B Sc PHYSICS

LOCF SYLLABUS 2025

Department of Physics

School of Physical Sciences

St. Joseph's College (Autonomous)

Tiruchirappalli - 620002, Tamil Nadu, India

SCHOOLS OF EXCELLENCE WITH CHOICE BASED CREDIT SYSTEM (CBCS) UNDERGRADUATE COURSES

St. Joseph's College (Autonomous), an esteemed institution in the realm of higher education in India, has embarked on a journey to uphold and perpetuate academic excellence. One of the pivotal initiatives in this pursuit is the establishment of five Schools of Excellence commencing from the academic year 2014-15. These schools are strategically designed to confront and surpass the challenges posed by the 21st century.

Each School amalgamates correlated disciplines under a unified umbrella, fostering synergy and coherence. This integrated approach fosters the optimal utilization of both human expertise and infrastructural assets. Moreover, it facilitates academic fluidity and augments employability by nurturing a dynamic environment conducive to learning and innovation. Importantly, while promoting collaboration and interdisciplinary study, the Schools of Excellence also uphold the individual identity, autonomy, and distinctiveness of every department within.

The overarching objectives of these five schools are as follows:

1. Optimal Resource Utilization: Ensuring the efficient use of both human and material resources to foster academic flexibility and attain excellence across disciplines.

2. Horizontal Mobility for Students: Providing students with the freedom to choose courses aligning with their interests and facilitating credit transfers, thereby enhancing their academic mobility and enriching their learning experience.

3. Credit-Transfer Across Disciplines (CTAD): The existing curricular structure, in accordance with regulations from entities such as TANSCHE and other higher educational institutions, facilitates seamless credit transfers across diverse disciplines. This underscores the adaptability and uniqueness of the choice-based credit system.

4. Promotion of Human Excellence: Nurturing excellence in specialized areas through focused attention and resources, thus empowering individuals to excel in their respective fields.

5. Emphasis on Internships and Projects: Encouraging students to engage in internships and projects, serving as stepping stones toward research endeavors, thereby fostering a culture of inquiry and innovation.

6. Addressing Stakeholder Needs: The multi-disciplinary nature of the School System is tailored to meet the requirements of various stakeholders, particularly employers, by equipping students with versatile skills and competencies essential for success in the contemporary professional landscape.

In essence, the Schools of Excellence at St. Joseph's College (Autonomous) epitomize a holistic approach towards education, aiming not only to impart knowledge but also to cultivate critical thinking, creativity, and adaptability – qualities indispensable for thriving in the dynamic global arena of the 21st century.

Credit system

The credit system at St. Joseph's College (Autonomous) assigns weightage to courses based on the hours allocated to each course. Typically, one credit is equivalent to one hour of instruction per week. However, credits are awarded regardless of actual teaching hours to ensure consistency and adherence to guidelines.

The credits and hours allotted to each course within a programme are detailed in the Programme Pattern table. While the table provides a framework, there may be some flexibility due to practical sessions, field visits, tutorials, and the nature of project work.

For undergraduate (UG) courses, students are required to accumulate a minimum of 137 credits, as stipulated in the programme pattern table. The total number of courses offered by the department is outlined in the Programme Structure.

OUTCOME-BASED EDUCATION (OBE)

OBE is an educational approach that revolves around clearly defined goals or outcomes for every aspect of the educational system. The primary aim is for each student to successfully achieve these predetermined outcomes by the culmination of their educational journey. Unlike traditional methods, OBE does not prescribe a singular teaching style or assessment format. Instead, classes, activities, and evaluations are structured to support students in attaining the specified outcomes effectively.

In OBE, the emphasis lies on measurable outcomes, allowing educational institutions to establish their own set of objectives tailored to their unique context and priorities. The overarching objective of OBE is to establish a direct link between education and employability, ensuring that students acquire the necessary skills and competencies sought after by employers.

OBE fosters a student-centric approach to teaching and learning, where the delivery of courses and assessments are meticulously planned to align with the predetermined objectives and outcomes. It places significant emphasis on evaluating student performance at various levels to gauge their progress and proficiency in meeting the desired outcomes.

Here are some key aspects of Outcome-Based Education:

Course: A course refers to a theory, practical, or a combination of both that is done within a semester.

Course Outcomes (COs): These are statements that delineate the significant and essential learning outcomes that learners should have achieved and can reliably demonstrate by the conclusion of a course. Typically, three or more course outcomes are specified for each course, depending on its importance.

Programme: This term pertains to the specialization or discipline of a degree programme.

Programme Outcomes (POs): POs are statements that articulate what students are expected to be capable of by the time they graduate. These outcomes are closely aligned with Graduate Attributes.

Programme Specific Outcomes (PSOs): PSOs outline the specific skills and abilities that students should possess upon graduation within a particular discipline or specialization.

Programme Educational Objectives (PEOs): PEOs encapsulate the expected accomplishments of graduates in their careers, particularly highlighting what they are expected to achieve and perform during the initial years postgraduation.

LEARNING OUTCOME-BASED CURRICULUM FRAMEWORK (LOCF)

The Learning Outcomes-Centric Framework (LOCF) places the learning outcomes at the forefront of curriculum design and execution. It underscores the importance of ensuring that these outcomes are clear, measurable, and relevant. LOCF orchestrates teaching methodologies, evaluations, and activities in direct correlation with these outcomes. Furthermore, LOCF adopts a backward design approach, focusing on defining precise and attainable learning objectives. The goal is to create a cohesive framework where every educational element is in harmony with these outcomes.

Assessment practices within LOCF are intricately linked to the established learning objectives. Evaluations are crafted to gauge students' achievement of these outcomes accurately. Emphasis is often placed on employing authentic assessment methods, allowing students to showcase their learning in real-life scenarios. Additionally, LOCF frameworks emphasize flexibility and adaptability, enabling educators to tailor curriculum and instructional approaches to suit the diverse needs of students while ensuring alignment with the defined learning outcomes.

Some Important Terminologies

Core Course (CC): Core Courses represent obligatory elements within an academic programme, imparting fundamental knowledge within the primary discipline while ensuring consistency and acknowledgment.

Allied Course (AC): *Allied Courses complement primary disciplines by furnishing supplementary knowledge, enriching students' understanding and skill repertoire within their academic pursuit.*

Skill Enhancement Course (SEC): *Skill Enhancement Courses aim to nurture students' abilities and competencies through practical training, open to students across disciplines but particularly advantageous for those in programme-related fields.*

Value Education (VE): *Value education encompasses the teaching of moral, ethical, and social values to students, aiming to foster their holistic development. It instills virtues such as empathy, integrity, and responsibility, guiding students towards becoming morally upright and socially responsible members of society.*

Ability Enhancement Compulsory Course (AECC): *Ability Enhancement Compulsory Course is designed to enhance students' knowledge and skills; examples include Communicative English and Environmental Science. These courses are obligatory for all disciplines.*

AE-1: Communicative English: This three-credit mandatory course, offered by the Department of English during the first semester of the degree programme, is conducted outside regular class hours.

AE-2: Environmental Science: This one-credit compulsory course, offered during the second semester by the Department of Human Excellence, emphasizes environmental awareness and stewardship.

Allied Optional (AO): *Allied optional course are elective modules that complement the primary disciplines by providing additional knowledge and skills. These courses allow students to explore areas of interest outside their major field of study, broadening their understanding and enhancing their skill set.*

Discipline Specific Elective (DSE): *These courses offer the flexibility of selection of options from a pool of courses. These are considered specialized or advanced to that particular programme and provide extensive exposure in the area chosen; these are also more applied in nature. Four courses are offered, two courses each in semester V and VI*

Note: To offer one DSE, a minimum of two courses of equal importance/weightage is a must. A department with two sections must offer two courses to the students.

Open Elective (OE): *A course chosen from a different discipline or subject area, typically to gain exposure. Students pursuing specific disciplines must select Open Elective courses from the options available across departments as per the college's course offerings. The breadth of Open Elective (OE) Courses is directly linked to the diversity of disciplines offered by the college. Two OE Courses are available, one in each semester V and VI, and are open to students from other departments.*

Self-Learning (SL): *A two-credit course designed to foster students' ability for independent and self-directed learning. There are* Four Self-Learning Courses:
- *Compulsory MOOC on NPTEL-SWAYAM in Semester I or II*
- *'Artificial Intelligence' as a Self-Learning Course jointly offered by the Departments of CS, AI, IT and Data Science on JosTEL in Semester III*
- *A Department-Specific Self-Learning Course in Semester IV on JosTEL*
- *A Certificate Course in Semester V: Each department will offer ONE certificate Course (45 – 60 hours) that will be creditised in the curriculum.*

Internship (IS): *Following the fourth semester, students are required to undertake an internship during the summer break. Subsequently, they must submit a comprehensive report detailing their internship experience along with requisite documentation. Additionally, students are expected to participate in a viva-voce examination during the fifth semester. Credits for the internship will be reflected in the mark statement for the fifth semester. One of the Core Courses in Sem IV is offered as internship embedded course which contains content related to industry.*

Experiential Learning (EL): *In the sixth semester, students are required to undertake a one credit Project / Industrial visit / Field visit chosen by the department. This component is intended to foster learning by direct experience and application of acquired knowledge to practical settings.*

Comprehensive Examination (CE): A detailed syllabus consisting of five units to be chosen from the courses offered over the five semesters which are of immense importance and those portions which could not be accommodated in the regular syllabus.

Extra Credit Courses: To support students in acquiring knowledge and skills through online platforms such as Massive Open Online Courses (MOOCs), additional credits are granted upon verification of course completion. These extra credits can be availed across five semesters (2 - 6). In line with UGC guidelines, students are encouraged to enhance their learning by enrolling in MOOCs offered by portals like SWAYAM, NPTEL, and others. Additionally, certificate courses provided by the college also qualify for these extra credits.

Outreach Programme (OR): It is a compulsory course to create a sense of social concern among all the students and to inspire them to dedicated service to the needy.

Course Coding
The following code system (11 alphanumeric characters) is adopted for Under Graduate courses:

25	UXX	0	0	XX	00/X
Year of Revision	UG Department Code	Semester Number	Part Specification	Course Specific Initials	Running Number/with Choice

Course Specific Initials

GL - Languages (Tamil / Hindi / French / Sanskrit)

GE - General English

CC - Core Theory; CP- Core Practical

AC - Allied Course

AP - Allied Practical

SEC - Skill Enhancement Course

VE - Value Education

WS - Workshop

AE - Ability Enhancement Course

AO - Allied Optional

OP - Allied Optional Practical

ES - Discipline Specific Elective

IS - Internship

SL - Self-Learning

OE - Open Elective

PW - Project and Viva Voce

CE - Comprehensive Examination

EL - Experiential Learning

OR - Outreach Programme

EVALUATION PATTERN (UG)
Continuous Internal Assessment

Sl No	Component	Marks Allotted
1	Mid Semester Test	30
2	End Semester Test	30
3	*Two Components (15 + 20)	35
4	Library Referencing	5
	Total	**100**

Passing minimum: 40 marks

* *The first component is a compulsory online test (JosTEL platform) for 15 marks comprising 7 questions (1 mark) at K1 level and 4 questions (2 marks) at K2 level; The second component is decided by the course in-charge in accordance with the prescribed K levels.*

Question Paper Blueprint for Mid and End Semester Tests

Duration: 2 Hours									Maximum Marks: 60
Section		K levels							**Marks**
		K1	**K2**	**K3**	**K4**	**K5**	**K6**		
A *(compulsory)*		7							$7 \times 1 = 7$
B *(compulsory)*			5						$5 \times 3 = 15$
C *(either…or type)*				3					$3 \times 6 = 18$
D *(2 out of 3)*	Mid Sem				1(2)	1*			$2 \times 10 = 20$
	End Sem				1*	1(2)			
								Total	**60**

* *Compulsory*

Question Paper Blueprint for Semester Examination

Duration: 3 Hours								Maximum Marks: 100
Section	K levels							**Marks**
	K1	**K2**	**K3**	**K4**	**K5**	**K6**		
A *(compulsory)*	10							$10 \times 1 = 10$
B *(compulsory)*		10						$10 \times 3 = 30$
C *(either…or type)*			5					$5 \times 6 = 30$
D *(3 out of 5)*				2(3)	1(2)			$3 \times 10 = 30$
							Total	**100**

* *Compulsory*

Evaluation Pattern for Part IV and One/Two-credit Courses

Title of the Course	CIA	Semester Examination	Final
• One credit Core Course (Sem 1) • Skill Enhancement Course (NCC and Department Specific)	25 + 25 = 50	50 *(Department)*	100
• Self - Learning Course (Dept Specific) • Comprehensive Examination	25 + 25 = 50	50 *(CoE)*	100
• Value Education • Environmental Studies	50	50 *(CoE)*	100
• Skill Enhancement Course: Soft Skills • Self - Learning Course (Common) • Self - Learning Online Course (NPTEL / SWAYAM) • Certificate Course • Internship	100	-	100
• Project / Industrial Visit / Field Visit	100	-	100

Grading System

The marks obtained in the CIA and semester for each course will be graded as per the scheme provided in Table - 1.

From the second semester onwards, the total performance within a semester and the continuous performance starting from the first semester are indicated by Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA), respectively. These two are calculated by the following formulae:

$$SGPA \ and \ CGPA = \frac{\sum_{i=1}^{n} C_i Gp_i}{\sum_{i=1}^{n} C_i}$$

$$WAM = \frac{\sum_{i=1}^{n} C_i M_i}{\sum_{i=1}^{n} C_i}$$

Where,

> *C_i - credit earned for the Course i*
>
> *Gp_i - Grade Point obtained for the Course i*
>
> *M_i - Marks obtained for the Course i*
>
> *n - Number of Courses **passed** in that semester*
>
> *WAM - Weighted Average Marks*

Classification of Final Results

- For each of the first three parts in the UG Programme, there shall be separate classification on the basis of CGPA, as indicated in Table - 2.

- For the purpose of declaring a candidate to have qualified for the Degree of Bachelor of Arts / Science / Commerce / Management as Outstanding / Excellent / Very Good / Good / Above Average / Average, the marks and the corresponding CGPA earned by the candidate in Part III alone will be the criterion, provided the candidate has secured the prescribed passing minimum in all the five Parts of the programme.

- Grade in Part IV and Part V shall be shown separately and it shall not be taken into account for classification.

- A pass in SHEPHERD will continue to be mandatory although the marks will not be counted for the calculation of the CGPA.

- Absence from an examination shall not be considered as an attempt.

Table - 1: Grading of the Courses

Mark Range	Grade Point	Corresponding Grade
90 and above	10	O
80 and above and below 90	9	A+
70 and above and below 80	8	A
60 and above and below 70	7	B+
50 and above and below 60	6	B
40 and above and below 50	5	C
Below 40	0	RA

Table - 2: Grading of the Final Performance

CGPA	Grade	Performance
9.00 and above	O	Outstanding*
8.00 to 8.99	A+	Excellent*
7.00 to 7.99	A	Very Good
6.00 to 6.99	B+	Good
5.00 to 5.99	B	Above Average
4.00 to 4.99	C	Average
Below 4.00	RA	Re-appear

The Candidates who have passed in the first appearance and within the prescribed duration of the UG programme are eligible. If the Candidates Grade is O/A+ with more than one attempt, the performance is considered "Very Good".

Vision

Forming globally competent, committed, compassionate and holistic persons, to be men and women for others, promoting a just society.

Mission

- Fostering learning environment to students of diverse background, developing their inherent skills and competencies through reflection, creation of knowledge and service.

- Nurturing comprehensive learning and best practices through innovative and value- driven pedagogy.

- Contributing significantly to Higher Education through Teaching, Learning, Research and Extension.

Programme Educational Objectives (PEOs)

- Graduates will be able to accomplish professional standards in the global environment.

- Graduates will be able to uphold integrity and human values.

- Graduates will be able to appreciate and promote pluralism and multiculturalism in working environment.

Programme Outcomes (POs)

1. Graduates will be able to comprehend the concepts learnt and apply in real life situations with analytical skills.

2. Graduates with acquired skills and enhanced knowledge will be employable/ become entrepreneurs or will pursue higher Education.

3. Graduates with acquired knowledge of modern tools communicative skills and will be able to contribute effectively as team members.

4. Graduates are able to read the signs of the time analyze and provide practical solutions.

5. Graduates imbibed with ethical values and social concern will be able to understand and appreciate social harmony, cultural diversity ensure sustainable environment.

Programme Specific Outcomes (PSOs)

1. Acquire academic excellence with an aptitude for higher studies and research.

2. Gain knowledge about properties of different matter and its application for developing technology to the problems related to the society.

3. Analyse the applications to the problems in Physics through experimental and theoretical means.

4. Acquire the ability to design knowledge and demonstrate their understanding of the scientific methods and processes.

5. Apply appropriate techniques and modern tools to complex scientific activities, and develop skills in communicating Physics-related topics by learning beyond syllabus.

B. Sc. Physics					
Programme Structure					
Part	**Semester**	**Specification**	**No. of Courses**	**Hours**	**Credits**
1	1- 4	Languages (Tamil / Hindi / French / Sanskrit)	4	16	12
2	1- 4	General English	4	20	12
3	1 - 6	Core Course	12	56	40
	1 - 6	Core Practical	6	24	14
	1	Workshop	1	2	1
	1 & 2	Allied Course	2	12	8
	1 & 2	Allied Practical	-	-	-
	3 & 4	Allied Optional	2	8	6
	3 & 4	Allied Optional Practical	2	4	2
	5 & 6	Discipline Specific Elective	4	16	12
	5	Internship	1	-	1
	6	Project / Industrial Visit / Field Visit	1	-	1
	6	Comprehensive Examination	1	-	2
4	1 - 4	Value Education	4	8	4
	1 & 2	Ability Enhancement Compulsory Course	2	2	3
	2 - 5	Self - Learning	4	-	8
	3 & 4	Skill Enhancement Course	2	4	2
	5 & 6	Open Elective	2	8	4
5	2 - 6	Outreach Programme (SHEPHERD)	-	-	4
	2 - 6	Co-curricular and Extracurricular Activities	-	-	1
	2 - 6	Extra Credit Courses (MOOC) / Certificate Courses	5	-	(15)
		Total	**59**	**180**	**137 (15)**

B. Sc. PHYSICS PROGRAMME PATTERN									
				Course Details			Scheme of Exams		
Sem.	Part	Course Code	Course Type	Title of the Course	Hours	Credits	CIA	SE	FINAL
1	I	25UTA11GL01	GL	General Tamil – 1	4	3	100	100	100
		25UFR11GL01		Language French– 1					
		25UHI11GL01		Language Hindi– 1					
		25USA11GL01		Language Sanskrit – 1					
	II	25UEN12GE01A	GE	**General English – 1:** Pre-Intermediate Stream	5	3	100	100	100
		25UEN12GE01B		**General English – 1:** Intermediate Stream					
	III	25UPH13CC01	CC Major	**Core Course – 1:** Properties of Matter	6	5	100	100	100
		25UPH13CP01		**Core Practical – 1:** Physics Practical – 1	3	2	100	100	100
		25UPH13CC02		**Core Course – 2:** Foundation Course in Physics	2	1	100	-	100
		25UPH13WS01	WS	Workshop practice	2	1	100	-	100
		25UPH13AC01	AC Minor	**Allied Course - 1:** Mathematics for Physics - 1	6	4	100	100	100
	IV	25UHE14VE01	VE	**Value Education – 1:** Essentials of Humanity*	2	1	50	50	100
		25UEN14AE01	AECC	Communicative English	-	2	100	-	100
				Total	30	22			
2	I	25UTA21GL02	GL	General Tamil – 2	4	3	100	100	100
		25UFR21GL02		Language French – 2					
		25UHI21GL02		Language Hindi– 2					
		25USA21GL02		Language Sanskrit – 2					
	II	25UEN22GE02A	GE	**General English – 2:** Pre-Intermediate Stream	5	3	100	100	100
		25UEN22GE02B		**General English – 2:** Intermediate Stream					
	III	25UPH23CC03	CC Major	**Core Course – 3:** Mechanics	4	3	100	100	100
		25UPH23CC04		**Core Course – 4:** Waves and Sound	4	3	100	100	100
		25UPH23CP02		**Core Practical – 2:** Physics Practical - 2	3	2	100	100	100
		25UPH23AC02	AC Minor	**Allied Course - 2:** Mathematics for Physics - 2	6	4	100	100	100
	IV	25UHE24AE02	AECC	Environmental Studies*	2	1	50	50	50
		25UHE24VE02	VE	**Value Education - 2:** Fundamentals of Human Rights*	2	1	50	50	50
		25UPH24SL01	SL	Online Courses: (NPTEL / SWAYAM)	0	2	-	100	100
				Extra Credit Course	0	(3)			
				Total	30	22 (3)			
3	I	25UTA31GL03	GL	General Tamil – 3	4	3	100	100	100
		25UFR31GL03		Language French– 3					
		25UHI31GL03		Language Hindi– 3					
		25USA31GL03		Language Sanskrit – 3					
	II	25UEN32GE03B	GE	General English – 3: English for Science - 1	5	3	100	100	100
	III	25UPH33CC05	CC Major	**Core Course – 5:** Mathematical Physics-1	4	3	100	100	100
		25UPH33CC06		**Core Course – 6:** Electromagnetism	4	3	100	100	100
		25UPH33CP03		**Core Practical – 3:** Physics Practical - 3	3	2	100	100	100
		25UPH33AO01A	AO Minor	**Allied Optional - 1:** Chemistry-1	4	3	100	100	100
		25UPH33AO01B		**Allied Optional - 1:** Computer Science - 1					
		25UPH33OP01		**Allied Optional Practical:** Chemistry Practical - 1	2	1	100	100	100
		@		**Allied Optional Practical:** Computer Science	(2)	-	-	-	-
	IV	25UHE34VE03A	VE	**Value Education – 3:** Social Ethics – 1*	2	1	50	50	50
		25UHE34VE03B		**Value Education – 3:** Religious Doctrine – 1*					
		25UNC34SE01 / 25USS34SE01	SEC	**Skill Enhancement Course – 1:** Introduction to NCC / **Skill Enhancement Course – 1:** Soft Skills	2	1	100	-	100
		25UAI34SL02	SL	Artificial Intelligence (Online)	0	2	100	-	100
				Extra Credit Course	0	(3)			
				Total	30	21/22 (3)			
4	I	25UTA41GL04B	GL	General Tamil – 4: அறிவியல் தமிழ (Scientific Tamil)	4	3	100	100	100
		25UFR41GL04		Language French– 4					
		25UHI41GL04		Language Hindi– 4					
		25USA41GL04		Language Sanskrit – 4					
	II	25UEN42GE04B	GE	General English – 4: English for Science - 2	5	3	100	100	100
	III	25UPH43CC07	CC Major	**Core Course – 7:** Mathematical Physics – 2	4	3	100	100	100

Sem	Part	Course Code	Category	Course Title					
		25UPH43CC08		**Core Course – 8:** Thermal Physics (Internship Embedded Course)	4	3	100	100	100
		25UPH43CP04		**Core Practical – 4:** Physics Practical – 4	3	2	100	100	100
		25UPH43AO02A	AO Minor	**Allied Optional - 2:** Chemistry–2	4	3	100	100	100
		25UPH43AO02B		**Allied Optional - 2:** Computer Science - 2					
		25UPH43OP02A		**Allied Optional Practical - 2:** Chemistry Practical- 2	2	1	100	100	100
		25UPH43OP02B		**Allied Optional Practical - 1:** Computer Science	(2)	(2)			
	IV	25UHE44VE04A	VE	**Value Education – 4:** Social Ethics – 2*	2	1	50	50	50
		25UHE44VE04B		**Value Education – 4:** Religious Doctrine – 2*					
		25UNC44SE02 / 25UPH44SE02	SEC	**Skill Enhancement Course – 2:** NCC (Special Subject) / **Skill Enhancement Course – 2:** Techniques of Problem Solving in Physics	2	1	100	-	100
		25UPH44SL03	SL	**Self Learning:** Astronomy*	0	2	50	50	50
				Extra Credit Course	0	(3)			
				Total	30	23/22 (3)			
5	III	25UPH53CC09	CC Major	**Core Course – 9:** Optics	6	4	100	100	100
		25UPH53CC10		**Core Course – 10:** Concepts of Modern Physics	6	4	100	100	100
		25UPH53CP05		**Core Practical – 5:** Physics Practical - 5	6	3	100	100	100
		25UPH53ES01A	DSE	**Discipline Specific Elective – 1:** Analog and Digital Electronics	4	3	100	100	100
		25UPH53ES01B		**Discipline Specific Elective – 1:** Design of Analog and Digital Circuits					
		25UPH53ES02A	DSE	**Discipline Specific Elective – 2:** Solid State Physics	4	3	100	100	100
		25UPH53ES02B		**Discipline Specific Elective – 2:** Classical Mechanics					
		25UPH53IS01	IS	Internship	--	1	100	-	100
	IV	25UPH54OE01A	OE	**Open Elective - 1 (WS):** Physics for Everyday life	4	2	100	100	100
		25UPH54OE01B		**Open Elective - 1 (WS):** Renewable Energy Physics					
		25UPH54SL04 A	SL	**Certificate Course:** Solar Power Systems Installation and Maintenance	0	2	100	-	100
		25UPH54SL04 B		**Certificate Course:** Non-Destructive Testing					
		25UPH54SL04 C		**Certificate Course:** Forensic science					
		25UPH54SL04 D		**Certificate Course:** Wind Energy Utilization					
				Extra Credit Course	0	(3)			
				Total	30	22 (3)			
6	III	25UPH63CC11	CC Major	**Core Course – 11:** Quantum Mechanics	6	4	100	100	100
		25UPH63CC12		**Core Course – 12:** Atomic, Nuclear and Particle Physics	6	4	100	100	100
		25UPH63CP06		**Core Practical – 6:** Physics Practical - 6	6	3	100	100	100
		25UPH63ES03A	DSE	**Discipline Specific Elective – 3:** Spectroscopy and Laser	4	3	100	100	100
		25UPH63ES03B		**Discipline Specific Elective – 3:** Statistical Mechanics					
		25UPH63ES04A	DSE	**Discipline Specific Elective – 4:** Sensors, Transducers and IoT	4	3	100	100	100
		25UPH63ES04B		**Discipline Specific Elective – 4:** Embedded System and Microcontroller					
		25UPH63EL01A	EL	Project /	0	1	100	-	100
		25UPH63EL01B		Industrial visit /					
		25UPH63EL01C		Field Visit					
		25UPH63CE01	CE	Comprehensive Examination*	0	2	50	50	50
	IV	25UPH64OE02A	OE	**Open Elective - 2:** Laser Technology and its Application	4	2	100	100	100
		25UPH64OE02B		**Open Elective – 2:** Physics of Earth					
				Extra Credit Course	0	(3)			
				Total	30	22 (3)			
	V	25UCW65OR01	OR	Outreach Programme	-	4			
		25UCW65EC01	EC	Co - Curricular & Extra Curricular Activities		1			
1-6				**TOTAL**	180	137 (15)			

*For Grade Calculation: Marks obtained out of 50 will be converted into 100 in the mark statements.

B. Sc. PHYSICS - 3

Open Elective - 1 (WS): 5th Semester

School	Course Code	Title of the Course
SPS		
Chemistry	25UCH54OE01	Everyday Chemistry
Electronics	25UEL54OE01A	Lab Equipment maintenance and Servicing
	25UEL54OE01B	PC Assembling and Servicing
Physics	25UPH54OE01A	Physics for Everyday life
	25UPH54OE01B	Renewable Energy Physics

Open Elective - 2: 6th Semester
Offered to students from other Departments

Department	Course Code	Title of the Course
Artificial Intelligence and Machine Learning	25UAI64OE02	Gen AI tools
Botany	25UBO64OE02	Landscape Designing and Waste Management
Biotechnology	25UBT64OE02	Food Science and Technology
BBA	25UBU64OE02A	Practical Stock trading
	25UBU64OE02B	Export Management
B Com Business Analytics	25UCB64OE02	Personal Investment Planning
B Com Computer Application	25UCC64OE02A	Social Media Marketing
	25UCC64OE02B	Basics of Banking
B Com Strategic Finance	25UCF64OE02	Personal Financial Management
Chemistry	25UCH64OE02	Food & Nutrition
B Com	25UCO64OE02A	Digital Marketing
	25UCO64OE02B	Digital Banking
	25UCO64OE02C	Stock Trading
Computer Science	25UCS64OE02	Design Thinking
BCA	25UBC64OE02	Web Design
Economics	25UEC64OE02	Economics for Competitive Exams
Electronics	25UEL64OE02A	CCTV and Smart Security Systems
	25UEL64OE02B	Entrepreneurial Electronics
English	25UEN64OE02	English for Employability
History	25UHS64OE02	Intellectual Revivalism in Tamil Nadu
Mathematics	25UMA64OE02	Mathematics for Competitive Examinations
Physics	25UPH64OE02A	Laser Technology and its Application
	25UPH64OE02B	Physics of Earth
Statistics	25UST64OE02	Applied Statistics
Tamil	25UTA64OE02	படைப்பிலக்கியம் (Creative writing)
Visual Communication	25UVC64OE02	Digital Media and Production

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	*25UTA11GL01*	பொதுத்தமிழ் – 1: *General Tamil - 1*	*4*	*3*

கற்றலின் நோக்கங்கள் (*Course Objectives*)
புதிய இலக்கிய வடிவங்களை அறியும் திறனைப் பெறுதல்
எழுத்து சொல் இலக்கணத்தில் இன்றியமையாமையை உணர்தல்
புதுக்கவிதைகளின் கூறுகளை வாழ்வியலோடு பொருத்திப்பார்த்தல்
தமிழ்க்கவிதைகளைப் பிறமொழிக் கவிதைகளோடு ஒப்பிட்டுப் பார்த்தல்
புதுக்கவிதைகளைப் படைக்கும் திறன் பெறுதல்

அலகு-1 (12 மணி நேரம்)

பாரதியார் கவிதைகள்	- பாஞ்சாலிசபதம்: சபதச் சருக்கம்
பாரதிதாசன் கவிதைகள்	- புரட்சிக்கவி : மன்னனின் சர்வாதிகாரம், கவிஞனின் எழுச்சியுரை, கவிஞனின் மொழிப்பற்று, மக்களாட்சி மலரும் விதம்
இலக்கிய வரலாறு	- இருபதாம் நூற்றாண்டுத் தமிழ்க்கவிஞர்கள்
உரைநடை	- முதல் மூன்று கட்டுரைகள்

அலகு-2 (12 மணி நேரம்)

வெ.இராமலிங்கனார்	- தமிழ், அரசியல்
முடியரசனார்	- தொழிலாளி, துறைதோறும் தமிழே காண்பீர், மொழியுணர்ச்சி
பெருஞ்சித்திரனார்	- என்னென்று சொல்வோம், இனியேனும் ஒன்றிணைவீர்
பட்டுக்கோட்டையார்	- என் விருப்பம், ஏட்டில் படித்ததோடு இருந்து விடாதே, அன்னசத்திரம் இருப்பதெதனாலே?
இலக்கிய வரலாறு	- புதுக்கவிதை வடிவங்கள்
இலக்கணம்	- எழுத்து

அலகு-3: சமூகக் கவிதைகள் (12 மணி நேரம்)

சுரதா	- நெஞ்சில் நிறுத்துங்கள், பூம்புகார்
மு. மேத்தா	- உன்னுடைய கொடியை
கண்ணதாசன்	- ஆணவம் அழியும்
அப்துல் ரகுமான்	- பசி
தங்கம் மூர்த்தி	- கூடு திரும்புதல் எளிதன்று
ஜெயபாஸ்கரன்	- ஒற்றைக் கேள்வியுடன் ஒருவர்
இலக்கிய வரலாறு	- சிறுகதை- உரைநடை
சிறுகதை	- முதல் மூன்று கதைகள்

அலகு-4: அரசியல் கவிதைகள் (12 மணி நேரம்)

ஈரோடு தமிழன்பன்	- எட்டாவது சீர்
யுகபாரதி	- பழைய புத்தக வியாபாரி
கனிமொழி	- கருவறை வாசனை
அ. வெண்ணிலா	- நீரில் அலையும் முகம்
பெருமாள் முருகன்	- குழந்தைகளைத் தண்டித்தல்
சீனு ராமசாமி	- அகதி
கல்கி சுப்பிரமணியம்	- விதியை எழுதினேன்
இலக்கணம்	- சொல்

அலகு-5: அயலகக் கவிதைகள் (12 மணி நேரம்)

தஸ்லீமா நஸ்ரின்	- கல் உடைக்கும் பெண்
மாயா ஏஞ்சலு	- கைத்தட்டுங்கள் கொண்டாடுங்கள்
நானிலு கவிதைகள்	- *10 கவிதைகள்*
உரைநடை	- நான்கு முதல் ஆறு வரை உள்ள கட்டுரைகள்
சிறுகதை	- நான்கு முதல் ஆறு வரை உள்ள கதைகள்

கற்பித்தல் அணுகுமுறை *Teaching Methodology*	விரிவுரை (*Lecture*), காணொளிக் காட்சி (*Videos*), விளக்கக் காட்சி (*PPT presentation*)
மதிப்பீட்டு முறைகள் *Assessment methods*	நூல் நோக்குத் தேர்வு (*Open Book Test*), இயங்கலைத்தேர்வு (*Online Test*), ஒப்படைவு (*Assignment*), வினாடி வினா (*Quiz*), கருத்துரை (*Seminar*)

B. Sc. PHYSICS - 6

பாடநூல்:
பொதுத்தமிழ்-1(2025), தமிழாய்வுத்துறை, தூய வளனார் கல்லூரி

Websites and eLearning Sources:
- *https://www.tamilvu.org/library/nationalized/pdf/35-subbureddiyar/452-panjalisabatham.pdf*
- *https://www.annacentenarylibrary.org - https://shorturl.at/KWZx5*
- *https://eluthu.com/kavithai*
- *https://www.tamilvu.org/courses/degree/p103/p1032/html/p1032614.htm*
- *https://kavithaivaasal.blogspot.com/2017/11/blog-post.html*

Course Outcomes

CO No.	CO-Statements இப்பாடத்தின் நிறைவில் மாணவர்கள்	Cognitive Levels (K –Levels)
CO–1	இக்கால இலக்கிய வகைகளைக் கண்டறிவர்	K1
CO–2	எழுத்து, சொல்லிலக்கணங்களின் அடிப்படைகளை வகைப்படுத்தி அறிவர்.	K2
CO–3	அயலகக் கவிதை வடிவங்கள் குறித்த தெளிவான விளக்கங்களைப் பெறுவர்.	K3
CO–4	மொழிபெயர்ப்புக் கவிதைகளைக் கற்பதன் வாயிலாகத் திறனாய்வு செய்யும் திறனை வளர்த்தெடுப்பர்.	K4
CO–5	புதுக்கவிதை வாயிலாக வெளிப்படும் சமூக, அரசியல் விழுமியங்களை மதிப்பிடுவர்	K5

Relationship Matrix											
Semester	Course Code		Title of the Course							Hours	Credits
1	25UTA11GL01		பொதுத்தமிழ் – 1: General Tamil - 1							4	3
Course Outcomes↓	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	
CO-1	3	3	2	2	3	3	3	2	3	3	2.7
CO-2	2	2	3	2	2	3	2	3	2	3	2.4
CO-3	3	2	3	3	3	3	3	3	3	2	2.8
CO-4	2	2	2	2	1	2	2	3	2	2	2.0
CO-5	3	2	3	2	2	3	2	2	3	3	2.5
Mean Overall Score											2.48 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	**25UFR11GL01**	Language French – 1	**4**	**3**

Course Objectives
Familiarize students with the French language through an exploration of francophone culture, traditions, and civilization.
Build fundamental knowledge in listening, speaking, reading, and writing (LSRW) as outlined by the Common European Framework of Reference for Languages (CEFR).
Enable students to understand and use basic grammatical structures and essential vocabulary in context.
Equip students with the skills needed to engage in simple, real-life conversations and interactions in French.
Foster a deeper connection to the language by integrating cultural elements, enhancing motivation and intercultural awareness.

UNIT I (12 Hours)

1. Titre - Je Suis
2. Lexique - L'alphabet, les salutations, les loisirs, les nombres
3. Grammaire - Les pronoms personnels sujets, les articles définis et indéfinis, les verbes auxiliaires, les adjectifs de nationalité, l'adjectif interrogatif 'quel'
4. Production orale- se présenter
5. Production écrite - Donner des informations personnelles

UNIT II (12 Hours)

6. Titre - Près de moi
7. Lexique – Les lieux, la famille, la situation familiale, les professions
8. Grammaire – les verbes en 'er'au présent, le masculin et le féminin des professions, les adjectifs possessifs
9. Production orale- Demander et dire le lieu d'habitation
10. Production écrite - Présenter et parler de sa famille

UNIT III (12 Hours)

11. Titre - Qu'est-ce qu'on mange ?
12. Lexique – les commerces, les commerçants, les aliments, les moyens de paiement
13. Grammaire – le singulier et le pluriel des noms, les prépositions de lieu, les verbes en 'ir'
14. Production orale- faire des courses alimentaires, demander et dire le prix
15. Production écrite - Donner une appréciation, commander au restaurant, créer un menu

UNIT IV (12 Hours)

16. Titre - C'est où
17. Lexique – la ville, les monuments, les transports
18. Grammaire – la fréquence, l'impératif, les connecteurs
19. Production orale- demander et indiquer le chemin, se déplacer des transports en commun
20. Production écrite - présenter une ville ou un quartier, créer un guide pour un monument

UNIT V (12 Hours)

21. Titre - C'est tendance
22. Lexique – les vêtements, les couleurs, les matières, les objets technologiques, la météo
23. Grammaire – le genre et le nombre des adjectifs, le futur proche, la place des adjectifs, l'adjectif démonstratif
24. Production orale- demander et dire l'utilité d'un produit, parler de la météo
25. Production écrite - Donner une appréciation sur un vêtement, décrire un objet
26. Indian knowledge system- Incorporating hand gestures and expressions to reinforce non-verbal communication in French and assimilating traditional Indian culinary knowledge while learning French food cultures (5%)

Teaching Methodology	Kinesthetic & Multi-Sensory Learning, Rhythm-Based Learning – ex.comptines, Deductive & Explicit Learning- structural approach, oral approach, blended learning, media integration
Assessment Methods	*Oral assessment:* Introduce Oneself – (Rubric –assessed on correct usage of vocabulary, personal pronouns and basic verbs) *TPR activity:* Evaluate comprehension of oral commands like action words. (Rubric –assessed on comprehension, response and reaction time) *Reading comprehension:* Read a simple passage like a personal description, and answer questions. (Rubric –assessed on accuracy of response) *Written assessment:* Write simple structured texts on short personal introduction. (Rubric –Graded on correct grammar, sentence structure, and vocabulary usage)

Books for Study:
1. Mensdorff-Pouilly, L., Opatski, S., Petitmengin, V., Pons, S., Sperandio, C., Djimli, H., &Veldeman-Abry, J. (2022). *Édito A1: Méthode de français* (2nd ed.). Didier FLE, Hatier. (P.1-P.86)

Books for Reference:
1. Dauda, P., Giachino, L., &Baracco, C. (2020). *Génération A1*. Didier.
2. Mérieux, R., &Loiseau, Y. (2012). *Latitudes A1*. Didier.

Websites and e-learning Sources:
1. https://apprendre.tv5monde.com/en
2. https://www.thefrenchexperiment.com
3. https://www.iletaitunehistoire.com
4. https://www.francaisfacile.com
5. https://www.francaisauthentique.com

CO No.	Course Outcomes	Cognitive Levels (K –Levels)
	CO–Statements On successful completion of this course, students will be able to	
CO1	Recognize and use fundamental vocabulary including greetings, while constructing simple sentences with personal pronouns and basic verbs.	**K1**
CO2	Introduce themselves, ask and answer questions about personal details, express preferences, and engage in role-play conversations related to daily life	**K2**
CO3	Differentiate between definite and indefinite articles, form plural and singular nouns, conjugate regular verbs in the present tense, and use adjectives correctly	**K3**
CO4	Ask for and give directions, order food, discuss weather conditions, describe clothing and objects, and create simple structured texts such as menus, guides, and personal descriptions.	**K4**
CO5	Demonstrate awareness of Francophone culture through language use in real-world scenarios, such as public transport, shopping, dining, and professional settings.	**K5**

Relationship Matrix										
Semester	**Course Code**		**Title of the Course**				**Hours**		**Credits**	
1	**25UFR11GL01**		Language French – 1				**4**		**3**	
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**				**Mean Score of Cos**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	2	2	2	1	3	2	1	1	2	3	1.9
CO2	3	2	3	3	1	3	2	3	3	3	2.6
CO3	2	2	2	2	2	2	1	2	2	2	1.9
CO4	3	3	3	3	2	3	2	2	2	3	2.6
CO5	3	2	2	3	3	3	3	2	3	3	2.7
									Mean Overall Score	**2.34 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	**25UHI11GL01**	Language Hindi - 1	**4**	**3**

Course Objectives
To understand the basics of Hindi Language
To make the students to be familiar with the Hindi words
To enable the students to develop their effective communicative skills in Hindi
To introduce the socially relevant subjects in Modern Hindi Literature
To empower the students with globally employable soft skills

UNIT I (12 Hours)
1. Swar
2. Vyanjan
3. Barah Khadi
4. Shabd aur Vakya

UNIT II (12 Hours)
5. Rishtom ke Naam
6. Gharelu Padartho ke Naam
7. Sangya
8. Hindi Ginthi

UNIT III (12 Hours)
9. Sapthah ke Din
10. Sarvanam
11. Vilom Shabd
12. Dr. Abdul Kalam

UNIT IV (12 Hours)
13. Sal ke Maheene
14. Shareer ke Ang
15. Visheshan
16. Batcheeth - Dookan mein

UNIT V (12 Hours)
17. Janvarom ke Naam
18. Rang
19. Dishayem
20. Adhikal (Introduction)

Teaching Methodology	Peer Instruction Exercise, Videos, PPT, Quiz, Group Discussion
Assessment Methods	Seminar, Quiz, Assignment

Books for Study:
1. *Prathamic Patya Pusthak*, Dakshina Bharath Hindi Prachara Sabha, Thiagaraya Nagar, Chennai, 2022.
2. M. Ravi Chandran, *Concise Trilingual Dictionary,* Lotus Publications, Madurai, 2021.
3. M. kamathaprasad Gupth, *Hindi Vyakaran*, Anand Prakashan, Kolkatta, 2020.
4. *Madyama Patya Pusthak*, Dakshina Bharath Hindi Prachara Sabha, Thiagaraya Nagar, Chennai, 2022.

Books for Reference:
1. Dr. A. P. J. Abdul Kalam, *Mere sapnom ka Bharath*, Prabath Prakashan, Noida, 2020,
2. *Meri Pratham Hindi Sulekh Shabd Gyaan*, Wonder House Books, Noida, 2022.
3. Aravind Kumar, *Sampoorna Hindi Vyakaran our Rachana*, Lucent publisher, 2022.
4. *Adhunik Hindi Vyakaran our Rachana,* Bharati Bhavan Publishers & distributors, 2024.
5. Acharya Ramchandra Shukla, *Hindi Sahitya Ka Itihas*, Prabhat Prakashan, 2023.

Websites and e-Learning Sources:
1. https://learningmole.com/hindi-alphabet-letters-pronunciation-guide/
2. https://www.careerpower.in/hindi-alphabet-varnamala.html
3. https://www.youtube.com/watch?v=b0UvXnIC8qc
4. https://www.importanceoflanguages.com/learn-hindi-language-guide/
5. https://parikshapoint.com/hindi-sahitya/

CO No.	Course Outcomes	
	CO–Statements	**Cognitive Levels**
	On successful completion of this course, students will be able to	**(K –Levels)**
CO1	Introduction to Hindi sounds.	**K1**
CO2	Acquisition of Hindi Vocabulary.	**K2**
CO3	Sentence formation in Hindi.	**K3**
CO4	Practical application of grammar.	**K4**
CO5	Justify the social & political conditions of Aadhi Kaal in Hindi Literature.	**K5**

Relationship Matrix

Semester	Course Code	Title of the Course	Hours/week	Credits
1	**25UHI11GL01**	Language Hindi - 1	**4**	**3**

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scoreof Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	2	1	3	3	3	1	3	2	2.3
CO2	2	3	2	3	1	2	3	3	3	2	2.4
CO3	3	2	2	2	1	3	2	3	2	3	2.3
CO4	3	1	2	3	2	3	2	3	3	2	2.4
CO5	2	3	3	2	3	2	3	3	1	3	2.5
								Mean overall Score			**2.38 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	25USA11GL01	Language Sanskrit – 1	4	3

Course Objectives
To improve knowledge in Sanskrit
To train students in reading Sanskrit words
To introduce the fundamental grammar
To coach ethics and improve self-confident
To train the students to use the tenses in Sanskrit

UNIT I (12 Hours)
Introduction to Sanskrit

UNIT II (12 Hours)
Subhandha shabda vicaraha (akaara, aakaara, ikaara, iikaara)

UNIT III (12 Hours)
Vartamankala lat lakaara vakya prayogaha

UNIT IV (12 Hours)
Samskrita sharala vakya paricayaha

UNIT V (12 Hours)
Selected verses from good saying in Sanskrit

Teaching Methodology	Videos, PPT, Blackboard, Demonstration, Exercises
Assessment Methods	Seminar, Quiz, Group Discussion.

Books for Study:
Shadhamanjari

Books for Reference:
1. Kulapathy, K.M., Sarala Samkrit Balabodh, Bharatiya Vidya Bhavan, Munushimarg Mumbai – 4000 007 2021
2. R.S. Vadhyar & Sons, Book – Sellers and publishers, Kalpathi. Palagahat 678003, Kerala, South Inida, Shabdha Manjari 2022
3. Balasubramaniam R, Samskrita Akshatra Siksha, Vangals Publications, 14th Main road, JP Nagar, Bangalore – 78 2020

Websites and e-Learning Sources:
1. https://www.learnsanskrit.org/static/pdf/vyakarana.pdf
2. https://archive.org/details/in.ernet.dli.2015.382597
3. https://openpathshala.com/sanskrit-grammar-basic/3

Course Outcomes		
CO No.	CO–Statements	Cognitive Levels (K –Levels)
	On successful completion of this course, students will be able to	
CO–1	Remember and Recall words relating to objects.	K1
CO–2	Understand classified vocabulary.	K2
CO–3	Apply nouns and verbs	K3
CO–4	Analyze different forms of names and verbs	K4
CO–5	Appreciate the good saying of Sanskrit Improve the self-values.	K5

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
1	**25USA11GL01**		Language Sanskrit - 1							**4**	**3**
Course Outcomes↓	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**					**Mean Scores of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PS02**	**PSO3**	**PSO4**	**PSO5**	
CO-1	3	1	1	3	2	3	2	3	2	2	2.2
CO-2	2	2	3	3	1	2	2	3	3	2	2.3
CO-3	3	2	2	2	2	2	2	3	3	2	2.3
CO-4	3	2	2	3	2	3	3	3	2	2	2.3
CO-5	3	2	3	2	3	2	2	3	3	3	2.6
Mean Overall Score											**2.34 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	25UEN12GE01A	**General English – 1:** Pre-Intermediate Stream	5	3

Course Objectives (CO)
To develop basic listening, speaking, reading, and writing skills
To improve comprehension and fluency in both oral and written communication
To learn language rules to create meaningful written and spoken communication
To learn and integrate new vocabulary to expand language proficiency
To construct grammatically correct sentences and engage in simple conversations

UNIT I: (15 Hours)

Listening:	(Skill)	:	Listening for familiar words in stories
	(Practice)	:	"The City Mouse and the Country Mouse"
Reading:	(Skill)	:	Reading aloud
	(Practice)	:	"The Peacock and the Crane"
			"The Curious Monkey"
Grammar:	(Practice)	:	Nouns: Types; Gender
Vocabulary:	(Practice)	:	Kinship terms
Speaking:	(Skill)	:	Repetition of Minimal Pairs
	(Practice)	:	Pronunciation of words
Writing:	(Skill)	:	Using capital letters correctly in names, the pronoun 'I,' days, months, languages, nationalities, sentence beginnings, and book titles
	(Practice)	:	Capitalisation

UNIT II: (15 Hours)

Listening:	(Skill)	:	Listening to identify phrases and sentences
	(Practice)	:	"How to Be Happy in Every Situation"
Reading:	(Skill)	:	Reading for main ideas
	(Practice)	:	"The World is a Mirror"
Grammar:	(Practice)	:	Countable and Uncountable Nouns; Singular and Plural Nouns; Pronouns
Vocabulary:	(Practice)	:	Human body vocabulary
Speaking:	(Skill)	:	Responding to basic questions
	(Practice)	:	Simple conversations
Writing:	(Skill)	:	Writing personal and academic information with correct spelling
	(Practice)	:	Using Correct Spelling in Writing

UNIT III: (15 Hours)

Listening:	(Skill)	:	Listening for main ideas
	(Practice)	:	"Magic Pot"
Reading:	(Skill)	:	Identifying the message of the story
	(Practice)	:	Zen story: "Carry On"
			Zen story: "Harmony"
Grammar:	(Practice)	:	Adjectives, Articles and Verbs
Vocabulary:	(Practice)		Vegetables and Fruits
Speaking:	(Skill)		Using 'be' verbs and adjectives to describe people, things and pictures
	(Practice)		Describing People, Things and Pictures
Writing:	(Skill)	:	Practising correct punctuation in writing
	(Practice)	:	Punctuation

UNIT IV: (15 Hours)

Listening:	(Skill)	:	Listening for the main ideas in the story and expressing one's views about them
	(Practice)	:	"A Glass of Milk"
Reading:	(Skill)	:	Understanding the central idea of the story and sharing personal views

	(Practice)	**:**	"Birbal: The Wise Man"
Grammar:	**(Practice)**	**:**	Simple Present Tense
Vocabulary:	**(Practice)**	**:**	Plants, Trees and Flowers
Speaking:	**(Skill)**	**:**	Describing daily routines using the simple present tense
	(Practice)	**:**	Describing one's own routine and a friend's routine
Writing:	**(Skill)**	**:**	**Writing simple sentences in response to questions and on a given topic**
	(Practice)	**:**	Writing Simple Sentences

UNIT V: **(15 Hours)**

Listening:	**(Skill)**	**:**	Listening to understand the sequence of ideas
	(Practice)	**:**	A Father and His Son
Reading:	**(Skill)**	**:**	Identifying the implicit idea of the story
	(Practice)	**:**	"The Stone Cutter"
Grammar:	**(Practice)**	**:**	Simple Past Tense
Vocabulary:	**(Practice)**	**:**	Birds, Animals and Insects
Speaking:	**(Skill)**	**:**	Narrating stories, events, or experiences using the simple past tense
	(Practice)	**:**	Narrating a Familiar Story or Past Events
Writing:	**(Skill)**	**:**	Writing a paragraph using a picture by answering questions or describing it.
	(Practice)	**:**	Picture Composition

Teaching Methodology	Lectures, task-based activities, audio-visual listening tasks, guided reading and writing exercises, discussions
Assessment Method	Listening and reading comprehension exercises, verbal presentations, role plays and conversations, writing tasks

Books for Study:
Seeds of English Skills by Dr. M. John Britto, Dr. B. Sam Jerome Sharone, and Dr. S. Sajeev.

	Course Outcomes	
CO No.	**CO-Statements**	**Cognitive Levels (K-Level)**
CO-1	Recognize basic sounds, words, and simple ideas through listening practice.	**K1**
CO-2	Understand and engage in simple conversations, improving fluency in both oral and written communication.	**K2**
CO-3	Apply grammatical rules to construct meaningful sentences in spoken and written forms.	**K3**
CO-4	Integrate new vocabulary into everyday communication to expand language proficiency.	**K4**
CO-5	Construct grammatically correct sentences and engage in simple conversations, expressing personal experiences and opinions.	**K5**

Relationship Matrix										
Semester	**Course Code**		**Title of the Course**						**Hours**	**Credits**
1	**25UEN12GE01A**		**General English – 1:** Pre-Intermediate Stream						**5**	**3**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**				**Mean Scores of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PS02**	**PSO3**	**PSO4**	**PSO5**	
CO1	2	3	2	3	2	3	2	3	2	2	**2.4**
CO2	3	2	2	3	2	3	2	3	2	3	**2.5**
CO3	3	2	2	2	3	2	2	3	2	2	**2.3**
CO4	3	2	2	2	2	2	2	2	2	3	**2.2**
CO5	3	2	3	2	3	2	3	2	3	2	**2.5**
									Mean Overall Score		**2.38 (High)**

Semester	Course Code	Title of the Course	Hours/ Week	Credits
1	25UEN12GE01B	**General English – 1:** Intermediate Stream	5	3

Course Objectives
To improve students' ability to listen, speak, read, and write in English through interactive and meaningful activities tailored to real-life contexts.
To enable students to use appropriate vocabulary, grammar, and pronunciation to introduce themselves, express opinions, describe people and places, and engage in conversations.
To equip students with reading strategies to comprehend texts, and apply structured writing methods to express ideas coherently.
To develop students' ability to use common grammar structures accurately and expand their vocabulary through word formation techniques.
To help students apply effective learning strategies to enhance their academic and professional success.

Unit 1: What's in a Name? (15 Hours)

1. Listening:	(Skill)	Listening for gist
	(Practice)	"Not Good with Names" by Cynthia Win (a TED talk)
2. Reading:	(Skill)	Skimming
	(Practice)	"Eli, the Equation"
3. Grammar:	(Practice)	Nouns
4. Vocabulary:	(Practice)	Forming compound nouns
5. Study Skill:		Using online dictionaries
6. Speaking:	(Skill)	Initiating conversations (Greeting – Starting a conversation with new people – Introducing and answering an introduction)
	(Practice)	Introducing oneself and others in conversations
7. Writing:	(Skill)	Narrating a personal anecdote – Using capitals and end mark punctuations in sentences
	(Practice)	Guided Composition: The story of my name

Unit 2: Family is Forever! (15 Hours)

1. Listening:	(Skill)	Predicting topics
	(Practice)	"Tracing Roots, Telling Stories"
2. Reading:	(Skill)	Scanning
	(Practice)	"Home Lost, Family Found"
3. Grammar:	(Practice)	Pronouns
4. Vocabulary:	(Practice)	Words related to family and relationships
5. Study Skill:		Recognising your learning style
6. Speaking:	(Skill)	Talking about your family (family members and relationships, their personalities and your attachment, family routines, and challenges)
	(Practice)	Talking about your family (in conversations)
7. Writing:	(Skill)	Narrating events in chronological order – Using punctuations in numbers
	(Practice)	Controlled Composition: My family history

Unit 3: Nothing is Better than a Good Friend (15 Hours)

1. Listening:	(Skill)	Listening for main idea
	(Practice)	"Nothing is better than a good friend"
2. Reading:	(Skill)	Predicting
	(Practice)	(Jigsaw reading) Fables about friends: (a) "The Hare with Many Friends" – (b) "The Two Fellows and the Bear" – (c) "The Fox and the Stork" – (d) "The Four Friends and a Hunter"
3. Grammar:	(Practice)	Adjectives
4. Vocabulary:	(Practice)	Forming nouns, adjectives, verbs and adverbs using suffixes
5. Study skill:		Setting and prioritising language learning goals
6. Speaking:	(Skill)	Talking about people (Describing people's appearance and their mannerism – Giving your opinion about people – Expressing what you like and dislike in a person)

	(Practice)	Delivering a short talk about one's best friend
7. Writing:	(Skill)	Describing people (What they wear, how they move and seem to feel, and where they are) Using comma in sentences.
	(Practice)	Controlled composition: Describing people in given pictures

Unit 4: The Inner Me   **(15 Hours)**

1. Listening:	(Skill)	Listening to understand pronunciation
	(Practice)	"The bare necessities" from *The Jungle Book*
2. Reading:	(Skill)	Previewing a text
	(Practice)	"The Surprising Benefits of Being an Introvert"
3. Grammar:	(Practice)	Articles and Quantifiers
4. Vocabulary:	(Practice)	Forming words with different meanings using prefixes
5. Study skill:		Planning a study schedule
6. Speaking:	(Skill)	Asking about feelings – Expressing one's feelings
	(Practice)	Talking about feelings in different situations
7. Writing:	(Skill)	Describing character traits (Writing about what characters would say or do) Using quotation marks and apostrophes in sentences
	(Practice)	Controlled Composition: Cruel Cinderella

Unit 5: Hometown Appetite   **(15 Hours)**

1. Listening:	(Skill)	Listening for supporting details
	(Practice)	"The Village that Raised Me"
2. Reading:	(Skill)	Questioning circles for active reading
	(Practice)	"Homecoming"
3. Grammar:	(Practice)	Prepositions of time, place and movement
4. Vocabulary:	(Practice)	Changing words from one class to another
5. Study skill:		Tracking progress in learning
6. Speaking:	(Skill)	Describing a place
	(Practice)	Talking about your hometown
7. Writing:	(Skill)	Describing objects – Using colon in sentences
	(Practice)	Controlled Composition: Writing posts for social media, describing your college campus and classroom

Teaching Methodology	Lectures, Demonstrations, Discussions, Peer-Review Tasks, Role-plays, Pair and group activities
Assessment Tools	Listening and reading comprehension tasks, Individual talks, Role plays, Controlled and guided compositions

Books for Study:

M.S. Xavier Pradheep Singh, J. Amalaveenus, and A. Napoleon. *English and Me* by Viva Books, 2025.

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, the students will be able to	**Cognitive Levels (K-Level)**
CO1	Identify and recall common grammar structures, vocabulary, and pronunciation patterns used in everyday communication.	**K1**
CO2	Demonstrate comprehension of spoken and written texts by summarising key ideas, identifying main points, and making inferences.	**K2**
CO3	Use appropriate vocabulary, grammar, and pronunciation to introduce themselves, express opinions, describe people and places, and engage in meaningful conversations.	**K3**
CO4	Differentiate between various reading and writing strategies, such as skimming, scanning, and structured writing, to effectively interpret and construct texts.	**K4**
CO5	Critically review written and spoken texts for clarity, coherence, and correctness, providing constructive feedback for improvement.	**K5**

Relationship Matrix											
Semester	**Course Code**	**Title of the Course**							**Hours**	**Credits**	
1	25UEN12GE01B	**General English – 1:** Intermediate Stream							5	3	
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2.5	3	3	2.5	3	3	2.5	2.5	3	2.8
CO2	2.5	3	2.5	2.5	2.5	3	3	2.5	2.5	3	2.7
CO3	3	2.5	2.5	3	3	2.5	2.5	2.5	3	2.5	2.7
CO4	2.5	2.5	2.5	3	2.5	2.5	2.5	3	2.5	2.5	2.6
CO5	3	2.5	2.5	2.5	3	2.5	2.5	2.5	3	2.5	2.65
Mean Overall Score											**2.69 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	25UPH13CC01	**Core Course - 1:** Properties of Matter	6	5

Course Objectives
To study the properties of matter leads to information this is of practical value to both the physicist and the engineers.
To recall about bending moments, beam deflection, energy of bending, and Cornu's method for measuring µ.
To provide students an insight into fluid types, coefficient of viscosity, Reynolds number, Poiseuille's formula, and viscosity measurement.
To understand molecular theory, surface energy, pressure differences in curved liquid surfaces, and surface tension measurement.
To understand Fick's law, diffusion measurement, Graham's law, osmotic pressure, and its relation to vapor pressure, boiling, and freezing points.

UNIT I: Elasticity   (18 Hours)

Stress and Strain - Stress - strain curve - Hooke's Law and Elastic Moduli - Poisson's ratio - Relation between elastic constants - Torsion of a Cylinder - Measurement of modulus of rigidity: Statical & Dynamical method - Measurement of moment of inertia by the torsional pendulum method - Potential Energy due to Deformation.

UNIT II: Bending of Beams   (18 Hours)

Internal bending moment - Beam bent by a constant couple - Cantilever - supported beam - energy of bending - cantilever - a supported beam - beam rigidly fixed at both ends - Asymmetrically bent beam - Cornu's method of measuring µ.

UNIT III: Viscosity   (18 Hours)

Streamline flow and Turbulent flow - coefficient of viscosity - Newtonian and non-Newtonian fluids - critical velocity and Reynolds Number - Poiseuille's formula - corrections - Experimental determination of coefficient of viscosity - Viscosity of gases - Rankine's method for determining viscosity of a gas – Body falling in fluid - terminal velocity.

UNIT IV: Surface Tension   (18 Hours)

Molecular theory of surface tension - surface energy - total surface energy - angle of contact - pressure difference between two sides of a curved liquid surface - soap bubbles in contact - water in U tube - a charged soap bubble - Measurement of surface tension: capillary rise method - drop weight method.

UNIT V: Diffusion and Osmosis   (18 Hours)

Diffusion: Introduction Fick's law - relation between time of diffusion and length of column - experimental measurement of diffusivity - Graham's law - effusion. Osmosis: Osmosis and Osmotic pressure - Laws of osmotic pressure - Osmosis and vapour pressure of a solution - osmosis and boiling point of a solution - osmosis and freezing point of a solution.

Teaching Methodology	Chalk and Talk, Demo Videos, PPT, Hand-outs
Assessment Methods	Seminar, Snap Test, MCQ, Online Quiz, Assignment

Books for Study:
1. Satyendra Nath Maiti, Debi Prasath Raychaudhuri. (2008). *Classical mechanics and general properties of Matter,* (2nd Ed.). New Age International Publishers.
2. D.S. Mathur (2010), *Elements of Properties of Matter*. S. Chand & Company.

Unit	Book	Chapters	Sections
I	1	11	11.1, 11.2, 11.3, 11.4, 11.4.1, 11.5.1, 11.5.2, 11.6, 11.6.1-11.6.3, 11.8, 11.8.1, 11.8.2
II	1	11	11.9, 11.9.2, 11.9.5, Ex.11.10-1 to 5, 11.10.5, 11.12.3, 11.13, 11.15
III	1	12	12.1-12.5, 12.6.1-12.6.3, 12.6.8, 12.6.9, 12.8, 12.8.3, 12.8.4
IV	1	14	14.1 -14.4, 14.5, 14.6, Ex. 14.6-1 to 3, 14.8, 14.8.1, 14.8.4
V	2	13	13.1-13.12

Books for Reference:

1. Robert Resnick, David Halliday, Jearl Walker, (2015), *Principles of Physics*, 10th Ed. John Wiley.
2. Richard Philip Feynman, (2012). *The Feynman lectures on Physics*, Pearson.
3. Irodov, I. E., (2016). *Problems in general Physics*, Arihant Publishers.

Websites and eLearning Sources:

1. https://civilprojectsonline.com/building-construction/stress-strain-modulus-of-elasticity-and-elastic-materials/
2. https://phys.libretexts.org/Bookshelves/University_Physics/University_Physics_(OpenStax)/Book%3A_University_Physics_I_-_Mechanics_Sound_Oscillations_and_Waves_(OpenStax)/12%3A_Static_Equilibrium_and_Elasticity/12.04%3A_Stress_Strain_and_Elastic_Modulus_(Part_1)
3. https://eng.libretexts.org/Bookshelves/Materials_Science/TLP_Library_I/07%3A_Bending_and_Torsion_of_Beams
4. https://scienceinfo.com/viscosity-definition-types-significance-applications/
5. https://www.pw.live/chapter-states-of-matter/surface-tension
   (* subject to availability - not to be used for exam purpose)

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, the students will be able to	**Cognitive Levels (K-Level)**
CO1	Acquire the knowledge of stress, strain, elastic moduli, Poisson's ratio, torsion, and modulus of rigidity measurement.	**K1**
CO2	Understand the concepts of bending moments, beam deflection, energy of bending, and Cornu's method for measuring μ.	**K2**
CO3	Explain the benefits of studying fluid behavior, viscosity, Reynolds number, Poiseuille's formula and viscosity measurement techniques.	**K3**
CO4	Analyze the molecular theory of surface tension, surface energy, pressure differences in curved liquid surfaces, and measurement methods.	**K4**
CO5	Evaluate the principles of diffusion, Fick's law, Graham's law, osmotic pressure, and their effects on physical properties.	**K5**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
1	25UPH13CC01		**Core Course - 1:** Properties of Matter							6	5
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	2	2	3	2	2	2	3	2.4
CO2	2	3	2	3	2	3	2	3	2	1	2.3
CO3	3	2	2	2	1	3	3	2	3	1	2.2
CO4	3	3	2	3	2	3	3	2	3	2	2.6
CO5	3	2	2	2	1	3	2	3	2	1	2.1
										Mean Overall Score	**2.4 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	**25UPH13CP01**	**Core Practical - 1:** Physics Practical - 1	**3**	**2**

Any 8 Experiments

1. Surface Tension – drop weight method.
2. Viscosity – constant pressure head method.
3. Viscosity – Stoke's method.
4. Young's modulus – cantilever / stretching.
5. Sonometer – frequency of the tuning fork – RD of solid.
6. Spectrometer – refractive index - solid prism (glass).
7. Potentiometer – internal resistance.
8. P.O Box – temperature coefficient.
9. Convex lens – f, R and μ.
10. Field along the axis of a coil – deflection magnetometer.
11. M1/M2- Tan A & Tan B simultaneous method.
12. Air wedge-Thickness of wire.
13. B.G. – Figure of merit.
14. Resonators - Helmholtz and Cylindrical Resonators.

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	25UPH13CC02	**Core Course - 2:** Foundation Course in Physics	2	1

Course Objectives
To provide students with a broad overview of physics before they engage in core courses
To bridge the gap between the school curriculum and the undergraduate programme
To introduce the fundamentals principles of waves, oscillations and light
To develop an understanding of thermodynamics, electricity and magnetism
To explore the foundational concepts of Modern Physics

UNIT 1: Waves and Oscillations (6 Hours)

Simple Harmonic Motion (SHM)-Damped and Forced Oscillations-Wave Motion: Transverse and Longitudinal Waves -Superposition Principle and Interference-Sound Waves and Doppler Effect- Relevant units of physical quantities and basic calculations.

UNIT 2: Optics (6 Hours)

Reflection and refraction: Laws, Snell's law, total internal reflection-Lenses, and mirrors: Thin lens formula, magnification-Wave optics: Interference, diffraction, polarization-LASER- Relevant units of physical quantities and basic calculations.

UNIT 3: Thermodynamics (6 Hours)

Laws of Thermodynamics-Heat, Work, and Internal Energy-Heat Transfer Mechanism-Entropy and Second Law of Thermodynamics-Kinetic Theory of Gases-Heat Engines and Refrigerators-Seebeck effect-Peltier effect - Relevant units of physical quantities and basic calculations.

UNIT 4: Electricity and Magnetism (6 Hours)

Coulomb's Law and Electric Fields-Gauss's Law -Electric Potential and Capacitance-Current, Resistance, and Circuits-Magnetic Fields and Forces-Faraday's Law of Electromagnetic Induction- Relevant units of physical quantities and basic calculations.

UNIT 5: Modern Physics (6 Hours)

Photoelectric Effect and Dual Nature of Light -Atomic nucleus-atomic number, Mass number, Isotopes-nuclear binding energy-Radioactivity-Nuclear Force-Artificial radioactivity-nuclear fission-nuclear fusion.

Teaching Methodology	Chalk and talk, PPT and Videos
Assessment Methods	Seminar, Snap Test, MCQ, Online Quiz, Assignment

Books for study:
1. Halliday Resnick, (2009). *Fundamentals of Physics,* (8th Ed) extended.

Unit	Book	Section
I	1	15.1,15.2,15.8,15.9,16.1,16.3,17.2,17.5,17.9
II	1	33.8, 33.9, 34.3, 34.7, 35.7, 35.3, 33.7
III	1	18.3,18.10, 20.4,18.7,18.9,18.12, 20.3, 20.6
IV	1	21.4, 22.2, 23.4, 24.3, 25.2, 26.2, 28.3, 30.3
V	1	38.3, 39.8, 42.2, 42.3, 43.2, 43.6

Books for Reference:
1. Verma, H. C. (2021). *Concepts of physics.* (Vol 1) and 1st Edition, Bharati Bhawan (Publishers & Distributors).
2. Young, H. D., Freedman, R. A., & Ford, A. L. (2021). *University physics with modern physics,* (15th Ed.). Pearsons Education.

Websites and eLearning Sources:
1. https://archive.nptel.ac.in/courses/115/106/115106119/

2. https://archive.nptel.ac.in/courses/115/107/115107131/
3. https://archive.nptel.ac.in/courses/112/105/112105266/

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, the students will be able to	**Cognitive Levels (K-Level)**
CO1	Recall and relate fundamental concepts of waves, oscillations, optics, thermodynamics, electricity, magnetism and modern physics.	**K1**
CO2	Summarize and explain the principles of wave motion, thermodynamic laws, and electromagnetism, bridging the transition from school physics to the undergraduate level.	**K2**
CO3	Apply the concepts of mechanics, wave optics, thermodynamics, and electromagnetism to solve basic numerical problems and interpret their mathematical formulations	**K3**
CO4	Analyze physical phenomena such as interference, diffraction, heat transfer, electromagnetic induction, and nuclear reactions, evaluating their applications in real-world scenarios.	**K4**
CO5	Demonstrate a deeper understanding of fundamental physics concepts and their interconnections, laying a strong foundation for advanced studies in physics.	**K5**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
1	**25UPH13CC02**		**Core Course - 2:** Foundation Course in Physics							**2**	**1**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	2	2	2	2	3	3	2	3	2	**2.4**
CO2	3	1	3	1	2	3	2	3	3	2	**2.3**
CO3	3	2	2	2	2	3	2	3	2	2	**2.3**
CO4	3	2	3	2	2	3	3	2	2	2	**2.4**
CO5	2	2	2	2	2	3	3	2	3	2	**2.3**
										Mean Overall Score	**2.34 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	**25UPH13WS01**	**Workshop – 1:** Workshop Practice	**2**	**1**

Any 8 Experiments

1. Multimeter functions
2. Spectrometer servicing
3. Resistance box servicing
4. Capacitance Box servicing
5. Inductance box servicing
6. Rheostat servicing
7. Logic module servicing
8. Extension cum Test board assembling
9. LED light assembling.
10. CRO operations
11. House wiring
12. Power supply assembling
13. MP3 player assembling
14. 3D object design and Printing
15. Solar light assembling

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	25UPH13AC01	**Allied Course - 1:** Mathematics for Physics - 1	6	4

Course Objectives
To train the students to use their basic skills of differentiation for successive differentiation
To have knowledge on integration and its properties
To know the methods of solving differential equations
To explore the basic ideas of matrices
To understand the nature of series

UNIT I **(18 Hours)**

Higher Derivatives - Trigonometrical Transformation - Formation of Equation Involving Derivatives - Leibnitz's Formula for the nth Derivatives of a Product (Without Proofs) - Integration by Parts.

UNIT II **(18 Hours)**

Properties of Definite Integrals - Integration by Parts - Reduction Formula for $x^n e^{ax}, x^n \cos ax, x^n \sin ax,$ $x^n \sin ax, \sin^n x \, cosnx, \sin^m x cosnx$ and $\tan^n x$

UNIT III **(18 Hours)**

First Order Differential Equations - Variable Separable - Homogenous Equations- Non-Homogenous Equations - Linear Equation - Bernoulli's Equation-Second Order Differential Equations - Linear Equation with Constant Coefficients

UNIT IV **(18 Hours)**

Matrices - Rank of a Matrix - Solving Simultaneous Linear Equations in Three Unknowns Using Elementary Operations Method - Eigen Values and Eigen Vectors - Verification of Cayley Hamilton Theorem.

UNIT V **(18 Hours)**

Concept of Limit of a Sequence - Limit of a Function - Simple Problems -Convergence, Divergence and Oscillation of a Series - Geometric Series -Tests of Convergence and Divergence, Comparison Test, Ratio Test and Root Test (Without Proofs).

Teaching Methodology	Chart, PPT, chalk and talk, videos
Assessment Methods	Seminar, Snap Test, MCQ

Books for Study:
1. S. Narayanan, R. Hanumantha Rao, T.K. Manicavachagom Pillay and Kandaswamy, *Ancillary Mathematics, Vol-I* ,2009 Edition.
   Unit I: *Chapter 6 - Sec 6.1, pp: 266-281*
   Unit IV: *Chapter 3 - Sec 3.2 - 3.4, pp: 137-160.*
2. S. Narayanan, R. Hanumantha Rao, T.K. Manicavachagom Pillay and Kandaswamy, *Ancillary Mathematics, Vol-II,* 2010 Edition.
   Unit I: *Chapter 1 - Sec 12, pp: 68-72*
   Unit II: *Chapter 1 - Sec 11, 13.1-13.6, pp: 61-67, 73-82*
3. S. Narayanan and T.K. Manickavasagam Pillai, *Ancillary Mathematics, Book II*, 1999 Edition.
   Unit III: *Chapter 2 - Sec 1-5, pp: 7-18, Chapter 3 - Sec 1-4, pp: 42-60*
4. M. K. Venkataraman, *Higher Mathematics for Engineering and Science*, Third Edition, The National Publishing Co., Madras, 1986,
   Unit V: *Chapter 6 - Sec 1-14*

Books for Reference:
1. S. Narayanan, R. Hanumantha Rao, T.K. Manicavachagom Pillay, *Ancillary Mathematics Volume-I-* 2009 Edition.
2. S. Narayanan & T.K. Manichavachagom Pillay, *Differential equation and its applications*, S. Viswanathan Pvt. Ltd., 2001 Edition.

Websites and eLearning Sources:
1. https://www.khanacademy.org/math/differential-quations
2. https://www.khanacademy.org/math/linear-algebra
3. https://www.khanacademy.org/math/integral-calculus
4. https://uom.lk/sites/default/files/math/files/MATRICES-COMPLETE_LECTURE_NOTE.pdf

	Course Outcomes	
CO No.	**CO-Statements** On successful completion of this course, the students will be able to	**Cognitive Levels (K-Level)**
CO1	Attain knowledge of higher derivatives, definite integrals, first and second order differential equations, matrices and infinite series.	**K1**
CO2	Understand formation of equations involving derivatives, trigonometrical transformation in derivatives, properties of definite integrals operations and properties of matrices and convergence of series.	**K2**
CO3	Illustrate integration by parts, reduction formula, simultaneous linear equations in three unknowns, different methods in first order differential equations and convergence of series	**K3**
CO4	Verify integration by parts, Leibnitz's formula, reduction formula, linear equation, Bernoulli's equation, Cayley Hamilton theorem and comparison test, ratio test and root test	**K4**
CO5	Evaluate definite integrals, reduction formula, solutions of first and second order differential equations, rank of a matrix eigenvalues and eigenvectors and convergence.	**K5**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
1	25UPH13AC01		Allied Course - 1: Mathematics for Physics - 1							6	4
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	2	1	3	3	2	2	3	2.3
CO2	3	2	2	1	2	3	3	3	2	3	2.4
CO3	2	3	2	2	1	2	3	2	3	2	2.2
CO4	2	3	2	3	1	2	3	2	2	3	2.3
CO5	2	2	2	2	1	2	3	2	2	3	2.1
										Mean Overall Score	**2.26 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
1	25UHE14VE01	**Value Education - 1:** Essentials of Humanity	2	1

Course Objectives
To identify one's own potentials, strengths and weaknesses
To identify various challenges (physical, emotional and social) in adolescence
To consciously overcome one's challenges and move towards self-esteem
To maximize one's own potential in enabling holistic development
To assimilate human values comprehensively

UNIT I: Value Education (6 Hours)

Introduction to values - Characteristics and Roots of Values - Value Education & Value Clarification - Moral Characters - Kinds of Values - Objectives of Values

UNIT II: Human Personality (6 Hours)

Personality: Introduction, Traits, Theories, Integration & Factors influencing the development of personality - Discovering self - Defense Mechanism -Power of positive thinking - Why worry?

UNIT III: Human Development (6 Hours)

Areas of Development: Physical, Intellectual, Emotional, Social Development, Moral & Spiritual development – Practical Sessions on Health and Wellness

UNIT IV: Responsible Parenthood (6 Hours)

Human Sexuality - Marriage and Family - Sex and Love - Characteristics of Responsible parent - Causes of Marriage disharmony - Art of wise parenting

UNIT V: Gender Equality and Empowerment (6 Hours)

Historical perspective - Women in Independence struggle - Women in Independent India - Education & Economic development - Crimes against Women - Women rights - Time-line of Women achievements in India

Teaching Methodology	Power point
Assessment Methods	Seminars, Reports, Group Discussion, Online Tests, Assignments

Books for Study:
1. Department of Human Excellence. (2023). *Essentials of Humanity.* St. Joseph's College.

Books for Reference:
1. Alex, K. (2009). *Soft Skills.* S. Chand.
2. Norman Vincent Peale (1952). *The Power of Positive Thinking Norman Vincent Peale.* New York Times
3. Kalam, A.A. P. J. (2012). *You Are Unique.* Punya Publishing.

Websites and eLearning Sources:
1. http://livingvalues.net. Accessed 05 March 2021.
2. https://www.psychologytoday.com/us/basics/defense-mechanisms.Accessed 12 March 2025.
3. http://www.apa.org/topics/personality#. Accessed 05 March 2021.
4. http://www.peacecorps.gov/educators/resources/global-issues-gender-equaligy-and-womens-empowerment/. Accessed 05 March 2021.
5. https://www.nextias.com/blog/women-empowerment/Accessed 12 March 2025.

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, students will be able to	**Cognitive Levels (K - Level)**
CO1	Recall the prescribed values and the dimensions.	**K1**
CO2	Examine themselves by learning the developmental changes happening in the course of their lifetime.	**K2**
CO3	Apply the trained values in the day-to-day life.	**K3**

Relationship Matrix											
Semester	**Course Code**	**Title of the Course**							**Hours**		**Credits**
1	**25UHE14VE01**	**Value Education - 1:** Essentials of Humanity							2		1
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	3	3	2	3	3	2	3	3	**2.8**
CO2	3	2	2	3	3	2	3	3	2	2	**2.5**
CO3	2	3	3	3	2	3	3	3	3	3	**2.8**
									Mean Overall Score		**2.7 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	*25UTA21GL02*	பொதுத்தமிழ் – 2: General Tamil - 2	*4*	*3*

கற்றலின் நோக்கங்கள் (Course Objectives)
காப்பியங்களின் தோற்றம், வரையறை, வகைகள் ஆகியவற்றை அறிந்து கொள்ளல்
பெருங்காப்பியம், சிறுகாப்பியம் இடையேயான வேறுபாட்டைக் கண்டறிதல்
சைவ வைணவ சமயப் பாடல்களில் சிறப்பினை ஒப்பிடுதல்
காப்பியங்கள் வெளிப்படுத்தும் விழுமியங்களையும் உணர்தல்
சமூகத்திற்கும், காப்பியத்திற்குமான பிணைப்புகள் குறித்துத் தெரிந்துகொள்ளுதல்

அலகு-1 *(12 மணி நேரம்)*

சிலப்பதிகாரம் - ஆய்ச்சியர் குரவை

மணிமேகலை – ஊர் அலர் உரைத்த காதை

இலக்கிய வரலாறு – சைவம் வளர்த்த தமிழ் முதல் புராணங்கள் முடிய

இலக்கணம் – அகப்பொருள் இலக்கணம்

அலகு-2 *(12 மணி நேரம்)*

திருநாவுக்கரசர் – திருவதிகை வீரட்டானம்

(கூற்றாயினவாறு எனத் தொடங்கும் முதல் 10 பாடல்கள்)

திருவாசகம் - அடைக்கலப்பத்து

(செழுக்கமலத் திரளனின் எனத் தொடங்கும் முதல் 10 பாடல்கள்)

திருமந்திரம் – மாகேசுர பூசை (11 பாடல்கள்)

சிவவாக்கியர் பாடல்கள் (15 பாடல்கள்)

பாடல் எண்கள் – 16,22,27,33,34,35,37,38,47,81,91,225,237,242,495

அலகு-3 *(12 மணி நேரம்)*

பெரியாழ்வார் திருமொழி – திருப்பல்லாண்டு – தாலப்பருவம் (10 பாடல்கள்

திருமங்கையாழ்வாரின் பெரிய திருமொழி – திருவரங்கம் -1 (10 பாடல்கள்)

கம்பராமாயணம் – கங்கை காண் படலம் - (தேர்ந்தெடுக்கப்பட்ட 35 பாடல்கள்)

பாடல் எண்கள்: 1, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 22, 24, 25, 26, 27, 29, 30, 32,33,35,39,40,41,42,43,47,62,64,65,67,69,70

நற்றமிழ்க் கோவை – முதல் மூன்று கட்டுரைகள்.

அலகு-4 *(12 மணி நேரம்)*

சீறாப்புராணம் – நதி கடந்த படலம் – 1 முதல் 31 முடிய உள்ள பாடல்கள்

கள்வரை நதிமறித்த படலம் – 1 முதல் 16 முடிய உள்ள பாடல்கள்

இலக்கணம் – புறப்பொருள் இலக்கணம்

இலக்கிய வரலாறு – தமிழ் இலக்கண நூல்கள் முதல் சிற்றிலக்கியங்கள் முடிய

அலகு-5 *(12 மணி நேரம்)*

வீரமாமுனிவரின் தேம்பாவணி – (காசா) காசை சேர் படலம்

(1 முதல் 50 முடிய உள்ள பாடல்கள்)

சீனயி (சீனாய்) - மாமலை காண்படலம் -(1 முதல் 56 முடிய உள்ள பாடல்கள்)

நற்றமிழ்க் கோவை – இறுதி மூன்று கட்டுரைகள்.

கற்பித்தல் முறை *(Teaching Methods)*	விரிவுரை *(Lecture)*, காணொளிக் காட்சி *(Videos)*, விளக்கக் காட்சி *(PPT presentation)*
மதிப்பீட்டு முறைகள் *(Assessment Pattern)*	இயங்கலைத்தேர்வு *(Online Test)*, நூல் நோக்குத் தேர்வு *(open book test)* ஒப்படைவு *(Assignment)*, வினாடி வினா *(Quiz)*, கருத்துரை *(Seminar)*

பாடநூல்கள்:

1. பொதுத்தமிழ் (2025), தமிழாய்வுத்துறை, தூய வளனார் கல்லூரி
2. நற்றமிழ்க் கோவை - கட்டுரைத்தொகுப்பு (2025), தமிழாய்வுத்துறை வெளியீடு, தூய வளனார் கல்லூரி

Websites and eLearning Sources:

1. *https://www.tamiluniversity.ac.in/english/library2-/digital-library/*
2. *https://www.tamilvu.org/ta/library-l3100-html-l3100pl1-132372*
3. *https://www.tamilvu.org/ta/courses-degree-p202-p2021-html-p202121-28011*
4. *https://www.chennailibrary.com/vaishnava/naalayiradivyaprabhandham.html*

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5. *https://www.tamilvu.org/ta/library-l4310-html-l4310por-141616*
6. *https://www.tamilvu.org/slet/l4100/l4100pd2.jsp?bookid=80&pno=287*

Course Outcomes

CO No.	CO–Statements இப்பாடத்தின் நிறைவில் மாணவர்கள்	Cognitive Levels (K –Levels)
CO–1	பழந்தமிழர் வாழ்வியலையும் பன்முக ஆளுமைகளையும் அறிவர்	K1
CO–2	தமிழரின் பல்துறை அறிவு, மரபு போன்றவற்றை அறிந்து கொள்வர்.	K2
CO–3	பெருங்காப்பிய மரபிற்குள் வரும் இலக்கியங்களை அடையாளம் காண்பதோடு அவற்றை விளக்கும் திறனையும் பெறுவர்.	K3
CO–4	புராண இதிகாச மரபுகளிலிருந்து, காப்பியம் என்னும் புதிய இலக்கிய வடிவம் உருவான விதத்தை மதிப்பிடுவர்.	K4
CO–5	இலக்கிய வரலாறு, இலக்கணம், காப்பியங்கள் ஆகியவற்றைக் கற்பதன் வழி போட்டித் தேர்வுகளை எதிர்கொள்ளும் திறன் பெறுவர்	K5

Relationship Matrix

Semester	Course Code		Title of the Course				Hours	Credits
2	25UTA21GL02		பொதுத்தமிழ் – 2: General Tamil - 2				4	3

Course Outcomes↓	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	2	3	3	3	3	3	3	3	2.8
CO-2	3	2	2	2	2	3	3	3	2	2	2.4
CO-3	2	3	1	3	1	3	3	3	1	2	2.2
CO-4	3	3	2	3	1	3	3	3	1	3	2.5
CO-5	3	3	2	2	3	3	3	2	2	2	2.5
									Mean Overall Score		2.48 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	**25UFR21GL02**	Language French – 2	**4**	**3**

Course Objectives
Develop Communicative Competence in French enabling students to engage in simple, real-life conversations and interactions
Master Fundamental Grammar and Vocabulary by understanding and applying essential grammatical structures in context
Explore Francophone Culture and Civilization by integrating cultural elements of French-speaking regions
Enhance Practical Language Use in Everyday Situations
Express Ideas in Different Contexts Using Appropriate Tenses

UNIT I (12 Hours)

1. Titre - Qu'est-ce qu'on fait aujourd'hui ?
2. Lexique –l'heure, les activités quotidiennes, la description physique
3. Grammaire –les verbes pronominaux au présent, le passé récent, la fréquence
4. Production orale- demander l'heure, proposer une sortie
5. Production écrite - présenter ses activités quotidiennes, décrire une personne

UNIT II (12 Hours)

6. Titre - Chez -moi
7. Lexique – le logement, les meubles, les pièces, l'équipement
8. Grammaire – le passe compose avec avoir, les pronoms COD
9. Production orale- s'informer sur un logement
10. Production écrite - expliquer un problème domestique, écrire une annonce pour un logement

UNIT III (12 Hours)

11. Titre - En forme
12. Lexique – les parties du corps, les maladies, les médicaments, les sports
13. Grammaire –Le passé composé avec être, le pronom 'y',
14. Production orale- parler de sa santé, exprimer une émotion positive
15. Production écrite - Donner un conseil, exprimer son accord ou son désaccord

UNIT IV (12 Hours)

16. Titre - Bonne vacances
17. Lexique – les destinations, l'hébergement, la réservation, la nature
18. Grammaire – la comparaison, les verbes impersonnels à l'imparfait comme c'était
19. Production orale- réserver une chambre a l'hôtel, décrire une ville ou un paysage
20. Production écrite - réaliser une brochure touristique, écrire une carte postale

UNIT V (12 Hours)

21. Titre - Au travail
22. Lexique – les études, les disciplines, les lieux de travail, les taches
23. Grammaire – la durée, les pronoms relatifs
24. Production orale- parler de ses études et son projet professionnel
25. Production écrite - comparer le système scolaire français et indien
26. Indian knowledge system–Highlighting on Gurukulam Education System that focuses on traditional teacher-student relationships, oral learning methods, and holistic education while discussing education systems in India vs. France (5%)

Teaching Methodology	Visual-Linguistic Learning, Descriptive & Interpretative Learning, experiential learning, The Lexical Approach, Differentiated Instruction
Assessment Methods	*Role -play:* A mock phone call on hotel reservation, discuss daily routines, housing, and health. (Rubric – graded on grammatical accuracy, and use of appropriate vocabulary) *Picture description activity:* Describe a landscape or travel destination shown in a picture. (Rubric – Assessed on descriptive abilities and vocabulary use) *Experimental learning task:* Doctor-patient conversation about a health issue, Conduct a mock interview about career plans. (Rubric – Assessed on real-life application of language skills) *Project based assessment*: Create a travel brochure for a French-speaking destination, make a poster comparing education in France and India (Rubric – Assessed on Application of language skills in a creative way) *Written assessment*: Write a short daily routine using time expressions, write a postcard describing a recent trip (Rubric – Assessed on ability to write structured texts related to themes)

Books for Study:
1. Mensdorff - Pouilly, L., Opatski, S., Petitmengin, V., Pons, S., Sperandio, C., Djimli, H., & Veldeman - Abry, J. (2022). *Édito A1: Méthode de français* (2nd ed.). Didier FLE, Hatier. (p.87-p.165)

Books for Reference:
1. Dauda, P., Giachino, L., & Baracco, C. (2020). *Génération A1*. Didier.
2. Mérieux, R., &Loiseau, Y. (2012). *Latitudes A1*. Didier.

Websites and eLearning Sources:
1. https://www.podcastfrancaisfacile.com
2. https://www.flevideo.com
3. https://savoirs.rfi.fr/fr
4. https://www.french4me.net/
5. https://apprendre.tv5monde.com/en

Course Outcomes		
CO No.	**CO–Statements** On successful completion of this course, students will be able to	**Cognitive Levels (K –Levels)**
CO1	Talk about daily routines, tell the time, describe people, and propose social outings using appropriate vocabulary and verb structures.	**K1**
CO2	Inquire about housing, describe household items, explain domestic issues, and write advertisements or announcements for accommodations.	**K2**
CO3	Describe body parts, discuss health conditions, give advice, express emotions, and use past tense structures to narrate past experiences.	**K3**
CO4	Make hotel reservations, describe destinations and landscapes, compare experiences, and write postcards or travel brochures.	**K4**
CO5	Discuss education, career plans, and workplace responsibilities while comparing educational systems in France and India.	**K5**

	Relationship Matrix									
Semester	**Course Code**		**Title of the Course**				**Hours**		**Credits**	
2	**25UFR21GL02**		Language French – 2				**4**		**3**	
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of Cos**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	2	2	1	1	2	2	2	3	2	2	1.9
CO2	2	2	2	3	1	3	3	2	3	3	2.4
CO3	2	3	2	1	2	2	1	3	2	1	1.9
CO4	3	2	2	2	2	3	2	1	2	3	2.2
CO5	3	3	3	2	3	2	3	2	3	2	2.6
									Mean Overall Score		**2.2 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	25UHI21GL02	Language Hindi - 2	4	3

Course Objectives
To understand the basics of Hindi Language
To make the students to be familiar with the Hindi words
To enable the students to develop their effective communicative skills in Hindi
To introduce the socially relevant subjects in Modern Hindi Literature
To empower the students with globally employable soft skills

UNIT I (12 Hours)
1. Moun hi Manthra Hay
2. Letter Writing - Chutti Patra
3. Bakthikal – Namakarn
4. Sarkari Kariyalayom Ka Naam

UNIT II (12 Hours)
5. Baathcheeth - Aspathal Mein
6. Letter Writing - Rishthedarom ko Patra
7. Bakthikal - Samajik Paristhithiyam
8. Kriya

UNIT III (12 Hours)
9. Premchand
10. Kriya visheshan
11. Letter Writing - Naukari Keliye Avedan Patra
12. Bakthikal - Sahithyik Paristhithiyam

UNIT IV (12 Hours)
13. Kabeer ke Dohae
14. Samas
15. Letter Writing - Kitab Maangne Keliye Patra
16. Bakthikal - Salient Features, Main Division

UNIT V (12 Hours)
17. Anuvad
18. Sandhi
19. Bakthikal - Visheshathayem
20. Apathit Gadyansh

Teaching Methodology	Peer Instruction Exercise, Videos, PPT, Quiz, Group Discussion
Assessment Methods	Group Discussion, Seminar, Snap Test

Books for Study:
1. Viswanath Tripaty. *(2021). Kuchh Kahaniyan*, Rajkamal Prakashan Pvt. Ltd.
2. Kamathaprasad Gupth, M. (2020). *Hindi Vyakaran*. Anand Prakashan.
3. Dr. Sadananth Bosalae. *(2020). kavya sarang*, Rajkamal Prakashan.

Books for Reference:
1. Acharya Ramchandra Shukla. (2021). *Hindi Sahitya Ka Itihas*. Prabhat Prakashan.
2. Krishnakumar Gosamy. (2023). *Anuvad vigyan ki Bhumika*. Rajkamal Prakashan.
3. Aravind Kumar. (2022). *Sampoorna Hindi Vyakaran our Rachana*, Lucent publisher.
4. Lakshman Prasad Singh. (2021). *Kavya ke sopan*. Bharathy Bhavan Prakashan.

Websites and e-Learning Sources:
1. https://hindigrammar.in/sandhi.html
2. https://www.successcds.net/class10/hindi/samas-in-hindi

3. https://mycoaching.in/kriya-ke-bhed-verb-in-hindi
4. https://namastesensei.in/adverb-in-hindi-examples/
5. https://viahindi.in/hindi-vyakaran/sandhi-paribhasha-prakar-or-udaharan

Course Outcomes		
CO No.	**CO–Statements** On successful completion of the course, the student will acquire the listed skills	**Cognitive Levels (K-Levels)**
CO1	Find out the Terms & Expressions related to letter writing.	**K1**
CO2	Providing knowledge of Letter writing in Hindi.	**K2**
CO3	Complete the sentences in Hindi using basic grammar.	**K3**
CO4	Analyze the social & political conditions of Devotional period in Hindi Literature.	**K4**
CO5	Justify the human values stressed on the works of Hindi writers	**K5**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**			**Hours/ week**		**Credits**			
2	**25UHI21GL02**		Language Hindi – 2			**4**		**3**			
Course Outcomes (Cos)	**Programme Outcomes (Pos)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of Cos**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	2	3	3	2	2	3	3	3	2	2	2.5
CO2	1	3	1	2	2	3	3	3	2	3	2.3
CO3	3	2	3	2	2	3	2	3	2	2	2.4
CO4	2	3	3	1	3	2	3	2	1	2	2.2
CO5	3	2	2	2	3	2	3	2	3	2	2.4
								Mean Overall Score			**2.36 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	25USA21GL02	Language Sanskrit - 2	4	3

Course Objectives
To bring out the salient aspects of classical Sanskrit poetry
To introduce court epics in Sanskrit
To train students in declensions of pronouns in Sanskrit
To coach the students in the conjugation patterns of verbs in Sanskrit
To offer coaching in morpho-phonemic rules and their applications in Sanskrit

UNIT I (12 Hours)

Asmathi usmath tat kim (MFN) sarva naama sabdaha

UNIT II (12 Hours)

Sandhi Niyamaah Abhyaash (Guna, Visarga, Dirgha, Vrddhi)

UNIT III (12 Hours)

Lang lakaarah Kriyapadaani Prayoga Vivaranam

UNIT IV (12 Hours)

Raguvamsaha Pratama sargaha (1 –15 slokas)

UNIT V (12 Hours)

Suvacanani Vakya Prayoga Vivaranam

Teaching Methodology	Videos, PPT, Blackboard, Demonstration, Exercises
Assessment Methods	Seminar, Quiz, Group Discussion.

Books for Study:
1. Saralasamkritham Siksha ,2021
2. Dhaatu Rupa Manjari ,2021

Books for Reference:
1. Paindrapuram Ashram, Srirangam – 620 006 Gopalavimshanthi 2021
2. R.S. Vadhyar & Sons book – Seller and Publishers, Kalpathi, Palghat – 678003, Kerala, South Inida, shabdha manjari
3. Kulapthy, K.M Saral sankrit Balabodh, Bharathiys Vidya Bhavan, Munshimarg Mumbai – 400007, 2020

Websites and eLearning Sources:
1. https://www.meritnation.com
2. https://www.aplustopper.com
3. https://mycoaching.in/lang-lakar
4. https://sanskritdocuments.org/sites/giirvaani/giirvaani/rv/sargas/01_rv.htm
5. https://resanskrit.com/blogs/blog-post/sanskrit-shlok-popular-quotes-meaning-hindi-english

Course Outcomes

CO No.	CO–Statements	Cognitive Levels (K –Levels)
	On successful completion of this course, students will be able to	
CO–1	Remembering names of different objects, remembering different verbal forms and sandhi	K1
CO–2	Contrast different verbal forms Explain good sayings, Relate good saying to life.	K2
CO–3	Apply and build small sentences	K3
CO–4	Analyze different forms of Verbs and nouns	K4
CO–5	Appreciate subhashitas and Sanskrit poetry	K5

Relationship Matrix

Semester	Course Code	Title of the Course								Hours	Credits
2	25USA21GL02	Language Sanskrit - 2								4	3

Course Outcomes↓	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	1	3	2	2	2	3	3	2	1	2.1
CO-2	3	2	3	2	2	3	2	3	3	2	2.5
CO-3	2	2	3	2	2	2	2	3	3	1	2.1
CO-4	3	2	3	3	1	2	3	3	3	1	2.4
CO-5	3	2	2	2	3	2	2	3	3	1	2.3
Mean Overall Score											2.28 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	**25UEN22GE02A**	**General English – 2:** Pre-Intermediate Stream	**5**	**3**

Course Objectives (CO)
To strengthen listening and speaking skills for identifying key ideas and details
To improve reading comprehension and analyze different texts
To express ideas clearly in conversations and presentations, using correct grammatical structures.
To develop writing skills by creating clear and structured texts
To assess and improve language use in both spoken and written communication

UNIT I: **(15 Hours)**

Listening:	(Skill)	:	Listening to respond to story-based questions
	(Practice)	:	"The Hare and His Friends"
Reading:	(Skill)	:	Understanding and interpreting proverbs
	(Practice)	:	"Necessity is the Mother of Invention"
Grammar:	(Practice)	:	Present Continuous Tense; Past Continuous Tense
Vocabulary:	(Practice)	:	Weather and Seasons
Speaking:	(Skill)	:	Describing on-going actions in the present and the past to describe real-life situations and activities
	(Practice)	:	Ongoing Actions: Present & Past
Writing:	(Skill)	:	Writing a biography of a famous personality using given details
	(Practice)	:	Writing a Biography

UNIT II: **(15 Hours)**

Listening:	(Skill)	:	Listening to identify factual details
	(Practice)	:	Recycling
Reading:	(Skill)	:	Reading to convert a story into a meaningful dialogue
	(Practice)	:	The Shepherd and the Stranger
Grammar:	(Practice)	:	Future Expressions: Simple Future & 'Going to'; Simple Present, Present Continuous and Future Continuous Tenses
Vocabulary:	(Practice)	:	Groceries
Speaking:	(Skill)	:	Developing conversational fluency by practising conversations on familiar and everyday topics
	(Practice)	:	Conversations on Familiar and Everyday Topics
Writing:	(Skill)	:	Writing clear, respectful and relevant online comments
	Practice	:	Writing Online Comments

UNIT III: **(15 Hours)**

Listening:	(Skill)	:	Listening for specific information
	(Practice)	:	Telephonic Conversation
Reading:	(Skill)	:	Reading a news report
	(Practice)	:	Iron Age in Tamil Nadu Began 5,300 Years Ago
Grammar:	(Practice)	:	Present Perfect Tense; Past Perfect Tense
Vocabulary:	(Practice)	:	Kitchen Utensils and Household Appliances
Speaking:	(Skill)	:	Using polite expressions in conversations to request, seek permission, grant or refuse permission, and apologise
	(Practice)	:	Polite Expressions in Conversations
Writing:	(Skill)	:	Expressing short reflective ideas in writing
	(Practice)	:	Thought for the Day

UNIT IV: **(15 Hours)**

Listening:	(Skill)	:	Predicting content and vocabulary before listening
	(Practice)	:	Our Earth
Reading:	(Skill)	:	Identifying direct and indirect speech
	(Practice)	:	Birbal story: "Hot Iron Test"

Grammar:	(Practice)	:	Active and Passive Voice
Vocabulary:	(Practice)	:	Human Diseases
Speaking:	(Skill)	:	Using polite expressions in conversations to interrupt, make suggestions, and agree or disagree
	(Practice)	:	Polite Expressions in Conversations
Writing:	(Skill)	:	Writing a report on a given topic
	(Practice)	:	Report Writing

UNIT V: (15 Hours)

Listening:	(Skill)	:	Listening to understand formal speeches
	(Practice)	:	"A Tryst with Destiny" by Jawaharlal Nehru
Reading:	(Skill)	:	Reading to understand an essay
	(Practice)	:	"Secularism"
Grammar:	(Practice)	:	Adverbs; Prepositions
Vocabulary:	(Practice)	:	**Occupations**
Speaking:	(Skill)	:	Delivering a short prepared speech on a familiar or inspiring topic
	(Practice)	:	Delivering a Short Speech
Writing:	(Skill)	:	Writing a clear and well-structured essay on a given topic
	(Practice)	:	Essay Writing

Teaching Methodology	Lectures, task-based activities, audio-visual listening tasks, guided reading and writing exercises, discussions
Assessment Method	Listening and reading comprehension exercises, verbal presentations, role plays and conversations, writing tasks

Books for Study:

Dr. M. John Britto, Dr. B. Sam Jerome Sharone, and Dr. S. Sajeev. *Nurturing English Skills*. Emerald Publishers, 2025.

Course Outcomes		
CO No.	**CO-Statements**	**Cognitive Levels (K-Level)**
	On successful completion of this course, the students will be able to	
CO1	Recognize key ideas and details in spoken and written texts, demonstrating effective listening and comprehension skills.	**K1**
CO2	Understand and interpret different types of texts, enhancing reading comprehension and critical thinking abilities.	**K2**
CO3	Apply correct grammatical structures to express ideas clearly in conversations and presentations.	**K3**
CO4	Analyze and organize ideas to write clear, coherent, and well-structured texts for various purposes.	**K4**
CO5	Evaluate and improve language use, refining both spoken and written communication.	**K5**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
2	**25UEN22GE02A**		**General English – 2:** Pre-Intermediate Stream							**5**	**3**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Scores of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PS02**	**PSO3**	**PSO4**	**PSO5**	
CO1	2	3	2	3	2	3	2	3	2	2	**2.4**
CO2	3	2	2	3	2	3	2	3	2	3	**2.5**
CO3	3	2	2	2	3	2	2	3	2	2	**2.3**
CO4	3	2	2	2	2	2	2	2	2	3	**2.2**
CO5	3	2	3	2	3	2	3	2	3	2	**2.5**
										Mean Overall Score	**2.38 (High)**

Semester	Course Code	Title of the Course	Hours/ Week	Credits
2	25UEN22GE02B	**General English – 2:** Intermediate Stream	5	3

Course Objectives
To develop students' ability to listen, speak, read, and write effectively in English through interactive and contextualised activities.
To improve students' understanding and application of essential grammar concepts, including verb usage, auxiliary verbs, modals, adverbs, and sentence structures.
To equip students with strategies to deduce meanings of unfamiliar words using contextual clues.
To foster students' ability to brainstorm, organise information using graphic organisers, and structure written communication effectively for academic and professional contexts.
To enable students to engage in discussions, express opinions, seek and provide information, and navigate real-life situations confidently through role plays.

Unit 1: My College & Studies   **15 Hours**

1. Listening:	(Skill)	Distinguishing between main ideas and supporting details
	(Practice)	"A Day in the Life of a College Student" (A conversation)
2. Reading:	(Skill)	Recognising the structure of written texts
	(Practice)	"Enter to learn, leave to serve"
3. Grammar:	(Practice)	Main Verb
4. Vocabulary:	(Practice)	Using synonyms as contextual clues to guess the meaning of unfamiliar words
5. Study skill:		Brainstorming to gather ideas in a group
6. Speaking:	(Skill)	Asking for, giving and refusing permission – Requesting – Communication repair: Finding about pronunciation, spelling and meaning.
	(Practice)	Role Play
7. Writing:	(Skill)	Writing an outline
	(Practice)	Controlled composition: Writing an outline for a given passage

Unit 2: Travel   **15 Hours**

1. Listening:	(Skill)	Listening for specific details
	(Practice)	"A Perfect Vacation" (A conversation)
2. Reading:	(Skill)	Identifying main ideas and supporting details
	(Practice)	"An Unforgettable Ride"
3. Grammar:	(Practice)	Auxiliary Verbs
4. Vocabulary:	(Practice)	Using antonyms as contextual clues to guess the meaning of unfamiliar words
5. Study skill:		Mind mapping to visually organise information
6. Speaking:	(Skill)	Asking for and giving directions – Asking for and giving information
	(Practice)	Role Play
7. Writing:	(Skill)	Writing effective paragraphs
	(Practice)	Free-writing composition: An adventurous journey

Unit 3: My Social Network   **15 Hours**

1. Listening:	(Skill)	Understanding the sequence of ideas
	(Practice)	"My Virtual Friends" (A conversation)
2. Reading:	(Skill)	Comprehending infographics
	(Practice)	"Social Media Etiquette
3. Grammar:	(Practice)	Modal Auxiliary Verbs
4. Vocabulary:	(Practice)	Using definitions and restatements as contextual clues to guess the meaning of unfamiliar words
5. Study skill:		Using graphic organisers (sequence of events chain, timeline, and storyboard)
6. Speaking:	(Skill)	Asking for and giving advice – Asking if someone agrees – Agreeing and disagreeing – Warning someone
	(Practice)	Role Play

| 7. **Writing:** | **(Skill)** | Developing stories from hints |
| | **(Practice)** | Controlled composition: Developing a story from given hints |

Unit 4: Shopping   15 Hours

1. **Listening:**	**(Skill)**	Detecting signposts
	(Practice)	"Let's go shopping!" (A conversation)
2. **Reading:**	**(Skill)**	Recognising transition of ideas
	(Practice)	"Adventures of the Grocery Store"
3. **Grammar:**	**(Practice)**	Adverbs and WH Question Words
4. **Vocabulary:**	**(Practice)**	Using examples and illustrations as contextual clues to guess the meaning of unfamiliar words
5. **Study skill:**		Using graphic organisers (Venn diagram, and cause-and-effect map)
6. **Speaking:**	**(Skill)**	Offering and accepting help – Asking for and giving opinions – Asking for and saying one's preference – Suggesting – Complaining
	(Practice)	Role Play
7. **Writing:**	**(Skill)**	Describing actions in a story
	(Practice)	Guided composition: Narrating a story in a comic strip

Unit 5: Ceremonies   15 Hours

1. **Listening:**	**(Skill)**	Listening to intonations
	(Practice)	"Happy Birthday to You!" (A conversation)
2. **Reading:**	**(Skill)**	Understanding moods in a reading passage
	(Practice)	"The Light has Gone out" by Jawaharlal Nehru
3. **Grammar:**	**(Practice)**	Sentences
4. **Vocabulary:**	**(Practice)**	Using root words as clues to guess the meaning of words
5. **Study skill:**		Using graphic organisers (idea wheel, idea web, and concept map)
6. **Speaking:**	**(Skill)**	Using intonations for different types of sentences – Expressing your feelings and emotions – Congratulating and wishing someone – Expressing sympathy
	(Practice)	Role Play
7. **Writing:**	**(Skill)**	Expressing emotions in narrative writing
	(Practice)	Controlled composition: Describing emotions and feelings conveyed in a picture story

Teaching Methodology	Lectures, Demonstrations, Discussions, Peer-Review Tasks, Role-plays, Pair and group activities
Assessment Tools	Listening and reading comprehension tasks, Individual talks, Role plays, Controlled and guided compositions

Books for Study:

M.S. Xavier Pradheep Singh, Amalaveenus, and A. Napoleon. English and My World, 2025.

Course Outcomes

CO No.	CO-Statements On successful completion of this course, the students will be able to	Cognitive Levels (K-Level)
CO1	Identify key ideas, supporting details, and organisational patterns in spoken and written texts.	K1
CO2	Explain the meaning of conversations and passages by recognising their structure, tone, and purpose.	K2
CO3	Use appropriate language functions such as requesting, suggesting, and expressing opinions effectively in real-life interactions.	K3
CO4	Compare different communication styles and linguistic features in various types of texts and conversations.	K4
CO5	Assess the effectiveness of spoken and written communication, providing constructive feedback for improvement.	K5

Relationship Matrix

Semester	Course Code	Title of the Course								Hours	Credits
2	25UEN22GE02B	General English – 2: Intermediate Stream								5	3

Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2.5	2.5	2.5	2.5	3	2.5	2.5	2.5	3	2.65
CO-2	2.5	3	2.5	2.5	2.5	3	3	2.5	2.5	3	2.7
CO-3	3	2.5	2.5	3	2.5	2.5	2.5	2.5	3	2.5	2.65
CO-4	2.5	2.5	2.5	3	2.5	2.5	2.5	3	2.5	2.5	2.6
CO-5	3	2.5	2.5	2.5	3	2.5	2.5	2.5	3	2.5	2.65
										Mean Overall Score	2.65 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	25UPH23CC03	**Core Course - 3:** Mechanics	4	3

Course Objectives
To know the fundamentals of kinematics and dynamics of an object in different coordinate systems.
To understand the techniques for studying motion of an object in different systems
To apply the fundamental concepts of vector for solving complex problems in mechanics.
To identify the relation between velocity, acceleration, force and momentum for different physical systems and solving the problems related to conservation laws.
To analyse the concepts of the different forces acting on various physical systems.

UNIT I: Kinematics and Dynamics (12 Hours)

Kinematic equation - plane polar coordinates-circular motion and straight-line motion - Newton's laws - applications of Newton's laws - astronaut's tug of war, Freight train - Constraints - wedge and block - masses and pulley - contact forces - block and string - normal force and friction- block and wedge with friction.

UNIT II: Momentum (12 Hours)

System of particles - Bola, center of mass - drum major's baton, non-uniform rod, conservation of momentum - Three body system, impulse -rubber ball rebound, flow of mass- spacecraft, rocket in free space and gravitational field, momentum transport to the surface.

UNIT III: Work and Energy (12 Hours)

Equation of motion in one dimension - mass thrown upward, simple harmonic oscillator - work energy theorem in one dimension - Vertical motion in an inverse square field - work energy theorem - escape velocity, Applying the work energy theorem - inverted pendulum- work done by a central force - Potential energy - Energy diagrams – Power.

UNIT IV: Rotational Dynamics (12 Hours)

Angular Momentum - Particle, sliding block, Torque - Sliding block, Fixed axis rotation, Moments of Inertia - uniform thin ring - uniform thin rod - circular disc, rotations about fixed axis, Atwood's machine, motion involving both translation and rotation - rolling wheel.

UNIT V: Gravitation and Central Force Motion (12 Hours)

Gravitational force, Potential energy and gravitational force due to spherical shell and solid sphere - Gravitational energy of a uniform sphere - Radius of an electron - Kepler's law.

Teaching Methodology	Chalk and talk, PPT and Videos
Assessment Methods	Seminar, Snap Test, MCQ, Online Quiz, Assignment

Books for Study:
1. Kleppner., & Kolenkow. (2017). *An introduction to Mechanics*, (1st Ed.). McGraw-Hill.
2. Kittel, C., Knight, W., Helmholtz., Ruderman., & Moyer. (2017). *Mechanics*, (2nd Ed.). McGraw-Hill.

Unit	Book	Sections
I	1	1.7-1.9, 2.2, 2.4
II	1	3.1-3.6
III	1	4.2, 4.3, 4.5-4.7, 4.9, 4.13
IV	1	6.2-6.7
V	2	Ch 9 - P.No. 271-775, 276-279, 286-289

Books for Reference:
1. Robert, R., Halliday, D., & Walker, J. (2015). *Principles of Physics*, (10th Ed.). John Wiley. 2. Feynman, R.P. (2012). *The Feynman lectures on Physics*, Pearson.
2. Irodov, I. E. (2016). *Problems in general Physics*, Arihant Publishers.

Websites and eLearning Sources:
1. https://www.youtube.com/@leokap
2. https://www.youtube.com/playlist?list=PLVOAwPuFGgdB4BvIJWAO_eq4uyAfNUdp4
   (* subject to availability - not to be used for exam purpose)

	Course Outcomes	
	CO-Statements	**Cognitive Levels (K-Level)**
CO No.	On successful completion of this course, the students will be able to	
CO1	Acquire the knowledge on the concepts of kinematics and dynamics for the application of physics in real life physical problems.	**K1**
CO2	Understand the concepts of motion for solving the problems related to conservation laws and rigid body dynamics.	**K2**
CO3	Apply laws of motion and gravitation for understanding the complex problems in physics.	**K3**
CO4	Analyse the relations between velocity, acceleration, force and momentum for different physical systems.	**K4**
CO5	Evaluate the forces acting on various physics systems and problems related to conservation laws.	**K5**

Relationship Matrix										
Semester	**Course Code**	**Title of the Course**							**Hours**	**Credits**
2	**25UPH23CC03**	**Core Couse - 3:** Mechanics							**4**	**3**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**				**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	2	3	2	1	3	3	3	2	1	**2.3**
CO2	3	2	3	2	1	3	3	2	3	1	**2.3**
CO3	3	3	2	2	2	3	3	2	1	1	**2.2**
CO4	3	3	2	3	1	3	3	3	2	1	**2.4**
CO5	3	3	*3*	2	1	3	3	2	2	1	**2.3**
								Mean Overall Score			**2.3 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	25UPH23CC04	**Core Course - 4:** Waves and Sound	4	3

Course Objectives
To acquire the knowledge of Simple Harmonic Motion (SHM), its mathematical formulation, and applications in physical systems.
To understand the concepts of damped and forced oscillations, resonance, and their significance in mechanical and electrical systems.
To apply the principles of wave motion to analyze the characteristics of transverse and longitudinal waves.
To analyze the effects of various factors on the velocity of sound, including temperature, pressure, and wind, and explore the Doppler effect.
To categorize different acoustic and ultrasonic phenomena and evaluate their applications in science and technology.

UNIT I: Simple Harmonic Motion (12 Hours)

Simple Harmonic Motion - Differential Equation of SHM - Graphical Representation of SHM - Simple & Compound Pendulum - Kater's Pendulum -Lissajous' Figures - Composition of Two Simple Harmonic Vibrations of Equal Time Periods Acting at Right Angles - Uses of Lissajous' Figures.

UNIT II: Damped and Forced Oscillations (12 Hours)

Free Vibrations- Undamped Vibrations- Damped Vibrations- Damped SHM in an Electrical Circuit- Forced Vibrations - Resonance and Sharpness of Resonance - Phase of Resonance - Examples of Forced and Resonant Vibrations.

UNIT III: Wave Motion (12 Hours)

Propagation in Wave Motion - Characteristics of Wave Motion - Transverse Wave Motion - Longitudinal Wave Motion – Definitions - Relation between Frequency and Wavelength - Properties of Longitudinal Progressive Waves - Equation of Simple Harmonic Wave - Differential Equation of Wave Motion.

UNIT IV: Sound (12 Hours)

Newton's Formula for Velocity of Sound- Effect of Temperature, Pressure, Density of the Medium, Humidity, Wind – Laws and Verification of Transvers vibration of Strings- Melde's Experiment - Doppler effect - observer at rest and source in motion - source at rest and observer in motion - both source and observer are in motion

UNIT V: Acoustics and Ultrasonics (12 Hours)

Acoustics: Measurement of Intensity of Sound (Decibel and Phon) - Reverberation - Sabine's reverberation formula - Determination of absorption coefficient - Factors affecting the acoustic buildings - Sound distribution in an Auditorium - Requisites for good acoustics.

Ultrasonics: Production of ultrasonic waves - Detection of ultrasonic waves - Applications of ultrasonic waves.

Teaching Methodology	Chalk and talk, PPT and Videos
Assessment Methods	Seminar, Snap Test, MCQ, Online Quiz, Assignment

Books for Study:
1. Lal, B., & Subrahmanyam. N. (2023). *Waves and Oscillations* (Second Revised Edition). Vikas Publishing House Pvt. Ltd.

Unit	Book	Chapters	Sections
I	1	1	1.1-1.4, 1.10,1.11,1.15
		2	2.1,2.4,2.9
II	1	3	3.1-3.7, 3.9
III	1	4	4.1-4.8, 4.11-4.12
IV	1	5, 9	5.4-5.9, 9.1-9.4
V	1	11	7.22, 11.14-11.17, 11.20-11.24 (2,3), 11.25, 11.27

Books for Reference:

1. Lal, L., & Subrahmanyam. N. (2021). *A Textbook of Sound (Second Revised Edition)*. Vikas Publishing House Pvt. Ltd.
2. French, A. P. (1987). *Vibrations and waves*. CBS Publishers and Distributors.
3. Bajaj, N. K. (1988). *The physics of waves and oscillations*. Tata McGraw-Hill.
4. Ingard, K. U. (1988). *Fundamentals of waves and oscillations*. Cambridge University Press.
5. Kleppner, D., & Kolenkow, R. J. (1973). *An introduction to mechanics*. McGraw-Hill.

Websites and eLearning Sources:

1. https://archive.nptel.ac.in/courses/115/106/115106119/
2. https://ocw.mit.edu/courses/8-01sc-classical-mechanics-fall-2016/mit8_01scs22_chapter23.pdf
3. https://www.ire.pw.edu.pl/~mmedia/pub/Acoustics%20and%20Audio%20Technology/Basics%20of%20physical%20acoustics/Basics%20of%20physical%20acoustics.pdf
4. https://courses.physics.ucsd.edu/2018/Winter/physics2c/lecture14.pdf
5. https://galileo.phys.virginia.edu/classes/635.stt.summer05/Manual/July%2025/Free%20Damped%20Forced%20Oscillations.pdf

(* subject to availability - not to be used for exam purpose)

Course Outcomes		
CO No.	**CO-Statements**	**Cognitive Levels (K-Level)**
	On successful completion of this course, the students will be able to	
CO1	Acquire the knowledge of Simple Harmonic Motion (SHM) and its governing differential equations.	**K1**
CO2	Understand the concepts of damped and forced oscillations, including resonance in mechanical and electrical systems.	**K2**
CO3	Compare the characteristics of transverse and longitudinal waves and their propagation properties.	**K3**
CO4	Analyze the factors influencing the velocity of sound and interpret the Doppler effect in different conditions.	**K4**
CO5	Evaluate the principles of acoustics and ultrasonics and their applications in various fields.	**K5**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
2	**25UPH23CC04**		**Core Course - 4:** Waves and Sound							**4**	**3**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	2	2	2	2	3	3	3	1	3	**2.4**
CO2	3	2	2	2	2	3	2	2	3	2	**2.3**
CO3	3	2	2	3	2	3	3	2	1	2	**2.3**
CO4	3	2	2	2	2	3	3	2	1	2	**2.2**
CO5	3	2	2	2	2	3	2	3	1	2	**2.2**
								Mean Overall Score			**2.28 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	25UPH23CP02	**Core Practical - 2:** Physics Practical - 2	3	2

Any 8 Experiments

1. Surface Tension – capillary rise method.
2. Viscosity – variable pressure head method.
3. Young's modulus – non uniform bending (pin and microscope).
4. Sonometer – AC frequency determination.
5. Spectrometer – dispersive power - prism.
6. Potentiometer – low range voltmeter.
7. Carey Fosters bridge – R and ρ (rho).
8. Concave lens – f, R and μ.
9. M1/M2 – Vibration magnetometer.
10. Newton's rings.
11. B.G. comparison of EMF's and capacitance.
12. g – by fall plate.
13. Specific heat capacity of solid by the method of mixture
14. Specific heat by cooling method.

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	25UPH23AC02	**Allied Course - 2:** Mathematics for Physics - 2	6	4

Course Objectives
To have knowledge on various numerical methods.
To have knowledge on solving partial differential equations.
To explore the knowledge on vector calculus in terms of Gradient - Divergence and Curl.
To have knowledge on expansion of trigonometry functions and hyperbolic functions.
To understand the concept of analytic functions.

UNIT I (18 Hours)

Simultaneous Linear Algebraic Equations - Gauss Elimination Method - Iteration Method: Gauss Seidel Method -Numerical Solution of O.D.E - Solution by Taylor's Methods - Euler's Method - Runge - Kutta Method (4th Order).

UNIT II (18 Hours)

Derivation of partial differential equations - By Elimination of Arbitrary Functions - Different Integrals of partial differential equations - Standard type of First Order Equations - Lagrange's Equation.

UNIT III (18 Hours)

Gradient - Divergence and Curl - Gauss Divergence Theorem - Green Theorem - Stokes Theorem (No proofs of theorem, only simple applications).

UNIT IV (18 Hours)

Expansion of $\text{Sin}n\theta$ and $\text{Cos}n\theta$ - Powers of Sines and Cosines of θ in terms of function of multiple of θ - Hyperbolic Functions - Inverse Hyperbolic Functions.

UNIT V (18 Hours)

Analytic function - Cauchy Riemann equations (No derivation, only simple applications) - Residues - Evaluation of definite integrals (Integral over the unit circle only).

Teaching Methodology	Lectures, Demonstrations.
Assessment Methods	MCQ, Quiz & Snap Test

Books for Study:
1. Venkataraman, M.K. (2013). *Numerical Methods in Science and Engineering.* The National Publishing Company, (5th Ed.).
   - **UNIT I:** *Chapter IV (Sec: 2, 6), Chapter XI (Sec: 6, 10, 16).*
2. Narayanan, S., Rao, H.R., Pillay, T.K.M., & Kandaswamy. (2010). *Ancillary Mathematics Vol-II.*
   - **UNIT II:** *Chapter 6 - Sec 1-6, pp: 252-274.*
   - **UNIT III:** *Chapter 8 - Sec 1.16-1.20, 6, 7 and 9, pp: 335-350, 381-392, 399-405.*
3. Narayanan, S., Rao, H.R., Pillay, T.K.M., & Kandaswamy. (2009). *Ancillary Mathematics Vol-I.*
   - **UNIT IV:** *Chapter 5 - Sec 5.1, 5.2 and 5.4, pp: 220-232, 242-256.*
4. Narayanan, S., Pillay, T.K.M. (1997). *Complex Analysis.*
   - **UNIT V:** *Chapter 1 - Sec 11, pp: 43-57, Chapter 5 - Sec 1-3, (pp: 185-196).*

Books for Reference:
1. Narayanan, S., Pillay, T.K.M. (2013). *Differential equations and its applications.* Viswanathan Pvt Ltd.
2. Venkataraman, M. K. (1986). *Higher Mathematics for Engineering and Science,* (3rd Ed.). The National Publishing Co.

Course Outcomes

CO No.	CO-Statements	Cognitive Levels (K - Level)
	On successful completion of this course, students will be able to	
CO1	Recall and define key mathematical concepts and methods, including numerical methods for solving linear equations and ODEs, types of PDEs, vector calculus theorems, trigonometric and hyperbolic identities, and complex analysis principles.	K1
CO2	Explain the underlying principles and applications of numerical methods, partial differential equations, vector calculus theorems, trigonometric and hyperbolic functions, and complex analysis	K2
CO3	Apply appropriate numerical to solve linear algebraic equations and ordinary differential equations, solve standard types of first-order PDEs and utilize vector calculus theorems to solve problems	K3
CO4	Analyze and compare the efficiency and accuracy of different numerical methods for solving linear equations and ODEs, examine the behavior of solutions to partial differential equations and determine the analyticity of complex functions using the Cauchy-Riemann equations.	K4
CO5	Evaluate definite integrals using the residue theorem in complex analysis, assess the applicability of vector calculus theorems to specific engineering problems, and justify the selection of appropriate methods for solving mathematical problems encountered in various disciplines.	K5

Relationship Matrix

Semester	Course Code	Title of the Course		Hours	Credits
2	25UPH23AC02	**Allied Course - 2:** Mathematics for Physics - 2		6	4

Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	1	3	3	1	2	3	2.3
CO2	3	3	2	1	2	3	3	2	2	2	2.3
CO3	3	2	3	1	2	2	3	2	3	2	2.3
CO4	3	2	3	1	2	3	2	1	2	3	2.2
CO5	3	3	3	2	2	2	3	1	2	3	2.4
									Mean Overall Score		**2.3 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	25UHE24AE01	**Ability Enhancement Compulsory Course - 2:** Environmental Studies	2	1

Course Objectives
To enable students connect themselves with nature
To Impart knowledge of the concept of Biodiversity
To create awareness of the causes and consequences of various pollution
To help them recognize the available natural resources and the need to sustain them
To enable them to Identify the environmental problems and offer alternatives by making interventions both individually and collectively

UNIT I: Introduction To Environmental Studies (6 Hours)

Introduction -Subsystems of Earth - Scope and Importance - Various Recycling Methods - Environmental Movements in India – Eco- Feminism - Public awareness - Suggestions to conserve environment

UNIT II: Natural Resources (6 Hours)

Introduction - Food Resources - Land Resources - Forest resources - Mineral Resources - Water Resources - Energy Resources

UNIT III: Ecosystems, Biodiversity and Conservation (6 Hours)

Kinds of Ecosystem - General structure of ecosystem - Functions of Ecosystem - Energy flow and Ecological pyramids - Levels of Biodiversity - Biodiversity at Global Level- Hot spots of Biodiversity - Endangered and Endemic Species - Value of Biodiversity - Threats to Biodiversity - Conservation of Biodiversity

UNIT IV: Environmental Pollution (6 Hours)

Air Pollution - Water Pollution - Oil Pollution - Soil Pollution - Marine Pollution - Noise Pollution - Thermal Pollution - Radiation Pollution

UNIT V: Environmental Organizations and Treatise (6 Hours)

United Nations Environment Program (UNEP) - International treaties on Environmental protection - Ministry of Environment, Forest and Climate Change - Important National Environmental Acts and rules- Environmental Impact assessment

Teaching Methodology	Power point and Field visit
Assessment Methods	Seminar, Group Discussion.

Book for Study:
1. Department of Human Excellence, (2021). *Environmental Studies.*

Books for Reference:
1. Rathor, V.S. & Rathor B. S. (2013). *Management of Natural Resources for Sustainable Development*. Daya Publishing House.
2. Sharma P.D. (2010). *Ecology and Environment*, (8th Ed.). Rastogi Publications.
3. Agrawal, A &Gibson, C.C. (2001). *Introduction: The Role of Community in Natural Resource Conservation.* Rutgers University Press.

Websites and eLearning Sources:
1. https://www.unep.org/
2. http://moef.gov.in/en/
3. https://www.ipcc.ch/reports/

Course Outcomes

CO No.	CO-Statements On successful completion of this course, students will be able to	Cognitive Levels (K - Level)
CO1	Identify the concepts related to global ecology and the environment	K1
CO2	Comprehend the natural resources and environmental organizations	K2
CO3	Apply the acquired knowledge to sensitize individuals and public about the environmental crisis	K3

Relationship Matrix

Semester	Course Code	Title of the Course				Hours	Credits
2	25UHE24AE01	Ability Enhancement Compulsory Course - 2: Environmental Studies				2	1

Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	1	2	2	3	2	2	2	2	2.1
CO2	3	2	1	2	2	3	2	2	2	2	2.1
CO3	3	2	2	2	2	2	3	2	1	2	2.1
Mean Overall Score											2.1 (Medium)

Semester	Course Code	Title of the Course	Hours/Week	Credits
2	25UHE24VE02	**Value Education - 2:** Fundamentals of Human Rights	2	1

Course Objectives
To sensitize students about various human rights and their importance
To empower them with the right understanding of human rights
To enable them to understand the Fundamental rights and the duties in the constitution of India
To help them comprehend the background, principles and the articles of UDHR
To make them involved in activities to defend human rights

UNIT I: Human Rights - An Introduction (6 Hours)

Introduction- Classification of Human Rights- Scope of Human Rights-Characteristics of Human Rights - Challenges for Human Rights in the 21st Century.

UNIT II: Historical Development of Human Rights (6 Hours)

Human Rights in Pre-World War Era- Human Rights in Post-World War Era- Evolution of International Human Rights Law - the General Assembly Proclamation- Institution Building, Implementation and the Post- Cold War Period. The ICC.

UNIT III: India and Human Rights (6 Hours)

Introduction-Preamble to Indian Constitution - Classification of Fundamental Rights-Salient Features of Fundamental Rights-and Fundamental Duties.

UNIT IV: Human Rights of Women and Children (6 Hours)

Women's Human Rights- Issues related to women's rights - and Rights of Women's and Children

UNIT V: Human Rights Violations and Organizations (6 Hours)

Human Rights Violations - Human Rights Violations in India - the Human Rights Watch Report - Human Rights Organizations - NHRC - SHRC.

Teaching Methodology	Power point, Handouts and Group discussion
Assessment Methods	Seminars, Group Discussion, Assignments.

Books for Study:
1. Department of Human Excellence, (2021). *Techniques of Social Analysis: Fundamentals of Human Rights.*

Books for Reference:
1. Venkatachalem. (2005). The *Constitution of India*, *Giri Law House.*
2. Naik, V. &Shany, M. (2011). *Human rights education and training*, Crescent Publishing Corporation.
3. Neera, B. (2011). *Human Rights Content and Extent.* Swastika Publications.

Websites and eLearning Sources:
1. https://www.un.org/en/universal-declaration-human-rights/
2. https://www.ilo.org/global/lang--en/
3. https://www.amnesty.org/en/

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, students will be able to	**Cognitive Levels (K - Level)**
CO1	Identify the importance and the values of human rights	**K1**
CO2	Understand the historical background and the development of Human Rights and the related organizations	**K2**
CO3	Apply the provisions of National and International human rights to themselves and the society	**K3**

Relationship Matrix								
Semester	**Course Code**	**Title of the Course**					**Hours**	**Credits**
2	**25UHE24VE02**	**Value Education - 2:** Fundamentals of Human Rights					**2**	**1**

Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	2	1	2	2	3	2	2	2	2	**2.1**
CO2	3	2	1	2	2	3	2	2	2	2	**2.1**
CO3	3	2	2	2	2	2	3	2	1	2	**2.1**
Mean Overall Score											**2.1 (Medium)**

Semester	Course Code	Title of the Course	Hours/ Week	Credits
3	*25UTA31GL03*	பொதுத்தமிழ் – 3: General Tamil - 3	*4*	*3*

கற்றலின் நோக்கங்கள் (Course Objectives)
சங்க இலக்கியங்களின் இன்றியமையாமையை அறிந்து கொள்ளுதல்
இலக்கியத்தினை நுட்பமாக அறிதலின் வழியாக ஆற்றுப்படுத்தும் திறன் பெறுதல்
இலக்கிய அறநெறிகளைத் தற்கால வாழ்வியலில் பயன்படுத்தும் திறன் பெறுதல்
திணை, துறைகளைப் பகுத்தாராயும் அறிவு பெறுதல்
இலக்கிய இலக்கண நுட்பங்களை வாழ்வியலோடு ஒப்பிடுதல்

அலகு – 1 : (12 மணி நேரம்)

குறுந்தொகை: குறிஞ்சித் திணை - பரணர் பாடல் (199), முல்லை - ஔவையார் பாடல் (99), மருதம் - கொல்லிக்கண்ணனார் பாடல் (34), நெய்தல் - கச்சிப்பேட்டு நன்னாகையார் பாடல் (172), பாலை - வெண்பூதி பாடல் (174)

நற்றிணை: குறிஞ்சி - கபிலர் பாடல் (194), முல்லை - இடைக்காடனார் பாடல் (142), மருதம் – உறையூர்க் கதுவாய்ச் சாத்தனார் பாடல் (370), நெய்தல் - அறிவுடைநம்பி பாடல் (15), பாலை - கணக்காயனார் பாடல் (24)

ஐங்குறுநூறு: குறிஞ்சி - அன்னாய் வாழிப் பத்து - அன்னாய் வாழி வேண்டன்னை நம் படப்பை (203), முல்லை - செவிலி கூற்றுப் பத்து - மறியிடைபடுத்த மான்பிணைபோல (401), மருதம் - வேட்கைப் பத்து - வாழி ஆதன் வாழி அவினி (01), நெய்தல் - வெள்ளாங்குருகுப் பத்து - வெள்ளாங் குருகின் பிள்ளை (157), பாலை - உடன்போக்கின் கண் இடைச் சுரத்து உரைத்த பத்து - அறம்புரி அருமறை நவின்ற (387)

புறநானூறு: பிசிராந்தையார் (67), அரிசில் கிழார் (146), காக்கைப்பாடினி (278), அள்ளூர் நன்முல்லையார் (306), பரணர் (352)

அலகு – 2 : (12 மணி நேரம்)

சிறுபாணாற்றுப்படை
இலக்கணம் - யாப்பு

அலகு – 3 : (12 மணி நேரம்)

கலித்தொகை: குறிஞ்சிக்கலி – திருந்திழாய்! கேளாய் எனத் தொடங்கும் பாடல் (64), முல்லைக்கலி – கண் அகன் இரு விசும்பில் எனத் தொடங்கும் பாடல் (101), மருதக்கலி - நறவினை வரைந்தார்க்கும் எனத் தொடங்கும் பாடல் (98), நெய்தல்கலி - இவர்திமில் எறிதிரை எனத் தொடங்கும் பாடல் (135) பாலைக்கலி - அறனின்றி அயல்தூற்றும் எனத் தொடங்கும் பாடல் (2)

பதிற்றுப்பத்து: குமட்டூர்க் கண்ணனாரின் புண் உமிழ் குருதி (11), பாலைக் கௌதமனாரின் கயிறு குறு முகவை (22)

இலக்கிய வரலாறு: சங்க இலக்கியங்கள், சங்க இலக்கியங்களின் தனித்தன்மைகள்

அலகு – 4 : (12 மணி நேரம்)

அகநானூறு: அளிநிலை பொறாது அமரிய முகத்தள் எனத் தொடங்கும் பாடல் (5) , திதலை மாமை தளிர்வனப்பு எனத் தொடங்கும் பாடல் (135), திருந்துஇழை நெகிழ்ந்து எனத் தொடங்கும் பாடல் (387)

தனிப்பாடல் திரட்டு:- பிறவிக் குணமும் பழக்கமும் (196), கொடியது (242), பெரியது (244), அரியது (245), இதுவே நலம் (223)

இலக்கிய வரலாறு: பதினெண்கீழ்க்கணக்கு நூல்கள்

அலகு – 5 : (12 மணி நேரம்)

திருக்குறள்: இனியவை கூறல் (10), நட்பு ஆராய்தல் (80)

பழமொழி நானூறு: ஆற்றவும் கற்றார் அறிவுடையார் எனத் தொடங்கும் பாடல் (40), வைத்தனை வைப்பென்று எனத் தொடங்கும் பாடல் (95), உடைப்பெருஞ் செல்வத்து எனத் தொடங்கும் பாடல் (154), தத்தமக்குக் கொண்ட எனத் தொடங்கும் பாடல் (276), நோக்கி அறிகல்லா எனத் தொடங்கும் பாடல் (337)

இனியவை நாற்பது:- முதல் பத்து பாடல்கள் (1-10)
இலக்கணம் - அணி
நாடகம் - விந்தனின் வாழப்பிறந்தவன்

கற்பித்தல் அணுகுமுறை (Teaching Methodology)	விரிவுரை (Lecture), காணொளிக் காட்சி (Videos), விளக்கக் காட்சி (PPT presentation)
மதிப்பீட்டு முறைகள் (Assesment methods)	கருத்துரை(Seminar), குழுக் கலந்துரையாடல் (Group Discussion), உடனடித்தேர்வு (Snap Test), ஒப்படைவு (Assignment)

பாடநூல்:
1. பொதுத்தமிழ்-3(2025), தமிழாய்வுத்துறை, தூய வளனார் கல்லூரி

பார்வை நூல்கள்:
1. சுப்பிரமணியன். ச. வே (உ.ஆ.), (2003), சங்க இலக்கியம் , கோவிலூர் மடாலயம்
2. கன்னியப்பன்.சிவ (உ.ஆ.), (2004),தனிப்பாடல் திரட்டு, முல்லை நிலையம்

Websites and eLearning Sources:
- *https://learnsangamtamil.com/*
- *https://www.tamilvu.org/library/*

Course Outcomes		
CO No.	**CO-Statements** இப்பாடத்தின் நிறைவில் மாணவர்கள்	**Cognitive Levels (K-Level)**
CO1	சங்க இலக்கியத்தின் தனித்தன்மைகளை அறிவர்	K1
CO2	ஆற்றுப்படை இலக்கியங்களைக் கற்பதன் வழி ஆற்றுப்படுத்தும் முறையை இனங்காண்பர்	K2
CO3	இலக்கிய நெறிகளை நடப்பியலில் பயன்படுத்துவர்	K3
CO4	திணை துறைகளை நன்கு கற்பதன் வாயிலாகப் பாடல்களைப் பகுப்பாய்வர்	K4
CO5	யாப்பு, அணியைக் கற்பதன் வாயிலாகப் புதிய இலக்கிய வடிவங்களைப் படைக்கும் திறன் பெறுவர்.	K5

Relationship Matrix												
Semester	**Course Code**		**Title of the Course**								**Hours**	**Credits**
3	25UTA31GL03		பொதுத்தமிழ் – 3: General Tamil - 3								4	3
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	1	2	2	2	1	3	3	2	3	2	2.1	
CO2	3	2	1	3	2	3	2	2	3	1	2.2	
CO3	3	2	1	3	2	3	2	2	3	2	2.3	
CO4	1	3	2	1	2	3	2	2	2	3	2.1	
CO5	2	3	2	2	1	3	2	2	2	2	2.1	
									Mean Overall Score		**2.16 (High)**	

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	25UFR31GL03	Language French – 3	4	3

	Course Objectives
1	Remember and Construct Narratives applying the *passé composé* with time indicators to recount past events
2	Understand and express personal memories using the *imparfait* in spoken and written communication to articulate likes, dislikes, and past events.
3	Analyze and interpret different housing options and engage in role-play scenarios to negotiate effectively.
4	Describe physical appearance and personality traits using appropriate adjectives, possessives, and comparatives to describe oneself
5	Evaluate future possibilities in science and communication, expressing hopes and possibilities using the *futur simple* and *conditionnel*

UNIT – I (12 Hours)

1. Titre - Nouvelles vies
2. Lexique – Parcours de vie, la vie personnelle, scolaire et professionnelle
3. Grammaire – le passé composé -formation, la phrase négative, les indicateurs de temps
4. Production orale- exprimer son intention de faire quelque chose
5. Production écrite - organiser une activité de loisir

UNIT – II (12 Hours)

6. Titre - Je me souviens
7. Lexique – le souvenir : la mémoire, les paysages : à la mer, à la montagne
8. Grammaire – l'imparfait -formation, les pronoms 'y' et 'en', la place de l'adjectif
9. Production orale- exprimer le fait d'aimer et de ne pas aimer
10. Production écrite - raconter un souvenir

UNIT – III (12 Hours)

11. Titre - Comme à la maison
12. Lexique – le logement et la location, les frais et les services, le cadre de vie
13. Grammaire – les pronoms relatifs, la comparaison, la condition
14. Production orale- jeu de rôle – louer un logement
15. Production écrite - Décrire un logement

UNIT – IV (12 Hours)

16. Titre - Tous pareils, tous différents
17. Lexique – l'apparence physique, les traits de caractère
18. Grammaire – les adjectifs indéfinis, les pronoms possessifs, la comparaison
19. Production orale- faire un compliment
20. Production écrite - faire le portrait physique de quelqu'un

UNIT – V (12 Hours)

21. Titre - En route vers le futur
22. Lexique – les sciences et les techniques, les technologies de communication
23. Grammaire – le futur simple, la condition avec 'si', le pronom 'on'
24. Production orale- exprimer un espoir – imaginer à l'avenir
25. Production écrite - Décrire l'utilité d'un objet
26. Indian knowledge system - Analyzing narrative structures in Indian epics vs. French literature by comparing the Mahabharata's moral stories especially the Panchatantra stories to French fables. Practicing French future tense by making simple predictions about personal life by referencing Indian astrology (5%)

Teaching Methodology	Project-Based Chronological Learning (PBL), Digital Media Integration, Genre-Specific Writing Approach, Scenario-based learning (SBL)
Assessment Methods	*Podcast creation:* Students record a short podcast episode on "Childhood Memory". (Rubric – assessed on ability to construct narratives using past tenses and expressing experiences. *Debate:* Debate on "Apartment vs. House: Students must compare housing options, rental costs, and services. (Rubric – evaluated on analytical skills through structured argumentation) *Timeline narrative activity:* Create a timeline about "A Typical College Day" (Rubric – Assessed on the ability to recall and construct a chronological narrative using past) *Letter writing:* Write a letter to a friend describing personal experiences. Write a formal inquiry to a landlord about an apartment (Rubric – Assessed on formal and informal written communication skills)

Books for Study:
1. Fafa, C., Gajdosova, F., Horquin, A., Pasquet, A., Perrard, M., Petitmengin, V., Sperandio, C., Dodin, M., &Veldeman-Abry, J. (2022). *Édito A2: Méthode de français* (2nd ed.). Didier FLE, Hatier. (p.13 – p.77)

Books for Reference:
1. Dauda, P., Giachino, L., &Baracco, C. (2016). *Génération A2*. Didier.
2. Girardet, J., &Pecheur, J. (2017). *Écho A2* (2nd ed.). CLE International

Websites and eLearning Sources:
1. https://www.bbc.co.uk/bitesize/subjects/zc7xpv4
2. https://conjuguemos.com/
3. https://www.busuu.com/en/course/learn-french-online
4. https://www.duolingo.com/learn
5. https://www.newsinslowfrench.com/

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, students will be able to	**Cognitive Levels (K-Level)**
CO1	Recall using vocabulary related to personal, academic, and professional life, and compose narratives using the *passé composé* and time indicators.	**K1**
CO2	Express experiences and preferences using *imparfait*to recount memories, express likes and dislikes accurately in spoken and written communication.	**K2**
CO3	Comparedifferent housing options and interpret rental-related expenses and services, and engage in role-play scenarios to negotiate accommodations.	**K3**
CO4	Characterise personal traits by describing physical appearance and personality traits, apply possessive and indefinite adjectives, and formulate comparisons effectively.	**K4**
CO5	Discuss advancements in science and communication, express hopes and possibilities using the *futur simple* and *conditionnel*structures.	**K5**

Relationship Matrix										
Semester	**Course Code**	**Title of the Course**							**Hours**	**Credits**
3	**25UFR31GL03**	Language French – 3							**4**	**3**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**				**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	2	3	2	3	2	3	1	3	3	3	2.5
CO2	3	2	3	3	1	2	2	2	2	2	2.2
CO3	3	1	3	3	2	2	2	2	1	1	2.0
CO4	2	2	2	2	2	1	2	1	1	1	1.6
CO5	2	3	3	2	2	2	3	3	3	3	2.6
Mean Overall Score											**2.18 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	25UHI31GL03	Language Hindi - 3	4	3

Course Objectives
To appreciate the features of Modern Hindi Prose
To understand the Hindi literature in association with the contemporary requirements
To enable the students to develop their effective communicative skills in Hindi
To strengthen the language competence among the students
To empower the students with globally employable soft skills

UNIT I   (12 Hours)
1. Tera Sneh na Khovoom
2. Samband Bodak
3. Reethikal - Namakarn
4. Chitra Varnan (Basic)

UNIT II   (12 Hours)
5. Paribakshik Shabdavali
6. Smuchaya Bodak
7. Reethikal - Samajik Paristhithiya
8. Vachan Badalo

UNIT III   (12 Hours)
9. Vismayadi Bodak
10. Reethikal - Sahithyik Paristhithiyam
11. Beerbal ki Chadurai
12. Patra-Patrikao mein Prakashit Gadyansho ka Patan (Basic)

UNIT IV   (12 Hours)
13. Avikary Shabdh
14. Reethikal - Main Divisions
15. Ling Badalo
16. Karak

UNIT V   (12 Hours)
17. Reethikal - Visheshathayem
18. Anuvad
19. Bahu Ki Vidha (One Act Play)
20. Bathcheeth - Kaksha mein

Teaching Methodology	Videos, PPT, Quiz, Group Discussion, Case Based Problem Solving
Assessment Methods	Quiz, Seminar, Assignment

Books for Study:
1. Dr. Sanjeev Kumar Jain. (2023). *Anuwad: Siddhant Evam Vyavhar*. Kailash Pustak Sadan.
2. Kamathaprasad Gupth, M. (2021). *Hindi Vyakaran*, Anand Prakashan.
3. Dr. Sadananth Bosalae. (2020)*. kavya sarang*. Rajkamal Prakashan.

Books for Reference:
1. Ramdev. (2021). *Vyakaran Pradeep*. Hindi Bhavan.
2. Lakshman Prasad Singh. (2022). *Kavya Ke Sopan*. Bharathy Bhavan Prakashan.
3. Acharya Ramchandra Shukla. (2021). *Hindi Sahitya Ka Itihas*, Prabhat Prakashan.
4. Krishnakumar Gosamy. (2023). *Anuvad vigyan ki Bhumika*. Rajkamal Prakashan.

Websites and eLearning Sources:
1. https://www.hindwi.org/poets/jaishankar-prasad/all
2. https://youtu.be/e9wK-pYfVPc

3. https://www.amarujala.com/kavya/sahitya/sumitranandan-pant-best-hindi-poems
4. https://mycoaching.in/samuchchay-bodhak-kya-hai
5. https://www.subhshiv.in/2021/06/avikari-shabd.html

	Course Outcomes	
CO No.	**CO-Statements** On successful completion of the course, the student will acquire thelisted skills	**Cognitive Levels (K-Level)**
CO1	Categorize the poetics in some selective poems.	**K1**
CO2	Practical application of grammar.	**K2**
CO3	Justify the social & political conditions of Riti Kaal in Hindi Literature.	**K3**
CO4	Find out the dialects of Hindi language.	**K4**
CO5	Illustrate the importance given to family ethics by the youth in the modern period according to "Bahoo Ki vidha" One Act play.	**K5**

	Relationship Matrix										
Semester	**Course Code**	**Title of the Course**							**Hours**	**Credits**	
3	**25UHI31GL03**	Language Hindi - 3							**4**	**3**	
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	2	3	3	2	3	2	1	3	2	2.4
CO2	3	2	3	2	2	3	2	3	2	3	2.5
CO3	3	2	2	3	1	3	2	3	2	3	2.4
CO4	2	3	3	2	3	2	3	3	2	1	2.4
CO5	3	2	2	3	3	2	1	3	2	3	2.4
										Mean Overall Score	**2.42 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	25USA31GL03	Language Sanskrit - 3	4	3

Course Objectives
To introduce simple poetry in Sanskrit
To give an exposure to the Vedas and Vedangas
To acquaint students with epics and puranas
To train students in conjugation of verbs in future tense
To introduce Upasarga-s and their role in verb formations

UNIT I (12 Hours)

Ramodantam, Balakandam (1-15 verses)

UNIT II (12 Hours)

Ramodantam, Balakandam (15-30 verses)

UNIT III (12 Hours)

Vedas – Vedangas vivaranam

UNIT IV (12 Hours)

Asta dasha Purana and Dashopanishads

UNIT V (12 Hours)

Upasargas and Bhavishyat Kaalah Vakya Prayoga

Teaching Methodology	Videos, PPT, Blackboard, Demonstration, Exercises
Assessment Methods	Seminar, Quiz, Group Discussion.

Books for Study:
1. VEDIC LITERATURE
2. RAMODANTAM

Books for Reference:
1. Parameshwara, Ramodantam, LIFCO Chennai 2020
2. R. S. Vadhyar & Sons, Book – sellers and publishers, Kalpathu, Palaghat – 678003, Kerala, south India, History of Sanskrit Literature 2021
3. Kulapathy, K.M Saral Sanskrit Balabodh, Bharathita vidya bhavan, Munshimarg Mumbai – 400 007 2020

Websites and eLearning Sources:
1. https://www.scribd.com/doc/210917188/Sri-Ramodantam-Sanskrit-Text-With-English-Translation
2. http://www.sushmajee.com/ms-ppp/text/ved-notes.pdf
3. https://occr.org.in/publication/Vedanga.pdf
4. https://www.forgottenbooks.com/en/download/TheThirteenPrincipalUpanishadsTranslatedFromtheSanskrit_10017247.pdf
5. https://www.learnsanskrit.org/guide/uninflected-words/the-upasarga/

	Course Outcomes	
CO No.	**CO–Statements**	**Cognitive Levels**
	On successful completion of this course, students will be able to	**(K –Levels)**
CO1	Remember Characters and events of Ramayana	**K1**
CO2	Understand social ethics and moral duties.	**K2**
CO3	Apply the values learnt, in day-to-day life	**K3**
CO4	Appreciate the Vedic Philosophy	**K4**
CO5	Evaluate and create new words with upasargas	**K5**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**						**Hours**		**Credits**
3	**25USA31GL03**		Language Sanskrit - 3						**4**		**3**
Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**					**Mean Scores of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	1	2	2	3	3	3	3	3	2	1	2.3
CO2	3	3	2	3	3	2	2	3	3	3	2.7
CO3	3	3	1	3	3	1	1	3	3	3	2.4
CO4	2	2	1	2	3	2	2	3	2	1	2.0
CO5	3	3	2	3	2	2	3	3	3	2	2.6
									Mean Overall Score		**2.4 (High)**

Semester	Course Code	Title of the Course	Hours/ Weeks	Credits
3	25UEN32GE03B	**General English - 3:** English for Science - 1	5	3

Course Objectives
To enable the students to comprehend the local and global issues through the lessons.
To enable the students to do the tasks centering on Skill Development and Grammar.
To empower the students with interactive skills.
To enhance their taste for reading that will naturally develop their vocabulary power and sentence structures
To develop the listening, speaking and writing skills of students through the prescribed texts.

UNIT I: Encounter Between Humans and Aliens (15 Hours)
1. "They're Made Out of Meat" by Terry Bisson
2. Vocabulary in Context: Meat Words
3. Writing: Informal Letter Writing
4. Speaking: Role Play
5. Grammar: Present Perfect Tense

UNIT II: Life After Death (15 Hours)
6. "The Egg" by Andy Weir
7. Vocabulary in Context: Cide Words
8. Writing: Formal Letter Writing
9. Speaking: Description of a Picture
10. Grammar: Present Perfect Continuous Tense

UNIT III: In Communion with Nature (15 Hours)
11. "A Tiger in the House" by Ruskin Bond
12. Vocabulary in Context: Animals and their babies
13. Writing: Job Application Writing (Writing Covering Letter and Curriculum Vitae)
14. Speaking: Description of an Advertisement
15. Grammar: Past Perfect Tense

UNIT IV: Mystery of Venus (15 Hours)
16. "All Summer in a Day" by Ray Bradbury
17. Vocabulary in Context: Rain Words
18. Writing: Drafting Invitation and Brochure
19. Speaking: Short Academic Presentation
20. Grammar; Past Perfect Continuous

UNIT V: Think Before You Trash (15 Hours)
21. "My Frog Recycles All His Trash" by Kenn Nesbitt
22. Vocabulary in Context: Ecological Words
23. Writing: Preparing an Advertisement
24. Speaking: Welcome Address and Vote of Thanks
25. Grammar: Future Perfect Tense and Future Perfect Continuous Tense

* Speaking Components are meant only for internal tests

Teaching Methodology	Lecture, Multimedia Presentations, Discussion and Enacting
Assessment Methods	Speaking, reading, listening and written tests

Books for Study:
1. Francis, V., Dr. D.R. Edwin Christy and Dr. D. Loyola Innaci. *Lingua Science – I,* St. Joseph's College (Autonomous), Tiruchirappalli.

Books for Reference:
1. Wilfred, D. Best. *Students Companion*. HarperCollins Publishers, 2020.

2. Wren & Martin. *Middle School English Grammar and Composition,* S Chand Publishing, 2023.
3. Carnegie, Dale. *The Quick and Easy Way to Effective Speaking*, Rupa Classics, 2013.

Websites and eLearning Sources:
1. https://jerrywbrown.com/wp-content/uploads/2020/02/They-are-made-out-of-meat-Bisson-Terry.pdf
2. https://www.are.na/block/12921440
3. https://pdfcoffee.com/andy-weir-the-egg-pdf-pdf-free.html
4. https://mrsdelcarmen.weebly.com/uploads/3/0/9/0/30908551/a_tiger_in_the_house_by_ruskin_bond.pdf
5. https://poetry4kids.com/poems/my-frog-recycles-all-his-trash/
6. https://www.stcyprianssprimaryacademy.co.uk/wp-content/uploads/2021/01/All-Summer-in-a-Day-by-Ray-Bradbury.pdf

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, students will be able to	**Cognitive Levels (K-Level)**
CO1	Identify and comprehend the local and global issues through the lessons	**K1**
CO2	Use interactive skills	**K2**
CO3	Develop the Listening and Reading Skills of the learners through teacher-led reading practice	**K3**
CO4	Enhance their Listening, Reading, Speaking, and Writing Skills	**K4**
CO5	Develop their Creative and Critical Thinking and Speaking Skills	**K5**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
3	**25UEN32GE03B**		**General English - 3:** English for Science - 1							**5**	**3**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Scores of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	2	3	2	2	3	2	3	2	3	2	2.4
CO2	2	2	3	2	3	3	2	3	2	2	2.3
CO3	2	3	2	3	2	2	3	2	3	2	2.4
CO4	2	2	3	2	3	3	2	3	2	3	2.5
CO5	2	2	2	3	2	2	2	3	2	2	2.2
										Mean Overall Score	**2.36 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	25UPH33CC05	**Core Course – 5:** Mathematical Physics - 1	4	3

Course Objectives
To know the fundamental concepts and theorems in vector calculus, multiple integrals and differential equation
To understand the results and effects of various concepts in differential equations, differential and integral calculus
To apply the basic principles of differential equations, vectors calculus and multiple integrals on various physics problems
To solve various physics problems using the mathematical tools
To analyze and investigate various physical systems using mathematical theory

UNIT I: Vectors Differential Calculus (12 Hours)

Vector function - Differentiation of vectors - Formulae of differentiation - Scalar and Vector point functions - Gradient of scalar function - Geometrical meaning of gradient - Normal and directional derivative - Divergence of vector function - Physical interpretation of divergence - Curl - Physical meaning of curl.

UNIT II: Vectors Integral Calculus (12 Hours)

Line integral - Surface integral - Volume integral - Stoke's theorem (relation between line and surface integral) - verification- Gauss's theorem of divergence - deductions from Gauss divergence theorem.

UNIT III: Multiple Integrals (12 Hours)

Double Integral: - Cartesian, cylindrical and spherical coordinate system, Evaluation - Applications: Area in cartesian and polar coordinates - volume of a solid by rotation. Triple Integrals: - Evaluation - Applications: Volume of solid bounder by sphere of cylinder and cone.

UNIT IV: First Order Differential Equation (12 Hours)

Introduction - Formation of differential equations - solution of a differential equation Geometrical meaning - first order differential equation - variables separable - homogenous differential equations - linear differential equations- electrical circuits - solving ODE for current - LR & CR circuits.

UNIT V: Second Order Differential Equation (12 Hours)

Nonlinear differential equations - second order differential equations - homogeneous and non-homogeneous equations- fundamental theorem for homogenous differential equation - complementary function - particular integral - damped LCR circuit - simple harmonic motion.

Teaching Methodology	Lectures, Presentations, Simulations, and Videos
Assessment Methods	Seminar, Snap, Test, MCQ, Problem solving, Online quiz

Books for Study:
1. Dass, H. K. (2014). *Mathematical Physics,* (7th Revised Ed.). S. Chand.

Unit	Book	Chapters	Sections
I	1	2	2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10, 2.11, 2.14
II	1	3	3.1, 3.2, 3.3, 3.6, 3.8, 3.9
III	1	4,5,6,7,8	4.1, 4.8, 5.1, 5.2, 6.2, 6.3, 6.4,7.1, 7.2, 8.2, 8.3, 8.4,
IV	1	12, 17	12.1, 12.2, 12.3, 12.4, 12.5, 12.6, 12.7, 12.8, 12.10, 17.2
V	1	13, 17	13.2, 13.3, 13.5, 13.6, 13.7, 13.14, 13.15, 13.22, 17.3, 17.8

Books for Reference:
1. Kreyszig, E. (2010). *Advanced Engineering Mathematics,* (9th Ed.). Wiley.
2. Griffiths, D. J. (2018). *Introduction to Electrodynamics,* (4th Ed.). Pearson.
3. Weber, H., & Arfken, G. (2003). *Essential Mathematical Methods for Physicists,* (1st Ed.). Elsevier.
4. Riley, K., Hobson, M., & Bence, S. (2006). *Mathematical Methods for Physics and Engineering: A Comprehensive Guide,* (3rd Ed.). Cambridge University Press.
5. Mukhopadhyay, A. K. (1998). *Mathematical Methods for Engineers and Physicists*. Wheeler.

6. Prakash, S. (2008). *Mathematical Physics*. S. Chand.

Websites and eLearning Sources:
1. https://www.geogebra.org/
2. https://mathworld.wolfram.com/
3. https://swayam.gov.in/explorer?category=Mathematics
4. https://ocw.mit.edu/search/?d=Mathematics
    (* subject to availability - not to be used for exam purpose)

CO No.	CO-Statements On successful completion of this course, students will be able to	Cognitive Levels (K- Level)
	Course Outcomes	
CO1	Acquire knowledge on different mathematical methods like vector calculus, multiple integrals and differential equations.	K1
CO2	Understand the concepts and techniques of differential and integral vector calculus, multiple integrals and differential equations.	K2
CO3	Apply vector calculus, differential equations and multiple integrals on various physical problems.	K3
CO4	Solve various problems using differential equations, multiple integrals, and vector calculus to obtain the solutions.	K4
CO5	Analyse and interpret the solutions obtained by mathematical methods.	K5

Relationship Matrix											
Semester	**Course Code**	**Title of the Course**								**Hours**	**Credits**
3	25UPH33CC05	**Core Course - 5:** Mathematical Physics - 1								4	3
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	2	2	1	3	3	3	2	2	2.4
CO2	3	3	2	2	1	3	2	3	2	2	2.3
CO3	3	2	2	2	1	2	3	2	2	2	2.1
CO4	3	2	2	2	1	2	2	3	2	2	2.1
CO5	3	3	2	2	2	3	2	2	2	2	2.3
Mean Overall Score											**2.24 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	25UPH33CC06	**Core Course - 6:** Electromagnetism	4	3

Course Objectives
To recall the fundamental laws of electrostatic, magnetostatic, and electromagnetic fields.
To understand the various fields in electrostatics, magnetostatics, electromagnetics, and their relation
To apply the principles of electrostatic and magnetostatics on solving problems involving electric, magnetic, and electromagnetic fields
To examine the behaviour of electric, magnetic, and electromagnetic fields in matter.
To assess Maxwell's equations, Ampere's law, Biot-savart law, and Gauss law in differential and integral forms

UNIT I: Electrostatics (12 Hours)

Coulomb's law – electric field-continuous charge distribution – Gauss's law and its applications- Electric field inside and outside the uniformly charged sphere, cylinder and plane surfaces - Introduction to Electric potential - Poisson's equation and Laplace's equation - potential of a localized charge distribution - Potential for a uniformly charged spherical shell- Conductors: Basic Properties - Capacitors

UNIT II: Electric Field in Matter (12 Hours)

Dielectrics-Induced dipoles – Alignment of polar molecules-polarization – Bound charges and its physical interpretation-Field produced by a polarized sphere- Field inside the dielectric- Gauss's law in the presence of dielectrics – Electric displacement in a long wire-deceptive parallel- Susceptibility, permittivity and dielectric constant

UNIT III: Magnetostatics (12 Hours)

Lorentz force Law-Magnetic Fields- Magnetic Forces- Currents- Biot-Savart's law: Steady currents - Magnetic field of a steady current- Magnetic field on a straight wire and a circular loop- Straight line currents-The Divergence and Curl of B- Ampere's Law- Magnetic field of an infinite planar surface, and of a solenoid-Comparison of magnetostatics and electrostatics

UNIT IV: Magnetic Field in Matter (12 Hours)

Diamagnets, paramagnets and ferromagnets - Torques and forces on a magnetic dipole- Effect of a magnetic field on atomic orbits- Magnetization -Field of a magnetized object: Bound currents and its physical interpretation - Magnetic field inside matter-The Auxiliary field H: Ampere's law in magnetized materials-Magnetic susceptibility and permeability.

UNIT V: Electrodynamics (12 Hours)

Ohm's law – Current flows in a cylindrical resistor- Electromotive force-Faraday's law – induced electric field - Inductance –- energy stored in magnetic field - Maxwell's equations: Electrodynamics before Maxwell - modified Ampere's law- Magnetic charge.

Teaching Methodology	Lectures, Presentations, Simulations, and Videos
Assessment Methods	Seminar, Snap, Test, MCQ, Problem solving, Online quiz

Book for Study:
1. Griffiths, D.J. (2017). *Introduction to Electrodynamics*, (4th Ed.). Cambridge University Press.

Unit	Book	Chapters	Sections
I	1	2	2.1.1 - 2.1.4, 2.2.1-2.2.3 2.3.1, 2.3.3, 2.3.4 2.5.1, 2.5.4
II	1	4	4.1.1- 4.1.4 4.2.1- 4.2.3 4.3.1., 4.3.2. 4.4.1, 4.4.3
III	1	5	5.1.1-5.1.3 5.2.1.-5.2.2 5.3.1-5.3.4
IV	1	6	6.1.1- 6.1.4 6.2.1-6.2.3 6.3.1 6.4.1
V	1	7	7.1.1, 7.1.2 7.2.1-7.2.4 7.3.1- 7.3.4

Books for Reference:
1. Purcell, E. M., & Morin, D. J. (2013). *Electricity and Magnetism,* (3rd Ed.). Cambridge University Press.

2. Halliday, D., Resnick, R., & Walker, J. (2007). *Fundamentals of Physics*, (10th Ed.). Wiley Publications.

Websites and eLearning Sources:
1. https://www.damtp.cam.ac.uk/user/tong/em.html
2. https://cosmolearning.org/video-lectures/maxwells-equations-12936/
3. https://www.youtube.com/playlist?list=PLD07B2225BB40E582
4. https://www.feynmanlectures.caltech.edu/II_04.html
5. https://oyc.yale.edu/physics/phys-201/lecture-1
6. http://web.mit.edu/8.02t/www/802TEAL3D/visualizations/magnetostatics/index.htm
(* subject to availability - not to be used for exam purpose)

	Course Outcomes	
CO No.	**CO-Statements** On successful completion of this course, students will be able to	**Cognitive Levels (K- Level)**
CO1	Acquire knowledge on the fundamentals of electrostatics, magnetostatics and electrodynamics.	**K1**
CO2	Understand the behaviour of electric fields, electromagnetic fields, and electromagnetic waves	**K2**
CO3	Apply the principles of Coulomb's Law, Gauss's law, Biot-Savart's law, Ampere's law, and Faraday's laws in various systems.	**K3**
CO4	Analyse electric field, electric potential, electric flux, magnetic field in different symmetry systems	**K4**
CO5	Assess Maxwell's equations, Ampere's law, Biot-savart law, and Gauss law in differential and integral forms	**K5**

Relationship Matrix											
Semester	**Course Code**	**Title of the Course**								**Hours**	**Credits**
3	**25UPH33CC06**	**Core Course - 6:** Electromagnetism								**4**	**3**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	2	2	1	3	3	3	2	2	**2.4**
CO2	3	3	2	2	1	3	2	3	2	2	**2.3**
CO3	3	2	2	2	1	2	3	2	2	2	**2.1**
CO4	3	2	2	2	1	2	2	3	2	2	**2.1**
CO5	3	3	2	2	2	3	2	2	2	2	**2.3**
									Mean Overall Score		**2.24 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	25UPH33CP03	**Core Practical - 3:** Physics Practical - 3	3	2

Any 8 Experiments

1. Jolly's bulb - pressure coefficient
2. Thermal conductivity – Lee's disc.
3. y, n, σ – Searles method.
4. Compound pendulum.
5. Kundt's tube.
6. Rankine's method.
7. Spectrometer – i-d curve.
8. Field along the axis of a coil – Vibration magnetometer.
9. Potentiometer – Ammeter calibration.
10. B.G. – comparison of mutual inductance.
11. Absolute determination of M and H.
12. Projectile as a function of the angle of inclination
13. Forced oscillation and resonance
14. Moment of Inertia of a fly wheel
15. Verification of Lenz's law and Faraday's law

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	25UPH33AO01A	**Allied Optional - 1:** Chemistry - 1	4	3

Course Objectives
To learn the nomenclature, hybridization, isomerism and the intermediates of organic compounds
To study the preparation, properties and mechanisms of alkanes and alkenes
To understand the structure and bonding of Boron, Sulphur and Phosphorous compounds
To explain the principles and applications of Analytical Techniques
To understand the principles of photochemistry

UNIT I: Hydrocarbons and Isomerism (12 Hours)

Nomenclature of simple hydrocarbons-covalent bond-bond length, bond angle, dipole moment, inductive effect, mesomeric effect and hyperconjugation effect-Hybridization-sp^3, sp^2, sp (examples: acetylene, ethylene and methane). Intermolecular forces - hydrogen bonding-Isomerism – geometrical and optical isomerism. Reactive intermediates-generation, structure and stability of carbocation, carbanion and carbon free radicals.

UNIT II: Alkanes and Alkenes (12 Hours)

Methods of preparation of alkanes (Wurtz method, Kolbe's method, using Grignard reagent and using HI/P)-chemical properties of alkanes - substitution reaction-only halogenation of alkanes with free radical mechanism- conformation analysis of ethane and cyclohexane. Methods of preparation of alkenes (Kolbe's method, Hoffman degradation, using Lindlar's catalyst and dehydration of alcohols)- chemical properties of alkenes - electrophilic addition mechanism- only mechanisms of bromination of alkenes, hydration of alkenes and addition of diborane to alkenes.

UNIT III: Bonding and Structure in Inorganic Compounds (12Hours)

Bonding - ionic, covalent, metallic and non-covalent interactions-ionic bonding-lattice energy-Born-Haber's cycle - factors influencing lattice energy-covalent bonding- Lewis theory and its limitations-VSEPR theory-deducing hybridization and predicting structure of some basic inorganic compounds (BF_3, NH_3, H_2O, PCl_5, Bent's Rule - PCl_3F_2, ClF_3, SF_4, I_3^-, SF_6, IF_7).

UNIT IV: Error Analysis and Corrosion (12 Hours)

Data in chemical analysis-The mean and the median-precision and accuracy-Types of Errors in chemical analysis-determinate errors and indeterminate errors-Chemistry of Corrosion-types- Chemical and electrochemical corrosion-Inhibitors in corrosion control.

UNIT V: Photochemistry (12 Hours)

Difference between photochemical reactions and dark reactions-Laws of photochemistry-Beer -Lambert's Law-derivation and applications-Grothuss-Drapper law-Stark-Einstein's law of photochemical equivalence-quantum yield - kinetics of hydrogen-chlorine reaction, hydrogen-bromine reaction and decomposition of HI-Photophysical processes-Jablonski diagram-internal conversion (IC), intersystem crossing (ISC), fluorescence and phosphorescence-chemiluminescence.

Teaching Methodology	Chart, PPT, chalk and talk and videos.
Assessment Methods	Snap Test, Seminar, group discussion and MCQ

Books for Study:
1. Lee, J. D. (2010). *Concise Inorganic Chemistry* (5th Ed.). Wiley-India.
2. Morrison, R. T., Boyd, R. N., & Bhattacharjee, K. (2010). *Organic Chemistry* (7th Ed.). Pearson.
3. Puri, B. R., Sharma, L. R., & Pathania, M. S. (1993). *Principles of Physical Chemistry* (23rd Ed.). Shoban Lal Nagin Chand and Co.
4. Skoog, D. A., West, D. M., Holler, F. J., & Crouch, S. R. (2014). *Fundamentals of Analytical Chemistry* (9th Ed.). Brooks/Cole, Cengage Learning.

Books for Reference:
1. Atkins, P. W. (2009). *Physical Chemistry* (7th Ed.). Oxford University Press.
2. Bruice, P. Y. (2011). *Organic Chemistry* (8th Ed.). Pearson Ltd., University of California.

3. Finar, I. L. (1996). *Organic Chemistry* (Vols. 1 & 2) (6th Ed.). Addison Wesley Longman Ltd.
4. Huheey, J. E., Keiter, E. A., Keiter, R. L., & Medhi, O. K. (2006). *Inorganic Chemistry: Principles of Structure And Reactivity* (4th Ed.). Pearson Education.
5. Miessler, G. L., Fischer, P. J., & Tarr, D. A. (2014). *Inorganic Chemistry* (5th Ed.). Pearson Education, Inc.

Websites and eLearning Sources:
1. https://opentextbc.ca/chemistry/chapter/20-1-hydrocarbons/
2. https://wou.edu/chemistry/courses/online-chemistry-textbooks/ch105-consumerchemistry/
3. http://chemed.chem.purdue.edu/genchem/topicreview/bp/ch8/vsepr.html
4. https://www.edinst.com/blog/jablonski-diagram/
5. https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_ Maps/Book%3A_Physical_Chemistry_(Fleming)/11%3A_Chemical_Kinetics_I   Hydrocarbons Organic Chemistry

Hydrocarbons

Organic Chemistry

VSPER Theory

Jablonski-Diagram

Chemical Kinetics

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, the students will be able to	**Cognitive Levels (K-Level)**
CO1	Explain the reactions of alkanes and alkenes and to apply them in new substrates.	**K1**
CO2	Summarize principles of photochemistry and photophysics.	**K2**
CO3	Understand the concepts of hybridization and isomerism in organic molecules.	**K3**
CO4	Solve the problems on reaction rates using principles of chemical kinetics.	**K4**
CO5	Examine the structures of various inorganic compounds.	**K5**

Relationship Matrix										
Semester	**Course Code**		**Title of the Course**						**Hours**	**Credits**
3	25UPH33AO01A		**Allied Optional - 1:** Chemistry- 1						4	3
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**				**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	2	3	2	3	1	2	2	3	1	3	**2.2**
CO2	1	3	2	2	2	2	2	2	2	1	**1.9**
CO3	2	1	2	2	2	2	3	1	3	2	**2.0**
CO4	1	3	1	3	1	2	3	1	2	3	**2.0**
CO5	2	2	1	2	1	2	3	3	3	2	**2.1**
Mean Overall Score											**2.04 (Medium)**

Semester	Course Code	Title of the Course	Hours/Weeks	Credits
3	25UPH33AO01B	**Allied Optional - 1:** Computer Science - 1	4	3

Course Objectives
To learn the fundamental concepts and features of HTML5.
To create hyperlinks, multimedia elements, and internal page navigation.
To explore the fundamentals of CSS.
To examine the concepts of DBMS.
To learn SQL syntax and its role in querying and managing data in RDBMS.

UNIT I: Getting Started with HTML5 (12 Hours)

HTML - Features of HTML5 - Importance of Learning HTML5 - Choosing a Text Editor - HTML5 Semantic Markup - Basic Structure of an HTML Document - Essential Tags and Attributes - Creating and Setting Up an HTML Document - Adding Content - Comments in HTML.

UNIT II: HTML Text Formatting, Links, Forms, and Tables (12 Hours)

Text Formatting and Lists HTML Headings and Paragraphs - Ordered, Unordered, and Nested Lists - Formatting Text with HTML. Links and Multimedia Creating Links - Relative URLs - Linking Within a Page - Adding Images, Videos, and Audio. Forms and Input Elements Creating Forms - Inputs - Form Validation. Tables Creating Tables - Basic Table Styling.

UNIT III: Cascading Style Sheets (CSS3) (12 Hours)

CSS Role of CSS in Web Development - CSS Syntax and Rules - Selectors and Declarations - Internal and External CSS - Linking CSS File. CSS Implementation and Styling to CSS Versions - Applying Styles - Media Types - User Styles. CSS Style Properties Text and Font Properties - Colors and Backgrounds - CSS Box Model - Margins, Borders, and Padding - Width and Height.

UNIT IV: Database Systems Concepts (12 Hours)

Database System Applications - Purpose of Database Systems - View of Data - Database Languages - Relational Databases - Database Design - Data Storage and Querying.

UNIT V: Relational Database and SQL (12 hours)

Structure of Relational Databases - Database Schema-Keys - Schema Diagrams - Relational Query Languages - Relational Operations-Overview of the SQL Query - SQL Data Definition - Basic Structure of SQL Queries - Additional Basic Operations - Set Operations.

Teaching Methodology	Lectures and Presentations, Demonstrations, Case Studies Examples, Group Discussions and Peer Learning
Assessment Methods	Written Examination, Assignment, Presentation

Book for Study:
1. Smith, S. (2023). *Responsive web development with HTML5 and CSS: Building modern and user-friendly websites for all devices*, (2nd Ed.). TechPress Publishing.
   Unit I *Chapter* 1
   Unit II *Chapter*s 2 and 4
   Unit III *Chapter*s 7 and 8
2. Henry F. Korth Abraham Silberschatz. (2011). *Database System Concepts* (6th Ed). McGraw Hill.
   Unit IV *Chapter 1(Section:1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7)*
   Unit V *Chapter 2(Section:2.1, 2.2, 2.3, 2.4, 2.5), Chapter 3(Section:3.1, 3.2, 3.3, 3.4, 3.5)*

Books for Reference:
1. Powell, T.A. (2000). *The Complete Reference Web Design*, Tata McGraw Hill.
2. Date, C.J. (2002). *An Introduction to Database System*, (7th Ed.). Pearson Education.
3. Willard, W. (2009). *Web Design - A Beginner's Guide*. Tata McGraw Hill Education.

Websites and eLearning Sources:

1. https://www.tutorialspoint.com/html/index.htm
2. https://www.geeksforgeeks.org/dbms/
3. https://www.w3schools.com/sql/
4. https://www.w3schools.com/html/

	Course Outcomes	
CO No.	**CO-Statements** On successful completion of this course, students will be able to	**Cognitive Levels (K-Level)**
CO1	Develop responsive and well-structured web pages using HTML5 and CSS3.	**K1**
CO2	Apply text formatting, multimedia integration, and form handling techniques to enhance web content.	**K2**
CO3	Utilize CSS3 styling properties to control the layout, design, and responsiveness of web applications.	**K3**
CO4	Design and manage relational databases using SQL queries for efficient data storage and retrieval.	**K4**
CO5	Demonstrate the ability to build dynamic and interactive web applications with effective database integration.	**K5**

Relationship Matrix										
Semester	**Course Code**		**Title of the Course**						**Hours**	**Credits**
3	**25UPH33AO01B**		**Allied Optional - 1:** Computer Science - 1						**4**	**3**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**				**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	2	2	2	2	3	3	2	2	3	**2.4**
CO2	2	3	2	2	2	3	3	2	2	3	**2.4**
CO3	2	2	3	2	3	2	3	3	3	2	**2.5**
CO4	2	2	2	3	2	2	3	2	3	3	**2.4**
CO5	1	2	2	2	3	2	3	2	2	3	**2.2**
									Mean Overall Score		**2.38(High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	25UPH33OP01	**Allied Optional Practical - 1:** Chemistry Practical-1	2	1

Course Objectives
To learn the different concentration terms
To learn the methods of preparing solutions and carrying out titrations
To understand the principles of titrimetric analysis
To understand the principles of quantitative analysis
To learn the principles of complexometric titrations

UNIT I: Principles of Quantitative Analysis (6 Hours)

Introduction – types of quantitative analyses – theory of significant figures– error analysis – apparatus used in titrimetric analysis – handling of digital balances and other apparatus – concept of molecular weight, formula weight, equivalent weight – concentrations of solutions – molarity, formality, normality, weight percentage.

UNIT II: Principles of Titrimetry (6 Hours)

Principle of titrimetry – primary and secondary standards – preparing standard solutions – standardizing the secondary standard solutions –types of titrimetric analyses – principal reactions – concepts of acids, bases, oxidants and reductants – theory of indicators – calculations for strengths of solutions and the amount of substances in solution.

UNIT III: Preparation of Solutions and Types of Titrimetric Methods (6 Hours)

1. Preparation of a standard solution.
2. Preparing a standard solution and doing a titration.
3. Making up a given solution and doing a titration.
4. Estimation of strength of a solution.
5. Types of titrimetric methods and indicators used.

UNIT IV: Volumetric Analysis-I (6 Hours)

1. Estimation of HCl by NaOH using a standard oxalic acid solution.
2. Estimation of NaOH by HCl using a standard sodium carbonate solution.
3. Estimation of oxalic acid by $KMnO_4$ using a standard FAS solution.
4. Estimation of FAS by $KMnO_4$ using a standard oxalic acid solution.
5. Estimation of $KMnO_4$ by FAS using a standard $K_2Cr_2O_7$ solution.
6. Estimation of oxalic acid by $KMnO_4$ using a standard Ferrous sulphate solution.
7. Estimation of $FeSO_4$ by $KMnO_4$ using a standard Ferrous sulphate solution.

UNIT V: Volumetric Analysis-II (6 Hours)

1. Estimation of $K_2Cr_2O_7$ using sodium thiosulphate solution.
2. Estimation of Na_2CO_3 by HCl using a standard Na_2CO_3 solution.
3. Estimation of zinc (EDTA titration).
4. Estimation of magnesium (EDTA titration).
5. Estimation of hardness of water (EDTA titration).

Teaching Methodology	Laboratory Demonstration
Assessment Methods	Test, viva voce

Books for Study:

1. Coulling, A. (2013). *A Complete Guide to Volumetric Analysis* (1st Ed.). CreateSpace Independent Publishing Platform.
2. Department of Chemistry, St. Joseph's College. (2021). *Allied Practical Manual* (Private circulation).
3. Puri, B. R., Sharma, L. R., & Kalia, K. K. (1993). *Principles of Inorganic Chemistry* (23rd Ed.). Shoban Lal Nagin Chand and Co.
4. Schimpt, H. W. (2019). *Essentials of Volumetric Analysis* (1st Ed.). Wentworth Press.

Books for Reference:

1. Furniss, B. S. (1984). *Vogel's Textbook of Practical Chemistry* (7th Ed.). ELBS.
2. McPherson, P. (2014). *Volumetric Analysis* (1st Ed.). Royal Society of Chemistry.
3. Venkateswaran, V., Veeraswamy, R., & Kulandaivelu, A. R. (1997). *Basic Principles Of Practical Chemistry* (2nd Ed.). Sultan Chand and Sons.

Websites and eLearning Sources:

1. https://www.youtube.com/watch?v=FUo428guKt0
2. https://www.youtube.com/watch?v=_G6_OEa1BjA
3. https://youtu.be/wRAo-M8xBHM
4. https://www.britannica.com/science/volumetric–analysis
5. https://www.youtube.com/watch?v=loxMW2honqw

	Course Outcomes	
CO No.	**CO-Statements** On successful completion of this course, the students will be able to	**Cognitive Levels (K-Level)**
CO1	Know about the handling of chemicals and safety measures in the laboratory.	**K1**
CO2	Estimate the principle of volumetric analysis and various types of titration.	**K2**
CO3	Illustrate the theoretical aspects of volumetric analysis.	**K3**
CO4	Detect the range of pH at which complexation takes place.	**K4**
CO5	Demonstrate various techniques of volumetric analysis.	**K5**

	Relationship Matrix										
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
3	**25UPH33OP01**		**Allied Optional Practical - 1:** Chemistry Practical- 1							**2**	**1**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	2	3	2	3	2	2	3	2	2	3	**2.4**
CO2	2	2	2	2	2	2	2	2	2	2	**2.0**
CO3	1	2	1	2	2	1	2	1	2	2	**1.6**
CO4	2	2	1	2	2	2	2	1	2	2	**1.8**
CO5	3	2	2	2	2	3	2	2	2	2	**2.2**
									Mean Overall Score		**2.0 (Medium)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	25UHE34VE03A	**Value Education - 3:** Social Ethics - 1	2	1

Course Objectives
To gain a comprehensive understanding of the principles advocated in social ethics.
To examine the different types of political systems in a thorough manner.
To comprehend the role and obligations of the educated youth.
To evaluate the conduct of the elected representatives in a detailed manner.
To thoughtfully analyze the various forms of cyber-crime.

UNIT I: Introduction to Social Ethics (6 Hours)

Social ethics, social ethics and social responsibility, social ethics play an important role on the areas, religion influences social changes and vice versa, secularism. Social ethics and corporate dynamics, forms of social ethics.

UNIT II: The Economic and Political System of Today (6 Hours)

Planned economy and communism - market economy and capitalism- socialism - mixed economy -the emerging market economy - political system- totalitarian system- oligarchic system.

UNIT III: Integrity in Public Life National Integration (6 Hours)

What is Integrity, Public Life, Integrity and Public Life, Integrity in a Democratic State, India as Democratic State, Behavior of a elected representative of India, Noticeable degradation acts of elected Representatives, Suggestions to stem this rot, Types of integrity, Transparency can be a guarantee for integrity.

UNIT IV: Cyber Crime (6 Hours)

Business Ethics, Business ethics permeates the whole organization, measuring business ethics, The Vital factors highlighting the importance of business ethics, Cyber-crime, Strategies in committing Cyber Crimes, Factors aiding Cyber Crime, computer Hacking, Cyber Bullying, Telecommunications piracy, Counter Measures to Cyber Crime, Ethical Hacking.

UNIT V: Social Integration (6 Hours)

Global challenges, the future is with the Educational Youth, Cost of the Sacrifice, Crusaders against corruption, Responsibility of the Educated Youth, Positive Global Scenario, right to Education, Eradicating gender inequality, Sustainable Human Development, Social Integration, Elimination Crime, Integration with Global Market

Teaching Methodology	Lecture, PPT, Power point
Assessment Methods	Online Test, Group Discussions

Books for Study:
1. Department of Human Excellence. (2021). *Formation of Youth*, St Joseph's College (Autonomous), Tiruchirappalli.

Books for Reference:
1. Arora, R.K. (2014). *Ethics, Integrity and Values*. Public Service Paperback.
2. Cunningham, D. (2004). *There's something happening here: The new left, the Klan, and FBI counterintelligence*. Berkeley: University of California Press.
3. Mali, P. (2017). *Cyber law & Cyber Crimes simplified*. Cyber Info Media Paperback.
4. Richardson, M. (2019). *Cyber Crime: Law and Practice Hardcover - Import*.

Websites and eLearning Sources:
1. https://cybercrime.gov.in/
2. https://open.lib.umn.edu/sociology/chapter/14-2-types-of-political-systems/
3. https://www.esv.org/resources/esv-global-study-bible/social-ethics/
4. https://en.wikipedia.org/wiki/Political_system

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, students will be able to	**Cognitive Levels (K - Level)**
CO1	Know the responsibility of the educated youth.	**K1**
CO2	Understand the values prescribed under social ethics.	**K2**
CO3	Apply their minds critically to the various types of cyber-crime.	**K3**

Relationship Matrix											
Semester	**Course Code**	**Title of the Course**							**Hours/Week**		**Credits**
3	**25UHE34VE03A**	Value Education - 3: Social Ethics - 1							**2**		**1**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Scores of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	3	3	2	3	2	2	3	3	**2.7**
CO2	3	2	2	2	3	2	2	3	2	2	**2.3**
CO3	2	3	3	3	2	3	3	3	3	3	**2.8**
									Mean Overall Score		**2.6 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	25UHE34VE03B	**Value Education - 3:** Religious Doctrine - 1	2	1

Course Objectives
To impart knowledge to students about Salvation History
To familiarize students with the life and mission of Jesus Christ
To help Students understand the Holy Spirit
To empower students on Gospel Values
To equip the students about Mother Mary

UNIT I (6 Hours)
God of salvation

UNIT II (6 Hours)
Life & Mission of Jesus Christ

UNIT III (6 Hours)
The Holy Spirit

UNIT IV (6 Hours)
Gospel Values

UNIT V (6 Hours)
Mary, the mother of God

Teaching Methodology	Power point, Assignment and Group discussion
Assessment Methods	Online Test, Group Discussions

Books for Study:
1. Department of Human Excellence. (2022). *Fullness of Life.* St. Joseph's College, Tiruchirappalli.

Books for Reference:
1. (1994). *Compendium: Catechism of the Catholic Church.* Bengaluru: Theological Publications in India.
2. Holy Bible (NRSV).

	Course Outcomes	
CO No.	**CO-Statements** On successful completion of this course, students will be able to	**Cognitive Levels (K - Level)**
CO1	Understand the Salvation History	**K1**
CO2	Grasp to the life and purpose of Jesus Christ	**K2**
CO3	Live out the teachings of the Gospel	**K3**

Relationship Matrix										
Semester	**Course Code**		**Title of the Course**					**Hours/Week**		**Credits**
3	25UHE34VE03B		Value Education - 3: Religious Doctrine - 1					2		1
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**				**Mean Scores of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	3	3	2	3	2	2	3	3	**2.7**
CO2	3	2	2	2	3	3	3	3	2	2	**2.5**
CO3	2	2	3	3	2	2	3	3	3	3	**2.6**
									Mean Overall Score		**2.6 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
3	25USS34SE01	**Skill Enhancement Course - 1:** Soft Skills	2	1

Course Objectives
To help students understand, practice, and improve their communication skills
To enable students with effective presentation skills
To help students attend interviews confidently and participate effectively in group discussions
To make students realise their potential and excel on personal as well as professional grounds
To develop the thinking skills of students for better performance in competitive exams, interviews and u discussions

UNIT I Communication Skills   (6 Hours)
Basics of Communication: Importance of Good Communication Skills, Types of Communication Skills, Verbal Communication, Non-verbal Communication, Tips for Improving Nonverbal Communication, Communication Styles, Barriers to Communication, Ways To Improve Communication Skills, Practicum. *Professional Grooming*: How to Create the Impact for that First Impression, Presentation Skills, Developing Handouts, Developing Notes, Adding Visual and Audio Effects, Practicum

UNIT II Resume Writing & Interview Skills   (6 Hours)
*Resume Writing***:** The Purpose of a Resume, Finding a Job & Making a Career, Length of Resume, Order of Resume, Tailoring the Resume, What your Resume should include, Some Tips for Listing a Bachelor's degree on Your Resume, What NOT to put on your Resume, Formatting Resume, Difference between Resume, Biodata and Curriculum Vitae, Preparation of a Resume *Interview Skills***:** Meaning of Interview, Types of Interviews, How to get ready for the big day?, Appropriate Attire, Etiquette, Mastering the Art of Meet and Greet, Resume - Points to Remember, Practicum *Group Discussion:* Why is GD Essential?, Factors that influence GD, Outcome of GD, Tips for participation in a GD, Useful phrases for GD, Success Tips in GD, Practicum.

UNIT III Personal Effectiveness   (6 Hours)
Self-Discovery: Characteristics of Personality, Kinds of Self, Who am I?, Personality Inventory Table *Goal Setting*: Why do Goal Setting?, Goal Setting Process, Smart Goals

UNIT IV Numerical Ability   (6 Hours)
Average, Simple Interest, Compound Interest, Profit and Loss, Area, Volume and Surface Area

UNIT V   (6 Hours)
Verbal Reasoning: Series Completion, Analogy. *Non-Verbal Reasoning*.

Teaching Methodology	Chart, PPT, chalk and talk, Video Presentation

Books for Study:
1. Balaiah, J., & Joy, J. L. (2024). Straight from the Traits: Securing Soft Skills, (Revised 3rd Ed.). St. Joseph's College, Tiruchirappalli.

Books for Reference:
1. Aggarwal, R.S. (2010). A Modern Approach to Verbal and Non-Verbal Reasoning, S. Chand.
2. Balaiah, J. & Joy, J. L. (2018). Winners in the Making: A primer on soft skills. St. Joseph's College, Tiruchirappalli.
3. Covey S. R. (2004). The 7 Habits of Highly Effective People: Restoring the Character Ethic (Rev. ed.). Free Press.
4. Egan, G. (1994). The Skilled Helper (5th Ed.). Pacific Grove, Brooks/Cole.
5. Khera, S. (2014). You Can Win. Macmillan Books.
6. Martin, Y. (2005). Hiring the Best: A Manager 's Guide to Effective Interviewing and Recruiting, (5th Ed.). Adams Media.
7. Sankaran, K., & Kumar, M. (2010). Group Discussion and Public Speaking, (5th Ed.). M.I. Publishers.
8. Trishna. (2012). How to do well in GDS & Interviews, (3rd Ed.). Pearson Education.

Websites and eLearning Sources:

1. https://www.indeed.com/career-advice/resumes-cover-letters/communication-skills
2. https://www.seek.com.au/career-advice/article/50-communication-skills-for-the-workplace-your-resume
3. https://southeast.iu.edu/career/files/power-phrases.pdf
4. https://dese.ade.arkansas.gov/Files/20201209124449_Professional-Communication.docx
5. https://www.dol.gov/sites/dolgov/files/ETA/publications/00-wes.pdf
6. https://www.tmu.ac.in/other_websites/cdoe.tmu.ac.in.old/study-material/28-08-2024/COMMON/SEMESTER_2/MAIN_SOFT_SKILLS.pdf
7. https://byjus.com/maths/profit-and-loss-questions/
8. https://www.indiabix.com/

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, the students will be able to	**Cognitive Levels (K-Level)**
CO1	Analyse problems directed at testing their cognitive abilities	**K1**
CO2	Present the best of themselves as job seekers and communicate effectively in all contexts	**K2**
CO3	Assess themselves, set goals, and manage conflicts that are expected of a good leader	**K3**
CO4	Enhance numerical ability required for the employees for various transactions	**K4**
CO5	Develop aptitude skills required by the employers	**K5**

Relationship Matrix											
Semester	**Course Code**	**Title of the Course**							**Hours**	**Credits**	
3	25USS34SE01	**Skill Enhancement Course - 1:** Soft Skills							2	1	
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	3	2	2	2	2	3	2	3	2.5
CO2	2	3	3	2	3	3	2	3	2	2	2.5
CO3	2	2	3	3	2	3	3	3	2	2	2.5
CO4	2	2	3	3	2	3	3	3	2	2	2.5
CO5	2	2	3	3	2	3	3	3	2	2	2.5
									Mean Overall Score		**2.5 (High)**

Semester	Course Code	Title of the Course	Hours	Credits
4	25UTA41GL04B	*General Tamil – 4: அறிவியல் தமிழ்* (Scientific Tamil)	4	3

கற்றலின் நோக்கங்கள் (Course Objectives)

அன்றாட வாழ்வில் அறிவியலின் செல்வாக்கை அறிந்துகொள்ளுதல்

பண்டைத்தமிழர் வாழ்வில் இடம்பெற்ற அறிவியல்கூறுகளைக் கண்டறிதல்

திரைப்படம், நூல் போன்றவற்றைத் திறனாய்வு நோக்கில் ஆராய்தல்

தமிழர்தம் பண்பாடும் அறிவியலும் கொண்ட தொடர்பைப் புலப்படுத்துதல்

படைப்பாற்றல் திறனைக் கண்டறிந்து அறிவியல் படைப்புகளை உருவாக்கல்

அலகு - 1 **(12 மணி நேரம்)**

கணிதவியல்: பார்ப்பார்க்கு அல்லது பணிபு அறியலையே(பதிற்றுப்பத்து : 63) - விசும்பில் ஊழி - ஊழ்-ஊழ் செல்லக் (பரிபாடல் : திருமால் : 4-15) - கண்ணுங்கால் கண்ணும் கணிதமே (சிறுபஞ்சமூலம் :92) - உண்ணாது வைக்கும் பெரும்பொருள் (இன்னா நாற்பது -16)

உயிரியல்: தொல்காப்பியம் : மரபியல்: (27-33) - சிறுவீ ஞாழல் (நற்றிணை 195) - நீடுவெயில் உழந்த (அகநானூறு 335) - வள் இதழ் ஒண் செங்காந்தள் (குறிஞ்சிப்பாட்டு 61-98) -வாள்வரி வயமான் (அகநானூறு 99) -புல்லாகிப் பூடாய்ப் புழுவாய் மரமாகிப் (திருவாசகம்- சிவபுராணம் 26-32

உரைநடைக்கட்டுரை: வியக்க வைக்கும் தமிழரின் அறிவியல்

பயன்முறை கற்றல்: வலைப்பூக்கள் உருவாக்கம்- அறிவியல்கலைச்சொல்லாக்கம்

அலகு - 2 **(12 மணி நேரம்)**

நீரியல்: அம்ம வாழி தோழி (குறுந்தொகை 287) -அம்ம வாழி, தோழி கைம்மிக (அகம் 141: 1-11) -முழங்கு முந்நீர் முழுவதும் வளைஇப் (புறநானூறு-18) -வீங்கு விளிம்பு உரீஇய விசை அமை நோன் சிலை (அகநானூறு-175) -விசும்பு ஆடு பறவை வீழ் பதிப் படர (குறிஞ்சிப்பாட்டு 46-53)- **திருக்குறள்** வான்சிறப்பு - **பதார்த்த சிந்தாமணி:** குளத்து சலந்தானே கொடிதான (27) - ஏரிசலம் வாதமிகு மதுவே (31) -அருவிநீர் மேக மகற்றுங் (39)

ஆழிப்பேரலை: வாழ்க எம் கோ மன்னவர் (சிலப்பதிகாரம் -காடுகாண் காதை15-22)- தீங்கனி நாவல் ஓங்கும்இத் தீவிடை (மணிமேகலை-பீடிகை கண்டு பிறப்புணரந்த காதை (17-22)

உரைநடைக்கட்டுரை: தமிழர்களின் மருத்துவ அறிவியல்

புதினம்: இரா. நடராசன் : சர்க்கஸ்.காம்

அலகு - 3 **(12 மணி நேரம்)**

உலகியல்: நிலம் தீ நீர் வளி விசும்போடு (தொல்.பொருள் 635) - நிலம் நீர் வளி விசும்பு என்ற நான்கின் (பதிற்று 14:1-4) - மண் திணித்த நிலனும் (புறம் 2 1-6)

வானியல்: செஞ்ஞா யிற்றுச் செலவும் (புறம் 30 1-7) - ஆடு இயல் அழல் குட்டத்து புறநானூறு (229) - நெடுவயின் ஒளிறு மின்னுப் பரந்தாங்கு (பதிற்று 24:1-26)

உரைநடைக்கட்டுரை: தமிழ் இலக்கியங்களில் வெளிப்படும் நீர் மேலாண்மையியல்

பயன்முறை கற்றல்: நூல் – திறனாய்வு

அலகு - 4 **(12 மணி நேரம்)**

மருத்துவம்: திருக்குறள்: மருந்து - இரும்பனம் புடையல் ஈகை வான்கழல் (பதிற்றுப்பத்து -42) – ஏற்றி இறக்கி இருகாலும் பூரிக்கும் – (திருமந்திரம் 571) - இல்லையே வாதம் எழில்நடை கோழியாம் (கர்ப்ப வாகடத் திரட்டு-23)

அணு இயற்பியல்: மணிமேகலை : சமயக் கணக்கர் தந்திறங் கேட்ட காதை (105-165) - மேவிய சீவன் வடிவது சொல்லிடில் (திருமந்திரம் –ஏழாம் தந்திரம் 29:1) - அணுவில் அணுவினை ஆதிபிரானை (திருமந்திரம் –ஏழாம் தந்திரம் 28:2) - அண்டப் பகுதியின் உண்டைப் பிறக்கம் (திருவாசகம்- திருவண்டப் பகுதி 106) - அண்டங்கள் எல்லாம் அணுவாக (திருவிளையாடல் புராணம் –அணுவியல் (பாயிரம்-6) - செகத்தையெல்லாம் அணுவளவுஞ் சிதறா வண்ணஞ் (தாயுமானவர் – தந்தை தாய் 6)

உரைநடைக்கட்டுரை: தமிழில் அறிவியல் புனைவுகள்

பயன்முறை கற்றல்: திரைப்படத் திறனாய்வு- ஆவணப் படத்திறனாய்வு

அலகு - 5 **(12 மணி நேரம்)**

கட்டடவியல்: வானம் ஊன்றிய மதலை போல (பெரும்பாண் : 346-351) - விரி கதிர் பரப்பிய வியல் வாய் மண்டிலம் (நெடுநல்வாடை 72-88) - காடுகொன்று நாடாக்கி (பட்டினப்பாலை 283-288) - பெருக்காறு சடைக்கணிந்த பெருமான் சேரும் (தேவாரம் 2801)

பகுத்தறிவியல்: ஓசை உள்ள கல்லை (சிவவாக்கியர் -412)- நட்டகல்லைத் தெய்வமென்று (சிவவாக்கியர்-482)

உரைநடைக்கட்டுரை: அறிவியல் தமிழின் வளர்ச்சி நிலைகள்;

பயன்முறை கற்றல்: பழமொழிகளில் அறிவியல், மூலிகைகளைக் கண்டறிதல்

கற்பித்தல் அணுகுமுறை *(Teaching Methodology)*	விரிவுரை *(Lecture)*, காணொளிக் காட்சி *(Videos)*, விளக்கக் காட்சி *(PPT presentation)*
மதிப்பீட்டு முறைகள் *(Assesment methods)*	வலைப்பூ உருவாக்கம், திரைப்படத் திறனாய்வு, மூலிகை சேகரிப்பு, நூல் திறனாய்வு

பாட நூல்கள்:

1. தமிழாய்வுத்துறை (2025), அறிவியல் தமிழ், தூய வளனார் தன்னாட்சிக் கல்லூரி
2. இரா.நடராசன்; (2010), சர்க்கஸ்.காம், *Books for Children*
3. மூர்த்தி அ.கி. (2001), அறிவியல் கலைச்சொல் அகராதி, மணிவாசகர் பதிப்பகம்.

பார்வை நூல்கள்:

1. அரிமாப்பாமகன்.ஆ (2017), சங்க இலக்கியத்தில் சூழலியல், இராசகுணா பதிப்பகம்
2. குழந்தைசாமி.வா.செ., (2001), அறிவியல்தமிழ், பாரதி பதிப்பகம்

Websites and eLearning Sources:

- *https://www.tamilcomputingjournal.org/?page_id=2622*
- *https://archive.org/details/dli.jZY9lup2kZl6TuXGlZQdjZl3lMyy*
- *https://thamizhiyal.com/?p=2775*
- *https://www.valaitamil.com/jan-month-Article_19160.html*

Course Outcomes

CO No	CO–Statements இப்பாடத்தின் நிறைவில் மாணவர்கள்	Cognitive Levels (K –Levels)
CO -1	அன்றாட வாழ்வில் அறிவியலின் செல்வாக்கை அறிந்துகொள்வர்	K1
CO -2	பண்டைத்தமிழர் வாழ்வில் இடம்பெற்ற அறிவியல்கூறுகளைக் கண்டறிவர்	K2
CO -3	திரைப்படம், நூல் போன்றவற்றைத் திறனாய்வு நோக்கில் ஆராய்வர்	K3
CO -4	தமிழர்தம் பண்பாடும் அறிவியலும் கொண்ட தொடர்பைப் புலப்படுத்துவர்	K4
CO -5	படைப்பாற்றல் திறனைக் கண்டறிந்து அறிவியல் படைப்புகளை உருவாக்கும் திறன் பெறுவர்	K5

Relationship Matrix

Semester	Course Code		Title of the Course			Hours	Credits
4	25UTA41GL04B		*General Tamil – 4: அறிவியல் தமிழ் (Scientific Tamil)*			4	3

Course Outcomes↓	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	
CO-1	3	2	3	2	2	3	3	2	2	2	2.4
CO-2	2	3	3	2	3	2	3	2	3	2	2.5
CO-3	3	2	2	3	3	3	2	3	3	3	2.7
CO-4	2	3	3	2	2	3	2	3	3	2	2.5
CO-5	3	1	2	3	2	2	3	2	3	3	2.4
									Mean Overall Score		2.5 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	25UFR41GL04	Language French – 4	4	3

Course Objectives
Express preferences and opinions with precision using quantity expressions, and pronouns to convey satisfaction or dissatisfaction.
Describe Health Conditions and provide medical advice using appropriate grammatical structures to engage in meaningful discussions
Communicate Effectively in Social and Professional Settings by expressing desires and requests and using polite expressions
Exchange Travel Information and construct well-structured narratives to recount journeys
Enhance communication through structured language with contextually appropriate statements across various topics

UNIT – I (12 Hours)
1. Titre - En cuisine
2. Lexique – les aliments, la restauration, les goûts et les sensations
3. Grammaire – les quantités et le pronom 'en', la restriction 'ne…que', l'obligation
4. Production orale- communiquer au restaurant
5. Production écrite - exprimer sa satisfaction et son insatisfaction

UNIT – II (12 Hours)
6. Titre - A votre sante
7. Lexique – les corps et la sante, la médecine et les urgences
8. Grammaire – les pronoms COD et COI, le superlatif, les pronoms interrogatifs
9. Production orale- parler des problèmes de santé
10. Production écrite - Donner un conseil pour une condition médicale

UNIT – III (12 Hours)
11. Titre - Dans les médias
12. Lexique – les médias audios et les réseaux sociaux
13. Grammaire – la cause et la conséquence, le subjonctif, la place des pronoms
14. Production orale- exprimer son intérêt et sa préférence
15. Production écrite - faire une critique positive et négative

UNIT – IV (12 Hours)
16. Titre - Consommer responsable
17. Lexique – la consommation, les catégories de produits, le travail manuel
18. Grammaire – le conditionnel présent – formation et emploi, le gérondif
19. Production orale- demander et proposer un service
20. Production écrite - exprimer un souhait ou un désir

UNIT – V (12 Hours)
1. Titre - Envies d'ailleurs
2. Lexique – le voyage, l'hébergement, le séjour, le tourisme
3. Grammaire – le passé composé et l'imparfait dans le récit, les pronoms démonstratifs
4. Production orale- demander des renseignements sur un voyage
5. Production écrite - parler d'une visite touristique
6. Indian knowledge system - Writing travel narratives based on ancient Indian pilgrimage sites and comparing with French monuments. Using French quantity expressions and pronouns to describe Ayurvedic food portions and dietary balance and offering Ayurvedic-based medical advice. (5%)

Teaching Methodology	L'approche communicative (Communicative Language Teaching -CLT), Genre-Based Approach, Experimental learning, Flipped Classroom Approach
Assessment Methods	*Role-Play:* Restaurant Experience: waiter and customer ordering food and expressing opinions on the meal. (Rubric – graded on usage of expressions related to food and grammatical accuracy) *Written assessment:* Write a short critique of a social media platform, movie, or advertisement. (Rubric – assessed on ability to express opinions and logical argumentation) *Travel Blog or Postcard Writing:* Write a blog post or postcard describing a recent travel experience, using descriptive language (Rubric – assessed on structured narrative writing in a travel context and usage of past tenses) *Group Debate:* Media & Society: Debate the impact of social media on education. (Rubric – graded on critical thinking, Argument clarity and participation

Books for Study:
1. Fafa, C., Gajdosova, F., Horquin, A., Pasquet, A., Perrard, M., Petitmengin, V., Sperandio, C., Dodin, M., &Veldeman-Abry, J. (2022). *Édito A2: Méthode de français* (2nd ed.). Didier FLE, Hatier. (p.83 – p.152)

Books for Reference:
1. Dauda, P., Giachino, L., & Baracco, C. (2016). *Génération A2*. Didier.
2. Girardet, J., &Pecheur, J. (2017). *Écho A2* (2nd ed.). CLE International

Websites and eLearning Sources:
1. https://cuisine-facile.com/
2. https://www.france.fr/en/
3. https://www.sncf-connect.com/
4. https://www.routard.com/
5. https://sante.lefigaro.fr/

Course Outcomes		
CO No.	**CO–Statements** On successful completion of this course, students will be able to	**Cognitive Levels (K –Levels)**
CO1	Apply vocabulary related to food by using quantity expressions and pronoun to communicate satisfaction or dissatisfaction in oral and written contexts.	**K1**
CO2	Identify and describe health conditions, construct superlative forms, and formulate medical advice using appropriate grammatical structures.	**K2**
CO3	Express opinions, preferences, and critiques about various media platforms, apply cause-and-consequence structures	**K3**
CO4	Utilize vocabulary related to consumption, express desires and requests effectively in professional and social interactions.	**K4**
CO5	Request and provide travel-related information and describe tourist experiences using demonstrative pronouns and structured narratives.	**K5**

Relationship Matrix											
Semester	**Course Code**			**Title of the Course**				**Hours**		**Credits**	
4	**25UFR41GL04**			Language French – 4				**4**		**3**	
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of Cos**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	2	1	2	2	1	3	2	1	2	2	1.8
CO2	2	2	2	3	1	2	2	2	2	2	2.0
CO3	2	3	2	3	3	2	2	3	1	1	2.2
CO4	3	3	3	2	3	3	1	2	2	2	2.4
CO5	3	2	2	3	2	2	2	1	1	2	2.0
										Mean Overall Score	**2.08 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	25UHI41GL04	Language Hindi - 4	4	3

Course Objectives
To strengthen the language competence among the students
To equip students with cinematic perspective by comparative studies of Hindi literature
To enable the students to develop their effective communicative skills in Hindi
To strengthen the language competence among the students
To incept research-oriented aspirations among students

UNIT I (12 Hours)
1. Prathyay
2. Char Bhai
3. Adhunik Kaal - Introduction
4. Adhunik Kal – Namakarn

UNIT II (12 Hours)
5. Chitra Varnan(Advanced)
6. Paryayvachy Shabdh
7. Bathcheeth - Hotel mein
8. Adhunik Kal - Samajik Paristhithiyam

UNIT III (12 Hours)
9. Upasarg
10. Thulsi ke Dhoe
11. Apathit Gadyansh
12. Adhunik Kal – Sahithyakar

UNIT IV (12 Hours)
13. Review- Book/Film
14. Paryavaran Pradookshan
15. Adhunik Kal -   Main Divisions
16. Anuvad

UNIT V (12 Hours)
17. Kaal
18. Patra-Patrikao mein Prakashit Gadyansho ka Patan (Advanced)
19. Sapnom Kee Home Delivery (Novel)
20. Adhunik Kal - Visheshathayem

Teaching Methodology	Debate Participation, Videos, PPT, Quiz, Project Work
Assessment Methods	Quiz, Snap Test, Group Discussion

Books for Study:
1. Dr. Sadananth Bosalae. (2022). *kavya sarang*. Rajkamal Prakashan.
2. Kamathaprasad Gupth, M. (2021). *Hindi Vyakaran*. Anand Prakashan.
3. Dr. Sanjeev Kumar Jain. (2022). *Anuwad: Siddhant Evam Vyavhar.* Kailash Pustak Sadan.

Books for Reference:
1. Rajeswar Prasad Chaturvedi. (2021). *Hindi vyakarana*. Upakar Prakashan.
2. Ramdev. (2021). *Vyakaran Pradeep*. Hindi Bhavan.
3. Krishnakumar Gosamy. (2023). *Anuvad vigyan ki Bhumika*. Rajkamal Prakashan.
4. Acharya Ramchandra Shukla. (2021). *Hindi Sahitya Ka Itihas*, Prabhat Prakashan.
5. Mamta Kaliya. (2022). *Sapno Ki Home Delivery.* Lokbharti Prakashan.

Websites and eLearning Sources:

1. https://youtu.be/xmr-DaQ3LhA
2. https://mycoaching.in/adhunik-kaal
3. https://m.sahityakunj.net/entries/view/bhartiya-sahitya-mein-anuvad-kee-bhoomika
4. https://mycoaching.in/upsarg-in-hindi
5. https://kalingaliteraryfestival.com/speakers/mamta-kalia/

Course Outcomes		
CO No.	**CO–Statements** On successful completion of the course, the student will acquire the listed skills.	**Cognitive Levels (K –Levels)**
CO1	List out the social conditions prevailed in Modern Period which are depicted in Hindi Literature.	**K1**
CO2	Discuss the dialects of Hindi language.	**K2**
CO3	Illustrate the works of some eminent Hindi Writers related to society.	**K3**
CO4	Evaluate the film & Literary works in Hindi.	**K4**
CO5	Analyze the human values expressed in life and literature of Hindi Novelist "Mamatha Kaliya".	**K5**

Relationship Matrix										
Semester	**Course Code**		**Title of the Course**				**Hours / week**		**Credits**	
4	25UHI41GL04		Language Hindi – 4				4		3	
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**				**Mean Score of Cos**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	2	3	2	3	3	2	3	2	3	1	2.4
CO2	3	2	3	3	2	3	2	3	1	2	2.4
CO3	3	2	2	3	2	2	1	3	2	3	2.3
CO4	3	2	3	1	3	3	2	3	3	2	2.5
CO5	3	2	2	3	3	2	3	2	3	3	2.6
									Mean Overall Score		**2.44 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	25USA41GL04	Language Sanskrit - 4	4	3

Course Objectives
To give an exposure to Sanskrit drama in general
To showcase the structure of pre-kalidasan plays in Sanskrit
To coach students in Sanskrit morphology
To acquaint students with the structures of Sanskrit syntax
To impart communicative skills in Sanskrit by training in the functional aspects of the language

UNIT I (12 Hours)

Samskrita Vyavahara sahasri vakiya Prayogaha

UNIT II (12 Hours)

Lot Lakaarah, Prayaogh Kartari Vaakyaani

UNIT III (12 Hours)

Naatakasya Itihaasah Vivaranam, Thuva and Tum Suffixs

UNIT IV (12 Hours)

Karnabhaaram, Naatakasya Visistyam

UNIT V (12 Hours)

Samskrita Racanani Vubhavoga

Teaching Methodology	Videos, PPT, Blackboard, Demonstration, Exercises
Assessment Methods	Seminar, Quiz, Group Discussion.

Books for Study:
1. Karnabhavam & Literature Language
2. Dhaatu Manjari
3. Samskrita Vyavahara Sahasri (A Collection of One Thousand Sentances),Samskrita Bharati, Delhi,2021

Books for Reference:
1. R. S. Vadhyar & Sons, Book – sellers and publishers, Kalpathu, Palghat – 678003, Kerala, south India, History of Sanskrit Literature 2021
2. Kulapathy, K. M Saral Sanskrit Balabodh, Bharathita vidya bhavan, Munshimarg Mumbai – 400 007 2020
3. Samskrita Bharathi, Aksharam 8 th cross, 2nd phase Giri nagar Bangalore Vadatu sanskritam – Samaskara Binduhu 2021

Websites and eLearning Sources:
1. https://sanskritdocuments.org/doc_z_misc_major_works/daily.pdf
2. https://www.learnsanskrit.org/guide/verbs-1/karmani-and-bhave-prayoga/
3. https://ia902903.us.archive.org/7/items/in.ernet.dli.2015.102820/2015.102820.The-Sanskrit-Drama-In-Its-Origin-Development-Theory-And-Practice.pdf
4. https://archive.org/details/oafI_karna-bharam-karnas-burden-of-bhasa-with-dr.-sudhakar-malaviya-gokuldas-sanskrit
5. https://sanskritwisdom.com/composition/essays/sanskrit-language/

	Course Outcomes	
CO No.	**CO–Statements**	**Cognitive Levels (K –Levels)**
	On successful completion of this course, students will be able to	
CO1	Understand human behaviors by studying dramas	**K1**
CO2	Remember and identifying Mahabharata characters and events	**K2**
CO3	Apply the morals learnt in day-to-day life	**K3**
CO4	Appreciate ancient Sanskrit dramas	**K4**
CO5	Create new conversational sentences and to Improve self-character (Personality Development)	**K5**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
4	**25USA41GL04**		Language Sanskrit - 4							**4**	**3**
Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**					**Mean Scores of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	2	2	2	2	3	3	3	3	3	2	2.4
CO2	2	2	3	3	2	3	2	3	3	2	2.5
CO3	3	3	2	3	2	1	1	3	3	3	2.4
CO4	2	2	3	2	3	3	3	3	2	3	2.6
CO5	2	3	3	3	2	1	3	3	3	2	2.5
Mean Overall Score											**2.48 (High)**

Semester	Course Code	Title of the Course	Hours/ Weeks	Credits
4	25UEN42GE04B	**General English - 4:** English for Science - 2	5	3

Course Objectives
To expand vocabulary by learning and using context-specific words.
To improve writing through practice in reports, reviews, and social media posts.
To master grammar by focusing on question tags and subject-verb agreement.
To enhance speaking skills through debates and discussions.
To appreciate literature and science to boost creative thinking.

UNIT I: Simple Ways to Explore Nature (15 Hours)
1. "Marie Curie Biographical" Taken from The Nobel Prize
2. Vocabulary in Context: Radioactive Elements
3. Writing: Media Reports
4. Speaking: Expansion of a Proverb
5. Grammar: Question Tag

UNIT II: The Limits of Human Knowledge (15 Hours)
1. "The Marry Month of May" by O. Henry
2. Vocabulary in Context: Seasonal Words
3. Writing: Book or Film Review
4. Speaking: Debate
5. Grammar: WH Questions

UNIT III: Difference Between Original and Copy (15 Hours)
1. "The story of Dolly the sheep" taken from Natural World, Science and Technology, Scotland
2. Vocabulary in Context: Cloning Words
3. Writing: E-mail Etiquette
4. Speaking: Group Discussion
5. Grammar: Yes or No Questions

UNIT IV: The Other Worlds (15 Hours)
1. "The Star" by Arthur C. Clarke
2. Vocabulary in Context: Astronomical Words
3. Writing: Writing for Social Media (Blogs, Twitter, Instagram and Facebook)
4. Speaking: Story Telling
5. Grammar: Conditional Sentences

UNIT V: Scientific Temparament (15 Hours)
1. "The Particle Dance" by Emily Dickinson
2. Vocabulary in Context: Scientific Instruments
3. Writing: Creating Digital Profile
4. Speaking: Spin a Yarn
5. Grammar: Subject Verb Agreement
  * Speaking Components are meant only for internal tests

Teaching Methodology	Lecture, Multimedia Presentations, Discussion and Enacting
Assessment Tools	Speaking, reading, listening and written tests

Books for Study:
1. Francis, V., Dr. D.R. Edwin Christy and Dr. D. Loyola Innaci. *Lingua Science – II,* St. Joseph's College (Autonomous), Tiruchirappalli.

Books for Reference:
1. Wilfred, D. Best. *Students Companion*. Harper Collins Publishers, 2020.
2. Dickinson, Emily. *The Complete Poems of Emily Dickinson*, Back Bay Books, 1973.

Websites and eLearning Sources:

1. https://www.nobelprize.org/prizes/physics/1903/marie-curie/biographical/
2. https://www.gutenberg.org/files/59637/59637-h/59637-h.htm
3. https://www.nms.ac.uk/discover-catalogue/the-story-of-dolly-the-sheep
4. https://sites.uni.edu/morgans/astro/course/TheStar.pdf
5. https://poemverse.org/short-poems-about-science/

CO No.	Course Outcomes	
	CO-Statements	**Cognitive Levels (K-Level)**
	On successful completion of this course, students will be able to	
CO1	Identify and comprehend the local and global issues through the lessons	**K1**
CO2	Use interactive skills	**K2**
CO3	Develop the Listening and Reading Skills of the learners through teacher-led reading practice	**K3**
CO4	Improve their General Writing Skills such as Note-Taking, Note- Making Précis Writing, Paragraph Writing, and Writing Short Essays on Current	**K4**
CO5	Develop their Creative and Critical Thinking and Speaking Skills	**K5**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
4	25UEN42GE04B		General English - 4: English for Science - 2							5	3
Course Outcome (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Scores of COs**
	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	2	2	3	2	3	2	3	2	2.4
CO2	2	2	3	2	3	3	2	3	2	2	2.3
CO3	2	3	2	3	2	2	3	2	3	2	2.4
CO4	2	2	3	2	3	3	2	3	2	3	2.5
CO5	2	2	2	3	2	2	2	3	2	2	2.2
										Mean Overall Score	**2.36 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	25UPH43CC07	**Core Course - 7:** Mathematical Physics – 2	4	3

Course Objectives
To know the fundamental concepts and theorems in numerical methods, special functions, Fourier series, Laplace transforms and matrices
To understand the principles of numerical methods, special functions, Fourier series, Laplace transforms and matrices
To apply the basic principles of numerical methods, special functions, Fourier series, Laplace transforms and matrices on various physics problems
To solve various physics problems using the numerical methods, special functions, Fourier series, Laplace transforms and matrices
To analyze and investigate various physical systems using mathematical theory

UNIT I: Special Functions   (12 Hours)
Definitions - simple properties of Gamma, Beta and Error functions - series solutions of differential equations - ordinary point: solutions and rules - Hermite: functions - polynomial - orthogonality.

UNIT II: Fourier Series   (12 Hours)
Periodic functions - Fourier series - Dirichlet's conditions for a Fourier series - Advantages of Fourier series - Useful integrals - determination of Fourier coefficients (Euler's Formulae) - Fourier series for discontinuous functions - two or more sub-ranges - Even and Odd functions - half range series - half period series.

UNIT III: Laplace Transforms   (12 Hours)
Definition - formulae and proofs - properties - transform rules: Addition, scaling, derivatives, integrals, differentiation, integration of transforms, shift of the time function, shift of the transform function, periodic function - inverse Laplace transforms.

UNIT IV: Matrices   (12 Hours)
Types of matrices - inverse of a matrix - Elementary transformations - Solution of simultaneous equations - Eigen Values - Eigen vectors - properties of eigenvectors - orthogonal vectors - non-symmetric matrices with non-repeated eigen values - diagonalisation of a matrix - theorem on diagonalisation - complex matrices - transpose of conjugate of a matrix - Hermitian and skew - Hermitian matrices.

UNIT V: Numerical Methods   (12 Hours)
Transcendental Equation - Solving by Graphical Method - Newton Raphson method - Numerical Method of solving differential equation - Taylor series method Numerical Integration - Trapezoidal and Simpson's 1/3 rule and Simpson's 3/8 rule.

Teaching Methodology	Lectures, Presentations, Simulations, and Videos
Assessment Methods	Seminar, Snap, Test, MCQ, Problem solving, Online quiz

Books for Study:
1. Dass, H. K. (2014). *Mathematical Physics,* (7th Revised Ed.). S. Chand.
2. Dass, H. K. (2014). *Higher Engineering Mathematics,* (3rd Revised Ed.). S. Chand.
3. Ramana, B. V. (2006). *Higher Engineering Mathematics*. Tata McGraw Hill.

Unit	Book	Chapters	Sections
I	1	9, 27, 30, 31	9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7, 9.8, 9.9, 9.18, 27.2, 27.3, 27.4, 27.5, 27.6, 30.2, 30.3, 30.4,
II	1	11	11.1, 11.2, 11.3, 11.4, 11.5, 11.6, 11.7, 11.8, 11.10, 11.11, 11.13
III	1	46, 47	46.1, 46.2, 46.3, 46.4, 46.5, 46.6, 46.7, 46.8, 46.10, 46.11, 46.21, 47.1, 47.2
IV	1	38, 41	38.2, 38.13, 38.14, 41.1, 41.2, 41.5, 41.6, 41.7, 41.8, 41.19, 41.21, 41.24, 41.26, 41.27, 41.29
V	2,3	4, 50,32	50.1-50.6, 50.10-50.15, 52.3,32.14

Books for Reference:

1. Kreyszig, E. (2010). *Advanced Engineering Mathematics,* (9th Ed.). Wiley.
2. Chapra, S. C., & Canale, R. P. (2015). *Numerical Methods for Engineers,* (7th Ed.). McGraw-Hill Education.
3. Weber, H., & Arfken, G. (2003). *Essential Mathematical Methods for Physicists,* (1st Ed.). Elsevier.
4. Riley, K., Hobson, M., & Bence, S. (2006). *Mathematical Methods for Physics and Engineering: A Comprehensive Guide,* (3rd Ed.). Cambridge University Press.
5. Prakash, S. (2008). *Mathematical Physics*. S. Chand.

Websites and eLearning Sources:

1. https://www.geogebra.org/
2. https://mathworld.wolfram.com/
3. https://swayam.gov.in/explorer?category=Mathematics
4. https://ocw.mit.edu/search/?d=Mathematics
   (* subject to availability - not to be used for exam purpose)

CO No.	Course Outcomes	
	CO-Statements On successful completion of this course, the students will be able to	**Cognitive Levels (K - Level)**
CO1	Acquire knowledge on different mathematical methods, numerical methods, special functions, Fourier series, Laplace transforms and matrices.	**K1**
CO2	Understand the concepts and techniques of numerical methods, special functions, Fourier series, Laplace transforms and matrices.	**K2**
CO3	Apply numerical methods, special functions, Fourier series, Laplace transforms and matrices on various physical problems.	**K3**
CO4	Solve various problems using numerical methods, special functions, Fourier series, Laplace transforms and matrices to obtain the solutions.	**K4**
CO5	Analyse and interpret the solutions obtained by numerical methods, special functions, Fourier series, Laplace transforms and matrices.	**K5**

Relationship Matrix											
Semester	**Course Code**	**Title of the Course**								**Hours**	**Credits**
4	**25UPH43CC07**	**Core Course - 7:** Mathematical Physics – 2								**4**	**3**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of Cos**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	2	2	1	3	3	3	2	2	**2.4**
CO2	3	3	2	2	1	3	2	3	2	2	**2.3**
CO3	3	2	2	2	1	2	3	2	2	2	**2.1**
CO4	3	2	2	2	1	2	2	3	2	2	**2.1**
CO5	3	2	2	2	2	2	2	2	2	2	**2.1**
										Mean Overall Score	**2.2 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	25UPH43CC08	**Core Course – 8:** Thermal Physics (Internship Embedded Course)	4	3

Course Objectives
To acquire knowledge of the flow of heat, change of state, various thermodynamical processes and probability theorems
To understand the physics of change of state, the laws of thermodynamics, black body radiation and comparison of three statistics
To apply the principles of transmission of heat, thermodynamical laws and statistical thermodynamics in real cases
To analyse the factors affecting sound waves, rectilinear flow of heat in different materials, thermodynamical laws and three statistics and phase transitions
To categorize the application of thermodynamical laws and summarize the three types of statistics and their applications

UNIT- I: Transmission of Heat (12 Hours)

Coefficient of thermal conductivity - Forbes method - Lee's method for bad conductors and liquids - Wiedemann – Franz law- convection and its applications - Black body - Stefan Boltzmann law - Wien's displacement law - Rayleigh - Jeans law - derivation and experimental verification of Stefan's law - Newton's law of cooling from Stefen's law - solar constant - temperature of the Sun - Angstrom's Pyrheliometer.

UNIT -II: Change of State (12 Hours)

Gas and vapour – Saturated and unsaturated vapour – Vapour pressure and liquids - Tripple point - Gibbs phase rule - Simple applications - Equilibrium between liquid and its vapour - Phase transitions: First order & Second order -Ehrenfest's equations - Gibbs Helmholtz equation

UNIT- III: Thermodynamics - I (12 Hours)

The thermodynamic system - zeroth law of thermodynamics - internal energy - I law of thermodynamics - reversible and irreversible process - Carnot's ideal heat engine - Carnot's cycle - second law of thermodynamics - entropy - change in entropy during reversible and irreversible process - entropy and second law of thermodynamics - third law of thermodynamics.

UNIT- IV: Thermodynamics II (12 Hours)

Thermodynamic variable - Maxwell's thermodynamic relations - applications - Joule Thomson cooling - temperature of inversion - Clausius Clapeyron's latent heat equation - thermodynamic potential - TdS equation – Joule – Thompson expansion - liquefaction of gases - liquefaction of hydrogen and Helium – peculiar properties of Helium II - adiabatic demagnetization

UNIT - V: Statistical Thermodynamics (12 Hours)

Statistical equilibrium - probability theorems in statistical thermodynamics - Maxwell Boltzmann distribution law - Maxwell - Boltzmann distribution in terms of temperature - Fermi-Dirac distribution law - application to electron gas - Bose-Einstein distribution law - application to photon gas comparison of the three statistics.

Teaching Methodology	Demo Videos, PPT, Handouts, Study materials
Assessment Methods	Seminar, Snap, Test, MCQ, Problem solving, Online quiz

Books for Study:

1. Lal, B., Subrahmanyam, N., & Hemne, P. S (2018). *Heat, Thermodynamics and Statistical Physics*, (Revised Ed). S. Chand & Co.

Unit	Book	Chapters	Sections
I	1	2 8	15.1, 15.9, 15.10, 15.12, 15.19, 15.22, 15.23 8.8, 8.12, 8.14, 8.15, 8.20, 8.22, 8.21, 8.26, 8.27, 8.28
II	1	16 6	16.21,16.22,16.23,16.24, 16.26 6.17, 6.18, 6.19, 6.20
III	1	4	4.1, 4.2, 4.6, 4.7, 4.20, 4.23, 4.24, 4.28, 4.33
		5	5.1-5.4, 5.6, 5.15
		6	6.15
IV	1	6	6.1, 6.3, 6.4.2, 6.4.4, 6.4.7, 6.5, 6.9
		7	7.5, 7.6, 7.10, 7.11, 7.12,7.13 7.16
V	1	9	9.8
		11	11.1-11.5
		12	12.5, 12.6, 12.8,12.9, 12.15

Books for Reference:

1. Zemansky. M.W., & Dittman, R. (1981). *Heat and Thermodynamics*. McGraw-Hill.
2. Blundell, S. J., & Blundell, K. M. (2012). *Concepts in Thermal Physics*, (2nd Ed.). Oxford University Press.
3. Saha, M., & Srivastava, B. N. (1958). *A Treatise on Heat*. Indian Press.
4. Carl, S. H. (2009), *Modern Thermodynamics with Statistical Mechanics*. Springer.
5. Sears., & Salinger. (1988). *Thermodynamics, Kinetic Theory & Statistical Thermodynamics*. Narosa.
6. Garg, S., Bansal, R. & Ghosh. (1993). *Thermal Physics*, (2nd Ed.). Tata McGraw-Hill. 7. Mathur, D. S. (2014). *Heat and Thermodynamics*, (5th Ed.). Sultan Chand & Sons Educational Publishers.

Websites and eLearning Sources:

1. https://scholar.harvard.edu/files/schwartz/files/lecture21-doppler.pdf
2. https://nptel.ac.in/courses/115104096
3. https://archive.nptel.ac.in/courses/112/104/112104113/
4. https://home.iitk.ac.in/~gtm/thermodynamics/ui/Course_home-34.htm
5. https://archive.nptel.ac.in/courses/104/103/104103112/
   (* subject to availability - not to be used for exam purpose)

	Course Outcomes	
CO No.	**CO-Statements** On successful completion of this course, the students will be able to	**Cognitive Levels (K-Level)**
CO1	Acquire knowledge of transmission of heat, change of state, reversible and reversible process, entropy, temperature of inversion, liquefaction, statistical and quantum statistics	**K1**
CO2	Understand the concepts of black body radiation, phase transition and its laws, Carnot's ideal heat engine, Otto and diesel engines, thermodynamic potentials, diabatic demagnetization and the three statistical thermodynamics	**K2**
CO3	Compare the thermodynamic laws and their applications, first order and second order phase transitions, three statistics, apply the radiation laws for good and bad conductors and the distribution laws	**K3**
CO4	Analyse the thermodynamics laws, radiation laws, change of state, types of transmission of heat, liquefaction of gases and the three statistics	**K4**
CO5	Categorize the thermodynamic and radiation laws and their applications and summarize the applications of three statistics of the three statistics.	**K5**

										Relationship Matrix		
Semester	Course Code		Title of the Course						Hours		Credits	
4	25UPH43CC08		Core Course – 8: Thermal Physics (Internship Embedded Course)						4		3	
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of Cos	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	2	3	2	3	2	3	2	3	2	1	2.3	
CO2	3	3	2	2	3	3	2	2	2	1	2.3	
CO3	3	2	2	3	3	2	3	3	2	1	2.4	
CO4	3	2	2	3	3	2	2	3	2	1	2.3	
CO5	3	3	2	2	3	2	2	3	2	1	2.3	
									Mean Overall Score		2.32 (High)	

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	25UPH43CP04	**Core Practical - 4:** Physics Practical – 4	3	2

Any 8 Experiments:

1. Thermal Conductivity – Forbes' method.
2. Kater's pendulum
3. Frequency – Melde's apparatus.
4. Rigidity modulus - static method.
5. Spectrometer – i-i' curve.
6. Resistance by Potentiometer – R and ρ.
7. B.G. – Resistance and figure of merit (condenser method).
8. Junction diode and Zener diode characteristics.
9. Study of basic and universal logic gates (IC's).
10. Electrical equivalent of heat
11. Lorentz force relation
12. Stefan's Constant using diode
13. Doppler effect
14. Conversion of galvanometer into an ammeter.
15. Conversion of galvanometer into voltameter.

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	25UPH43AO02A	**Allied Optional - 2:** Chemistry- 2	4	3

Course Objectives
To learn the chemistry of carbohydrates, amino acids, proteins
To study the theories of co-ordination compounds
To study the group 18 elements and silicates
To understand phase rule and adsorption
To understand the principles and applications of electrochemistry

UNIT I: Carbohydrates, Amino Acids and Proteins (12 Hours)

carbohydrates – photosynthesis - classification of carbohydrates based on hydrolysis and reducing nature - structure of (+)-Glucose, (-)-Fructose - epimers - mutarotation- conversion of glucose to fructose. Amino acids - classification based on acidic and basic groups - essential and non-essential amino acids - Gabriel and Strecker synthesis -zwitter ions- isoelectric point and separation of amino acids – electrophoresis - chemical properties of glycine. Proteins - peptide linkage – classification of proteins - primary, secondary and tertiary structure of proteins.

UNIT II: Coordination Chemistry (12 Hours)

Coordination compounds - Werner's theory - central metal atom - types of ligands - Primary valency and secondary valency - nomenclature of coordination compounds- isomerism in coordination compounds - effective atomic number (EAN) - VBT - prediction of structure and calculation of spin only magnetic moment –Magnetic properties of materials. Functions of haemoglobin and cis-platin.

UNIT III: Silicates and Group 18 Elements (12Hours)

Silicates - principles of silicate structures - classification - silicates in technology -silicones. Group18 – Noble gases – physical properties- special properties of helum –clathrates (Host-Guest model) - structure and bonding in xenon compounds (XeF_2, XeF_4 and XeF_6).

UNIT IV: Phase Rule and Adsorption (12 Hours)

Phases(P) - components(C) - degree of freedom(F) - derivation of Gibbs phase rule – reduced phase rule - one component system - phase diagram of H_2O and S system - triple point of water and polymorphism - two component system – simple eutectic system - Pattinson's process of desilverisation of lead (Pb-Ag system) - Adsorption - Langmuir and Freundlich adsorption isotherms - applications of adsorption.

UNIT V: Electrochemistry (12 Hours)

Difference between Galvanic cell and electrolytic cell – construction and working of Daniel cell - types of electrodes - primary reference electrode - standard hydrogen electrode(SHE) – secondary reference electrode - calomel electrode - single electrode potential - oxidation potential and reduction potential - sign of electrode potential - Nernst equation - electro chemical series and its significance - electro motive force(EMF) - Potentiometric titrations - acid - base titration and precipitation titration.

Teaching Methodology	Chart, PPT, chalk and talk and videos.
Assessment Methods	Snap Test, group discussion and MCQ

Books for Study:
1. Lee, J. D. (2010). *Concise Inorganic Chemistry* (5th Ed.). Wiley-India.
2. Morrison, R. T., Boyd, R. N., & Bhattacharjee, S. K. (2010). *Organic Chemistry* (7th Ed.). Pearson.
3. Puri, B. R., Sharma, L. R., & Pathania, M. S. (1993). *Principles of Physical Chemistry* (23rd Ed.). Shoban Lal Nagin Chand and Co.

Books for Reference:
1. Atkins, P. W. (2009). *Physical Chemistry* (7th Ed.). Oxford University Press.
2. Bruice, P. Y. (2011). *Organic Chemistry* (8th Ed.). Pearson Ltd., University of California.
3. Finar, I. L. (1996). *Organic Chemistry* (Vols. 1 & 2) (6th Ed.). Addison Wesley Longman Ltd.
4. Huheey, J. E., Keiter, E. A., Keiter, R. L., & Medhi, O. K. (2006). *Inorganic Chemistry: Principles of Structure And Reactivity* (4th Ed.). Pearson Education.

5. Miessler, G. L., Fischer, P. J., & Tarr, D. A. (2014). *Inorganic Chemistry* (5th Ed.). Pearson Education, Inc.

Websites and eLearning Sources:
1. https://opentextbc.ca/chemistry/chapter/19-2-coordination-chemistry-of-transition-metals/
2. https://www.tulane.edu/~sanelson/eens211/silicate_structures08.htm
3. https://www.youtube.com/watch?v=HjeQOKomAQc
4. https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Supplemental_Modules_ (Analytical_Chemistry)/Electrochemistry/Basics_of_Electrochemistry

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, the students will be able to	**Cognitive Levels (K-Level)**
CO1	List out the different types of carbohydrates, aminoacids and proteins	**K1**
CO2	Explain the concepts in coordination chemistry and apply them to infer the properties of complexes.	**K2**
CO3	Outline the principles and applications of electrochemistry.	**K3**
CO4	Illustrate phase rule and relate the applications of adsorption.	**K4**
CO5	Classify silicates and understand the industrial applications.	**K5**

Relationship Matrix											
Semester	**Course Code**			**Title of the Course**					**Hours**	**Credits**	
4	25UPH43AO02A			Allied Optional - 2: Chemistry– 2					4	3	
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	2	3	2	2	2	2	3	1	3	2	**2.2**
CO2	2	3	2	3	2	2	2	3	2	3	**2.4**
CO3	2	3	2	2	2	2	2	3	3	1	**2.2**
CO4	2	3	1	3	3	2	3	1	3	3	**2.4**
CO5	2	3	1	2	1	2	3	3	3	2	**2.2**
									Mean Overall Score		**2.28 (High)**

Semester	Course Code	Title of the Course	Hours/ Weeks	Credits
4	25UPH43AO02B	**Allied Optional - 2:** Computer Science - 2	4	3

Course Objectives
To understand the basic concepts of computer networks and data transmission
To impart knowledge of components of computer network
To explore the importance of computer network standards and LAN
To study the features of Wireless LAN and Bluetooth Technology
To acquire the knowledge of Internet of Things

UNIT I: Fundamentals of Computer Networks (12 Hours)

Computer networks and Data Communication: Need for Computer Networks - Evolution -Data Communication Fundamentals - Data Transmission - Transmission Media.

UNIT II: Network Classification and Communication Components (12 Hours)

Network classification - Communication Components: Classification of Computer Networks - Switching and Routing - Multiplexing and Concentration-concentrator - Terminal Handling-Components of Computer Network.

UNIT III: Network Standards, OSI Model and LAN (12 Hours)

Network Standards and OSI Model: Need for Network Standards - The OSI Reference Model - Local Area Network: The Evolution of LAN - LAN Architecture - LAN advantages and Services - Characteristics of LAN - LAN Topologies.

UNIT IV: Wireless LAN and Bluetooth Technology (12 Hours)

Wireless LAN and VSAT: Wireless LAN - Components of Wireless LAN - Working of Wireless LAN - Infrared Technology - Wireless LAN types - Protocols for Wireless LAN - Uses of Wireless LAN - Bluetooth Technology.

UNIT V: Internet of Things (12 Hours)

Internet of Things: Definition of Internet of Things - Application Areas of IoT - Characteristics of IoT - Things in IoT - IoT Stack - Enabling Technologies - IoT Challenges.

Teaching Methodology	Lecture with Demonstration, Peer Learning and Flipped Classroom.
Assessment Methods	Objective Test, Quiz and Assignment.

Books for Study:
1. Rajesh, E, & Balasubramanian. (2002). *Computer Networks, Fundamentals and Applications,* Vikas Publishing House.
   Unit I: *Chapter*-1
   Unit II: *Chapter*-2
   Unit III: *Chapter*-3(Sec.3.1 and 3.2) *Chapter*-5(Sec.5.1 to 5.5)
   Unit IV: *Chapter*-7(Sec.7.1 to 7.3, 7.5 to 7.7,7.9 and 7.12)
2. Vasudevan, S.K., Nagarajan, A.S., & Sundaran, R.M.D. (2020). *Internet of Things,* (2nd Ed.,) Wiley Publication.
   Unit V: *Chapter*-1(Sec.1.1, 1.3 to 1.8)

Books for Reference:
1. Bahga, A., & Madisetti, V. (2015). *Internet of Things*-A Hands-on Approach, Universities Press.
2. Tanenbaum, A.S. (1999), *Computer Networks,* Prentice Hall of India.
3. Stallings, W. (2004), *Data and Computer Communications*, (7th Ed.) PHI.

Websites and eLearning Sources:
1. https://www.geeksforgeeks.org/computer-network-tutorials/
2. https://www.tutorialspoint.com/data_communication_computer_network/index.htm
3. https://www.w3schools.com/cybersecurity/cybersecurity_networking.php
4. https://www.geeksforgeeks.org/introduction-to-internet-of-things-iot-set-1/

5. https://www.tpointtech.com/iot-internet-of-things
6. https://www.tutorialspoint.com/internet_of_things/index.html

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, students will be able to	**Cognitive Levels (K-Level)**
CO1	Recall the fundamental concepts of computer network, data communication, OSI model, wireless LAN, and IoT.	**K1**
CO2	Demonstrate data transmission, network components, LAN architectures, and wireless communication.	**K2**
CO3	Apply switching, routing, multiplexing, and wireless protocols to solve network problems.	**K3**
CO4	Analyze network standards, topologies, wireless LANs, and IoT challenges.	**K4**
CO5	Evaluate the applications of networks, wireless LANs, and IoT in real-world scenarios.	**K5**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
4	**25UPH43AO02B**		**Allied Optional - 2:** Computer Science - 2							**4**	**3**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	2	2	2	2	3	3	2	2	3	**2.4**
CO2	2	3	2	1	2	3	3	2	2	3	**2.3**
CO3	1	2	3	2	3	2	3	2	3	3	**2.4**
CO4	2	2	2	3	2	2	3	2	2	3	**2.3**
CO5	2	2	2	2	3	1	3	2	2	3	**2.2**
Mean Overall Score											**2.32 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	25UPH43OP02A	**Allied Optional Practical - 2:** Chemistry Practical-2	2	1

Course Objectives
To learn the safety in the lab
To understand the chemical nature of organic compounds
To understand the principles of organic qualitative analysis
To learn the elemental analysis
To learn the tests for confirming the presence of functional groups

UNIT I: Safety Rules in the Laboratory   (6 Hours)

Introduction - personal protection - nature of chemicals - toxic, corrosive, explosive, inflammable, Carcinogenic and other hazardous chemicals - philosophy of lab safety - first-aid techniques -General work culture inside the chemistry lab - handling of chemicals and apparatus in the laboratory - storage and handling of chemicals - disposal of chemical wastes - glassware - handling of glassware – handling of different types of laboratory equipments like Bunsen burner – centrifuging apparatus –Kipp's apparatus.

UNIT II: Introduction to Aromatic and aliphatic compounds   (6 Hours)

Flame test and nitration test for the presence of Aromatic compounds – explosive nature of sodium metal in water – reason for kept in kerosene – Saturated and unsaturated organic compounds – reaction with bromine water and potassium permanganate – reason for decolourisation - nitrogen, sulphur and halogen compounds - Ferrous sulphate test for nitogen – sodium nitroprusside test for sulphur – silver nitrate test for halogens - Functional group tests- tests for carbohydrates – tests for phenols – tests for amines – tests for carboxylic acids –tests for nitrobenzene.

UNIT III: Theory of Organic Qualitative Analysis   (6 Hours)

Qualitative analysis of organic substances - solubility test in $NaHCO_3$, NaOH and HCl – acidic, basic and neutral nature of organic compounds - test for saturation and unsaturation - aliphatic and aromatic nature of organic compounds - preparation of Lassaign's sodium fusion extract - element tests for N, S and halogens.

UNIT IV: Analysis of Organic Compounds   (6 Hours)

1. Identification of acidic, basic, phenolic and neutral organic substances.
2. Test for aliphatic and aromatic nature.
3. Test for saturation and unsaturation.
4. Preparation of sodium fusion extract.
5. Detection of N, S, and Cl.

UNIT V: Functional Group Analysis   (6 Hours)

1. Test for monocarboxylic acid
2. Test for dicarboxylic acid
3. Test for monohydric phenols
4. Test for dihydric phenols
5. Test for amine
6. Test for nitro compounds
7. Test for Carbohydrates

Teaching Methodology	Chart, PPT, chalk and talk and videos.
Assessment Methods	Snap Test, group discussion and MCQ

Books for Study:
1. Gnanapragasam, N. S., & Ramamurthy, G. (2007). *Organic Chemistry Lab Manual* (2nd Ed.). S. Viswanathan Printers and Publishers (P) Ltd.
2. Department of Chemistry, St. Joseph's College. (n.d.). *Allied Practical Manual* (Private circulation).

Books for Reference:
1. Furniss, B. S. (1984). *Vogel's Textbook of Practical Chemistry* (7th Ed.). ELBS.
2. Venkateswaran, V., Veeraswamy, R., &Kulandaivelu, A. R. (1997). *Basic Principles Of Practical Chemistry* (2nd Ed.). Sultan Chand and Sons.

Websites and eLearning Sources:
1. https://www.youtube.com/watch?v=FUo428guKt0
2. https://www.youtube.com/watch?v=_G6_OEa1BjA

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, the students will be able to	**Cognitive Levels (K-Level)**
CO1	Learn the concept of organic analysis	**K1**
CO2	Learn the methods of preparing Lassaign's extract	**K2**
CO3	Understand the principles of organic reactions	**K3**
CO4	Understand the methods of elemental analysis	**K4**
CO5	Learn the confirmatory tests of functional groups.	**K5**

Relationship Matrix											
Semester	**Course Code**	**Title of the Course**						**Hours**		**Credits**	
4	**25UPH43OP02A**	**Allied Optional Practical - 2:** Chemistry Practical- 2						**2**		**1**	
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	1	2	2	3	3	2	1	3	2	**2.2**
CO2	2	2	2	3	2	2	1	3	3	2	**2.2**
CO3	3	2	2	3	3	2	3	2	2	3	**2.5**
CO4	2	3	2	3	2	3	3	2	3	2	**2.5**
CO5	3	3	2	1	2	2	2	3	2	1	**2.1**
										Mean Overall Score	**2.3 (High)**

Semester	Course Code	Title of the Course	Hours/Weeks	Credits
4	25UPH43OP02B	**Allied Optional Practical:** Computer Science	2	2

List of Exercises

HTML5 Exercises
1. Create a web page using Text Formatting and semantic tags.
2. Adding Images to Web Pages
3. Creating Lists (Ordered and Unordered List)
4. Design an HTML form with validation attributes
5. Creating Tables and links to structure webpage content

CSS Exercises
5. Apply CSS3 selectors and styles to format a webpage.
6. Implement CSS transitions and transformations.

SQL Exercises
7. Basic operations (Arithmetic Operattions)
8. Set Operations
9. Create and manage tables using DDL commands
10. Perform data operations using DML commands.

Simple Projects using HTML
11. Student Profile Management System.
12. Creating Online Registration form.

 - for semester 3 and 4

Semester	Course Code	Title of the Course	Hours / Week	Credits
4	25UHE44VE04A	**Value Education - 4:** Social Ethics - 2	2	1

Course Objectives
To understand the significance of natural resources and strive to coexist harmoniously with nature.
To implement strategies for disaster management within the community.
To evaluate the significance and distinctions between science and religion.
To recognize the importance of maintaining a healthy lifestyle.
To utilize counseling techniques to address and resolve individuals' issues.

UNIT I: Harmony with Nature (6 Hours)

What is environment, why should we think of harmony, longing for human well-being, Principles to conserve environmental resources, causes of disharmony, the fruits of harmony with nature, Forest resources, Water resources, Mineral resources, Food resources, Fruits of disharmony, Economic values and growth, Environmental Ethics, Guidelines to live in harmony with nature, Towards life-centered system for better quality of life. Harmony with animal kingdom.

UNIT II: Issues Dealing with Science and Religion (6 Hours)

What is Science, Science and Religion, Social Relevance of Science and Technology, Science and technology for social justice, Difference caused by Science and Technology, Need for indigenous technology, Science, Technology and Innovation Policy of India.

UNIT III: Public Health (6 Hours)

Health related issues, Health Care in India vs Developed Countries, Health and Heredity, Public Health - The Indian Scenario, Objectives of public health in India, Public Health System in India, Failure on the public health front, Role of the central government, Hospitals Services in India, Health and Abortion, Health and Drug Addiction, Drug abuse.

UNIT IV: Disaster Management (6 Hours)

Disaster Management, Types of disaster, plans of disaster management, Technology to manage natural disasters and catastrophes, Disaster Management, Rehabilitation and Reconstruction, Human-induced disaster, First Aid, The importance of First-aid, Disaster Declaration and Response.

UNIT V: Counseling for Adolescents (6 Hours)

High Risk Behaviours, Developmental Changes in Adolescents, Key Issues of the Adolescents, need for Counseling, Nature of Counseling, Counseling Goals, does helping help? The Good and the Bad news. Importance of Career Guidance Counseling.

Teaching Methodology	Power point, Assignment and Group discussion
Assessment Methods	Online Test, Group Discussions, Seminar, Assignment

Books for Study:
1. Department of Human Excellence. (2021). *Formation of Youth*, St Joseph's College (Autonomous), Tiruchirappalli.

Books for Reference:
1. Albert, D., & Steinberg, L. *Judgment and decision making in adolescence*: Journal of Research on
2. Adolescence, page no: 211-224 (2011).
3. Larry, R. C. (2000). *Disaster Management and Preparedness,* Lewis Publications.
4. Hurlock, E.B. (2001). *Developmental Psychology: A: Life-Span Approach*. (5th Ed.). Tata McGraw-Hill.
5. Sangha., & Kamaljit. (2015). *Ways to Live in Harmony with Nature: Living Sustainably and
6. Working with Passion.* Australia, Woods lane Pty Limited.

Websites and eLearning Sources:

1. https://en.wikipedia.org/wiki/Disaster_management_in_India
2. https://ndma.gov.in/
3. https://talkitover.in/services/child-adolescent-counselling/
4. https://www.nipccd.nic.in/schemes/adolescent-guidance-centre-19#gsc.tab=0

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, students will be able to	**Cognitive Levels (K - Level)**
CO1	Know the value of natural recourses and to live in a harmony with nature.	**K1**
CO2	Apply the plans of disaster management in the society.	**K2**
CO3	Analyse the importance and differences of science and religion.	**K3**

Relationship Matrix										
Semester	**Course Code**		**Title of the Course**						**Hours**	**Credits**
4	**25UHE44VE04A**		**Value Education - 4:** Social Ethics - 2						**2**	**1**
Course Outcome	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**				**Mean Scores of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	3	3	2	3	3	2	3	3	**2.8**
CO2	3	2	2	3	3	2	3	3	2	2	**2.5**
CO3	2	3	3	3	2	3	3	3	3	3	**2.8**
									Mean Overall Score		**2.7 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	25UHE44VE04B	**Value Education - 4:** Religious Doctrine - 2	2	1

Course Objectives
To explore the rich historical background of the Catholic Church
To explore and comprehend the Sacraments practiced by the Catholic Church
To incorporate Christian Prayer into daily routines
To reflect on personal growth through the lens of Sacraments and Christian Prayer
To promote unity by embracing universal values from various religions

UNIT I : The Catholic Church **(6 Hours)**

UNIT II : Sacraments of Initiation **(6 Hours)**

UNIT III : Sacraments of Healing & at the Service of Community **(6 Hours)**

UNIT IV : The Christian Prayer **(6 Hours)**

UNIT V : Harmony of Religions **(6 Hours)**

Teaching Methodology	Power point, assignment, and Group discussion
Assessment Methods	Seminars, Group Discussion, Online Tests, Assignments

Books for Study:
1. Department of Human Excellence (2022). Fullness of Life, St Joseph's College (Autonomous), Tiruchirappalli.

Books for Reference:
1. (1994). *Compendium: Catechism of the Catholic Church.* Bengaluru: Theological Publications in India. Holy Bible (NRSV).

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, students will be able to	**Cognitive Levels (K - Level)**
CO1	Understand the history of the Catholic Church	K1
CO2	Examine and grasp the Sacraments of the Catholic Church	K2
CO3	Apply the Christian Prayer to their everyday life	K3

Relationship Matrix										
Semester	Course Code		Title of the Course						Hours	Credits
4	25UHE44VE04B		**Value Education - 4:** Religious Doctrine - 2						2	1
Course Outcome	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**				**Mean Scores of COs**
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	2	3	2	2	3	3	2.7
CO2	3	2	2	2	3	3	3	3	2	2	2.5
CO3	2	2	3	3	2	2	3	3	3	3	2.6
									Mean Overall Score		2.6 (High)

B. Sc. PHYSICS - 110

Semester	Course Code	Title of the Course	Hours	Credits
4	25UPH44SE02	**Skill Enhancement Course - 2:** Techniques of Problem Solving in Physics	2	1

Course Objectives
To understand the diverse basic physics concepts.
To apply physics concepts into different physical systems.
To identify the suitable methodology for solving the physics problems.
To acquire the knowledge on solving basic and applied physics problems.
To apply modern physics concepts to solve simple physics problems.

UNIT–I: Mechanics (6 Hours)

Newton's laws of motion, distance - displacement - speed - velocity and acceleration - difference between instantaneous and average quantities - motion in straight a line and a plane-projectile motion.

UNIT– II: Properties of Matter (6 Hours)

Elasticity, stress, strain-Hooks law and Moduli of Elasticity- Surface tension, Surface energy - Excess pressure inside a drop and a soap bubble-viscosity - Poiseuille's equation-Stokes' law

UNIT – III: Electricity and Magnetism (6 Hours)

Coulomb's law, electric field, electric force, electric potential, electric potential due to point charge, Gauss's law and its applications- Kirchhoff's law, resistance in parallel and series.

UNIT - IV: Waves and Optics (6 Hours)

Reflection and transmission of waves, standing waves, standing waves on string, transverse and longitudinal waves, Doppler effect, refraction, critical angle, simple microscope, compound microscope, telescope, resolving power

UNIT - V: Modern Physics (6 Hours)

Photon theory of light - Photoelectric effect - matter waves, X-rays, continuous and characteristics X-rays, soft and hard X-rays, Bragg's law, properties and uses of X-rays.

Teaching Methodology	Demo Videos, PPT, Handouts, Study materials
Assessment Methods	Seminar, Snap, Test, MCQ, Problem solving, Online quiz

Books for Study:
1. H. C. Verma. (2021). *Concepts of Physics (Part-1)*, Bharati Bhawan Publishers.
2. H. C. Verma. (2021). *Concepts of Physics (Part-2)*, Bharati Bhawan Publishers.

Unit	Book	Chapters	Sections
I	1	3,5	3.2-3.8, 5.1-5.4
II	1	14	14.2-14.6, 14.9-14.12, 14.15-14.17
III	2	29,30, 32	29.2 – 29.4, 29.6-29.8, 30.3, 30.4, 32.7, 32.8
IV	1	15, 16,18,19	15.8-15.10, 15.14, 16.13, 18.5, 18.6, 19.3-19.6
V	2	42, 44	42.1-42.3, 44.1, 44.3, 44.5, 44.6

Books for Reference:
1. Walter Benenson John W. Harris and Holger Lutz. (2002). *Handbook of Physics*, Springer.

Websites and eLearning Sources:
1. http://www.csun.edu/science/courses/525/old_files/thinking/probsolv_physics.htm
2. https://phys.libretexts.org/Bookshelves/University_Physics/Book%3A_University_Physics_(OpenStax)/Book%3A_University_Physics_I_-_Mechanics_Sound_Oscillations_and_Waves_(OpenStax)/01%3A_Units_and_Measurement/1.08%3A_Solving_Problems_in_Physics
3. https://phys.libretexts.org/
   (* subject to availability - not to be used for exam purpose)

Course Outcomes

CO No.	CO-Statements On successful completion of this course, the students will be able to	Cognitive Levels (K-Level)
CO1	Acquire knowledge on physics concepts in mechanics, properties of matter, electricity and magnetism, optics, sound and modern physics and all related problems.	K1
CO2	Understand the different physics concepts and related problems by gaining the knowledge.	K2
CO3	Use physics principles to solve simple physics problems.	K3
CO4	Apply the modern physics concepts to solve simple physics problems.	K4
CO5	Identify the physics formulae and method of solving the physics problems and interpret it.	K5

Relationship Matrix											
Semester	**Course Code**	**Title of the Course**								**Hours**	**Credits**
4	**25UPH44SE02**	**Skill Enhancement Course - 2:** Techniques of Problem Solving in Physics								2	1
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	2	2	2	2	2	2	2	3	2.3
CO2	2	3	2	2	2	3	2	3	2	2	2.3
CO3	3	3	3	2	2	2	3	2	2	2	2.4
CO4	3	3	2	2	2	2	2	3	2	2	2.3
CO5	3	3	2	2	2	3	2	2	2	2	2.3
										Mean Overall Score	**2.32 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
4	25UPH44SL03	**Self Learning:** Astronomy	-	2

Course Objectives
To describe the geology of the Moon and to explain several theories of the Moon's formation
To explain what a solar eclipse is and to state the difference between a total solar eclipse and partial lunar eclipse and to describe how the Sun, Moon, and Earth must be aligned for a solar eclipse to occur
To summarize the methods and techniques of astronomical imaging
To articulate the various planets in the solar system and to determine the position of the planets from the sun and also to describe the properties of different planets and classify them into rocky and gassy
To illustrate the solar calendar whose dates, indicate the season or almost equivalently the apparent position of the Sun relative to the stars

UNIT - I: The Moon

Introduction - Sidereal month - Synodic month - daily motion of the moon - age of moon –phase of moon - position of moon at rising and setting.

UNIT - II: Eclipses

Introduction - umbra and penumbra - lunar eclipse - solar eclipse - duration of lunar and solareclipse - comparison of solar and lunar eclipses.

UNIT - III: Astronomical Instruments

Sidereal clock - chronometer - gnomon - sun dual - the heliometers - the sextant -chronograph - radio telescope.

UNIT - IV: Solar System

Introduction - the Sun - Mercury - the Venus - Mars - Jupiter - Saturn - Uranus - Neptune -Pluto.

UNIT - V: The Calendars

Lunar and Solar calendars - Egyptian - Mayan - Roman - Julian and Gregorian calendars -Indian National calendar - Tamil and Malayalam calendars.

Teaching Methodology	Self-learn
Assessment Methods	MCQ, Online quiz

Books for Study:
1. Kumaravelu S., Susheela Kumaravelu (2013), *Astronomy*, (Revised Ed), SKV publications.

Unit	Book	Chapters	Sections
I	1	XII	229 - 246
II	1	XIII	256 - 283
III	1	XV	305 - 320
IV	1	XVII	327 - 337
V	1	XX	362 - 370

Books for Reference:
1. Bhatia V.B. (2001), *Textbook for Astronomy and Astrophysics with elements of Cosmology*, (2nd Ed), Narosa Publishing House, New Delhi.
2. Karttunen H., Kroger P., Oja H., Poutanen M., Donner K. J. (2007), *Fundamental Astronomy*, (5th Ed), Springer Berlin Heidelberg, New York.

Websites and eLearning Sources:
1. https://archive.nptel.ac.in/courses/115/105/115105046/
2. https://onlinecourses.nptel.ac.in/noc23_ph42/preview
3. https://archive.nptel.ac.in/courses/121/104/121104006/
4. https://ocw.mit.edu/courses/8-282j-introduction-to-astronomy-spring-2006/
   (* subject to availability - not to be used for exam purpose)

Course Outcomes

CO No.	CO-Statements On successful completion of this course, the students will be able to	Cognitive Levels (K-Level)
CO1	Acquire the knowledge on the solar systems, Eclipses, Lunar and Solar calendars.	K1
CO2	Describe the features of an astronomical instruments, a variety of calendars and the planets in the solar systems	K2
CO3	Understand the various physical phenomena exercised in the astronomical instruments	K3
CO4	Apply astronomical telescopes to examine the features of Moon and plants in the solar systems	K4
CO5	Analyse the changes observed in the sky and understand the causes responsible for any observed changes.	K5

Relationship Matrix

Semester	Course Code	Title of the Course								Hours	Credits
4	25UPH44SL03	Self Learning: Astronomy								-	2

Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	3	2	2	3	3	2	2	2.5
CO2	3	2	2	2	2	2	3	2	3	2	2.3
CO3	3	2	2	2	2	3	3	2	2	2	2.3
CO4	3	2	2	2	2	3	3	2	1	2	2.2
CO5	3	3	3	3	2	3	3	3	1	2	2.6
									Mean Overall Score		2.38 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
5	25UPH53CC09	**Core Course - 9:** Optics	6	4

Course Objectives
To recall the properties of light and apply them in lenses and prism.
To understand the central concepts and basic formalisms of interference, diffraction, polarization and basics of Fiber optics.
To apply the concepts in interference, diffraction and polarization to solve relevant numerical problems related to relevant optical applications.
To analyze some of the fundamental laws and principles of light which are used in many important optical instruments.
To evaluate the interaction of light with matter and a few applications.

UNIT- I: Geometrical Optics   (18 Hours)

Laws of reflection and refraction from Fermat's principle - ray paths in an inhomogeneous medium - the ray equation and its solution - refraction of rays at the interface between an isotropic medium and an anisotropic medium - refraction at a single spherical surface - the Gaussian formula for a single spherical surface - reflection by a single spherical surface - the thin lens - the Newton formula - aplanatic points of a sphere.

UNIT- II: The Matrix Method   (18 Hours)

The matrix method - effect of translation - effect of refraction - imaging by a spherical refracting surface - unit planes - nodal planes - a system of two thin lenses - chromatic aberration - the achromatic doublet - removal of chromatic aberration of a separated doublet - monochromatic aberrations - coma - astigmatism and curvature of field - distortion.

UNIT III: Interference   (18 Hours)

Light waves and its properties – Interference – Young's Double Slit Experiment – Conditions for sustainable interference - Fresnel biprism – Determination of wavelength – Interference in thin films -due to reflected and transmitted light – Newton's Rings – Michelson's Interferometer-Theory and its applications.

UNIT IV: Diffraction And Polarization   (18 Hours)

Fresnel's assumptions - Fresnel's explanation of rectilinear propagation of light - Zone plate – construction and theory - Diffraction at circular aperture and straight edge - Fraunhofer diffraction - Diffraction at single and double slit - Plane transmission grating - theory and applications - Rayleigh's criterion for resolving power.

Basics - Production of Linearly Polarized Light - Nicol prism – Wave Plates - Production and detection of elliptically and circularly polarized light -Analysis of Polarized light - Optical activity.

UNIT V: Optical Fiber   (18 Hours)

Optical Fiber - Optical Fiber system - Total internal reflection - Propagation of light through an optical fiber - critical angle - acceptance angle - the numerical aperture - multimode fibers - plastic optical fibers - attenuation in optical fibers - material dispersion - fiber optic sensors - Merits of optical fibers.

Teaching Methodology	Demo Videos, PPT, Handouts, Study materials, chalk and talk
Assessment Method	Seminar, Snap Test, MCQ, Online quiz, Problem Solving

Books for Study:

1. Ajoy Ghatak, *Optics*, 6th Edition, McGraw Hill Education (India) Private Limited, 2017.
2. Subrahmanyam, N., Lal, B., & Avandhanulu, M. N. (2018). *A textbook of Optics,* (24th Ed.).
S. Chand Publishing**.**

Unit	Book	Chapters	Sections
I	1	3 & 4	3.2-3.5, 4.1-4.4, 4.6, 4.8
II	1	5 & 6	5.1-5.5, 6.1-6.4
III	2	14,15	14.2, 14.4.1 – 14.4.4, 14.5, 14.7, 14.9, 15.2, 15.3, 15.6, 15.7, 15.8
IV	2	17, 18 ,19 &20	17.3, 17.4, 17.5, 17.8, 17.10, 18.2, 18.2.1, 18.4 only, 18.7.1 – 18.7.2, 19.2., 20.5 full, 20.6.1.20.17, 20.18,20.19, 20.20, 20.24
V	2	24	24.2, 24.2.2, 24.3, 24.4, 24.4.1, 24.4.2, 24.6, 24.8, 24.12, 24.12.2, 24.15.1, 24.16.2, 24.23, 24.22

Books for Reference:

1. Rajpal, S., Sirohi. (2012). *Wave Optics and its Application*, (1st Ed.). Orient Blackswan Publication.
2. Jenkins, F. A., & White, H. E. (1957). *Fundamentals of Optics*, (3rd Ed.), McGraw-Hill.
3. Kakani, S. L., & Bhandari, K. C. S. (2005). *A textbook of Optics*, (10th Ed.). Chand and Sons.
4. Khanna., & Gulati. (1991). *Fundamentals of Optics*, (14th Ed.). R. Chand & Co.

Websites and eLearning Sources:

1. https://ocw.mit.edu/courses/mechanical-engineering/2-71-optics spring-2009/
2. https://nptel.ac.in/courses/115/107/115107095/
3. https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-ph09/
   (* subject to availability - not to be used for exam purpose)

CO No.	CO-Statements On successful completion of this course, the students will be able to	Cognitive Levels (K-Level)
Course Outcomes		
CO1	Recite the concepts of Geometrical optics and Wave optics, focal length, aperture, resolving power, dispersive power, total internal reflection	K1
CO2	Understand various natural phenomena (like interference and diffraction) that are happening in their surroundings, atmospheric refraction, aberrations of lenses	K2
CO3	Apply the knowledge of interference, diffraction, polarization and Optical fibers and study the basic principles behind fiber optic sensors.	K3
CO4	Analyze the interference, diffraction, polarization and evaluate the functions of an optical instrument, Brewster's angle, angle of acceptance	K4
CO5	Design and align optical elements to set up new optical systems for studies and in the field of medical diagnostic systems.	K5

Relationship Matrix										
Semester	Course Code		Title of the Course						Hours	Credits
5	25UPH53CC09		Core Course - 9: Optics						6	4
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	1	3	2	3	3	1	2.2
CO2	3	3	3	2	1	3	2	2	3	1	2.3
CO3	3	2	2	3	1	3	3	3	2	1	2.3
CO4	3	3	2	3	1	3	3	2	2	1	2.3
CO5	3	2	2	3	1	3	2	3	3	1	2.3
								Mean Overall Score			2.38 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
5	25UPH53CC10	**Core Course - 10:** Concepts of Modern Physics	6	4

Course Objectives
To recall the basic concepts in relativity, particle nature, wave nature of particles.
To understand the foundational theories of modern physics from atomic to astronomical systems
To apply suitable methods to solve problems in physics of subatomic structure, matter waves, astronomical objects and relativistic speeds.
To explain various theoretical and experimental methods in relativity and quantum physics.
To analyze various complex systems using the concepts of modern physics.

UNIT I: Relativity I (18 Hours)

Theory of relativity – Origin of the theory - The Michelson-Morley Experiment: principle, experimental arrangement, results, negative results- Lorentz-Fitzgerald contraction - Einstein's theory of relativity - Postulates - The Lorentzian Transformation equations derivation - relativity of time, simultaneity and space – addition of velocities.

UNIT II: Relativity II (18 Hours)

Conclusions of special theory of relativity – futility of ether -intrinsic quantum nature of radiations – validity of EM theory – variation of mass with velocity – mass-energy relations - Experimental verification of the mass-energy relation - The General Theory of Relativity - Principle of equivalence - The relativistic law of gravity - Minkowski's 4-D space-time continuum -Einstein's solution of the problem of gravitation. Experimental confirmation: Advance of the perihelion of Mercury - Bending of a ray of light due to a gravitational field.

UNIT III: Origin of Quantum theory (18 Hours)

Blackbody Radiation - Stefan's law - Wien's displacement law - Classical Theory of Cavity Radiation Rayleigh-Jeans Formula derivation - Ultraviolet catastrophe - Planck's Theory of Cavity Radiation - Planck's radiation formula derivation – wavelength form of Planck's formula - Planck's Radiation Law in Thermometry -Planck's Postulate and its Implications.

UNIT IV: Particle Properties of Waves (18 Hours)

The Photoelectric Effect - Einstein's Quantum Theory of the Photoelectric Effect - The Compton Effect – experiment and results- derivation of Compton's equation - The Dual Nature of Electromagnetic Radiation - Photons and X-Ray Production - bremsstrahlung process - Pair Production and Pair Annihilation

UNIT V: Wave Properties of Particles (18 Hours)

Matter Waves - de Broglie's postulate - Davisson-Germer experiment - Thomson experiment - The Wave-Particle Duality - principle of complementarity - The Uncertainty Principle - Bohr's microscope thought experiment - Properties of Matter Waves - wave and group velocities - Fourier integral and superposition.

Teaching Methodology	Demo Videos, PPT, Lectures (chalk and talk)
Assessment Method	Seminar, Snap Test, MCQ, Online quiz, Problem Solving

Books for Study:
1. Rajam, J. B (2007), *Atomic Physics*, S. Chand
2. Eisberg R. and Resnick R. (2006), *Quantum physics of atoms, molecules, solids, nuclei, and particles* (2nd Edition), Wiley.

Unit	Book	Sections
I	1	Ch VI Pg: 374 - 394
II	1	Ch VI Pg: 395 - 411
III	2	1.1, 1.2, 1.3, 1.4 EX1.4, EX1.5, 1.5, 1.6
IV	2	2.1 -2.7
V	2	3.1-3.4

Books for Reference:
1. Serway. R. A., Moses & C. J. Moyer. C.A. (2004). *Modern Physics*, (3rd Ed.). Brooks/Cole Publications.
2. Tipler, P. A. & Lewellyn, R. L. (2007). *Modern Physics,* (5th Ed.). W.H. Freeman. 3. Resnick, R. (2007). *Introduction to Special Relativity*, (1st Ed.). Wiley Publications.
3. Besier, A., Mahajan, S., & Choudhury, R. S. (2017). *Concepts of Modern Physics*, (7th Ed.). McGraw Hill Education.
4. Stephen, T. T., & Rex, A. (2013). *Modern Physics for Scientists and Engineers*, (4th Ed.). Brooks/Cole, Cengage Learning.

Websites and eLearning Sources:
1. https://oyc.yale.edu/physics
2. https://ocw.mit.edu/courses/physics/
3. https://www.understandingnano.com/
4. https://ras.ac.uk/
   (* subject to availability - not to be used for exam purpose)

Course Outcomes		
CO No.	**CO-Statements**	**Cognitive Levels (K-Level)**
	On successful completion of this course, the students will be able to	
CO1	Acquire conceptual knowledge of space-time, frames of references and creating changes of physical parameters, their behaviour as particulate and matter waves and to differentiate the size of the matter.	**K1**
CO2	Explain and demonstrate various theoretical and experimental methods in relativity and quantum physics.	**K2**
CO3	Apply suitable methods to solve problems in subatomic structure, matter waves and relativistic speeds.	**K3**
CO4	Examine the existence of a modern physics solution to various problems.	**K4**
CO5	Compare the concepts of modern physics to classical physics under different situations	**K5**

Relationship Matrix											
Semester	**Course Code**	**Title of the Course**								**Hours**	**Credits**
5	**25UPH53CC10**	**Core Couse - 10:** Concepts of Modern Physics								6	4
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	2	2	2	3	2	2	2	2 3	**2.3**
CO2	3	3	2	2	2	3	2	2	2	2 3	**2.3**
CO3	3	3	2	2	2	3	2	2	2	2 3	**2.4**
CO4	3	3	2	2	2	3	2	2	2	2 3	**2.5**
CO5	3	3	2	2	2	3	2	2	2	2 3	**2.5**
									Mean Overall Score		**2.4 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
5	25UPH53CP05	**Core Practical – 5:** Physics Practical - 5	6	3

Any 16 Experiments

1. Spectrometer – grating – normal incidence.
2. Spectrometer – grating – minimum deviation.
3. Magnetic moment – using coil carrying current by Cu voltmeter.
4. Magnetic moment – using coil carrying current by ammeter.
5. Determination of Stefan's constant.
6. Earth inductor – magnetic field of the Earth.
7. Fresnel's biprism – wavelength, refractive index and thickness of transparent sheet.
8. B.G. - absolute Mutual Inductance.
9. B.G. – absolute Capacitance
10. Zener Diode - regulated power supply.
11. Clipping and clamping circuits – construction and performance study
12. Transistor characteristics – CB mode.
13. Transistor characteristics – CE mode.
14. FET – characteristics.
15. Hartley oscillator using BJT – f and Inductance
16. Colpitt's oscillator using BJT – f and Inductance
17. Study the frequency response of transistor CE amplifier.
18. Study the frequency response of FET amplifier.
19. Logic gates using Diodes and Transistors – construction and operation.
20. De-Morgan's theorem and Boolean algebra – verification using logic gates
21. Specific Rotation of Sugar solution by Polarimeter.
22. Two port network analysis – admittance, transmission and h parameters.
23. PWM using IC555 – construction and performance study
24. Thevenin's and Norton theorems – verification and measurement
25. Study of transistor biasing
26. Solar Characteristics measurement
27. Study of Diamagnetism, Paramagnetism and Ferromagtism.
28. Verification of Biot-Savart's law
29. Faraday effect – rotation of the plane polarized light beam, Verdet constant and e/m
30. BH loop – Retentivity, Permeability, Residual Magnetism and Reluctance
31. Determination of Transistor h-parameter
32. Anderson's Bridge – self-inductance and inductive reactance.
33. Determination of Planck's constant using LED and Photo diode

Semester	Course Code	Title of the Course	Hours/Week	Credits
5	25UPH53ES01A	**Discipline Specific Elective - 1:** Analog and Digital Electronics	4	3

Course Objectives
To Study of the characteristics and operations of semiconductor devices and analog digital circuits.
To explain the concepts and analysis procedure of analog and digital circuits.
To apply the operations of semiconductor devices in analog and digital circuits.
To assess the need of analog and digital circuits for different applications.
To evaluate the working of analog and digital circuits of simple applications.

UNIT I: Diode Applications, BJT and FET Amplifier (12 Hours)

Review of diodes and transistors - LED - Switching circuits: clipping and Clamping; Power supply: Linear Power Supply - SMPS. Amplifier: h-parameter - Frequency response of common emitter amplifier - MOSFET switch and amplifier.

UNIT II: Oscillators (12 Hours)

Positive Feedback - Barkhausen Criterion - classification of oscillators - Phase shift oscillator -Wien Bridge oscillator - Tuned oscillator - Hartley oscillator - Crystal oscillator - Clock generator - Digital Modulation.

UNIT III: Operational Amplifiers (12 Hours)

Op-amp - Ideal Op-amp - Parameters of Op-amp - Practical Op-amp - Voltage transfer curve -Open loop configuration - Closed loop configuration - Comparator - Summing amplifier - Error amplifier - Schmitt Trigger.

UNIT IV: Combinational Logic Circuits (12 Hours)

Basic and Universal gates - K-map simplification - 4:1 and 16:1 Multiplexer - 1:4 and 1:16 Demultiplexer - Encoder - Decoder - Parity generator and checker.

UNIT V: Sequential Logic Circuits (12 Hours)

Flip-Flops (RS, JK, D, T) - Shift Register - 4-bit Asynchronous Counter - 4-bit Synchronous Counter - Decade Counter - Pre-settable counter - Mod counter - EEPROM - Static and Dynamic RAM - Solid State Disc.

Teaching Methodology	Black board teaching, PPT, Video lectures, Demonstrations with models, Handouts.
Assessment Method	Seminar, Snap Test, MCQ, Online quiz, Problem Solving

Books for Study:
1. Bakshi, U. A., & Godse, A. P. (2009). *Analog and Digital Electronics*. Technical Publications Pune.

Unit	Book	Chapters	Sections
I	1	1, 2	1.2, 1.7, 2.3-2.6
II	1	4	4.2, 4.3, 4.4, 4.5.2, 4.6, 4.8, 4.9, 4.12, 4.13
III	1	9	9.1, 9.2, 9.3, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 9.14, 9.15
IV	1	5	5.2, 5.3, 5.4, 5.5, 5.6
V	1	6, 7, 8	6.4, 6.5, 6.6, 7.2, 7.3, 8.2, 8.5, 8.7, 8.8

Books for Reference:
1. Luecke, J. (2005). *Analog and Digital Circuits for Electronic Control System Applications*. Elsevier.
2. Anil Kumar Maini. (2007). *Digital Electronics*. John Wiley & Sons Ltd.

Websites and eLearning Sources:
1. https://en.wikipedia.org/wiki/Digital_electronics
2. https://en.wikipedia.org/wiki/Analogue_electronics
3. https://www.elprocus.com/difference-between-analog-circuit-and-digital-circuit/
   (* subject to availability - not to be used for exam purpose)

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, the students will be able to	**Cognitive Levels (K - Level)**
CO1	Describe semiconductor devices and outline the concepts of analog and digital circuits.	**K1**
CO2	Understand the concepts and analyze the analog and digital circuits for various applications.	**K2**
CO3	Examine real time problems, implement with analog and digital circuits by employing modern tools.	**K3**
CO4	Assess the need of modern society with professional ethics in electronics and recommend solutions for the same.	**K4**
CO5	Evaluate the electronic project to plan an eco-friendly environment.	**K5**

Relationship Matrix											
Semester	**Course Code**	**Title of the Course**								**Hours**	**Credits**
5	**25UPH53ES01A**	**Discipline Specific Elective - 1:** Analog and Digital Electronics								**4**	**3**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	2	3	2	3	3	2	3	2	**2.6**
CO2	3	3	3	2	2	3	3	3	3	2	**2.7**
CO3	3	3	3	2	2	3	3	3	3	2	**2.7**
CO4	3	3	3	2	2	3	3	2	3	2	**2.6**
CO5	3	3	2	2	2	3	3	3	2	2	**2.5**
										Mean Overall Score	**2.62 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
5	25UPH53ES01B	**Discipline Specific Elective - 1:** Design of Analog and Digital Circuits	4	3

Course Objectives
To describe various analog and digital circuits.
To understand the principle and working of analog and digital circuits of various applications.
To apply the working principle of semiconductor devices in different circuits.
To analyse the working of networks, oscillators, op amp circuits, combinational and sequential logic circuits.
To evaluate the performance of different analog and digital circuits.

UNIT I: Network Analysis **(12 Hours)**

Networks and Kirchhoff's law - Series resistors - Parallel resistors - Voltage - Thevenin's - VoltageDivider - Connected Circuits and Power Transfer - Matrix Solution of Resistor Networks - MatrixForm of the Resistance Network - Series and Parallel Light Bulbs - Thevenin Circuit.

UNIT II: Design of Amplifiers and Oscillators **(12 Hours)**

Common - Emitter Amplifier - Bias Network (AC Coupling) - Ebers - Moll Equation - JFET voltage amplifier - MOSFET - JFET Wein's bridge oscillator - Transistor astable multivibrator.

UNIT III: Op Amp: Design of ADC, DAC **(12 Hours)**

Op-amp basics - Op-amp circuits - Op-amp (closed and open loop) - Finite gain analysis - Bandwidth - Comparator - PID Control - R-2R ladder DAC - Successive Approximation Register ADC.

UNIT IV: Design of Combinational Logic Circuits **(12 Hours)**

K-map Simplification - Design of 4:1 Multiplexer - Design of 1:4 Demultiplexer - Encoder - Decoder - 1-bit full Adder - 1-bit full subtractor - Design of Multiplexer.

UNIT V: Design of Sequential Logic Circuits **(12 Hours)**

Flip-flops - 4-bit Asynchronous Counter - 4-bit Synchronous Counter - Shift register - SRAM - DRAM - Design of counter divide by 3.

Teaching Methodology	Black board teaching, PPT, Video lectures, Demonstrations with models, Handouts.
Assessment Method	Seminar, Snap Test, MCQ, Online quiz, Problem Solving

Books for Study:

1. Steck, A. D. (2015). *Analog and Digital Electronics*. Department of Physics, University of Oregon.

Unit	Book	Chapters	Sections
I	1	1	All
II	1	4, 5	4.8, 4.9, 4.10, 4.11, 5.2, 5.4.3, 5.6
III	1	7, 8, 16	7.1, 7.3, 7.4, 7.5, 7.7, 7.8, 7.9, 8.1, 8.4, 16.1, 16.2
IV	1	10, 12	10.3, 10.4.2, 12.1-12.7
V	1	13	13.1-13.9

Books for Reference:

1. Agarwal, A., & Jeffrey, H. L. (2005). *Foundations of Analog and Digital ElectronicCircuits*. Elsevier.
2. Johan, H. H., Steyaert, M., & Roermund, A.V. (2003). *Analog Circuit Design*. Kluwer Academic Publishers.
3. Balch. M. (2003). *Complete Digital design*. McGraw-Hill.
4. John, E. A. (2005). *Digital Integrated Circuits*. CRC Press.

Websites and eLearning Sources:

1. https://www.synopsys.com/glossary/what-is-analog-design.html
2. https://neurophysics.ucsd.edu/courses/physics_120/Agarwal%20and%20Lang%20(2005)%20Foundations%20of%20Analog%20and%20Digital.pdf

3. https://medium.com/@TeksunGroup/difference-between-analog-design-and-digital-design-18c5d1ce566a

(* subject to availability - not to be used for exam purpose)

CO No.	Course Outcomes	
	CO-Statements	Cognitive Levels (K-Level)
	On successful completion of this course, the students will be able to	
CO1	Acquire the knowledge of basic network concepts emphasizing series and parallel combination of passive components, discuss working principle and biasing concepts of JFETs and MOS FETs, and outline the concepts of op amp and its basic circuit operation.	K1
CO2	Experimenting the configuration of Op-amp into its application tosolve various circuit parameters.	K2
CO3	Apply the working principle of various analog and digital instruments and analyse them in the measurement of physical parameters	K3
CO4	Assess the need of automatic electronics devices by the society and recommend solutions by inventing the circuits.	K4
CO5	Evaluate the requirements of analog and digital circuits for social needs.	K5

Relationship Matrix											
Semester	Course Code	Title of the Course								Hours	Credits
5	25UPH53ES01B	Discipline Specific Elective - 1: Design of Analog and Digital Circuits								4	3
Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	2	2	3	3	3	3	2	2.7
CO2	3	3	3	2	2	3	3	2	3	2	2.6
CO3	3	3	2	3	2	3	3	2	3	2	2.6
CO4	3	3	3	2	2	3	3	2	3	2	2.6
CO5	3	3	2	3	2	3	3	2	3	2	2.6
									Mean Overall Score		2.62 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
5	25UPH53ES02A	**Discipline Specific Elective - 2:** Solid State Physics	4	3

Course Objectives
To understand the electronic and crystalline attributes of solid materials.
To study crystal structure, bonding in crystals, specific heat and superconductivity.
To examine the structure and models of nucleus and also to study the process of radioactivity and its applications and also.
To analyse the working of detectors, accelerators and cosmic rays.
To study the aspects related to elementary particle and space physics.

UNIT I: Crystal Structure and X-Ray Diffraction   (12 Hours)

The Crystalline State - Basic Definitions - Bravais lattices and crystal systems - Symmetry - Miller indices - Crystal structures: FCC, BCC, NaCl, Diamond - Interatomic Forces - Types of Bonding - Bragg's Law - The reciprocal lattice - Experimental X-ray diffraction Techniques: The Rotating - Crystal Method.

UNITII: Lattice Vibrations and Free-Electron Model   (12 Hours)

Elastic waves - Density of states of a continuous medium - Specific heat: Einstein and Debye models - the phonon - The free electron theory: electrical conductivity - heat capacity of conduction electrons - the Fermi surface.

UNIT III: Semiconductors   (12 Hours)

Band theory of solids - The Bloch theorem: Bloch function, energy bands and energy gap, crystal potential - Brillouin zones - number of states in a band - Classification of solids - Effective mass - The Hole - Semiconductor band structure - Carrier concentration: Fermi-Dirac function, derivation.

UNIT IV: Dielectric and Optical Properties   (12 Hours)

Introduction - polarizability - the local field - Maxwell and Lorentz fields - Clausius-Mosotti relation - Sources of polarizability - Dipolar polarizability - Dipolar polarization in solids - Ionic polarizability - Electronic polarizability: Classical treatment - Piezoelectricity - Ferroelectricity: Curie-Weiss law.

UNIT V: Magnetic Properties and Superconductivity   (12 Hours)

Magnetic susceptibility - classification of materials - Langevin theory of diamagnetism - paramagnetism: classical theory - Ferromagnetism - antiferromagnetism and Ferrimagnetism - Superconductivity - zero resistance - The Meissner effect - critical field - BCS theory - Josephson effect - Type I and II superconductors.

Teaching Methodology	Demo Videos, PPT, Handouts, Study materials
Assessment Method	Seminar, Snap Test, MCQ, Online quiz, Problem Solving

Books for Study:
1. Omar, M.A. (2010). *Elementary Solid State Physics*. Pearson India.

Unit	Book	Chapter	Section
I	1	1 & 2	1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.9, 1.10, 2.3, 2.9
II	1	3 & 4	3.2, 3.3, 3.4, 3.5, 4.3, 4.4, 4.6, 4.7
III	1	5 & 6	5.2, 5.3, 5.4, 5.5, 5.10, 5.15, 5.17, 6.3, 6.4
IV	1	8	8.2, 8.3, 8.4, 8.5, 8.7, 8.8, 8.9, 8.10
V	1	9 & 10	9.3, 9.4, 9.5, 9.6, 9.7, 9.8, 9.9, 10.2, 10.3, 10.4, 10.7, 10.8

Books for Reference:
1. Ashcroft, N. W., & Mermin, N. D. (1976). *Solid State Physics*. Brooks/Cole; New edition.
2. Kittel, C. (2019). *Introduction to Solid State Physics,* (India Edition). Wiley.
3. Simon, S. H. (2013). *The Oxford Solid State Basics*. Oxford University Press.
4. Holgate, S. A. (2010). *Understanding Solid State Physics*. CRC Press.

Websites and eLearning Sources:
1. https://oyc.yale.edu/physics
2. https://ocw.mit.edu/courses/physics/
3. http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html
4. http://www.umop.net/spectra/spectrum.php?elem=H&sw=430&lw=710
   (* subject to availability - not to be used for exam purpose)

Course Outcomes		
CO No.	**CO-Statements**	**Cognitive Levels (K - Level)**
	On successful completion of this course, the students will be able to	
CO1	Remember the knowledge of Crystal structures, free electron model, band structure, dielectric properties and superconductivity.	**K1**
CO2	Understand and describe the different experimental X-ray diffraction methods and lattice vibration, free-electron, band theories of solids.	**K2**
CO3	Apply the theories underlying dielectric, optical, magnetic and superconductive properties.	**K3**
CO4	Analyse the properties of semiconductors, dielectrics, optical, magnetic and superconductive materials.	**K4**
CO5	Evaluate the theories to explain the properties of solids.	**K5**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
5	**25UPH53ES02A**		**Discipline Specific Elective - 2:** Solid State Physics							**4**	**3**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	2	2	2	3	2	2	2	2	**2.3**
CO2	3	3	3	2	2	3	2	2	2	2	**2.4**
CO3	3	3	2	2	2	3	3	2	2	1	**2.3**
CO4	3	3	3	2	2	3	3	2	2	1	**2.4**
CO5	3	3	2	2	2	3	3	2	1	1	**2.2**
										Mean Overall Score	**2.32 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
5	25UPH53ES02B	**Discipline Specific Elective - 2:** Classical Mechanics	4	3

Course Objectives
To recognize the various laws and principles involved in Newtonian Mechanics.
To interpret and find the solution for central force problem in a dynamic system.
To articulate the understanding of dynamic system using Lagrangian, Hamiltonian and Euler formalisms.
To solve the problems of classical Mechanics by applying Euler, Lagrangian, Hamiltonian and Legendre mechanisms.
To evaluate the rotation of rigid bodies and develop the solution for problems based on rotational motion.

UNIT I: Laws of Motion and Momentum (12 Hours)

Classical Mechanic Space and Time - Mass and Force - Newton's First and Second Laws; Inertial Frame - The Third Law and Conservation of Momentum - Newton's Second Law in Cartesian Coordinates - Two-Dimensional Polar Coordinates - conservation of Momentum - Rocket - The Center of Mass - Angular Momentum for a Single Particle - Angular Momentum for several particles.

UNIT II: Energy (12 Hours)

Kinetic Energy and Work - Potential Energy and Conservative Forces - Force as the Gradient of Potential Energy - The Second Condition that Force be Conservative - Time-Dependent Potential Energy - Energy for Linear One-Dimensional Systems - Curvilinear One-Dimensional Systems - Central Forces - Energy of Interaction of Two Particles - The Energy of a Multiparticle System.

UNIT III: Lagrange's Equations (12 Hours)

Lagrange's Equations for Unconstrained Motion - Constrained Systems; Examples - Constrained Systems in General - Proof of Lagrange's Equations with Constraints - Examples of Lagrange Equations - Generalized Momenta and Ignorable Coordinates - Lagrange's Equations for Magnetic Forces - Lagrange Multipliers and Constraint Forces.

UNIT IV: The Calculus of Variations and Hamilton's Principle (12 Hours)

Some typical minimization problems - The Euler-Lagrange equation - Variational principles - Hamilton's principle - Systems of first order ODEs - Legendre transforms - Hamilton's equations - Hamiltonian phase space ((q, p)-space) - Liouville's theorem and recurrence.

UNIT V: Rotational Motion of Rigid Bodies (12 Hours)

Properties of the Center of Mass - Rotation about a Fixed Axis - Rotation about Any Axis: the Inertia Tensor - principal Axes of Inertia - finding the Principal Axes: Eigenvalue Equation - Precession of a Top due to a Weak Torque - Euler's Equations - Euler's Equations with Zero Torque - Euler Angles - Motion of a Spinning Top.

Teaching Methodology	Demo Videos, PPT, Handouts, Study materials
Assessment Method	Seminar, Snap Test, MCQ, Online quiz, Problem Solving

Books for Study:
1. John, R. T. (2005). *Classical mechanics*. University Science Books. Edwards Brothers.
2. Gregory, D. R. (2006). *Classical Mechanics an Undergraduate text*. Cambridge University Press.

Unit	Book	Chapters	Sections
I	1	1,3	1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 3.1, 3.2, 3.3, 3.4, 3.5
II	1	4	4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10
III	1	7	7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.9, 7.10
IV	2	13,14	13.1, 13.2, 13.3, 13.4, 14.1, 14.2, 14.3, 14.4, 14.5
V	1	10	10.1, 10.2, 10.3, 10.4, 10.5, 10.6, 10.7, 10.8, 10.9, 10.10

Books for Reference:

1. Goldstein. H., Poole. C.P., Safko J.L. (2002), *Classical Mechanics* (3rd Ed.). Pearson Education.
2. Joag P.S., Rana N.C. (1991), *Classical Mechanics*, McGraw Hill.
3. Raychaudhuri, A.K. (1983), *Classical Mechanics: A Course of Lectures*, Oxford University Press.
4. Upadhaya, J.C. (2022), *Classical Mechanics* (3rd Ed.). Himalaya Publishing House.

Websites and eLearning Sources:

1. https://plato.stanford.edu/entries/newton-stm/
2. https://www.texasgateway.org/resource/74-conservative-forces-and-potential-energy
3. https://phys.libretexts.org/Bookshelves/Classical_Mechanics/Classical_Mechanics_(Tatum)/04%3A_Rigid_Body_Rotation/4.05%3A_Euler's_Equations_of_Motion
   (* subject to availability - not to be used for exam purpose)

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, the students will be able to	**Cognitive Levels (K - Level)**
CO1	Acquire the knowledge of the fundamental quantities of a dynamic system using Lagrangian, Hamiltonian and Eulerian formalism.	**K1**
CO2	Understand the concept of Force, Energy, and momentum of dynamic system by comparing Newtonian, Lagrangian and Hamiltonian formalism and culminate the accurate solution for complex problems in dynamic system.	**K2**
CO3	Apply the variation principle to minimize the problem and find the simple solution in Hamiltonian space.	**K3**
CO4	Analyze motion of a particle under the central force and establish canonical and conjugate momentum is conserved in conservative system.	**K4**
CO5	Evaluate the rotation, oscillation and linear motion of rigid bodies and develop the solution for problems based on Lagrangian, Hamiltonian and Eulerian formalism.	**K5**

Relationship Matrix										
Semester	**Course Code**	**Title of the Course**							**Hours**	**Credits**
5	**25UPH53ES02B**	**Discipline Specific Elective - 2:** Classical Mechanics							**4**	**3**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**				**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	2	3	2	3	2	3	2	3	2	1	**2.3**
CO2	3	3	2	2	2	3	2	2	2	1	**2.2**
CO3	3	2	2	3	2	2	3	3	2	1	**2.3**
CO4	3	2	2	3	3	2	2	3	2	1	**2.3**
CO5	3	3	2	2	3	2	2	3	2	1	**2.3**
Mean Overall Score											**2.28 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
5	**25UPH54OE01A**	**Open Elective - 1 (WS):** Physics for Everyday life	4	2

Course Objectives
To understand the basic laws of mechanics that apply to mechanical objects
To examine the underlying scientific principles and functioning of optical instruments and their applications in various everyday situations
To explore the physics of home appliances which enables us to appreciate the scientific principles that govern their functionality
To grasp the principles behind solar cells and the efficient conversion of sunlight into electricity and to appreciate the benefits of harnessing solar power and its potential to reduce the reliance on non- renewable energy sources
To Familiarize the notable achievements of Indian physicists and their contributions to the global scientific community

UNIT I: Mechanical Objects   (6 Hours)

Laws of motion- Hook's law - conservation of energy-conservation of momentum-force and friction- Spring scales - Bouncing balls - Roller coasters - Bicycles - Rockets and space travel.

UNIT II: Optical Instruments and Laser   (6 Hours)

Vision corrective lenses - Polaroid glasses - UV protective glass - Polaroid camera - Colour photography - Holography and Laser

UNIT III: Physics of Home Appliances   (6 Hours)

Bulb - structure- types- Fluorescent Electric Bulb - LED - Halogen Bulb-Fan - Hair drier - Television - Air conditioners - Microwave oven - Vacuum cleaners

UNIT IV: Solar Energy   (6 Hours)

Solar constant - General applications of solar energy - Solar water heaters - Solar Photo - voltaic cells - General applications of solar cells

UNIT V: Indian Physicists and their Contributions   (6 Hours)

C.V. Raman, Homi Jehangir Bhabha, Vikram Sarabhai, Subrahmanyan Chandrasekhar, Venkatraman Ramakrishnan, Dr. APJ Abdul Kalam and their contribution to science and technology.

Teaching Methodology	Videos, PPT and Demonstration
Assessment Method	Seminar, Snap Test, MCQ, Online quiz, Problem Solving

Books for Study:
1. Ammara, U. & Gugucool. (2019). *The physics in our daily lives*. (Unit I, II, III)
2. Lawin, W. (2011). *For the love of physics*. Free Press. (Unit V)
3. Roy, G. D. (2014). *Solar energy utilisation,* (5th Ed.). Khanna Publishers. (Unit IV)

Books for Reference:
1. Mathur, D. S. (2010), *Elements of properties of matter.* S. Chand & Company.
2. Ghatak, A. (2017). *Optics*. Tata McGraw-Hill publishing Company Ltd.
3. Tiwari, G. N. (2002). *Solar energy fundamentals- Design, modelling and applications*, Alpha Science.
4. Cauldwell, R. (2014). *Wiring a house*. Taunton Press.
5. Cengaga. (2017). *The great indian scientists*. Indian Pvt., Ltd.

Websites and eLearning Sources:
1. https://www.nrel.gov/research/re-solar
2. https://www.coherent.com/news/glossary/laser-optics

Course Outcomes

CO No.	CO-Statements On successful completion of this course, the students will be able to	Cognitive Levels (K-Level)
CO1	Study the principles of Physics to everyday life	K1
CO2	Examine the fundamental laws of Physics and discover its importance	K2
CO3	Analyze solar energy and systems for power generations	K3
CO4	Interpret the concepts learnt to daily life by recognizing the physics of mechanical objects, home appliances, solar energy, and their influence in the modern world.	K4
CO5	To admire at Indian physicist and their contribution for science and technology	K5

Relationship Matrix

Semester	Course Code	Title of the Course		Hours	Credits
5	25UPH14SE01A	Open Elective - 1 (WS): Physics for Everyday Life		4	2

Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	2	2	3	2	2	2	1	2.3
CO2	3	3	2	2	2	3	2	3	2	1	2.3
CO3	3	3	3	2	1	3	3	1	2	1	2.3
CO4	3	3	3	2	1	3	2	2	2	1	2.2
CO5	3	3	2	2	2	3	2	2	2	1	2.2
Mean Overall Score											2.26 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
5	25UPH54OE01B	**Open Elective - 1 (WS):** Renewable Energy Physics	4	2

Course Objectives
To identify the importance of renewable energy resources and to solve the problem of energy crisis globally.
To summarize the working principles and the connection methods of wind, hydro, and solar power for generating electricity from renewable energy resources.
To use the generated power from renewable energy resources by connecting to various appliances.
To device new methods, techniques to meet the challenges and to improve the efficiency of wind, hydro, and solar power systems.
To analyze the potential economic and societal benefits of widespread adoption and integration of renewable energy technologies into the existing energy infrastructure.

UNIT I: Introduction (12 Hours)

Importance of energy to society - new forms of energy and units of energy - Laws of thermodynamics - Energy sources - World's Energy problem - Green or renewable energy and conservation - World leaders in renewable energy - Energy future - Complexities in charting the best course for the future.

UNIT II: Wind Power (12 Hours)

Historical uses - Wind characteristics and resources - Power transfer to a Turbine - Turbine types and terms - Controlling and optimizing wind turbine performance - Electrical aspects and grid integration - small wind - Offshore wind - Environmental impacts - unusual design and applications.

UNIT III: Hydro Power (12 Hours)

Hydro power - Wave, Tidal and Ocean thermal power resources - Introduction to tidal power and cause of the tides - Ocean thermal energy conversion - Social and environmental impacts of hydro power.

UNIT IV: Photovoltaics (12 Hours)

Conductors, Insulators and semiconductors - Increasing the conductivity of semiconductors through doping - PN junction - Generic photovoltaic cell - Electrical property of a solar cell - Efficiency of solar cells and solar system - Grid connection and inverters - Other types of solar cells.

UNIT V: Energy Conversion and Efficiency (12 Hours)

Factors besides efficiency influencing energy-related choices - Lowest of the low hanging fruit - Obstacles to efficiency and conversion - Problems.

Teaching Methodology	Demo Videos, PPT, Handouts, Study materials.
Assessment Method	Seminar, Snap Test, MCQ, Online quiz, Problem Solving

Books for Study:
1. Ehrlich, R. (2013). *Renewable energy: A first course,* (3rd Edition). CRC press, by Taylor & Francis Group, LLC.

Unit	Book	Chapters	Sections
I	1	1	1.2-1.9, 1.13-1.15
II	1	7	7.1-7.10
III	1	8	8.1-8.5
IV	1	11	11.2-11.11
V	1	12	12.2-12.5

Books for Reference:
1. Agarwal, M. P. *Solar energy*. S Chand and Co. Ltd.
2. *Boyle, G. Energy Systems and Sustainability.*
3. Rai, G.D. *Non-conventional energy sources*. Khanna Publishers.

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, the students will be able to	**Cognitive Levels (K - Level)**
CO1	Acquire knowledge on wind power, hydro power, solar energy, and their utilization.	**K1**
CO2	Understand the importance of energy to the society.	**K2**
CO3	Interpret wind power, hydro power and the photovoltaic solar energy.	**K3**
CO4	Analyse wind power, hydro power, solar photovoltaic system and solar efficiency.	**K4**
CO5	Compare new methods and techniques to meet the challenges and to improve theefficiency of wind, hydro, and solar power systems.	**K5**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
5	**25UPH54OE01B**		**Open Elective - 1 (WS):** Renewable Energy Physics							**4**	**2**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	2	2	2	3	3	1	2	3	**2.4**
CO2	3	2	2	2	3	3	2	2	2	3	**2.4**
CO3	3	3	3	2	2	3	3	3	2	2	**2.6**
CO4	3	2	2	3	3	3	2	2	3	3	**2.6**
CO5	3	3	2	2	3	3	3	2	2	3	**2.6**
									Mean Overall Score		**2.52 (High)**

Semester	Course Code	Title of the Course	Hours	Credits
5	25UPH54SL04A	**Certificate Course:** Solar power systems installation and maintenance	-	2

Course Objectives
To introduce students to the basics of electricity, power generation, and photovoltaic (PV) systems.
To demonstrate the principles of solar energy conversion and its applications.
To equip students with the skills to assess site conditions and implement PV installation techniques.
To introduce different installation methods, including rooftop and ground-mount solar systems.
To train students in commissioning, troubleshooting, and maintaining solar power plants.

UNIT -I: Basics of Electricity, Solar Energy and Components of a PV System

Basics of Electricity and Power Generation System - Renewable Energy and Solar Energy System - Solar Cells - Photovoltaic Solar Panels - Electrical Power System - Solar PV Modules - PV Panel components

UNIT - II: Solar Panel Installation Skill

Responsibilities of a Solar Panel Installation Technician - Prerequisites for Solar Panel Installation - Site Analysis - Installation and Maintenance of Solar Panel - Work Ethics - Workplace Safety - Soft Skills - Assessing site conditions - installation requirement - quality of material and handling - tools used

UNIT - III: Solar PV System Design and Installation

PV Circuit Fundamentals - Sample System Designs - Power and PV Panel calculation - One-Line Electrical Diagrams - Mechanical Installation: Rooftop - Mechanical Installation: Ground-Mount

UNIT - IV: Electrical Installation

Batteries in a PV System - Study of Charge Controllers - Study of Inverters - Mounting Structures - Tracking mechanisms - Off-Grid System Installation - On Grid System Installation.

UNIT - V: Commissioning, Testing and Trouble Shooting

Troubleshooting of different PV system - Commissioning and Testing of Solar Power Plant - O & M of Solar Power Plant - Grid Integration and System - Jawaharlal Nehru National Solar Mission - MNRE guidelines - DPR preparation for power plants - Visit to a solar power plant

Teaching Methodology	Demo Videos, PPT, Handouts, Study materials.
Assessment Method	Seminar, Snap Test, MCQ, Online quiz, Problem Solving

Books for Study:

Text Prepared by the Department.

Books for Reference:

1. Joseph Burdick and Philip Schmidt, *install your own solar panels designing and installation*, eBook version 1.0, 2017.
2. Mike Sullivan, *Solar Rooftop DIY*, The Countryman Press, 2016.

Websites and eLearning Sources:

1. https://www.greenmatch.co.uk/blog/2014/09/solar-panel-installation-and-maintenance
2. https://solar-to-the-people.com/solar-installation-solar-maintenance/
3. https://merculexenergy.com/design-installation-and-maintenance-of-solar-pv-systems/ (* subject to availability - not to be used for exam purpose)
   (* subject to availability - not to be used for exam purpose)

	Course Outcomes	
CO No.	**CO-Statements** On successful completion of this course, the students will be able to	**Cognitive Levels (K-Level)**
CO1	Acquire the knowledge about basics of electricity, PV system and its installation.	**K1**
CO2	Understand and realize the need for solar power and its conversion.	**K2**
CO3	Identify and implement the PV installation technique for suitable places and analyze the different installation techniques, categorize the work ethics and workplace safety.	**K3**
CO4	Evaluate the efficiency of PV system, know the need for its improvement and recommend the techniques to install the PV system.	**K4**
CO5	Design and construct the solar PV system to power a house.	**K5**

Relationship Matrix											
Semester	**Course Code**	**Title of the Course**							**Hours**		**Credits**
5	**25UPH54SL04A**	**Certificate Course:** Solar Power System Installation and Maintenance							**-**		**2**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	2	2	2	3	3	1	2	3	**2.4**
CO2	3	2	2	2	3	3	2	2	2	3	**2.4**
CO3	3	3	3	2	2	3	3	3	2	2	**2.6**
CO4	3	2	2	3	3	3	2	2	3	3	**2.6**
CO5	3	3	2	2	3	3	3	2	2	3	**2.6**
								Mean Overall Score			**2.52 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
5	**25UPH54SL04B**	**Certificate Course:** Non-Destructive Testing	-	**2**

Course Objectives
To define the principles involved in the various Non-destructive testing and to differentiate the non-destructive testing from destructive testing techniques
To provide a basic understanding of different surface NDT techniques and apply them for inspecting materials in accordance with industry specification and standard
To relate the advantages and limitations of one method over other methods
To critically appraise the NDT techniques available and to select the most appropriate one for a given situation or application
To analyze the practical applications associated with Ultrasonic testing, Acoustic emission Testing, Electromagnetic Testing, Liquid Penetrant Testing, Magnetic Flux Leakage and Magnetic Particle Testing

UNIT - I: Visual Inspection and Acoustic Emission Testing

Fundamentals - Vision and light - Ambient Conditions - Test object characteristics – Equipment Accessories - Magnifiers/microscopes - Mirrors - Dimensional - Borescopes - Video Systems -Machine Vision - Replication - Temperature indicating devices and materials - Chemical aids - Surface Comparators - Raw Materials - Primary process materials - Determination of dimensions (depth, width, length, etc.) - Process for reporting visual discontinuities. Instrumentation and Signal Processing - Cables - Signal Conditioning - Signal Detection - Source Location Techniques - Acoustic emission test systems - Accessory Techniques - Advanced signal processing techniques - Acoustic Emission Test Techniques - Factors affecting test equipment selection - Applications of Acoustic Emission Testing.

UNIT - II: Thermography and Electromagnetic Testing

Principles/Theory - Conduction - Convection - Radiation - The nature of heat and heat flow - Temperature measurement principles - Proper selection of Thermal/Infrared testing - Heat flux indicators - Performance parameters of non-contact devices - Contact temperature indicators - Non-contact pyrometers - Infrared line scanners - Thermal/Infrared imaging - Heat flux indicators - Exothermic or endothermic investigations - Friction investigations - Fluid Flow investigations - Thermal resistance - Thermal capacitance investigations - Interpretation - Procedures -Safety and health. Principles/Theory - Equipment - Materials - Techniques - Interpretation - Procedures - Remote Field Testing (RFT) Principles & Theories - Principles and Theory

UNIT - III: Leak Testing and Liquid Penetrant Testing

Principles and theory - Physical principles in leak testing - Principles of gas flow-Proper selection of LT as method of choice - Leak testing standards - Detector/instrument performance factors - Vacuum Pumps - Bubble testing practices and techniques - Absolute pressure testing equipment - Absolute pressure hold testing of containers - Absolute pressure leakage rate testing of containers - Bubble Test - Pressure change/measurement test - Leak interpretation evaluation - procedures - Safety precautions. Principles/Theory - Principles of liquid penetrant process - Theory - Proper selection of PT as method of choice - Liquid penetrant processing - Equipment/Materials - Liquid penetrant test s - Methods of measurement - Lighting for liquid penetrant testing - Materials for liquid penetrant testing - Testing and maintenance of materials - Interpretation - Liquid penetrant testing procedures - specifications - Safety and Health.

UNIT - IV: Magnetic Flux Leakage and Magnetic Particle Testing

Principles/Theory - Flux leakage theory - Forster and other theories - Finite element methods - DC/AC flux leakage - Equipment/Materials - Detectors - Coils - Factors affecting choice of sensing elements - Read out selection - Instrument design considerations Techniques - Consideration affecting choice of test - Coupling - Field Strength - Flaw Detection - Process control - Defect Characterization - Standards. Principles/Theory - Principles of magnets and magnetic fields - Characteristics of magnetic fields - Equipment/Materials - Magnetic particle test equipment - Inspection Materials - Techniques - Magnetization by means if electric current - Selecting the proper method of magnetization - Demagnetization - Interpretation - Safety and Health.

UNIT - V: Radiographic Testing and Ultrasonic Testing

Principles and Theory - Equipment/Materials - Electrically generated sources - Particulate radiation sources - Radiation Detectors - Techniques - Imaging Considerations - Film Processing - Viewing of radiographs - Judging radiographic quality - Exposure Calculations - Radiographic Techniques - Interpretation and Evaluation - Procedures - Safety and Health Exposure Hazards - Methods of controlling radiation exposure - Operational and emergency procedures - Dosimetry and Film Badges. Principles/Theory - Equipment/Materials - Techniques - Contact - Immersion - Comparison of contact and immersion methods - Remote Monitoring - Interpretation - Evaluation of base metal product forms

Teaching Methodology	Demo Videos, PPT, Handouts, Study materials.
Assessment Method	Seminar, Snap Test, MCQ, Online quiz, Problem Solving

Books for Study:
1. Text Prepared by the Department.

Books for Reference:
1. Dr. Baldev Raj, Jayakumar and M. Thavasimuthu, "Practical Non- Destructive testing", Narosa Publications, New Delhi, 2009.
2. Non-Destructive Testing and Evaluation of Materials J Prasad C G K Nair Tata McGraw Hill Education Private limited
3. C. Hellier, Handbook of Nondestructive Evaluation, McGraw-Hill Professional, 1st edition (2001).

Websites and eLearning Sources:
1. https://www.flyability.com/ndt
2. https://www.asnt.org/MajorSiteSections/About/Introduction_to_Nondestructive_Testing.aspx
3. https://www.asnt.org/MajorSiteSections/About/Introduction_to_Nondestructive_Testing.aspx
   (* subject to availability - not to be used for exam purpose)

	Course Outcomes	
CO No.	**CO-Statements** On successful completion of this course, the students will be able to	**Cognitive Levels (K-Level)**
CO1	Have a basic knowledge of surface NDE techniques which enables to carry out various inspection in accordance with the established procedures	**K1**
CO2	Calibrate the instrument and inspect for in-service damage in the components.	**K2**
CO3	Differentiate various defect types and select the appropriate NDT methods for better evaluation	**K3**
CO4	Communicate the conclusions effectively	**K4**
CO5	Document the testing and evaluation of the results for further analysis.	**K5**

Relationship Matrix											
Semester	**Course Code**	**Title of the Course**						**Hours**		**Credits**	
5	25UPH54SL04B	Certificate Course: Non-Destructive Testing						-		2	
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	2	2	3	3	3	2	2	2	2.4
CO2	3	2	3	2	3	3	3	2	2	2	2.5
CO3	3	3	2	2	2	3	3	2	2	2	2.4
CO4	3	2	3	2	2	3	3	2	2	3	2.5
CO5	3	2	2	3	3	3	3	2	3	3	2.7
								Mean Overall Score			2.5 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
5	25UPH54SL04C	**Certificate Course:** Forensic Science	-	2

Course Objectives
To Understand the history and evolution of forensic science
To Describe the various disciplines within forensic science.
To Apply scientific methods to the collection, preservation, and analysis of evidence.
To Interpret laboratory results and understand quality control and chain-of-custody issues.
To Recognize the importance of ethical considerations and legal standards in forensic investigations.

UNIT I: Introduction to Forensic Science

History and evolution of forensic science. The role of science in modern criminal investigations. Overview of forensic disciplines.

UNIT II: Crime Scene Investigation

The role and responsibilities of a Crime Scene Investigator (CSI). Crime scene management: securing, documenting, and processing. Techniques for evidence collection, packaging, and preservation.

UNIT III: Forensic Laboratory Techniques

Introduction to laboratory methods: microscopy, chromatography, spectroscopy. Overview of the chain of custody and quality assurance. Laboratory safety protocols and ethics.

UNIT IV: Forensic Biology and DNA Analysis

Types of biological evidence and their significance DNA extraction, amplification (PCR), and profiling. Case studies on the use of DNA evidence in solving crimes.

UNIT V: Forensic Physics & Crime Scene Physics

Definition and scope of forensic physics. Role of physics in forensic science. Historical applications and case studies. Laws of motion and their forensic applications. Impact analysis and reconstruction of events. Measurement techniques for crime scene evidence.

Teaching Methodology	Demo Videos, PPT, Handouts, Study materials.
Assessment Method	Seminar, Snap Test, MCQ, Online quiz, Problem Solving

Books for Study:

1. Stuart H. James and Jon J. Nord by Edition, *Forensic Science: An Introduction to Scientific and Investigative Techniques*, 4th Edition Publication 2014 Publisher CRC Press.
2. Vincent J.M. DiMaio and Dominick DiMaio "*Forensic Pathology*",3rd Edition Publication Year: 2007Publisher: CRC Press
3. Richard Saferstein, *Criminalistics: An Introduction to Forensic Science*, 11th Edition Publication Year: 2018Publisher: Pearson
4. Alan J. N. Traub, *Forensic Toxicology: Principles and Applications*, 1st Edition Publication Year: 2004Publisher: Wiley

Books for Reference:

1. Max M. Houck and Jay A. Siegel, *Introduction to Forensic DNA Evidence for Criminal Justice Professionals*, Edition Publication Year 2009 Publisher: Wiley
2. Stephanie L. Bond, *Forensic Anthropology: Fundamentals and Field Methods*, 1st Publication Year: 2019Publisher: CRC Press
3. Richard Saferstein, *The Forensic Science Handbook*, (Volumes 1–3) Edition 2nd Publication Year: 2010Publisher: CRC Press
4. Henry C. Lee and R. E. Brion, *Practical Handbook of Forensic Chemistry,* 1st Edition Publication Year: 2008Publisher: CRC Press
5. B. R. Sharma, *Forensic Science in Criminal Investigation and Trials,*1st Edition Publication Year: 2008Publisher: Eastern Book Company
6. William J. P. Gannon, *The Forensic Scientist's Guide to DNA Evidence,* Edition: 1st Publication Year: 2004Publisher: CRC Press

CO No.	Course Outcomes	
	CO-Statements	**Cognitive Levels (K - Level)**
	On successful completion of this course, the students will be able to	
CO1	Understand the history, evolution, and modern applications of forensic science in criminal investigations	**K1**
CO2	Develop skills in the proper management of a crime scene, including securing, documenting, and processing evidence	**K2**
CO3	Acquire knowledge in basic forensic laboratory methods such as microscopy, chromatography, and spectroscopy, and understand the importance of chain of custody, quality assurance, and laboratory safety protocols.	**K3**
CO4	Grasp the principles of modern biology as applied to forensic science, including DNA analysis and serology	**K4**
CO5	Understand how physics principles, such as laws of motion and impact analysis, are applied to forensic investigations.	**K5**

Relationship Matrix

Semester	Course Code	Title of the Course			Hours	Credits
5	25UPH54SL04C	**Certificate Course:** Forensic Science			-	2

Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	2	3	2	2	3	2	**2.4**
CO2	2	3	2	3	2	3	2	3	2	1	**2.3**
CO3	2	2	3	2	1	3	3	2	3	1	**2.2**
CO4	3	3	2	3	2	3	3	2	3	2	**2.6**
CO5	2	2	3	2	1	3	2	3	2	1	**2.1**
									Mean Overall Score		**2.4 (High)**

Semester	Course Code	Title of the Course	Hours	Credits
5	**25UPH54SL04D**	**Certificate Course:** Wind Energy Utilization	-	2

Course Objective
Describe the history and evolution of wind energy, including early windmills and modern wind turbines.
Explain the fundamentals of electricity, AC circuits, and electromagnetism as applied to wind turbines.
Identify the key materials used in wind turbine construction and their mechanical properties.
Outline the key considerations for wind turbine setting and system design.
Describe the various applications of wind energy, including distributed generation and hybrid power systems.

UNIT I - Origin and Wind Energy Characteristics

Modern Wind Turbines - Modern Wind Turbine Design- Power Output Prediction   -   History of Wind Energy -A Brief History of Windmills- Early Wind Generation of Electricity -The Re-Emergence of Wind Energy- Technological Underpinnings of Modern Wind Turbines-   General Characteristics of the Wind Resource- Wind Resource: Global Origins- Mechanics of Wind Motion,- Wind Speed Measuring Instrumentation.

UNIT II - Electrical Aspects of Wind Turbines

Basic Concepts of Electrical Power-Fundamentals of Electricity,- Alternating Current,- Capacitors in AC Circuits- Inductors in AC Circuits- Power in AC Circuits- Power in AC Circuits- Three-phase AC Power- Voltage Levels- Fundamentals of Electromagnetism,- Ampere's Law- Faraday's Law- Induced Force- Power Transformers- Electrical Machines- Simple Electrical Machines- Starting Wind Turbines with Induction Generators- Off-design Operation of Induction Machines- DC Generators- Permanent Magnet Generators- Generator Mechanical Design.

UNIT III - Wind Turbine Materials, Design, and Testing

Wind Turbine Materials- Review of Basic Mechanical Properties of Materials- Steel- Composites- Machine Elements- Principal Wind Turbine Components.

UNIT IV - Wind Turbine Siting, System Design, and Integration

Overview- Design Procedure- Wind Turbine Design Loads- Design Evaluation- A Wind Turbine Test Program- Component Testing.

UNIT V - Wind Energy Applications

General Overview- Distributed Generation- Hybrid Power Systems- Offshore Wind Energy- Energy Storage- Fuel Production.

Teaching Methodology	Demo Videos, PPT, Handouts, Study materials
Assessment Method	Seminar, Snap Test, MCQ, Online quiz, Problem Solving

Books for Study:
1. F. Manwell, J. G. McGowan, A. L. Rogers, *Wind energy explained: Theory, Design and Application.* Second Edition John Wiley & Sons, Ltd (2009).

Unit	Book	Chapters	Sections
I	1	1,2	1.1.1, 1.1.2, 1.2, 1.2.1, 1.2.2,1.2.3, 1.2.4,2.2, 2.2.1,2.2.1.2, 2.8.3
II	1	5	5.2, 5.2.1, 5.2.2,5.2.2.1, 5.2.2.2, 5.2.2.5, 5.2.2.5, 5.2.2.6,5.2.2.7, 5.2.3, 5.2.3.1,5.2.3.3, 5.2.3.4,5.3, 5.4, 5.4.1, 5.4.4.3, 5.4.4.5, 5.4.5, 5.4.6, 5.4.8
III	1	6	6.3, 6.3.1, 6.3.2, 6.3.3, 6.4, 6.5
IV	1	7	7.1, 7.2, 7.5, 7.9, 7.10.1, 7.10.3
V	1	10	10.1,10.2, 10.3, 10.4,10.7, 10.8

Books for Reference:
1. Dr. A.G. Powar, Er. A.G. Mohod, *Fundamentals of Wind Energy Utilization*, Jain Brothers, 1st Edition, 2010

2. Alexandar A, Vijayan N, *Introduction to wind energy,* Vetrimozhi Veliyeetagam, 2024.

Websites and eLearning Sources:
1. https://www.youtube.com/watch?v=MRREJZdRA8g
2. https://www.youtube.com/watch?v=8S5I4pmmnG4
3. https://www.youtube.com/watch?v=HE_CKEuT9S4
   (*subject to availability -not to be used for exam purpose)

Course Outcomes		
CO No.	**CO-Statements**	**Cognitive Levels (K-Level)**
	On successful completion of this course, the students will be able to	
CO1	Recall the fundamental concepts and history of wind energy.	**K1**
CO2	Explain the characteristics of wind resources and wind turbine principles.	**K2**
CO3	Apply electrical concepts to analyze wind turbine power generation.	**K3**
CO4	Examine the design, materials, and testing of wind turbines.	**K4**
CO5	Analyze wind turbine siting, system integration, and energy applications.	**K5**

Relationship Matrix											
Semester	**Course Code**	**Title of the Course**								**Hours**	**Credits**
5	25UPH54SL04D	**Certificate Course:** Wind Energy Utilization								-	3
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	2	3	1	3	3	3	2	1	2.4
CO2	3	2	3	3	1	2	3	2	3	1	2.3
CO3	3	3	2	3	1	3	2	3	3	1	2.4
CO4	3	2	3	3	1	3	2	2	3	1	2.3
CO5	3	3	3	3	1	2	3	2	2	1	2.3
										Mean Overall Score	2.34 (High)

Semester	Course Code	Title of the Course	Hours/Week	Credits
6	25UPH63CC11	**Core Couse - 11:** Quantum Mechanics	6	4

Course Objectives
To know the fundamental principles and systems in quantum mechanics
To understand the results and phenomena of various quantum mechanical concepts and systems
To apply the basic principles of quantum mechanics on various systems.
To solve various potential problems using Schrodinger theory and general formalisms.
To analyse and investigate various quantum systems using the quantum theory.

UNIT I: The Schrödinger Equation   (18 Hours)

The principle of superposition – Wave packet - Schrödinger's Equation: 1d equation for a free particle - Operators for momentum and energy - Extension to 3 dimensions - Inclusion of force - Born's interpretation of wave functions: probability interpretation - Probability current density - Normalization - Expectation value - The Ehrenfest theorem.

The time - independent Schrödinger equation **-** Stationary states - Conditions on the wavefunction.

UNIT II: The General Formalism   (18 Hours)

Linear vector space - Hilber Space – orthogonal functions – Linear Operator – Eigenfunctions and Eigen Values – Hermitian operator – Schmidt orthogonalization procedure - Postulates of quantum mechanics: Wavefunction, operators, expectation value, eigen values, time development of a quantum system - Simultaneous measurability of observables – General uncertainty relation.

UNIT III: Exactly Solvable Problems – I   (18 Hours)

The zero potential - The step potential (energy less than step height) – Dust particle – conduction electron - The step potential (energy greater than step height) – neutron enters a nucleus - The barrier potential – electron in a rectangular barrier - Examples of barrier penetration by particles.

UNIT IV: Exactly Solvable Problems – II   (18 Hours)

The square well potential - Analytical solution for square well potential - The infinite square well potential – infinite square well quantization law – zero-point energy of electron - The simple harmonic oscillator potential – verification - Series solution for a simple harmonic oscillator potential.

UNIT V: The Hydrogen Atom   (18 Hours)

Introduction - Development of the Schrödinger equation - Separation of the time independent equation - Solution of the equations - Eigenvalues, Quantum numbers and degeneracy - Eigen functions - Verification of eigen functions - Probability densities – size of hydrogen atom from uncertainty principle.

Teaching Methodology	Chalk and talk, PPT, Simulations
Assessment Methods	Seminar, Snap Test, MCQ, Problem solving, Online Quiz.

Books for Study:
1. Aruldhas G. (2008), *Quantum mechanics* (2nd Edition), PHI Learning Pvt. Ltd.
2. Eisberg R. and Resnick R. (2006), *Quantum physics of atoms, molecules, solids, nuclei, and particles* (2nd Edition), Wiley.

Unit	Book	Chapters	Sections
I	1	2	2.3, 2.4 2.5, 2.6, 2.7, 2.8, 2.9, 2.10
II	1	3	3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7
III	2	6	6.1, 6.2, 6.3, EX. 6.1, EX 6.2, EX 6.3, EX 6.4, EX 6.3, 6.5, 6.6
IV	2	6	6.7, AP.H, 6.8, EX. 6.5, EX 6.6, EX 6.7, 6.9, AP.I, 6.10
V	2	7	7.1, 7.2, 7.3, 7.4, 7.5, 7.6, EX 7.2, 7.7, EX 7.4

Books for Reference:
1. Mathews P.M. and Venkatesan K. (2017), *A text book of Quantum mechanics* (2nd Edition), Tata McGraw Hill.
2. Bransden B. and Joachain C. (2004), *Quantum Mechanics* (2nd Edition), Pearson.

3. Griffiths D. J. and Schroeter D. F. (2019), *Introduction to Quantum mechanics* (3rd Edition), Cambridge University Press.

Websites and eLearning Sources:
1. https://oyc.yale.edu/physics
2. https://ocw.mit.edu/courses/physics/
3. http://www.quantumvisions.net/en/
4. https://vqm.uni-graz.at/
   (* subject to availability - not to be used for exam purpose)

	Course Outcomes	
CO No.	**CO-Statements**	**Cognitive Levels (K-Level)**
	On successful completion of this course, the students will be able to	
CO1	Describe the Schrodinger theory, the fundamental postulates of quantum mechanics and know various potential problems in quantum mechanics.	**K1**
CO2	Understand the concepts of Schrodinger equations, the various mathematical formalisms, and different quantum systems.	**K2**
CO3	Apply the Schrodinger theory and various principles of quantum mechanics to solve various potential problems and utilize them to interpret different properties.	**K3**
CO4	Analyse the consequences of the principles of quantum mechanics and investigate the properties of various quantum systems.	**K4**
CO5	Evaluate the principle of quantum theory in addressing various problems and explain its results.	**K5**

	Relationship Matrix										
Semester	**Course Code**	**Title of the Course**								**Hours**	**Credits**
6	**25UPH63CC11**	**Core Couse - 11:** Quantum Mechanics								6	4
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	3	2	1	3	3	3	2	2	**2.5**
CO2	3	3	3	2	1	3	3	3	2	2	**2.5**
CO3	3	3	3	2	1	3	3	3	2	2	**2.5**
CO4	3	3	3	2	1	3	3	3	2	2	**2.5**
CO5	3	3	3	2	3	3	3	3	2	2	**2.7**
										Mean Overall Score	**2.54 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
6	25UPH63CC12	Core Course - 12: Atomic, Nuclear and Particle Physics	6	4

Course Objectives
To recognize the fundamentals of structure of atoms and nucleus and their properties
To acquire knowledge about the atomic models and electronic and nuclear structures
To interpret the concepts of radioactivity and different radioactive decays
To discuss the idea of the elementary particles, particle accelerators, and detectors
To apply the concepts of atomic and nuclear physics in appropriate junctions

UNIT I: Atomic Structure (18 Hours)
The Nuclear Atom - Rutherford Scattering - Scattering Formula derivation - The Bohr Atom - Atomic Spectra - Ritz combination principle - Correspondence Principle - Atomic Excitation - The Sommerfeld Atom Model – Vector Atom Model - Quantum numbers.

UNIT II: Electronic Structure of Atoms (18 Hours)
Coupling Schemes - Pauli Exclusion Principle - The periodic table - Magnetic dipole moment of electron-Spin- Stern-Gerlach Experiment - Spin-Orbit Coupling - Zeeman Experiment - Quantum mechanical explanation - Anomalous Zeeman Effect - Paschen-Back effect - Stark effect -Production of X-rays - Bragg's Law - Bragg X-ray Spectrometer.

UNIT III: Nuclear Structure (18 Hours)
Nucleus - Classification of nucleus - General Properties - Binding Energy - Nuclear Stability -Theories of nuclear Composition - Nuclear forces - Meson theory of nuclear forces - Liquid drop model - Shell Model - Explanation of Magic numbers - Fermi gas model of the nucleus.

UNIT IV: Nuclear Transformations (18 Hours)
Radioactivity - Alpha Particle Spectra - Theory of Alpha decay - Theory of beta decay - Law of radioactive disintegration - Half life - Mean life - Units of radioactivity - Law of successive disintegration - Age of earth - Nuclear reactions - Scattering cross section - Nuclear fission - Nuclear reactors - Nuclear fusion - Source of stellar energy.

UNIT V: Particle Detectors, Particle Accelerators and Elementary Particles (18 Hours)
Particle Detectors: Ionization chamber - solid state detectors - Geiger Muller Counter - Wilson Cloud chamber.
Particle Accelerators: Cyclotron - Betatron - Synchrotron - Proton synchrotron.
Elementary Particles: Particles and antiparticles - Fundamental interactions - Elementary Particle Quantum numbers - Quark model.

Teaching Methodology	Chalk and talk, PPT, Simulations
Assessment Methods	Seminar, Snap Test, MCQ, Problem solving, Online Quiz.

Books for Study:
1. Murugeshan and Kiruthiga Sivaprasath. (2005). *Modern Physics*, (12th Edition), S. Chand.

Unit	Book	Chapters	Sections
I	1	6	6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9, 6.11, 6.12, 6.13.
II	1	6	6.14, 6.15, 6.16, 6.186.19, 6.20, 6.21, 6.23, 6.25, 6.26, 6.27, 6.28.
		7	7.2, 7.6, 7.7.
III	1	27	27.2 - 27.1.
		28	28.5, 28.6.
IV	1	31	31.13, 31.14, 31. 22, 31.30, 31.31, 31.3, 31.34, 31.35.
		34	34.4, 34.8.
		35	35.2, 35.6, 35.7, 35.8.
V	1	29	29.3, 29.4, 29.6, 29.7.
		30	30.4, 30.7, 30.8, 30.9.
		38	38.1, 38.2, 38.4, 38.5, 38.7.

Books for Reference:

1. Besier, Mahajan. S and Choudhury. S. R, (2017), *Concepts of Modern Physics*, (7th Edition), Mcgraw Hill Education.
2. Kolanoski. H and Wermes. N, (2020), *Particle Detectors*, Oxford University Press.
3. Irving Kaplan, (1977), (2nd Edition), Nuclear *Physics*, Addison-Wesley.
4. Eisberg. R and Resnick. R, (2006), (2nd Edition) *Quantum physics of atoms, molecules, solids, nuclei, and particles*, Wiley.
5. Serway. R. A, Moses. C. J. and Moyer C. A., (2004), (3rd Edition), *Modern Physics*, Brooks/Cole Publications.
6. Mathews. P.M. and Venkatesan. K., (2017), (2nd Edition), *A text book of Quantum mechanics*, Tata McGraw Hill.
7. Semat. H and Albright. J. R, (1985), (5th Edition), *Introduction to Atomic and Nuclear Physics*, Chapman and Hall.

Websites and eLearning Sources:

1. https://oyc.yale.edu/physics
2. https://ocw.mit.edu/courses/physics/
3. http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html
4. http://www.umop.net/spectra/spectrum.php?elem=H&sw=430&lw=710
    (* subject to availability – not to be used for exam purpose)

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, the students will be able to	**Cognitive Levels (K - Level)**
CO1	Acquire knowledge on the structure of atom and nucleus using different models	**K1**
CO2	Understand the properties of atom under external field, radioactive decay, nuclear reactions, and experimental methods to detect and accelerate particles	**K2**
CO3	Interpret the atomic spectra and periodic table based on the atomic models	**K3**
CO4	Classify elementary particles based on various physical properties	**K4**
CO5	Summarize the applications of atomic and nuclear physics	**K5**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
6	**25UPH63CC12**		**Core Course - 12:** Atomic, Nuclear and Particle Physics							**6**	**4**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	3	2	2	3	2	2	2	2	**2.4**
CO2	3	3	3	2	2	3	2	2	2	2	**2.4**
CO3	3	3	3	2	2	3	3	2	2	2	**2.4**
CO4	3	3	3	2	2	3	3	2	2	2	**2.4**
CO5	3	3	3	2	2	3	3	2	2	2	**2.4**
									Mean Overall Score		**2.4 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
6	25UPH63CP06	**Core Practical - 6:** Physics Practical - 6	6	3

Any 16 Experiments

1. Monostable and Bistable multivibrators – construction and study
2. Spectrometer – Cauchy's constant.
3. Spectrometer – Small angle prism.
4. B.G. – Inductance by Anderson's bridge.
5. B.G. – High resistance by leakage.
6. Potentiometer – EMF of a thermocouple.
7. Potentiometer – High range voltmeter.
8. Series and parallel resonance circuits.
9. NAND and NOR as universal building blocks.
10. Adders and Subtractors - construction and study
11. Op-amp – study of basic operations.
12. Astable multivibrator using Transistors - construction and study.
13. Simplification of Boolean expression using k map and implementation.
14. Encoder and Decoder - construction and study.
15. Binary adder and subtractor - construction and study.
16. Multiplexer and Demultiplexer - construction and study.
17. Flip Flops using logic gates - construction and study.
18. 4-bit Shift registers – SISO, SIPO and PISO - construction and study
19. 3 bit synchronous and asynchronous counters - construction and study.
20. V-I characteristics of Solar panel.
21. C Programs – Basic programming
22. C Program - Application to physics problem
23. Arduino basic programs
24. DC voltmeter using Arduino
25. Calculator using Arduino and 4x4 key pad
26. Stepper motor control using Arduino
27. Light intensity measurement using Arduino
28. Resistance measurement using Arduino
29. Capacitance measurement using Arduino
30. Study characteristics of sensors (any three like pressure, position, distance, motion, etc.,)
31. Wave length of laser using spectrometer
32. Determination of Boltzmann constant using V-I characteristic of PN diode
33. Determination of the Coupling Coefficient of a Piezoelectric crystal.
34. Diameter of a wire using laser
35. Study of AM and FM

Semester	Course Code	Title of the Course	Hours/Week	Credits
6	25UPH63ES03A	**Discipline Specific Elective - 3:** Spectroscopy and Laser	4	3

Course Objectives
To understand the concepts of Dispersion of Light classification of molecules
To study the principles of Raman and Resonance Spectroscopy and its applications
To analyse the principles of MW, ESR Spectroscopy and its applications
To examine the working principle of Lasers, and their applications
To study different types of optical fiber and its applications

UNIT I: Microwave and Infrared Spectroscopy   (12 Hours)

Electromagnetic spectrum - Types of molecular energies - Different spectroscopic methods - Rotational spectra: Classification of molecules - Interaction of radiation with rotating molecule - Rigid diatomic molecules - Microwave spectrometer - Information derived from rotational spectra - IR Spectroscopy - Vibrational energy - IR spectra preliminaries - Vibrations of polyatomic molecules: Normal vibrations of CO_2 and H_2O molecules - Dipole moment - IR spectrometer

UNIT II: Raman and Laser Spectroscopy   (12 Hours)

Raman Spectroscopy: Theory of Raman scattering: Classical and quantum - Mutual exclusion Principle - Raman spectrometer - Fourier transform Raman spectrometer - resonance Raman scattering - Laser spectroscopy - Nonlinear optical effects - frequency generation - Hyper Raman effect - stimulated Raman scattering - Inverse Raman scattering - Coherent anti-stoke Raman scattering - Multi-photon processes.

UNIT III: Electronic and Spin Resonance Spectroscopy   (12 Hours)

Electronic spectroscopy: Introduction - Dissociation - Pre-dissociation - Electronic angular momentum - Photoelectron spectroscopy: Principle - Instrumentation - information from photoelectron spectra - Nuclear Magnetic Resonance: Magnetic properties of nuclei - Resonance condition - Instrumentation - relaxation process - Chemical shift - Electron spin resonance: Introduction - Principle - ESR spectrometer - Nuclear Quadrupole resonance (Principle).

UNIT IV: Principles of Laser   (12 Hours)

Absorption and emission of light - Stimulated absorption - Spontaneous and stimulated emission - difference between spontaneous and stimulated emission - Einstein Relations - condition for stimulated emission - Condition for light amplification - Population inversion - Pumping methods and schemes - Metastable states - Optical resonator and its action - Characteristics of laser - Two level and three level laser systems.

UNIT V: Types and Applications of Lasers   (12 Hours)

Classification of lasers - solid state lasers: Ruby - Nd: YAG - Gas lasers: He-Ne- CO_2 - Semiconductor lasers: population inversion - pn-junction - lasing condition - Homojunction laser - Heterojunction lasers - Applications: LIDAR - Holography: Principle and method - Bar code reader - Medical and engineering applications.

Teaching Methodology	Lectures, Demonstrations, Presentations and Videos
Assessment Methods	Seminar, Snap Test, MCQ, Problem solving, Online Quiz.

Books for Study:
1. Aruldhas, G. (2008). *Molecular Structure and Spectroscopy*, (2nd Ed.). PHI learning.
2. Avadhanulu, M. N., & Memne, P. S. (2012). *An introduction to Lasers*. S. Chand.

Unit	Book	Chapter	Section
I	1	1, 6 & 7	1.1, 1.2, 1.3, 6.1, 6.2, 6.3, 6.14, 6.15, 7.1, 7.2, 7.7, 7.7.1, 7.7.2, 7.16
II	1	8 & 15	8.1, 8.2, 8.5, 8.6, 8.9, 8.16, 15.1, 15.2, 15.5, 15.6, 15.7, 15.8, 15.10
III	1	9, 10, 11 & 12	9.1, 9.9, 9.10, 9.11, 9.12, 10.1, 10.2, 10.3, 10.5, 10.8, 11.1, 11.2, 11.3, 12.1, 12.2
IV	2	1	1.18, 1.20, 1.21, 1.22, 1.23, 1.27, 1.28, 1.29, 1.31, 1.32, 1.35, 1.36
V	2	2 & 5	2.2, 2.3, 2.3.1, 2.3.2, 2.4, 2.4.1, 2.4.3, 2.7, 2.7.3, 2.7.4, 2.7.5, 2.7.13, 2.7.14, 5.17, 5.20, 5.21.1

Books for Reference:
1. Svanberg, S. (2004). *Atomic and Molecular Spectroscopy*. Springer-Verlag.
2. Hollas, J.M. (2002). *Basic Atomic and Molecular Spectroscopy*. Royal Society of Chemistry.
3. Banwell, C. (2017). *Fundamentals of Molecular Spectroscopy*, (4th Ed.). McGraw Hill Education.
4. Thyagarajan, K., & Ghatak, A. (2010). *Lasers*, (2nd Ed.). Springer.

Websites and eLearning Sources:
1. https://oyc.yale.edu/physics
2. https://ocw.mit.edu/courses/physics/
3. https://edu.rsc.org/resources/analysis
4. https://www.rp-photonics.com/laser_physics.html
   (* subject to availability - not to be used for exam purpose)

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, the students will be able to	**Cognitive Levels (K - Level)**
CO1	Know the basic concepts indifferent spectroscopic methods, MW, IR and Raman Spectroscopy and fundamental of laser.	**K1**
CO2	Understand the different physical phenomena in various spectroscopic techniques, principles of Laser and types.	**K2**
CO3	Explain the theory, principles, different types of Spectroscopy and Laser.	**K3**
CO4	Analyse the various experimental techniques in different spectroscopies and different types of laser models.	**K4**
CO5	Evaluate the spectroscopy methods based on interaction of light with matter and classify lasers and its application.	**K5**

Relationship Matrix										
Semester	**Course Code**		**Title of the Course**						**Hours**	**Credits**
6	25UPH63ES03A		**Discipline Specific Elective - 3:** Spectroscopy and Laser						4	3
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**				**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	2	2	2	3	2	2	1	2	**2.2**
CO2	3	3	3	2	2	3	2	2	1	1	**2.2**
CO3	3	3	2	2	2	3	3	2	1	1	**2.2**
CO4	3	3	3	2	2	3	3	2	1	1	**2.3**
CO5	3	3	2	2	2	3	3	2	1	2	**2.3**
Mean Overall Score											**2.24 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
6	25UPH63ES03B	**Discipline Specific Elective - 3:** Statistical Mechanics	4	3

Course Objectives
To recognize fundamental ideas of Statistical thermodynamics and its laws
To understand the concepts of Classical and Quantum statistics
To interpret the molecular distribution of gas system based on Maxwell-Boltzmann statistics
To compare the Classical Statistics and Quantum Statistics
To evaluate the Bose-Einstein Statistics and Fermi-Dirac Statistics in the case of photon gas and electron gas respectively

UNIT I: Statistical Thermodynamics (12 Hours)

Macroscopic and Microscopic states - phase space - statistical interpretation of entropy - partition function and thermodynamic properties of systems -partition function for an ideal monoatomic gas: single particle and N-particle partition function, thermodynamic variables - mixing of two different ideal gases - Gibbs Paradox - Sackur Tetrode equation - Law of equipartition of energy - applications-specific heat and limitations.

UNIT II: Classical Statistics of Maxwell Boltzmann (12 Hours)

Maxwell - Boltzmann distribution law - distribution law of molecular speeds - specific heat capacity of gases - partition function of diatomic molecule: specific heat capacity of diatomic molecule, specific heat capacity of Hydrogen, thermodynamic functions of a two-energy levels system - negative temperature.

UNIT III: Quantum Statistics (12 Hours)

Gibbs factor: Carbon monoxide poisoning - Bosons and Fermions - Bose-Einstein distribution law - Fermi Dirac distribution law, degenerate Fermi gases - zero temperature - small non- zero temperature - density of states - Sommerfeld expansion, Blackbody radiation: ultraviolet catastrophe, Planck's distribution, Photons, summing over modes, Planck's spectrum, total energy, entropy of a photon gas, cosmic background radiation, photons escaping through a hole.

UNIT IV: Bose-Einstein Statistics (12 Hours)

Bose-Einstein distribution law, strongly degenerate Boson gas: Bose-Einstein condensation in ultra-cold atomic gases - Thermodynamic functions of photon gas, Applications of Bose - Einstein statistics to Blackbody radiation.

UNIT V: Fermi-Dirac Statistics (12 Hours)

Fermi-Dirac distribution law - ideal quantum gases: particle distribution and internal energy, weakly degenerate quantum systems - completely and strongly degenerate Fermi gas - Fermi energy - electron gas in a metal, application of Fermi-Dirac statistics - thermionic emission, photoelectric emission ultra-cold atomic Fermi gases.

Teaching Methodology	Chalk and talk, PPT, Simulations
Assessment Methods	Seminar, Snap Test, MCQ, Problem solving, Online Quiz.

Books for Study:
1. Garg, S C., Bansal, R. K., & Ghosh, C. K. (2013). *Thermal Physics: with Kinetic Theory, Thermodynamics and Statistical Mechanics,* (2nd Ed.). McGraw Hill Education India.
2. Daniel, V. S. (2014). *An introduction to thermal physics,* (1st Ed.). Pearson Education India.

Unit	Book	Chapters	Sections
I	1	1, 12, 13	12.1, 12.2, 12.3, 12.5, 12.8, 12.9, 13.2, 13.3, 13.4, 1, 4
II	1	12, 13	12.9, 13.4, 13.6, 13.6.1, 13.7
III	2	7	7.1, 7.2, 7.3, 7.4, 7.5, 7.6
IV	1	15	15.1, 15.2, 15.3
V	1	14	14.1, 14.2, 14.3, 14.4, 14.5

Books for Reference:

1. Pathria, R. K., & Heinemann, B. (1996). *Statistical Mechanics,* (2nd Ed.). Oxford University Press.
2. Reif, F. (2008). *Berkeley Physics Course- Statistical Physics*. Tata McGraw-Hill.
3. Sears, F. W., & Salinger, G. L. (1982), *Thermodynamics, Kinetic Theory, and Statistical Thermodynamics*, (3rd Ed.). Addison-Wesley Publishing Company.

Websites and eLearning Sources:

1. https://web.mit.edu/16.unified/www/SPRING/propulsion/notes/node55.html
2. https://openstax.org/books/university-physics-volume-2/pages/2-4-distribution-of-molecular-speeds
3. https://scholar.harvard.edu/files/schwartz/files/10-quantumstatmech.pdf
4. http://hyperphysics.phy-astr.gsu.edu/hbase/quantum/disbe.html
5. http://hyperphysics.phy-astr.gsu.edu/hbase/quantum/disfd.html
   (* subject to availability - not to be used for exam purpose)

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, the students will be able to	**Cognitive Levels (K - Level)**
CO1	Acquire the knowledge about macroscopic and microscopic systems with a description of temperature, entropy, and free energy.	**K1**
CO2	Understand the classical statistics and the applications of Maxwell-Boltzmann distributions.	**K2**
CO3	Apply the quantum statistics to photon gas and electron gas.	**K3**
CO4	Analysis the strength and limitations of the different microscopic models and be able to compare different microscopic models.	**K4**
CO5	Evaluate weakly degenerate quantum systems, completely and strongly degenerate Fermi gas.	**K5**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
6	**25UPH63ES03B**		**Discipline Specific Elective - 3:** Statistical Mechanics							**4**	**3**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	2	2	3	2	3	3	2	2	1	**2.3**
CO2	2	3	2	3	2	3	3	2	3	1	**2.4**
CO3	3	2	2	3	2	3	3	3	2	1	**2.4**
CO4	3	3	2	3	2	2	2	3	2	1	**2.2**
CO5	3	2	2	2	2	3	3	2	2	1	**2.2**
Mean Overall Score											**2.3 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
6	25UPH63ES04A	**Discipline Specific Elective - 4:** Sensors, Transducers and IoT	4	3

Course Objectives
To describe the principles of sensors, transducers and IoT
To understand the principle and working of sensors, transducers and IoT
To apply the basic working characteristics of sensor and transducer in different measuring applications
To analyse the performance of sensors and transducers in IoT applications
To evaluate the working of IoT applications

UNIT I: Analog and Digital Sensor (12 Hours)

Resistive - Capacitive - Voltage-Generating - Hall effect Sensor - LVDT - Load cell - Ionizing Radiation Sensors - Electrochemical Sensors - Mechano-Optical Sensors - Temperature sensor.

UNIT II: Strain, Pressure, Position, Distance and Motion Transducers (12 Hours)

Accelerometer - Magnetometer - Gyro Sensor - Pressure Sensor - Rotation - Smart sensor - Sound.

UNIT III: Sensor, Transducer Application Circuit Design (12 Hours)

Volt, Current, Resistance, magnetic Field, Distance, Position, Temperature meters.

UNIT IV: IoT Architecture and Platforms (12 Hours)

Internet of Things - Importance - Architecture - IoT data - MQTT protocols - Security - Applications.

UNIT V: IoT Weather Forecasting Station - Case Study (12 Hours)

Temperature and humidity by using the DHT11 sensor - Wind speed using an Anemometer - Light intensity using an LDR - Carbon monoxide levels in the air using MQ7 - Soil moisture using Hygrometer - Ultrasonic sensor for rainwater level - Raindrop sensor for detecting rainfall or snow fall - System Architecture.

Teaching Methodology	Chalk and talk, PPT, Simulations
Assessment Methods	Seminar, Snap Test, MCQ, Problem solving, Online Quiz.

Books for Study:
1. Usher, M. J., & Keating, D. A. (1996). *Sensors and Transducers, (*2nd Ed.). Palgrave Macmillan.
2. Serpanos, D., & Wolf, M. (2018) *Internet of Things (IoT) Systems, (*1st Ed.). Springer International Publishing.
3. Text Prepared by Department.

Unit	Book	Chapters	Sections
I	1	1, 2, 3, 5, 6	1.3-1.6, 2.2, 2.5, 3.2, 5.2, 5.3, 5.4, 6.2, 7.2
II	1	11	Relevant sections
III	1	8	Relevant sections
IV	2	1, 2, 5	1.1-1.6, 2.1-2.6, 5.1-5.6
V	3	All	

Books for Reference
1. Sinclair, I. (2000). *Sensors and Transducers,* (3rd Ed.). Newnes.
2. Toronto, B. S. L. (2000). *Sensors & Transducer*. IFSA Publishing.

Websites and eLearning Sources:
1. https://www.electronics-tutorials.ws/io/io_1.html
2. https://www.variohm.com/news-media/technical-blog-archive/difference-between-asensor-and-a-transducer
3. https://internetofthingsagenda.techtarget.com/definition/Internet-of-Things-IoT
   (* subject to availability - not to be used for exam purpose)

Course Outcomes

CO No.	CO-Statements On successful completion of this course, the students will be able to	Cognitive Levels (K - Level)
CO1	Describe and discuss the analog and digital sensors, its applications, IOT Architecture and Platforms.	**K1**
CO2	Classify the sensors and transducers and identify its applications.	**K2**
CO3	List various sensors and use them to identify different physical parameters.	**K3**
CO4	Assess the global need of the IoT system and recommend solutions by designing the circuits.	**K4**
CO5	Find suitable sensors and transducers, and evaluate the IoT projects.	**K5**

Relationship Matrix

Semester	Course Code	Title of the Course		Hours	Credits
6	**25UPH63ES04A**	**Discipline Specific Elective - 4:** Sensors, Transducers and IoT		**4**	**3**

Course Outcomes	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	3	2	2	3	3	2	2	2	**2.5**
CO2	3	3	2	2	2	3	3	3	3	2	**2.6**
CO3	3	3	2	2	2	3	3	3	2	2	**2.5**
CO4	3	3	2	2	2	3	3	3	2	2	**2.5**
CO5	3	3	2	2	2	3	3	3	2	2	**2.5**
									Mean Overall Score		**2.52 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
6	25UPH63ES04B	**Discipline Specific Elective - 4:** Embedded System and Microcontroller	4	3

Course Objectives
To recognize the structure of C language, AVR microcontroller and Arduino programming
To understand the basics of C language, microcontroller and programming
To apply the programming language and microcontroller to in embedded system for various applications
To analyse the performance of embedded systems of simple applications
To evaluate the need of embedded systems for automation

UNIT I: C Language (12 Hours)

Structure of C language - C character set - constants - keywords - variables - data types and sizes - Arithmetic operators - relational operators - logical operators - assignment operators - increment and decrement operators - conditional operator - bitwise operators - special operators - arithmetic expressions - evaluation of expressions - precedence of arithmetic operators - variable declaration - labels - statements - input functions - output functions - formatted input/output - Unconditional control - bidirectional conditional control - multi conditional control - loop control structures - Arrays - Functions - simple programs.

UNIT II: The AVR Microcontroller (12 Hours)

AVR Atmega328P - Features - Block diagram - architecture - CPU core - ALU - Status register - General purpose register - Stack pointer - Instruction execution timing - Reset and Interrupt handling - AVR memories - In-System Reprogrammable Flash Program Memory - SRAM Data Memory - EEPROM Data Memory - I/O Memory - Register Description - Fuse bits.

UNIT III: Arduino IDE and AVR Programming (12 Hours)

Embedded System - Boot Loader - Arduino IDE - Installing IDE - Description - Commands - LOAD - interfacing and programming LCD, Keypad.

UNIT IV: AVR Peripheral Programming (12 Hours)

Analog Comparator - ADC - Interrupts - Timers - Volt, measurement - light intensity measurement - counter using timer/counter.

UNIT V: Communication Protocols (12 Hours)

SPI - Serial Peripheral Interface - USART - 2-wire Serial Interface (I2C) - Simple programs.

Teaching Methodology	Chalk and talk, PPT, Simulations
Assessment Methods	Seminar, Snap Test, MCQ, Problem solving, Online Quiz.

Books for Study:
1. (2016). *The C Programming Language*. Easy Programming Publisher
2. (2019). *ATmega328P DATASHEET*.Text Prepared by the Department (Arduino Reference)

Unit	Book	Chapters	Sections
I	1	2-9	All
II	2	1-5	All
III	3	1	All
IV	3	2	All
V	3	3	All

Books for Reference:
1. Mazidi, M.A., Naimi, S., & Naimi, S., (2012), *The AVR Microcontroller and Embedded System*. Pearson Prentice Hall.

Websites and eLearning Sources:
1. https://www.arduino.cc/

2. https://www.totalphase.com/blog/2020/12/differences-between-embedded-system-vsmicrocontroller/
3. https://www.tutorialspoint.com/embedded_systems/es_microcontroller.htm
(* subject to availability - not to be used for exam purpose)

	Course Outcomes	
	CO-Statements	**Cognitive Levels (K-Level)**
CO No.	On successful completion of this course, the students will be able to	
CO1	Acquire the knowledge on fundamentals of c-programming and explain C programs for embedded systems and microcontrollers	**K1**
CO2	Predict the automatic solutions and complete the embedded system for day-to-day activities.	**K2**
CO3	Identify the suitable microcontroller along with appropriate interfacing circuits and use the same for an application with C program.	**K3**
CO4	Assess the global need of the embedded system and recommend solutions by inventing the circuits.	**K4**
CO5	Select the features of microcontrollers and evaluate the embedded system for social needs.	**K5**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
6	**25UPH63ES04B**		**Discipline Specific Elective - 4:** Embedded System and Microcontroller							**4**	**3**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	3	2	2	3	3	3	3	2	**2.7**
CO2	3	3	3	2	2	3	3	3	3	2	**2.7**
CO3	3	3	3	2	2	3	3	3	3	2	**2.7**
CO4	3	3	2	2	2	3	3	3	3	2	**2.6**
CO5	3	3	2	2	2	3	3	3	3	2	**2.6**
										Mean Overall Score	**2.66 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
6	25UPH64OE02A	**Open Elective – 2:** Laser Technology and its Application	4	2

Course Objectives
To recapture the basic principles of laser
To compare the different types of lasers
To implement the laser on industrial, communication and medical fields.
To explain the construction and applications of lasers.

UNIT I: Fundamentals of Laser (12 Hours)

Absorption and emission of light - spontaneous emission, stimulated emission - Einstein's relation - Condition for light amplification - Population inversion - Pumping methods - Active medium - Metastable states – Laser Beam characteristics.

UNIT II: Production of Laser (12 Hours)

Classification of LASERs - solid state Lasers - Ruby Laser - Nd: YAG Laser - Fiber Lasers – Gas Lasers - Helium - Neon Laser - Argon Laser - CO_2 Laser - Tunable dye Lasers - Semiconductor Lasers.

UNIT III: Industrial Applications of Laser (12 Hours)

Lasers in material processing - The surface treatments - Drilling - Cutting - Welding - Heat treating - Lasers in Electronics industry - Lasers in nuclear energy - Holography - Recording and reconstruction of hologram.

UNIT IV: Laser in Communication (12 Hours)

Optical data storage - Optical fibre communication - Types of optical fiber - Block diagram of Laser communication system - advantages of fibre optic communication - Optical computer - LASER Rangers - LIDAR.

UNIT V: Laser in Medicine (12 Hours)

LASER in Medicines and Surgery - LASER in ophthalmology - LASER endoscopy - photocoagulation - LASER safety and hazard.

Teaching Methodology	Chalk and talk, PPT, Simulations
Assessment Methods	Seminar, Snap Test, MCQ, Problem solving, Online Quiz.

Books for Study:
1. Avadhanulu M.N. Hemne P.S, (2012), *An introduction to LASERS theory and applications*, (Second Edition). S. Chand & Company, New Delhi.
2. Subrahmanyam N., Brijlal, M. N. Avadhanulu, (2006), *A Textbook of Optics*, (23rd revised Edition), S. Chand & Company, New Delhi.

Unit	Book	Chapters	Sections
I	1 2	1, 22	1.18-1.21, 1.22-1.24, 1.25, 1.27, 1.29, 1.30, 1.31 22.19
II	1	2	2.2, 2.3, 2.3.1, 2.3.2, 2.3.5, 2.4, 2.4.1, 2.4.2.1, 2.4.3, 2.5, 2.7
III	1 2	5, 23	5.3, 5.3.1, 5.3.2, 5.3.3, 5.2.3, 5.3.5, 5.4, 5.20 23.2
IV	1 2	5, 24	5.21.3, 5.22, 5.23, 5.17, 5.1.6.2 24.8, 24.13
V	1	5	5.6, 5.7, 5.8, 5.9

Books for Reference:
1. Nambiyar. K.R. (2004), *LASER: Principles, Types and Applications*, (First Edition), New Age International Publishers.
2. Nagabhushana. S. Sathyanarayana. N. (2013), *Lasers and optical instrumentation*, (Reprint) I . K International Publishing House Pvt.Ltd.

Websites and eLearning Sources:

1. https://www.eriesd.org/cms/lib/PA01001942/Centricity/Domain/691/Science-Resource- Guide.pdf
2. https://www.fisica.net/optica/Laser-and-its Applications.pdf
   (* subject to availability - not to be used for exam purpose)

Course Outcomes		
	CO-Statements	**Cognitive**
CO No.	On successful completion of this course, the students will be able to	**Levels (K-Level)**
CO1	Retrieve the fundamentals of light and their properties.	**K1**
CO2	Associate various lasers and categorize modes of their operation.	**K2**
CO3	Describe and execute the obtained knowledge about lasers in various technological and industrial applications	**K3**
CO4	Correlate the different types of lasers, Check the work ethics and work place safety.	**K4**
CO5		**K5**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
6	**25UPH64OE02A**		**Open Elective – 2:** Laser Technology and its Applications							**4**	**2**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	2	3	2	1	3	3	3	2	1	**2.3**
CO2	3	3	3	2	1	3	3	2	2	1	**2.3**
CO3	3	3	3	2	1	3	2	3	2	1	**2.3**
CO4	3	3	2	2	1	3	3	3	2	1	**2.3**
CO5	3	3	3	2	1	3	3	2	2	1	**2.3**
									Mean Overall Score		**2.3 (High)**

Semester	Course Code	Title of the Course	Hours/Week	Credits
6	25UPH64OE02B	**Open Elective – 2:** Physics of Earth	4	2

Course Objectives
To retrieve the idea of earth's shape, the concepts of heat, acceleration, currents, magnetic field and atmosphere.
To distinguish the earth's layers, to consider the heat transfer in core and mantle, to interpret the gravitation, to describe the electric and magnetic fields of earth and to interpret the geologic cycling of water.
To measure the earthquakes, to estimate the earth's age, to foresee the temperatures in core and mantle.
To analyse the plate tectonic system, volcanos, earth's rotation, geodynamic and gravitational potential.
To explain the physical characteristics and geological functions of earth through scientific method.

UNIT I: The Earth System (12 Hours)

The scientific method - Geology as a science - Earth's shape and surface - Earth's density - The Mantle and core - The crust - The inner core Chemical Composition of Earth's Major Layers - The plate tectonic system - Continental drift - seafloor spreading - divergent Boundaries - Convergent Boundaries - Seismic Waves - measuring earthquakes - Exploring Earth's Interior with Seismic Waves - Layering and Composition of Earth's Interior.

UNIT II: Geothermic and Geochronology (12 Hours)

Geothermics: Earth's Internal Temperature: Heat flow through Earth's interior - Conduction through the Lithosphere - Convection through the Mantle and the Core - Temperature inside the Earth - Volcanism - Volcanoes and its types - Geochronology: Estimating the Earth's age - Cooling of the Sun - cooling of the Earth - Increase of the Earth - Moon separation - Oceanic salinity and Sedimentary accumulation

UNIT III: Geomechanics (12 Hours)

Kepler's Law of planetary motion - Orbital parameters - Earth's Size and Earth's shape - Gravitation: The law of universal gravitation - Gravitational acceleration – Gravitational potential - The Earth's Rotation: Centripetal and centrifugal acceleration - Changes in the earth rotation.

UNIT IV: Geoelectricity and Geomagnetism (12 Hours)

Geoelectricity: Electrical properties of the Earth - Electrical surveying - Natural potentials and currents - self potential - Telluric currents - Electrical conductivity in the Earth - Geodynamo - Geomagnetism: Introduction - The magnetic field of external origin - The magnetic field of internal origin.

UNIT V: Ground Water and Climate System (12 Hours)

Components of the climate system: Atmosphere – hydrosphere – cryosphere - lithosphere and biosphere. The greenhouse effect: A Planet without Greenhouse Gases - Earth's Greenhouse Atmosphere - Geologic cycling of water - Hydrology of ground water - Hydrology and climate.

Teaching Methodology	Chalk and talk, PPT, Simulations
Assessment Methods	Seminar, Snap Test, MCQ, Problem solving, Online Quiz.

Books for Study:

1. Grotzinger, J.P. (2014), *Understanding Earth* (7th Edition), W.H. Freeman and Company.
2. William Lowrie (2007), *Fundamentals of Geophysics* (2nd Edition), Cambridge University Press.
3. Monroe, J.S. (2007), *Physical Geology* (6th Edition), Thomson Corporation.

Unit	Book	Chapters	Sections
I	1	1, 2, 13, 14	Relevant topics in page No. 4-17, 28-38, 356-361, 383-390.
II	1	14	Relevant topics in page No. 390-394.
	2	4	4.1.1, 4.1.2
	3	5	5.1, 5.2, 5.3
III	1	1	Relevant topics in page No. 17-18.
	2	4,5	4.3.3.1, 4.3.4, 4.3.7, 5.4.1, 5.4.3, 5.4.4
IV	2	1, 2	1.1.1, 2.1, 2.2, 2.3
V	1	15, 17	Relevant topics in page No. 407-414, 469-488.

Books for Reference:
1. Stacey, F.D. and Davis, P.M. (2008), *Physics of the Earth* (4th Edition), Cambridge University Press.
2. Mussett, A.E. (2000), *Looking into the Earth* 1st Edition), Cambridge University Press.

Websites and eLearning Sources:
1. https://www.visionlearning.com/en/library/Earth-Science/24/Earth-Structure/69/reading
2. https://serc.carleton.edu/NAGTWorkshops/geophysics/index.html
   (* subject to availability - not to be used for exam purpose)

	Course Outcomes	
CO No.	**CO-Statements** On successful completion of this course, the students will be able to	**Cognitive Levels (K-Level)**
CO1	Envisage and frame the whole earth structure with its subsystem's atmosphere, biosphere, hydrosphere, lithosphere, mantle and core.	**K1**
CO2	Explore their physical characteristics and geological functions of macro earth in scientific method.	**K2**
CO3	Estimate the earth's age and temperature by applying the laws of thermodynamics	**K3**
CO4	Understand the gravity, electric and magnetic fields of the earth	**K4**
CO5	Predict the events like earthquake, landslide, Valona through geophysical techniques and to step to save life.	**K5**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
6	25UPH64OE02B		Open Elective – 2: Physics of Earth							4	2
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	2	3	2	2	2	2	2	2	3	**2.3**
CO2	2	2	1	2	3	3	2	3	2	2	**2.2**
CO3	3	3	3	2	3	2	2	2	2	2	**2.4**
CO4	3	2	2	2	3	2	2	3	2	2	**2.3**
CO5	2	3	2	2	2	3	2	2	3	2	**2.3**
									Mean Overall Score		**2.3 (High)**