familiarize solid-state devices for rectification	1/1, 5	U, R, Ap	F, C	L	
CO-2	Understand different amplifier circuits	1/1, 5	U, Ap	C	L	
CO-3	Understand positive and negative feedback circuits	1/1, 2	U	C	L	
CO-4	Understand the concept and applications of operational amplifiers.	1/1, 5	U, Ap	F, C	L	
CO-5	Familiarise digital electronics principles	1/1, 2	U, R	F, C	L	
CO-6	Fabrication of elementary electronic circuits	1/5	Ap	P	-	P

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

Mapping of COs with PSOs and POs :

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

CO 5	2	2						2						
CO 6					2			-						

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

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

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK3DSCPHY202.1				
Course Title	**Digital Electronics and Data Science**				
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 Hrs	5 Hrs
Pre-requisites					
Course Summary	This course introduces the fundamental concepts of Digital and Computational Methods in Physics. The first module comprises of the introduction to various number systems and codes. The idea of digital logic gates are introduced in the second module. The third module incorporates Boolean Laws and Theorems along with the concept Kamaugh Maps. The basics of data science which includes the types, collection pre-processing etc are discussed in fourth module. Fifth module explains the various data analysis and analytic techniques				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**NUMBER SYSTEMS AND CODES (Chapter 5) Book 1**	**9**	
	1	Binary Number System	1	1
	2	Binary-to-decimal Conversion, Decimal-to-binary Conversion, BCD	2	1
	3	Octal Numbers-Conversions , Hexadecimal Numbers-Conversions	3	1
	4	The ASCII Code, The Excess-3 Code, The Gray Code	1	1
	5	Error Detection and Correction	2	1
II		**DIGITAL LOGIC GATES (Chapter 3) Book 2**	**9**	
	6	The AND Gate, The OR Gate ,The Inverter and Buffer	2	2
	7	The NAND Gate, The NOR Gate,	2	2
	8	The Exclusive OR Gate, The Exclusive NOR Gate	2	2
	9	The NAND Gate as a Universal Gate ,The NOR Gate as a Universal Gate	2	2
	10	Gates with More Than Two Inputs	1	2
III		**COMBINATIONAL LOGIC CIRCUITS (Chapter 3) Book 1**	**9**	
	11	Boolean Laws and Theorems	2	3
	12	Sum-of-Products Method	1	3
	13	Truth Table to Kamaugh Map, Kamaugh Simplifications	3	3
	14	Don't-care Conditions	1	3

	15	Product-of-sums Method, Product-of-sums Simplification	2	3
IV	**INTRODUCTION TO DATA SCIENCE (Chapter 1 & 2 , Book 3)**		**9**	
	16	Introduction- Data Science, Relation to other fields	1	4
	17	Data Types	2	4
	18	Data Collections	3	4
	19	Data Pre-processing	3	4
V	**DATA ANALYSIS AND DATA ANALYTICS (Chapter 3 , Book3)**		**9**	
	20	Descriptive Analysis- Variables, Frequency Distribution, Measures of Centrality, Dispersion of a Distribution	4	5
	21	Diagnostic Analytics- Correlations	3	5
	22	Predictive Analytics, Prescriptive Analytics	1	5
	23	Exploratory Analysis, Mechanistic Analysis	1	5

Practical's

Part A (Any 5)

1. Familiarising different logic gates using 74XX series
2. Construction and Verification of the truth tables of AND gate using diodes
3. Construction and Verification of the truth tables of OR gate using diodes
4. Construction and Verification of the truth tables of NOT gates using transistors
5. Construction and Verification of the truth tables of AND gate using IC's
6. Construction and Verification of the truth tables of OR gate using IC's
7. Construction and Verification of the truth tables of NOT gate using IC's
8. Construction and Verification of the truth tables of NAND gate using IC's
9. Construction and Verification of the truth tables of NOR gate using IC's
10. Verification of Demorgan's theorem for 2 variables

Part B (Any 1)

1. Implementation of the Given Boolean Function using Logic Gates (Y=AB+A'B).
2. Familiarising different logic gates using 74XX series
3. Construction and Verification of the truth tables of AND and OR gateS using diodes

Books for study:

1. DIGITAL PRINCIPLES AND APPLICATION Albert Paul Malvino , Donald P Leach 7th Edition , Tata McGraw Hill Education Private limited
2. Digital Electronics_ Principles and Applications, Roger L. Tokheim, Patrick E. (2021, McGraw-Hill Education)
3. A Hands-On Introduction to Data Science- Chirag Shah - Cambridge University Press (2020)

Books for Reference:

1. Albert P. Malvino, Jerald A. Brown - Digital Computer Electronics (1993, McGraw-Hill)

2. Anil K. Maini - Digital Electronics. Principles, Devices and Applications [messy] (2007, Wiley)
3. Basics of Digital Electronics , Banani Ghosh, CRC Press, 2024
4. Electronics. Analog and Digital , Barun Raychaudhuri, Cambridge University Press, 2024
3. Ozdemir, Sinan - Principles of Data Science_ Learn the techniques and math you need to start making sense of your data (2016, Packt Publishing)
4. Sinan Ozdemir - Principles of Data Science_ A beginner's guide to essential math and coding skills for data fluency and machine learning-Packt Publishing Pvt Ltd (2024)

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Discuss the conversion of different types of number system and codes	U	PSO 1,3,6
CO-2	Realize the concepts of digital logic gates and its applications	U	PSO 1,3,6
CO- 3	Use DeMorgan's theorems to create equivalent circuits and to simplify complex logic circuits using fundamental Boolean algebra laws, make Karnaugh maps and Entered variable maps and use them to simplify Boolean expressions.	U	PSO 1,3,6
CO-4	Distinguish different Data types, major data sources, and formats and to perform basic data cleaning and transformation	U, Ap	PSO 1,2
CO-5	Discuss Various forms of data analysis and analytics techniques.	U	PSO 1,2
CO- 6	Construct and verify the working of various digital logic gates using diode/transistors and IC's	Ap, An	PSO 7

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

Note: 1 or 2 COs/module

Name of the Course: DIGITAL ELECTRONICS AND DATA SCIENCE

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

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Discuss the conversion of different types of number system and codes	PO 1/PSO 1,3,6	U	F, C	L	-
CO-2	Realize the concepts of digital logic	PO 1/PSO 1,3,6	U	C	L	-

	gates and its applications					
CO- 3	Use DeMorgan's theorems to create equivalent circuits and to simplify complex logic circuits using fundamental Boolean algebra laws, make Karnaugh maps and Entered variable maps and use them to simplify Boolean expressions.	PO 1/PSO 1,3,6	U	C	L	-
CO-4	Distinguish different Data types, major data sources, and formats and to perform basic data cleaning and transformation	PO 1/PSO 1,2	U, Ap	C	L	-
CO-5	Discuss Various forms of data analysis and analytics techniques.	PO 1/PSO 1,2	U	C	L	-
CO- 6	Construct and verify the working of various digital logic gates using diode/transistors and IC's	PO 6,7/PSO 7	Ap, An	C,P	-	P

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

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	1	-	1	-		1		1	-	-				
CO 2	2	-	2	-		2		2	-	-				
CO 3	2	-	1	-		1		2	-	-				
CO 4	2	1	-	-	-	-		2	-	-				
CO 5	2	2	-	-	-	-		2	-	-				
CO 6	-	-	-	-	-		2	-	-	-			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	✓			

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK3DSCPHY203.1				
Course Title	**Solid State Physics & Spectroscopy**				
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	Students should know the atom model Students should be aware of different types of materials.				
Course Summary	This course aims to provide the basic concepts of solid state physics and spectroscopy and make the students aware of some of the applications of spectroscopy.				

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs**	CO
I		**SOLID STATE PHYSICS (Book 3)**	**9**	
	1	Types of molecular bonds- ionic bond, covalent bond, metallic bond, molecular bond, Hydrogen bond, Van der waal bond	2	1
	2	Crystal structure-crystal lattice and translation vectors	2	1
	3	Unit cell-symmetry operations point groups and space groups	2	1
	4	Types of lattices-lattice directions and planes, interplaner spacing-simple crystal structures	3	1
II		**BAND THEORY OF SOLIDS (Book 2, Sec. 9.5)**		
	5	Energy bands- Valence band , Conduction band, Energy Gap	1	2
	6	Classification of solids as conductors, semiconductors and insulators based on band theory	2	2
	7	Semiconductors and doping, break down mechanism	2	2
	8	Semiconductor devices- Junction diode, zener diode, light emitting and light absorbing diodes, Transistors, integrated circuits.	4	2
III		**SPECTROSCOPY (Book 2 & 3)**	**9**	
	9	Atomic spectra, selection rule, Hydrogen spectrum	1	3
	10	X-ray spectrum, Moseley's law	2	3
	11	Optical spectra- spectral terms and notations, selection rules	1	3

	12	Molecular spectra- origin and nature of molecular spectra	1	3
	13	Rotational spectra of diatomic molecules-rotational energy levels	2	**3**
	14	Diatomic vibrational spectra-vibrational energy levels	2	3
IV	**SPECTROSCOPIC TECHNIQUES (Book 3)**		**9**	
	15	EM Spectrum- UV, Visible, IR, Radio and microwave regions	1	4
	16	Principle of various spectrometers used in specific regions of EM spectrum	2	4
	17	Absorption spectroscopy, Emission spectroscopy	2	4
	18	Block diagram of absorption spectrometer	2	4
	19	Mass spectroscopy-qualitative ideas of ESR & NMR spectrometers.	2	4
V	**LASER (Book 3)**		**9**	
	20	Interaction of light with matter, absorption, spontaneous emission, stimulated emission	2	5
	21	Principle of laser, population inversion, metastable states, pumping, light amplification,	2	5
	22	Types of Laser- Ruby laser, He-Ne laser, Semiconductor laser	4	5
	23	Application- Holography	1	5

PRACTICALS

(15 Weeks with 2 hours of laboratory session per week)

Sl No	Experiment	CO
	Part A **At least FIVE experiments to be performed**	
1	LED characteristics: To (i) study the variations in resistance with varying current	6
2	Photo diode characteristics: To study the output characteristics of a photo diode	6
3	Half wave rectifier-Measurement of ripple factor with and without filter capacitor	6
4	Full wave rectifier- Measurement of ripple factor with and	6

	without filter capacitor	
5	LED circuit design	6
6	Zener diode as a voltage regulator-To construct a voltage regulator using Zener diode and to study the output voltage variation (i) for different RL and (ii) for different input voltage with same RL.	6
7	Bridge rectifier-To construct a bridge rectifier using junction diodes and to calculate the ripple factor with and without shunt filter (10 readings for RL 100 to 5000).	6
	Part B **At least ONE experiment to be performed**	
1.	To determine the Planck's constant using LEDs of at least 4 different colours	
2	Bridge rectifier- Dual power supply-To construct a dual power supply using bridge rectifier and measure the output voltages for different pair of identical load resistors.	
3	Transistor characteristics-CE-To draw the input and output characteristic curves of a transistor in the CE configuration	

Book for study

1. Physics for scientists and engineers with Modern Physics, 7th Edition, Serway & Jewett,
2. University Physics Vol.3, OpenStax
3. Modern Physics: R.Murugesan, S.Chand & Co.

Book for reference

1. Fundamentals of Molecular Spectroscopy: Banwell, TMH
2. Molecular Spectroscopy: G.Aruldhas, PHI, 2004

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Describe various molecular bonds and crystal structures	U	1
CO-2	Identify different types of solids and get basic knowledge about semiconductors and semiconductor devices	U	1
CO-3	Identify the basic concepts of atomic and molecular spectra.	U	1,2
CO-4	Differentiate various spectroscopic techniques and its applications	U, Ap	1

CO-5	Describe the fundamental knowledge about lasers	U	1
CO-6	Inculcate experimental skills and to interpret experimental data through laboratory experiments	U, Ap	1,5

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

Note: 1 or 2 COs/module

Name of the Course: Solid State Physics & Spectroscopy

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

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Describe various molecular bonds and crystal structures	1,3/1	U	F, C	L	
CO-2	Identify different types of solids and get basic knowledge about semiconductors and semiconductor devices	1,3/1	U	F, C	L	
CO-3	Identify the basic concepts of atomic and molecular spectra.	1,3/1,2	U	F, C	L	
CO-4	Differentiate various spectroscopic techniques and its applications	1,3/1	U, Ap	F, C	L	
CO-5	Describe the fundamental knowledge about lasers	1,3/1	U	F, C	L	
CO-6	Inculcate experimental skills and to interpret experimental data through laboratory experiments	1,2/1,7	U, Ap	F, C, P		P

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

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2							2		1			2	
CO 2	2							2		1			2	
CO 3	2	1						2		1			2	
CO 4	2							2		1			2	
CO 5	2							2		1			2	
CO 6	2						2	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	✓			✓

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK3DSEPHY201.1				
Course Title	**Circuit Elements and Network Theorems**				
Type of Course	**DSE**				
Semester	III				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	0	4
Pre-requisites	1. 2.				
Course Summary	This course aims to get knowledge on basic electrical technology, network theorems, circuit analysis. It also helps to understand the ac circuit analysis and an idea regarding optoelectronic devices.				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**OHM'S LAW (Book 1, Chapter 1,2&3)**	**12**	
	1	Linear and non-linear Resistors, Resistor Colour code	2	1
	2	Resistor Types-Wire wound Resistors, Carbon composition Resistors, Carbon film Resistors, Metal film Resistors	2	1
	3	Resistive circuits, Series and Parallel Resistor circuits, Series aiding and Series opposing Voltages	2	2
	4	Proportional Voltage formula, Proportional Current formula, Series Voltage Dividers	2	2
	5	'Open' and 'Short' in Series, Parallel and Series –Parallel Circuits.	2	1,2
	6	Cells in series and parallel	2	1,2
II		**INDUCTORS AND CAPACITORS (Book 1, Chapter 5)**	**12**	
	7	Inductance, Inductor Types: Air core inductor, Iron-core Inductor, Ferrite-core Inductor	2	1
	8	Self-Induction, Mutual Induction, relation connecting self-inductance and mutual inductance	2	1
	9	Coefficient of Coupling, Inductors in Series or Parallel without M, series combination with M,	2	2
	10	Stray Inductance, Reactance offered by a Coil.	1	1
	11	Capacitance, Capacitors in Series and Parallel, Reactance offered by the Capacitor	2	1
	12	Type of Capacitors- Fixed Capacitors, Variable Capacitors	1	1
	13	Charging and discharging of a capacitor	2	1,2
		NETWORK THEOREMS (Book 1, Chapter 4)	**12**	

III	14	Ideal constant Voltage Source, Ideal constant Current Source	2	1
	15	Kirchhoff's Law	2	2
	16	Super position theorem	2	3
	17	Thevenin's and Norton's Theorem	4	3
	18	Maximum Power Transfer Theorem	2	3
IV		**ALTERNATING CURRENT (Book 1, Chapter 5)**	**12**	
	19	Type of alternating waveforms, Different values of sinusoidal voltage and current, Phase and Phase difference of A.C	2	1
	20	Non-sinusoidal waveform, Harmonics	1	1
	21	A.C through Resistor, Inductor, Capacitor	2	2
	22	L-R, R-C and LCR circuits	3	2
	23	Sharpness of resonance, Q-factor, Bandwidth	2	5
	24	Tuning of radio, Parallel LCR	2	5
V		**OPTOELECTRONIC DEVICES (Book 1, Chapter 16)**	**12**	
	25	Light Emitting Diode (LED) – theory, construction and applications	3	4,5
	26	Photo Emissive Devices	2	4
	27	Photomultiplier Tube	2	4
	28	Photovoltaic Devices – bulk type photoconductive cells	2	4,5
	29	Photodiodes – P-N junction photodiode – PIN photodiode – avalanche photodiode.	3	4,5

Books for Study

1. Basic Electronics Solid State: B. L. Theraja, S Chand & Company LTD.
2. Principles of Electronics, V K Mehta and Rohith Mehta, S Chand & Company LTD.
3. Basic Electronics: Devices, circuits and IT fundamentals: Santiram Kal, PHI, 2010

Course Outcome

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Familiarise basic electronic components	U	PSO-1
CO-2	Analyse Series and Parallel Networks	Ap, E	PSO-1, 2
CO-3	Understand the basic network theorems	U	PSO-1,2
CO-4	Familiarize the different semiconductor devices	U	PSO-1
CO-5	Understand the V-I characteristics of the circuits	Ap	PSO-1

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

Note: 1 or 2 COs/module

Name of the Course: CIRCUIT ELEMENTS AND NETWORK THEOREMS

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

CO No.	CO	PO/PSO	Cognitive	Knowledge Category	Lecture (L)/Tutoria	Practical (P)

			Level		**l (T)**	
1	Describe basic electronic components	PO 1/PSO 1	U	C	L	
2	Analyse Series and Parallel Networks	PO 1,2/ PSO 1,2	Ap, E	C	L	
3	Understand the basic network theorems	PO 1/PSO 1,2	U	C	L	-
4	Familiarize the different semiconductor devices	PO 1/PSO 1	U	F	L	-
5	Analyze the V-I characteristics of the circuits	PO 1,2/PSO 1	Ap	P	L	-

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

Mapping of COs with PSOs and POs :

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

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK3DSEPHY202.1				
Course Title	**Mathematical Tools for Physics**				
Type of Course	**DSE**				
Semester	III				
Academic Level	200 – 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-		4
Pre-requisites					
Course Summary	Mathematical tools serve as the backbone for solving complex physics problems. They encompass concepts such as curvilinear coordinate systems for describing non-linear geometries, differential equations for modeling dynamic systems, complex functions for analyzing oscillatory behavior, infinite and Fourier series for understanding periodic phenomena, matrices and linear vector spaces for handling transformations, and operators for representing physical observables and their interactions within a structured mathematical framework. These tools provide physicists with powerful techniques to describe, analyze, and predict various physical phenomena across diverse fields.				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I	**VECTOR ALGEBRA AND ORTHOGONAL CURVILINEAR COORDINATE SYSTEMS (Books for study 1&2)**		**12**	
	1	Orthogonal curvilinear coordinate systems: plane polar, Spherical polar and cylindrical coordinate systems- unit vectors, coordinate transformations.	3	1
	2	Infinitesimal line segment, scale factors, area elements, volume elements, line-surface-volume integrals with examples	3	1
	3	Gradient, divergence, curl and Laplacian in spherical polar and cylindrical coordinate systems (derivation excluded).	3	1
	4	Integral theorems- Stoke’s theorem and Gauss divergence theorem (verification with examples only).	3	1
II	**INFINITE SERIES (Books for study 3 & 4)**		**11**	
	5	Infinite series – convergence test (Book 4)	2	2
	6	Maclaurin and Taylor series (Book 4)	3	2
	7	Convergence of Taylor series (Book 4)	1	2

	8	Fourier series – examples (Book 3)	3	2
	9	Fourier transform (qualitative discussion only) (Book 3)	2	2
III	**COMPLEX FUNCTIONS (Books for study 2 & 3)**		**10**	
	10	Complex numbers, graphical representation (Book 3)	2	3
	11	Complex functions, arithmetic operation-conjugates, modulus (Book 3)	2	3
	12	Polar form, powers and roots (Book 3)	2	3
	13	Euler's formula, Demovre's theorem (Book 3)	1	3
	14	Analytical functions and Cauchy-Riemann Conditions, examples of analytic functions (Book 3)	3	3
IV	**DIFFERENTIAL EQUATIONS AND MATRICES (Books for study 2 &3)**		**15**	
	15	First order equations and linear second order differential equations with constant coefficients, homogeneous and inhomogeneous equations. (Book 2)	7	4
	16	Partial differential equation- variable separable solution (elementary ideas). (Book 2)	2	4
	17	Matrices: symmetric matrices, skew symmetric matrices, Hermitian-orthogonal-unitary matrices, rank, trace. (Book 2)	2	5
	18	Eigen value problems, eigen vectors. (Book 2)	2	5
	19	Diagonalization, similarity transformation, rotation matrices, function of a matrix. (Book 2)	2	5
V	**LINEAR VECTOR SPACE AND OPERATORS (Books for study 5 & 6)**		**12**	
	20	Group, field, linear vector space, linear independence of vectors, vector space of n-tuplets.	3	6
	21	Inner product, orthonormality and linear independence, bases and dimensions, norm.	2	6
	22	Schmidt's orthogonalization method.	1	6
	23	Operators-linear operators, eigen value and eigen functions of an operator.	2	6
	24	Hermitian operator, unitary operator, projection operator.	2	6

Book for study:

1. Introduction to Electrodynamics by David J Griffith; 4th edition
2. Introduction to mathematical physics by Charlie Harper
3. Mathematical Methods in The Physical Sciences by Mary L Bose; 3rd edition
4. Calculus by Anton, Bivens and Davis; 10th edition
5. Matrices and tensors in physics by A W Joshi; 3rd edition
6. Quantum mechanics by V K Thankappan; 3rd edition

Books for reference:

1. Mathematical Methods for Physicists by Arfken, Weber and Harris; 7th edition.
2. Calculus by Thomas; 13th edition
3. Differential equations with applications with Historical notes by George F Simmons; 3rd edition

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Explain the curvilinear coordinates which have applications in problems with spherical and cylindrical symmetries.	U, Ap	PSO-1, 2
CO-2	Express functions as infinite series and understand its applications in physics	U, Ap	PSO-1, 2
CO-3	Explain the fundamental ideas of complex numbers and complex functions	U, Ap	PSO-1, 2
CO-4	Describe the methods used for solving differential equations, emphasizing the various approaches based on the type and characteristics of the equations.	U	PSO-1, 2
CO-5	Explain the classification of matrices and their corresponding operations, highlighting the distinctions among different types of matrices and the procedures involved in matrix operations	U, Ap	PSO-1, 2
CO-6	Explain linear vector space and different operations in linear vector space	U	PSO-1, 2

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

Note: 1 or 2 COs/module

Name of the Course: MATHEMATICAL TOOLS FOR PHYSICS

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 curvilinear coordinates which have applications in	PO-1,2,3 PSO -1, 2	U, Ap	F, C	L	-

	problems with spherical and cylindrical symmetries.					
CO-2	Express functions as infinite series and understand its applications in physics	PO-1,2,3 PSO -1, 2	U, Ap	F, C	L	-
CO-3	Explain the fundamental ideas of complex numbers and complex functions	PO-1,2,3 PSO -1, 2	U, Ap	F, C	L	-
CO-4	Describe the methods used for solving differential equations, emphasizing the various approaches based on the type and characteristics of the equations.	PO-1,2,3 PSO -1, 2	U, Ap	F, C	L	-
CO-5	Explain the classification of matrices and their corresponding operations, highlighting the distinctions among different types of matrices and the procedures involved in matrix operations	PO-1,2,3 PSO -1, 2	U, Ap	F, C	L	-
CO-6	Explain linear vector space and different operations in linear vector	PO-1,2,3 PSO -1, 2	U	F, C	L	-

	space					

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

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PS O5	PS O6	PSO 7	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2	3	-	-	-	-	-	3	2	1	-	-	-	
CO 2	2	3	-	-	-	-	-	3	2	1	-	-	-	
CO 3	2	3	-	-	-	-	-	3	2	1	-	-	-	
CO 4	2	3	-	-	-	-	-	3	2	1	-	-	-	
CO 5	2	3	-	-	-	-	-	3	2	1	-	-	-	
CO 6	2	3	-	-	-	-	-	3	2	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	✓			✓
CO 6	✓			

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK3DSEPHY203.1				
Course Title	**Basics of Nanoscience and Nanotechnology**				
Type of Course	**DSE**				
Semester	III				
Academic Level	200 – 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4
Pre-requisites					
Course Summary	Materials Structure and Bonding. Crystals and Imperfections in Solids, Electrical and Optical Properties of Materials, Generation of Nanoscience and Nanotechnology, Applications of Nanoscience and Nanotechnology for a Sustainable Future: Addressing Global Challenges				

Detailed Syllabus:

Module	Unit	Content	Hrs	COs
I	**MATERIALS STRUCTURE AND BONDING (Book 1)**		12	
	1	Why Study Materials Science and Engineering?	1	1
	3	Arrangement of Atoms, Two-Dimensional Crystal Structures, Three-Dimensional Crystal Structures, Elementary ideas and examples of Three-Dimensional Crystals	3	1
	4	Planes in the Crystals, Crystallographic Directions, Reciprocal Lattice	3	1
	5	Atomic bonding in solids - bonding forces and energies	3	1
	6	Primary bonding - Ionic bonding, Covalent bonding	1	1
	7	Metallic bonding, Secondary bonding- van der Waals bonding	1	1
II	**CRYSTALS AND IMPERFECTIONS IN SOLIDS (Book 1)**		12	
	5	Crystalline and non-crystalline materials -Single crystals, Polycrystals	2	2,3
	7	Atomic packing factors of FCC, BCC, Hexagonal close packed crystal structure	4	2,3
	8	Imperfection in solids – Point and line defects-Frenkel defect	3	2,3
	9	Schottky defect-Burger vectors Vacancies, Interstitial	3	2,3
III	**ELECTRICAL AND OPTICAL PROPERTIES OF MATERIALS (Book1)**		12	
	11	Electrical Conductivity, Electronic and Ionic Conduction	2	4
	12	Energy Band Structures in Solids, Conduction in Terms of Band and Atomic Bonding Models, Electron Mobility	3	4

	13	**Semiconductivity**-Intrinsic Semiconduction, Extrinsic Semiconduction, Temperature Dependence of Carrier Concentration, Factors affect Carrier Mobility	3	4
	14	**Optical Properties**, Electromagnetic Radiation, Light Interactions with Solids	2	4
	15	Refraction , Reflection, Absorption, Transmission, Colour	2	4
IV	**GENERATION OF NANOSCIENCE AND NANOTECHNOLOGY (Book3)**		**12**	
	16	Nano and Nature, Nanoscopic colours (Butterfly wings), Bioluminescence (Fireflies),	2	5
	17	Tribology in nature - Geckos Sticky feet, lotus-leaf effect.	2	5
	18	The development of nanoscale science: Size scale, Nanotechnology timeline, pre-18th Century; 19th Century, 20th Century, 21th Century	2	5
	19	Carbon age-New form of Carbon- Fullerenes, Bucky balls, Carbon Nanotubes (CNTs) , Multi walled CNTs	3	5
	20	Influence of nano over micro/macro, size effects and crystals, large surface to volume ration, surface effects on the properties, mechanical-physical-chemical properties,	3	5
V	**APPLICATIONS OF NANOSCIENCE AND NANOTECHNOLOGY FOR A SUSTAINABLE FUTURE: ADDRESSING GLOBAL CHALLENGES (Book2)**		**12**	
	21	Food and Agricultural Industry, Cosmetic and Consumer Goods,	4	6
	22	Energy ,Water treatment and Environment, Nano Medical Applications	4	6
	23	Textiles, Paints, Defence and Space Applications	4	6

Books for Study

1. Materials Science and Engineering: An Introduction, 10th Edition by William D. Callister Jr, David G. Rethwisc, Wiley (2018)
2. Textbook Of Nanoscience And Nanotechnology, B.S Murthy, P.Shankar. Baldev Raj,B.B.Rath , James Murday, Orient Blackswan, (2021)
3. Nanotechnology: Principles and Practices, Third Edition, by Sulabha K. Kulkarn (2014)
4. Introduction To Nanoscience And Nanotechnology By Chattopadhyay, PHI ,India

Book for Reference:

1. Fundamentals of Nanotechnology, CRC press, by G.L. Hornyak, J.J. Moone, H.F. Tihhale, J. Dutta
2. Nanotechnology Technology Revolution of 21st Century by Rakesh Rathi, published by S.Chand
3. Nanomaterials by A.K. Bandyopadhyay; New Age International Publishers.
4. Nanotechnology by Mark Ratner and Daniel Ratner, Pearson Education.
5. Nano Essentials- T.Pradeep/TMH

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. 1 https://nptel.ac.in/courses/113/104/113104076/

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Explain the fundamentals of nanoscale systems and its physical, chemical, and electrical properties	U	PSO-1,2
CO-2	List and classify the fundamental crystal structure of the materials	R, U	PSO-2,3
CO-3	Outline the various defects occurs in materials	U	PSO-1,3
CO-4	Illustrate the electrical and optical properties of materials	Ap	PSO-3,4
CO-5	Illustrate the surface effects on mechanical-physical-chemical properties of materials	Ap	PSO-5
CO-6	Define and analyse the fundamental applications of nanotechnology and point out how it supports for a sustainable future in modern era	R, An	PSO-6,7

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

Note: 1 or 2 COs/module

Name of the Course: BASICS OF NANOSCIENCE AND NANOTECHNOLOGY

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 fundamentals of nanoscale systems and its physical, chemical, and electrical properties	PO1, 2/PSO-1,2	U	F,C	L	
CO-2	List and classify the fundamental crystal structure of the materials	PO2, 5/PSO-2,3	R,U	F,C	L	
CO-3	Outline the various defects occurs in materials	PO1, 5/PSO-1,3	U	F,C	L	
CO-4	Illustrate the electrical and optical properties of materials	3,5/PSO-3,4	Ap	F,C	L	
CO-5	Illustrate the surface effects on mechanical-physical-	PO5/PSO-5	Ap	F,C	L	

	chemical properties of materials					
CO-6	Define and analyse the fundamental applications of nanotechnology and point out how it supports for a sustainable future in modern era	PO2/ PSO -6	R,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	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2	2	-	-	-	-		2		1	1	2	2	
CO 2	-	2	1	-	-	-		1	2	2	1	2		
CO 3	2	-	1	-	-	-		1	2	2			1	
CO 4	-	-	3	2	-	-		2	2	1	1		1	
CO 5	-	-	-	-	3	-		1	2	2				2
CO 6	-	-	-	-	-	2		1	-	2	2	2		1

Correlation Levels:

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

Assessment Rubrics:

▪ Quiz / Assignment/ Discussion / Seminar

▪ Midterm Exam

▪ Programming Assignments

▪ Final Exam

Mapping of COs to Assessment Rubrics :

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

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK3VACPHY201.1				
Course Title	**History of Physics and its Role in Society**				
Type of Course	**VAC**				
Semester	III				
Academic Level	200 - 299.				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 hours	-	NIL	3
Pre-requisites					
Course Summary	This course aims to provide students with a comprehensive understanding of the historical progression of physics and its far-reaching influence on society, technology, and culture. Through examining the past, students gain insights into the present and future roles of physics in addressing global challenges and shaping human civilization.				

Detailed Syllabus:

Module	Unit	Content	Hrs	COs
I		**PHYSICS AND EARLY HUMAN SOCIETY (Book1)**	**6**	
	1	Science during Babylonian, Egyptians, Romans, Arabs, Greeks: contribution of Aristotle, Atomic theory	2	1
	2	Europe during Middle Ages: Invention of gunpowder, Mariner's Compass	2	1
	3	Contributions of Indians - Aryabhata, Brahmagupta, Varahamihira, Bhaskara (Use online resources)	2	1
II		**RENAISSANCE AND NEWTONIAN ERA (Book1)**	**6**	
	4	Contribution of Copernicus and Kepler	2	2
	5	Galileo’s experiments and discourses, Invention of telescope and microscopes.	2	2
	6	Laws of Motion, Thoughts of gravitation, Motion of projectiles	1	2
	7	Light, Velocity of light, Reflection telescope.	1	2
III		**PHYSICS IN 18TH AND 19TH CENTURIES**	**14**	
	8	(a) Laws of thermodynamics (results only) and their implications (qualitative): zeroth law & concept of temperature, first law and conservation of energy, second law & disorder and entropy, third law and idea of absolute zero temperature. (b) Thermometers, Early development of steam engine	3	3
	9	(a) Concept of atoms & molecules (b) Light: Concepts of	2	3

		wave theory of light, solar spectrum, color photography, human eye		
	10	(a) Electricity: Contributions of Benjamin Franklin's experiment, Cavendish, Volta and Coulomb (b) Beginning of electrolysis, voltage cell and storage batteries, Ohm's law	2	3
	11	Evolution of dynamo and alternating current, Transmission of electricity, Invention of telegraph and telephones (Book 1,4)	2	3
	12	History of Electrification in India (Book 1,4)	1	3
	13	(a) Contributions of Becquerel and Curie. Radio activity: alpha, beta and gamma rays (b) Nuclear fission and fusion, Einstein's Mass energy equivalence (Book 1,5	2	3
	14	Destructive and Peaceful use of nuclear energy Nuclear power plants in India: Their location, capacity, fuel etc (Book 6)	2	3
IV	**PHYSICS IN 20th & 21st CENTURIES (Book 7, 8, 9 & 10)**		**11**	
	15	Emergence of quantum mechanics: (a) Max Plank: Light as photons and a new constant - h (b) de Broglie: The idea of matter wave (c) Schrodinger: Wave equation of matter wave (d) Heisnberg: The uncertainty relation and its implications	2	4
	16	Medical application of quantum theory: Mind, diagnosis & DNA (based on Article: It's time to go quantum in medicine, book 8)	2	4
	17	Brief discussion on the Invention of transistor & IC chips: Germanium and silicon transistors, monolithic IC's, Full custom & semi custom circuits, microprocessors (Chapter 4 of book 9)	2	4
	18	Definition of Satellite. Orbit of satellite, Basic Principles of orbiting satellite - Newton's Law of Gravitation & Newton second law of motion.	2	4
	19	(a) History of the Evolution of Satellites: Early Communications, Meteorology & Scientific Exploration, Non-geosynchronous Communication Satellites, Emergence of Geosynchronous Communication Satellites, International Communication Satellite Systems, Domestic Communication Satellite Systems (Book 10) (b) Indian Space programmes: Cartosat, Astrosat, Chandrayan I & II, Aditya L1 (refer any relevant source)	3	4
V	**INDIAN CONTRIBUTIONS IN MODERN ERA** **(Book 2 and any other resource)** (Note: Tutor can use any available resources to impart knowledge on this topic)		**9**	
	20	Three major discoveries (results only) by Indian scientists in modern physics & their implications: (a) Bose-Einstein statistics & Bosons (b) Raman effect & Raman spectroscopy (c) Chandrasekhar limit & death of stars	3	8
	21	Brief discussion on the contribution of Indian scientists &	3	8

		their role in nation building: (a) Homi J Baba & Indian atomic energy research (b) Vikram Sarabahi & his contribution to the development of ISRO (c) J V Narlikar and IUCAA		
	22	Eminent scientists from Kerala and their contribution: (a) R S Krishnan (b) E C G Sudarshan (c) T Padmanabhan	3	8

Books for study:

1. History of Physics, Florian Cajori, Dover Publications/Maven Books, ISBN-13: 978-9387488472 2. Biographical dictionary of Indian scientists, Anjana Chattopadhyay, Rupa & Company
2. Heat and Thermodynamics, M W Zemansky, McGraw Hill
3. Article: Steps of Power: Note on the history of electrification in India (1883 - 1930), Proceedings of the Indian History Congress, 2017, Vol 78(2107), pp 498-506
4. Nuclear Physics, D C Tayal, Himalaya Publishing House
5. Website of Atomic Energy Regulatory Board, Govt. of India
6. Quantum Mechanics, G Aruldas, PHI Learning Pvt Ltd
7. Article: It's time to go quantum in medicine, J Clin Med, 2023 Jul; 12(13): 4506.
8. A history of the world - Semiconductor Industry, P R Morris, Peter Peregrinus LTD, ISBN: 0863412270
9. Satellite technology: Principles and applications, Anil K. Maini & Varsha Agrawal, John Wiley & Sons

Books for Reference:

1. Science- A four-thousand-year history, Patrica Fara, Oxford University Press. ISBN: 978-0-19-922689-4
2. The Rocket: The History and Development of Rocket and Missile Technology, ISBN-13978-0517534045
3. https://www.ias.ac.in/Initiatives/Women_in_Science/The_Women_Scientists_of_India

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Recall the historical evolution of physics from ancient times to the present day.	U	PSO-1,4
CO-2	Identify important figures and their contributions to physics during pivotal periods, such as the Renaissance and Newtonian Era, highlighting the work of Copernicus, Galileo, and Newton.	R, U	PSO-1,4
CO-3	Understand the importance of the two fundamental branches which fill the gap between Newton's mechanics and physics of the modern era - namely thermodynamics and electricity, radioactivity etc	U	PSO-1,4

CO-4	Understand the glimpse of the most revolutionary discovery in the history of modern physics - quantum mechanics and how profoundly it is influencing human evolution through say medical research, semiconductor electronic industry etc.	U, C	PSO-1,4
CO-5	Familiarize the contributions of Indian scientists to physics and their influence on the general public.	U, C	PSO-1,4

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

Note: 1 or 2 COs/module

Name of the Course: HISTORY OF PHYSICS AND ITS ROLE IN SOCIETY

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

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Recall the historical evolution of physics from ancient times to the present day.	PO-1, 7/ PSO-1,4	U	F, C	L	
CO-2	Identify important figures and their contributions to physics during pivotal periods, such as the Renaissance and Newtonian Era, highlighting the work of Copernicus, Galileo, and Newton.	PO-1, 7/ PSO-1,4	R, U	F, C	L	
CO-3	Understand the importance of the two fundamental branches which fill the gap between Newton's mechanics and physics of the modern era - namely thermodynamics and electricity, radioactivity etc	PO-1, 7/ PSO-1,4	U	F, C	L	
CO-4	Understand the glimpse of the most	PO-1, 7/	R, U	F, C	L	

	revolutionary discovery in the history of modern physics - quantum mechanics and how profoundly it is influencing human evolution through say medical research, semiconductor electronic industry etc.	PSO -1,4				
CO-5	Familiarize the contributions of Indian scientists to physics and their influence on the general public	PO-1,7/ PSO -1,4	R, U	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**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO 1	1							2						
CO 2	1			2				2						
CO 3	1			2				1						
CO 4	1							1						2
CO 5	1													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	✓	✓	✓	✓
CO5	✓			✓

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK3VACPHY202.1				
Course Title	**Introduction to Laboratory Safety Measurements**				
Type of Course	**VAC**				
Semester	III				
Academic Level	200 - 299.				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 hours	-		3
Pre-requisites					
Course Summary	This course provides a comprehensive overview of laboratory safety, covering general safety principles, operational rules, and safety equipment. It also includes an introduction to electrical and chemical safety measures, focusing on inspection, testing, protective clothing, and safe handling of hazardous substances. Additionally, the course explores radiation effects, monitoring, and safety protocols in nuclear physics labs, as well as gas safety norms, including the characteristics, properties, and standard operating procedures for various gases used in industrial and laboratory environments.				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**INTRODUCTION**	**9**	
	1	Introduction to general lab safety	4	1
	2	Lab operational rules, safety equipment	5	1
II		**ELECTRICAL SAFETY MEASURES (Book2)**	**9**	
	3	Introduction to electrical safety measures	2	1
	4	General Inspection and Testing, Safety clothing, Insulated tools,	2	1
	5	Arc, Electrical flash and thermal protection.	2	1
	6	Safety tags, locks, barriers. Safety grounding, circuit breaker, safety measuring instruments	3	1,2
III		**CHEMICAL SAFETY MEASURES**	**9**	
	7	Introduction to use of chemical substances.	1	1
	8	Classification/Categorization of chemicals causing - irritation effect, allergens, asphyxiants, acids, alkalies, carcinogens	3	2, 3
	9	Cryogenic gases, EDC, Neurotoxins.	2	1, 3
	10	Safe disposal of Chemical substances, Regulatory agencies and their role.	2	1, 3

	11	Chemical substances, exposure, occupation and hazards	1	1, 3
IV	**RADIATION EFFECTS (Book4)**		**9**	
	12	Radiation monitoring and dose meter, Physical effects of radiation. Chemical effects of radiation	3	4
	13	Absorbed dose, Relative biological effectiveness, dose equivalent, Biological effects, Maximum	3	4
	14	Permissible Dose (MPD), Schielding, Radiation safety in nuclear physics lab (Book 5, Chapter 3)	3	4
V	**GAS SAFETY NORMS**		**9**	
	15	Different gases used in industry and lab,	3	5
	16	characteristics and properties of gases - O2, O3, N2, H2, Co, methylene, ethylene, Petroleum gases, CNG	4	5
	17	Standard operating procedures for gases	2	5

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Comprehend fundamental laboratory safety guidelines, operational rules, and the appropriate use of safety equipment, fostering a safe lab environment and minimizing the likelihood of accidents or injuries during experiments.	U	PSO-1,3
CO-2	Understand and remember essential electrical safety measures, including inspection, safety clothing, insulated tools, arc protection, and safety devices like tags, locks, grounding, and circuit breakers, ensuring safe practices in electrical work environments.	R, U	PSO-1,3
CO-3	Apply knowledge of chemical substance classification, disposal methods, regulatory agencies, and occupational hazards to effectively manage and mitigate risks in practical scenarios.	Ap	PSO-1,3
CO-4	Demonstrate proficiency in radiation monitoring and the use of dose meters, comprehend the physical and chemical effects of radiation, including absorbed dose and relative biological effectiveness, understand concepts such as dose equivalent and maximum permissible dose (MPD), apply principles of shielding for radiation safety in nuclear physics laboratories.	U	PSO-1,3
CO-5	Identify various gases utilized in industry and laboratory settings, discern their unique characteristics and properties, including O2, O3, N2, H2, Co, methylene,	U	PSO-1,3

	ethylene, petroleum gases, and CNG, and develop standard operating procedures for their safe handling and usage.		

BOOKS FOR STUDY:

1. Safety measurements for Indian Laboratories, Ajay Kumar Gupta & Prithanshu, ISBN: 1312254084, Lulu. (Chapter 1)
2. Electrical Safety Hand book, John Cadick, Mary-Capelli-Schellpfeffer, Dennis, Neitzal (3rd Edition), McGraw-Hill (Chapter 2)
3. Hand book of Chemicals and Safety, TSS, Dikshith, ISBN No: 13-978-1-4398-2 (E-book), CRC Press, Taylor & Francis. (Chapter 2 & Chapter 3)
4. Nuclear Physics, D. C. Tayal, Himalaya Publishing (Chapter 16)
5. Techniques for Nuclear and Particle Physics experiments, W. R. Leo (Chapter 3)
6. Hazardous Gases: Risk Assessment on the environment and Human health, Jospel singh, R. D. Koushik and Malavika Chawala, ISBN: 978-0323898577, Academic Press

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Comprehend fundamental laboratory safety guidelines, operational rules, and the appropriate use of safety equipment, fostering a safe lab environment and minimizing the likelihood of accidents or injuries during experiments.	U	PSO-1,3
CO-2	Understand and remember essential electrical safety measures, including inspection, safety clothing, insulated tools, arc protection, and safety devices like tags, locks, grounding, and circuit breakers, ensuring safe practices in electrical work environments.	R, U	PSO-1,3
CO-3	Apply knowledge of chemical substance classification, disposal methods, regulatory agencies, and occupational hazards to effectively manage and mitigate risks in practical scenarios.	Ap	PSO-1,3
CO-4	Demonstrate proficiency in radiation monitoring and the use of dose meters, comprehend the physical and chemical effects of radiation, including absorbed dose and relative biological effectiveness, understand concepts such as dose equivalent and maximum permissible dose (MPD), apply principles of shielding for radiation safety in nuclear physics laboratories.	U	PSO-1,3
CO-5	Identify various gases utilized in industry and laboratory settings, discern their unique characteristics and properties, including O2, O3, N2, H2, Co, methylene, ethylene, petroleum gases, and CNG, and develop standard operating procedures for their safe handling and	U	PSO-1,3

	usage.		

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

Note: 1 or 2 COs/module

Name of the Course: INTRODUCTION TO LABORATORY SAFETY MEASUREMENTS

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

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Comprehend fundamental laboratory safety guidelines, operational rules, and the appropriate use of safety equipment, fostering a safe lab environment and minimizing the likelihood of accidents or injuries during experiments.	PSO -1,3	U	F, C	L	
CO-2	Understand and remember essential electrical safety measures, including inspection, safety clothing, insulated tools, arc protection, and safety devices like tags, locks, grounding, and circuit breakers, ensuring safe practices in electrical work environments.	PSO -1,3	R, U	P	L	
CO-3	Apply knowledge of chemical substance classification, disposal methods, regulatory agencies, and occupational hazards to effectively manage and mitigate risks in practical scenarios.	PSO -1,3	Ap	F, C	L	
CO-4	Demonstrate proficiency in radiation monitoring and the use of dose meters, comprehend the physical and chemical effects of radiation, including absorbed dose and relative biological effectiveness, understand concepts such as dose equivalent and maximum permissible dose (MPD), apply principles of shielding for radiation safety in nuclear physics	PSO -1,3	U	F, C	L	

	laboratories.					
CO-5	Identify various gases utilized in industry and laboratory settings, discern their unique characteristics and properties, including O2, O3, N2, H2, Co, methylene, ethylene, petroleum gases, and CNG, and develop standard operating procedures for their safe handling and usage.	PSO -1,3	U	F	L	

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

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO 1	**1**	**-**	**-**	**-**	**-**	**-**								
CO 2	**2**	**3**	**-**	**-**	**-**	**-**							**1**	
CO 3	**-**	**-**	**1**	**-**	**-**	**-**								
CO 4	**-**	**-**	**2**	**3**	**-**	**-**								
CO 5	**-**	**1**	**-**	**-**	**-**	**-**								**2**
CO 6	**-**	**-**	**-**	**3**	**-**	**-**								**2**

Mapping of COs with PSOs and POs :

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 IV

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK4DSCPHY251.1				
Course Title	**Electromagnetics and Transient Currents**				
Type of Course	**DSC**				
Semester	IV				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites					
Course Summary	This course aims to provide a strong foundation to the principles of electrostatics and magnetostatics and equip the students to be familiar with the theoretical basis of electrodynamics. The course also provides hands on experience in handling different electrical circuits.				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**ELECTROSTATIC FIELD**	**9**	
	1	Coulomb's law, Electric field due continuous charge distribution	2	1
	2	Field lines, flux, Gauss's law, Divergence and Curl of electrostatic fields.	2	1
	3	Electric potential, Poisson's and Laplace's equations, Potential of a localized charge distribution.	2	1
	4	Work and Energy in Electrostatics: The work done to move a charge, Energy of a point charge distribution, The energy of a continuous charge distribution	2	1
	5	Electrostatic boundary conditions	1	1
II		**ELECTROSTATIC FIELD IN MATTER**	**9**	
	6	Polar and Nonpolar molecules, Induced dipole and polarizability. Alignment of polar molecules in uniform and nonuniform electric field.	2	2
	7	Polarization in a Dielectric Material, The field of a polarized object: Bound and Free Charges, Bound Charge Density, Physical interpretation of bound charges	3	2
	8	Electric displacement, Gauss's law in presence of dielectric.	2	1,2
	9	Boundary conditions, Linear Dielectrics	2	2
III		**MAGNETOSTATICS**	**9**	

	10	Lorentz Force, Electric Current- surface current density, volume current density, Equation of continuity.	2	3
	11	The Biot- Savarts law, Applications-Magnetic field due to long wire and circular loop	2	3
	12	Magnetic flux, Gauss's law in magnetism, Divergence of B (Physical interpretation only)	1	3
	13	Ampere's circuital theorem, Curl of B (Physical interpretation only), Applications- Magnetic field due to Solenoid and Toroid	2	3
	14	Magnetic vector potential.	1	3
	15	Boundary conditions	1	3
IV		**ELECTROMAGNETIC INDUCTION**	**9**	
	16	Electromagnetic Induction, Faraday's law, Lenz's law, Motional e m f, Induced electric field	2	4
	17	Self - inductance and Mutual inductance, back e m f	1	4
	18	Maxwell's equation, correction of Ampere's circuital theorem,	2	4
	19	Waves in one dimension: Wave equation of electromagnetic waves in vacuum, propagation of electromagnetic waves through vacuum and linear dielectric media	3	5
	20	Monochromatic planes waves, Energy and Momentum in EM waves	1	5
V		**TRANSIENT CURRENTS**	**9**	
	21	Growth and decay of current in LR Circuit	2	6
	22	Growth and decay of current in CR Circuit	2	6
	23	Measurement of high resistance by leakage	1	6
	24	Charging of a capacitor through LCR circuit.	2	6
	25	Discharging of a capacitor through LCR circuit.	2	6

PRACTICALS

(15 Weeks with 2 hours of laboratory session per week)

PART A

At least **five** experiments to be performed from the following list

1. Potentiometer- Resistivity
2. Potentiometer –Calibration of ammeter
3. Carey Foster's Bridge-Resistivity
4. Carey Foster's Bridge-Temperature coefficient of resistance.
5. Mirror galvanometer-figure of merit.
6. BG- Absolute capacity of a condenser
7. Conversion of galvanometer into ammeter and calibration using digital Multimeter
8. Circular coil-Calibration of ammeter.
9. Absolute determination of m and Bh using box type and Searle's type vibration

magnetometers.
10. Searle's vibration magnetometer-comparison of magnetic moments.
11. Potentiometer – Calibration of high range voltmeter
12. Potentiometer - Reduction factor of TG

PART B
At least **one** experiment to be performed from the following list
1. Potentiometer –Calibration of low range voltmeter
2. Study of network theorems-Thevenin's & Norton's theorems and maximum power transfer theorem.
3. Thermo emf- Measurement of thermo e m f of thermocouple (Seebeck effect)
4. Circular coil-Study of earth's magnetic field using compass box.
5. Conversion of galvanometer into voltmeter and calibration using digital Multimeter.

BOOKS FOR STUDY:

1. Electrodynamics: David J Griffith, PHI, 3rdEdn.

2.Electricity and Magnetism: Murugesan, S. Chand & Co.

3. Electricity and Magnetism: K.K. Tiwari, S. Chand & Co. 4. Principles of electromagnetics: Matthew N.O. Sadiku and S. V. Kulkarni, Oxford University Press, 6thEdn.

BOOKS FOR REFERENCES

1. Electricity and Magnetism: E.M. Purcell, Berkley Physics course, Vol.2, MGH

2. Classical Electromagnetic Theory, Jack Vanderlinde, Second Edition, Kluwer Academic Publishers, 2004

3. Classical Electrodynamics: Walter Greiner, Springer International Edn.

4. Electricity and Magnetism: Muneer H. Nayfeh & Norton K. Bressel, John Wiley & Sons

5.Electricity and Magnetism: J.H. Fewkes & John Yarwood, University Tutorial Press

6. Electromagnetic waves and radiating systems: Jordan & Balmain, PHI

7. Electromagnetics: B.B.Laud, Wiley Eastern Ltd., 2ndEdn.

8. Introduction to electrodynamics: Reitz & Milford Addison Wesley

9. Electromagnetic theory fundamentals: Bhag Guru and Huseyin Hizirogulu, Cambridge University Press, 2ndEdn.

10. Electricity and Magnetism: D.C.Tayal, Himalaya Publishing Co.

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Identify the principles of electrostatics and apply it to	U, Ap	PSO-1,2,3

	the solutions of problems relating to electric field and electric potential and boundary conditions		
CO-2	Identify the mechanism of polarization and its various effects in dielectric, by applying the principles of electrostatics.	U, Ap	PSO-1,2,3
CO-3	Identify the principles of magnetostatics and apply it to the solutions of problems relating to magnetic field and boundary conditions.	U, Ap	PSO-1,2,3
CO-4	Recognize the concepts related to Faraday 's law, induced emf, Maxwell 's equations	U, Ap	PSO-1,2,3,5
CO-5	Compare the properties of electromagnetic waves in vacuum, and matter	U, Ap	PSO-1,2,3,6
CO-6	Analyse the growth and decay of current in various electrical circuits	U, An	PSO-1,2,3

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

Note: 1 or 2 COs/module

Name of the Course: ELECTROMAGNETICS AND TRANSIENT CURRENTS

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

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Identify the principles of electrostatics and apply it to the solutions of problems relating to electric field and electric potential and boundary conditions	PSO - 1,2,3	U, Ap, An	F, C	L	
CO-2	Identify the mechanism of polarization and its various effects in dielectric, by applying the principles of electrostatics.	PSO - 1,2,3	U, Ap, An	C	L	
CO-3	Identify the principles of magnetostatics and apply it to the solutions of problems relating to magnetic field and boundary conditions.	PSO - 1,2,3	U, Ap, An	C	L	
CO-4	Recognize the concepts related to Faraday 's law, induced emf, Maxwell 's equations	PSO - 1,2,3 ,5	U, Ap, An	F, C	L	
CO-5	Compare the properties of electromagnetic waves in vacuum, and matter	PSO - 1,2,3	U, Ap, An	C, P	L	

		,6				
CO-6	Analyse the growth and decay of current in various electrical circuits	PSO - 1,2,3	U, Ap, An	P	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	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	3	2			-		2						
CO 2	3	3	2			-		2						
CO 3	3	3	2			-		1						
CO 4	3	3	2		1	-		2						
CO 5	2	3	2			-		2						
CO 6	2	3	2			-		2						

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

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

CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓			✓
CO 6	✓			

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK4DSCPHY252.1				
Course Title	**Classical Mechanics**				
Type of Course	**DSC**				
Semester	IV				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	**3** hours	-	2 hours	5
Pre-requisites	1. Knowledge about Newton's laws and their implications. 2. Basic knowledge about a simple pendulum, centre of mass and oscillations.				
Course Summary	The course has the following major objectives: Gain deeper understanding of classical mechanics: Consolidate the understanding of concepts in mechanics such as Lagrangian, Hamiltonian, central force field, relativity and small oscillations. Advance skills and capability for formulating and solving problems: applications of LaGrange's and Hamilton's equations of motion, motion in central force field, theory of relativity and the theory of small oscillations. Expand and exercise the students' physical intuition and thinking process through the understanding of the theory and application of this knowledge of classical mechanics to the solution of practical problems.				

Detailed Syllabus:

Module	Unit		Hrs	CO
I	**Lagrangian Dynamics (Book2: Chapter2 and Book1: Chapter3)**		**09**	
	1	A brief review of Newtonian mechanics of a particle and a system particle	1	1
	2	Constraints and generalized coordinates	1	1
	3	Principle of virtual Work and D' Alembert's principle	1	1
	4	Lagrange's equation from D'Alembert's Principle, Comparison between Newtonian and Lagrangian dynamics	3	1
	5	Applications of Lagrange's equation in simple pendulum, Atwood's machine and compound pendulum	3	1
II	**Hamiltonian Dynamics (Book2: Chapter3)**		**09**	
	1	Generalized momentum and cyclic coordinates	1	2
	2	Hamiltonian function and conservation of energy	2	2
	3	Hamilton's equation	2	2
	4	Examples of Hamiltonian dynamics: Equation of motion of i) one dimensional harmonic oscillator ii) particle in central force field	3	2
	5	Comparison between Hamiltonian and Lagrangian	1	2

		dynamics		
III	**Motion in Central Force Field (Book2: Chapter4 and Book1: Chapter5)**		**09**	
	1	Reduction to one body problem-equations of motion-equivalent one-dimensional problem	2	3
	2	Differential equation for the orbit in the case of integrable power law potentials	2	3
	3	Virial theorem	1	3
	4	Kepler's problem	2	3
	5	Inverse square law of force	2	3
IV	**Special Theory of Relativity (Book2: Chapters 1, 11 & 12 and Book3: Chapters 10,11 & 12)**		**09**	
	1	Inertial and non- inertial frames of reference, Galilean transformations	1	4
	2	Ether Hypothesis, The Michelson-Morley experiment and explanation of negative result	1	4
	3	Postulates of special theory of relativity and Lorentz transformations.	2	4
	4	Consequences of Lorentz transformations- length contraction, simultaneity, time dilation, twin paradox	3	4
	5	Addition of velocities, Variation of mass with velocity–mass energy relation	2	4
V	**Theory of Small Oscillations (Book1: Chapter 9 and Book2: Chapter 9)**		**09**	
	1	Equilibrium and potential energy	3	5
	2	Theory of small oscillations-normal modes	4	5
	3	Two coupled pendula	2	5

Practical			**CO**
Table A (Any Five)			
1	Verification of Newton's second law using an Air Track		6
2	Verification of conservation principles (momentum and energy) using a friction free metal track.		6
3	To determine g and velocity for a freely falling body using Digital Timing Technique		6
4	Estimation of the value of "g" using a Kater's pendulum.		6
5	Estimation of the moment of inertia about the different axes of a bifilar suspension.		6
6	Estimation of the Rigidity modulus of a metallic wire using a torsion pendulum.		6
7	Estimation of the moment of inertia of a Fly wheel (Calculate percentage error and standard deviation).		6
8	Estimation of acceleration due to gravity and Radius of gyration using Compound pendulum (Symmetric)		6
9	Estimation of acceleration due to gravity and Radius of gyration using Compound pendulum (Asymmetric)		6

10	Estimation of the Rigidity modulus of a metallic wire using a torsion pendulum with two equal masses		6
Table B (Any one)			
11	Numerical interpolation using Newton and Lagrangian methods		6
12	Study of motion of projectile in a central force field		6
13	Study of Planetary motion and Kepler's laws		6
14	Symplectic integration for linear harmonic oscillator		6
15	Solve the simple harmonic oscillator problem with /without damping and visualize the phase-space diagram.		6

Books for study:

1. Classical Mechanics: G. Aruldhas, PHI Learning Pvt Ltd., 2008.
2. Classical Mechanics: J. C. Upadhyaya, Himalaya Publishing House.,2005.
3. Mechanics: H. S. Hans and S. P. Puri, Tata-McGraw Hill.,1984.

Books for Reference:

1. Classical Mechanics, Goldstein, C.P. Poole, J.L. Safko, 3rd Edition. 2002, Pearson Education
2. Introduction to Special Relativity: R. Resnick, John Wiley and Sons, 2005.
3. Solved Problems in classical Mechanics, O.L. Delange and J. Pierrus, 2010, Oxford Press
4. Classical Mechanics, P.S. Joag, N.C. Rana, 1st Edition., McGraw Hill.

<u>Course Outcomes</u>

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Define generalised coordinates, generalised velocities, and generalised force and write Lagrangian for mechanical system in terms of generalised coordinates.	R, U, Ap	PSO-1,2
CO-2	Reproduce Hamiltonian for mechanical systems and describe and solve Hamilton's equation of motion for simple mechanical systems.	R, U, Ap	PSO-1,2
CO-3	Define equations of motion corresponding to reduction to one body problem and to manipulate equation for orbit and explain Virial theorem, Kepler's problem and inverse square law of force.	R, U, Ap	PSO-1,2
CO-4	Recapitulate and learn the special theory of relativity and postulates of the special theory of relativity and develop applications of special theory of relativity to dynamical systems of particles	R, U, Ap	PSO-1,2
CO-5	Formulate the problem of small amplitude oscillation and solve them to obtain normal modes of oscillation	R, U, Ap	PSO-1,2

	and their frequencies in simple mechanical systems.		
CO-6	Describe and demonstrate simple experiments related to applications of classical dynamics and to compute simple computer programs related to applications of classical dynamics.	U, Ap	PSO-5, 7

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

Note: 1 or 2 COs/module

Name of the Course: CLASSICAL MECHANICS

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

CO No.	CO	PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Define generalised coordinates, generalised velocities, and generalised force and write Lagrangian for mechanical system in terms of generalised coordinates.	PSO -1,2	R, U, Ap	F, C	L	
CO-2	Reproduce Hamiltonian for mechanical systems and describe and solve Hamilton's equation of motion for simple mechanical systems.	PSO -1,2	R, U, Ap	F, C	L	
CO-3	Define equations of motion corresponding to reduction to one body problem and to manipulate equation for orbit and explain Virial theorem, Kepler's problem and inverse square law of force.	PSO -1,2	R, U, Ap	F, C	L	
CO-4	Recapitulate and learn the special theory of relativity and postulates of the special theory of relativity and develop applications of special theory of relativity to dynamical systems of particles	PSO -1,2	R, U, Ap	F, C	L	
CO-5	Formulate the problem of small amplitude oscillation and solve them to obtain normal modes of oscillation and their frequencies in simple mechanical systems.	PSO -1,2	R, U, Ap	F, C	L	
CO-6	Describe and demonstrate simple experiments related to applications of classical dynamics and to compute simple computer programs related to applications of classical dynamics	PSO -5, 7	U, Ap	P		P

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

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2	2	-	-	-	-	-	2			2	-		
CO 2	2	2	-	-	-	-	-	3			2	-		
CO 3	2	2	-	-	-	-	-	2			2	-		
CO 4	2	2	-	-	-	-	-	2			2	-		
CO 5	2	2	-	-	-	-	-	2			2	-		
CO 6	=	-	-	-	2	-	3	2	2		2	-		

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics:

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

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK4DSEPHY251.1				
Course Title	**Basic Digital Principles and Applications**				
Type of Course	**DSE**				
Semester	IV				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	1. 2.				
Course Summary	To equip the students with the concepts of Boolean algebra, digital logic gates, combinational and sequential digital circuits				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**NUMBER SYSTEMS, BOOLEAN ALGEBRA (Book 2, Chapter 32&34 Book 1 Chapter 3)**	**9**	
	1	Review of number system, binary, octal, hexa-decimal	2	1
	2	Binary addition and subtraction (1's and 2's complement methods)	2	1
	3	Boolean algebra- Laws and identities, De-Morgan's Theorems	2	1,6
	4	Simplification of Boolean expressions using Boolean identities	1	6
	5	Reduction of Boolean expressions using Karnaugh Maps - Sum of Products (SOP) representation (up to four variables)	2	6,
II		**LOGIC FAMILIES (Book 2, Chapter 35)**	**9**	
	6	Saturated and Non-Saturated Logic Circuits - Characteristics of Logic Families	2	2
	7	RTL Circuit - DTL Circuit - TTL Circuit	3	3
	8	ECL Circuit - I^2L Circuit	2	3
	9	MOS Family - PMOS, NMOS and CMOS Circuits.	2	3,5
III		**ADDERS, SUBTRACTORS AND FLIP FLOPS (Book 2 Chapter 33 & Book 1 Chapter 8)**	**9**	
	10	Half and Full adder	2	5,
	11	Half and Full Subtractors	2	5,
	12	Flip flops –SR flip flop, JK flip flop, JK Master slave Flip flop	3	4,5
	13	D flip flop, T flip flop	2	4,5
IV		**COUNTERS (Book 1, Chapter 10)**	**9**	
	14	Asynchronous Counter, Synchronous Counter (timing diagram)	3	2
	15	Ring Counter, Ripple Counters	3	5
	16	Mod 10,16, n Counter- popular IC versions (7490A)	3	5

V		**REGISTERS (Book 1, Chapter 9)**	**9**	
	17	Shift registers Serial in – Serial out shift register	2	5
	18	Serial in – Parallel out shift register	2	5
	19	Parallel in – Serial out shift register	2	5
	20	Parallel in – Parallel out shift register	2	5
	21	Bidirectional Shift Register	1	5

Practicals

Part A (At least 5 Experiments to be performed)

1. Characteristics of PN junction diode.
2. Network theorems (Superposition, Thevenin's & Norton's theorems) - To verify the (i) Superposition, (ii) Thevenin's & (iii) Norton's theorems
3. Characteristics of LED
4. Familiarising and verifying different logic gates using 74XX series
5. Verification of truth tables of AND, OR, NOT Gates using IC 74XX series
6. Verification of truth tables of NAND, NOR, EXOR Gates using IC 74XX series.
7. Construction of basic gates using NAND and NOR gates using IC.
8. Construct and verify a Half Adder using IC 74XX series.
9. Construct and verify a Full Adder using IC 74XX series.
10. Verification of truth tables of flip flops: RS, D, and JK using IC 74XX series.

Part B (At least One Experiment to be performed

1. To verify the Maximum Power Transfer Theorem
2. Characteristics of photo diode
3. Construction of binary counters using IC 74XX series.

Books for study

1. Digital Principles and Applications: Malvino and Leach, Tata McGraw Hill Education Private Limited
2. Basic Electronics Solid State: B. L. Theraja, S Chand& Company LTD
3. Basic Electronics: Devices, circuits and IT fundamentals: Santiram Kal, PHI, 2010

Reference books

1. Digital Fundamentals: Thomas L Floyd, 11th Edition by Pearson Education

2. Fundamentals of Digital Circuits – Anand Kumar – PHI

3. Digital Electronics Principles and Integrated circuits – Maini – Wiley India.

COURSE OUTCOMES

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Understanding the basics of number systems	U	1
CO-2	Understanding basics of Digital electronics	U	1
CO-3	Familiarising commonly used logic families	E	1
CO-4	Testing commonly used IC chips	Ap, E	3
CO-5	Design logic circuits using ICs	Ap	5
CO-6	Solving digital equations using De-Morgans theorem	Ap	2

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

Note: 1 or 2 COs/module

Name of the Course: BASIC DIGITAL PRINCIPLES AND APPLICATIONS

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

CO No.	**CO**	**PO/PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture (L)/Tutorial (T)**	**Practical (P)**
1	Understanding the basics of number systems	PO1/PSO 1	U	C	L	
2	Understanding basics of Digital electronics	PO1/PSO 1	U	C	L	
3	Familiarising commonly used logic families	PO2,3 /PSO 1	E	C	L	
4	Testing commonly used IC chips	PO 2,3/ PSO 3	An, E	P	L	P
5	Design logic circuits using ICs	PO 2,3 /PSO 5	Ap	P	L	P
6	Solving digital equations using De-Morgans theorem	PO 1/ PSO 2	Ap	C,P	L	

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

	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO 6	PSO 7	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2				-	-		1						
CO 2	2				-	-		1						

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

Mapping of COs with PSOs and POs :

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

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

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK4DSEPHY252.1				
Course Title	**Object Oriented Programming**				
Type of Course	**DSE**				
Semester	IV				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3hours	-	2hours	5
Pre-requisites					
Course Summary	This course discusses basic programming concepts in C++. Students will get an understanding of programming logic in C++. Discussion on conditional statements, loops, arrays and functions will allow students to write any simple programs in C++.				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**INTRODUCTION**	**9**	
	1	Introduction to OOP, Procedural vs Object oriented Programming, Characteristics, and applications of OOP,	3	1
	2	Concepts: Object, Class, data abstraction, Data encapsulation, Inheritance, Polymorphism, Static and dynamic binding, Message passing,	4	1
	3	Advantages of object orientation- reusability, maintenance, security	2	1
II		**PROGRAM STRUCTURE AND CONTROL STRUCTURES**	**9**	
	4	Basic C++ program structure, Preprocessor directive, data types, operators, variables, and constant declarations.	3	2
	5	Input and Output statements, type conversion	2	2
	6	Control statements- if, if…else, switch…case, jump statements- break, continue, goto, exit- looping statements- for, while, do...while.	4	2
III		**OBJECTS AND CLASSES**	**9**	
	7	Introduction to objects-classes- Declaration of classes in C++- Abstraction and Encapsulation, Member function definition, Creating Objects- Calling member functions	4	3
	8	Array of objects-Objects as Function arguments- Scope resolution operator	3	3
	9	Static data members, access modifiers	2	3
IV		**Polymorphism, Friend functions and Constructors**	**9**	
	10	Polymorphism- function overloading, early binding and late binding, inline functions	3	3
	11	Friend functions- Member functions of a class as friends of another class, Friend function as a bridge between two classes. Friend classes	3	3
	12	Constructors – default and parameterized constructor, constructor	3	3

		overloading, copy constructor -destructors		
V	**INHERITANCE, EXCEPTIONAL HANDLING AND TEMPLATES**		**9**	
	13	Inheritance-Introduction to code reuse, containership-Parent and Derived classes, public, private and protected inheritance, single, multilevel, multiple, hierarchical inheritances- function overriding-virtual functions	4	4
	14	Objects and pointers, this pointer, pointers to derived class, object slicing	1	4
	15	C++ Exception Handling: Try Throw, Catch, Throwing an Exception, Catching an Exception	2	4
	16	Templates-Introduction to code sharing-function templates and class templates	2	4

Book For Study:

1. Object oriented Programming with C++- E Balaguruswamy – Sixth Edition
2. Object-oriented Programming with C++ - A. K. Sharma – Second edition
3. Object-oriented Programming in C++- Robert Lafore - Fourth Edition
4. Programming with C++, D. Ravichandran, Third edition, Tata McGraw Hill, 2011

Books for Reference:

1. The C++ programming language, Biome Stroustrup, Addison Wiley

2. Programming in C++, M T Somasekharan, PHI PVT Publishing, 2005

PRACTICALS

PART A (at least 5 experiments to be performed)

1. Program to find Cross product and fit product of two vectors
2. Program to check whether the entered number is prime or not
3. Program to list values of sin(x), tan(x) and exp(x) for a range of x values.
4. Program to display factors of a number
5. Program to convert given number to binary number
6. Program to find roots of a quadratic equation
7. Program to calculate range and maximum height of a projectile
8. Program to display sum and difference of two matrices
9. Program to find factorial of a number using functions
10. Program to find reduced mass and centre of mass of two spherical objects

PART B (at least one experiment to be performed)

1. Program to enter name and marks of n students and to generate rank list
2. Program to multiply two matrices
3. Program to enter names of n students and to sort them alphabetically.
4. Program to manage inventory of a supermarket with name, quantity and price of items.

Course Outcomes

No.	Upon completion of the course the graduate will be	Cognitive	PSO

	able to	**Level**	**addressed**
CO-1	Explain the concepts of object-oriented programming	U	PSO-2,5
CO-2	Illustrate the structure of C++ program and control structures	U, Ap	PSO-2,5
CO-3	Apply the concepts of classes, objects, and polymorphism	U, Ap	PSO-2,5
CO-4	Apply the concept of inheritance to reduce the length of code and implement reusability	U, Ap	PSO-2,5

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

Note: 1 or 2 COs/module

Name of the Course: OBJECT ORIENTED PROGRAMMING

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

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Explain the concepts of object-oriented programming	PSO-2,5	U	F, C	L	
CO-2	Illustrate the structure of C++ program and control structures	PSO-2,5	U, Ap	F, C	L	P
CO-3	Apply the concepts of classes, objects, and polymorphism	PSO-2,5	U, Ap	C,P	L	P
CO-4	Apply the concept of inheritance to reduce the length of code and implement reusability	PSO-2,5	U, Ap	C,P	L	P

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

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

Mapping of COs with PSOs and POs :

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

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

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK4DSEPHY253.1				
Course Title	**Fiber Optic Communication**				
Type of Course	**DSE**				
Semester	IV				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites					
Course Summary	This course gives the learner a good understanding of the role of fiber optic technology in the current telecommunications industry. It will equip the learner with the ideas of optical fibers and its constitution. Starting from the basics of light and ending with the testing of cables, the proposed modules will ensure that a good knowledge in OFC is transacted.				

Detailed Syllabus:

Module	Unit	Content	Hr	CO
I		**BASIC CONCEPTS OF LIGHT**	**9**	
	1	Electromagnetic waves, electromagnetic spectrum, modes of light- single mode, multi mode	2	1
	2	Critical angle, acceptance angle, cone of acceptance, numerical aperture	2	2
	3	Losses- absorption, scattering, reflection, dispersion: intermodal, intramodal	3	1
	4	Effect on bandwidth, optical power: gain, loss	2	1
II		**INTRODUCTION TO OPTICAL FIBRE**	**9**	
	5	Structure of Optical fiber	1	1
	6	Types of fibers: based on refractive index, material, modes	2	1
	7	Fiber optic cable construction, geometry of cable	2	2
	8	Cable sizes, colour coding, types of cables: simplex, duplex, multifiber, GI, SI, tight buffer, loose tube, ribbon, breakout cable, distribution cable, hybrid cable, composite, aerial and submarine cables	4	1
III		**FIBRE CABLING TOOLS**	**9**	
	9	General tools, slit and ring tool, stripping tool, buffer stripper, polishing film, polishing pad, polishing puck	2	1
	10	Cleaning devices, crimping tool, inspection microscope, cleavers, fusion splicer	2	1
	11	Light source, power meter, optical loss test set	2	2
	12	Visual fault locator, mechanical splices, splice tray	2	3
	13	Optical time domain reflectometer	1	2
IV		**CABLE SPLICING**	**9**	

	18	Fusion in splicing, mechanical splicing, single fiber fusion splicing, mass fusion splicing	2	1
	19	Stages of splicing, splicing precautions	3	4
	20	Misalignment, end gap, end angle	2	1
	21	Numerical Aperture mismatch, core mismatch	1	3
	22	Axial run-out, bubble, incomplete fusion	1	3
V		**TESTING OF CABLES**	**9**	
	23	Continuity test, light source power meter, OLTS, visual fault locator	3	2
	24	OTDR testing, measuring cable span, attenuation coefficient, connector/splice loss measurement	3	3
	25	Distance-to-fault, OTDR trace analysis, optical loss budget	3	3

List of Practicals

No.	**Section A (Any 5 to be done)**	CO
1	Introduction to optical fiber cable (i) Study the composition of fiber optic cable (ii) single and ribbon type (iii) underground and overhead and colour coding (iv) pig tail (v) patch chord (vi) splice protection sleeve (vii) fusion splicer (viii) fiber closure	1
2	Measuring instruments identification: (ix) Light source, (x) power meter, ((xi) optical loss test set (xii) OTDR	1
3	Connectors (i) FC/SC/ST/LC/FDDI/ESCON/SMA (ii) various types of ratio couplers (iii) splitters	2
4	Measurement of Numerical Aperture of a fiber	
5	Study of losses in Optical fiber	
6	Power vs Current (P-I) characteristics and measure slope efficiency of Laser Diode	
7	Voltage vs Current (V-I) characteristics of Laser Diode	
8	Power vs Current (P-I) characteristics and measure slope efficiency of LED	
9	Voltage vs Current (V-I) characteristics of LED	
10	Characteristics of Photodiode and measure the responsivity.	
Part B – At least One Experiment to be performed		
1	Splicing (i) fusion splicing setup (ii) splicing stages (iii) arranging in splice tray (iv) securing in fiber closure	4
2	Fiber optic testing (i) fiber continuity test using light source and power meter (ii) cable loss test	3
3	OTDR test (i) setting up of OTDR (ii) measuring cable span (iii) measuring attenuation coefficient (iv) connector/splice loss measurement (v) distance to fault	3
4	OTDR trace analysis and optical loss budget in long distance optical links and FTTH networks.	5

Books for Study:

1. Fiber Optics Installer and Technician Guide: Bill Woodward and Emile B. Hauson, Neil Eddie, San Francisco (2005)
2. Fiber-optic communication systems: Govind P. Agrawal, Wiley Interscience, 3rd edition (2002)
3. Introduction to Fiber Optics: John Crisp and Barry Elliot, Elsevier, Amsterdam, 3rd Edition (2005)

Books for reference:

1. Introduction to Fiber Optics: Ajoy Ghatak and K. Thyagarajan, Cambridge University Press (1997)
2. Troubleshooting Optical-Fiber Networks - Understanding and using your optical time-Domain reflectometer: Duwayne R, Anderson, Larry Johnson and Florian G. Bell, Elsevier Academic Press, Amsterdam, 2nd Edition (2004)

Web resources

1. https://www.vedantu.com/physics/optical-fiber
2. http://krct.ac.in/ktgadmin/assets/php/pdf/1576331029.pdf

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand the essential basic elements of Fiber optics and telecommunication systems	U	PSO-1,5
CO-2	Apply the acquired knowledge in the selection of desired optical fibres, cabling tools, splicing and its testing	Ap	PSO-5,7
CO-3	Analyse different aspects of optical Fiber communication including OTDR trace analysis and optical loss budget	An	PSO-1,5
CO-4	Evaluate the different types of cable splicing in selecting the optimum configuration for low-loss communication	E	PSO-1,5,7
CO-5	Create various types of miniature models of optical communication systems, fueling the development of real-time scenarios	C	PSO-1,5,7

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

Name of the Course: FIBRE OPTIC COMMUNICATION
Credits: 3:0:1 (Lecture:Tutorial:Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Understand the essential basic elements of Fiber optics and telecommunication systems	PO-1,3,6 PSO-1,5	U	F, C	22	4
CO-2	Apply the acquired knowledge in the selection of desired optical fibres, cabling tools, splicing and its testing	PO-1,2,3 PSO-5,7	Ap	P	10	4
CO-3	Analyse different aspects of optical Fiber communication including OTDR trace analysis and optical loss budget	PO-1,2,6 PSO-1,5	An	C, P	10	8
CO-4	Evaluate the different types of cable splicing in selecting the optimum configuration for low-loss communication	PO-1,2,3 PSO-1,5,7	E	C, P	3	4
CO-5	Create various types of miniature models of optical communication systems, fueling the development of real-time scenarios	PO-1,2,3,6 PSO-1,5,7	C	P, M	0	10

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

Mapping of COs with PSOs and POs

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

CO	Internal Exam	Assignment	Lab Experiments	End Semester Examination
CO 1	✓		✓	✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓		✓	✓
CO 5		✓	✓	

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK4VACPHY251.1				
Course Title	**Disaster management**				
Type of Course	**VAC**				
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					
Course Summary	This course provides a comprehensive overview of various phases of disaster management. The course is intended to provide a general concept in the dimensions of disasters caused by nature beyond the human control as well as the environmental hazards induced by human activities with emphasis on disaster preparedness, response and recovery. Additionally, the course explores role of national and state level agencies in disaster mitigation and disaster reduction. It also aims case studies of a few disasters happened in India and across the globe.				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**TYPE OF NATURAL DISASTERS (Book 2:Chapter 1 & Book 1:Chapter 1)**	**9**	
	1	Natural Disasters - Flood Drought, Cyclone,	2	1
	2	Geographical Disaster, Earthquake, Landslide	2	1
	3	Climatic Disaster- Heat and Cold Wave, Climate Change	3	1
	4	Lecture/Tutorial Session (Debate/group discussion on) . Impacts of Global Warming - Sea level Rise, . Ozone Depletion and its impacts on other natural disasters (Group discussion)	2	1
II		**MAN MADE DISASTER (Book 2, Chapter 2 & Book 1:Chapter 1)**	**9**	
	5	Nuclear Disaster, Chemical Disaster, Biological Disaster,	3	1,2
	6	Building Fire, Coal Fire, Oil Fire,	2	1,2
	7	Air Pollution, Water Pollution, Industrial Pollution, Deforestation	2	1,2
	8	Tutorial/Lecture - GroupWise presentation on Main Air & Sea Accidents in the last decade	2	1,2
III		**DISASTER PREVENTION AND CONTROL (Book 2, Chapter 3 & Book 1:Chapter 2)**	**9**	

	9	Disaster preparedness, prevention and mitigation, Community based disaster management (CBDM) and its operation, Disaster Information	5	3
	10	Role of Various Agencies in Disaster Mitigation- National level and State levels - National Disaster Response Force (NDRF)	3	3
	11	Tutorial/Lecture - GroupWise presentation on "the role and awareness of of National and State level agencies"	1	3
IV		**RISK ASSESSMENT AND MANAGEMENT (Book 2, Chapter 3,4 & Book 1:Chapter 3,4)**	**9**	
	12	Role of the UN, and international agencies in disaster management; United Nations Disaster Relief coordinator (UNDRO), UNDRO Mandate in Disaster Relief and Management, General Assembly, Guiding Principles, Prevention, Preparedness, Stand-By Capacity, Consolidated Appeals; Coordination, Cooperation And Leadership; Continuum From Relief To Rehabilitation And Development, International Decade For Natural Disaster Reduction, Yokohama Conference, Kobe Conference, Plan of Action	3	4
	13	National disaster management in India - an overview National Policy, Historical Framework, National Crisis Management Committee (NCMC), Crisis Management Group, Funding Mechanisms, The Disaster Management Act, 2005, The National Disaster Management Authority (NDMA), State Disaster Management Authorities, District Disaster Management Authority, Role of District Magistrate, National Disaster Response Force (NDRF), Indian Agencies for Disaster Management, Indian Red Cross Society, National Institute of Disaster Management	4	4
	14	Tutorial/Lecture Discussion on the role of various agencies in disaster management Natio	2	4
V		**CASE STUDIES (Book 1, Chapter 3)** Note: Tutor can use any available resources to impart knowledge on this topic	**9**	
	15	Disasters in India: Bhopal gas tragedy of 1984, Orissa cyclone 1999, Kerala Flood 2018	3	4,5

	16	Disasters across globe: Chernobyl nuclear accident 1986, Tsunami 2004, Brumadinho Dam, Brazil 2019	3	4,5
	17	Tutorial/Lecture Power point presentation and discussion on the various disasters and mitigation across globe and in our country	3	4,5

BOOKS FOR STUDY:

1. Introduction to disaster management, Satish Modh, Mcmillan Publishers, India Ltd
2. DISASTER MANAGEMENT, Uday Singh,VIKAS╟ PUBLISHING HOUSE PVT LTD
3. Natural disaster mitigation – a scientific and practical approach: Science Press, Beijing, 2009
4. Environmental health in emergencies and disasters: A practical guide, B.Wisner & J.Adams (Eds.), WHO, Geneva, 2002 ISBN 92-4 154541-0

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Understanding the basic knowledge of Disaster Management concept and different approaches to reduce the impact of disaster	U	PSO-1,2,3
CO-2	Learning to apply the knowledge of technology for monitoring and management of the Disaster	R, U	PSO -1,2,4
CO-3	Understand the types of disaster their origin causes and their management and the disaster profile of India	R, U	PSO -1,3,6
CO-4	Learning to apply the knowledge of technology for monitoring and management of the Disaster	Ap	PSO-1,3,6
CO-5	Explain Emergencies and controls, with examples of natural and manmade disasters and their consequences.	R, Ap	PSO-2,4,5

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

Note: 1 or 2 COs/module

Name of the Course: DISASTER MANAGEMENT

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

CO No.	**CO**	**PO/ PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture (L)/Tutorial (T)**	**Practical (P)**
CO-1	Understanding the basic knowledge of Disaster Management concept and different	PSO 1,2,3	U	F, C	L and T	-

	approaches to reduce the impact of disaster					
CO-2	Learning to apply the knowledge of technology for monitoring and management of the Disaster	PSO 1,2,4	R, U	F, C	L and T	-
CO-3	Understand the types of disaster their origin causes and their management and the disaster profile of India	PSO 1,3,6	R, U	C	L and T	-
CO-4	Learning to apply the knowledge of technology for monitoring and management of the Disaster	PSO 1,3,5, 6	A p	C	L and T	-
CO-5	Explain Emergencies and controls, with examples of natural and manmade disasters and their consequences.	PSO 2,4,5	R, A p	C,P	L and T	-

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

Mapping of COs with PSOs and POs :

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

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK4VACPHY252.1				
Course Title	**Research and Publication Ethics**				
Type of Course	**VAC**				
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					
Course Summary	The objective of this course is to instruct the students interested and expecting to do research, about the philosophy of research; research and publication ethics; accessibility of .publications and the publication misconduct				

Module	Unit	Content	Hrs	CO
I		**INTRODUCTION**	**9**	
	1	Introduction to philosophy: definition, nature and scope, concept, branches	4	1
	2	Ethics: definition, moral philosophy, nature of moral judgements and reactions	5	1
II		**SCIENTIFIC CONDUCT**	**9**	
	3	Ethics with respect to science and research,Ethics in Measurement Practices,Ethical Practices in Science Outreach,Ethical Issues Associated with Gender-Bias	3	1
	4	Intellectual honesty and research integrity,	2	1
	5	Scientific Misconducts: Falsification, Fabrication, and Plagiarism (FFP)	2	2
	6	Redundant publications: duplicate and overlapping publication, salami slicing, Selective reporting and misrepresentation of data	2	2
III		**PUBLICATION ETHICS (chapter 4 and 5 of Book 3, Chapter 5,6 and 8 of Book 6)**	**9**	
	7	Publication Ethics: definition, introduction and importance. Best practices – standards setting initiatives and guidelines: COPE, WAME, etc.	3	3
	8	Conflict of interest d. Publication misconduct: definition, concept, problems that lead to unethical behaviour and vice-versa, types	2	2
	9	. Violation of publication ethics, authorship and contributiorship ,	2	3

	10	Identification of publication misconduct, complaints and appeals ,Predatory publishers and journal	2	2
1V	**DATABASES AND RESEARCH METRICS (Book 6 : Chapter 11 & 12)**		9	
	11	Databases (4Hrs) a. Indexing databases b. Citation databases: Web of Science, Scopus, etc.	4	4
	12	Research Metrics (3Hrs) a. Impact factor of journal as per journal citation report, SNIP, SJR, IPP, Cite Score b. Metrics: h-index, g index, i10 index, altmetrics	5	4
V	**OPEN ACCESS PUBLISHING (Book 6 : Chapter 7 ,9 and 10)**		**9**	
	13	Open Access publications and Initiatives	2	5
	14	online resource to check publisher copyright and self-achieving policies	2	5
	15	Software tool to identify predatory publications developed by SPPU	2	5
	16	Journal Finder/ Journal Suggestion tools viz. JANE, ELSEVIER, SPINGER, Journal suggester etc.	2	5
	17	Use of plagiarism software like Turnitin, Urkund and other open source software tools	1	5

BOOKS FOR STUDY:

1. Indian National Science Academy. 2019. Ethics in Science Education, Research and Governance.Edited by K Muralidhar Amit Ghosh AK Singhvi ISBN: 978-81-939482-1-7
2. Research and Publication Ethics,Dr. Upendra Pratap,Ms. Sakshi Ahlawat,Dr. Sushma Sharma SULTAN CHAND & SONS

BOOKS FOR REFERENCE:

1. Alexander Bird,. (2006). Philosophy of Science. Routledge.ISBN 9781857285048

2. Chaddah, P. (2018) Ethics in Competitive Research: Do not get scooped; do not getplagiarised. ISBN 9387480860

3. Israel, M. (2015). *Research Ethics and Integrity for Social Scientists: Beyond Regulatory Compliance*. (Second ed.) SAGE Publications Ltd.

4. RESEARCH & PUBLICATION ETHICS, Dr.S.B.Kishor , Dr.Ajay S.Kushwaha , Dr.Gitanjali J ,DAS GANU Prakashan.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand on basics of philosophy of science and ethics, research integrity, publication ethics.	U	PSO-4,7
CO-2	Identify research misconduct and predatory publications	R, U	PSO-4,7
CO-3	Understanding best practises in publications ,violations , author contributions	R,U	PSO-,7
CO-4	Understanding on Indexing and citation databases. Students will be able to calculate open access publications research metrics(citations, h-index, Impact Factor, etc.) and plagiarism tools	Ap	PSO-7
CO-5	Familiarize the use Software tool to identify predatory publications, Journal Finder/ Journal Suggestion tools, plagiarism softwares and other open source software tools	U, Ap	PSO-7

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

Note: 1 or 2 COs/module

Name of the Course: RESEARCH AND PUBLICATION ETHICS

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

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Understand on basics of philosophy of science and ethics, research integrity, publication ethics.	PSO -4,7	U	F, C	L	-
CO-2	Identify research misconduct and predatory publications	PSO -4,7	R, U	P	L	-
CO-3	Understanding best practises in	PSO	R,U	F	L	-

	publications ,violations , author contributions	-,7				
CO-4	Understanding on Indexing and citation databases. Students will be able to calculate open access publications research metrics(citations, h-index, Impact Factor, etc.) and plagiarism tools	PSO -7	Ap	C,P	L	-
CO-5	Familiarize the use Software tool to identify predatory publications, Journal Finder/ Journal Suggestion tools, plagiarism softwares and other open source software tools	PSO -7	U,AP	C,P	L	-

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

Mapping of COs with PSOs and POs :

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PO1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**
CO 1				1			2			1		1	1	
CO 2				1			2			1		1	1	
CO 3				2						2		2		
CO 4				2						2		2		
CO 5				2						2		2		

Correlation Levels:

Leve	**Correlation**

l	
-	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	PHYSICS				
Course Code	MIUK4SECPHY251.1				
Course Title	**Physics of Everyday Appliances**				
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	NIL				
Course Summary	This course provides a basic exploration of the physical principles underlying everyday appliances and technologies. From the basics of electronics and electricity to modern communication technology, students will gain a comprehensive understanding of how various devices work, their impact on energy consumption and efficiency.				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**EVOLUTION OF LIGHTING TECHNOLOGY (Ref Web Link -1, Book-1 section 13.2-13.3, Book 3)**	**9**	
	1	History and evolution of light bulbs	1	1
	2	Discharge Lamps – gas discharges - Fluorescent Lamps - Mercury, Metal-Halide, and Sodium Lamps	3	1
	3	Light-Emitting Diodes - Electrons in Solids - Metals, Insulators, and Semiconductors – Diodes – working of LED	2	1
	4	Lasers and Laser Light - How a Laser Medium Works – types of lasers	1	1
	5	Need for saving energy - Standards & Labelling Program of BEE	2	1
II		**MIRRORS, LENSES, AND CAMERA (Book-1, section 14.1)**	**7**	
	6	Introduction to mirrors and lenses, real images - Focusing and Lens Diameter	2	2
	7	Focal Lengths and f-Numbers - Improving the Quality of a Camera Lens - The Viewfinder and Virtual Images	2	2
	8	Image sensors - limit of resolution	2	2
	9	Eyes and Eyeglasses	1	2
III		**HEAT TRANSFER AND COOLING SYSTEMS (Book-1, section 7.1, 8.2, 8.1)**	11	
	10	Woodstoves-thermal conductivity, conduction, convection, radiation, heat capacity	1	3
	11	Microwave Ovens – speed, frequency, and wavelength in electromagnetic waves - polar and nonpolar Molecules -	2	3

		working of ovens		
	12	Automobiles - Using Thermal Energy: Heat Engines – The Internal Combustion engine	2	3
	13	Engine Efficiency - Improving Engine Efficiency - Diesel Engines and Turbochargers - Multicylinder Engines – *Energy efficiency of electrical vehicles	3	3
	14	Air conditioners - Pumping Heat Against Its Natural Flow - How an Air Conditioner Cools the Indoor Air - How an Air Conditioner Warms the Outdoor Air	3	3
IV		**OTHER DOMESTIC APPLIANCES** **(Book-1, section 9.1, 9.2, Web Link-2)**	**9**	
	15	Clocks- working - time and space, natural resonance, simple harmonic motion, frequency, period, amplitude	3	1
	16	Musical Instruments: sound; music; vibrations in strings, air, and surfaces fundamental and higher-order modes; harmonic and nonharmonic overtones; sympathetic vibration; standing and traveling waves; transverse and longitudinal waves;.	5	1
	17	Understanding Ceiling Fan Power Consumption -Advantages of BLDC fans	1	1
V		**HANDS ON TRAINING** **(Book-2, Chapter 6 & 7)**	**9**	
	19	1. Soldering technique 2. Electric tester 3. Checking the continuity of electrical components in simple circuits using multimeter 4. Assembling/replacing of fuse wire in household devices 5. Familiarization of resistor, capacitor, diode, transformer 6. One lamp controlled by one switch - soldering 7. One lamp controlled by two switch - soldering 8. Led bulb/tube light making, and troubleshooting 9. Finding the focal length of lens 10. Making of simple electrical extension boards 11. Electric earthing system 12. Energy auditing of devices	9	4

BOOKS FOR REFERENCE:

1. Edison's Electric Light: The Art of Invention (Johns Hopkins Introductory Studies in the History of Technology)
2. LED Lighting: A Primer to Lighting the Future, Sal Cangeloso
3. "The Physics of Everyday Things: The Extraordinary Science Behind an Ordinary Day" by James Kakalios
4. "Optics" by Eugene Hecht

WEB REFERENCES :

1. https://www.energy.gov/articles/history-light-bulb
2. Energy_efficient_Ceiling_fans_using_BLDC_motors-A_practical_implementation - Dr Mahesh Rao (https://www.researchgate.net/profile/Mahesh-Rao8/publication/325922681_Energy_efficient_Ceiling_fans_using_BLDC_motorsA_practic

al_implementation/links/5b2c7dcfa6fdcc8506bc8680/Energy-efficient-Ceilingfans-using-BLDC-motors-A-practical-implementation.pdf)
3. Induction stoves: An option for clean and efficient cooking in Indonesia – Tiandho, Yuant etal 2020 (doi:10.1088/1757-899X/1034/1/012068)

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Summarize the basics of lighting technology, domestic appliances including proficiency in energy efficiency standards and labelling programs established by the Bureau of Energy Efficiency (BEE)	U	PSO-1, 4,6
CO-2	Understand the working of optical systems and imaging devices such as camera.	R, U	PSO-1, 2,3,4
CO-3	Develop basic knowledge of heat transfers and technology in common appliances.	R, U	PSO-1, 4
CO-4	Administer practical skills through hands-on experiments, including soldering, circuit construction etc.	R, U, Ap	PSO-3,6,7

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

Note: 1 or 2 COs/module

Name of the Course: PHYSICS OF EVERYDAY APPLIANCES

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

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Summarize the basics of lighting technology, domestic appliances including proficiency in energy efficiency standards and labelling programs established by the Bureau of Energy Efficiency (BEE)	PSO-1, 4,6	U	F, C	L	P
CO-2	Understand the working of optical systems and imaging devices	PSO-1, 2,3,4	R, U	F, C, P	L/T	P

	such as camera.					
CO-3	Develop basic knowledge of heat transfers and technology in common appliances.	PSO-1, 4	R, U	F, C, P	L	-
CO-4	Administer practical skills through hands-on experiments, including soldering, circuit construction etc.	PSO-3,6,7	R, U, AP	F,C,P	L	P

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

Mapping of COs with PSOs and POs :

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

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK4SECPHY252.1				
Course Title	**Basic Instrumentation Skills**				
Type of Course	**SEC**				
Semester	IV				
Academic Level	200-299.				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	2 hours	-	2 hours	4
Pre-requisites	1. 2.				
Course Summary	This course provides students with a comprehensive understanding of key concepts and practical skills in instrumentation. It will help the students to emerge with a solid foundation in instrumentation, equipped with the knowledge and skills needed to design experiments, collect and analyze data, and effectively communicate their findings in various settings.				

Module	Unit	Content	Hrs	CO
I		**CHARACTERISTICS OF MEASUREMENTS**	**6**	
	1	Qualities of measurements, Static characteristics, Errors in measurements, Sources of error	3	1
	2	Dynamic characteristics, types of errors, Significant figures, resolution	3	1
II		**FUNDAMENTALS OF MEASUREMENTS**	**6**	
	3	Passive components- resistors, types, colour code, capacitors, principle, inductors, principle, types. Active components - diodes, Zener diode, construction, working, characteristics.	2	2
	4	Transistors, types, characteristics, IC chips	2	2
	5	DC voltmeter, multirange voltmeter, DC ammeter, multirange ammeter, loading.	2	2
III		**SIGNAL GENERATORS**	**6**	
	6	Types of Signal Generators, signal analysers, distortion,	3	3
	7	Spectrum analyser, Types of spectrum analysers (names only), Applications and limitations	3	3
IV		**CRO**	**6**	
	8	Block diagram of basic CRO, CRT (explanation only), Types of CRO probes, Applications of CRO,	3	4
	9	Digital CRO, comparison of digital and analog measurements	3	4
V		**DISPLAY DEVICES**	**6**	

	10	Led Emitting Diode (LED), Advantages and Disadvantages of LED, Applications of LED, Multicolour LEDs	3	
	11	Liquid Crystal Displays, Advantages and Disadvantages of LCD, Applications of LCD, comparison between LED and LCD	3	

PRACTICALS

No.	**Section A (Any 5 to be done)**	
1	Identify the measuring equipments and their functioning (Multimeter, voltmeter, ammeter)	
2	Identifying and measuring the values of the passive components	
3	Test the circuits with active and passive components	
4	Make a two-socket electric extension board	
5	Observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance.	
6	Design and construction of variable dc power supply (0-12V) using diodes, capacitors and IC 7812	
7	Study the operation of Multimeters (Analog and Digital)	
8	Measurement of voltage, frequency, time period and phase angle using CRO.	
9	Measurement of rise, fall and delay times using a CRO	
10	Study the operation of Signal Generator, Regulated Power Supplies, CRO.	
Part B – At least One Experiment to be performed		
1	LED bulb assembling	
2	LED tube assembling	
3	Familiarization with basic transducers	
4	Measurement of speed using photoelectric transducers	

Books for Study:

1. Electronic Instrumentation, 3rd edition, H.S.Kalsi, Tata McGraw Hill.
2. Electronic measurements and Instrumentation, K.Lal Kishore, Pearson.
3. Electronic Instruments and Instrumentation Technology, M.M.S Anand, PHI Learning (2009).
4. Electronic Measurements and Instrumentation, Dr. R.S. Sedha, S. Chand (2013).

Books for Reference :

1. Principles of Electronics, Malvino A.P, 7th Edition, Tata McGraw Hill (2011).
2. Principles of Electronics, Mehta V. K. (11th ed.),S. Chand & Co. (2014).

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand the possible errors in the measurements and the methods to minimize it.	U	PSO-1,2
CO-2	Identify various circuit elements in the electronic gadgets and their specific functions.	R, U	PSO-1,2,3
CO-3	Understand the use of various instrumentation techniques and its limitations	R,U	PSO-1,2,3
CO-4	Recognise various components of CRO and able to analyse electrical signals using it.	U,Ap	PSO-1,2,3
CO-5	Compare the properties, advantages and disadvantages of LED and LCD	R,U	PSO-1,2

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

Note: 1 or 2 COs/module

Name of the Course: BASIC INSTRUMENTATION SKILLS

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

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Understand the possible errors in the measurements and the methods to minimize it.	PSO-1,2 PO-1,2,3,5,6	U	F, C	L	-
CO-2	Identify various circuit elements in the electronic gadgets and their specific functions.	PSO-1,2,3 PO-1,2,3,4,5,6,7,8	R, U	F,P	L	P
CO-3	Understand the use of various instrumentation techniques and its limitations	PSO-1,2,3 PO-1,2,3,4,5,6,7,8	R,U	C,P	L	P
CO-4	Recognise various components of CRO and able to analyse electrical signals using it.	PSO-1,2,3 PO-1,2,3,4,5,6,	U,Ap	C,P	L	P

		7,8				
CO-5	Compare the properties, advantages and disadvantages of LED and LCD	PSO-1,2 PO-1,2,3, 5,6	R,U	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	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	1	2						1	2					
CO 2	1	2						2	3					
CO 3	1	2						2	2					
CO 4		2						2	2					
CO 5		1						1	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	PHYSICS				
Course Code	MIUK5DSCPHY301.1				
Course Title	**Optics**				
Type of Course	**DSC**				
Semester	V				
Academic Level	300 – 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites					
Course Summary	Optics, a branch of physics dedicated to the study of light, delves into a myriad of phenomena such as interference, where light waves interact to form distinct patterns of constructive and destructive interference. Diffraction, another fundamental aspect, elucidates the bending of light waves around obstacles or through small apertures, altering their propagation paths. Furthermore, dispersion unveils the separation of light into its constituent wavelengths. Finally, polarization explores the alignment of light waves along specific planes, influencing various optical properties.				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**INTERFERENCE OF LIGHT**	**9**	
	1	The principle of superposition - coherent sources – superposition of waves from coherent and incoherent sources, Young's double slit experiment	2	1
	2	Interference by division of wave front-Fresnel's biprism	2	1
	3	Interference by division of amplitude -interference in thin films (reflection only), colours in thin films, air wedge testing of optical flatness	3	1
	4	Newton's rings (reflected system)-refractive index of a liquid	2	1
II		**FRESNEL DIFFRACTION**	**9**	
	1	Introduction, Huygens theory, Fresnel and Fraunhofer diffractions.	1	1,2
	2	Fresnel diffraction: Fresnel's assumptions, Half-period zones, - explanation of rectilinear propagation of light	2	1,2
	3	Diffraction at a straight edge	2	2

	4	Zone plate-Comparison between zone plate and convex lens.	2	2
III		**FRAUNHOFER DIFFRACTION**	**9**	
	1	Introduction, Diffraction at a single slit	1	2
	2	Diffraction through a circular aperture	2	2
	3	Diffraction through double slits and N-slits	2	2
	4	Diffraction grating	2	2
	5	Limit of resolution, Rayleigh's criterion for resolution, resolving power of microscope and grating.	2	2
IV		**POLARISATION AND DISPERSION**	**9**	
	1	Polarization, Plane polarized light, Malus law	1	4
	2	Polarization by reflection, Brewster's law	1	4
	3	Double refraction, positive and negative crystals, Nicol prism-construction, Nicol prism as a polarizer and analyzer	3	4
	4	Quarter and half wave plates. Theory- production and analysis of plane, circularly and elliptically polarized light.	3	4
	5	Dispersion: Normal and anomalous dispersion-Cauchy's relation (Qualitative ideas only).	1	3
V		**LASERS**	**9**	
	1	Laser beam characteristics, spatial and temporal coherence (qualitative ideas)	1	5
	2	Basic principle of laser operation, spontaneous and stimulated emission, Einstein coefficient	2	5
	3	Light propagation through medium and condition for light amplification, metastable state and population inversion, pumping and optical resonant cavity	2	5
	4	Ruby laser , He-NE laser and semiconductor laser	3	5
	5	Application of lasers.	1	5

PRACTIALS

(15 Weeks with 2 hours of laboratory session per week)

<u>Part A</u>

At least **five** experiments to be performed from the following list

1. Spectrometer-A, D and n of a solid prism.
2. Spectrometer –Dispersive power and Cauchy's constants
3. Spectrometer Grating—Normal incidence- N & wavelength
4. Spectrometer-i-d curve
5. Spectrometer- Hollow prism
6. Liquid lens-refractive index of liquid and lens
7. Newton's Rings—Reflected system
8. Air wedge-diameter of a wire

9. Method of parallax: optical constants of convex lens
   i) using mirror and mercury
   ii) using mirror and water
10. Method of parallax: refractive index of a liquid

Part B

At least **ONE** experiments to be performed from the following list

1. a) Laser beam characteristics
   b) Diffraction grating
   c) Diffraction at different types of slits and apertures

2. Refractive index of liquids and liquid mixtures using Abbe's refractometer
3. Optical activity studies using Polarimeters

Book for study:

1. Optics by Ajoy Ghatak 7th edition
2. Text Book of Optics: Subramaniam & Brijlal
3. Optics and spectroscopy: R.Murugesan and K Sivaprasad, S. Chand & Co., 2010

Books for reference:

1. Optics: Eugene Hecht, Addison-Wesley 2002
2. Basic optics: principles and concepts: Avijit Lahiri, Elsvier
3. Lasers-Principles, types and applications, K R Nambiar

Course Outcomes

:

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Describe the different basic phenomena of light such as Interference, Diffraction, Dispersion and Polarization	U	PSO-1,2,3
CO-2	Relates diffraction theory in Rayleigh's criterion for resolution and in finding resolving power of diffraction grating	U, Ap	PSO-1,2,3
CO-3	Explain the phenomenon- dispersion	U	PSO-1,2,3
CO-4	Differentiate the different types of polarizations, its theory and the production/analysis methods and apply the concept in studying Nicol prism, quarter wave and half wave plates	U, Ap, An	PSO-1,2
CO-5	Explain the basic constituents of a laser, different types and working	U	PSO-1,2
CO-6	Apply various optical instruments and techniques to analyse and manipulate light, including lenses, mirrors, prisms, and optical fibers.	U, Ap	PSO-2, 7

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

Name of the Course: OPTICS
Credits: 3:0:1 (Lecture:Tutorial:Practical)

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Describe the different basic phenomena of light such as Interference, Diffraction, Dispersion and Polarization	PO-1, 2 PSO -1,2,3	U	F, C	L	
CO-2	Relates diffraction theory in Rayleigh's criterion for resolution and in finding resolving power of diffraction grating	PO-1, 2 PSO -1,2,3	U, Ap	C,P	L	
CO-3	Explain the phenomenon-dispersion	PO-1, 2 PSO -1,2,3	U	F, C	L	
CO-4	Differentiate the different types of polarizations, its theory and the production/analysis methods and apply the concept in studying Nicol prism, quarter wave and half wave plates	PO-1, 2 PSO -1,2	U,Ap, An	F, C	L	
CO-5	Explain the basic constituents of a laser, different types and working	PO-1, 2 PSO -1,2	U	F, C	L	
CO-6	Apply various optical instruments and techniques to analyse and manipulate light, including lenses,	PO-1, 2 PSO -2,7	U, Ap	F, C,P	T	P

	mirrors, prisms, and optical fibers.					

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

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2	2	1	-	-	-	-	3	2	-	-	-	-	
CO 2	2	2	3	-	-	-	-	3	2	-	-	-	-	
CO 3	1	2	1	-	-	-	-	3	2	-	-	-	-	
CO 4	3	1	-	-	-	-	-	3	2	-	-	-	-	
CO 5	3	2	-	-	-	-	-	3	2	-	-	-	-	
CO 6	-	2	-	-	-	-	2	3	2	-	-	-	-	

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

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

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK5DSCPHY302.1				
Course Title	**Quantum Mechanics I**				
Type of Course	**DSC**				
Semester	V				
Academic Level	300 – 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	0 hours	4
Pre-requisites	The students should have a basics understanding of elementary classical mechanics The students should have basic ideas in electricity and magnetism The students be familiar with the fundamentals of algebra and trigonometry, vectors, matrices, complex numbers, ordinary differential and integral calculus				
Course Summary	This course aims to present the basics of quantum mechanics in an easily understandable way. The course begins with an introduction to limitations of classical mechanics and the emergence of quantum mechanics. The second module comprises of the basic ideas of wave packets and wave functions. The Schrodinger equation, operators, eigenfunctions etc are discussed in the third module. One dimensional eigen value problems and a glossary of the approximate methods is described with a few examples in the fourth module. Finally, general formalism of quantum mechanics and various operators are also presented.				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**Limitations of Classical Physics and Emergence of Quantum theory (Book :1, Chapter-2 & 4; Book: 4, Chapter-1)**	**12**	
	1	Black Body Radiation	4	1
	2	Photoelectric Effect	2	1
	3	Compton effect	2	1
	4	Bohr atom model	2	1
	5	Stability of atoms, Atomic spectra, Correspondence Principle	2	1
II		**Wave packets and wave functions (Book:1, Chapter-3; Book:2- Chapter 1; Book:3, Chapter-2; Book:4, Chapter-2)**	**12**	
	1	Wave particle duality, de Broglie Wave, Electron diffraction - Experimental confirmation	3	3
	2	Wave packet, group velocity, phase velocity	2	2

	3	Wave functions, properties of wave function, statistical interpretation and normalisation of wave functions	3	2
	4	de Broglie's explanation for Bohr's quantisation condition for angular momentum, Application of wave nature of electrons - electron microscope	2	2
	5	Uncertainty Principle and its applications- non existence of electron inside the nucleus, width of spectral lines	2	2
III		**Schrodinger Equation (Book:2- Chapter 1; Book:3, Chapter-2 & 3; Book:4, Chapter-3)**	**12**	
	1	Postulates of Quantum Mechanics: wave functions, superposition principle, physical quantities and their operators (position, momentum, angular momentum, time and energy), expectation value, eigen functions and eigenvalues, time evolution of wave function	2	4
	2	Time dependent Schrodinger Equation	3	4
	3	Time independent Schrodinger equation and stationary states	3	5
	4	Commutation operation: properties, operator form of uncertainty principle	2	5
	5	General uncertainty relation	2	5
IV		**One Dimensional energy eigen value problems (Book:2, Chapter2; Book:3, Chapter-4; Book:4, Chapter-4)**	**12**	
	1	Free particle	2	5
	2	Particle in infinite square well potential (particle in a box), energy levels for particle in a box problem	3	5
	3	Particle in finite square well potential	4	5
	4	Finite square barrier potential (No Derivation), Ideas of Quantum Tunnelling	2	5
	5	Harmonic oscillator (No Derivation), Energy expression	1	5
V		**Mathematical Formulation of quantum mechanics (Book:3, Chapter 3; Book:4, Chapter-5)**	**12**	
	1	Linear vector space, linear operators, Dirac Notation	4	6
	2	Hilbert space – properties	2	6
	3	Hermitian operators: properties and examples	2	6
	4	Unitary operators: properties and general form	2	6
	5	Schrodinger’s cat paradox	2	3

Book for study:

1. Concepts of Modern Physics: Arthur Beiser, Mc Graw Hills
2. Introduction to Quantum Mechanics : David, J Griffith, Prentice Hall
3. Quantum Mechanics : G Aruldhas, PHI, 2^{nd} Edition, 2020
4. Quantum Mechanics, Bransden and Joachain, 2^{nd} Edition, Pearson education Ltd.,2000

Books for reference:

1. Quantum Mechanics Theory and Applications-Ajoy Ghatak, S Lokanathan , 5^{th} Edn
2. Quantum Mechanics-Leonard I Schiff ,3rd Edn
3.Quantum Mechanics-V K Thankappan , 5^{th} Edn
4.Principles of Quantum Mechanics-R Shankar, 2^{nd} Edn

Web Resources

1. **https://nptel.ac.in/courses/115101010**

Course Outcomes

:

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Recognize the limitations of Classical Physics and to understand the quantum concept-based explanation.	U	PSO-1
CO-2	Identify the properties and quantum mechanical concepts applicable to Physical systems	U	PSO-1,2
CO-3	Learn the physical and mathematical concepts of quantum physics	U	PSO-1,2
CO-4	Apply the concept of quantum mechanics to derive equations and solve problems	Ap	PSO-1,2
CO-5	Employ the quantum mechanical concept to explain certain physical phenomena and Analysis of specific problems.	Ap,An	PSO-1,2
CO-6	Application and evaluation of the operators to explain various physical states	U, Ap	PSO-1,2

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

Note: 1 or 2 COs/module

Name of the Course: Quantum Mechanics I

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

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

CO-1	Recognize the limitations of Classical Physics and to understand the quantum concept-based explanation.	PO1/ PSO 1	U	F, C	L	
CO-2	Identify the properties and quantum mechanical concepts applicable to Physical systems	PO1/ PSO 1,2	U	C	L	
CO-3	Learn the physical and mathematical concepts of quantum physics	PO1/ PSO 1,2	U	C	L	
CO-4	Apply the concept of quantum mechanics to derive equations and solve problems	PO2/ PSO 1,2	Ap	C		
CO-5	Employ the quantum mechanical concept to explain certain physical phenomena and Analysis of specific problems.	PO2/ PSO 1,2	Ap,An	C	L	
CO-6	Application and evaluation of the operators to explain various physical states	PO1/ PSO 1,2	U, 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	1		-	-	-	-		1	-					
CO 2	2	2	-	-	-	-		2						
CO 3	2	2						2						
CO 4	2	1		-	-	-			1					
CO 5	2	3			-	-			3					
CO 6	1	2		-	-	-		2						

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

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

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK5DSCPHY303.1				
Course Title	**Thermodynamics and Statistical Mechanics**				
Type of Course	**DSC**				
Semester	V				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	Students should know the basic concept of heat, temperature, calorimetry, specific heat capacities and latent heat Students should be aware of transfer of heat through conduction, convection, and radiation. Students should be familiar with Thermal equilibrium, Zeroth law and first law of thermodynamics Students should know the basics mathematics of permutations, combinations, logarithm, and Sterling's approximation				
Course Summary	Get an essence of the basic concepts of thermodynamics, the first and the second law of thermodynamics, the concept of entropy and the associated theorems, the thermodynamic potentials, and their physical interpretations along with Maxwell's thermodynamic relations and Phase transition Gain the basic knowledge about the fundamentals of Statistical Mechanics, Maxwell-Boltzmann distribution law. Learn about thermal conductivity, black body radiations, Stefan's law, and Planck's law and their significances.				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**TRANSFER OF HEAT (Book 1)**	**11**	
	1	Thermoelectric effects – Seebeck, Peltier and Thomson effects, Thermoelectric power	2	3
	2	Thermal conductivity – Radial flow of heat, cylindrical flow	2	3
	3	Black body radiation – Discussion of black body radiation curve, Wein's Displacement Law, Rayleigh - Jeans Law, Planck's Quantum Postulates- Radiation law, Stefan Boltzmann law (Proof not required).	3	1, 3
	4	Air conditioning System– Equipments used in Air conditioning system, Classification of Air Conditioning systems- Summer Air conditioning system, Winter Air Conditioning System.	3	1, 3
	5	Global Warming – Effects, Efforts to control Global warming	1	3
II		**THERMODYNAMICS (Book 1, 2, 3)**	**14**	

	6	Thermodynamic Equilibrium, Equation of state, Hydrostatic systems, Work in changing the volume of hydrostatic system, stretched wire, P V diagram. (Book 2)	4	3
	7	First law of thermodynamics, Thermodynamic processes – Isothermal, Adiabatic, reversible, and irreversible, Isobaric and Isochoric, adiabatic expansion of gas, cyclic processes (Basic ideas)	2	1, 3
	8	Expression for work done in isothermal and adiabatic process	1	3
	9	Carnot's Ideal Heat engine	2	3
	10	Petrol engine & Diesel engine – working and efficiency, Multi Cylinder Engines(Book 1), Diesel Engines and Turbochargers (Book3)	4	1, 3
	11	Second law of thermodynamics – Clausius and Kelvin - Planck statements, Refrigerator (Qualitative idea)	1	3
III		**ENTROPY (Book 1, 2)**	**5**	
	12	Change in entropy – physical Concept, Change of entropy in reversible and irreversible thermodynamic processes.	1	4
	13	Principle of increase of entropy, Heat Death of universe	1	1, 4
	14	T -S diagram (Book 2)	1	4
	15	Change in Entropy for the conversion of ice to steam	1	4
	16	Nernst theorem and third law of thermodynamics, Zero-point energy	1	1, 4
IV		**THERMODYNAMIC POTENTIALS AND MAXWELL'S RELATIONS (Book 1)**	**7**	
	17	Basic concept of thermodynamic variables & potentials	1	5
	18	Internal energy, enthalpy, Helmholtz free energy, Gibb's free energy – Physical Significance	1	5
	19	Relation of thermodynamic Potentials with variables - Maxwell's thermodynamic relations - Clausius - Clapeyron's Latent Heat equation	3	5
	20	Change of phase - Phase diagram – first and second order phase transitions	2	5
V		**STATISTICAL MECHANICS (Book 1)**	**9**	
	21	Statistical Basis – Probability, Principle of equal A priory, probability	1	6
	22	Macrostates and Microstates, Phase space	1	6
	23	Density of quantum states of energy of a particle	1	6
	24	Statistical Ensembles – Microcanonical, Canonical, Grand Canonical	1	6
	25	Partition function	1	6
	26	Maxwell – Boltzmann statistics- Energy and velocity distribution – Derivation	2	6
	27	Need of Quantum statistics, Maxwell - Boltzmann statistics, Bose - Einstein statistics, Fermi - Dirac statistics – Comparative study only	2	6

PRACTICALS

(15 Weeks with 2 hours of laboratory session per week)

At least **five** experiments to be performed from the following list

Sl No	Experiment	CO
Part A At least **FIVE** experiments to be performed		
1	To determine the coefficient of thermal conductivity of Cu by Searle's apparatus.	2
2	To determine the coefficient of thermal conductivity of a bad conductor by Lee's disc method.	2
3	To determine the temperature coefficient of resistance by Carey Foster's Bridge.	2
4	To study the variation of thermo-emf across two junctions of a thermocouple with temperature.	2
5	To determine mechanical equivalent of heat, J, by Callender and Barne's constant flow method.	2
6	Determination of thermal conductivity of rubber.	2
7	Measurement of Planck's constant using black body radiation.	2
8	Characteristics of Thermistor.	2
9	Determine the specific heat capacity of water	2
10	Determine the Latent heat of fusion of ice	2
Part B At least **ONE** experiment to be performed		
1	Verification of Newton's Law of Cooling.	2
2	Phase transition-determination of Melting Point of wax	2
3	To determine the temperature coefficient of resistance using Platinum Resistance Thermometer using Callender and Griffith Bridge	2

BOOKS FOR STUDY:

1. Heat and Thermodynamics: Brijlal and Subramaniam, S. Chand &Co.
2. Heat and Thermodynamics: M. Zemansky, McGraw Hill, New Delhi (2007).
3. " How things works – The Physics of everyday life" Louis A Bloomfield , 5th Edition, Wiley Publications (2013)

BOOKS FOR REFERENCES

1. Heat and Thermodynamics: D. S. Mathur, S. Chand & Sons, New Delhi (1995)
2. Statistical Mechanics, Sathyaprakash, Kedar Nath Ram Nath, Delhi, Edn (2021).
3. Statistical Mechanics, B K Agarwal, Melvin Eisner, New Age International (P) Limited, Publishers London – Dew Delhi (2024).
4. Introduction to Statistcal Mechanics, S K Sinha, Narosa publishing House Pvt. Limited.
5. Heat and Thermodynamics: Rose C. McCarthy, The Rosen Publishing Group, Inc. NY, (2005).
6. Thermodynamics Kinetic Theory and Statistical Thermodynamics: F. W. Sears and G.L. Salinger, Addison-Wesley Publishing Company, 3rd Edn. (1975).
7. Thermal and Statistical Mechanics: S. K. Roy, New Age International- 2001

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO - 1	Describe the fundamental laws of thermal Physics, Thermodynamics and Statistical Mechanics and its significance	U, Ap	PSO - 1
CO - 2	Identify the thermal properties, applications of heat transfer, various thermodynamic processes and judge the efficiency of engines by comparing the performance of various vehicles	U, Ap	PSO-1,2
CO - 3	Distinguish entropy and available energy in various thermodynamic processes and illustrate various phase transitions	U, Ap	PSO – 1,2
CO - 4	Describe thermodynamic variables, thermodynamic potentials, and its physical significance and hence derive maxwell's equations	U	PSO – 1,2
CO - 5	Able to explain phase space, microstate, microstate, ensemble and learn to distinguish different statistical distributions and judge which distribution applies to a given system	U, Ap	PSO – 1,2
CO - 6	Identify thermal properties of materials, inculcate experimental skills, and appraise the temperature dependent properties through experimentation.	U, Ap	PSO – 1,2,7

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

Note: 1 or 2 COs/module

Name of the Course: THERMODYNAMICS AND STATISTICAL MECHANICS
Credits: 3:0:1 (Lecture:Tutorial:Practical)

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO - 1	Describe the fundamental laws of thermal Physics, Thermodynamics and Statistical Mechanics and its significance	PSO - 1	U	C	L	
CO - 2	Identify the thermal properties, applications of heat transfer, various thermodynamic processes and judge the efficiency of engines by comparing the performance of various vehicles	PSO -1,2	U, Ap	C, P		P
CO - 3	Distinguish entropy and available energy in various thermodynamic processes and illustrate various phase transitions	PSO – 1,2	R, U,Ap	C	L	
CO - 4	Describe thermodynamic variables, thermodynamic potentials, and its physical significance and hence derive maxwell’s equations	PSO – 1,2	U, Ap	C, P	L	
CO - 5	Able to explain phase space, microstate, microstate, ensemble and learn to distinguish different statistical distributions and judge which distribution applies to a given system	PSO – 1,2	U	C	L	
CO - 6	Identify thermal properties of materials, inculcate	PSO – 1,2,7	U,Ap	C	L	

	experimental skills, and appraise the temperature dependent properties through experimentation.					

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

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3		-	-	-	-		1	1					
CO 2	3	3	-	-	-	-		3	3					
CO 3	3	3						3	3					
CO 4	3	3		-	-	-		3	3					
CO 5	3	3			-	-		3	3					
CO 6	3	3		-	-	-	3	3	2					

Correlation Levels:

Level	**-**	**1**	**2**	**3**
Correlation	**Nil**	**Slightly / Low**	**Moderate / Medium**	**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 / Practical Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓		✓	

CO 3	✓	✓		✓
CO 4	✓			✓
CO 5	✓			✓
CO 6	✓			

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK5DSEPHY301.1				
Course Title	**Transistor Amplifier Circuits and Oscillators**				
Type of Course	**DSE**				
Semester	V				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	0	4
Pre-requisites	1. 2.				
Course Summary	To equip the student to understand the theory of different amplifier and oscillator circuits using transistors. It also gives an idea regarding different breakdown devices and FET.				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**LARGE SIGNAL AMPLIFIERS (Book 1, Chapter 22)**	**12**	
	1	Power Amplification: Class A, Class B, Class C Operations	2	1
	2	Power rectangle and power efficiency	2	1
	3	Class B Push-Pull Amplifier Circuit	2	1,3
	4	Complementary Symmetry Push-Pull amplifier and crossover distortion	2	1,3
	5	Distortion in Amplifiers: linear and nonlinear distortions	3	1
	6	Noise and Noise Figure	1	1
II		**SINUSOIDAL OSCILLATORS (Book 1, Chapter 28)**	**12**	
	7	Oscillator circuit and Barkhausen criterion for sustained oscillations,	1	1
	8	Tuned Base Oscillator	2	1,6
	9	Tuned Collector Oscillator	2	1,6
	10	Hartley Oscillator - Colpitt's Oscillator - Clapp Oscillator - Phase Shift Oscillator (derivations not required for all oscillators)	3	1,6
	11	Wien Bridge Oscillator.	2	1,6
	12	Crystal: piezoelectric effect, equivalent electric circuit, Q-factor, temperature coefficient - Crystal Controlled Oscillators	2	1,2
		NONSINUSOIDAL OSCILLATORS (Book 1, Chapter 29)	**12**	
	13	Nonsinusoidal Waveforms – mark-to-space ratio, pulse	2	1,6

III		repetition time, pulse repetition frequency		
	14	Classification of Nonsinusoidal Oscillators	2	1,6
	15	Multivibrators - Astable Multivibrator	2	6
	16	Monostable Multivibrator	2	6
	17	Bistable Multivibrator	2	6
	18	Schmitt Trigger	2	6
IV		**FIELD EFFECT TRANSISTORS (Book 1, Chapter 26)**	**12**	
	19	FET - JFET: Structure, Theory of Operation	3	2
	20	JFET Characteristics and JFET Parameters	3	5
	21	Common source JFET Amplifier	2	2
	22	MOSFET - DE MOSFET and E only MOSFET Working and Characteristics	4	2,5
V		**BREAKDOWN DEVICES (Book 1, Chapter 27)**	**12**	
	23	Unijunction Transistor (UJT)	2	4
	24	UJT Relaxation Oscillator	2	6
	25	Silicon Controlled Rectifier (SCR), 90^0 phase control of SCR	3	4
	26	Triac and Diac	3	4
	27	Silicon Controlled Switch	2	4

Books for study

1. Basic Electronics Solid State: B. L. Theraja, S Chand & Company LTD.
2. Principles of Electronics, V K Mehta and Rohith Mehta, S Chand & Company LTD.
3. Electronic Devices and Circuit theory, Robert Boylestad

COURSE OUTCOMES

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understanding the basics of Analog electronic functions.	U, R	**1**
CO-2	Analyse different solid-state devices	An	3
CO-3	Analyse transistor amplifier circuits	Ap, An	3
CO-4	Understanding the working of breakdown devices	U	1
CO-5	Analyze the V-I characteristics of the circuits	E	2
CO-6	Familiarising oscillator circuits	U	1,2

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

Note: 1 or 2 COs/module

Name of the Course: TRANSISTOR AMPLIFIERS AND OSCILLATORS

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

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

					l (T)	
1	Understanding the basics of Analog electronic functions.	PO 1/ PSO 1	U, R	F	L	
2	Analyse different solid-state devices	PO 1/PSO 3	An	C	L	
3	Analysing transistor amplifier circuits	PO2/ PSO 3	Ap, An	P	L	P
4	Understanding the working of breakdown devices	PO 1/ PSO 1	U	C	L	
5	Analyze the V-I characteristics of the circuits	PO1 /PSO 2	E	P	L	P
6	Familiarising oscillator circuits	PO1, 3/PSO 1,2	U	C, P	L	P

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

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO 6	PSO7	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2							1						
CO 2			2					1						
CO 3			2						1					
CO 4	2							1						
CO 5		3						1						
CO 6	3	3						1		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	✓			✓
CO 6	✓	✓		✓

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK5DSEPHY302.1				
Course Title	Research Methodology				
Type of Course	**DSE**				
Semester	V				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	0 hours	4
Pre-requisites	1. 2.				
Course Summary	The aim of this course is to impart research skills to the beginners and help to improve the quality of research by the existing researchers. It also encompasses the understanding of appropriate research design, statistics and report writing.				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**INTRODUCTION (Book.1 chapter1)**	**13**	
	1	Meaning and Objectives of Research	2	1
	2	Different types of Research	2	1
	3	Research approaches	1	1
	4	Significance of Research	2	1
	5	Research methods and methodology	2	1
	6	Criteria of a Good Research	2	1
	7	Ethics of Research and Plagiarism	2	1
II		**RESEARCH DESIGN (Book.1 chapter3)**	**12**	
	8	Concept and Importance	1	4
	9	Features of a good research design	2	3
	10	Exploratory Research Design – concept, types and uses	2	3
	11	Descriptive Research Designs – concept, types and uses.	3	2
	12	Experimental Design: Concept of Independent & Dependent variables	3	2
	13	Review of related literature,Hypothesis-Characteristics and Types	1	2
III		**SAMPLING AND INTERPRETATION OF DATA (Book.1 chapter4, Book.2 chapter1))**	**11**	

	14	Types and sources of data – primary and secondary	2	4
	15	Concepts and Characteristics of a good sample	4	4
	16	Sampling frame, sample, characteristics of good sample, simple random sampling, purposive sampling, convenience sampling, snowball sampling,	5	4
IV	**APPLICATIONS OF STATISTICAL TOOLS & METHODS (Book.2, Book.3)**		**12**	
	17	Diagrammatic & graphical presentation of data	2	5
	18	Data analysis with statistical tools like mean, median, mode; dispersion: variance and deviation	3	5
	19	Analysis of variance : ANOVA and ANOCOVA, correlation, regression	3	5
	20	Hypothesis testing: parametric and nonparametric tests(chi square, t-test, two tailed test, one tailed test etc.)	4	5
V	**LAYOUT OF A RESEARCH REPORT/THESIS WRITING (Book 1 chapter 14)**		**12**	
	21	Preliminary section (Title page, declaration of author, certificate of supervisor, table of contents, list of tables and figures, preface acknowledgement)	4	6
	22	Main Text (abstract, introduction, experimental section, results and discussion)	4	6
	23	Conclusions, references, scope for future study.	4	6

BookS for study:

1.Research Methodology Methods & Techniques, C.R. Kothari – New Age international Publishers, Reprint 2008.

2. Research in Education Best, John W(2003)

3. Fundamentals of Mathematical statistics, S.C. Gupta and V.K. Kapoor, Sultan Chand & Sons, New Delhi,1999.

BookS for reference:

1. Santhosh Gupta, Research Methodology and Statistical Techniques, New Delhi: Deep and Deep Publication, 2000.

2. Segha, R.L. Statistical Techniques for Librarians, New Delhi: Ess Ess Publication, 1998.

3. Young, Pauline. Scientific Social Surveys and Research, New York: Prentice Hall, 1982.

4. Creswell, J.W. and Creswell, J.D., 2017. Research design: Qualitative, quantitative, and mixed methods approaches. Sage publications

5.Kaul, Lokesh (1984). Methodology of Educational Research. New Delhi: Vikas Publications

6. Research Methodology, Mukul Gupta, Deepa Gupta – PHI Learning Private Ltd., New Delhi, 2011(units-1,2,3,).

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Describe about the nature, purpose, scope, areas, and types of research methodology	U	PSO-1,2
CO-2	Interpret Research Designs – concept, types and uses.	R, U	PSO-1,2
CO-3	Relate knowledge about Sampling and interpretation of data	U, An	PSO-1,2,4
CO-4	Connect the students with Applications of Statistical tools & Methods	U,An	PSO-1,2
CO-5	Extend the knowledge about Research Report/Thesis writing	U, An	PSO-1,2

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

Note: 1 or 2 COs/module

Name of the Course: RESEARCH METHODOLOGY

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

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Describe about the nature, purpose, scope, areas, and types of research methodology	1/1,2	U	F, C	L	
CO-2	Interpret Research Designs – concept, types and uses.	1/1,2	R, U	F,C	L	
CO-3	Relate knowledge about Sampling and interpretation of data	1/1,2 ,4	U, An	F,C	L	
CO-4	Connect the students with Applications of Statistical tools & Methods	1,2/1 ,2	U,An	F, P	L	
CO-5	Extend the knowledge about Research Report/Thesis writing	1/1,2	U, An	F, M	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	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	1	1	-	-	-	-		1	-	1	1	2	-	1
CO 2	2	2	-	-	-	-		2	-	1	1	1	-	1
CO 3	1	1	-	-	-	-		2	-	1	1	1	-	1
CO 4	3	3	-	2	-	-		2	2	1	2	3	2	1
CO 5	3	2	-	-	-	-		2	-	1	2	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	✓	✓		✓

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK5DSEPHY303.1				
Course Title	**Python for Physics**				
Type of Course	**DSE**				
Semester	V				
Academic Level	300 – 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3hours	-	2hours	5
Pre-requisites	1.				
Course Summary	Learners will possess a solid foundation in Python programming, enabling them to tackle a wide range of computational tasks and pursue further learning and specialization in Python-based development and data science domains.				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**INTRODUCTION TO PYTHON**	**9**	
	1	What is Python, Features of Python, Python input/ output.	2	1
	2	Syntax and Comments in Python	2	1
	3	Identifiers, Keywords, Variables and its types.	2	1
	4	Import Functions, Operators.	2	1
	5	● Write a program that takes input in Celsius and converts it to Fahrenheit using the formula (°C × 9/5) + 32. ● Display the result using print () function.	1	
II		**DATA TYPE AND CONTROL STATEMENTS**	**9**	
	6	Python Data types- int, float, complex, Strings, List, Tuple, Set, Dictionary and Boolean.	2	2
	7	Mutable and Immutable Objects, Type Conversions in Python.	2	2
	8	Flow control - Decision Making, Loops-for, range() while, break, continue, pass;	3	2
	9	● Implement a program that prints the multiplication table of a number entered by the user using a for loop. ● Write a program that asks the user for a number and prints whether it is prime or not using a while loop. ● Develop a program that takes a string input from the user and checks if it is a palindrome (reads the same forwards and backwards), then prints the result.	2	
III		**FUNCTIONS AND MODULES**	**9**	
	10	Creating and calling a function, arguments and types, passing and returning values, Lambda Function.	1	3
	11	Modules & Packages - Built-in Modules, Creating Modules and importing Modules	1	3
	12	Packages in Python; How to Create Package in Python.	2	3

	13	File Handling- open, close, write, read, methods, rename, delete, directories. Defined exceptions. Assertions in Python.	2	3
	14	• Write a program that defines a function to calculate the area of a rectangle based on its length and width. Allow the user to input the length and width, call the function, and print the result. • Write a program that defines a function to check if a number is even or odd. Allow the user to input a number, call the function, and print whether the number is even or odd. • Develop a program that uses a lambda function to calculate the square of a given number entered by the user. • Develop a program that renames a file named old_name.txt to new_name.txt and then deletes the new_name.txt file.	3	
IV	**OBJECT ORIENTED PROGRAMMING IN PYTHON**		**9**	
	15	Class, object, Creating a class and object with class and instance attributes; inheritance and polymorphism.	3	4
	16	Collections in Python: named tuple (), Dequeue, Chain Map and Counter.	2	4
	17	Memory allocation for classes and objects. Arrays of objects.	2	4
	18	• Write a program that reads the contents of a text file named sample.txt, capitalizes all the letters, and writes the modified content into another file named output.txt. • Create a program that lists all the files in a specified directory and prints their names to the console. • Develop a program that defines a function to calculate the factorial of a number. Use assertions to ensure that the input number is non-negative.	2	
V	**DATA VISUALIZATION AND PYTHON SQL DATABASE ACCESS**		**9**	
	19	NumPy - Basics, creating arrays, Arithmetic, Slicing, Matrix Operations, Random numbers Plotting and visualization. Matplotlib - Basic plot, Ticks, Labels, and Legends. Working with CSV files. – Pandas - Reading, Manipulating, and Processing Data.	3	5
	20	Python SQL DBMS Access-Connection, Create, insert, update, delete, commit, rollback, disconnection.	2	5
	21	Iterators- Data type supports iterators, CGI Programming- HTTP Header, Env variables, Forms, Radio button, Dropdown box, check box, text area, cookies, uploading file. Regular Expressions-Introduction, Split and quatifiers**.**	2	5
	22	• Write a program that imports NumPy and creates a one-dimensional array containing numbers from 1 to 10. • Create a two-dimensional array representing a 3x3 matrix and print its shape and dimensions. • Implement a program that performs arithmetic operations	2	

		like addition, subtraction, multiplication, and division on two NumPy arrays. ● Perform matrix multiplication and dot product of two matrices using NumPy. ● Write a program that demonstrates slicing of NumPy arrays to extract specific elements or sub-arrays. ● Create a simple line plot using Matplotlib to visualize the trend of a dataset. ● Customize the plot by adding title, labels to x and y-axis, and a legend. ● Develop a program that reads a CSV file containing student data using Pandas. ● Manipulate the data by sorting, filtering, and performing basic		

Programming Lab

Part A (at least 5 programes to be done)

1. **Projectile Motion**: Calculate the trajectory of a projectile given initial velocity, angle, and gravity.
2. **Newton's Laws**: Simulate motion using Newton's laws of motion.
3. **Simple Pendulum**: Calculate the period of a simple pendulum based on its length and gravity.
4. **Spring Force**: Calculate the force exerted by a spring using Hooke's Law.
5. **Circular Motion**: Simulate circular motion using centripetal force equations.
6. **Kepler's Laws**: Simulate planetary motion using Kepler's laws of planetary motion.
7. **Gravitational Force**: Calculate the gravitational force between two objects based on their masses and distance.
8. **Density Calculation**: Calculate the density of an object given its mass and volume.
9. **Thermodynamics**: Simulate simple thermodynamic processes such as isothermal expansion or adiabatic compression.
10. **Heat Transfer**: Calculate heat transfer using basic principles of conduction, convection, and radiation.

Part B (at least 1 programe to be done)

1. **Electric Field**: Calculate the electric field generated by point charges or charge distributions.
2. **Coulomb's Law**: Calculate the electrostatic force between two charged particles.
3. **Ohm's Law**: Calculate voltage, current, or resistance in electrical circuits using Ohm's law.
4. **RC Circuit**: Simulate the charging or discharging of a capacitor in an RC circuit.
5. **Magnetic Field**: Calculate the magnetic field generated by current-carrying wires or solenoids.

Books for Study:

- Kenneth A Lambet , Fundamentals of Python : first Programs, 2/e, Cengage Publishing, 2016.

- Christian Hill, Learning Scientific Programming with Python, Cambridge University Press (2015)
- Jeeva Jose, "Taming PYTHON By Programming", Khanna Publications, 2017.
- Peter Norton etal., Beginning Python, Wiley Publishing (2005)

Books for Reference:

- Allen B. Downey, Think Python- How to think like a computer scientist, 2nd Edition, O'Reilly, 2016.
- Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand the programming basics of interactive mode, script mode, the order of operations in python .and apply to simple programs	U, Ap	PSO-4,5,7
CO-2	Understand the data type and control system and able to do the python programmes of higher order.	U, Ap	PSO-4,5,7
CO-3	Understand to perform call function, modules and able to create packages in python leading to analyse and apply in python programmes.	U, Ap	PSO- 4,5,7
CO4	understand object-oriented programming (OOP) concepts in Python and proficiently applied them to develop robust and efficient Python programs	U, Ap	PSO-4,5,7
CO5	Explain data analysis, visualization and management in Python articulate the knowledge to do higher order pro Data Visualization and Python SQL Database Access	U, Ap	PSO-4,5,7

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

Note: 1 or 2 COs/module

Name of the Course: PYTHON FOR PHYSICS

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

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Understand the programming basics of interactive mode, script mode, the order of operations in python .and apply to simple programs	PO-6,7/ PSO - 4,5,7	U, Ap	F, C	L	

CO-2	Understand the data type and control system and able to do the python programmes of higher order.	PO-6,7/ PSO - 4,5,7	U, Ap	C,P	L	
CO-3	Understand to perform call function, modules and able to create packages in python leading to analyse and apply in python programmes.	PO-6,7/ PSO - 4,5,7	U, Ap	C,P	L	
CO-4	understand object-oriented programming (OOP) concepts in Python and proficiently applied them to develop robust and efficient Python programs	PO-6,7/ PSO - 4,5,7	U, Ap	C,P	L	
CO-5	Explain data analysis, visualization and management in Python articulate the knowledge to do higher order pro Data Visualization and Python SQL Database Access	PO-6,7/ PSO - 4,5,7	U, Ap	C,P	L	

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

Mapping of COs with PSOs and POs :

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

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK5DSEPHY304.1				
Course Title	**Forensic Physics**				
Type of Course	**DSE**				
Semester	V				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4
Pre-requisites	1.				
Course Summary	The elective course "Forensic Physics" offers a comprehensive exploration of physics principles as they apply to forensic investigations. Starting with an introduction to forensic science, students gain a foundational understanding of its core concepts and methodologies. The microscopy module delves into advanced techniques for analyzing microscopic evidence.Moving on to blood pattern analysis, students learn the principles of physics behind stain formation and to interpret bloodstains at crime scenes, contributing crucial insights to case reconstructions. The ballistics module introduces the physics of firearms and trajectory analysis, focusing on ballistic evidences. The Physical Evidence module widens the scope to include various types of physical evidence encountered in forensic settings, teaching students how to collect, preserve, and analyze diverse materials using physics principles.				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**INTRODUCTION TO FORENSIC SCIENCE [Book 1, Chapter 1,2,3 (sec 1,3,4); Book 2, Chapter 1, sec 2]**	**12**	
	1	Definition and scope of forensic science, History and Development of Forensic Science	2	1
	2	Basic Principles of Forensic Science	1	1
	3	Processing the Crime Scene, Collecting and Packaging Physical Evidences, Maintaining the chain of custody, Ensuring crime scene safety	5	1
	4	Common types of physical evidences, The significance of physical evidences	4	1
II		**MICROSCOPY [Book 1, Chapter 8]**	**8**	
	5	Basics of microscope	1	2
	6	The compound microscope	2	2
	7	The comparison microscope	1	2
	8	The Sterioscopic microscope	1	2
	9	The polarizing microscope	1	2
	10	The Spectrophotometer	1	2
	11	The Scanning Electron microscope	1	2

III		**BLOOD PATTERN ANALYSIS [Book 3, Chapter 5]**	**14**	
	12	Spatter droplet dynamics	2	3
	13	Spatter droplet dynamics on impact: {contact/collapse, displacement, dispersion, refraction, liquid-to-liquid impacts}	4	3
	14	Blood behaviour when exposed to different mediums: {Blood dispersed through the air as a function of gravity, Blood dispersed from a point source, Blood ejected from an object in motion, Blood ejected in volume under pressure, Blood that accumulates and/or flows on a surface, Blood deposited through transfer}	8	3
IV		**BALLISTICS [Book 2, Chapter 9 (sec 15,16); Book 4, Chapter 3 (sec 17,18,19)]**	**14**	
	15	Importance	1	4
	16	Nature -Firearms, Firearm parts, Classifications, Single shot firearms, Repeaters, Ammunition, The firing process.	4	4
	17	Internal Ballistics - Introduction, Velocity, Recoil and muzzle lift, Theory of recoil, Recoil energy.	3	4
	18	External Ballistics - Introduction, Ballistic coefficient, Maximum range of missiles, Angle of elevation of the barrel, Muzzle energy, Momentum.	3	4
	19	Terminal Ballistics - Introduction, General wound ballistic concepts, Other factors influencing the wounding capabilities of a missile, Penetration of bullet-resistant jackets and vests.	3	4
V		**PHYSICAL EVIDENCES [Book 1, Chapter 10 (sec 20,21,22), Chapter 14 (sec 23,24,25)]**	**12**	
	20	Forensic analysis of glass - Composition of glass, Comparing glass fragments, Measuring and comparing density, Determining and comparing refractive index, Classification of glass samples.	3	5
	21	Glass fractures	1	5
	22	Collection and preservation of glass evidences	1	5
	23	Forensic analysis of trace elements - Evidence in the Assassination of President Kennedy	1	5
	24	Forensic examination of paint - Composition of paint, Microscopic examination of paint, Analytical Techniques used in paint comparison, Significance of paint evidence, Collection and Preservation of paint evidence.	3	5
	25	Forensic analysis of soil - Significance of soil evidence, Forensic examination of soil, Variations in soil, Collection and preservation of soil evidence.	3	5

BOOKS FOR STUDY:

1. Criminalistics: An Introduction to Forensic Science, Richard Saferstein, (12/e), Pearson Education Inc.
2. Forensic Science in Criminal Investigation and trials, Dr. BR.Sharma, (4/e), Universal Law Publishing Co. Pvt. Ltd.
3. Bloodstain Pattern Analysis: With an Introduction to Crime Scene Reconstruction, (3/e), Tom Bevel & Ross M. Gardner, CRC Press.
4. Handbook of Firearms and Ballistics, Brian J. Heard, (2/e), Wiley - Blackwell.

BOOKS FOR REFERENCE:

1. Beginners Forensic Science, Dr. C. Hegde & Dr. R. Shekhar, Himalaya Publishing House.
2. Crime Scene Forensics: A Scientific Method Approach, Robert C Shaler, CRC Press
3. Bloodstain Pattern Analysis in Crime Scenarios, Kacper Choromanski, Springer
4. Solving Crimes with Physics, Carla Miller Nozigia, Mason Crest Publishers

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Describe the various aspects in a crime scene including values of physical evidences as well as the physical principles behind their analysis.	R, U	1, 3, 7
CO-2	Connect different features and utility of various microscopes to forensic analysis.	R, U, An	1, 3, 7
CO-3	Examine the general features and physical principles of bloodstain formation	R, U, Ap	1, 3, 7
CO-4	Discuss the physical principles of Forensic Ballistics	R, U	1, 3, 7
CO-5	Illustrate the physical principles behind the forensic analysis of glass, trace elements, paint and soil.	R, U, Ap	1, 3, 7

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

Note: 1 or 2 COs/module

Name of the Course: **FORENSIC PHYSICS**

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

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Describe the various aspects in a crime scene including values of physical evidences as	PO-1 PSO -1, 3,	R, U, Ap	F, C	L/T	

	well as the physical principles behind their analysis.	7				
CO-2	Connect different features and utility of various microscopes to forensic analysis.	PO-1, 6 PSO -1, 3, 7	R, U, An	F,C	L/T	
CO-3	Examine the general features and physical principles of bloodstain formation	PO-1, 2, 3, 6 PSO -1, 3, 7	R, U, Ap	F,C	L/T	
CO-4	Discuss the physical principles of Forensic Ballistics	PO-1, 2, 3, 6 PSO -1, 3, 7	R, U	F,C	L/T	
CO-5	Illustrate the physical principles behind the forensic analysis of glass, trace elements, paint and soil.	PO-1, 2, 3, 6 PSO -1, 3, 7	R, U, Ap	F,C	L/T	

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

Mapping of COs with PSOs and POs :

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

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK5SECPHY301.1				
Course Title	**Programming in Java**				
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	3 Hours	-	-	3 Hrs
Pre-requisites	1. 2.				
Course Summary	The course aims to provide a solid foundation in object-oriented programming concepts using Java, equipping students with the skills necessary to design and implement Java programs effectively.				

Detailed Syllabus:

Module	Unit	Content	Hrs	COs
I		**JAVA INTRODUCTION**	**9**	
	1	Object Oriented Programming concepts, Overview of Java programming, Java program structure, Literals.	1	1
	2	Primitive Data types - Integers, Floating Point Types, and Characters, Boolean. Literals, Type Conversion and Casting, Variables, Arrays, Strings, Vector class.	1	1
	3	Control Statements - Selection Statements, Iteration Statements and Jump Statements.	2	1
	4	Operators - Arithmetic Operators, Bitwise Operators, Relational Operators, Boolean Logical Operators, Assignment Operator, Conditional (Ternary) Operator, Operator Precedence.	2	1
	5	Discuss minimum two ● Implement inheritance, polymorphism, and encapsulation within the class hierarchy. ● Write a basic "Hello, World!" program in Java. ● Create a simple Java program to demonstrate the use of packages and imports. ● Write a program to perform arithmetic operations using integer and floating-point literals. ● Create a Java program to manipulate characters and demonstrate the use of boolean literals.	3	5
II		**OBJECT ORIENTED PROGRAMMING**	**9**	
	6	Object Oriented Programming in Java - Class Fundamentals, Declaring Class and Objects, Introduction to Methods, and this Keyword.	2	2

	7	Method Overloading, Using Objects as Parameters, Returning Objects, Recursion, Access Control, Static Members, Final Variables, Inner Classes, Command Line Arguments, Variable Length Arguments.	2	2
	8	Inheritance - Super Class, Sub Class, The Keyword super, protected Members, Method Overriding, the Object class, Abstract Classes and Methods, using final with Inheritance.	2	2
	9	Method Overloading and Overriding, Constructors and encapsulation.	2	2
	10	Discuss minimum one program ● Create a Java program with a class representing a student, including attributes like name, age, and grade. Demonstrate the instantiation of multiple student objects and access their properties. ● Develop a Java program with a class representing a bank account. Implement methods for deposit, withdrawal, and balance inquiry, utilizing the 'this' keyword to distinguish between instance variables and parameters. ● Write a program demonstrating method overloading for calculating the area of different shapes (e.g., circle, rectangle, triangle) by passing objects as parameters to the methods. ● Write a program showcasing the usage of final variables in Java, both as instance variables and local variables. Implement an inner class within another class and access its members. ● Create an abstract class representing a shape with abstract methods for calculating area and perimeter. Implement concrete subclasses (e.g., Circle, Rectangle) extending the abstract class. Also, demonstrate the usage of 'final' with methods and classes in the context of inheritance.	1	5
III	**PACKAGES, THREAD AND EXCEPTION HANDLING**		**9**	
	11	Packages and Interfaces - Defining Package, CLASSPATH, Access Protection, Importing Packages, Interfaces.	2	3
	12	Input/Output - I/O Basics, Reading Console Input, Writing Console Output, Print Writer Class, Object Streams and Serialization, Working with Files.	1	3
	13	Introduction, types of errors- Compile time errors and run time errors. Exception Handling - Checked Exceptions, Unchecked Exceptions, try Block and catch Clause, Multiple catch Clauses, Nested try Statements, throw, throws and finally.	2	3
	14	Multithreaded Programming - The Java Thread Model, The Main Thread, Creating Thread, Creating Multiple Threads, Synchronization, Suspending, Resuming and Stopping Threads.	1	3
	15	Discuss minimum two ● Create a package structure for a simple Java project, including multiple classes organized within different packages. Demonstrate how to define packages, set	3	5

		the CLASSPATH, and import packages into other classes. • Implement an interface representing a shape with methods for calculating area and perimeter. Create classes representing specific shapes (e.g., Circle, Rectangle) that implement the interface. • Create a Java program that demonstrates multithreading by creating multiple threads to perform different tasks concurrently. • Implement synchronization mechanisms to ensure thread safety when accessing shared resources, such as using synchronized methods or blocks. • Write a program that illustrates suspending, resuming, and stopping threads using thread control methods like suspend(), resume(), and stop(). • Write a Java program to implement a simple client-server application using sockets. Demonstrate how clients can connect to the server and exchange messages.		
IV	**JAVA LIBRARY AND COLLECTIONS**		**9**	
	16	Java Library - String Handling – String Constructors, String Length, Special String Operations -Character Extraction, String Comparison, Searching Strings.	2	4
	17	Collections framework - Collections overview, Collections Interfaces- Collection Interface.	2	4
	18	Event handling - Event Handling Mechanisms, Delegation Event Model	1	4
	19	Collections Class – Array List class. Accessing a Collection via an Iterator.	1	4
	20	Discuss minimum two • Create a program that demonstrates various String constructors by initializing String objects using different methods (e.g., literals, character arrays, String Buffer). • Write a program that calculates the length of a given String and displays it to the user. • Implement a program that performs special string operations such as extracting characters, creating substrings, comparing strings, and searching for specific substrings within a given string. • Create a program that utilizes the Array List class to store and manipulate a collection of objects. Implement operations such as adding, removing, and accessing elements from the Array List. • Develop a program that demonstrates how to access elements in an Array List using an Iterator.	3	5
V	**GRAPHICAL USER INTERFACE PROGRAMMING**		**9**	
	21	Introduction, Applet class, Applet Structure, Examples of Applet Program- , Applet Life Cycle,	2	4
	22	Creating an executable applet, Graphics, Graphic class-Lines and Rectangles, Circles and ellipse, Line graphs, Drawing Polygons, drawing arcs, Line graphs, Drawing bar	2	4

		charts		
	23	Swings fundamentals - Swing Key Features, Model View Controller (MVC), Swing Controls, and Components.	2	4
	24	• Develop an applet program that draws basic shapes such as lines, rectangles, circles, and ellipses using the Graphics class. • Implement a program that draws various polygons and arcs using the Graphics class.	3	5

Book of Study:

1. E Balagurusamy, "Programming with Java – A Primer", McGraw Hill, 2017.

Book of References:

2. Dr. K. Somasundaram, Programming in Java 2, Jaico publishing House, McGraw Hill,2018.
3. "Java the Complete Referenc" Java Seventh Edition,Herbert Schildt,
4. Deitel, Java: How to Program, Pearson Education
5. Java Programming, Schaum Outline Series.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand JAVA basics, primitive data type, master control system and explore operators.	R, U	PSO-4,5
CO-2	Relate the basic concepts and fundamentals of platform independent object-oriented language and apply it to do programs in JAVA.	U, Ap	PSO-4, 5, 7
CO-3	Demonstrate the skills in writing programs using exception handling techniques and multithreading.	R, U, Ap	PSO-4, 5, 7
CO-4	Administer the utilization of JAVA library and collections and able to solve real time applications using event handling concepts	R, U, Ap	PSO-4, 5, 7
CO-5	Experiment Graphical User Interface Programming to develop an APPLET program.	R, U, Ap	PSO-4, 5, 7

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

Note: 1 or 2 COs/module

Name of the Course: PROGRAMMING IN JAVA

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

CO	CO	PO/	Cognitive	Knowledg	Lecture	Practi

No.		PSO	Level	e Category	(L)/Tutorial (T)	cal (P)
CO-1	Understand JAVA basics, primitive data type, master control system and explore operators.	PO-7/ PSO-4,5	U, Ap	F, C	L	
CO-2	Relate the basic concepts and fundamentals of platform independent object-oriented language and apply it to do programs in JAVA.	PO-7/ PSO-4, 5, 7	U, Ap	C,P	L	P
CO-3	Demonstrate the skills in writing programs using exception handling techniques and multithreading.	PO-7/ PSO-4, 5, 7	R, U, Ap	C,P	L	P
CO-4	Administer the utilization of JAVA library and collections and able to solve real time applications using event handling concepts	PO-7/ PSO-4, 5, 7	R, U, Ap	C,P	L	P
CO-5	Experiment Graphical User Interface Programming to develop an APPLET program.	PO-7/ PSO-5	R, U, Ap	C,P	L	P

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

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1				2	2		3						2	
CO 2				2	2		3						2	
CO 3				2	2		3						2	1
CO 4				2	2		3						2	1
CO 5				2	2		3						2	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	✓	✓		

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK5SECPHY302.1				
Course Title	**Optics in Photography and Holography**				
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	2hours	-	1 hours	3
Pre-requisites	1. 2.				
Course Summary	The course is intended to equipped with the knowledge and skills needed to understand the basics of light, how cameras work, different types of photographic lenses, composition techniques, and the art of taking photos, including handling various light situations and conditions. With hands-on training, students will be able to experiment and enhance their photography skills.				

Module	Unit	Content	Hrs	CO
I		**BASICS OF LIGHT AND PHOTOGRAPHY**	**9**	
	1	Introduction, The role of lens in Photography- Imaging, Recording, Measurement, Extension , Self expression	1	1
	2	Properties of light-Transmission, Absorption, Reflection, Refraction, Dispersion, Interference, Diffraction, Scattering, Polarisation and Attenuation(Basics Only),	1	1
	3	Lens- Convergent and Divergent lens, Principal axis, and the optical centre of lenses Design, manufacture, and testing of a lens -Lens Design, Computer-aided Design, stages of production, Special fabrication Techniques, Lens-Testing routines, MTF testing routines	2	1
	4	Image formation by simple optical Systems of Images, Pinhole, Simple lenses- Definition, Focal length, Simple Mirrors-Plane Mirrors, Spherical Mirrors, Aspherical Mirrors, Image Characteristics	2	1
II		**OPTICAL COMPONENTS AND ABERRATIONS**	**9**	
	5	Lenses-Spherical lenses, Aspherical lenses, Mirrors-Curved mirrors, Plane mirrors, Beamsplitters, Optical flats, and windows	2	2
	6	Aberrations-Definition, Spherical aberration, Chromatic aberration	2	2
	7	Field Curvature, Coma, Astigmatism, Distortion	2	2

III	**THE OPTICS OF CAMERA MOVEMENTS AND CLOSE-UP PHOTOGRAPHY**		**9**	
	8	The optics of camera movements- Degrees of freedom, Lens covering power, Control of image sharpness, control of image shape	3	3
	9	Optics of closeup-photography- Magnification and subject area, Optical systems, Framing and focusing, Perspective and working distance, Depth of field, Illumination systems, Exposure considerations	3	3
IV	**OPTICAL FILTERS**		**9**	
	10	Optical filters-Spectral properties, Filter factor, Optical quality, Filter sizes, Focusing, Colour filters for Photography	2	4
	11	Haze Penetration, Ultraviolet and Infrared filters Graduated filters and vignette, Neutral density filters and attenuators, Direction sensitive filters	2	4
	12	Colour Splitter Systems, Colour enhancing filters, Tunable filters, Filters for darkroom use-safelight filters,filter for colour printing, Dichoric filters	2	4
V	**HOLOGRAPHY**		**9**	
	13	Principle of holography , recording of holograms	2	5
	14	Reconstruction of images, application of holography	2	5
	15	-different types of holograms - transmission and reflection types.	2	5

HANDS ON TRAINING

1. Refraction Experiment
2. Lens Focal length experiment
3. Camera Obscura Demonstration
4. Optical Filters Experiment
5. Aberration Demonstration
6. Close-Up photography Experiment
7. Photo editing using Photoshop CS3

BOOKS FOR STUDY:

1. Text Book of Optics: Subramaniam & Brijlal, .Avadhanulu, 23rd edition,2006
2. Applied Photographic Optics: Sidney F. Ray, Third Edition, Focal Press, 2002.
3. Optics and spectroscopy: R.Murugesan and K Sivaprasad, S. Chand & Co., 2010
4. Photoshop: Beginner’s Guide for Photoshop-Digital Photography, Photo Editing, Color Grading & Graphic ….19 February 216, David Maxwell
5. Adobe PhotoShop Class Room in a Book by Adobe Creative Team.

BOOKS FOR REFERENCE:

1. Optics: Eugene Hecht, Addison-Wesley 2002.
2. Optics in Photography: Rudolf Kingslake, SPIE Press,1992.

3. Optical Imaging and Photography:Introduction to science and Technology of optics, Sensors and Systems: Ulrich Teubner, Hans Jose Bruckner, de Grruyter,2019
4. Fundamentals of Optics: Jenkins and White, MCH
5. Fundamentals of Optics-Geometrical Physical and Quantum:D. R. Khanna and H. R. Gulati, R. Chand,1984
6. Modern Classical Optics: Geoffrey Brooker, Oxford University Press, 2003

HANDS ON TRAINING ON

1. Refraction Experiment
2. Lens Focal length experiment
3. Camera Obscura Demonstration
4. Optical Filters Experiment
5. Aberration Demonstration
6. Close-Up photography Experiment
7. Photo editing using Photoshop CS3

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand the basic principles of Photography and different types of lenses used	U	PSO-1,2
CO-2	Familiarize the phenomenon of aberration	R, U	PSO-1,2
CO-3	Understand the basic mechanism of camera optics	U	PSO-3,
CO-4	Differentiate different filters used in camera for photography	U, Ap	PSO-1,3
CO-5	Attain knowledge on principle of holography and its applications	U	PSO-1,2

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

Note: 1 or 2 COs/module

Name of the Course: OPTICS IN PHOTOGRAPHY AND HOLOGRAPHY

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

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Understand the basic principles of Photography and different types of lenses used	PO-5,6,/ PSO -1,2	U	F, C	L	P
CO-2	Familiarize the phenomenon of aberration	PO-5,6/ PSO	R, U	C, P	L	P

		-1,2				
CO-3	Understand the basic mechanism of camera optics	PO-5,6/ PSO -1,2	U	P	L	P
CO-4	Differentiate different filters used in camera for photography	PO-5,6/ PSO -1,2	U, Ap	C, P	L	P
CO-5	Attain knowledge on principle of holography and its applications	PO-5,6/ PSO -1,2	U	C	L	

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

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	1												1	
CO 2		1										1	2	
CO 3	2	2										2		
CO 4	2	2										1		
CO 5	2	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	✓	✓		✓

SEMESTER VI

Mar Ivanios College (Autonomous)

Discipline	PHYSICS
Course Code	MIUK6DSCPHY351.1
Course Title	**Atomic and Molecular Physics**
Type of Course	**DSC**
Semester	VI
Academic Level	300 - 399

Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	**4** hours	-	0 hours	4

Pre-requisites	1. Basic knowledge about atoms and molecules. 2. Basic knowledge about electromagnetic spectrum and quantum theory. 3. Basic ideas about Bohr model of atom and structure of hydrogen atom. 4. Basic ideas about influence of electric and magnetic fields on charges.
Course Summary	The course has the following major objectives: The course introduces students to the basic physics of atoms, molecules, their spectra and the interaction of light with matter including the study of influence of electric and magnetic fields on atoms with the help of Zeeman and Stark effect. The students are expected to learn spin of electrons, space quantisation, and effect of nuclear motion on atomic spectra, Raman effect, NMR, ESR, rotational, vibrational and electronic spectra of diatomic molecules.

Detailed Syllabus:

Module	Unit	CONTENTS	Hrs	CO
I		**ATOMIC SPECTRA & ATOMS IN EXTERNAL FIELDS** **(Book2 chapter 4 and Book3)**	**12**	
	1	Hydrogen atom spectrum	1	1
	2	Stern Gerlach experiment, Vector atom model	2	1
	3	Quantum states of electron in atoms	2	1
	4	Spin-orbit coupling (LS and JJ coupling schemes)	1	1
	5	Fine structure – Spectroscopic terms and selection rules	2	1
	6	Hyperfine structure	1	1
	7	Normal Zeeman effect	2	1
	8	Elementary Ideas of Anomalous Zeeman effect, Paschen Back effect and Stark effect	1	1
II		**MICROWAVE & INFRARED SPECTROSCOPY** **(Book1 chapters 6 and 7 and Book4 chapters 2 and 3)**	**13**	
	9	Classification of molecules, Rotational spectra of	3	1,2

		diatomic molecules, Intensity of spectral lines, Effect of isotopic substitution		
	10	The non-rigid rotor	1	1,2
	11	Rotational spectra of polyatomic molecules – Linear, symmetric top and asymmetric top molecules	2	1,2
	12	Microwave Oven	1	1,2
	13	Vibrational energy levels of diatomic molecules-harmonic oscillator and anharmonic oscillator (Morse Curve)	2	1,3
	14	IR spectra of vibrating diatomic molecule, selection rule	1	1,3
	15	Diatomic Vibrating rotator – selection rules, P, Q, R branches. Linear and symmetric top molecules	3	1,3
III	**ELECTRONIC SPECTROSCOPY OF MOLECULES (Book1 chapter 9 and Book4 chapter 6)**		**10**	
	16	Vibrational coarse structure: Progression and sequences	2	1
	17	The Franck-Condon principle	1	1
	18	Dissociation energy and dissociation products.	2	1
	19	Rotational fine structure of electronic vibration transitions	3	1
	20	Fortrat diagram, Pre-dissociation (elementary ideas)	2	1
IV	**RAMAN SPECTROSCOPY (Book1 chapter 8 and Book4 chapter 4)**		**13**	
	21	Quantum and Classical theory of Raman effect	3	4
	22	Pure rotational Raman Spectrum –linear, Symmetric and Spherical top molecule	3	4
	23	Vibrational Raman Spectra, mutual exclusion principle	2	4
	24	Instrumentation and methods: Raman spectrometer	2	4
	25	Structure determination from Raman and IR spectroscopy	3	4
V	**RESONANCE SPECTROSCOPY (Book1 chapters 10 and 11 and Book4 chapter 7)**		**12**	
	26	NMR principle-Resonance condition	2	5
	27	NMR spectrometer	1	5
	28	Chemical shift-indirect spin-spin Interaction	1	5
	29	Applications of NMR spectroscopy- NMR Imaging and Interpretation of NMR Spectra	2	5
	30	ESR principle- Resonance condition	2	5
	31	ESR spectrometer	1	5
	32	Hyperfine interaction	1	5
	33	Applications of ESR spectroscopy-Study of Free Radicals and Structural Determination, Advantages of ESR Spectroscopy	2	5

Books for study:

1. G Aruldas: “Molecular structure and Spectroscopy” Prentice Hall of India ,2002.

2. Modern Physics: R. Murugesan, S Chand & Co., Reprint, 2002
3. Atomic Physics: J B Rajam, S Chand & Co.,1980.
4. C N Banwell and E.M. McCash: "Fundamentals of Molecular Spectroscopy", Tata McGrow Hill.,1983.

Books for Reference:

1. Straughan and Walker (Eds): "Spectroscopy"- Vol. I and II (Chapman and Hall)
2. G.M. Barrow: "Introduction to molecular Spectroscopy", (McGraw Hill)
3. Modern Physics: G Aruldas and P Rajagopal, PHI, New Delhi, 2005.
4. Atomic Physics: Christopher J Foot, Oxford Master series in Physics,2005
5. J.M. Hollas, Modern Spectroscopy, Fourth Edition, John Wiley &Sons (2004)
6. Suresh Chandra, Molecular Spectroscopy, Narosa Publishing Co (2009)
7. H E White, Introduction to Atomic Spectroscopy McGraw-Hill Inc. 1st Edition. (1934).
8. D.N. Satyanarayana, Vibrational Spectroscopy-Theory and applications, New Age International Pvt Ltd (2004)
9. J.L. McHale, Molecular Spectroscopy, Pearson education Inc (2008).

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Identify and describe the rotational, vibrational and electronic energy states of various types of molecules and the interaction of electromagnetic radiation with molecules.	R, U	PSO-1,2
CO-2	Define and describe the microwave spectra of the molecule and compute various parameters	R, U, Ap	PSO-1,2
CO-3	Outline and explain the IR spectra of molecule and manipulate information about the molecule.	R, U, Ap	PSO-1, 2
CO-4	Describe, explain and construct molecular structure from combined analysis of Raman and IR spectra	R, U, Ap	PSO-1,2
CO-5	Recognise and infer the mechanism of spin resonances and interaction of electromagnetic radiations under resonance conditions of spin reorientation.	R, U	PSO-1,2

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

Name of the Course: ATOMIC AND MOLECULAR PHYSICS

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

CO No.	CO	PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Identify and describe the rotational, vibrational and electronic energy states of various types of molecules and the interaction of electromagnetic radiation with molecules.	PSO-1,2	R, U	F, C	L	
CO-2	Define and describe the microwave spectra of the molecule and compute various parameters	PSO-1,2	R, U, Ap	F, C	L	
CO-3	Outline and explain the IR spectra of molecule and manipulate information about the molecule.	PSO-1, 2	R, U, Ap	F, C	L	
CO-4	Describe, explain and construct molecular structure from combined analysis of Raman and IR spectra	PSO-1,2	R, U, Ap	F, C	L	
CO-5	Recognise and infer the mechanism of spin resonances and interaction of electromagnetic radiations under resonance conditions of spin reorientation.	PSO-1,2	R, U	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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO 1	2	1						2		2		2		
CO 2	2	2						2		3		2		
CO 3	2	1						2		2		2		
CO 4	2	12						3		2		2		
CO 5	2							2		2		2		

Correlation Levels:

Level	-	1	2	3
Correlation	Nil	Slightly / Low	Moderate / Medium	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	PHYSICS				
Course Code	MIUK6DSCPHY352.1				
Course Title	**Nuclear and Particle Physics**				
Type of Course	**DSC**				
Semester	VI				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	0 hours	4
Pre-requisites					
Course Summary	This course introduces the fundamental concepts of nuclear and particle physics. The first module comprises of the properties of nucleus and nuclear models. The nuclear decays and basics of radioactivity are discussed in the second module. The third module incorporates different types of nuclear reactions including fission and fusion, associated with nuclear science and technology as well as expanding the scope of application of radioactivity. The basics of particle physics, fundamental interactions and the dynamics of elementary particles under these forces are included in the fourth module. Fifth module explains the physical principles of various particle accelerators and detectors				

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs**	CO
I	**PROPERTIES OF NUCLEI AND NUCLEAR MODELS (Book:1 - Chapter: 11)**		**12**	
	1	Constituents of nucleus and their Intrinsic properties	2	1
	2	Binding energy, binding energy versus mass number curve, nuclear stability	2	1
	3	Nuclear forces- properties	1	1
	4	Meson theory	2	1
	5	Liquid drop model -semiempirical mass formula and significance of various terms	2	1
	6	Assumptions of Shell model-evidence for nuclear shell structure, nuclear magic numbers	2	1
	7	Collective model	1	1
II	**RADIOACTIVITY (Book: 1 - Chapter: 12; Book: 2 – Chapter: 34)**		**12**	
	1	Basics of radioactivity, properties of α, β and γ	1	2
	2	Law of radioactive disintegration, Half life, mean life	2	3

	3	Law of successive disintegration, Radioactive equilibrium (Transient, Secular)	2	3
	4	Basics of α-decay processes, theory of α-emission, α-ray spectrum, Geiger Nuttal law	3	2
	5	Beta decay- beta ray spectrum, Pauli's neutrino hypothesis, positron emission, electron capture	3	2
	6	Gamma decay, Gamma ray spectrum, internal conversion	1	2
III		**NUCLEAR REACTIONS (Book: 1 – Chapter: 12; Book: 2 - Chapter 34; Book: 4 – Chapter: 19)**	**12**	
	1	Types of Reactions, Conservation Laws	1	4
	2	Kinematics of reactions, Q-value- reaction rate- reaction cross section	2	4
	3	Reaction mechanism-Concept of direct reaction mechanism and compound nucleus.	2	4
	4	Nuclear fission-Bohr and Wheeler's theory	1	4
	5	Chain reaction -multiplication factor-critical size-atom bomb	2	4
	6	Nuclear fusion-sources of stellar energy, thermonuclear reactions-hydrogen bomb	2	4
	7	Controlled thermo-nuclear reactions, plasma confinement basics (magnetic bottle-Tokamak- inertial confinement).	2	4
IV		**PARTICLE PHYSICS (Book: 1 – Chapter: 13; Book: 3 - Chapter 18)**	**12**	
	1	Classification of elementary particles, basic features, Fundamental interactions	4	5
	2	Quantum numbers - Baryon number, Lepton number, Isospin, Hypercharge, Strangeness	2	5
	3	Symmetries and Conservation Laws	3	5
	4	Concept of quark model and standard model	3	5
V		**PARTICLE DETECTORS AND ACCELERATORS (Book: 2 – Chapter: 29 & 30; Book: 4 – Chapter: 20; Book: 5 – Chapter: 2&9)**	**12**	
	1	Charged particle interaction with matter- Range, stopping power, The Bethe Bloch Formula (qualitative only)-Interaction of Radiation with matter	4	6
	2	Particle detectors - GM counter, scintillation counter, Resistive Plate Chambers	4	6
	3	Particle Accelerators - Linear accelerator, Cyclotron, Synchrotron, betatron	3	6
	4	Large Hadron Collider (Qualitative concepts only)*	1	6

Books for study:

1. Concepts of Modern Physics: Arthur Beiser, Mc Graw Hills, Fifth Edition, 1995
2. Modern Physics – R Murugesan, S. Chand & Co., 2008
3. Nuclear Physics- D C Tayal, Himalaya Publication House, Fifth Edition, 2009
4. Modern Physics – G Aruldhas, PHI, 2018
5. Techniques for Nuclear and Particle Physics Experiments: A How-to Approach, Second Revised Edition, W. R. Leo, Springer-Verlag

Books for reference:

1. Atomic and Nuclear Physics, N Subramaniam and Brijlal, S. Chand & Co.
2. Nuclear Physics, S N Ghoshal, S. Chand & Co.
3. Introduction to Elementary Particles, D Griffith, John Wiley & sons
4. Introductory Nuclear Physics, Kenneth S Krane, Wiley India Pvt. Ltd. 2008
5. Gaseous radiation detectors: Fundamentals and Applications, Fabio Sauli, Cambridge University Press.
6. The Quantum Frontier :The Large Hadron Collider :Don Lincoln, Johns Hopkins University Press,2009

Web Resources

1. https://nptel.ac.in/courses/115102017
2. *https://www.space.com/large-hadron-collider-particle-accelerator (LHC)

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Identify nuclear constituents and general properties of nuclei and distinguish different nuclear models	U	PSO-1
CO-2	Describe the phenomenon of radioactivity	R, U	PSO-1
CO-3	Discuss and apply the basic idea of radioactivity for the mathematical formulation.	U, Ap	PSO-1,2
CO-4	Interpret different types of nuclear reactions, fission & fusion energies and applications	U, Ap	PSO-1,2
CO-5	Classify the elementary particles and relate their properties	U	PSO-1,2
CO-6	Delineate the application of different particle detectors and accelerators	Ap	PSO-1,2

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

Note: 1 or 2 COs/module

Name of the Course: NUCLEAR AND PARTICLE PHYSICS

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

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Identify nuclear constituents and general properties of nuclei and distinguish different nuclear models	1/1	U	F, C	L	
CO-2	Describe the phenomenon of radioactivity	1/1	R, U	F,C	L	
CO-3	Discuss and apply the basic idea of radioactivity for the mathematical formulation.	1,2/1,2	U, Ap	C	L	
CO-4	Interpret different types of nuclear reactions, fission & fusion energies and applications	1/1,2	U, Ap	F,C	L	
CO-5	Classify the elementary particles and relate their properties	1/1,2	U	F, C	L	
CO-6	Delineate the application of different particle detectors and accelerators	1/1,2	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	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	1		-	-	-	-		1						
CO 2	2		-	-	-	-		2						
CO 3	2	2	-	-	-	-		2	2					
CO 4	2	2		-	-	-		2						
CO 5	2	2	-	-	-	-		2						
CO 6	2	2		-	-	-		2						

Correlation Levels:

Level	**-**	**1**	**2**	**3**

Correlation	Nil	Slightly / Low	Moderate / Medium	Substantial / High

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

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

Mar Ivanios College (Autonomous)

Discipline	PHYSICS
Course Code	MIUK6DSCPHY353.1
Course Title	**Solid State Physics**
Type of Course	**DSC**
Semester	VI
Academic Level	300 – 399

Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	0	4

Pre-requisites	1. 2.
Course Summary	This course is designed to introduce the structure, electronic, and other fundamental properties of solids to the students. This course covers the detailed representation of crystal structure, symmetries in solid, x-ray diffraction, bonding, transport properties, electronic structure, vibration of the lattice, outline of magnetism, and superconductivity.

Detailed Syllabus:

Module	Unit	Content	Hrs	CO No
I		**CRYSTAL STRUCTURE (Book 1)**	**12**	
	1	Basic Crystal Structure- Unit cell: primitive cell structures- Symmetry operations	2	1
	2	Crystal types- Indices of a lattice direction and a lattice plain- Crystal point groups and space groups	2	1
	3	Common crystal structures	1	1
	4	Reciprocal lattice- Bragg's law, Miller indices	2	1
	5	Laue's interpretation- Construction of a reciprocal lattice and applications	2	1
	6	X-ray diffraction Technique- Powder diffraction method.	1	1
	7	Electron and neutron diffraction techniques	2	1
II		**FREE ELECTRON THEORY AND BAND THEORY OF SOLIDS (Book 1)**	**12**	
	8	The Drude - Lorentz theory: Electrical, thermal conductivity and specific heat	2	2
	9	The Sommerfield model: Fermi surface and Fermi energy	3	2
	10	The electronic heat capacity- Wiedmann-Franz Law - Hall effect	2	2
	11	Bloch Theorem	1	2

	12	Kronig-Penney Model	3	2
	13	Brillouin Zones (Basic concepts only)	1	2
III		**MAGNETIC PROPERTIES OF MATERIALS (BOOK 2)**	**12**	
	14	Classification of magnetic materials-Origin of permanent magnetic moments	1	3
	15	Langevin's classical theory of diamagnetism	2	3
	16	Langevin's classical and quantum theory of paramagnetism	3	3
	17	Ferromagnetism- Temperature dependence of spontaneous magnetisation	2	3
	18	Ferromagnetic domains and Domain theory	2	3
	19	Antiferromagnetism-ferrimagnetism and ferrites (Basic concepts)	1	3
	20	Multiferroics and Giant Magnetic Resistance (Basic concepts only)	1	3
IV		**SUPERCONDUCTIVITY (Book 3)**	**12**	
	21	Superconductor- Properties, Critical Temperature	1	4
	22	Critical magnetic field- Meissner effect- Type I and Type II superconductors	2	4
	23	Origin of energy gap- Isotope effect	2	4
	24	London's Equations - London Penetration Depth-Coherence length	2	4. 5
	25	BCS theory	2	4,5
	26	dc and ac Josephson Effect	1	4,5
	27	High Temperature superconductivity, Metallic superconductors- Superconductivity in fullerenes-Applications of superconductivity (Basic concepts only)	2	4
V		**DIELECTRIC PROPERTIES OF MATERIALS (Book 3)**	**12**	
	28	Polarisation-Local electric field at an atom, Sources of polarisability	2	6
	29	Dielectric constant and its measurements, Electric susceptibility	2	6
	30	Polarizability- (Dipolar, Ionic and Electronic)-Clausius -Mossotti Equation	3	6
	31	Dipolar polarizability - Classical Theory	3	6
	32	Piezo, Pyro and ferro electric properties of crystals (Derivations not required)	1	6
	33	Ferroelectricity and ferroelectric domains-Qualitative ideas only	1	6

BOOKS FOR STUDY:

1 Elements of Solid-State Physics, J. P Srivastava, Prentice Hall of India 2015 Fourth Edition

2 Elementary Solid-State Physics- Principles and Applications, M. Ali Omar, Pearson Education inc. 2011
3 Solid state Physics- Structure and properties of Materials, M. A Wahab, Narosa Publishing House Third Edition

BOOKS FOR REFERENCE:

1 Introduction to Solid State Physics: Charles Kittel, Wiley India Pvt. Ltd., 8 th Edn., 2004
2 Solid State Physics- S. O. Pillai, New Age international Publishers 10th Edition
3 Introduction to Solids: Leonid V. Azaroff, Tata Mc-Graw Hill, 2004
4 Solid State Physics: Neil W. Ashcroft and N. David Mermin, Cengage Learning, 1976
5 Solid State Physics: Rita John, McGraw Hill, 2014

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Identify different crystal systems, reciprocal lattice and diffraction techniques.	U, Ap	1,2
CO-2	Understand the theories of electrical and thermal conduction	U, Ap	1,2
CO-3	Understand the magnetic properties of different materials	U, Ap	1, 4
CO-4	Understand the phenomena of superconductivity	R. Ap	2, 4
CO-5	Discuss the theoretical formulations of superconductors and applications	U	1, 2
CO-6	Understand and evaluate dielectric properties of materials	U, Ap	1,2

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

Note: 1 or 2 COs/module

Name of the Course: SOLID STATE PHYSICS

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

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Identify different crystal systems, reciprocal lattice and diffraction techniques.	1/1,2	U, Ap	F, C	L	
CO-2	Understand the theories of electrical and thermal conduction	1/1,2	U, Ap	F, C	L	
CO-3	Understand the	1/1,	U, Ap	C	L	

	magnetic properties of different materials	4				
CO-4	Understand the phenomena of superconductivity	1/2, 4	R. Ap	F	L	
CO-5	Discuss the theoretical formulations of superconductors and applications	1/1, 2	U	C	L	
CO-6	Understand and evaluate dielectric properties of materials	1/1,2	U, Ap	C	L	

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

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2	2						1						
CO 2	2	1						1						
CO 3	2	1						1						
CO 4		2		2				1						
CO 5	2	1						1						
CO 6	1	2						1						

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

	Internal	Assignmen	Project	End Semester

	Exam	t	Evaluation	Examinations
CO 1	✓	✓		✓
CO 2	✓			✓
CO 3	✓			✓
CO 4	✓			✓
CO 5	✓			✓
CO 6	✓			✓

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK6DSEPHY351.1				
Course Title	**Operational Amplifiers and Applications**				
Type of Course	**DSE**				
Semester	VI				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	1. 2.				
Course Summary	This course aims to get a thorough knowledge of analog ICs. It also helps to understand instrumentation techniques and get an idea regarding transducers.				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**OPERATIONAL AMPLIFIERS (Book 2, Chapter 25)**	**9**	
	1	Emitter Coupled Differential amplifier, Block diagram of Op-Amp	1	1
	2	Concept of Virtual ground Characteristics of Op-Amp, Op-Amp parameters - Input resistance, Output resistance, Common Mode Rejection Ratio (CMMR), Slew rate, offset voltages	2	1
	3	Basic Op-Amp circuits - Inverting Op-Amp, Non-inverting Op-Amp	2	1,3
	4	Op-Amp as: Summing amplifier, Subtractor, Comparator, Voltage follower	2	1,3
	5	Integrator, and Differentiator	2	1,3
II		**ACTIVE FILTERS (Book 1, Chapter 8)**	**9**	
	6	Introduction, Active Filters (different types- qualitative idea only)	1	2
	7	First Order Low Pass Butterworth filter: filter design and frequency scaling	3	2
	8	First Order High Pass Butterworth filter	3	2
	9	Band-Pass Filter: Wide Band-Pass Filter	1	2
	10	Band Reject Filters: Wide Band-Reject Filter	1	2
III		**OP-AMP OSCILLATORS (Book 1, Chapter 8)**	**9**	
	11	Oscillator types, frequency stability	1	3
	12	Phase Shift Oscillator	1	4
	13	Wien Bridge oscillator	1	4

	14	Quadrature Oscillator	1	4
	15	Square Wave Generator, Triangular Wave Generator (derivations not required)	3	4
	16	Sawtooth Wave Generator (derivations not required)	2	4
IV	**SPECIALISED IC APPLICATIONS (555 TIMER) (Book 1, Chapter 10)**		**9**	
	17	The 555 Timer – block diagram	2	2
	18	The 555 Timer as a Monostable Multivibrator	1	2,4
	19	Monostable Multivibrator applications: frequency divider, pulse stretcher	2	4
	20	The 555 Timer as an Astable Multivibrator	2	4
	21	Astable multivibrator applications: square wave oscillator, free running ramp generator	2	4
V	**TRANSDUCERS AND INSTRUMENTATION (Book 3, Chapter 36,37)**		**9**	
	22	Transducers and its Classification	1	5
	23	LVDT - Piezoelectric Transducer - Strain Gauge	2	5
	24	Temperature Transducers – Resistance Temperature Detectors - Thermistors - Thermocouples	2	5
	25	Various Types of Microphones- Loudspeaker	1	5
	26	Analog and Digital Instruments - Essentials of an Electronic Instrument - Multimeter	1	5
	27	Cathode Ray Oscilloscope - Cathode Ray Tube - Deflection Sensitivity of CRT, Digital Storage Oscilloscope (working principles only)	2	6

Practicals

Part A (At least 5 Experiments to be performed)

1. FET characteristics: (i) To plot the static drain characteristics of FET (ii) To calculate the FET parameters (drain dynamic resistance, mutual conductance and amplification factor at a given operating point).
2. Hartley oscillator: To observe the output wave form and to measure the frequency of oscillations
3. Phase shift oscillator: (i) Trace the circuit (ii) To measure the frequency from the output waveform
4. OP Amp as Summing amplifier and Comparator (Zero crossing detector)
5. OP amp. - Inverting amplifier using IC 741 (i) Trace the circuit (ii) To construct an inverting amplifier using IC 741 and determine its voltage gain for different input voltages.

6. OP amp. – Non-inverting amplifier using IC 741 (i) Trace the circuit (ii) To construct a Non-inverting amplifier using IC 741 and determine its voltage gain for different input voltage
7. Astable Multivibrator using IC 555- To design and set up an astable multivibrator using 555 timer for a frequency of 1 kHz.
8. Monostable Multivibrator using IC 555 - To design a monostable multivibrator using 555 timer for 1 ms pulse width.
9. First Order Low pass filter using IC 741.

Part B (At least 5 Experiments to be performed)

1. Operational Amplifier - Integrator
2. Operational Amplifier - Differentiator
3. First Order High pass filter using IC 741.

Books for Study:

1. Op Amps and Linear Integrated Circuits by Ramakant A Gayakwad
2. Principles of Electronics: V. K. Mehta and Rohit Mehta, S. Chand Ltd.,2020 Edition
3. Basic Electronics-Solid State: B. L. Theraja, S. Chand Ltd. 2005

Books for Reference :

1. Basic Electronics: Devices, circuits and IT fundamentals: Santiram Kal, PHI, 2010
2. Linear Integrated Circuits- D Roy Choudhury and Shail B Jain
3. Integrated Electronics by Jacob Millman& C Halkias (Tata McGraw Hill).

COURSE OUTCOMES

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand the concept of differential amplifier	U, R	1
CO-2	Describe the Op-Amp IC 741 and IC 555 Timer	U	1
CO-3	Apply the concepts of op-amp in electronic functions	Ap	2
CO-4	Construct waveform generators using IC 741 and IC 555 Timer	Ap	5
CO-5	Understand the basics of different transducers	U	1
CO-6	Apply the concepts of transducers in instrumentation	Ap	2

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

Note: 1 or 2 COs/module

Name of the Course: OPERATIONAL AMPLIFIERS AND APPLICATIONS

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

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Understand the concept of differential amplifier	PO1/ PSO 1	U, R	F	L	
CO-2	Familiarising the Op-Amp IC 741 and IC 555 Timer	PO 1/PS O 1	U	C	L	
CO-3	Apply the concepts of op-amp in electronic functions	PO 1/PS O 2	Ap	C	L	P
CO-4	Construct waveform generators using IC 741 and IC 555 Timer	PO 1/PS O 5	Ap	C,P	L	P
CO-5	Understand the basics of different transducers	PO 1/PS O1	U	C, P	L	
CO-7	Apply the concepts of transducers in instrumentation	PO 1/PS O 2	Ap	C	L	

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

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2							2						
CO 2	2							2						
CO 3		2						2						
CO 4					2			2						
CO 5	2							2						
CO 6		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	✓			✓

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK6DSEPHY352.1				
Course Title	**Applied Optics**				
Type of Course	**DSE**				
Semester	VI				
Academic Level	300 – 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 Hrs
Pre-requisites					
Course Summary	The course on Applied Optics delves into advanced topics including holography for three-dimensional imaging, optical fibers for communication and sensing applications, nonlinear optics for manipulating light properties, optical sensors for detection and measurement purposes, and biophotonics for applications in biological and medical sciences. Students explore practical applications and theoretical principles underlying these optical technologies, gaining insights into their significance across various fields such as telecommunications, healthcare, and scientific research.				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**HOLOGRAPHY**	**8**	1
	1	Principle of holography, recording of holograms, reconstruction of images, theory, requirements, distinguishing characteristics of holograms.	4	1
	2	Different types of holograms, transmission and reflection types.	2	1
	3	Applications of holography	2	1
II		**OPTICAL FIBERS**	**9**	
	4	Introduction, total internal reflection, optical fibre, step index fibre, Graded index fibre, Coherent bundle, the numerical aperture	3	2
	5	Attenuation in optical fibre, single mode fibre, multimode fibre, power law profile	2	2
	6	Pulse dispersion in multimode fibre: Ray Dispersion in Multimode Step Index Fibers, Material Dispersion.	2	2
	7	Fibre sensors (qualitative), fibre optic communication (qualitative), Advantages of fibre optic communication system.	2	2
III		**NON-LINEAR OPTICS**	**9**	
	8	Harmonic generation- second harmonic generation-phase matching, third harmonic generation	4	3

	9	Optical mixing, parametric generation of light, self-focusing of light	2	3
	10	Multiquantum photoelectric effect, two photon processes and theory of two photon processes	2	3
	11	Multiphoton processes- three photon processes, second harmonic generation	1	3
IV	**BIO PHOTONICS**		**10**	
	12	Photobiology—At the Core of Biophotonics, Interaction of Light with Cells, Light Absorption in Cells, Light-Induced Cellular Processes, Photochemistry Induced by Exogenous Photosensitizers.	3	4
	13	Interaction of Light with Tissues, Photoprocesses in Biopolymers- The Human Eye and Vision, Photosynthesis	3	4
	14	In Vivo Photoexcitation, Free-Space Propagation, Optical Fiber Delivery System, Articulated Arm Delivery, Hollow Tube Waveguides	2	4
	15	In Vivo Spectroscopy, Optical Biopsy, Single-Molecule Detection	2	4
V	**NANO PHOTONICS**		**9**	
	16	Introduction to nanophotonics-breaking through diffraction limit, evanescent waves, nanophotonics and its true nature	2	5
	17	Foundations of nanophotonics: photons and electrons; similarities and differences, free space propagation, confinement of photons and electrons, propagation through classically forbidden zone: tunnelling.	2	5
	18	Localization under a periodic potential: band gap, Cooperative effects for photons and electrons.	2	5
	19	Nanoscale optical interactions, nanoscale confinement of electronic interactions; nanoscale electronic energy transfer, Near field interaction and microscopy, nanoscale enhancement of optical interactions.	3	5

Books for study:

1. Optics by Ajoy Ghatak 7th edition
2. Laser and Non-linear Optics by B B Laud
3. Introduction to Biophotonics by P N Prasad
4. Principles of nanophotonics by Motoichi Ohtsu , Kiyoshi Kobayashi, Tadashi Kawazoe, Takashi Yatsui
5. Nanophotonics by Paras N Prasad

Books for reference:

1. Optics: Eugene Hecht, Addison-Wesley 2002
2. Nonlinear Optics by Robert W Boyd
3. Biophotonics: Concepts to Applications by Gerd Keiser
4. Introduction to Nanophotonics by Sergey V. Gaponenko

PRACTIALS

(15 Weeks with 2 hours of laboratory session per week)

Part A

At least **five** experiments to be performed from the following list

1. Optical fibre characteristics – numerical aperture of an optical fiber
2. Attenuation in Optical fiber
3. Bandwidth of given optical fiber.
4. Fiber optic testing (i) fiber continuity test using light source and power meter (ii) cable loss test
5. Characteristics light detectors
   (i) Photodiode
   (ii) LDR
6. Study of photoelectric effect and determination of of Planck's constant

Part B

At least **ONE** experiments to be performed from the following list

1. Bio photonics box experiments: Light penetration, Fluorescence, Sunscreen, Lightscatteringandpropagation.
2. Recording and reconstruction of a transmission hologram.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Expalin the process of holographic imaging and the principles behind the formation of three-dimensional images from holographic recordings.	U	PSO-1,2,3,5,6
CO-2	Explain the basic principles of optical fiber, propagation of light through optical fiber, attenuation in optical fiber and applications of optical fibers	U, Ap	PSO-1,2,3,5,6
CO-3	Explain the mechanism behind non-linaer optical phenomena such as harmonic generations, optical mixing, multiphoton process etc.	R, U	PSO-1,2,3,5
CO-4	Explain the fundamental concepts of bio photonics, such as light tissue interactions and the principles of biphotonic imaging technique.	U	PSO-1,2,3,5
CO-5	Explain the basic principles of light matter interactions in the nanoscale.	R, U	PSO-1,2,3,5

CO-6	Apply theoretical knowledge in designing, conducting, and interpreting experiments in applied optics to solve real-world problems effectively.	U, Ap, An	PSO-1,2,3,5

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

Note: 1 or 2 COs/module

students will be proficient, enabling them to

Name of the Course: APPLIED OPTICS

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

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Expalin the process of holographic imaging and the principles behind the formation of three-dimensional images from holographic recordings.	PSO-1,2,3,5,6 PO-1,2	U	F, C	L and T	
CO-2	Explain the basic principles of optical fiber, propagation of light through optical fiber, attenuation in optical fiber and applications of optical fibers	PSO-1,2,3,5,6 PO-1,2	U, Ap	F, C	L	
CO-3	Explain the mechanism behind non-linaer optical phenomena such as harmonic generations, optical mixing, multiphoton process etc.	PSO-1,2,3,5 PO-1,2	R, U	F, C	L	
CO-4	Explain the fundamental concepts of bio photonics, such as light tissue interactions and the principles of biphotonic imaging technique.	PSO-1,2,3,5 PO-1,2	U	F, C	L	
CO-5	Explain the basic principles of light matter interactions in the nanoscale.	PSO-1,2,3,5 PO-1,2	R, U	F, C	L	
CO-6	Apply theoretical knowledge in designing, conducting, and interpreting experiments in applied optics to solve real-world problems	PSO-1,2,3,5 PO-1,2	U, Ap, An	F, C	-	P

	effectively.					

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

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2	2	2		2			3	2					
CO 2	2	2	2		2			3	2					
CO 3	3	2	2		1			3	2					
CO 4	3	2	2		1			3	2					
CO 5	3	2	2		1			3	2					
CO 6	1	2	1		2			3	2					

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

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

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK6DSEPHY353.1				
Course Title	**Numerical Methods in Physics**				
Type of Course	**DSE**				
Semester	VI				
Academic Level	300 - 399				
Course Details	Credit	Lecture Hr per week	Tutorial Hr per week	Practical Hr per week	Total Hours/Week
	4	3	-	2	5
Pre-requisites	1. Knowledge of programming languages such as Python/C++ 2.				
Course Summary	By the end of the course, students will acquire a solid foundation in different numerical methods for solving complex problems in theoretical and applied physics. They will construct programs in python/C++ to solve the problems using these techniques. Students will be equipped to apply the techniques in their higher studies and research in areas such as Computational Physics and statistical data Analysis.				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**ROOTS OF EQUATIONS (Chapter 6,7,8)**	**9**	
	1	Bi-Section Method, False Position Method,	3	1
	2	Newton-Raphson Method, Secant Method,	3	1
	3	Two Equation Newton-Raphson Method, Mullers Method	3	1
II		**ROOTS OF EQUATIONS II (Chapter 6,7,8)**	**9**	
	4	Gauss elimination method, Gauss elimination with pivoting,	3	1
	5	Gauss-Jordan method, Computing Matrix Inverse	3	1
	6	Jacobi Iteration Method, Gauss-Seidel Method	3	1
III		**CURVE-FITTING (Chapter 9,10)**	**9**	
	7	Linear Interpolation, Lagrange Interpolation, Newton Interpolation	3	2
	8	Interpolation with Equidistant Points, Forward, Backward difference Table	3	2
	9	Fitting Linear Equation: Least Square Method , Fitting Polynomial Function	3	2

IV	**NUMERICAL DIFFERENTIATION AND INTEGRATION (Chapter 11,12)**		**9**	
	10	Differentiating continuous functions: Forward difference only	2	3
	11	Differentiating tabulated functions	3	3
	12	Trapezoidal Rule, Simpson's 1/3 rule, Simpson's 3/8 rule, Boole's Rule	4	3
V	**ORDINARY & PARTIAL DIFFERENTIAL EQUATIONS (Chapter 13,15)**		**9**	
	13	Taylor Series Method, Eulers Method	2	4
	14	Rung Kutta Methods	2	4
	15	Elliptic Equation: Laplace Equation	3	4
	16	Parabolic Equation : Heat Equation	2	4

Practicals

Section A Attempt Any Five		**CO**
1	Root of a nonlinear equation using the bisection method	5
2	Root of an equation by false position method	
3	Root of an equation by Newton-Raphson method	
4	Root of a nonlinear equation by secant method	
5	Root of a polynomial using Muller's method	
6	Solution of first order differential equation using Runge-Kutta method	
7	Integrate a given function using trapezoidal rule	
8	Integrate a given function using the Simpsons 1/3 rule	
9	Integrate a given function using the Simpsons 3/8 rule	
10	Least square fitting	
Section B Attempt Any One		
1	Numerical interpolation using Newton and Lagrangian methods	
2	Program to solve a system of linear equations using simple Gaussian elimination method	
3	Solution of the first order differential equation at a given point using Euler's method	
4	First derivative of tabulated function by difference table	

Books for study:

1. Numerical Methods , E Balaguruswamy McGraw Hill Education

Books for Reference:

2. S. S. Sastry, Introductory method of Numerical analysis, Fifth Edition, PHI (2012).
3. Numerical methods: Dr. V. N. Vedamurthy and Dr. N. Ch. S. N. Iyengar, Vikas Publishing House, Pvt Ltd. New Delhi, India
4. P. Ghosh, Numerical Methods with computer programs in C++,PHI learning Pvt Ltd
5. Introduction to Numerical Analysis, F.B.-Hildebrand, Second Edition
6. Numerical Methods for Scientists and Engineers Richard Hamming.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand and apply different methods to find the roots of nonlinear equations to solve problems.	U, Ap	PSO-2
CO-2	Understand and apply different interpolation methods and curve fitting methods.	U, Ap	PSO-2
CO-3	Understand different methods of numerical differentiation and integration and apply those methods to solve problems.	U, Ap	PSO-2
CO-4	Understand the methods to solve ordinary and partial differential equations.	U, Ap	PSO-2
CO-5	Create programs in C^{++} or python for solving problems using different Numerical Techniques.	U, Ap	PSO-2,5

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

Note: 1 or 2 COs/module

Name of the Course: NUMERICAL METHODS IN PHYSICS

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

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Understand and apply different methods to find the roots of nonlinear equations to solve problems.	1/2	U, Ap	F, C, P	L	
CO-2	Understand and apply different interpolation methods and curve fitting methods.	1/2	U, Ap	C,P	L	
CO-3	Understand different methods of	1/2	U, Ap	C,P	L	

	numerical differentiation and integration and apply those methods to solve problems.					
CO-4	Understand the methods to solve ordinary and partial differential equations.	1/2	U, Ap	C,P	L	
CO-5	Create programs in C^{++} or python for solving problems using different Numerical Techniques.	1,7/2 ,5	U, Ap	C, P	P	

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

Mapping of COs with PSOs and POs :

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

Correlation Levels:

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

	High

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

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

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK6SECPHY351.1				
Course Title	**Scientific Writing**				
Type of Course	**SEC**				
Semester	VI				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Hands on Training per week	Total Hours/Week
	3	3 hours	-	-	3 Hr
Pre-requisites	1.				
Course Summary	The course on Scientific Writing typically aims to equip students with the necessary skills and knowledge to undertake research effectively. It enables the students with the essential knowledge, skills, and competencies to engage in demanding, ethical, and impactful research practice across various disciplines and professional settings.				

Detailed Syllabus: Scientific Writing

Module	Unit	Content	Hrs	CO
I		**INTRODUCTION TO RESEARCH**	**9**	
	1	Meaning and Objectives of Research, Significance of Research, Criteria for good research, Meaning of Research design, Need for Research design, Features of a Good Design Book :1, Chapter1,3	4	1
	2	Validity and reliability in research (basic information only), hypothesis- sources of hypothesis, types of hypothesis, characteristics of good hypothesis Book :2, Chapter 3, 4	2	1
	3	**Training** Familiarising any one document editing software	3	6
II		**DATA COLLECTION AND PRESENTATION**	**9**	
	4	Data collection and analysis – Introduction, Need for data collection Book : 2, Chapter 5	1	1
	5	Methods of data collection, principles for accessing research data Book : 2, Chapter 5	3	1
	6	Presentation of data, error analysis- types of errors. Book : 2, Chapter 5	2	1

	7	Training Preparing a slide presentation using any one software	3	6
III		**RESEARCH IN PRACTICE**	**9**	
	8	Literature review, Need for Literature review, Writing a Literature review Book : 2, Chapter 6	2	2
	9	Research ethics – importance, values and principles, plagiarism (basic information only) Book : 2, Chapter 8	1	2,3
	10	Publication Types in Journals- Short communication, Rapid communication, Research paper, Review paper, Conference Proceedings Book : 2, Chapter 6	2	2
	11	Indexing - Journal impact factor, citation index, h- index, g-index, hg-index (basic information only) Book : 2, Chapter 6	1	2,3
	12	Practices Writing literature review and plagiarism checking	3	5
IV		**SCIENTIFIC PAPER WRITING**	**9**	
	13	Scientific paper – Title, Abstract, Keywords, Introduction, Materials and Methods, Results and Discussion, Conclusion, acknowledgements, References. Book : 2, Chapter 7	2	4
	14	Writing a scientific paper, Importance of scientific writing, Characteristics of scientific writing, Rules for scientific writing. Book : 2, Chapter 7	2	4
	15	Communicating to a Journal- Submission methods, Peer review (basic informations only). Book : 2, Chapter 7	2	4,5
	16	Practices Writing a model scientific paper	3	4,5
V		**Softwares**	**9**	
	17	Basics of Latex – Document Structure, Typesetting Text, Tables, Figures, Equations, References Book : 3	6	6
	18	Training Creating a scientific document using Latex	3	6

Books for Study:

1. C.R. Kothari, *Research Methodology Methods and Techniques*, New Age International Publishers (2013).
2. K.Prathapan, *Research Methodology for Scientific Research*, I.K International Publishing House Pvt. Ltd. (2014).

3. Latex for beginners Work book 5th edition, Document Reference:3722-2014, March 2014

Books for Reference :

1. Research Methods Design, and Analysis, Larry B. Christensen, R. Burke Johnson, Lisa A Turner, Eleventh edition, Pearson (2015).
2. Research Methodology, Ranjit Kumar, Sage Publications (2012).
3. Fundamentals of Research Methodology and statistics: Yogesh Kumar Singh, New Age international Publications
4. Ethics in science education, research and governance: Edited by Kambadur Muralidhar, Amit Ghosh, Ashok Kumar Singhvi, Indian National Science Academy
5. L. Lamport, *LATEX: A Document Preparation System, User's Guide and Reference Manual*, Addison- Wesley.

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Understand Research Principles and design research	U	PSO- 2
CO-2	Understand the need for Literature review, Familiarise with different types of journal publications and Literature reviewing.	U	PSO- 2
CO-3	Recognize and understand the importance, values, and principles of research ethics	R,U	PSO- 8
CO-4	Inculcate a culture of integrity, transparency, and accountability in research and scientific writing	U, Ap	PSO- 6
CO-5	Interpret and apply research findings	Ap	PSO- 6
CO-6	Enhance skills in communicating research findings	Ap	PSO- 6

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

Note: 1 or 2 COs/module

Name of the Course: SCIENTIFIC WRITING

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

CO No.	**CO**	**PO/ PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture (L)/Tutorial (T)**	**Hands on Training (H)**
CO-1	Understand Research Principles and design research	PSO - 2	U	F, C	L	
CO-2	Understand the need for Literature review, Familiarise with different types of journal publications and Literature reviewing.	PSO - 2	U	F, C	L	

CO-3	Recognize and understand the importance, values, and principles of research ethics	PSO - 8	R,U	C	L	
CO-4	Inculcate a culture of integrity, transparency, and accountability in research and scientific writing	PSO - 6	U, Ap	C, P	L	
CO-5	Interpret and apply research findings	PSO - 6	Ap	C, P	L	
CO-6	Enhance skills in communicating research findings	PSO - 6	Ap	C, P	L	

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

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO7
CO 1	-	1	-	-	-	-	-	1	-	1	-	-	-	-
CO 2	-	1	-	-	-	-	-	1	-	1	-	-	-	-
CO 3	-	-	-	-	-	-	-	1	-	-	-	-	-	-
CO 4	-	-	-	-	-	1	-	1	-	1	1	-	-	1
CO 5	-	-	-	-	-	1	-	1	-	1	1	-	-	1
CO 6	-	-	-	-	-	1	-	2	-	2	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	End Semester Examinations
CO 1	✓		✓
CO 2	✓		✓
CO 3	✓		✓
CO 4	✓	✓	✓
CO 5	✓	✓	
CO 6	✓	✓	

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK6SECPHY352.1				
Course Title	**Fiber Optic Technology**				
Type of Course	**SEC**				
Semester	VI				
Academic Level	300-399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	2 hours	-	1 Hr	3
Pre-requisites	1. 2.				
Course Summary	This course provides a well-rounded understanding of optical fiber communication, from theoretical concepts to practical skills necessary for installation, maintenance, troubleshooting and safety measures for the same.				

Detailed Syllabus:

Module	Unit	Content	Hrs	COs
I		**OVERVIEW OF OPTICAL FIBER COMMUNICATION**	**9**	
	1	Introduction to fiber optics, peripheral structure of optical fibers, numerical aperture, acceptance angle. Optical fibers communication-block diagram and principle, Optical fiber classification on the variation of refractive index, mode of transmission	3	1
	2	Light sources for fiber optics, optical fiber cables design, optical fiber connection. Fiber optics cable- fibre optic tools- fiber, Buffer, Strength, member jacket. Indoor and Outdoor cables.	2	1
	3	Fiber to cable assembling characteristics- Length, Colour coding, Load, Understanding cable specification.	1	1
	4	Hands-on training: Fiber Optic Cable Handling. • Understanding cable specification.	3	5
II		**CONNECTORS AND SPLICERS**	**9**	
	5	Connectors and Splicers -difference and their need, Connector components, recent connector technology, connector installation overview, inter connection losses, intrinsic and extrinsic factors, fiber termination, ferrules, epoxy and polish.	3	2
	6	Boot or Dust Cap, Strain Relief, Latching Mechanism	2	2
	7	Splicers- fusion splice and mechanical splice. Splicing equipment – steps involved in splicing.	1	2
	8	Hands-on training: Splicing and Termination	3	5
III		**BASICS OF CABLE LYING**	**9**	
	9	System specification, Basics of power budget and risetime budget.	3	3
	10	Cable installation and hardware- Installation specification,	3	3

		Installation hardware, hardware management		
	11	Hands- on training: Installation and Maintenance	3	5
IV		**FIBER OPTIC SYSTEM APPLICATION**	**9**	
	12	LANS – Topology, Network layer, Quality of Service, ETHERNET	3	4
	13	Fiber Optic Testing- Standard test- Power Meter, OTDR and its uses.	3	4
		Hands- on training: Testing and Measurement	3	4
V		**LINK/CABLE TROUBLESHOOTING AND OPTICAL POWER SAFETY**	**9**	
	14	Connector Inspection, Connector End face Evaluation, Visible Fault Locator, , Fiber Identifier, Restoration Practices	3	4
	15	Laser Safety, Handling Fiber, Site Safety, Emergencies	3	4
	16	Hands on training: Safety Procedures	3	5

Books for study:

1. “An introduction to fiber optics.” Ghatak AK, Thyagarajan K. Cambridge university press; 1998 Jun 28.
2. “Technician Guide to Fiber Optics, by Donald J Sterling1999
3. “Fiber optics installer and technician guide.” by Woodward B, Husson EB. John Wiley & Sons; 2006

Books for Reference:

1. “Technician Guide to Fiber Optics, by Donald J Sterling1999
2. “Fiber optics installer and technician guide.” by Woodward B, Husson EB. John Wiley & Sons; 2006 Feb 20.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand the basic principles, classifications and operation of optical fibre communications	U	PSO-1,5,6,7
CO-2	Familiarize related mechanisms behind connectors and splicers, their uses and will be able to perform splicing and connector installation	R, U, Ap	PSO-1,5,6,7
CO-3	Understand system specifications, different cable installation techniques and hardware management.	R, U	PSO-1,5,6,7
CO-4	Familiarize various features and types of Local Area Network (LAN) concepts, including various topologies and the network layer and familiarise principles behind various tests and their applications in assessing optical fiber network performance.	R, U, C	PSO-1,5,6,7

CO-5	Understand various connector inspection, maintenance procedures and will be equipped with the knowledge and skills to mitigate potential hazards associated with optical fiber systems	U, An, Ap	PSO-1,5,6,7

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

Note: 1 or 2 COs/module

Name of the Course: FIBER OPTICS TECHNOLOGY

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

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Understand the basic principles, classifications and operation of optical fibre communications	PSO-1,5,6,7 PO-1,6,7	U	F, C	L/T	
CO-2	Familiarize related mechanisms behind connectors and splicers, their uses and will be able to perform splicing and connector installation	PSO-1,5,6,7 PO-1,6,7	R, U, Ap	F,C,P	L/T	P
CO-3	Understand system specifications, different cable installation techniques and hardware management	PSO-1,5,6,7 PO-1,6,7	R, U	F, C		P
CO-4	Familiarize various features and types of Local Area Network (LAN) concepts, including various topologies and the network layer and familiarise principles behind various tests and their applications in assessing optical fiber network performance.	PSO-1,5,6,7 PO-1,6,7	R, U, C	F, C, P	L/T	P
CO-5	Understand various connector inspection, maintenance procedures and will be	PSO-1,5,6,7	U, An, Ap	F, C, P	L/T	P

	equipped with the knowledge and skills to mitigate potential hazards associated with optical fiber systems	PO-1,6,7				

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

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2					-		1			1		1	
CO 2						-								
CO 3						-								
CO 4						-								
CO 5						-								
CO 6						-								

Correlation Levels:

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

Assessment Rubrics:

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

Mapping of COs to Assessment Rubrics :

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

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

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK6SECPHY353.1				
Course Title	**PCB Making and Designing**				
Type of Course	**SEC**				
Semester	VI				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Hands on Training per week	Total Hours/Week
	3	2 hours	-	1 hour	3
Pre-requisites					
Course Summary	This course aims to provide students with a comprehensive understanding of the PCB manufacturing process, from initial design to final assembly, enabling them to create functional and reliable circuit boards for a variety of electronic applications.				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**PRINTED CIRCUIT BOARDS (Book 1: Chapter 1)**	**9**	
	1	Components of a printed circuit board , Classification of printed circuit boards (basic information only)	3	1
	3	Manufacturing of basic printed circuit boards	2	1
	4	Challenges in Modern PCB design and manufacture	1	1
		Hands on training Familiarising of the components used in PCB (resistors, transistors, capacitors)	3	2
II		**LAY OUT PLANNING (Book 1: Chapter 3)**	**9**	
	5	General PCB Design considerations, Mechanical Design considerations	3	2
	6	Electrical Design considerations	2	2
	7	Conductor Patterns (Rules for lay out design), component placement rules	2	2
		Hands on training Preparation of layout and artwork layout planning.	3	5
III		**LAY OUT DESIGN (Book 1: Chapter 3)**	**9**	
	8	Grid systems, Layout scale, Layout sketch/design, Lay out considerations	2	3
	9	Materials and aids, Land requirements, Manual Lay out Procedure, Layout methodology	2	3
	10	Layout Design checklist, Documentation	2	3
		Hands on training	3	5

		Creating a sample layout design of a simple PCB.		
IV	**MECHANICAL OPERATIONS (Book 1: Chapter 9,10)**		**9**	
	11	Need for Mechanical Operations, Methods (Brief study of cutting, hole punching, drilling)	2	4
	12	Brief discussion on Etching solutions and chemistry (Ferric chloride, Ammonium persulphate, chromic aid, cupric chloride, alkaline ammonia), Etching equipments	4	4
		Hands on training Etching and Drilling of PCB. Preparation and mounting components.	3	4,5
V	**FABRICATION (Book 1: Chapters 8, 13, 14)**		**9**	
	13	Solder Mask	3	4
	14	PCB Assembly Process, Testing for quality control	3	4
		Hands on training Prepare a PCB for any one of the following: Seven Segment Display driver interface Light switching using LDR LED Flasher circuit Water level controller circuit. (Use of Transistor)	3	5

Books for Study:

1. Printed Circuit Boards, Design, Fabrication, Assembly and Testing, R.S. Khandpur Tata McGraw Hill Publishing Company Limited (2005).

Books for Reference :

1. Introduction to Embedded Systems, Shibu K.V.2nd Edition, McGraw Hill Education (India) Private Limited (2017).
2. Printed Circuit Boards, Design and Technology, Walter C Bosshart, Tata McGraw Hill Publishing Company Limited (2002).

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Recognize and explain the basic concepts of PCBs and their importance in electronic devices.	U	PSO-1
CO-2	Distinguish PCBs that meet electrical, mechanical, and manufacturing requirements, and enable to contribute effectively in roles related to PCB design, engineering, and manufacturing.	R, U	PSO-1,5
CO-3	Interpret appropriate components for a design and how to place them optimally on the PCB layout.	U	PSO-1,5
CO-4	Administer and apply the various	U, Ap	PSO-1,5

	manufacturing techniques such as etching, drilling, and soldering involved in producing PCBs.		
CO-5	Infer and Interpret the process of assembling components onto the fabricated PCB and assemble a PCB	U, Ap, An	PSO-1,5, 7

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

Note: 1 or 2 COs/module

Name of the Course: PCB MAKING AND DESIGNING

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

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Hands on Training (H)
CO-1	Recognize and explain the basic concepts of PCBs and their importance in electronic devices.	PSO -1	U	F, C	L	
CO-2	Distinguish PCBs that meet electrical, mechanical, and manufacturing requirements, and enable to contribute effectively in roles related to PCB design, engineering, and manufacturing.	PSO -1,5	U, Ap	P	L	H
CO-3	Interpret appropriate components for a design and how to place them optimally on the PCB layout	PSO -1,5	U	C	L	
CO-4	Administer and apply the various manufacturing techniques such as etching, drilling, and soldering involved in producing PCBs.	PSO -1,5	U, Ap	C,P	L	H
CO-5	Infer and Interpret the process of assembling components onto the fabricated PCB and assemble a PCB	PSO -1,5, 7	U, Ap, An	C,P		H

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

Mapping of COs with PSOs and POs :

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

SEMESTER VII

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK7DSCPHY401.1				
Course Title	**Advanced Mathematical Physics**				
Type of Course	**DSC**				
Semester	VII				
Academic Level	400 - 499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-		4 hours
Pre-requisites	1. Need an understanding of vectors, Fourier series, Complex numbers, Partial and Ordinary differential equations. 2.				
Course Summary	By the end of the course, students will have developed advanced mathematical skills and a solid foundation in the mathematical techniques essential for tackling complex problems in theoretical and applied Physics. They will be well-equipped to pursue further studies or research in areas such as quantum field theory, general relativity, condensed matter physics, and mathematical physics.				

Detailed Syllabus:

Module	Unit	Content	Hrs	COs
I		**COMPLEX ANALYSIS**	**10**	
	1	Cauchy's integral theorem and Formula	3	1
	2	Taylor expansion and Laurent series, zeroes and singularities	2	1
	3	Cauchy's residue theorem, Poles	3	1
	4	Evaluation of definite Integrals.	2	1
II		**DIFFERENTIAL EQUATIONS AND SPECIAL FUNCTIONS**	**16**	
	5	Second Order linear ODEs- singular points	1	2
	6	Series solution- Frobenius method and its applications to differential equations	2	2
	7	Legendre, Bessel (first and second kind), Hermite and Laguerre Differential Equations	6	2
	8	Properties -Rodrigues Formula (Derivations not needed), Generating Function	4	2

	9	Orthogonality and recurrence relations of Legendre, Bessel, Hermite and Laguerre.	3	2
III		**INTEGRALS TRANSFORMS**	**16**	
	10	Fourier Transforms- Fourier Integral theorem	1	3
	11	Fourier sine and cosine transform	1	3
	12	Examples: Fourier transform of single pulse, trigonometric, exponential and Gaussian Functions.	2	3
	13	Inverse Fourier transform and Convolution theorem	2	3
	14	Properties of Fourier transforms (translation, change of scale, complex conjugation, One dimensional Wave Equations	2	3
	15	Laplace Transform (LT) of Elementary functions.	1	3
	16	Properties of LTs: Change of Scale Theorem, Shifting Theorem	1	3
	17	LTs of Derivatives and Integrals of Functions	2	3
	18	Derivatives and Integrals of LTs	1	3
	19	LT of Unit Step function, Periodic Functions	1	3
	20	Convolution Theorem and Inverse LT	2	3
IV		**SOME SPECIAL INTEGRALS**	**06**	
	21	Gamma Functions, Expression of Integrals in terms of Gamma Functions	2	4
	22	Dirac delta function and properties, Laplace and Fourier transform of Dirac delta function.	2	4
	23	Green Function and general properties.	2	4
V		**TENSOR ANALYSIS**	**12**	
	24	Coordinate transformation, Contravariant and mixed tensors	2	5
	25	Addition, Subtraction, Outer product, Inner product and Contraction	2	5
	26	Symmetric and antisymmetric tensors. Quotient law	1	5
	27	Metric tensor, Raising and lowering of indices	1	5
	28	Tensor derivatives, The Christoffel symbols and their transformation laws	2	5
	29	Covariant derivative of tensors	1	5
	30	Equation of Geodesic	1	5
	31	Riemannian curvature tensor	2	5

Books for Study

1. G.B. Arfken and H.J. Weber, Mathematical methods for Physcisits,6th Edition, Elsevier, 2005.
2. C. Harper, Introduction to Mathematical Physics, Prentice Hall ,1986.
3. B.S. Rajput, Mathematical Physics, 16th edition, Pragati Prakashan, 2003.
4. Daniel Fleisch, A Student’s guide to Vectors and Tensors, Ist Edition, Cambridge University Press, 2012.

5. A.W. Joshi, Matrices and Tensors in Physics,3rd Edition, New Age International Pub, 2003.

References:

1. Complex Variables and Applications, J.W. Brown& R.V. Churchill, 7th Ed. 2003, Tata McGraw-Hill
2. Differential Equations, George F. Simmons, 2006, Tata McGraw-Hill.
3. W.W. Bell, Special Functions for Scientists and Engineers, Dover Publications (2004)
4. H.K. Dass and R. Verma, Mathematical Physics, S. Chand & Co Pvt Ltd (1997)
5. B.D. Gupta, Mathematical Physics, 4th Edition, Vikas Publishing House (2004)
6. Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J. Bence, 3rd ed., 2006, Cambridge University Press
7. Mathematics for Physicists, P. Dennery and A. Krzywicki, 1967, Dover Publications.

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO1	Develop a strong foundation in complex analysis and apply its applications in Physics.	Ap, An	1,2,7
CO2	Solve second-order linear ODEs with singular points, applying series solutions using the Frobenius method, and understanding the properties and applications of special functions such as Legendre, Bessel, Hermite, and Laguerre functions.	Ap.An	1,2,7
CO3	Acquired skills to solve complex problems involving differential equations and system analysis using transform techniques.	U,Ap	1,2,7
CO4	Understand and apply Gamma function, Green function and Dirac Delta function to express integrals, analyse distributions and solve differential equations.	U,Ap	1,2,7
CO5	Understand basic tensor operations, using tensor notation, and Apply of tensor calculus in studying physical systems.	U, Ap	1,2,7

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

Note: 1 or 2 COs/module

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

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1	Develop a strong foundation in complex analysis and its applications in Physics.	1,2/1, 2,7	Ap, An	C,P	L	
2	Solve second-order linear ODEs with singular points, applying series solutions using the Frobenius method, and understanding the properties and applications of special functions such as Legendre, Bessel, Hermite, and Laguerre functions.	1,2/1, 2,7	Ap.An	C,P	L	
3	Acquired skills to solve complex problems involving differential equations and system analysis using transform techniques.	1,2/1, 2,7	U,Ap	C,P	L	
4	Understand and apply Gamma function, Green function and Dirac Delta function to express integrals, analyse distributions and solve differential equations.	1,2/1, 2,7	U,Ap	F,C,P	L	
5	Understand basic tensor operations, using tensor notation, and Apply of tensor calculus in studying physical systems.	1,2/1, 2,7	U, Ap	F,C,P	L	

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

Mapping of COs with PSOs and POs :

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

Correlation Levels:

Level	**-**	**1**	**2**	**3**
Correlation	**Nil**	**Slightly / Low**	**Moderate / Medium**	**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	PHYSICS				
Course Code	MIUK7DSCPHY402.1				
Course Title	**Quantum Mechanics – II**				
Type of Course	**DSC**				
Semester	VII				
Academic Level	400 – 499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4
Pre-requisites	Inadequency of classical theory, Basic quantum mechanics, Schrodinger equation, One dimensional problem-solutions				
Course Summary	This course aims to provide a strong foundation to the principles of quantum mechanics and equip the students to apply these principles to solve advanced quantum mechanical problems				

Detailed Syllabus:

Module	Unit	Content	Hrs	CO
I		**SYMMETRIES AND CONSERVATION LAWS**	**11**	
	1	Unitary transformation: Definition and properties, Infinitesimal and finite unitary transformation	3	1,2
	2	Generator of infinitesimal and finite translation, Conservation of linear momentum	3	1
	3	Generator of infinitesimal and finite rotation, Conservation of angular momentum	3	1
	4	Time evolution operator	2	1
II		**MATRIX REPRENSENTATION AND PICTURES**	**11**	
	5	Matrix representation of operators and wave functions	2	2
	6	Simple Harmonic Oscillator: Operator form	3	2,4
	7	Matrix representation of Hamiltonian, Number operator, raising and lowering operators	3	2
	8	Pictures: Schrodinger picture, Heisenberg picture and interaction picture	3	2
III		**ANGULAR MOMENTUM**	**20**	
	9	Orbital angular momentum operators and commutation relations	2	3
	10	Eigen values and eigen functions of L^2 and Lz	4	2,3
	11	General angular momentum-eigen values of J^2 and Jz-	4	2,3
	12	Matrix representation of angular momentum operators	3	2,3
	13	Spin angular momentum –spin vectors for a spin ½ system	3	3
	14	Addition of angular momentum- Clebsch-Gordan coefficients.	4	3
IV		**THREE-DIMENSIONAL ENERGY EIGENVALUE**	**6**	

	PROBLEMS			
	15	Particle in spherical symmetric potential-general solution	2	4
	16	Rigid rotator	1	2,4
	17	Hydrogen atom problem	3	4
V	**RELATIVISTIC WAVE EQUATIONS**		**12**	
	18	Klein Gordon Equation, interpretation and equation of continuity	2	5
	19	Dirac Equation: Dirac matrices	2	5
	20	Probability current density and equation of continuity	2	5,2
	21	Covariant form of Dirac equation	1	5
	22	Plane wave solution of Dirac equation	3	5
	23	Negative energy states, Spin of Dirac particle	2	5

BOOKS FOR STUDY

1. Introduction to quantum mechanics : David, J Griffith, Prentice Hall, Second Edition
2. Quantum Mechanics : B H Bransden and C J Joachain, Pearson Education Ltd
3. Quantum Mechanics : G Aruldhas, PHI, 2^{nd} Edition, 2020

BOOKS FOR REFERENCE

1. A text book of Quantum Mechanics- P M Mathews & Venkitesan, Tata Mc Graw Hill, 2010
2. Quantum Mechanics Theory and Applications-Ajoy Ghatak, S Lokanathan , 5^{th} Edn
3. Quantum Mechanics-Leonard I Schiff ,3rd Edn
4.Quantum Mechanics-V K Thankappan , 5^{th} Edn
5. Quantum Mechanics: Concepts and Applications- Nouredine Zettili, Second Edition,Wiley.

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Identify the quantum mechanical concepts of symmetry operations and associated conservation laws	U, Ap	PSO-1,2
CO-2	Identify the concepts of matrix representation of operators and wave functions and apply these concepts to solve quantum mechanical problem	U, Ap	PSO-1,2
CO-3	Recognize the concepts related to angular momentum operators, their eigen values, eigen functions, commutation relations and matrix representation	U, Ap	PSO-1, 2
CO-4	Apply problem solving techniques in quantum mechanics to three dimensional problems	U, Ap	PSO-1, 2, 3
CO-5	Compare the physical concepts of Klein Gordon equation and Dirac relativistic equation	U, Ap	PSO-1,2

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

Note: 1 or 2 COs/module

Name of the Course: QUANTUM MECHANICS – II

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

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Identify the quantum mechanical concepts of symmetry operations and associated conservation laws	PSO -1,2	U, Ap	F, C	L	
CO-2	Identify the concepts of matrix representation of operators and wave functions and apply these concepts to solve quantum mechanical problem	PSO -1,2	U, Ap	F, C	L	
CO-3	Recognize the concepts related to angular momentum operators, their eigen values, eigen functions, commutation relations and matrix representation	PSO -1, 2	U, Ap	F, C	L	
CO-4	Apply problem solving techniques in quantum mechanics to three dimensional problems	PSO -1, 2, 3	U, Ap	F, C	L	
CO-5	Compare the physical concepts of Klein Gordon equation and Dirac relativistic equation	PSO -1,2	U, 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	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	2						2		2	2	2	2	

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

Correlation Levels:

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

Assessment Rubrics:

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

- Final Exam

Mapping of COs to Assessment Rubrics :

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

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK7DSEPHY401.1				
Course Title	**Semiconductor Physics and Nanoelectronics**				
Type of Course	**DSE**				
Semester	VII				
Academic Level	400-499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4
Pre-requisites					
Course Summary	Upon completion of this course, the student may have a profound understanding about the physics behind the semiconductor materials. The movement of charge carriers inside the crystalline lattice will be discussed in detail and the discussion may extend up to metal oxide semi conductors. In addition, the basic ideas about the developing nano electronic devices will be gained by the student.				

Detailed Syllabus:

Module	Unit	Content	Hrs	COs
I		**SEMICONDUCTORS IN EQUILIBRIUM**	**9**	**1**
	1	Charge carriers in semiconductors and their equilibrium distribution	2	1
	2	The n_0 and p_0 equations - the intrinsic Fermi-level position	2	1
	3	Dopant atoms and energy levels, The extrinsic semiconductor – equilibrium distribution of electrons and holes	2	1
	4	Carrier transport phenomena- Drift current and Diffusion current	2	1
	5	The Hall effect	1	1
II		**THE PN JUNCTION**	**9**	
	6	Basic structure of the pn junction	1	1
	7	Zero applied bias - built-in potential barrier	1	1
	8	Electric field-space charge width- reverse applied bias-space charge width and electric field	1	1
	9	Junction capacitance - one-sided junctions- Junction breakdown	2	1
	10	pn junction current- qualitative description of charge flow in a pn junction	2	1
	11	Ideal current- voltage relationship- boundary conditions- minority carrier distribution- ideal pn junction current- temperature effects	2	1
III		**FUNDAMENTALS OF METAL SEMICONDUCTORS**	**9**	
	12	Fundamentals of MOSFET	1	2
	13	MOS structure and Energy band diagrams	2	2
	14	Depletion layer thickness- surface charge density- work	2	2

		function differences- threshold voltage		
	15	The basic MOSFET operation- MOSFET structure	2	2
	16	Current-Voltage relationship	2	2
IV		**OPTICAL DEVICES**	**9**	
	17	Optical absorption- photon absorption coefficient	1	3
	18	Solar cells- the pn junction solar cell- conversion efficiency and solar concentration	2	3
	19	Photo detectors– photoconductor– photodiode- light emitting diodes- generation of light	2	3
	20	Semiconductor microwave and power devices	2	3
	21	Tunnel diode and GUNN diode	2	3
V		**NANOELECTRONICS**	**9**	
	22	Introduction to nanoelectronics	2	4
	23	Single electron tunnelling - single electron transistor- Quantum Hall effect	2	4
	24	Molecular machines- molecular and nanoelectronics	2	4
	25	Fuel cells - hydrogen storage	1	4
	26	Photonic nanocrystals and integrated circuits - quantum computers	2	4

Books for Study:

1. D. A. Neamen, Semiconductor Physics and Devices, 3 rd Edition, McGraw Hill (2003)
2. B. G. Streetman, Solid State Electronic Devices, 3rd Edition, PHI Pvt. Ltd. (2000)
3. Charles Kittel, Introduction to Solid State Physics, John Wiley&Sons (2007)
4. S. M. Sze, Semiconductor Devices: Physics and Technology, 2 nd Edition, John Wiley & Sons (2002)
5. Sedra A. S. and Smith K. C., Microelectronic Circuits, 2nd Edition, Holt, Rinehart and Winston (1987)
6. Ben G. Streetman and Sanjay K.Banerjee, Solid State Electronic Devices, Pearson Education (2002) D. K. Roy, Physics of Semiconductor Devices,Universities Press (2002)
7. M. S. Tyagi, Introduction to Semiconductor Materials and Devices, John Wiley & Sons (2000)
8. S. Bandyopadhyay and M. Cahay, Introduction to Spintronics, 2nd Edition, CRC Press (2008)
9. M. Johnson, Magnetoelectronics,1st Edition, Academic Press (2004)
10. S. Maekawa, Concepts in Spin Electronics, Oxford University Press (2006)

Books for Reference:

1. C. P. Poole and F. J. Owens, Introduction to Nanotechnology, John Wiley & Sons (2007)
2. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday ,Textbook of Nanoscience and Nanotechnology, Universities Press Pvt. Ltd. (2003)

3. Cornelius T. Leondes, MEMS/NEMS Handbook: Techniques and Applications, Volume1, Design Methods, Springer (2006)
4. D. D. Awschalom, R. A. Buhrman, J. M. Daughton, S. V. Molnar, and M. L. Roukes, Spin Electronics, Kluwer Academic Publishers(2004)
5. Y. B. Xu and S. M. Thompson, Spintronic Materials and Technology, Taylor & Francis, (2006)

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Explain the basic properties of semiconductors including the band gap, charge carrier concentration, doping and charge carrier injection/excitation.	R	PSO-1,2
CO-2	Explain the working, design considerations and applications of various semiconducting devices including p-n junctions, BJTs and FETs	U	PSO-3,4
CO-3	Describe the working and design considerations for the various photonic devices like photodetectors, solar - cells and LEDs	Ap	PSO-2,4
CO-4	Explain the design and working of Nanoelectronic devices	E	PSO-2,5

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

Note: 1 or 2 COs/module

Name of the Course: SEMICONDUCTOR PHYSICS AND NANO ELECTRONICS

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

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Understand the basic properties of semiconductors including the band gap, charge carrier concentration, doping and charge carrier injection/excitation.	5/1,2	R, U	F, C	L	
CO-2	Describe the working, design considerations and applications of various semiconducting devices including p-n	1/3,4	U	F, C	L	

	junctions, BJTs and FETs					
CO-3	Describe the working and design considerations for the various photonic devices like photodetectors, solar - cells and LEDs	2/2,4	U, Ap	F, C	L	
CO-4	Understand the design and working of Nanoelectronic devices	1/2,5	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	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2	2										2		
CO 2			2	1				2						
CO 3		3	2						2					
CO 4		2			1			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	✓	✓		✓

Mar Ivanios College (Autonomous)

Discipline	PHYSICS				
Course Code	MIUK7DSEPHY402.1				
Course Title	**Environmental Sustainability and Nanotechnology**				
Type of Course	**DSE**				
Semester	VII				
Academic Level	400 - 499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	--	4
Pre-requisites					
Course Summary	Knowledge about Photocatalysis for Environmental Remediation, Understanding Photocatalysis and Photocatalyst, Water Splitting for Hydrogen Production, Nanotechnology for Carbon Dioxide Capture and Conversion, Circular Economy for Waste Reduction and Carbon Footprint.				

Detailed Syllabus:

Module	Unit	Content	Hrs	COs
I		**PHOTOCATALYSIS FOR ENVIRONMENTAL REMEDIATION (Book1; Chapter 1&2)**	**12**	
	1	Introduction – Definition – type of photocatalysis	2	1
	2	TiO_2 based photocatalytic reactions - Key Species in Photocatalytic Reactions -	3	1
	3	Trapped Electron and Hole - Superoxide Radical and Hydrogen Peroxide - Hydroxyl Radical (OH•) - Singlet Molecular Oxygen	3	1
	4	Reaction Mechanisms of Visible-Light-Responsive Photocatalysts - Photocatalytic Reaction Pathways – Effects of Molecular Structure, Catalyst, and Wavelength	4	1
II		**UNDERSTANDING PHOTOCATALYSIS AND PHOTOCATALYTS (Book1; Chapter 3)**	**12**	
	5	Photocatalyic rate -Kinetic models -	2	2
	6	Thermodynamic Aspect of Photocatalysis - Design of Active Photocatalysts –	2	2
	7	A Conventional Kinetics in Photocatalysis: First-Order Kinetics – Langmuir–Hinshelwood Mechanism	3	2
	8	Problems Related to Particle Size of Photocatalysts -	2	2
	9	Recombination of a Photoexcited Electron and a Positive Hole - Electron Traps as a Recombination Center –	3	2
III		**WATER SPLITTING FOR HYDROGEN PRODUCTION (Book 2; Chapter 1 and 5)**	**12**	
	10	General – The water splitting reaction – Natural water splitting	2	3

	11	Water oxidation catalysts – Semiconductors for water splitting	4	3
	12	Electrochemical measurement as screening method for water oxidation	3	3
	13	Preparation of active electrodes – wet method – dry method – Assessment of electrocatalytic activity.	3	3
IV	**NANOTECHNOLOGY FOR CARBON DIOXIDE CAPTURE AND CONVERSION (Book 3)**		**12**	
	14	Introduction – CO_2 as a resource – Circular CO_2 economy	2	4
	15	CO_2 capture/Separation technologies – Direct air capture and nanomaterials.	3	4
	16	Nanomaterials – Metal Organic Frame (MOF) Gas separation	3	4
	17	Carbon Nanotubes (CNTs) Nanoporous membranes –	2	4
	18	Elementary ideas of CO_2 conversion technologies;	2	4
V	**CIRCULAR ECONOMY FOR WASTE REDUCTION AND CARBON FOOTPRINT**		**12**	
	19	Carbon's critical role as life essential element and in non-renewable fuels and chemicals.	3	5
	20	Various sources of carbon waste eg., industrial emissions, biomass residue, manure, garbage which are of environmental concern.	4	5
	21	Integration of Circular economy and Sustainable Development.	3	5
	22	Possible supply chain scenarios for conversion of waste carbon to valuable products.	2	5

Books for Study:

1. Photocatalysis and Water Purification - From Fundamentals to Recent Applications, Pierre Pichat (Editor), Wiley-VCH Verlag GmbH &Co. K Ga A, Boschstr. 12, 69469 Weinheim, Germany 2013.
2. Testing Novel Water Oxidation Catalysts for Solar Fuels Production, Ed. By Carminna Ottone, Simelys Hernández, Marco Armandi, Barbara Bonelii, Springer, 2019.
3. Nanomaterials and Direct Air Capture of CO_2, Dirk Fransaer, Nanotechnology for Energy Sustainability, Ed. Marcel Van de Voorde, Wiley VCH, 2017.
4. Green Carbon Dioxide: Advances in CO_2 Utilization - Gabriele Centi, Siglinda Perathoner ISBN: 978-1- 118-59088-1 March 2014.
5. Waste Valorisation: Waste Streams in a circular economy - Carol Sze Ki Lin, Guneet Kaur, Chong Li, Xiaofeng Yang, Christian V. Stevens, Wiley, ISBN: 978-1-119-50270-8; 2020.

Books for References:

1. Sustainable Bioconversion of Waste to Value Added Products - Inamuddin, Anish Khan, Springer Cha, ISBN978-3-030-61839-1; 2021.

2. Nanomaterials for Environmental Protection, Ed. By Boris I. Kharisov, Oxana V. Kharissova, H. V. Rasikha Dias, John Wiley, 2015.
3. Nanotechnologies for Environmental Remediation : Applications and Implications, edited by Giusy Lofrano, Giovanni Libralato, Jeanette Brown, Springer, 2016.
4. Hydrogen Production by Electrolysis, Edited by AgataGodula –Jopek, Wiley – VCH, 2015.
5. Environmental Applications of Nanomaterials: Synthesis, Sorbents and Sensors By Glen E. Fryxell, Guozhong Cao, Imperial Collge Press, 2007.

Web Reference:

1 https://nptel.ac.in/content/storage2/courses/105108075/module9/Lecture40.pdf

2.https://nptel.ac.in/courses/118/107/118107015/

3 https://nptel.ac.in/courses/105/107/105107181/

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand the role of nanotechnology for sustainable energy and conversion of energy directly or indirectly and describe nanoscale catalysts used to enhance the production rate	U	PSO-1,2
CO-2	Discuss and analyse synthesis and characterisation of nanomaterials for photocatalysi	R, U, An	PSO-1,3
CO-3	Discuss various methods for hydrogen production and summarise knowledge about photochemical and photocatalysts and analyse techniques used to hydrogen storage.	U , An	PSO-1,2
CO-4	Describe, demonstrate and analyse CO2 capturing and circular economy for sustainable development	U, An	PSO-5,6
CO-5	Define and appraise and integrate circular economy for sustainable development	R, U	PSO-1,2

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

Note: 1 or 2 COs/module

Name of the Course: ENVIRONMENTAL SUSTAINABILITY AND NANOTECHNOLOGY

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

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Understand the role of nanotechnology for sustainable energy and	PSO -1,2	U	F, C	L	

	conversion of energy directly or indirectly and describe nanoscale catalysts used to enhance the production rate					
CO-2	Discuss and analyse synthesis and characterisation of nanomaterials for photocatalysi	PSO -1,3	R, U, An	F,C	L	
CO-3	Discuss various methods for hydrogen production and summarise knowledge about photochemical and photocatalysts and analyse techniques used to hydrogen storage.	PSO -1,2	U , An	F,C	L	
CO-4	Describe, demonstrate and analyse CO2 capturing and circular economy for sustainable development	PSO -5,6	U, An	F,C	L	
CO-5	Define and appraise and integrate circular economy for sustainable development	PSO -1,2	R, U	C,P	L	

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

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2	2										2		
CO 2	1		2					2						
CO 3	2	1							2					
CO 4					1	2		1						
CO5	2	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	✓	✓		✓

Board of studies in Physics and Physics with Machine Learning, 2023 – 2026

No	Name	Designation
1	Dr. John Jacob (Chairman)	Head of the Department of Physics Mar Ivanios College
2	Dr. I Hubert Joe (University Nominee)	Associate Professor, Department of Physics University of Kerala
3	Dr. Jijimon K. Thomas	Former Professor Department of Physics
4	Dr. R S Jayasree	Scientist F, Sree Chitra Thirunal Institute for Medical Science and Technology Thiruvananthapuram-12
5	Dr. Anil Abraham Samuel	Scientist/Engineer-SG Vikram Sarabhai Space Centre, (VSSC), Thiruvananthapuram
6	Mr. Nabeel Koya A	Scientist E , CSG Group, Centre for Development of Advanced Computing
7	Dr. D. Joymon	Assistant General Manager (Mobile Planning), Office of the Principal General Manager, BSNL Bhavan,
8	Dr. K. S. Sibi	Assistant Professor Department of Physics University of Kerala

9	Dr. Radhakrishnan S. R.	Principal Scientist, Environmental Sciences and Biomedical Metrology Division, CSIR-National Physical Laboratory,
10	Mr. Twinkle A R	Assistant Professor, Department of Physics
11	Dr. Suma Bai K C	Assistant Professor, Department of Physics
12	Dr. Bright K C	Assistant Professor, Department of Physics
13	Dr. Sreeja R	Assistant Professor, Department of Physics
14	Dr. Mathew C T	Assistant Professor, Department of Physics
15	Dr. Rajesh S	Assistant Professor, Department of Physics
16	Dr. Leenaraj D R	Assistant Professor, Department of Physics