B.Sc. PHYSICS

LOCF SYLLABUS – 2021

SCHOOLS OF EXCELLENCE

WITH CHOICE BASED CREDIT SYSTEM (CBCS)

DEPARTMENT OF PHYSICS
SCHOOL OF PHYSICAL SCIENCES
ST.JOSEPH'S COLLEGE (AUTONOMOUS)
Special Heritage Status Awarded by UGC
Accredited at A^{++} Grade (IV Cycle) by NAAC
College with Potential for Excellence by UGC
DBT-STAR & DST-FIST Sponsored College
Tiruchirappalli - 620 002, Tamil Nadu, India

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

St. Joseph's College (Autonomous), a pioneer in higher education in India, strives to maintain and uphold the academic excellence. In this regard, it has initiated the implementation of five "Schools of Excellence" from the academic year 2014 – 15, to meet and excel the challenges of the 21st century.

Each School integrates related disciplines under one roof. The school system enhances the optimal utilization of both human and infrastructural resources. It also enhances academic mobility and enriches employability. The School system preserves the identity, autonomy and uniqueness of every department and reinforces Student centric curriculum designing and skill imparting. These five schools adhere to achieve and accomplish the following objectives.

Optimal utilization of resources both human and material for the academic flexibility leading to excellence.

Students experience or enjoy their choice of courses and credits for their horizontal mobility.

The existing curricular structure as specified by TANSCHE and other higher educational institutions facilitate the Credit-Transfer Across the Disciplines (CTAD) - a uniqueness of the choice based credit system.

Human excellence in specialized areas

Thrust in internship and / or projects as a lead towards research and

The multi-discipline nature of the School System caters to the needs of stake-holders, especially the employers.

Credit system:

Weightage to a course is given in relation to the hours assigned for the course. Generally one hour per week has one credit. For viability and conformity to the guidelines credits are awarded irrespective of the teaching hours. The credits and hours of each course of a programme is given in the table of Programme Pattern. However, there could be some flexibility because of practical, field visits, tutorials and nature of project work.

For UG courses, a student must earn a minimum of 130 credits as mentioned in the programme pattern table. The total number of minimum courses offered by the Department is given in the Programme Structure.

OUTCOME-BASED EDUCATION (OBE)
LEARNING OUTCOME-BASED CURRICULUM FRAMEWORK (LOCF)

OBE is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience, each student should have achieved the goal. There is no single specified style of teaching or assessment in OBE; instead, classes, opportunities and assessments should all help the students achieve the specific outcomes

Outcome Based Education, as the name suggests depends on Outcomes and not Inputs. The outcomes in OBE are expected to be measurable. In fact each Educational Institute can state its own outcomes. The ultimate goal is to ensure that there is a correlation between education and employability

Outcome –Based Education (OBE): is a student-centric teaching and learning methodology in which the course delivery, assessment are planned to achieve, stated objectives and outcomes. It focuses on measuring student performance i.e. outcomes at different levels.

Some important aspects of the Outcome Based Education

Course: is defined as a theory, practical or theory cum practical subject studied in a semester.

Course Outcomes (COs): are statements that describe significant and essential learning that learners have achieved, and can reliably demonstrate at the end of a course. Generally three or more course outcomes may be specified for each course based on its weightage.

Programme: is defined as the specialization or discipline of a Degree.

Programme Outcomes (POs): Programme outcomes are narrower statements that describe what students are expected to be able to do by the time of graduation. POs are expected to be aligned closely with Graduate Attributes.

Programme Specific Outcomes (PSOs):

PSOs are what the students should be able to do at the time of graduation with reference to a specific discipline.

Programme Educational Objectives (PEOs): The PEOs of a programme are the statements that describe the expected achievement of graduates in their career, and also in particular, what the graduates are expected to perform and achieve during the first few years after Graduation.

Some important terminologies repeatedly used in LOCF.

Core Courses (CC)

A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course. These are the courses which provide basic understanding of their main discipline. In order to maintain a requisite standard certain core courses must be included in an academic program. This helps in providing a universal recognition to the said academic program.

Discipline Specific Elective Courses (DSE)

Elective course may be offered by the main discipline/subject of study is referred to as 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.

DSE: 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.

One DSE Course may be offered as interdisciplinary course among the departments in a School (Common Core Course) at the PG level.

Generic Elective Courses

An elective course chosen generally from an **unrelated discipline/subject,** with an intention to seek exposure is called a Generic Elective.

Generic Elective courses are designed for the students of **other disciplines**. Thus, as per the CBCS policy, the students pursuing particular disciplines would have to opt Generic Elective courses offered by other disciplines, as per the basket of courses offered by the college. The scope of the Generic Elective (GE) Courses is positively related to the diversity of disciplines in which programmes are being offered by the college.

Two GE Courses are offered one each in semesters V and VI.

(open to the students of other Departments)

The Ability Enhancement Courses (AEC)

"AECC" are the courses based upon the content that leads to Knowledge enhancement; Communicative English, Environmental Science. These are mandatory for all disciplines.

AECC-1: Communicative English: It is a 4 credits compulsory course offered by the Department of English in the first semester of the Degree Programme, Classes are conducted outside the regular class hours.

AECC-2: Environmental Science: is a 2 credit course offered as a compulsory course during the second semester by the Department of Human Excellence.

Skill Enhancement Courses (SECs)

These courses focus on developing skills or proficiencies in the student, and aim at providing hands-on training. Skill enhancement courses can be opted by the students of any other discipline, but are highly suitable for students pursuing their academic programme.

These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge**.**

There are four courses under this category

SEC-1 is offered in semester **III as a course** Within the Department **(WD)** it is More of main discipline related skills.

SEC-2is offered in semester **IV as a course** Between schools **(BS)** Offered to students of other schools (Except the school offering the course)

SEC-3 is offered in semester **V as** a compulsory course on Soft Skills offered by the Department of Human Excellence, common to all the students of UG programme.

SEC-4 is offered in semester **VI** as a course **Within School (WS)** Open to all the students within the same school (including the students of the parent department)

Self–paced Learning: It is a course for two credits. It is offered to promote the habit of independent/self learning of Students. Since it is a two credit course, syllabus is framed to complete within 45 hours. It is not taught in the regular working hours.

Field Study/Industrial Visit/Case Study: It has to be completed during the fifth semester of the degree programme. Credit for this course will be entered in the fifth semester's marks statement.

Internship: Students must complete internship during summer holidays after the fourth semester. They have to submit a report of internship training with the necessary documents and have to appear for a viva-voce examination during fifth semester. Credit for internship will be entered in the fifth semester's mark statement.

Comprehensive Examinations: 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: In order to facilitate the students, gaining knowledge/skills by attending online courses MOOC, credits are awarded as extra credits, the extra credit are at three semesters after verifying the course completion certificates. According to the guidelines of UGC, the students are encouraged to avail this option of enriching their knowledge by enrolling themselves in the Massive Open Online Courses (MOOC) provided by various portals such as SWAYAM, NPTEL and etc.

Undergraduate Programme:

Programme Pattern:

The Under Graduate degree programme consists of **FIVE** vital components. They are as follows:

Part -I : Languages (Tamil / Hindi / French / Sanskrit)

Part-II : General English

Part-III : Core Course (Theory, Practicals, Discipline Specific Electives, Compulsory and Optional Allied courses, Project, Self paced courses, Internship , Comprehensive Examinations and field visit /industrial visit/Case Study)

Part-IV: Value Education, Ability Enhancement Courses, Skill Enhancement Courses/ Soft Skills , Generic Electives/ National Cadet Corps etc.

Part-V: Outreach Programme (SHEPHERD).

Ability Enhancement Courses (AEC): There are two Ability Enhancement courses viz AECC and SEC.

Value Education Courses:

There are four courses offered in the first four semesters for the First & Second UG Programme.

Course Coding

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

21	UXX	N	N	XX	NN/NNX
Year of Revision	UG Department Code	Semester number	Part specification	Part Category	Running number/with choice

N:- Numeral X :- Alphabet

Part Category

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

GE - General English

CC - Core Theory; CP- Core Practical

WS- Workshop

SP- Self Paced Learning

IS- Internship

FV- Field visit

CE- Comprehensive Examination

PW- Project Work& viva-voce

Electives Courses

ES – Department Specific Electives

EG- Generic Electives

Allied Courses

AC - Allied Compulsory

AO- Allied Optional

EC - Additional Core Courses for Extra Credits (If any)*

Ability Enhancement Courses

AE – Ability Enhancement Compulsory Courses; Bridge Course and Environment Science

SE – Skill Enhancement (WD), (BS), (WS) and Soft skills

VE - Value Education/ Social Ethics/Religious Doctrine

OR – Outreach SHEPHERD & Gender Studies (Outreach)

SU - AICUF / Nature Club / Fine Arts / NCC / NSS /etc. (Service Unit)

CIA AND SEMESTER EXAMINATION

Continuous Internal Assessment (CIA):

Distribution of CIA Marks	
Passing Minimum: 40 Marks	
Library Referencing	5
3 Components	35
Mid-Semester Test	30
End-Semester Test	30
Total CIA	100

MID-SEM & END – SEM TEST

Centralised – Conducted by the office of COE

1. Mid-Sem Test & End-Sem Test: (2 Hours each); will have Objective and Descriptive elements; with the below mentioned question pattern PART-A; PART-B; PART-C and PART D.
2. One of the CIA Component II/III for UG & PG will be of 15 marks and compulsorily a online objective multiple choice question type.
3. The online CIA Component must be conducted by the Department / faculty concerned at a suitable computer centre.
4. The 7 marks of PART-A of Mid-Sem and End-Sem Tests will comprise only: OBJECTIVE MULTIPLE CHOICE QUESTIONS.
5. The number of hours for the 5 marks allotted for Library Referencing/ work would be 30 hours per semester. The marks scored out of 5 will be given to all the courses (Courses) of the Semester.
6. English Composition once a fortnight will form one of the components for UG general English

Duration of Examination must be rational; proportional to teaching hours 90 minute-examination / 50 Marks for courses of 2/3 hours/week (all Part IV UG Courses) 3-hours examination for courses of 4-6 hours/week.

Knowledge levels for assessment of Outcomes based on Blooms Taxonomy

S. No.	Level	Parameter	Description
1	K1	Knowledge/Remembering	It is the ability to remember the previously learned
2	K2	Comprehension/Understanding	The learner explains ideas or concepts
3	K3	Application/Applying	The learner uses information in a new way
4	K4	Analysis/Analysing	The learner distinguishes among different
5	K5	Evaluation/Evaluating	The learner justifies a stand or decision
6	K6	Synthesis /Creating	The learner creates a new product or point of view

WEIGHTAGE of K – LEVELS IN QUESTION PAPER

(Cognitive Level) K- LEVELS	Lower Order Thinking			Higher Order Thinking			Total %
	K1	K2	K3	K4	K5	K6	
SEMESTER EXAMINATIONS	15	20	35	30			**100**
MID / END Semester TESTS	12	20	35	33			**100**

QUESTION PATTERN FOR SEMESTER EXAMINATION	
SECTION	**MARKS**
SECTION–A (No choice ,One Mark) **THREE** questions from each unit **(**15x1 =15)	**15**
SECTION-B (No choice ,2-Marks) **TWO** questions from each unit (10x2 =20)	**20**
SECTION-C (Either/or type) (7- Marks) **ONE** question from each unit (5x7 =35)	**35**
SECTION-D (3 out of 5) (10 Marks) **ONE** question from each unit (3x10 =30)	**30**
Total	**100**

BLUE PRINT OF QUESTION PAPER FOR SEMESTER EXAMINATION							
DURATION: 3. 00 Hours.							**Max Mark : 100**
K- LEVELS / **SECTIONS**	**K1**	**K2**	**K3**	**K4**	**K5**	**K6**	**Total Marks**
SECTION–A (One Mark, No choice) (15x1=15)	15						**15**
SECTION-B (2-Marks, No choice) (10x2=20)		10					**20**
SECTION-C (7- Marks) (Either/or type) (5x7=35)			5				**35**
SECTION-D (10 Marks) (3 out of 5) (3x10=30) Courses having only **K4** levels				3			**30**
Courses having **K4** and **K5** levels **One K5 level question is compulsory**				2	1		
(Courses having **all the 6** cognitive levels **One K5 and K6 level questions can be compulsory**				1	1	1	
Total	**15**	**20**	**35**	**30**			**100**

QUESTION PATTERN FOR MID/END TEST			
SECTIONS			**MARKS**
SECTION–A	(No choice, One Mark)	(7x1 =7)	**7**
SECTION-B	(No choice , 2-Marks)	(6x2 =12)	**12**
SECTION-C	(Either/or type) (7- Marks)	(3x7 =21)	**21**
SECTION-D	(2 out of 3) (10 Marks)	(2x10=20)	**20**
		Total	**60**

BLUE PRINT OF QUESTION PAPER FOR MID/END TEST							
DURATION: 2. 00 Hours.							**Max Mark: 60.**
K- LEVELS / **SECTIONS**	**K1**	**K2**	**K3**	**K4**	**K5**	**K6**	**Total Marks**
SECTION –A (One Mark, No choice) (7 x 1 = 7)	7						**07**
SECTION-B (2-Marks, No choice) (6 x 2 = 12)		6					**12**
SECTION-C (Either/or type) (7- Marks) (3 x 7 =21)			3				**21**
SECTION-D (2 out of 3) (10 Marks) (2x10=20) Courses having only **K4** levels				2			**20**
Courses having **K4** and **K5** levels **One K5 level question is compulsory**				1	1		
Courses having **all the 6** cognitive levels **One K6 level question is compulsory**					1	1	
Total Marks	**07**	**12**	**21**	**20**			**60**
Weightage for 100 %	**12**	**20**	**35**	**33**			**100**

Assessment pattern for two credit courses.

S. No.	Course Title	CIA	Semester Examination	Total Marks
1	Self Paced Learning Course	25 + 25 = 50	50 Marks (MCQ) (COE)	100
2	Comprehensive Examinations	25 +25 = 50	50 Marks (MCQ) (COE)	100
3	Internship	100	--	100
4	Field Visit	100	--	100
5	Ability Enhancement Course (AEC) for PG	50 (Three Components)	50 (COE) (Specific Question Pattern)	100
Assessment Pattern for Courses in Part - IV				
6	Value Education Courses and Environmental Studies	50	50 Marks (For 2.00 hours) (COE)	100
7	Skill Enhancement Courses(SECs)	50 marks (by Course in-charge) 50 Marks (by an External member from the Department)		100
8	SEC: SOFT SKILLS (For UG and PG)	100 (Fully Internal)		100

EVALUATION

GRADING SYSTEM

Once the marks of the CIA and the end-semester examination for each of the courses are available, they will be added and converted as final mark. The marks thus obtained will then 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 (GPA) and Cumulative Grade Point Average (CGPA) respectively. These two are calculated by the following formulae:

$GPA = \frac{\sum_{i=1}^{n} C_i G_i}{\sum_{i=1}^{n} C_i}$	$WAM\,(Weighted\,Average\,Marks) = \frac{\sum_{i=1}^{n} C_i M_i}{\sum_{i=1}^{n} C_i}$
Where, C_i is the Credit earned for the Course i G_i is the Grade Point obtained by the student for the Course i M_i is the marks obtained for the course i and n is the number of Courses **Passed** in that semester.	

CGPA: Average GPA of all the Courses starting from the first semester to the current semester.

CLASSIFICATION OF FINAL RESULTS:

i) For each of the first three parts, there shall be separate classification on the basis of CGPA, as indicated in Table-2.
ii) For the purpose of declaring a candidate to have qualified for the Degree of Bachelor of Arts/Science/Commerce/Management/Literature 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 the all the Five parts of the Prgoramme.
iii) Grade in Part –IV and Part-V shall be shown separately and it shall not be taken into account for classification.
iv) A Pass in SHEPHERD will continue to be mandatory although the marks will not count for the calculation of the CGPA.
v) Absence from an examination shall not be taken an attempt.

Table-1: Grading of the Courses

Marks 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: Final Result

CGPA	Corresponding Grade	Classification of Final Result
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**
5.0 0 to 5.99	**B**	**Above Average**
4.00 to 4.99	**C**	**Average**
Below 4.00	**RA**	**Re-appearance**

Credit based weighted Mark System is adopted for the individual semesters and cumulative semesters in the column 'Marks secured' (for 100)

Declaration of Result

Mr./ MS. _____ has successfully completed the Under Graduate in _____programme. The candidate's Cumulative Grade Point Average (CGPA) in Part – III is _____ and the class secured is _____ by completing the minimum of 130 credits. The candidate has acquired _____ (if any) more credits from SHEPHERD / AICUF/ FINE ARTS / SPORTS & GAMES / NCC / NSS / NATURE CLUB, ETC. The candidate has also acquired _____ (if any) extra credits by attending MOOC courses.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

The Programme Outcomes (POs)/Programme Specific Outcomes(PSOs) are the qualities that must be imbibed in the graduates by the time of completion of their programme. At the end of each programme the PO/PSO assessment in done from the CO attainment of all curriculum components. The POs/PSOs are framed based on the guidelines of LOCF. There are five POs UG programme and five POs for PG programme framed by the college. PSOs are framed by the departments and they are five in numbers.

For each Course, there are five Course Outcomes to be achieved at the end of the course. These Course outcomes are framed to achieve the POs/PSOs. All course outcomes shall have linkage to POs/PSOs in such a way that the strongest relation has the weight 3 and the weakest is 1. This relation is defined by using the following table.

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

Mean Scores of COs $= \frac{\text{Sum of values}}{\text{Total No.of POs \& PSOs}}$		**Mean Overall Score** $= \frac{\text{Sum of Mean Scores}}{\text{Total No.of COs}}$	
Result	**Mean Overall Score**	**< 1.2**	**# Low**
		≥ 1.2 and < 2.2	**# Medium**
		≥ 2.2	**# High**

If the mean overall score is low then the course in charge has to redesign the particular course content so as to achieve high level mean overall score.

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 apply the concepts learnt, 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 and communicative skills will be able to contribute effectively as team members.
4. Graduates will be able to read the signs of the times analyze and provide practical solutions.
5. Graduates imbibed with ethical values and social concern will be able to appreciate cultural diversity, promote social harmony and ensure sustainable environment.

Programme Specific Objectives (PSOs)

1. Acquired academic excellence with an aptitude for higher studies and research.
2. Gained knowledge about properties of different matter and its application for developing technology to the problems related to the society.
3. Analysed the applications to the problems in Physics through experimental and theoretical means.
4. Acquired 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	**Sem.**	**Specification**	**No. of Courses**	**No. of Hours**	**Credits**	**Total Credits**
I	**1-IV**	**Languages** **(Tamil / Hindi/ French/ Sanskrit)**	**4**	**16**	**12**	**12**
II	**I-IV**	**General English**	**4**	**20**	**12**	**12**
III	**I –VI**	**Core course : Theory** **Core course : Practical**	**10** **5**	**74**	**45**	**82**
	I-IV	**Core course- Allied /(Practical)**	**4 / (2)**	**24**	**16**	
	V-VI	**Discipline Specific Elective**	**4**	**20**	**12**	
	VI	**Project Work**	**1**		**2**	
	V	**Self-paced learning –** to promote independent learning Syllabus for 5 units 1 Staff in charge to conduct CIA outside regular class hours	**1**	**--**	**2**	
	V	**Field study/ Industrial visit/ Case study** (Submit a detailed report- with photos- staff in charge)	**1**		**1**	
	V	**Internship (3 weeks during summer holidays after semester iv) credit will be entered in the 5th Sem. Mark sheet**	**1**	**-**	**2**	
	VI	**Comprehensive Exam** **(Syllabus must be given)**	**1**	**--**	**2**	
	II,III ,V	**Extra Credit courses (MOOC)**	**(3)**	**--**	**(6)**	**(6)**
IV	**V-VI**	**Generic Elective**	**2**	**8**	**6**	20
	I	**AECC-1 Communicative English**	**1**	**--**	**4**	
	II	**AECC-2 Environmental studies**	**1**	**2**	**2**	
	III	**SEC -1 Within Dept. (WD)**	**1**	**2**	**1**	
	IV	**SEC -2 Between Schools (BS)**	**1**	2	1	
	V	**SEC -3 Soft skill**	**1**	2	1	
	VI	**SEC -4 within school (WS)**	**1**	2	1	
	I-IV	**Value Education**	**4**	**8**	**4**	
V	**I-V**	**Outreach Programme /NCC**	**-**	**-**	**4**	4
		Total		**180**	**130(6)**	**130(6)**

B.Sc. PHYSICS								
PROGRAMME PATTERN								
Course Details						**Scheme of Exams**		
Sem	**Part**	**Code**	**Course Title**	**Hrs**	**Cr**	**CIA**	**SE**	**Final**
I	1	21UTA11GL01	General Tamil - I	4	3	100	100	100
		21UFR11GL01	French-I					
		21UHI11GL01	Hindi-I					
		21USA11GL01	Sanskrit-I					
	2	21UEN12GE01	General English -I	5	3	100	100	100
	3	21UPH13CC01	Properties of Matter and Sound	7	6	100	100	100
	3	@	Physics Practical – I	3	--			
		@	Basic Workshop Practice	3	-			
	3	21UPH13AC01	**Allied:** Mathematics for Physics– I	6	4	100	100	100
	4	21UEN14AE01	**AECC-1:** Communicative English	(6)	4	100	-	100
	4	21UHE14VE01	Essentials of Humanity	2	1	50	50	100
			Total	**30**	**21**			
II	1	21UTA21GL02	General Tamil - II	4	3	100	100	100
		21UFR21GL02	French-II					
		21UHI21GL02	Hindi-II					
		21USA21GL02	Sanskrit-II					
	2	21UEN22GE02	General English -II	5	3	100	100	100
	3	21UPH23CC02	Mechanics	*5*	3	100	100	100
	3	21UPH23CP01	Physics Practical – I	*3*	2	100	100	100
		21UPH23WS01	Basic Workshop Practice	*3*	2	100	-	100
	3	21UPH23AC02	**Allied :** Mathematics for Physics– II	6	4	100	100	100
	4	21UHE24AE02	**AECC-2**: Environmental studies	2	2	50	50	50
		21UHE24VE02	Techniques of Social Analysis: Fundamentals of Human Rights	2	1	50	50	50
			Extra Credit Courses (MOOC)-1	-	(2)			
			Total	**30**	**20(2)**			
III	1	21UTA31GL03	General Tamil - III	4	3	100	100	100
		21UFR31GL03	French-III					
		21UHI31GL03	Hindi-III					
		21USA31GL03	Sanskrit-III					
	2	21UEN32GE03	General English -III	5	3	100	100	100
	3	21UPH33CC03	Mathematical Physics - I	4	4	100	100	100
	3	21UPH33CC04	Elctromagnetism	4	3	100	100	100
	3	@	Physics Practical – II	3	-			
	3	21UPH33AO03A	**Allied Optional** : Chemistry –I	4	3	100	100	100
		21UPH33AO03B	**Allied Optional** : Computer Science-I					
		@	**Allied: Practical**	2	*	*		
	4	21UPH34SE01A	**SEC -1 (WD):** Solar Power System Installation and Maintenance	2	1	100	-	100
		21UPH34SE01B	**SEC -1 (WD):** Techniques of Problem Solving in Physics					
	4	21UHE34VE03A	Professional Ethics–I: Social Ethics - I	2	1	50	50	50
		21UHE34VE03B	Professional Ethics -I: Religious Doctrine-I					
			Extra Credit Courses (MOOC)-2	-	(2)			
			Total	**30**	**18 (2)**			
IV	1	21UTA41GL04B	Scientific Tamil (SBS, SPS,SCS)	4	3	100	100	100
		21UFR41GL04	French- IV					
		21UHI41GL04	Hindi- IV					
		21USA41GL04	Sanskrit- IV					
	2	21UEN42GE04	General English - IV	5	3	100	100	100

	3	21UPH43CC05	Mathematical Physics - II	4	4	100	100	100
	3	21UPH43CC06	Thermal Physics	4	3	100	100	100
	3	21UPH43CP02	Physics Practical – II	3	2	100	100	100
	3	21UPH43AO04A	**Allied Optional** : Chemistry –II	4	3	100	100	100
		21UPH43AO04B	**Allied Optional** : Computer Science-II					
		21UPH43AP01A	**Allied Optional** : Chemistry Practical	2	2	100	100	100
		21UPH43AP01B	**Allied Optional** : Computer Science Practical					
	4	21UPH44SE02A	**SEC -2 (BS):** Weather Physics	2	1	100	-	100
		21UPH44SE02B	**SEC -2 (BS):** Electrical Wiring					
	4	21UHE44VE04A	Professional Ethics–II: Social Ethics - II	2	1	50	50	50
		21UHE44VE04B	Professional Ethics -II: Religious Doctrine-II					
			Total	**30**	**22**			
V	3	21UPH53CC07	Optics	4	2	100	100	100
	3	21UPH53CC08	Concepts of Modern Physics	4	2	100	100	100
	3	21UPH53CP03	Physics Practical – III	6	4	100	100	100
	3	21UPH53ES01A	**DSE-1:** Analog and Digital Electronics	5	3	100	100	100
		21UPH53ES01B	**DSE-1:** Design of Analog and Digital Circuits					
	3	21UPH53ES02A	**DSE-2:** Classical Mechanics	5	3	100	100	100
		21UPH53ES02B	**DSE-2:** Solid State Physics					
	3	21UPH53IS01	Internship	-	2	100	-	100
	3	21UPH53SP01	**Self-paced learning:** Astronomy	-	2	50	50	50
	3	21UPH53FV01	Field study/ Industrial visit/ Case study	-	1	100	-	100
	4	21USS54SE03	**SEC -3:** Soft Skills	2	1	100	-	100
	4	21UPH54EG01A	**GE-1:** Everyday Physics	4	3	100	100	100
		21UPH54EG 01B	**GE-1:** Renewable Energy Physics					
			Extra Credit Courses (MOOC)-3	-	(2)			
			Total	**30**	**23(2)**			
VI	3	21UPH63CC09	Quantum Mechanics	4	2	100	100	100
	3	21UPH63CC10	Atomic, Nuclear and Particle Physics	4	2	100	100	100
	3	21UPH63CP04	Physics Practical – IV	6	4	100	100	100
	3	21UPH63ES03A	**DSE-3:**Statistical Mechanics	5	3	100	100	100
		21UPH63ES03B	**DSE-3:** Spectroscopy and Laser					
	3	21UPH63ES04A	**DSE-4:** Embedded System and Microcontroller	5	3	100	100	100
		21UPH63ES04B	**DSE-4:** Sensors, Transducers and IoT					
	3	21UPH63PW01	Project Work and Viva Voce	-	2	100	100	100
	3	21UPH63CE01	Comprehensive Exam	-	2	50	50	50
	4	21UPH64SE04A	**SEC -4 (WS):**Radiation Physics and Safety	2	1	100	-	100
		21UPH64SE04B	**SEC -4 (WS):** Non Destructive Testing					
	4	21UPH64EG02A	**GE-2:**Laser Technology and its Application	4	3	100	100	100
		21UPH64EG02B	**GE-2:** Physics of Earth					
			Total	**30**	**22**			
	1 - 5	21UCW65OR01	Outreach Programme (SHEPHERD)		4			
			Total	**180**	**130(6)**			

@ Practical Exam will be conducted at even semester

For the courses with scheme of Exam 50 in CIA and SE will be converted to 100.

SEC-2: BETWEEN SCHOOL 4th Semester							
Between schools (BS)- Offered to students of other schools (Except the school offering the course)							
Course Details					Scheme of Exams		
Offering Department	**Course Code**	**Course Title**	**Hr**	**Cr**	**CIA**	**SE**	**Final**
SBS							
Botany	21UBO44SE02	Mushroom Technology	2	1	100	-	100
SCS							
Computer Science	21UCS44SE02	Data Analysis Using Spreadsheet	2	1	100	-	100
Mathematics	21UMA44SE02	Numerical Ability	2	1	100	-	100
Statistics	21UST44SE02	Quantitative Methods	2	1	100	-	100
Information Technology	21UBC44SE02	Digital Artwork	2	1	100	-	100
SLAC							
English	21UEN44SE02	English for Competitive Examinations	2	1	100	-	100
History	21UHS44SE02	Historical Monuments in Tiruchirappalli	2	1	100	-	100
Tamil	21UTA44SE02A	மேடைப் பேச்சுக்கலை	2	1	100	-	100
Tamil	21UTA44SE02	திரைப்படத் திறனாய்வும் குறும்பட உருவாக்கம்	2	1	100	-	100
SMS							
Commerce	21UCO44SE02A	Personal Finance Management	2	1	100	-	100
Commerce	21UCO44SE02B	Marketing Skills	2	1	100	-	100
Commerce	21UCO44SE02C	Event Planning and Management	2	1	100	-	100
Economics	21UEC44SE02	Financial Economics	2	1	100	-	100
BBA	21UBU44SE02A	Entrepreneurial Skills Enhancement	2	1	100	-	100
BBA	21UBU44SE02B	Practical Stock Trading	2	1	100	-	100
CommerceCA	21UCC44SE02	Practical Banking in India	2	1	100	-	100
SPS							
Chemistry	21UCH44SE02A	Health Chemistry	2	1	100	-	100
Chemistry	21UCH44SE02B	Industrial Chemistry	2	1	100	-	100
Physics	21UPH44SE02A	Weather Physics	2	1	100	-	100
Physics	21UPH44SE02B	Electrical Wiring	2	1	100	-	100
Electronics	21UEL44SE02	PC Assembling and Servicing	2	1	100	-	100

GENERIC ELECTIVE -1: 5th Semester							
Generic Elective Courses are designed for the students of other disciplines. (open to the students of other departments)							
Course Details					**Scheme of Exams**		
Offering Department	**Course Code**	**Course Title**	**Hrs**	**Cr**	**CIA**	**SE**	**Final**
SBS							
Botany	21UBO54EG01	Landscape Designing	4	3	100	100	100
SCS							
Computer Science	21UCS54EG01	Ethical Hacking	4	3	100	100	100
Mathematics	21UMA54EG01	Mathematics for Competitive Examinations	4	3	100	100	100
Statistics	21UST54EG01	Actuarial Statistics	4	3	100	100	100
Information Technology	21UBC54EG01	Fundamentals Of Data Science	4	3	100	100	100
SLAC							
English	21UEN54GE01	Film Studies	4	3	100	100	100
History	21UHS54EG01	Tamil Heritage and Culture	4	3	100	100	100
Tamil	21UTA54EG01	தமிழிலயக்கத்தில் மனித உரிமைகள்	4	3	100	100	100
SMS							
Commerce	21UCO54EG01A	Computerised Accounting	4	3	100	100	100
Commerce	21UCO54EG01B	Basics of Excel	4	3	100	100	100
Commerce	21UCO54EG01C	Personal Investment Planning	4	3	100	100	100
Economics	21UEC54EG01	Principles of Economics	4	3	100	100	100
Commerce CA	21UCC54EG01	E-commerce and E Business Management	4	3	100	100	100
BBA	21UBU54EG01A	Global Supply Chain Management	4	3	100	100	100
BBA	21UBU54EG01B	Start – Ups and Small Business Management	4	3	100	100	100
SPS							
Chemistry	21UCH54EG01A	Chemistry for Competitive Examinations	4	3	100	100	100
Chemistry	21UCH54EG01B	Everyday Chemistry	4	3	100	100	100
Physics	21UPH54EG01A	Everyday Physics	4	3	100	100	100
Physics	21UPH54EG01B	Renewable Energy Physics	4	3	100	100	100
Electronics	21UEL54EG01A	Everyday Electronics	4	3	100	100	100
Electronics	21UEL54EG01B	Wireless Communication	4	3	100	100	100

GENERIC ELECTIVE -2: 6th Semester							
Generic Elective Courses are designed for the students of other disciplines. (open to the students of other departments)							
Course Details					**Scheme of Exams**		
Offering Department	**Course Code**	**Course Title**	**Hrs**	**Cr**	**CIA**	**SE**	**Final**
SBS							
Botany	21UBO64EG02	Solid Waste Management	4	3	100	100	100
SCS							
Computer Science	21UCS64EG02	3D Printing and Design	4	3	100	100	100
Mathematics	21UMA64EG02	Analytical Skill for Competitive Examinations	4	3	100	100	100
Statistics	21UST64EG02	Applied Statistics	4	3	100	100	100
Information Technology	21UBC64EG02	Industry 4.0	4	3	100	100	100
SLAC							
English	21UEN64EG02	English for the Media	4	3	100	100	100
History	21UHS64EG02	Intellectual Revivalism in Tamil Nadu	4	3	100	100	100
Tamil	21UTA64EG02	சித்த மருத்துவம்	4	3	100	100	100
SMS							
Commerce	21UCO64EG02A	Rural Marketing	4	3	100	100	100
Commerce	21UCO64EG02B	Entrepreneurship Development	4	3	100	100	100
Commerce	21UCO64EG02C	Digital Marketing	4	3	100	100	100
Economics	21UEC64EG02	Economics for Competitive Exams	4	3	100	100	100
CommerceCA	21UCC64EG02	Total Quality Management	4	3	100	100	100
BBA	21UBU64EG02A	Personality Development	4	3	100	100	100
BBA	21UBU64EG02B	NGO Management	4	3	100	100	100
SPS							
Chemistry	21UCH64EG02A	Food And Nutrition	4	3	100	100	100
Chemistry	21UCH64EG02B	Waste Management	4	3	100	100	100
Physics	21UPH64EG02A	Laser Technology and its Application	4	3	100	100	100
Physics	21UPH64EG02B	Physics of Earth	4	3	100	100	100
Electronics	21UEL64EG02A	CCTV and Smart Security System	4	3	100	100	100
Electronics	21UEL64EG02B	Entrepreneurial Electronics	4	3	100	100	100

Semester	Course Code	Title of the Course	Hours	Credits
I	21UTA11GL01	General Tamil - I	4	3

CO No.	CO–Statements இப்பாடத்தின் நிறைவில் மாணவர்கள்	Cognitive Levels (K –Levels)
CO–1	இக்கால இலக்கிய வகைகளைக் கண்டறிவர்	K1
CO–2	எழுத்து,சொல் இலக்கணங்களின் அடிப்படைகளைக் கண்டறிவர்	K1
CO–3	அயலகக் கவிதை வடிவங்களை விளங்கிக் கொள்வர்	K2
CO–4	மொழிபெயர்ப்புக் கவிதைகளின் வாயிலாக மொழிபெயர்ப்புத் திறனை வளர்த்தெடுப்பர்	K3
CO–5	புதுக்கவிதை வாயிலாக வெளிப்படும் சமூக, அரசியல் விழுமியங்களை மதிப்பிடுவர்	K4

அலகு - 1 **(12 மணிநேரம்)**

பாரதியார் கவிதைகள் - குயில்பாட்டு (குயில் தன் பூர்வ ஜன்மக் கதை உரைத்தல்)
பாரதிதாசன் கவிதைகள் - சஞ்சீவி பர்வதத்தின் சாரல்
உரைநடை - முதல் மூன்று கட்டுரைகள்

அலகு - 2 **(12 மணிநேரம்)**

வெ.இராமலிங்கனார் - சொல், தமிழன் இதயம்
முடியரசனார் - உயிர் வெல்லமோ, மனத்தூய்மை
பெருஞ்சித்திரனார் - அஞ்சாதீர், மொழி இனம் நாடு,
பட்டுக்கோட்டை
கல்யாணசுந்தரனார் - வருங்காலம் உண்டு, உழைக்காமல் சேர்க்கும் பணம்.
இலக்கணம் - எழுத்து
இலக்கிய வரலாறு - மூன்றாம் பாகம் - தண்டமிழ்த் தொண்டர்கள்

அலகு - 3 **(12 மணிநேரம்)**

சுரதா - நல்ல தீர்ப்பு
கண்ணதாசன் - ஒரு பானையின் கதை
அப்துல் ரகுமான் - வீடு
மேத்தா - ஒரே குரல்
இலக்கிய வரலாறு - மூன்றாம் பாகம் - இருபதாம் நூற்றாண்டு
இலக்கியவளர்ச்சி
சிறுகதை - முதல் ஐந்து சிறுகதைகள்

அலகு – 4 : அரசியல் கவிதைகள் **(12 மணிநேரம்)**

ஈரோடு தமிழன்பன் - அகல் விளக்காக இரு
ஆதவன் தீட்சண்யா - இன்னும் இருக்கும் சுவர்களின் பொருட்டு

சுகிர்தராணி - என் கண்மணியே இசைப்பிரியா
சக்தி ஜோதி - யுகாந்திர உறக்கம்
பழநிபாரதி - வெள்ளைக்காகிதம்
லிவிங் ஸ்மைல் வித்யா - நினைவில் பால்யம் அழுத்தம்
இலக்கணம் - சொல்

அலகு - 5 அயலகக் கவிதைகள் **(12 மணிநேரம்)**

ஓசே ரிசால் - விடைகொடு என் தாய் மண்ணே
ஹைபுன் கவிதைகள் - அறுவடை நாளின் மழை (மூன்று கவிதைகள்)
சிறுகதை - ஆறு முதல் பத்து சிறுகதைகள்
உரைநடை - நான்கு முதல் ஆறு கட்டுரைகள்

பாட நூல்கள்

1. **பொதுத்தமிழ்,** *செய்யுள் திரட்டு, தமிழாய்வுத்துறை, தூய வளனார் தன்னாட்சிக் கல்லூரி, திருச்சிராப்பள்ளி, முதற்பதிப்பு, 2021*
2. **சமூகவியல் நோக்கில் தமிழிலக்கிய வரலாறு,** *தமிழாய்வுத்துறை, தூய வளனார் தன்னாட்சிக் கல்லூரி, திருச்சிராப்பள்ளி, பத்தாம் பதிப்பு, 2017*
3. **நற்றமிழ்க் கோவை** (கட்டுரைத் தொகுப்பு). *தமிழாய்வுத்துறை, தூய வளனார் தன்னாட்சிக் கல்லூரி, திருச்சிராப்பள்ளி, முதற்பதிப்பு, 2021*
4. **சிறுகதைத் தொகுப்பு** - ஒவ்வொரு கல்வியாண்டிற்கும் ஒவ்வொரு சிறுகதைத்தொகுப்பு
5. *(2021–2022 கல்வியாண்டுக்கு மட்டும்)*: **நல்லாசிரியர்**, சிறுகதைத் தொகுப்பு, - *தமிழாய்வுத்துறை, நியூ செஞ்சுரி புக் ஹவுஸ், சென்னை, முதற்பதிப்பு, 2021*

Relationship matrix for Course outcomes, Programme outcomes / Programme Specific Outcomes

Semester	Course code	Title of the Course	Hours	Credits
I	21UTA11GL01	General Tamil - I	4	3

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of Cos
	PO–1	PO–2	PO–3	PO–4	PO–5	PSO–1	PSO–2	PSO–3	PSO–4	PSO–5	
CO–1	2	1	2	2	3	3	3	2	3	2	2.3
CO–2	2	1	2	2	2	3	2	2	2	2	2.0
CO–3	2	1	2	2	3	3	3	2	3	2	2.3
CO–4	1	2	1	2	2	3	2	2	3	2	2.0
CO–5	1	1	2	2	3	3	3	2	3	2	2.2
Mean overall Score											2.16 (High)

Semester	Course Code	Title of the Course	Hours	Credits
I	21UFR11GL01	FRENCH – I	4	3

CO No.	CO–Statements On successful completion of this course, students will be able to	Cognitive Levels (K –Levels)
CO–1	recall and spell the alphabets, numbers, colours, days of the week and months in French.	K1
CO–2	compare the definite and indefinite articles and its usages.	K2
CO–3	construct simple phrases by using 'er' verbs in present tense.	K3
CO–4	make use of correct terminology and introduce oneself in French.	K3
CO–5	distinguish between affirmative and negative phrases and take part in role play - conversation.	K4

Unit – I **(12 hours)**

TITRE:BONJOUR CA VA?
GRAMMAIRE : Les pronoms personnels sujets, les articles définis et indéfinis, Etre et avoir (verbes auxiliaires)
LEXIQUE : Saluer, Entrer en contact, demander et dire comment ça va ?, L'alphabet, les couleurs, les pays et les nationalités, les animaux domestiques.
PRODUCTION ORALE : Epeler son nom et son prénom, Comprendre des personnes qui se saluent.
PRODUCTION ECRITE : Les formules de politesse

Unit – II **(12 hours)**

TITRE:SALUT ! JE M'APPELLE AGNES
GRAMMAIRE : La conjugaison du 1er groupe, les adjectifs possessifs, la formation du féminin, la formation du pluriel.
LEXIQUE : Se présenter, Présenter quelqu'un, Remercier, Les jours de la semaine, les mois de l'année, les nombres de 0 à 69, la famille
PRODUCTION ORALE : Comprendre des informations essentielles
PRODUCTION ECRITE : Présentez –vous

Unit - III **(12 hours)**

TITRE:QUI EST-CE?
GRAMMAIRE : La phrase interrogative : Qu'est-ce que… ?/Qu'est-ce que c'est ?/Qui est-ce ?, quelques indicateurs du temps, la formation du féminin, les verbes aller et venir
LEXIQUE : Demander et répondre poliment,les professions
PRODUCTION ORALE : Parler de ses projets
PRODUCTION ECRITE : Ecrire de brefs messages

Unit - IV **(12 hours)**

TITRE:DANS MON SAC, J'AI?
GRAMMAIRE : la phrase négative, c'est/il est, les articles contractes, les pronoms personnels toniques
LEXIQUE : Demander des informations personnelles, Quelques objets, la fiche d'identité, les

nombres à partir de 70
PRODUCTION ORALE : Comprendre un message sur un répondeur téléphonique
PRODUCTION ECRITE : Remplir une fiche d'identité

Unit - V **(12 hours)**

TITRE:IL EST COMMENT? / ALLO?
GRAMMAIRE : les adverbes interrogatifs, les prépositions de lieu, les verbes du deuxième groupe, le verbe faire
LEXIQUE : Parler au téléphone, décrire quelqu'un, l'aspect physique, le caractère
PRODUCTION ORALE : Un jeu de rôle – la conversation téléphonique
PRODUCTION ECRITE : Décrivez votre aspect physique et votre caractère en quelques lignes

Book for Study

P. Dauda, L.Giachino and C.Baracco, *Generation A1*, Didier, Paris 2016.

Books for Reference

1. J.Girardet and J.Pecheur, *Echo A1*, CLE International, 2^{e}edition, 2017
2. Régine Mérieux and Yves Loiseau, *Latitudes A1*, Didier, 2012.
3. Isabelle Fournier, *Talk French*, Goyal Publishers,2011

Web Resources

1. https://www.wikihow.com/Pronounce-the-Letters-of-the-French-Alphabet
2. https://francais.lingolia.com/en/grammar/tenses/le-present
3. https://www.lawlessfrench.com/grammar/articles/
4. https://www.frenchpod101.com/french-vocabulary-lists/10-lines-you-need-for-introducing-yourself
5. https://www.tolearnfrench.com/exercises/exercise-french-2/exercise-french-3295.php

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course code			Title of the Course				Hours		Credits
I	21UFR11GL01			FRENCH – I				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	
CO–1	3	1	2	3	2	3	2	1	2	3	2.2
CO–2	3	3	3	2	2	2	1	2	2	3	2.3
CO–3	3	1	2	3	2	3	2	1	2	2	2.1
CO–4	2	2	3	2	1	3	2	1	2	3	2.1
CO–5	3	2	3	2	2	3	2	2	3	2	2.4
Mean overall Score											2.22 (High)

Semester	Course Code	Title of the Course	Hours	Credits
I	21UHI11GL01	HINDI- I	4	3

CO No.	CO–Statements On successful completion of the course, students will be able to	Cognitive Levels (K –Levels)
CO -1	list out the literary works in Hindi during the period of 12th century in India.	K1
CO -2	compare the vocabulary & expressions related to day-to-day conversation.	K2
CO -3	use simple Phrases from English to Hindi.	K3
CO -4	investigate the values of Indian society & summarize the duties of a citizen for his/her country.	K4
CO -5	identify the sentences in Hindi using basic grammar.	K4

Unit - I **(12 Hours)**

Dr. Abdul Kalam
Ling
Kabir Ke Dohe
Baathcheeth - Aspathal mein
Adhikal - Namakarn

Unit - II **(12 Hours)**

Vachan Badaliye
Thulasi ke Dohe
Adhikal - Samajik Paristhithiyam
Moun Hee Mantra Hai

Unit - III **(12 Hours)**

Sangya
Soordas ke Pad
Baathcheeth - Hotel mein
Adhikal - Sahithyik Paristhithiyam

Unit - IV **(12 Hours)**

Sarvanam
Rahim ke Dohe
Bathcheeth - Kaksha mein
Adhikal - Salient Features, Main Divisions

Unit - V **(12 Hours)**

Anuvad - 1
Visheshan
Bihari - Dohe
Bathcheeth - Kariyalay mein
Adhikal - Visheshathayem

Books for Study

1. M.kamathaprasad Gupth, *Hindi Vyakaran*, Anand Prakashan, Kolkatta,2020.
   Unit-I *Chapters 2 and 3*
2. Viswanath Tripaty, *Kuchh Kahaniyan*, Rajkamal Prakashan Pvt. Ltd, New Delhi,2018.
   Unit-II, III and IV *Chapters 4 and 5*
3. Dr. Sanjeev Kumar Jain, *Anuwad: Siddhant Evam Vyavhar*, Kailash Pustak Sadan, Madhya Pradesh 2019.
   Unit-V *Chapter 1*

Books for Reference

1. Dr.A.P.J.Abdul Kalam, Mere sapnom ka Bharath, Prabath Prakashan, Noida, 2020,
2. Lakshman prasad singh, Kavya ke sopan, Bharathy Bhavan Prakashan, 2017.
3. Aravind Kumar, Sampoorna Hindi Vyakaran our Rachana, Lucent publisher, 2019.
4. Adhunik Hindi Vyakaran our Rachana, bharati bhawan publishers & distributors, 2018.
5. Acharya ramchandra shukla, Hindi Sahitya Ka Itihas, Prabhat Prakashan, 2021.

Web Resources

1. https://youtu.be/LrdrcP2oiyU
2. https://youtu.be/Cib2FNv8KyA
3. https://youtu.be/aXARykpYCxA
4. https://youtu.be/RUDFis-tdg4
5. https://youtu.be/upivTmLTPQA

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code			Title of the Course					Hours	Credits
I	21UHI11GL01			HINDI - I					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	1	3	1	3	3	2	2.3
CO-2	2	2	3	3	1	3	2	3	3	2	2.4
CO-3	3	2	2	1	2	3	2	3	2	3	2.3
CO-4	3	2	1	3	2	3	2	3	3	2	2.4
CO-5	2	3	3	2	3	2	3	3	3	1	2.5
									Mean Overall Score		2.38 (High)

Semester	Course Code	Title of the Course	Hours	Credits
I	21USA11GL01	SANSKRIT - I	4	3

CO No.	CO–Statements On successful completion of the course, the student will be able to	Cognitive Levels (K –Levels)
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

Unit - I **(12 Hours)**

Samyakthakshatra pada paricaya

Unit - II **(12 Hours)**

Vartmanakala prayogaha

Unit - III **(12 Hours)**

Samskruta varathamanakalaha

Unit - IV **(12 Hours)**

Shadha priyoghaa aakaarnta ikaraantha ukarantha

Unit - V **(12 Hours)**

Subhashitani manoharani Dasaslokani

Book for Study

Shaptamanjari , K.M.,Saral Snakrit Balabodh , Bharathiya Vidya Bhavan , Munushimarg Mumbai – 4000 007 2018, 2019

Books for Reference

1. Kulapathy , K.M.,Saral Snakrit Balabodh , Bharathiya Vidya Bhavan , Munushimarg Mumbai – 4000 007 2018
2. R.S.Vadhar & Sons , Book – Sellers and publishers , Kalpathi.Palgahat 678003, Kerala South India , Shabdha Manjari 2019

3. Balasubramaniam R, Samskrita Akshatra Siksha , Vangals Publications, 14th Main road JP Nagar , Bangalore – 78

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code			Title of the Course				Hours		Credit
I	21USA11GL01			SANSKRIT- I				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	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
Result											# High

Semester	Course Code	Title of the Course	Hours	Credits
I	**21UEN12GE01**	**GENERAL ENGLISH - I**	**5**	**3**

CO No.	CO-Statements	Cognitive Levels (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	recall what they observe and experience	**K1**
CO-2	arrange different parts of a text in a coherent manner	**K2**
CO-3	examine the underlying meaning in a text	**K3**
CO-4	analyse and evaluate letters regarding the use of appropriate language and format	**K4 & K5**
CO-5	use conversational English to communicate with friends	**K6**

Unit-I **(15 Hours)**

01. Personal Details
02. Positive Qualities
03. Listening to Positive Qualities
04. Relating and Grading Qualities
05. My Ambition
06. Abilities and Skills
07. Self-Improvement Word Grid
08. What am I Doing?
09. What was I Doing?
10. Unscramble the Past Actions
11. What did I Do Yesterday?

Unit-II **(15 Hours)**

12. Body Parts
13. Actions and Body Parts
14. Value of Life
15. Describing Self
16. Home Word Grid
17. Unscramble Building Types
18. Plural Forms of Naming Words
19. Irregular Plural Forms
20. Plural Naming Words Practice
21. Whose Words?

Unit-III **(15 Hours)**

22. Plural Forms of Action Words
23. Present Positive Actions
24. Present Negative Actions
25. Un/Countable Naming Words
26. Recognition of Vowel Sounds
27. Indefinite Articles

28. Un/Countable Practice
29. Match the Visual
30. Letter Spell-Check
31. Drafting a Letter

Unit-IV **(15 Hours)**

32. Friendship Word Grid
33. Friends' Details
34. Guess the Favourites
35. Guess Your Friend
36. Friends as Guests
37. Introducing Friends
38. What are We Doing?
39. What is (S)He / are They Doing?
40. Yes / No Question
41. What was S/He Doing?
42. Names and Actions
43. True Friendship
44. Know Your Friends
45. Giving Advice/Suggestions
46. Discussion on Friendship
47. My Best Friend

Unit-V **(15 Hours)**

48. Kinship Words
49. The Odd One Out
50. My Family Tree
51. Little Boy's Request
52. Occasions for Message
53. Words Denoting Place
54. Words Denoting Movement
55. Phrases for Giving Directions
56. Find the Destination
57. Giving Directions Practice
58. SMS Language
59. Converting SMS
60. Writing Short Messages
61. Sending SMS
62. The Family Debate
63. Family Today

Book for Study

Joy, J.L., and Peter, F.M. *Let's Communicate 1*. New Delhi, Trinity P, 2014.

Books for Reference

1. Ahrens, Sönke. *How to Take Smart Notes: One Simple Technique to Boost Writing, Learning and Thinking*. New York: Create Space, 2017.
2. Aspinall, Tricia. *Test Your Listening.* London: Pearson, 2002.
3. Bailey, Stephen. *Academic Writing: A Practical Guide for Students*. New York: Routledge, 2004.
4. Fitikides, T.J. *Common Mistakes in English* (6th ed.). London: Longman, 2002.

5. Wainwright, Gordon. *How to Read Faster and Recall More: Learn the Art of Speed Reading with Maximum Recall* (3rd ed.). Oxford: How to Books, 2007.

Web Resources

1. https://learnenglish.britishcouncil.org/
2. https://oneminuteenglish.org/en/best-websites-learn-english/
3. https://www.dailywritingtips.com/best-websites-to-learn-english/

Relationship Matrix for Course Outcomes, Programme Outcomes, and Programmes Specific Outcomes

Semester	Course Code			Title of the Course						Hours	Credit
I	21UEN12GE01			GENERAL ENGLISH – I						5	3
Course Outcome (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO -1	2	3	2	2	3	2	3	2	3	2	2.4
CO -2	2	2	3	2	3	3	2	3	2	2	2.3
CO -3	2	3	2	3	2	2	3	2	3	2	2.4
CO -4	2	2	3	2	3	3	2	3	2	3	2.5
CO -5	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	Credits
I	21UPH13CC01	CORE-1: PROPERTIES OF MATTER AND SOUND	7	6

CO No.	CO- Statements	Cognitive Levels (K-Levels)
	On the successful completion of the course, student will be able to	
CO-1	acquire the knowledge on elastic moduli, elasticity and viscosity of liquids and gases, molecular theory of surface tension, diffusion, osmosis, Doppler Effect in sound and ultrasonics.	K1
CO-2	understand the concepts of elasticity, viscosity and surface tension in real situations, the diffusion in liquids, the methods to produce ultrasonic waves and the factors affecting the acoustics of building.	K2
CO-3	apply the knowledge to find the bending of beams, internal pressure in a shell, coefficient of viscosity, surface tension of liquids, Doppler effect and acoustic measurements.	K3
CO-4	analyse the characteristics of Exhaust pumps, factors affecting the acoustics of building.	K4
CO-5	analyse the bending moments in beams, flow of liquids in capillary tubes, surface tension of liquid versus temperature.	K4

Unit- I: Elasticity **(21 Hours)**

Hooke's law and elastic moduli - relation between the elastic constants - limiting value of μ - stresses subjected to internal pressure in a spherical shell and cylindrical shell - torsion of a cylinder - torsional oscillation - experimental determination of I by torsional oscillation - Elasticity of liquids and gases - potential energy due to strain - bending of beams - internal bending moment - energy of bending - cantilever - a supported beam - beam rigidly fixed at both ends - Asymmetrically bent beam - Cornu's method of measuring μ.

Unit - II: Viscosity **(21 Hours)**

Introduction - coefficient of viscosity - Newtonian and non-Newtonian fluids - critical velocity and Reynolds Number - Poiseuille's formula - corrections - Experimental determination of coefficient of viscosity - Falling pressure at the inlet end - Flows through capillaries in series and in parallel - Viscosity of gases - Rankine's method for determining viscosity of a gas - pressure drag - viscous drag - terminal velocity - nature of motion through viscous fluid - effects of temperature and pressure on viscosity.

Unit - III: Surface Tension **(21 Hours)**

Molecular theory of surface tension - surface energy - total surface energy - Measurement of 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 - the force between two plates separated by a thin layer of liquid - Measurement of surface tension: capillary rise method - Quincke's method - drop weight method - surface tension of solids and gases - empirical relations between surface tension and temperature.

Unit- IV: Diffusion, Osmosis and Low Pressure **(21 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.
Low Pressure: Production of low pressure - Exhaust pump characteristics - Rotary oil pumps - diffusion condensation pump - Mc Leod vacuum gauge - Pirani gauge - Knudsen gauge.

Unit - V: Sound, Acoustics and Ultrasonics (21 Hours)
Sound: Doppler Effect - applications - **Acoustics:** Reverberation - Sabine's reverberation formula - Determination of absorption coefficient - Acoustic Intensity - Acoustic measurements - Factors affecting the acoustic buildings - Sound distribution in an Auditorium - Requisites for good acoustics.
Ultrasonics: Production of ultrasonic waves - Detection of ultrasonic waves - Acoustic grating - Applications of ultrasonic waves.

Books for Study
1. Satyendra Nath Maiti, Debi Prasath Raychaudhuri - *Classical mechanics and general properties of Matter* - New Age International Publishers, 2008.
2. D.S. Mathur - *Elements of Properties of Matter* - S. Chand & Company, 2010.
3. N. Subrahmanyam and Brij Lal - *A text book of Sound*, Vikas Publishing House private Ltd., 2014.

Books for Reference
1. Michael de Podesta, *Understanding of Properties of matter*, second edition.
2. Saighal R.L, *Text book of sound*, 2nd edition, S. Chand & Co Ltd, 1998.
3. Murugesan R, *Properties of Mater*, S. Chand & Co Pvt Ltd, 2013.

Unit	Book	Chapters	Sections
I	1	11	11.4, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.6, 11.6.1, 11.6.3, 11.7, 11.8, 11.9, 11.10.1, 11.10.2, 11.10.3, 11.10.4, 11.15
II	1	12	12.1-12.5, 12.6.1-12.6.3, 12.6.5, 12.6.7-12.6.9, 12.8.1-12.8.5, 12.9
III	1	14	14.2 -14.4, 14.5.2, 14.6, 14.6.2, 14.8, 14.8.1, 14.8.2, 14.8.4, 14.11, 14.12
IV	2	13,15	13.1-13.12, 15.12-15.16, 15.19, 15.24, 15.25, 15.29
V	3	8,10	8.1-8.6, 10.14-10.27

Relationship matrix for Courae outcomes, Programme outcomes/Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credit
I	21UPH13CC01	CORE-1: PROPERTIES OF MATTER AND SOUND	7	6

Course Outcomes (COs)	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	3	2	2	2	2	3	2	2	2.3
CO-2	2	2	3	2	3	2	2	2	3	2	2.3
CO-3	3	2	2	3	3	2	3	2	2	2	2.4
CO-4	3	2	2	2	3	2	2	3	2	2	2.3
CO-5	2	2	3	2	2	3	2	2	2	2	2.2
Mean Overall Score											2.3 (High)

Semester	Course Code	Title of the Course	Hours	Credits
I	21UPH13AC01	ALLIED: MATHEMATICS FOR PHYSICS-I	6	4

CO No.	CO-Statements On successful completion of this course, students will be able to	Cognitive Levels (K-levels)
CO-1	attain knowledge of higher derivatives, definite integrals, first and second order differential equations, matrices and infinite series.	K1
CO-2	understand formation of equations involving derivatives, trigonometrical transformation in derivatives, properties of definite integrals operations and properties of matrices and convergence of series.	K2
CO-3	Illustrate integration by parts,reduction formula,simultaneous linear equations in threeunknowns, different methods in first order differential equations and convergence of series.	K3
CO-4	verify integration by parts, Leibnitz's formula, reduction formula, linear equation, Bernoulli's equation, Cayley Hamilton theorem and comparisontest, ratiotest and root test.	K4
CO-5	evaluate definite integrals, reduction formula, solutions of first and second order differential equations, rank of a matrix eigenvalues and eigenvectorsand convergence.	K5

Unit-I **(18 Hours)**

Higher Derivatives – Trigonometrical Transformation – Formation of Equation Involving Derivatives – Leibnitz's Formula for the n^{th} Derivatives of a Product (Without Proofs) – Integration by Parts.

Unit-II **(18 Hours)**

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

Unit-III **(18Hours)**

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 ThreeUnknowns Using Elementary Operations Method - Eigen Values and EigenVectors - 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, ComparisonTest, RatioTest and Root Test(Without Proofs).

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. Narayananand 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.

Relationship matrix for Courae outcomes, Programme outcomes/Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credits
I	21UPH13AC01	ALLIED: MATHEMATICS FOR PHYSICS-I	6	4

Course Outcomes (COs)	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	2	2	1	3	3	2	2	3	2.3
CO-2	3	2	2	1	2	3	3	3	2	3	2.4
CO-3	2	3	2	2	1	2	3	2	3	2	2.2
CO-4	2	3	2	3	1	2	3	2	2	3	2.3
CO-5	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	Credits
I	21UHE14VE01	ESSENTIALS OF HUMANITY	2	1

CO. No	CO – Statements	Cognitive Levels (K-levels)
	On completion of this course, the graduates will be able to	
CO-1	recall the prescribed values and their dimensions	K1
CO-2	examine themselves by learning the developmental changes happening in the course of their life time	K2
CO-3	apply the trained values in their day today life	K3
CO-4	analyze themselves as responsible men and women	K4
CO-5	create a constructive approach to life	K5 & K6

Unit-I Principles of 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 The Development of Human Personality (6 Hours)

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

Unit-III The Dimensions of Human Development (6 Hours)

Areas of Development: Physical, Intellectual, Emotional, Social Development, Moral & Spiritual development

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

Books for Study

Department of Human Excellence. *Essentials of Humanity*, St. Joseph's College, Tiruchirappali-02, 2021.

Books for Reference:

1. Alphonse Xavier Dr SJ. *You Shall Overcome,*(6th Ed.) Chennai: ICRDCE Publication, 2012.
2. Alex K. *Soft Skills*, New Delhi: S. Chand, 2009.
3. Kalam Abdul APJ. *You Are Unique*, Bangalore: Punya Publishing, 2012.

Web Sources:

http://livingvalues.net. Accessed 05 Mar. 2021.

https://www.apa.org/topics/personality#. Accessed 05 Mar. 2021.

https://www.peacecorps.gov/educators/resources/global-issues-gender-equality-and-womens-empowerment/. Accessed 05 Mar. 2021.

Semester	Course Code	Title of the Course	Hours	Credits
II	**21UTA21GL02**	**General Tamil - II**	**4**	**3**

CO No.	CO- Statement	Cognitive Level (K- level)
இப்பாடத்தின் நிறைவில் மாணவர்கள்		
CO-1	தமிழிலக்கிய வரலாற்றில் சைவ, வைணவ இலக்கியங்கள் பெறும் இடத்தை அறிந்துகொள்வர்	**K 1**
CO-2	அகப்பொருள், புறப்பொருள் இலக்கணங்களின் அடிப்படை அறிவைப் பெறுவர்.	**K 1**
CO-3	காப்பியச் சுவையை மாணவர்கள் புரிந்துகொள்வர்	**K 2**
CO-4	இஸ்லாமிய இலக்கியச் சிந்தனைகளைப் பெறுவர்	**K 3**
CO-5	கிறித்தவ மதிப்பீடுகளைச் சிற்றிலக்கிய வகைகளின் வழியாகத் திறனாய்வர்.	**K 4**

(12 மணிநேரம்)

அலகு - *1*

சிலப்பதிகாரம் - கனாத்திறம் உரைத்த காதை
மணிமேகலை - ஆபுத்திரன் திறம் அறிவித்த காதை
இலக்கிய வரலாறு - சைவம் வளர்த்த தமிழ் முதல் புராணங்கள் முடிய.
இலக்கணம் - அகப்பொருள் இலக்கணம்

அலகு - *2* ***(12 மணிநேரம்)***

திருவாசகம் - திருச்சாழல்
சிவவாக்கியார் பாடல்கள் - *25 பாடல்கள் (04, 14, 16, 22, 27, 33, 34, 35, 36,37, 38, 47, 81, 91, 225, 237, 242, 495, 504, 520,522, 533, 534, 536, 548.)*

அலகு - *3* ***(12 மணிநேரம்)***

நாலாயிர திவ்வியப் பிரபந்தம்- அமலானாதிபிரான் *(10 பாடல்கள்)*
- பெருமாள் திருமொழி *(11 பாடல்கள்)*
கம்பராமாயணம் - கைகேயி சூழ்வினைப்படலம்
உநைடை - *7 முதல் 9 முடிய உள்ள கட்டுரைகள்*

அலகு - *4* ***(12 மணிநேரம்)***

சீறாப்புராணம் - உடும்பு பேசிய படலம்
இலக்கணம் - புறப்பொருள் இலக்கணம்
இலக்கிய வரலாறு - தமிழ் இலக்கண நூல்கள் முதல் சிற்றிலக்கியங்கள் முடிய

அலகு - 5 **(12 மணிநேரம்)**

திருக்காவலூர்க் கலம்பகம் - சமூக உல்லாசம்
உரைநடை - 10 முதல் 12 வரையிலான கட்டுரைகள்

பாடநூல்கள்:

1. **பொதுத்தமிழ் - செய்யுள் திரட்டு**, தமிழாய்வுத்துறை வெளியீடு, தூய வளனார் கல்லூரி. திருச்சிராப்பள்ளி, முதற்பதிப்பு, 2021
2. **சமூகவியல் நோக்கில் தமிழிலக்கிய வரலாறு,** *தமிழாய்வுத்துறை, தூய வளனார் தன்னாட்சிக் கல்லூரி, திருச்சிராப்பள்ளி, பத்தாம் பதிப்பு, 2017*
3. **நற்றமிழ்க் கோவை** (கட்டுரைத் தொகுப்பு). *தமிழாய்வுத்துறை, தூய வளனார் தன்னாட்சிக் கல்லூரி, திருச்சிராப்பள்ளி,* முதற்பதிப்பு, 2021

Relationship matrix for Courae outcomes, Programme outcomes/Programme Specific Outcomes

Semester	Course Code			Title of the Course				Hours	Credit
II	21UTA21GL02			General Tamil - II				4	3
Course Outcomes (Cos)	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	2	2	1	2	3	2	2	2	3	2	2.1
CO-2	2	1	2	2	3	3	2	2	3	2	2.2
CO-3	2	1	2	2	3	3	2	2	3	2	2.2
CO-4	1	1	2	2	3	3	2	2	3	2	2.1
CO-5	1	1	2	2	3	2	2	3	3	2	2.1
Mean Overall Score											2.14 (High)

Semester	Course Code	Title of the Course	Hours	Credits
II	**21UFR21GL02**	**FRENCH – II**	**4**	**3**

CO No.	CO–Statements On successful completion of this course, students will be able to	Cognitive Levels (K –Levels)
CO–1	relate pronominal verbs in expressing one's day today activity.	**K1**
CO–2	compare the different types of articles.	**K2**
CO–3	construct texts using pronouns – passages and dialogues.	**K3**
CO–4	discover the food habits of the French culture.	**K4**
CO–5	appraise the French fashion.	**K5**

Unit - I **(12 hours)**

TITRE:LES LOISIRS
GRAMMAIRE : les adjectifs interrogatifs, les nombres ordinaux, les verbes pronominaux
LEXIQUE : les différentes activités quotidiennes,les loisirs, les activités quotidiennes, les matières
PRODUCTION ORALE : parler sur votre passe-temps
PRODUCTION ECRITE : décrire sa journée

Unit -II **(12 hours)**

TITRE:LA ROUTINE
GRAMMAIRE : les pronoms personnels COD, les verbes du premier groupe en e/er/eler/eter, le verbe prendre
LEXIQUE : exprimer ses gouts et ses préférences, le temps, l'heure, la fréquence
PRODUCTION ORALE : savoir comment dire l'heure
PRODUCTION ECRITE : écrire vos préférences en quelques lignes

Unit - III **(12 hours)**

TITRE:OU FAIRE SES COURSES?
GRAMMAIRE : les articles partitifs, le pronom en (la quantité), très ou beaucoup
LEXIQUE : inviter et répondre à une invitation, les commerces et les commerçants, demander et dire le prix, les quantités
PRODUCTION ORALE : faire des courses pour une soirée
PRODUCTION ECRITE : écrire un message en acceptant l'invitation

Unit - IV **(12 hours)**

TITRE:DECOUVREZ ET DEGUSTEZ
GRAMMAIRE : l'impératif, il faut, les verbes devoir, pouvoir, savoir,vouloir
LEXIQUE : Commander et commenter sur un plat de la carte,les aliments, les services, les moyens depaiement
PRODUCTION ORALE : Jeu de rôle – au restaurant (entre vous et le garçon)
PRODUCTION ECRITE : faire une comparaison avec la carte française et indienne

Unit - V **(12 hours)**

TITRE:TOUT LE MONDE S'AMUSE/ LES ADOS AU QUOTIDIEN
GRAMMAIRE : les adjectifs démonstratifs, le pronom indéfini on, le futur proche, le passé composé, les verbes en –yer, voir et sortir
LEXIQUE : connaitre les marques connues sur les vêtements, les sorties, situer dans le temps, les vêtements et les accessoires
PRODUCTION ORALE : décrire une tenue
PRODUCTION ECRITE : écrire une lettre amicale, une carte postale

Book for Study

P.Dauda,L.Giachino and C.Baracco, *Generation A1*, Didier, Paris 2016.

Books for Reference

1. J.Girardet and J.Pecheur, *Echo A1*, CLE International, 2^{e}edition,2017
2. Régine Mérieux and Yves Loiseau, *Latitudes A1*, Didier, 2012.
3. Isabelle Fournier, *Talk French*, Goyal Publishers, 2011

Web Resources

1. https://www.frenchtoday.com/blog/french-verb-conjugation/french-reflexive-verbs-list-exercises/
2. https://www.fluentu.com/blog/french/french-subject-pronouns/
3. https://grammarist.com/french/french-partitive-article/
4. https://www.talkinfrench.com/guide-french-food-habits/
5. https://www.fluentu.com/blog/french/talking-about-clothes-in-french/

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course code			Title of the Course				Hours		Credits
II	21UFR21GL02			FRENCH – II				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	
CO–1	3	3	3	3	1	3	1	2	2	2	2.2
CO–2	2	1	2	3	2	3	1	2	2	2	2.0
CO–3	3	2	3	2	2	3	3	1	3	2	2.4
CO–4	3	2	2	1	3	3	3	1	1	3	2.2
CO–5	2	1	2	2	3	3	3	2	2	2	2.2
Mean overall Score											2.2 (High)

Semester	Course Code	Title of the Course	Hours	Credits
II	**21UHI21GL02**	**HINDI - II**	**4**	**3**

CO No.	CO–Statements	Cognitive Levels (K –Levels)
	On successful completion of the course, students will be able to	
CO -1	Find out the Terms & Expressions related to letter writing	**K1**
CO -2	Explain the works of Hindi writers	**K2**
CO -3	Complete the sentences in Hindi using basic grammar	**K3**
CO -4	Analyze the social & political conditions of Devotional period in Hindi Literature	**K4**
CO -5	Justify the human values stressed on the works of the following authors “Premchand, Nirala, etc.”	**K5**

Unit - I **(12 Hours)**

Kafan
Letter Writing - Chutti Patra
Bakthikal - Namakarn
Sarkari kariyalayom ka naam

Unit - II **(12 Hours)**

Baathcheeth - Dookan mein
kriya
Letter Writing - Rishthedarom ko patra
Bakthikal - Samajik Paristhithiyam

Unit - III **(12 Hours)**

Vah Thodthi patthar
Adverb
Letter Writing - Naukari keliye Avedan Patra
Bakthikal - Sahithyik Paristhithiyam

Unit - IV **(12 Hours)**

Mukthi
Samas
Letter Writing - Kitab Maangne Keliye Patra
Bakthikal - Salient Features, Main Divisions

Unit - V **(12 Hours)**

Anuvad - 2
Sandhi
Letter writing - Nagarpalika ko Patra
Bakthikal - Visheshathayem

Books for Study

1. Viswanath Tripaty, *Kuchh Kahaniyan*, Rajkamal Prakashan Pvt. Ltd, New Delhi, 2018.
   Unit-I *Chapter 1*
2. M.kamathaprasad Gupth, *Hindi Vyakaran*, Anand Prakashan, Kolkatta, 2020.
   Unit-II, III and IV *Chapter 2*
3. Dr.Sadananth Bosalae, *kavya sarang*, Rajkamal Prakashan, New Delhi, 2020.
   Unit-V *Chapter 4*

Books for Reference

1. Adhunik Hindi Vyakaran our Rachana, bharati bhawan publishers & distributors, 2018.
2. Acharya ramchandra shukla, Hindi Sahitya Ka Itihas, Prabhat Prakashan, 2021.
3. Krishnakumar Gosamy, Anuvad vigyan ki Bhumika, Rajkamal Prakashan, 2016.
4. Aravind Kumar, Sampoorna Hindi Vyakaran our Rachana, Lucent publisher, 2019.
5. Lakshman prasad singh, Kavya ke sopan, Bharathy Bhavan Prakashan, 2017.

Web Resources

1. https://youtu.be/tE2RHQcqlbI
2. https://youtu.be/Xxvco3qa284
3. https://youtu.be/1z8x95IFGi4
4. https://youtu.be/CBMYf8NRLW4
5. https://youtu.be/h31tMLeFtHs

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code			Title of the Paper				Hours		Credits
II	21UHI21GL02			HINDI - II				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	3	2	2	3	3	3	2	2	2.5
CO-2	1	3	1	2	2	3	3	3	2	3	2.3
CO-3	3	2	3	2	2	3	2	3	2	2	2.4
CO-4	2	3	3	1	3	2	3	2	1	2	2.2
CO-5	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	Credits
II	21USA21GL02	SANSKRIT - II	4	3

CO No.	CO–Statements On successful completion of the course, the student will be able to	Cognitive Levels (K –Levels)
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 Expand Sanskrit vocabulary.	K5

Unit - I **(12 Hours)**

Asmath usmath tat kim (MFN)

Unit - II **(12 Hours)**

Sandhi Niyamaaha Abuyaasha (Guna , Visarga , Dirgha , Vrddhi)

Unit - III **(12 Hours)**

Lang lakaaraha Kriyapadaani

Unit - IV **(12 Hours)**

Raguvamsaha Pratama sargaha (1 –15)

Unit - V **(12 Hours)**

Suvachana Prayogha

Book for Study

SARALASAMKRITHAM SIKSHA, 2020 , K.M Saral sankrit Balabodh , Bharathiys Vidya Bhavan , Munshimarg Mumbai – 400007, 2018

Books for Reference

1. Paindrapuram Ashram , Srirangam – 620006 Gopalavimshanthi 2019
2. R.S.Vadhyar & Sons book Kulapthy , K.M Saral sankrit Balabodh , Bharathiys Vidya Bhavan , Munshimarg Mumbai – 400007, 2018

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code		Title of the Course			Hours		Credit			
II	21USA21GL02		SANSKRIT -II			4		2			
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
Result											# High

Semester	Course Code	Title of the Course	Hours	Credits
II	**21UEN22GE02**	**GENERAL ENGLISH - II**	**5**	**3**

CO No.	CO-Statements	Cognitive Levels (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	remember the use of suitable punctuation marks in appropriate places	**K1**
CO-2	describe their pictures with appropriate expressions	**K2**
CO-3	infer meaning from the given context	**K3**
CO-4	analyse real-life situations and ask open-ended questions	**K4 & K5**
CO-5	use polite expressions in appropriate ways	**K6**

Unit-I **(15 Hours)**

01. Education Word Grid
02. Reading Problems and Solutions
03. Syllabification
04. Forms for Expressing Quality
05. Expressing Comparison
06. Monosyllabic Comparison
07. Di/polysyllabic Comparison
08. The Best Monosyllabic Comparison
09. The Best Di/Polysyllabic Comparison
10. Practising Quality Words

Unit –II **(15 Hours)**

11. Wh Words
12. Yes/No Recollection
13. Unscramble Wh Questions
14. Wh Practice
15. Education and the Poor
16. Controlled Role Play
17. Debate on Education
18. Education in the Future
19. Entertainment Word Grid
20. Classify Entertainment Wordlist
21. Guess the Missing Letter
22. Proverb-Visual Description
23. Supply Wh Words
24. Rearrange Questions
25. Information Gap Questions

Unit-III **(15 Hours)**

26. Asking Questions
27. More about Actions

28. More about Actions and Uses
29. Crime Puzzle
30. Possessive Quiz
31. Humourous News Report
32. Debate on Media and Politics
33. Best Entertainment Source

Unit-IV **(15 Hours)**

34. Career Word Grid
35. Job-Related Wordlist
36. Who's Who?
37. People at Work
38. Humour at Workplace
39. Profession in Context
40. Functions and Expressions
41. Transition Fill-in
42. Transition Word Selection
43. Professional Qualities
44. Job Procedures
45. Preparing a Resume
46. Interview Questions
47. Job Cover Letter Format
48. Emailing an Application
49. Mock Interview

Unit-V **(15 Hours)**

50. Society Word Grid
51. Classify Society Wordlist
52. Rearrange the Story
53. Storytelling
54. Story Cluster
55. Words Denoting Time
56. Expressing Time
57. What Can You Buy?
58. Noise Pollution
59. Positive News Headlines
60. Negative News Headlines
61. Matching Conditions
62. What Would You Do?
63. If I were Elected
64. My Dream Country

Book for Study

Joy, J.L. & Peter, F.M. *Let's Communicate 2*, New Delhi: Trinity Press, 2014.

Books for Reference

1. Ahrens, Sönke. *How to Take Smart Notes: One Simple Technique to Boost Writing, Learning and Thinking*. New York: CreateSpace, 2017.
2. Aspinall, Tricia. *Test Your Listening.* London: Pearson, 2002.

3. Bailey, Stephen. *Academic Writing: A Practical Guide for Students*. New York: Routledge, 2004'
4. Fitikides, T.J. *Common Mistakes in English* (6th ed.). London: Longman, 2002
5. Wainwright, Gordon. *How to Read Faster and Recall More: Learn the Art of Speed Reading with Maximum Recall* (3rd ed.). Oxford: How to Books, 2007.

Web Resources

1. https://learnenglish.britishcouncil.org/
2. https://oneminuteenglish.org/en/best-websites-learn-english/
3. https://www.dailywritingtips.com/best-websites-to-learn-english/

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester	Course Code			Title of the Course						Hours	Credits
II	21UEN22GE02			GENERAL ENGLISH - II						5	3
Course Outcomes (COs)	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	2	3	2	2	3	2	3	2	3	2	2.4
CO-2	2	2	3	2	3	3	2	3	2	2	2.3
CO-3	2	3	2	3	2	2	3	2	3	2	2.4
CO-4	2	2	3	2	3	3	2	3	2	3	2.5
CO-5	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	Credits
II	**21UPH23CC02**	**CORE-2: MECHANICS**	**5**	**3**

CO No.	CO- Statements	Cognitive Levels (K-Levels)
	On the successful completion of the course, student will be able to	
CO-1	acquire the knowledge on the concepts of mechanics for the application of physics in real life physical problems	**K1**
CO-2	understand the concepts of kinematics and dynamics for solving the problems related to conservation laws and rigid body dynamics	**K2**
CO-3	apply laws of motion and gravitation for understanding the complex problems in physics	**K3**
CO-4	analyze the behavior of nature from the understanding of the various laws and theories of mechanics	**K4**
CO-5	analyze the concepts in the theory of gravitation and cosmology	**K4**

Unit -I: Kinematics and Dynamics (15 Hours)

Formal Solution of Kinematic Equation - Derivative of a vector - Circular Motion of Rotating Vectors - Motion in plane polar coordinates - velocity of a bead on a spoke - Newton's laws - Astronauts in space - Some applications of Newton's laws - Freight train - Constraints - wedge and block - masses and pulley - pulley system - Block on strings - The whirling rope - contact forces - block and string - Dangling rope - pulleys - tension and atomic forces - normal force and friction- block and wedge with friction.

Unit -II: Work and Energy (15 Hours)

Equation of motion in one dimension - Mass thrown upward in gravitational field - solving the equation of motion of simple harmonic oscillator - The work energy theorem in one dimension - Vertical motion in an inverse square field - The work energy theorem - Applying the work energy theorem - The inverted pendulum- work done by a uniform force - work done by a central force - A Path-dependent line integral - Potential energy - Potential energy of a uniform force field - Potential energy of an inverse square field - Potential energy from force - Energy diagrams - Non Conservative forces - The general law of conservation of energy - Power.

Unit -III: Conservation of Linear and Angular Momentum (15 Hours)

Internal forces and momentum conservation - Centre of mass - collision of particles that stick together - Transverse momentum components - Collision of particles with internal excitations - General elastic collision of particles with different masses - Systems with variable mass - satellite in interplanetary dust - space vehicle problem - Force due to a falling chain - Conservation of angular momentum - Torques due to internal forces sum to zero - Torque due to gravity - Angular momentum of the centre of mass - Angular acceleration accompanying contraction - shape of the galaxy.

Unit - IV: Dynamics of Rigid Bodies (15 Hours)

The vector nature of angular velocity and angular momentum - rotations through finite angles - rotations in the XY plane - vector nature of angular velocity. The equation of motion - Angular momentum and kinetic energy - Moments of inertia - Paralleland perpendicular axis theorem - thin ring - uniform thin rod - circular disc - rectangular plate - Rotations about fixed axis -

Rotation about point of contact - energy consideration - acceleration of the center of mass and angular acceleration of the center of mass - Torques about a center of mass - cylinder on an accelerated rough plane.

Unit - V: Inverse Square Law Force **(15 Hours)**

Potential energy and the force between a point mass and a spherical shell - Potential energy between a point mass and a solid sphere - Gravitational and electrostatic self-energy - Gravitational energy of a galaxy - Gravitational energy of a uniform sphere - Radius of the obit of the electron - Inverse square law forces and static equilibrium - orbits: equation and eccentricity - circular orbit - Kepler's laws - Two body problem: Reduced mass - Vibration of a diatomic molecule.

Books for Study

1. Kleppner and Kolenkow, *An introduction to Mechanics*, 1ST Edition, McGraw Hill Education, 2017.
2. Charles Kittel, Walter Knight, Helmholtz, Ruderman and Moyer, *Mechanics*, McGraw Hill Education 2017.

Unit	Chapters	Sections
I	1 2	1.7-1.9 2.2, 2.4
II	1	4.2, 4.3, 4.5-4.9, 4.11
III	2	Ch 6
IV	1 2	7.2 Ch 8
V	2	Ch 9

Books for Reference

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

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	**Course Code**			**Title of the Course**				**Hours**		**Credit**
II	**21UPH23CC02**			**CORE-2: MECHANICS**				**5**		**3**
Course Outcomes (COs)	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**					**Mean Scores of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO-1	3	2	3	2	1	3	3	3	2	1	2.3
CO-2	3	2	3	2	1	3	3	2	3	1	2.3
CO-3	3	3	2	2	2	3	3	2	1	1	2.2
CO-4	3	3	2	3	1	3	3	3	2	1	2.4
CO-5	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	Credits
II	**21UPH23CP01**	**PHYSICS PRACTICAL – I**	**3**	**2**

Any 20 Experiments

1. Surface Tension – drop weight method.
2. Surface Tension – capillary rise method.
3. Viscosity – constant pressure head method.
4. Viscosity – variable pressure head method.
5. Viscosity – Stoke's method.
6. Young's modulus – cantilever / stretching.
7. Young's modulus – non uniform bending (pin and microscope).
8. Sonometer – frequency of the tuning fork – RD of solid.
9. Sonometer – AC frequency determination.
10. Spectrometer – refractive index - solid prism (glass).
11. Spectrometer – dispersive power - prism.
12. Potentiometer – internal resistance.
13. Potentiometer – low range voltmeter.
14. P.O Box – temperature coefficient.
15. Carey Fosters bridge – R and ρ (rho).
16. Convex lens – f, R and μ.
17. Concave lens – f, R and μ.
18. Field along the axis of a coil – deflection magnetometer.
19. M1/M2- Tan A & Tan B simultaneous method.
20. M1/M2 – Vibration magnetometer.
21. Air wedge-Thickness of wire.
22. Newton's rings.
23. B.G. – Figure of merit.
24. B.G. comparison of EMF's and capacitance.
25. Resonators - Helmholtz and Cylindrical Resonators.
26. g – by fall plate.
27. Specific heat by cooling method.
28. Specific heat capacity of solid by the method of mixture.

Semester	Course Code	Title of the Course	Hours	Credits
II	**21UPH23WS01**	**BASIC WORKSHOP PRACTICE**	**3**	**2**

1. Paper Weight
2. Pen Stand
3. Letter box
4. Wood Carving
5. Electroplating
6. Assembling the Extension board
7. Tube light assembling.
8. LED light assembling.

Semester	Course Code	Title of the Course	Hours	Credits
II	21UPH23AC02	ALLIED: MATHEMATICS FOR PHYSICS-II	6	4

CO No.	CO-Statements	Cognitive Levels (K-levels)
	On successful completion of this course, students will be able to	
CO-1	acquire knowledge of basic concepts of numerical methods, partial differential equations, vector analysis, trigonometry and complex analysis.	K1
CO-2	understand numerical methods, curl and divergence of a vector function, types of PDEs, series expansion , analyticity of a function.	K2
CO-3	apply various methods in solving problems.	K3
CO-4	illustrate with suitable examples.	K4
CO-5	evaluate numerical solutions of ODE by numerical methods , PDEs, line, surface and volume integrals, series expansion, complex integration.	K5

Unit-I: **(18Hours)**

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 $Sinn\theta$ and $Cosn\theta$ - Powers of Sines and Cosines of θ in terms of function of multiple of θ - Hyperbolic Functions - Inverse Hyperbolic Functions .

Unit -V: **(18Hours)**

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

Books for Study:

1. M.K.Venkataraman, *Numerical Methods in Science and Engineering*, The National Publishing Company, 5th Edition, 2013.

UNIT I: *Chapter IV (Sec: 2, 6), Chapter XI (Sec: 6, 10, 16).*

2. S. Narayanan, R. Hanumantha Rao, T.K. Manicavachagom Pillay and Kandaswamy,*Ancillary Mathematics Vol-II*, 2010 Edition.

UNIT II: *Chapter 6-Sec 1-6, pp: 252-274.*

UNIT III:*Chapter 8 - Sec 1.17-1.20, 6, 8 and 9, pp: 335-350, 381-389, 399-407.*

3. S. Narayanan, R. Hanumantha Rao, T.K. Manicavachagom Pillay and Kandaswamy,

Ancillary MathematicsVol-I, 2009 Edition.
UNIT IV:*Chapter 5 - Sec 5.1, 5.2 and 5.4, pp: 220-232, 242-256.*
4. S. Narayanan and T.K.Manickavachagom Pillay, *Complex Analysis*, 1997 Edition.
UNIT V:*Chapter 1 - Sec 11, pp : 43-57, Chapter 5 - Sec 1-3, (pp : 185-196).*

Books for Reference:
1. S.Narayanan & T.K. Manichavachagom Pillay, *Differential equations and its applications*, Viswanathan Pvt Ltd 2013.
2. M.K.Venkataraman, *Higher Mathematics for Engineering and Science*, Third Edition, The National Publishing Co., Madras, 1986.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	**Course Code**			**Title of the Course**					**Hours**	**Credits**
II	**21UPH23AC02**			**ALLIED: MATHEMATICS FOR PHYSICS-II**					**6**	**4**
Course Outcomes (COs)	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**					**Mean Scores of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO-1	3	2	3	2	1	3	3	1	2	3	2.3
CO-2	3	3	2	1	2	3	3	2	2	2	2.3
CO-3	3	2	3	1	2	2	3	2	3	2	2.3
CO-4	3	2	3	1	2	3	2	1	2	3	2.2
CO-5	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	Credits
II	**21UHE24AE02**	**Environmental Studies**	**2**	**2**

CO No.	CO - Statements	Cognitive Levels (K-levels)
	On Completion of this course, the graduates will be able to:	
CO-1	identify the concepts related to the environmental global scenario	**K1**
CO-2	comprehend the natural resources and environmental organizations	**K2**
CO-3	apply the acquired knowledge to sensitize individuals and public about the environmental crisis	**K3**
CO-4	analyze the causes and changes in the structure of biodiversity	**K4**
CO-5	enhance their skills in the society by solving the environmental problems and preserving nature by the acquired knowledge	**K5**

Unit I Introduction to Environmental Studies (6 Hours)

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

Unit II Natural Resources (6 Hours)

Food Resources – Land Resources – Forest resources – Mineral Resources – Water Resources – Energy Resources

Unit III Ecosystems, Biodiversity and Conservation (6 Hours)

General structure of ecosystem - Functions of Ecosystem - Energy flow and Ecological pyramids – Levels of Biodiversity - 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 VEnvironmental 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.

Books for Study

Department of Human Excellence, *Environmental Studies*, St. Joseph's College, Tiruchirappali-02, 2021.

Books for Reference

1. Rathor, V.S. and Rathor B. S. *Management of Natural Resources for Sustainable Development*. New Delhi: Daya Publishing House, 2013.
2. Sharma P.D,*Ecology and Environment*, 8 ed., Meerut: Rastogi Publications, 2010.
3. Agrawal, A and C.C. Gibson. *Introduction: The Role of Community in Natural Resource*

4. *Conservation.* NJ: Rutgers University Press, 2001.
Web Sources:
https://www.unep.org/. Accessed 05 Mar. 2021.
http://moef.gov.in/en/ Accessed 05 Mar. 2021.
https://www.ipcc.ch/reports/. Accessed 05 Mar.2021.

Semester	Course Code	Title of the Course	Hours	Credits
II	**21UHE14VE02**	**TECHNIQUES OF SOCIAL ANALYSIS: FUNDAMENTALS OF HUMAN RIGHTS**	**2**	**1**

CO. No.	CO - Statements	Cognitive Levels (K-levels)
	On completion of this course, the graduates will be able to:	
CO-1	identify the importance and the values of human rights	**K1**
CO-2	understand the historical background and the development of Human Rights and the related organizations	**K2**
CO-3	apply the provisions of National and International human rights to themselves and the society	**K3**
CO-4	analyse the violations of human rights to the marginalized section in the society	**K4**
CO-5	animate the people to involve in the struggles and activities of the human rights organizations	**K5**

Unit-I Human Rights - An Introduction (6-Hours)
Introduction- Classification of Human Rights- Scope of Human Rights-Characteristics of Human Rights-NHRC-SHRC- Challenges for Human Rights in the 21stCentury.

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-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, January 2012- Human Rights Organizations.

Books for Study
The Department of Human Excellence, *Techniques of Social Analysis: Fundamentals of Human Rights*, St. Joseph's college, Tiruchirappalli -02, 2021.

Books for Reference

1. Venkatachalem. Dr.*The Constitution of India,Salem:Giri Law House,* 2005.
2. NaikVarunand Mukesh Shany. *Human rights education and training,* New Delhi:crescent Publishing Corporation, 2011.

3. BhathokeNeera. *Human Rights content and extent*,New Delhi: swastika publications, 2011.

Web Sources

https://www.un.org/en/universal-declaration-human-rights/. Accessed 05 Mar. 2021.
https://www.ilo.org/global/lang--en/index.htm. Accessed 05 Mar. 2021.
https://www.amnesty.org/en/. Accessed 05 Mar. 2021.

Semester	Course Code	Title of the Course	Hours	Credits
III	21UTA31GL03	General Tamil - III	4	3

CO No.	CO- Statement	Cognitive Level (K- level)
இப்பாடத்தின் நிறைவில் மாணவர்கள்		
CO-1	சங்க இலக்கிய வகைகளை நினைவுகூருவர்	K 1
CO-2	இலக்கியத்தினை நுட்பமாக அறிதலின் வழியாக ஆற்றுப்படுத்தும் திறன் பெறுவர்	K 2
CO-3	இலக்கிய அறநெறிகளைத் தற்கால வாழ்வியலில் பயன்படுத்தும் திறன் பெறுவர்	K 3
CO-4	அகம் மற்றும் புற இலக்கியத் திணை, துறைகளைப் பகுத்தாராய்வர்	K 4
CO-5	யாப்பு, அணி இலக்கண நுட்பங்களை இலக்கியங்களில் மதிப்பிடுவர்	K 5

அலகு - 1 **(12 மணிநேரம்)**

பொருநராற்றுப்படை (முழுமையும்)

அலகு - 2 **(12 மணிநேரம்)**

நற்றிணை - 5 பாடல்கள் - (1, 19, 21, 70, 148)
ஐங்குறுநூறு - அன்னாய் வாழிப்பத்து.
யாப்பிலக்கணம் - வெண்பா, ஆசிரியப்பா

அலகு - 3 **(12 மணிநேரம்)**

கலித்தொகை - (குறிஞ்சிக்கலி- 62, பாலைக்கலி -22, மருதக்கலி- 87, நெய்தற்கலி-149, முல்லைக்கலி - 116)
இலக்கிய வரலாறு - முதற்பாகம் ('தமிழ் மொழியின் தொன்மையும் சிறப்பும்' முதல் 'சங்க தொகை நூல்கள்' முடிய),
புதினம் - குடும்ப அட்டை (2022-2023)

அலகு - 4 **(12 மணிநேரம்)**

பதிற்றுப்பத்து - 3 பாடல்கள் (14, 32, 61)
புறநானூறு - 5 பாடல்கள் (95, 121, 130, 204, 279)
அணியிலக்கணம்

அலகு - 5 **(12 மணிநேரம்)**

திருக்குறள் - புறங்கூறாமை, பழமை, புலவி நுணுக்கம் ஆகிய அதிகாரங்கள்

திரிகடுகம் - 5 பாடல்கள் (2, 6, 12, 15, 42)

இலக்கிய வரலாறு - சங்க இலக்கியங்களின் தனித்தன்மைகள் முதல் இரட்டைக் காப்பியங்கள் முடிய

பாடநூல்கள் :

1. **பொதுத்தமிழ்** செய்யுள் திரட்டு, தமிழாய்வுத்துறை வெளியீடு, தூய வளனார் கல்லூரி, திருச்சிராப்பள்ளி-2, முதற்பதிப்பு, 2021
2. **சமூகவியல் நோக்கில் தமிழிலக்கிய வரலாறு,** *தமிழாய்வுத்துறை, தூய வளனார் தன்னாட்சிக் கல்லூரி, திருச்சிராப்பள்ளி, பத்தாம் பதிப்பு, 2017*
3. **புதினம்** (ஒவ்வொரு கல்வியாண்டிற்கும் ஒவ்வொரு புதினம்)

2022 – 2023 கல்வியாண்டுக்கு மட்டும் : வீ.செந்தில் குமார், **குடும்ப அட்டை,** தாமரை பப்ளிகேஷன்ஸ் பிரைவேட் லிமிடெட், சென்னை, முதற்பதிப்பு, 2009

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code			Title of the Course				Hours		Credit
III	21UTA31GL03			General Tamil - III				4		3
Course Outcomes (COs)	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	2	3	2	3	2	3	3	2	2.5
CO-2	2	2	2	3	3	2	2	3	3	2	2.4
CO-3	3	3	2	3	3	2	2	3	3	3	2.7
CO-4	3	2	2	3	2	3	2	3	2	3	2.5
CO-5	2	3	2	3	2	3	2	3	2	3	2.5
Mean Overall Score											2.52 (High)

Semester	Course Code	Title of the Course	Hours	Credits
III	**21UFR31GL03**	**FRENCH – III**	**4**	**3**

CO No.	CO–Statements	Cognitive Levels (K –Levels)
	On successful completion of this course, students will be able to	
CO–1	relate colours, materials and shapes to the french clothing.	**K1**
CO–2	select appropriate prepositions in giving directions.	**K2**
CO–3	construct a text in present tense using different verbs.	**K3**
CO–4	examine the travel manners and celebrations of the French.	**K4**
CO–5	justify the usage of past tense in a biography.	**K5**

Unit – I **(12 hours)**

TITRE:VIVRE LAVILLE
GRAMMAIRE : la comparaison, les prépositions avec les noms géographiques, les pronoms personnels COI, le pronom y (le lieu)
LEXIQUE : se repérer sur un plan de ville, la ville, les lieux de la ville
PRODUCTION ORALE : demander et indiquer une direction dans un dialogue
PRODUCTION ECRITE : décrire votre ville natale, créez les affiches en appréciant votre ville

Unit - II **(12 hours)**

TITRE:VISITER UNE VILLE
GRAMMAIRE : la position des pronoms compléments, les verbes du premier groupe en – ger et – cer, les verbes ouvrir et accueillir
LEXIQUE : dire les informations sur une ville de votre choix, les transports, les points cardinaux, les prépositions de lieu
PRODUCTION ORALE : Indiquer le chemin
PRODUCTION ECRITE : Demander des renseignements touristiques

Unit - III **(12 hours)**

TITRE:ON VEND OU ON GARDE
GRAMMAIRE : la formation du pluriel, les adjectifs de couleurs, l'adjectif beau, nouveau,vieux
LEXIQUE : savoir comment s'habiller des grandes occasions, les couleurs, les formes, les matériaux
PRODUCTION ORALE : comprendre une présentation de catalogues vestimentaires en France
PRODUCTION ECRITE : adresser des souhaits à quelqu'un

Unit - IV **(12 hours)**

TITRE:VENTES D'AUTREFOIS, VENTES D'AUJOURD'HUI
GRAMMAIRE : les pronoms relatifs qui et que, l'imparfait, les verbes connaitre, écrire, mettre et vendre, la question avec inversion
LEXIQUE : comprendre la description de personnes dans un extrait de roman, les mesures, l'informatique
PRODUCTION ORALE : imaginez un dialogue avec un personnage célèbre. Utilisez

l'inversion.
PRODUCTION ECRITE : écrire une biographie en utilisant les pronoms relatifs

Unit- V **(12 hours)**

TITRE:FELICITATIONS ! / ON VOYAGE!
GRAMMAIRE : les pronoms démonstratifs, les articles : particularités, les pronoms interrogatifs variables : lequel, les adverbes de manières, les verbes recevoir et conduire
LEXIQUE : les moyens de transports, les voyages, les fêtes, l'aéroport et l'avion, la gare et le train, l'hôtel
PRODUCTION ORALE : Présenter ses vœux
PRODUCTION ECRITE : Faire une réservation

Book for Study

P.Dauda,L.Giachino and C.Baracco, *Generation A2*, Didier, Paris 2016.

Books for Reference

1. J.Girardet and J.Pecheur, *EchoA2*, CLE International, 2^{e}edition,2017
2. Régine Mérieux and Yves Loiseau, *Latitudes A2*, Didier, 2012.
3. Isabelle Fournier, *Talk French*, Goyal Publishers, 2011

Web Resources

1. https://francais.lingolia.com/en/grammar/prepositions
2. https://www.lawlessfrench.com/grammar/present-tense/
3. https://www.thoughtco.com/textures-french-adjectives-and-expressions-1368980
4. https://study.com/academy/lesson/past-tense-in-french.html
5. https://absolutely-french.eu/french-celebrations/?lang=en

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course code			Title of the Course				Hours		Credits
III	21UFR31GL03			FRENCH – III				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	
CO–1	2	1	2	2	3	2	3	1	2	3	2.1
CO–2	3	2	3	3	1	2	1	2	2	3	2.2
CO–3	2	1	3	2	2	3	1	3	2	2	2.1
CO–4	3	1	3	2	3	3	3	1	2	3	2.4
CO–5	3	2	3	2	2	3	3	2	2	1	2.3
Mean overall Score											2.22 (High)

Semester	Course Code	Title of the Course	Hours	Credits

III	21UHI31GL03	HINDI - III	4	3

CO No.	CO–Statements On successful completion of the course, students will be able to	Cognitive Levels (K –Levels)
CO-1	find out the dialects of Hindi language.	K1
CO-2	compare the poems of Sumithra Nandanpanth, Prasad & Bachan in Context with their experience of life.	K2
CO-3	illustrate the importance given to family ethics by the youth in the modern period according to "Bahoo Ki vidha" One Act play.	K3
CO-4	categorize the poetics in some selective poems.	K4
CO-5	justify the social & political conditions of Devotional period in Hindi Literature.	K5

Unit - I **(12 Hours)**

Tera sneh na khooon
Samband Bodak
Reethikal - Namakarn
Tense

Unit - II **(12 Hours)**

Himadri Thung Sring Se
Paribakshik shabdavali
Samuchaya Bodak
Reethikal - Samajik Paristhithiyam

Unit - III **(12 Hours)**

Insan our Kuthae
Vismayadi Bodak
Reethikal - Sahithyik Paristhithiyam
Reethikal - Salient Features

Unit - IV **(12 Hours)**

Shokgeeth
Avikary shabdh
Reethikal - Main Divisions
Social media and modern world

Unit - V **(12 Hours)**

Reethikal - Visheshathayem
Anuvad – 3
Bahoo ki vidha (one act play)

Books for Study

1. Dr. Sanjeev Kumar Jain, Anuwad: Siddhant Evam Vyavhar, Kailash Pustak Sadan, Madhya Pradesh, 2019.
Unit-I *Chapter 1*

2. M. Kamathaprasad Gupth, *Hindi Vyakaran*, Anand Prakashan, Kolkatta, 2020.
   Unit-II, III and IV *Chapter 2*
3. Dr. Sadananth Bosalae, *kavya sarang*, Rajkamal Prakashan, New Delhi, 2020.
   Unit-V *Chapter 4*

Books for Reference

1. Ramdev, Vyakaran Pradeep, Hindi Bhavan, 2016.
2. Lakshman prasad singh, Kavya ke sopan, Bharathy Bhavan Prakashan, 2017.
3. Acharya ramchandra shukla, Hindi Sahitya Ka Itihas, Prabhat Prakashan, 2021.
4. Hindi Niband Sangrah,V&S Publishers, 2015.
5. Krishnakumar Gosamy, Anuvad vigyan ki Bhumika, Rajkamal Prakashan, 2016.

Web Resources

1. https://youtu.be/Xxvco3qa284
2. https://youtu.be/e9wK-pYfVPc
3. https://youtu.be/75tHr53f5_o
4. https://youtu.be/eFNM6y_cpjY
5. https://youtu.be/jHWXWLMxJtw

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code			Title of the Course					Hours	Credits
III	21UHI31GL03			HINDI - III					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	3	2	3	3	2	3	2	1	3	2	2.4
CO-2	3	2	3	2	2	3	2	3	2	3	2.5
CO-3	3	2	2	3	1	3	2	3	2	3	2.4
CO-4	2	3	3	2	3	2	3	3	2	1	2.4
CO-5	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	Credits

III	21USA31GL03	SANSKRIT - III	4	3

CO No.	CO–Statements On successful completion of the course, the student will be able to	Cognitive Levels (K –Levels)
CO-1	remember Characters and events of Ramayana.	K1
CO-2	understand social ethics and moral duties.	K2
CO-3	apply the values learnt , in day to day life.	K3
CO-4	analyzing the Vedic Philosophy.	K4
CO-5	evaluate and create new words with upasargas.	K5

Unit - I **(12 Hours)**

Romodantam , Balakandam (1-15)

Unit - II **(12 Hours)**

Romodantam , Balakandam (15-30)

Unit - III **(12 Hours)**

Vedas – Vedangas vivaranam

Unit - IV **(12 Hours)**

Puranas .Upanishands

Unit - V **(12 Hours)**

Upasargas , Bhavishyat Kaalah

Book for Study

VEDIC LITERATURE, 2019

Books for Reference

1. Parameshwara, Ramodantam, LIFCO Chennai 2018
2. R.S.Vadhyar & Sons , Book – sellers and publishers , Kalpathu ,Palghat – 678003 , Kerala , south India , History of Sanskrit Literature 2019
3. Kulapathy , K.M Saral Sanskrit Balabodh , Bharathita vidya bhavan , Munshimarg Mumbai – 400 007 2018

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credit
III	21USA31GL03	SANSKRIT-III	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	1	2	2	3	3	3	3	3	2	1	2.3
CO-2	3	3	2	3	3	2	2	3	3	3	2.7
CO-3	3	3	1	3	3	1	1	3	3	3	2.4
CO-4	2	2	1	2	3	2	2	3	2	1	2.0
CO-5	3	3	2	3	2	2	3	3	3	2	2.6
Mean Overall Score											2.4
Result											# High

Semester	Course Code	Title of the Course	Hours	Credits

III	21UEN32GE03	GENERAL ENGLISH - III	5	3

CO No.	CO-Statements	Cognitive Levels (K-Levels)
	On successful completion of this course, students will be able to	
CO -1	recall the meaning of familiar words in different contexts	**K1**
CO-2	comprehend the complex written texts by guessing meaning of unfamiliar words using contextual clues	**K2**
CO-3	use tenses and punctuations appropriately in sentences	**K3**
CO-4	analyse formal and informal letters to rewrite them meaningfully	**K4**
CO-5	compare different genres of writing and construct paragraphs	**K5 & K6**

Unit-I **(15 Hours)**

1. Suggestions to Develop Your Reading Habit
2. General Writing Skill: Letter Writing – Informal
3. Grammar: Simple Present Tense

Unit-II **(15 Hours)**

4. The Secret of Success: An Anecdote
5. General Writing Skill: Letter Writing – Formal
6. Grammar: Present Continuous Tense

Unit-III **(15 Hours)**

7. The Impact of Liquor Consumption on the Society
8. General Writing Skill: Letter to Newspaper
9. Grammar: Simple Past Tense

Unit-IV **(15 Hours)**

10. Dr. A.P.J. Abdul Kalam: A Short Biography
11. General Writing Skill: Job Application Letter
12. Grammar: Past Continuous Tense

Unit-V **(15 Hours)**

13. Golden Rule: A Poem
14. General Writing Skill: Circular-Writing
15. Grammar: Simple Future Tense and Future Continuous Tense

Book for Study

Jayraj, S. Joseph Arul et al. *Trend-Setter*: *An Interactive General English Textbook for Undergraduate Students*. Trinity, 2016.

Books for Reference

1. Malkani, Neelam. *A comprehensive Guide on General English for Competitive Exams*. Agra: Oswal Publications, 2020.
2. Jain, B. B. *Compendium General English*. Agra: Upkar Prakashan, 2010.

3. Aggarwal, R.S. *Quick Learning Objective General English*. India: S Chand, 2006.
4. T. Ferrari, Bernard. *Power Listening: Mastering the Most Critical Business Skill of All.* USA: Penguin Publishers, 2012.
5. Barry, Marian. *Steps to Academic Writing*. USA: Cambridge University Press, 2011.

Web Resources

1. https://www.nypl.org/events/classes/english
2. https://www.waywordradio.org/listen/podcast-itunes/?gclid=EAIaIQobChMIrbeRtbP12AIVCYZpCh0-XwnvEAAYAiAAEgLcjvD_BwE
3. https://eltlearningjourneys.com/2015/05/19/websites-for-learning-english/

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester	Course Code	Title of the Course					Hours	Credits
III	21UEN32GE03	GENERAL ENGLISH - III					5	3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					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	2	3	2	2	3	2	3	2	3	2	2.4
CO-2	2	2	3	2	3	3	2	3	2	2	2.3
CO-3	2	3	2	3	2	2	3	2	3	2	2.4
CO-4	2	2	3	2	3	3	2	3	2	3	2.5
CO-5	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	Credits
III	21UPH33CC03	CORE-3: MATHEMATICAL PHYSICS –I	4	4

CO No.	CO- STATEMENTS	COGNITIVE LEVELS (K-Levels)
	On the successful completion of the course, student will be able to	
CO-1	acquire and understand the knowledge about different mathematical methods like vector and matrix algebra, differential equations, multiple integrals and Fourier series for solving different physics problems.	**K1, K2**
CO-2	solve first order differential equations, and Fourier series to identify the solutions of physics problems like radio carbon dating, harmonic oscillator.	**K3**
CO-3	apply matrices, differential equations, Fourier series, multiple integrals, and vector calculus to obtain the solution for complex physics problems.	**K3**
CO-4	compute vector calculus, multiple integrals for different physics problems and apply the concept of change of variables in different coordinate systems.	**K4**
CO-5	analyse and interpret the solutions obtained by mathematical methods.	**K4**

Unit - I: Matrices **(12 Hours)**

Linear transformation - Vector spaces - Eigen Values and Eigen Vectors - Application of Eigen value problems - stretching of an elastic membrane - Vibrating system of two masses on two springs - Symmetric, Skew symmetric and orthogonal matrices - Diagonalization of matrices - Complex matrices - Hermitian and Skew Hermitian form.

Unit - II: Vector Calculus **(12 Hours)**

Position, Displacement and Separation vectors - Vector Transformation - Derivatives - Gradient - Del operator - Divergence - Curl - Product rule - second derivatives - Line, surface and volume integrals - Fundamental theorems of calculus - Fundamental theorems of gradient, divergence and curl - Integration by parts - Curvilinear coordinates - Spherical polar and cylindrical coordinates - one dimension Dirac delta function.

Unit - III: Differential Equation **(12 Hours)**

First order differential equation - Basic concepts - concept of a solution - Initial value problem - radioactivity: exponential decay - separable ODE - Radio Carbon dating - Mixing problems - Newton's law of cooling - leaking tank (Torricelli's law) - differential operators - Free oscillation - undamped system - undamped motion , Harmonic oscillation - Damped system - forced oscillation resonance - damped and undamped forced oscillation - electrical circuits - solving ODE for current - LCR circuit.

Unit - IV: Multiple Integrals **(12 Hours)**

Double integral - Application - Change of order of the Integral - Change of variables - general change of variables in double integral - Change of variable in Cartesian polar coordinates - triple integral - Application - general change of variables in triple integral - cylindrical and spherical polar coordinates.

Unit -V: Fourier Series **(12 Hours)**

Fourier series - periodic rectangular wave - Function of period p:2L - periodic rectangular wave I and II - Half wave rectifier - Even and Odd function - rectangular pulse - half wave rectifier - sawtooth wave - half range expansion - triangle - Complex Fourier series - Forced oscillation - under non sinusoidal periodic force - Fourier integral.

Books for Study

1. Erwin Kreyszig, *Advanced Engineering Mathematics*, 9th edition, Wiley; 2010.
2. B. V. Ramana, *Higher Engineering Mathematics*, Tata McGraw Hill, 2006
3. David J. Griffiths, *Introduction to Electrodynamics*, 4th edition, Pearson, 2018.

Unit	Book	Chapters	Sections
I	1	7,8	7.9, 8.1-8.5
II	3	1	1.1.4-1.1.5
III	1	1,2	1.1, 1.3, 2.3, 2.4, 2.8, 2.9
IV	2	7	7.1-7.6
V	1	11	11.1-11.5, 11.7

Books for Reference

1. H.K. Dass, *Mathematical Physics*, S. Chand, New Delhi, 2006.
2. Satya Prakash, *Mathematical Physics*, Sultan Chand, New Delhi, 2008.
3. AK Mukhopadhyay, *Mathematical Methods for Engineers and Physicists*, Wheeler Pub, New Delhi, 1998.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific outcomes

Semester	Course Code	Title of the Course	Hours	Credit
III	21UPH33CC03	CORE-3: MATHEMATICAL PHYSICS - I	4	4

Course Outcomes (COs)	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	2	3	2	3	3	3	2	2	2.6
CO-2	3	3	2	3	2	3	2	3	2	2	2.5
CO-3	3	2	2	3	2	3	3	3	2	2	2.5
CO-4	3	2	2	2	2	2	3	3	2	2	2.3
CO-5	3	3	2	3	2	3	2	3	2	3	2.6
Mean Overall Score											2.5 (High)

Semester	Course Code	Title of the Course	Hours	Credits
III	21UPH33CC04	CORE-4:	4	3

		ELECTROMAGNETISM		

CO No.	CO- Statements	Cognitive Levels (K-Levels)
	On the successful completion of the course, student will be able to	
CO 1	acquire and describe the knowledge on basic electrostatics, magnetostatics and electrodynamics laws.	**K1**
CO 2	understand the behaviour of electric fields, electromagnetic fields and electromagnetic wave propagation in matter.	**K2**
CO 3	understand the basic knowledge of the static and time varying electromagnetic field as determined by Maxwell's equations.	**K2**
CO 4	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**
CO 5	analyse electric field, electric potential, electric flux, and magnetic field in different symmetry systems.	**K4**

Unit - I: Electrostatics (12 Hours)

Coulombs law - electric field - charge distribution - Flux - Gauss's law: applications of Gauss's law in spherical - Cylindrical and Planar symmetry - Electric potential: potential of a localized charge distribution - Potential for a uniformly charged spherical shell and solid sphere - Energy of point charge distribution and continuous charge distribution - Electric field and charge density: inside and on the surface of a conductor - Surface charge and force on a conductor - Capacitor: capacitance of an isolated spherical conductor and parallel plate capacitor.

Unit - II: Electric Field in Matter (12 Hours)

Dielectrics - induced dipoles - polarisation - electric potential and field due to dipole - force and torque on dipole - bound charged field inside the dielectric - Gauss's law in dielectrics - linear dielectrics: Susceptibility - Permittivity and dielectric constant - Energy in capacitor (parallel plate, spherical and cylindrical) filled with dielectric.

Unit - III: Magnetostatics (12 Hours)

Lorentz force law - Force on a moving point charge - Biot-Savart's law - Application of Biot - Savart's law: determination of magnetic field on a straight wire - circular coil - Force between two straight current carrying wires - divergence and curl of magnetic field - magnetic vector potential - Ampere's law - applications of Ampere's law in: an infinite straight wire - an infinite planar surface current and Solenoid.

Unit - IV: Magnetostatic Fields in Matter (12 Hours)

Magnetisation - diamagnets - paramagnets and ferromagnets - torque and force on a magnetic dipole - effect if a magnetic field on atomic orbits - field of a magnetised object - bound currents and its physical interpretation - magnetic field inside matter - auxiliary field H-Ampere's law in magnetised materials - boundary conditions - linear and non-linear media - magnetic susceptibility and permeability - ferromagnetism.

Unit - V: Electrodynamics (12 Hours)

Electro motive force - Faraday's laws of electromagnetic induction - Lenz's law - induced electric field - self-inductance and mutual inductance - energy stored in magnetic field - electrodynamics before Maxwell - modified Ampere's law - Maxwell's equations - magnetic charge - Maxwell's equations inside the matter - boundary conditions.

Book for Study

1. D.J. Griffiths, *Introduction to Electrodynamics*, 4th Edition, PHI Learning, New Delhi, 2012.

Unit	Book	Chapters	Sections
I	1	2	2.1, 2.2, 2.3, 2.4, 2.5
II	1	4	4.1, 4.2, 4.3, 4.4, 4.5
III	1	5	5.1, 5.2, 5.3, 5.4
IV	1	6	6.1, 6.2, 6.3, 6.4
V	1	7	7.1, 7.2, 7.3

Books for Reference

1. Edward M. Purcell and David J. Morin, *Electricity and Magnetism*, 3rd Edition, Cambridge University Press, 2013.
2. J. Walker, D. Halliday, R. Resnick, Wiley, *Fundamentals of Physics*, 10th Edition, United states of America, 2007.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credit
III	21UPH33CC04	CORE-4: ELECTROMAGNETISM	4	3

Course Outcomes (COs)	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	2	3	2	3	3	3	2	2	2.5
CO-2	3	2	2	2	2	2	3	2	3	2	2.3
CO-3	3	3	3	3	2	3	3	3	1	2	2.6
CO-4	3	2	2	3	2	3	3	2	1	2	2.3
CO-5	3	2	2	2	2	3	3	2	1	2	2.2
Mean Overall Score											2.38 (High)

Semester	Course Code	Title of the Course	Hours	Credits
III	21UPH33AO03A	ALLIED OPTIONAL:	4	2

		CHEMISTRY–I		

CO No.	CO – Statements	Cognitive Level (K–Level)
	On successful completion of this course, students will be able to	
CO–1	explain the reactions of alkanes and alkenes and to apply them in new substrates.	**K1**
CO–2	summarize principles of photochemistry and photophysics.	**K2**
CO–3	understand the concepts of hybridization and isomerism in organic molecules.	**K2**
CO–4	solve the problems on reaction rates using principles of chemical kinetics.	**K3**
CO–5	examine the structures of various inorganic compounds.	**K4**

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, asymmetry, (R, S notation not necessary). Reactive intermediates – carbocation, carbanion and carbon free radicals (generation, structure and stability).

Unit – II: Alkanes and Alkenes (12 Hours)

Methods of preparation of alkanes (Wurtz method, Kolbe's method, using Grignard reagent, using HI/P), chemical properties of alkanes – substitution reaction only (example: only halogenation of alkanes with free radical mechanism), conformation analysis of ethane, n–butane and cyclohexane. Methods of preparations of alkenes (Kolbe's method, Hoffman degradation, using Lindlar's catalyst, Birch reduction of alkynes, dehydration of alcohols, dehydrohalogenation of alkyl halides), chemical properties of alkenes – electrophilic addition mechanism (example: only mechanisms of bromination of alkenes, hydrohalogenation of alkenes, hydration of alkenes and addition of diborane to alkenes)

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

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: Elements of Analytical Techniques (12 Hours)

Data in chemical analysis- The mean and the median, precision and accuracy. Types of errors in chemical analysis- determinate errors and its types and indeterminate error.

Chromatographic separations, classification of chromatographic methods, chromatogram, principles of TLC and HPLC and instrumentation of HPLC.

Unit – V: Photochemistry (12 Hours)

Difference between photochemical reactions and dark reactions. Laws of photochemistry – Beer – Lambert's Law – derivation and applications. Einstein law of photochemical equivalence – quantum yield – kinetics of hydrogen–chlorine reaction, hydrogen–bromine reaction and decomposition of HI. Photophysical processes– Jablonski diagram, chemi–luminescence.

Books for Study

1. Morrison R T, Boyd R N and Bhattacharjee S K, *Organic Chemistry*, 7th Edition, Pearson, New Delhi, 2010.
   Unit-I *Chapter 1*
   Unit-II *Chapter 3 and Chapter 8*
2. Lee J D, *Concise Inorganic Chemistry*, 5th Edition, Wiley–India, New Delhi, 2010.
   Unit-III *Chapter 4*
3. Skoog D A, WestD M, Holler F J, and Crouch S R, *Fundamentals of Analytical Chemistry*, 9th Edition, Brooks/Cole, Cengage Learning, Delmont, CA, USA, 2014.
   Unit-IV *Chapter 5, Chapter 31E and 33*

Books for Reference

1. Atkins P W, *Physical Chemistry*, 7th Edition, Oxford University Press, London, 2009.
2. Finar I L, *Organic Chemistry*, Vol 1and2, 6th Edition, England, Addison Wesley Longman Ltd., 1996.
3. Miessler G L, Fischer P J and Tarr D A, *Inorganic Chemistry* 5th Edition, Pearson Education, Inc., New York, 2014.
4. Bruice P Y, *Organic Chemistry*, 8th Edition, Pearson Ltd., University of California, Santa Barbara, 2011.
5. Huheey J E, Keiter E A, Keiter R L and Medhi O K, *Inorganic Chemistry: Principles of Structure and Reactivity*, 4th Edition, Pearson Education, New Delhi, 2006.

Web Resources

1. https://opentextbc.ca/chemistry/chapter/20-1-hydrocarbons/
2. https://wou.edu/chemistry/courses/online-chemistry-textbooks/ch105-consumer chemistry/
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

VSPER Theory

Jablonski– Diagram

Chemical Kinetics

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course code	Title of the Course	Hours	Credits
III	21UPH33AO03A	ALLIED OPTIONAL: CHEMISTRY–I	4	2

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO–1	2	3	2	3	1	2	2	3	1	3	2.2
CO–2	1	3	2	2	2	2	2	2	2	1	1.9
CO–3	2	1	2	2	2	2	3	1	3	2	2.0
CO–4	1	3	1	3	1	2	3	1	2	3	2.0
CO–5	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	Credits
III	21UPH33AO03B	Allied: Computer Science-I	4	3

		(INTERNET AND DATABASE CONCEPTS)		

CO No.	**CO-Statements**	**Cognitive Levels (K- Levels)**
	On successful completion of this course, students will be able to	
CO-1	define and understand the Internet concepts and Protocols.	**K1**
CO-2	understand and classify the basic knowledge of HTML.	**K2**
CO-3	apply the knowledge of HTML tags in web related applications.	**K3**
CO-4	analyze the basic concepts of database &	**K4**
CO-5	examine and analyze the skills of queries using SQL.	**K4**

UNIT- I **(12 Hours)**

Introduction to the Internet: Computers in Business – Networking – Internet – Email – Resource Sharing – WWW – Protocols.

UNIT - II **(12 Hours)**

Introduction to HTML: Designing a home page – HTML document – Anchor tag - Hyperlinks – Head and Body sections – Header section – Title – Prologue – links – colourful pages – comments – body section – heading – Horizontal ruler – paragraph – tabs.

UNIT – III **(12 Hours)**

Images and pictures - Lists and their types – nested lists – table handling. Forms and form elements.

UNIT - IV **(12 Hours)**

Database System Applications – Database Systems versus File Systems – View of Data – Data Models – Database Languages – Database Users and Administrators – Transaction Management – Database System Structure – Application Architectures.

UNIT - V **(12 Hours)**

SQL Statements: Data Retrieval: SELECT, Data Definition Languages: Create, Alter, Drop, Rename, and Truncate, Data Manipulation Language: Insert – Update, Delete – Merge. Transactional Control: Commit, Rollback and Data Control Language: Grant, Revoke, Select Order By – Select Group By.

Books for study

1. C. Xavier, "*World Wide Web Design with HTML*", Tata McGraw Hill, New Delhi 2000. Unit 1-3
2. Henry F. Korth Abraham Silberschatz, *"Database System Concepts"*, McGraw Hill, New Delhi, Fourth Edition, 2002.

Books for reference

1. Wendy Willard, "*Web Design – A beginners Guide*", Tata McGraw Hill Education, New Delhi, 2009
2. Thomas A. Powell, "The Complete Reference Web Design", Tata McGraw Hill, New Delhi.
3. C.J. Date, *"An Introduction to Database System",* Pearson Education, New Delhi, Seventh Edition, 2002.

Semester	Course Code	Title of the Course	Hours	Credit
III	21UPH33AO03B	Allied: Computer Science-I (INTERNET AND DATABASE CONCEPTS)	4	3

Course Outcomes↓	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					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	2	2	2	3	3	2	2	3	2.4
CO-2	2	3	2	2	2	3	3	2	2	3	2.4
CO-3	2	2	3	2	3	2	3	3	3	2	2.5
CO-4	2	2	2	3	2	2	3	2	3	3	2.4
CO-5	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	Credits
III	**21UPH34SE01A**	**SEC-1 (WD): SOLAR POWER SYSTEM INSTALLATION AND MAINTENANCE**	**2**	**1**

CO No.	CO- Statements	Cognitive Levels (K-Levels)
	On the successful completion of the course, student will be able to	
CO-1	acquire the knowledge about basics of electricity, PV system and its installation.	**K1**
CO-2	understand and realise the need of solar power and its conversion.	**K2**
CO-3	identify and implement the PV installation technique for suitable places and analyze the different installation techniques, categorize the work ethics and work place safety.	**K3, K4**
CO-4	evaluate the efficiency of PV system, know the need of its improvement and recommend the techniques to install the PV system.	**K5**
CO-5	design and construct the solar PV system to power a house.	**K6**

Unit -I: Basics of Electricity, Solar Energy and Components of a PV System (6 Hours)
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 (6 Hours)
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 (6 Hours)
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 (6 Hours)
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 (6 Hours)

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

Book 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.

Web Reference*

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)

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credit
III	21UPH34SE01A	SEC–1 (WD): SOLAR POWER SYSTEM INSTALLATION AND MAINTENANCE	2	1

Course Outcomes (COs)	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	2	2	2	3	3	1	2	3	2.4
CO-2	3	2	2	2	3	3	2	2	2	3	2.4
CO-3	3	3	3	2	2	3	3	3	2	2	2.6
CO-4	3	2	2	3	3	3	2	2	3	3	2.6
CO-5	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
III	21UPH34SE01B	SEC - 1 (WD): TECHNIQUES OF PROBLEM SOLVING IN PHYSICS	2	1

CO No.	CO- Statements	Cognitive Levels (K-Levels)
	On the successful completion of the course, student will be able to	
CO-1	acquire the knowledge on physics concepts in mechanics, properties of mater, electricity and magnetism, optics, sound and modern physics and all related problems.	K1
CO-2	understand the different physics concepts and related problems by gaining the knowledge.	K2
CO-3	use physics principles to solve the simple physics problems.	K3
CO-4	apply the modern physics concepts to solve simple physics problems.	K3
CO-5	identify the physics formulae and method of solving the physics problems and interpret it.	K4

Unit–I: Mechanics (6 Hours)

Newton's Laws of Motion: Everyday phenomena - examples - problems with Newton's first and second laws of motion - Newton's third law - effect of Newton's third law on the motion of an object - identifying the third law pair to a force.

Kinematics: Definition of position - distance - displacement - speed - velocity and acceleration - difference between instantaneous and average quantities - unit conversions using dimensional analysis.

Gravitation: Problems with Newton's Universal Law of Gravitation - problems with gravitational field strength - Difference between mass and weight - conversion of mass and weight and vice versa.

Unit– II: Properties of Matter (6 Hours)

Definitions and Units: work - mechanical energy - kinetic energy - gravitational potential energy - joule in basic SI units - application of the concept of conservation of energy to solve problems - Determination of an appropriate height in the system to label as zero and understand that this choice is arbitrary - application of the work - kinetic energy theorem to solve problems.

Unit – III: Electricity and Magnetism (6 Hours)

The electric field - Coulomb's law - Gauss's law - Potential of the electric field - Calculation of the electric field intensity from the potential - Capacitors and dielectrics - Electric current and resistance - Kirchhoff's rules for solving DC circuits - Magnetic field - Hall effect - Laws: Biot-Savart, Ampere and Faraday - Inductance and self-inductance - Magnetic properties of matter.

Unit - IV: Sound and Optics (6 Hours)

Oscillations (spring-mass system, pendulums) - Waves and wave characteristics and phenomena: velocity, frequency, wavelength, amplitude, Sound: Pitch, intensity, decibels, power, beats, interference, Doppler effect - Application of sound to musical instruments - Optics: Mirrors,

lenses, ray diagrams, EM spectrum, refraction, Snell's law - Application of optics to optical instruments and telescopes

Unit - V: Modern Physics **(6 Hours)**

Quantum theory of light and the particle nature of matter - basics of quantum mechanics: wave functions and Schrödinger equation, nuclear reactions and nuclear processes - molecular structure - basic laws of statistical physics for classical and quantum particles - application of quantum mechanical concepts in solid state physics.

Book for Study

Text Prepared by the Department

Book for Reference

1. Walter Benenson John W. Harris and Holger Lutz, *Handbook of Physics,* Springer, 2002.

Web Reference*

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)

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credit
III	21UPH34SE01B	SEC - 1 (WD): TECHNIQUES OF PROBLEM SOLVING IN PHYSICS	2	1

Course Outcomes (COs)	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	2	2	2	2	2	2	2	3	2.3
CO-2	2	3	2	2	2	3	2	3	2	2	2.3
CO-3	3	3	3	2	2	2	3	2	2	2	2.4
CO-4	3	3	2	2	2	2	2	3	2	2	2.3
CO-5	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	Credits
III	21UHE24VE03A	PROFESSIONAL ETHICS–I: SOCIAL ETHICS - I	2	1

CO. No.	Co- Statements	Cognitive Levels (K-Levels)
	On completion of this course the graduates will be able to:	
CO-1	know the responsibility of the educated youth.	K1
CO-2	understand the values prescribed under social ethics.	K2
CO-3	apply their minds critically to the various types of cyber crime.	K3
CO-4	analyse the various kinds of political systems.	K4
CO-5	analyse the behaviour of the elected representatives.	K4

Unit-I Introduction to Social Ethics (6-Hours)

Introduction to social ethics and social responsibility, important role of Social ethics on the various areas, religion influences social changes - 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

Book for Study

Department of Human Excellence, *Formation of Youth*, St Joseph's College(Autonomous), Tiruchirappali -02, 2021

Books for Reference

1. Ramesh K. Arora, *Ethics, Integrity and Values* by Public Service Paperback ,– 1 January 2014
2. Cunningham, D. *There's something happening here: The new left, the Klan, and FBI counterintelligence*. Berkeley: University of California Press, 2004.
3. Adv. Prashant Mali, *Cyber law & Cyber Crimes simplified* by Cyber Info media Paperback – 1 January 2017.
4. Matthew Richardson, *Cyber Crime: Law and Practice Hardcover – Import*, Wildy publications, 29 November 2019

Web Sources

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

Semester	Course Code	Title of the Course	Hours	Credits
III	**21UHE34VE03B**	**PROFESSIONAL ETHICS I: RELIGIOUS DOCTRINE- I**	**2**	**1**

CO.No.	Co – Statements	Cognitive Levels (K-Levels)
	On completion of this course, the graduates will be able to:	
CO-1	understand the history of the Catholic Church	**K1**
CO-2	examine and grasp the Sacraments of the Catholic Church	**K2**
CO-3	apply the Christian Prayer to their everyday life	**K3**
CO-4	analyze themselves in the light of Sacraments & Christian Prayer	**K4**
CO-5	create a harmonious society learning values from all religions	**K5 & K6**

Unit-I	**God of salvation**	**(6 Hours)**
Unit-II	**Life & Mission of Jesus Christ**	**(6 Hours)**
Unit-III	**The Holy Spirit**	**(6 Hours)**
Unit-IV	**Biblical Values**	**(6 Hours)**
Unit-V	**Mother Mary**	**(6 Hours)**

Books for Study

Department of Human Excellence, *Life in the Lord: Religious Doctrine.* St. Joseph's College, Trichirappalli-02, 2021.

Books for Reference

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

Semester	Course Code	Title of the Course	Hours	Credits
IV	21UTA41GL04B	Scientific Tamil (SBS, SPS,SCS)	4	3

CO No.	CO- Statement	Cognitive Level (K- level)
இப்பாடத்தின் நிறைவில் மாணவர்கள்		
CO-1	பண்டைத் தமிழர்களின் அறிவியலறிவை அறிந்துகொள்வர்.	K 1
CO-2	பண்டைத் தமிழிலக்கியங்களுள் காணலாகும் அறிவியல் சிந்தனைகளைப் புரிந்துகொள்வர்.	K 2
CO-3	தமிழரின் அறிவியல் மருத்துவத்தையும், நீர் மேலாண்மை அறிவையும் அறிந்துகொள்வர்.	K 3
CO-4	இக்கால இலக்கியங்களுள் அறிவியல்துறை பெற்றுள்ள செல்வாக்கை அறிந்துகொள்வர்.	K 4
CO-5	அறிவியல் கலைச்சொற்களைத் தமிழில் கற்றுக் கொண்டு அறிவியல் தமிழ் வளரத் துணைபுரிவர்.	K 5

அலகு – 1 **(12 மணிநேரம்)**

தொல்காப்பியம் :

நிலம் தீ நீர் வளி விசும்போடு (தொல்.பொருள் 635)

ஒன்றறிவதுவே (தொல்.பொருள் 571)

புறநானூறு

மண் திணிந்த நிலனும் (புறம்.2)

செஞ்ஞா யிற்றுச் செலவும் (புறம். 30)

அகநானூறு

அம்ம வாழி, தோழி (அகம்.141)

பதிற்றுப்பத்து

நிலம் நீர் வளி விசும்பு என்ற நான்கின் (பதிற்று.14)

நெடுவயின் ஒளிறு மின்னுப் பரந்தாங்கு (பதிற்று.24)

உரைநடைக்கட்டுரை : வியக்க வைக்கும் தமிழரின் அறிவியல்

அலகு- 2 **(12 மணிநேரம்)**

சித்தர் பாடல்கள்

பதார்த்த குண சிந்தாமணி

குளத்து சலந்தானே கொடிதான (27)

ஏரிசலம் வாதமிகு மதுவே *(31)*

அருவிநீர் மேக மகற்றுங் *(39)*

மேவிய சீவன் வடிவது சொல்லிடில் *(திருமூலர்)*

அணுவில் அணுவினை ஆதிபிரானை *(திருமூலர்)*
நட்டகல்லைத் தெய்வமென்று *(சிவவாக்கியர்)*
உரைநடைக்கட்டுரை: தமிழர்களின் மருத்துவ அறிவியல்

அலகு - 3 **(12 மணிநேரம்)**

திருக்குறள் *(2 அதிகாரங்கள்)*

வான் சிறப்பு, மருந்து

வலைப்பூக்கள் உருவாக்கல், பராமரித்தல்

புதிய அறிவியல் கலைச்சொல்லாக்கங்களை உருவாக்குதல்

உரைநடைக்கட்டுரை: தமிழ் இலக்கியங்களில் நீர் மேலாண்மையியல்

அலகு- 4 **(12 மணிநேரம்)**

புதினம்: சொர்க்கத்தீவு – சுஜாதா

நூல் - திறனாய்வு

அறிவியல் புனைவு ஆவணப்படம், திரைப்படம் - திறனாய்வு

உரைநடைக்கட்டுரை: தமிழில் அறிவியல் புனைவுகள்

அலகு - 5 **(12 மணிநேரம்)**

அறிவியல் கலைச்சொற்கள்

அன்றாட வாழ்வில் அறிவியல் பழமொழிகளைத் தொகுத்தல்

மூலிகைகள், கீரைகள் ஆகியவற்றின் முக்கியத்துவத்தைக் காட்சிப்படுத்துதல்.

தமிழர் அறிவியல் கண்காட்சி நடத்துதல்

உரைநடைக்கட்டுரை: அறிவியல் தமிழின் வளர்ச்சி நிலைகள்

பாட நூல்கள்

1. **அறிவியல் தமிழ்**, தமிழாய்வுத்துறை, தூய வளனார் தன்னாட்சிக் கல்லூரி, திருச்சிராப்பள்ளி, முதற்பதிப்பு, *2022*
2. சுஜாதா, **சொர்க்கத்தீவு,** விசா பப்ளிகேஷன்ஸ், சென்னை-17, ஒன்பதாம் பதிப்பு, *2009*
3. மூர்த்தி அ.கி., **அறிவியல் அகராதி,** மணிவாசகர் பதிப்பகம், சென்னை, *2001*

பார்வை நூல்கள்

1. குழந்தைசாமி.வா.செ., **அறிவியல்தமிழ்,** பாரதி பதிப்பகம், சென்னை-17, 6ஆம்பதிப்பு, *2001*
2. நெடுஞ்செழியன், **இன்னும் மீதமிருக்கிறது நம்பிக்கை,** பூவுலகின் நண்பர்கள் வெளியீடு, சென்னை, முதற்பதிப்பு, *2017*

3. பரிமேலழகர்(உரை.), **திருக்குறள்,** பாரதி பதிப்பகம், சென்னை-17, ஏழாவது பதிப்பு, *2000.*
4. வையாபுரிப்பிள்ளை, **பாட்டும் தொகையும்,** பாரி நிலையம், சென்னை, இரண்டாம் பதிப்பு, *1967.*

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code			Title of the Course				Hours		Credit
IV	21UTA41GL04B			Scientific Tamil (SBS, SPS,SCS)				4		3
Course Outcomes (COs)	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	1	2	3	2	2	3	3	2	2	2	2.2
CO-2	2	2	3	2	2	2	3	2	3	2	2.3
CO-3	1	2	2	3	2	2	2	3	3	3	2.3
CO-4	2	2	3	2	2	3	2	3	3	2	2.4
CO-5	3	1	2	2	2	2	3	2	3	3	2.3
Mean Overall Score											2.3 (High)

Semester	Course Code	Title of the Course	Hours	Credits
IV	**21UFR41GL04**	**FRENCH – IV**	**4**	**3**

CO No.	CO–Statements	Cognitive Levels (K –Levels)
	On successful completion of this course, students will be able to	
CO–1	recall the vocabulary pertaining to dwelling place.	**K1**
CO–2	outline crisis management in France.	**K2**
CO–3	develop a travel diary of your own.	**K3**
CO–4	simplify the French education system.	**K4**
CO–5	interpret past tenses in a text.	**K5**

Unit- I **(12 hours)**

TITRE:ON FAIT LE MELANGE!
GRAMMAIRE : le présent progressif, les pronoms possessifs, la phrase négative
LEXIQUE : décrire les étapes d'une action, la maison, les taches ménagères
PRODUCTION ORALE : comprendre le récit d'un voyage
PRODUCTION ECRITE : raconter ses actions quotidiennes

Unit – II **(12 hours)**

TITRE:A PROPOS DE LOGEMENT
GRAMMAIRE : quelques adjectifs et pronoms indéfinis, les verbes lire, rompre et se plaindre
LEXIQUE : la localisation et le logement, les pièces, meubles et équipement
PRODUCTION ORALE : jeu de rôle –votre ami et vous s'installe dans un nouveau meuble
PRODUCTION ECRITE : décrire votre maison/appartement

Unit- III **(12 hours)**

TITRE:TOUS EN FORME!
GRAMMAIRE : le passé composé et l'imparfait, le passé récent, l'expression de la durée
LEXIQUE : un souvenir et les évènements du passées, le corps humain : extérieur, le corps humain : intérieur
PRODUCTION ORALE : échanger sur ses projets de vacances
PRODUCTION ECRITE : raconter un souvenir

Unit – IV **(12 hours)**

TITRE:ACCIDENTS ET CATASTROPHES
GRAMMAIRE : les adjectifs et les pronoms indéfinis : rien/ personne/aucun, les verbes dire, courir et mourir
LEXIQUE : savoir les mots et les expressions des catastrophes naturelles, les maladies et les remédies, les accidents, les catastrophes naturelles
PRODUCTION ORALE : comprendre des personnes qui expriment leur accord ou leur désaccord selon un thème donné
PRODUCTION ECRITE : écrivez sur une catastrophe naturelle en articulant la cause et la conséquence

Unit –V **(12 hours)**

TITRE:FAIRE SES ETUDES A L'ETRANGER/ BON VOYAGE/ LA METEO
GRAMMAIRE : les pronoms démonstratifs neutres, le futur simple, situer dans le temps, moi aussi/non-plus – moi non/si, les verbes impersonnels, les verbes croire, suivre et pleuvoir
LEXIQUE : savoir vivre en France, le système scolaire, les formalités pour partir à l'étranger.
PRODUCTION ORALE : exprimer son opinion sur la météo/parler del'avenir
PRODUCTION ECRITE: comparer le système scolaire français et indien

Book for Study

P.Dauda,L.Giachino and C.Baracco, *Generation A2*, Didier, Paris 2016.

Books for Reference

1. J.Girardet and J.Pecheur, *Echo A2*, CLE International, 2^{e}edition,2013
2. Régine Mérieux and Yves Loiseau, *Latitudes A2*, Didier, 2012.
3. Isabelle Fournier, *Talk French*, Goyal Publishers,2011

Web Resources

1. https://www.frenchcourses-paris.com/french-travel-journal/
2. http://www.saberfrances.com.ar/vocabulary/house.html
3. https://www.thoughtco.com/different-past-tenses-in-french-1368902
4. https://www.youtube.com/watch?v=JZdwJM7sEY8
5. https://www.scholaro.com/pro/Countries/France/Education-System

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course code			Title of the Course				Hours		Credits
IV	21UFR41GL04			FRENCH – IV				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	
CO–1	3	1	3	2	2	3	2	1	2	2	2.1
CO–2	3	1	2	3	3	3	2	1	3	1	2.2
CO–3	3	2	3	2	2	3	2	1	3	2	2.3
CO–4	3	1	2	2	3	3	3	1	3	3	2.4
CO–5	2	2	3	3	1	3	1	2	3	2	2.2
Mean overall Score											2.24 (High)

Semester	Course Code	Title of the Course	Hours	Credits
IV	21UHI41GL04	HINDI - IV	4	3

CO No.	CO–Statements On successful completion of the course, students will be able to	Cognitive Levels (K –Levels)
CO-1	list out the social conditions prevailed in Modern Period which are depicted in Hindi Literature.	K1
CO-2	discuss the dialects of Hindi language.	K2
CO-3	illustrate the works of some eminent Hindi Writers related to society.	K3
CO-4	analyze the human values expressed in life and literature of Hindi Novelist “Mamatha Kaliyah”.	K4
CO-5	evaluate the film & Literary works in Hindi.	K5

Unit - I **(12 Hours)**

Computer ka yug
Prathyay
Adhunik Kal - Namakarn
Namakaran

Unit - II **(12 Hours)**

Vigyan hani/labh
Paryayvachy Shabdh
Adhunik Kal - Samajik Paristhithiyam
Samanarthy Shabdh

Unit - III **(12 Hours)**

Nari shiksha
Upasarg
Adhunik Kal – Sahithyik Paristhithiyam
Adhunik kal – Salient Features

Unit - IV **(12 Hours)**

Review- Book/Film
Paryavaran Pradookshan
Adhunik Kal - Main Divisions
Adhunik Kal - Visheshathayem

Unit - V **(12 Hours)**

Sapnom Kee Home Delivery (Novel)
Anuvad - 4

Books for Study

1. Dr. Sadananth Bosalae, *kavya sarang*, Rajkamal Prakashan, New Delhi, 2020. **Unit-I** *Chapters 4*
2. M. Kamathaprasad Gupth, *Hindi Vyakaran*, Anand Prakashan, Kolkatta, 2020. **Unit-II, III and IV** *Chapter 2*
3. Dr. Sanjeev Kumar Jain, *Anuwad: Siddhant Evam Vyavhar*, Kailash Pustak Sadan, MadhyaPradesh,2019 **Unit-V** *Chapter 2*

Books for Reference

1. Hindi Niband Sangrah,V&S Publishers, 2015.
2. Rajeswar Prasad Chaturvedi, Hindi vyakarana, Upakar prakashan,2015.
3. Ramdev,Vyakaran Pradeep, Hindi Bhavan, 2016.
4. Krishnakumar Gosamy, Anuvad vigyan ki Bhumika, Rajkamal Prakashan, 2016.
5. Acharya ramchandra shukla, Hindi Sahitya Ka Itihas, Prabhat Prakashan, 2021.

Web Resources

1. https://youtu.be/xmr-DaQ3LhA
2. https://youtu.be/xIm-VEmgEg0
3. https://youtu.be/ZHuqxWbMtas
4. https://youtu.be/HGS63OJuHto
5. https://youtu.be/r-i3autqPug

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code			Title of the Course					Hours	Credits
IV	21UHI41GL04			HINDI - IV					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	2	3	2	3	1	2.4
CO-2	3	2	3	3	2	3	2	3	1	2	2.4
CO-3	3	2	2	3	2	2	1	3	2	3	2.3
CO-4	3	2	3	1	3	3	2	3	3	2	2.5
CO-5	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	Credits
IV	21USA41GL04	SANSKRIT - IV	4	3

CO No.	CO–Statements	Cognitive Levels (K –Levels)
	On successful completion of the course, the student will be able to	
CO-1	remember and identifying Mahabharatha characters and events.	K1
CO-2	understand human behaviors by studying dramas.	K2
CO-3	apply the morals learnt in day to day life.	K3
CO-4	create new conversational sentences and to Improve self-character (Personality Development).	K4
CO-5	appreciate ancient Sanskrit dramas.	K5

Unit - I **(12 Hours)**

Samskrita Vyavahara sahasri vakiya Prayogaha

Unit - II **(12 Hours)**

Lot Lakaarah , Prqayaogh Kartari Vaakyaani

Unit - III **(12 Hours)**

Naatakasya Itihaasah Vivaranam, Thuva and Tum Prathiyaha

Unit - IV **(12 Hours)**

Karnabhaaram , Naatakasya Visistyam

Unit - V **(12 Hours)**

Samskrita Rachanani priyogaha

Book for Study

Karnabhavam & Literature Language, 2019 , K.M Saral Sanskrit Balabodh , Bharathita vidya bhavan , Munshimarg Mumbai – 400 007

Books for Reference

1. R.S.Vadhyar & Sons , Book – sellers and publishers , Kalpathu ,Palghat – 678003 , Kerala , south India , History of Sanskrit Literature 2019
2. Kulapathy , K.M Saral Sanskrit Balabodh , Bharathita vidya bhavan , Munshimarg Mumbai – 400 007 2018
3. Samskrita Bharathi , Aksharam 8 th cross , 2nd phase Giri nagar Bangalore Vadatu sanskritam – Samaskara Binduhu 2019

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code			Title of the Course				Hours		Credit
IV	21USA41GL04			SANSKRIT-IV				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	2	2	3	2	3	2	3	3	2	2.5
CO-2	2	2	3	2	3	3	3	3	3	2	2.4
CO-3	3	3	2	3	2	1	1	3	3	3	2.4
CO-4	2	3	3	3	2	1	3	3	3	2	2.5
CO-5	2	2	3	2	3	3	3	3	2	3	2.6
Mean Overall Score											2.48
Result											# High

Semester	Course Code	Title of the Course	Hours	Credits
IV	21UEN42GE04	GENERAL ENGLISH - IV	5	3

CO No.	CO-Statements	Cognitive Levels (K- Levels)
	On successful completion of this course, students will be able to	
CO-1	identify different local and global issues in given passages	K1
CO-2	understand explicit and implicit information given in written texts	K2
CO-3	use appropriate words and punctuations in writing	K3
CO-4	analyse written texts and modify them for better clarity	K4
CO-5	assess the coherence and cohesion of written texts and rewrite them	K5 & K6

Unit-I **(15 Hours)**

1. Women through the Eyes of Media
2. General Writing Skill: Writing Minutes of a Meeting
3. Grammar: Present Perfect Tense

Unit-II **(15 Hours)**

4. Effects of Tobacco Smoking
5. General Writing Skill: Note-Taking
6. Grammar: Present Perfect Continuous Tense

Unit-III **(15 Hours)**

7. Short Message Service (SMS)
8. General Writing Skill: Note-Making
9. Grammar: Past Perfect Tense

Unit-IV **(15 Hours)**

10. An Engineer Kills Self as Crow Sat on his Head: A Newspaper Report
11. General Writing Skill: Précis Writing
12. Grammar: Past Perfect Continuous Tense

Unit-V **(15 Hours)**

13. Traffic Rules
14. General Writing Skill: Paragraph Writing
15. Grammar: Future Perfect Tense and Future Perfect Continuous Tense

Book for Study

Jayraj, S. Joseph Arul et al. *Trend-Setter: An Interactive General English Textbook for Under Graduate Students*. Trinity, 2016.

Books for Reference

1. Clark Peter, Roy. *Writing Tools: 50 Essential Strategies for Every writer*. USA: Little, Brown Spark Publishers, 2008.
2. Carnegie, Dale. *The Quick and Easy Way to Effective Speaking*. India: Fingerprint Publishers, 2018.
3. Vaughn, Steck. *Reading Comprehension*. USA: Steck-Vaughn Co, 2014.
4. Birkett, Julian. *Word Power: A Guide to Creative writing*. India: Bloomsburry Acdemic, 2016.
5. Knight, Dudley. *Speaking with Skill: An Introduction to Knight-Thompson Speechwork*. USA: Methuen Drama, 2016.

Web Resources

1. https://blog.lingoda.com/en/10-news-sites-to-practice-your-english-reading-skills/
2. https://www.espressoenglish.net/how-to-learn-english-for-free-50-websites-for-free-english-lessons/
3. https://www.ef.com/wwen/english-resources/

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes

Semester	Course Code			Title of the Course					Hours	Credits
IV	21UEN42GE04			GENERAL ENGLISH - IV					5	3
Course Outcome (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	2	2	3	2	3	2	3	2	2.4
CO-2	2	2	3	2	3	3	2	3	2	2	2.3
CO-3	2	3	2	3	2	2	3	2	3	2	2.4
CO-4	2	2	3	2	3	3	2	3	2	3	2.5
CO-5	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	Credits
IV	21UPH43CC05	CORE-5: MATHEMATICAL PHYSICS - II	4	4

CO No.	CO- Statements	Cognitive Levels (K-Levels)
	On the successful completion of the course, student will be able to	
CO-1	gain knowledge on the mathematical methods in complex analysis, numerical methods, transformation methods and error analysis to understand the problems in physics.	K1, K2
CO-2	apply the knowledge gained in computational and numerical methods to solve problems in physics.	K3
CO-3	compute problems in physics by various theoretical models.	K4
CO-4	analyse complex problems in physics based on the special functions and find the solution for higher order differential equation by understanding Laguerre and Hermite polynomials.	K4
CO-5	elaborate the Numerical methods to produce precise and accurate results for physics problems.	K4

Unit-I: Errors, Approximations and Extremum of Functions

(12 Hours)

Introduction to errors - classifications - accuracy of a function methods - errors in laboratory instruments and methods - utility of errors. Approximation and applications. Maxima and minima: Geometrical interpretation and physical application - two and more independent variables - Lagrangian multiplier.

Unit -II: Special Functions **(12 Hours)**

Definitions - simple properties of Gamma, Beta, Delta and Error functions - series solutions of differential equations: Laguerre and Hermite - functions and polynomial - Orthogonality properties.

Unit -III: Laplace Transforms and its Applications **(12 Hours)**

Definition - 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 - denominator containing: distinct linear factors, repeated linear factors and quadratic factors – Applications

Unit -IV: Complex Analysis **(12 Hours)**

Cauchy - Riemann conditions - Cauchy's integral theorem - applications to multiply connected region - Cauchy's II integral theorem - derivatives of analytic Complex function - Singular points and their classification - Laurent series - Cauchy's residue theorem

Unit -V: Numerical Methods **(12 Hours)**

Transcendental Equation - Solving by Graphical Method - Newton Raphson method - Numerical Integration - Trapezoidal and Simpson's 1/3 rule Numerical Method of solving differential equation - Euler's Method – Runge Kutta IV order method - applications.

Books for Study

1. Study material prepared by the department
2. AK Mukhopadhyay, *Mathematical Methods for Engineers and Physicists*, Wheeler Pub, New Delhi, 1998.
3. M.K Venkatraman, *Numerical Method for Science and Engineering*, National publishing company Madras, (year)

Unit	Book	Chapters	Sections
I	1	1	Chapter – 1
II	1	4	Chapter – 4
III	1	3	Chapter – 3
IV	2	11	11.25, 11.5, 11.6, 11.10-11.15
V	3	3	1, 2, 5
		9	7, 8, 10
		11	10, 11, 12, 13

Books for Reference

1. H.K. Dass, *Mathematical Physics*, S. Chand, New Delhi, 2006.
2. Satya Prakash, *Mathematical Physics*, Sultan Chand, New Delhi, 2008.
3. Erwin Kreyszig, *Advanced Engineering Mathematics*, 9th edition, Wiley;2010.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credit
IV	21UPH43CC05	CORE-5: MATHEMATICAL PHYSICS - II	4	4

Course Outcomes (COs)	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	2	3	2	3	3	3	2	2	2.6
CO-2	3	3	2	3	2	3	3	3	2	2	2.6
CO-3	3	3	2	3	2	3	3	3	2	2	2.6
CO-4	3	3	2	3	2	3	3	3	2	2	2.6
CO-5	3	3	2	3	2	3	3	3	2	3	2.7
Mean Overall Score											2.4 (High)

Semester	Course Code	Title of the Course	Hours	Credits
IV	21UPH43CC06	CORE-6: THERMAL PHYSICS	4	3

CO No.	CO- Statements	Cognitive Levels (K-Levels)
	On the successful completion of the course, student will be able to	
CO-1	acquire the knowledge of thermodynamic laws and its applications, thermal properties of solids and its behavior.	K1
CO-2	understand the concepts of thermodynamic potentials, thermo dynamical behavior and different phase transitions.	K2
CO-3	compare thermodynamic laws and its applications, thermal properties of solids based on its applications.	K3
CO-4	analyze the thermodynamical laws, phase transition and thermo dynamical behavior of real gases.	K4
CO-5	categorize the thermo dynamical laws and their applications, thermal properties of solids and its behavior and advancement of thermodynamics.	K4

Unit- I: Law of Thermodynamics (12 Hours)

Macroscopic point of view - Microscopic point of view - Scope of thermodynamics - Thermal equilibrium and the zeroth law – Thermocouple - Thermodynamic equilibrium - work and heat - adiabatic work - Mathematical formulation of the first law - Differential form of the first law - Heat conduction - Heat convection - Thermal radiation - Black body - Kirchhoff's law; Radiated heat - Conversion of work into heat and vice versa - Heat engine - Kelvin Planck statement of the second law – Refrigerator - Clausius's statement of the second law - Equivalence of the Kelvin Planck's and Clausius's statements - Reversibility and irreversibility.

Unit- II: Thermodynamic Potentials and Phase Transitions (12 Hours)

Enthalpy - Helmholtz function and Gibbs function - two mathematical functions - Maxwell's relations - TdS Equations - Internal energy equations - Heat capacity equations - Latent heat - Chemical potential and phase changes - The Clausius - Clapeyron equation - Stability &metastability - The Gibbs phase rule - Colligative properties - Classification of phase transitions.

Unit- III: Thermal Properties of Solids (12 Hours)

Statistical mechanics of a Nonmetallic crystal - Frequency spectrum of crystals - thermal properties of non metals - thermal properties of metal - critical state - critical point exponents of a hydrostatic system - critical point exponents of a magnetic system - higher order phase transitions - Lambda transition in ^{4}He - Liquid and solid Helium.

Unit - IV: Thermodynamical Behaviour of Real Gases (12 Hours)

Relativistic dispersion relation for massive particles - ultra relativistic gas - Adiabatic expansion of an ultra relativistic gas - van der Waals gas - Dieterici equation - Virial expansion - The law of corresponding states - The Joule expansion - Isothermal expansion - Joule-Kelvin expansion - Liquefaction of gases - The non-interacting quantum fluid - The Fermi gas - The Bose gas - Bose–Einstein condensation.

Unit-V: Advanced Thermodynamics **(12 Hours)**

Entropy – change in entropy during reversible and irreversible process – entropy and second law of thermodynamics. **Sound waves:** Sound waves under isothermal conditions - Sound waves under adiabatic conditions - Are sound waves in general adiabatic or isothermal - Derivation of the speed of sound within fluids. **Shock waves:** The Mach number - Structure of shock waves - Shock conservation laws - The Rankine-Hugoniot conditions.

Books for Study

1. M.W. Zemansky, Richard Dittman, *Heat and Thermodynamics*, McGraw-Hill, 1981
2. S.J. Blundell and K.M. Blundell, *Concepts in Thermal Physics*, 2nd Edition, Oxford University Press, 2012.

Unit	Book	Chapters	Sections
I	1	1	1.1, 1.2, 1.4, 1.5, 1.15,
		2	2.1
		4	4.1, 4.2, 4.4, 4.6, 4.11, 4.12, 4.13, 4.14,
		6	6.1, 6.6, 6.7, 6.8, 6.9
II	1	10	10.2, 10.3, 10.4, 10.5, 10.6, 10.7, 10.8
	2	28	28.1, 28.2, 28.3, 28.4, 28.5, 28.6, 28.7
III	1	13	13.1, 13.2, 13.3, 13.4,
		14	14.1, 14.2, 14.3, 14.4, 4.5, 14.6
IV	2	25	25.1, 25.2, 25.3, 26.1,
		26	26.2, 26.3, 26.4,
		27	27.1, 27.2, 27.3, 27.4,
		30	30.1, 30.2, 30.3, 30.4
V	2	31	31.1, 31.2, 31.3, 31.4,
		32	32.1, 32.2, 32.3, 32.4

Books for Reference

1. Meghnad Saha, and B.N. Srivastava, *A Treatise on Heat*, Indian Press, 1958.
2. Carl S. Helrich, *Modern Thermodynamics with Statistical Mechanics*, Springer, 2009.
3. Sears and Salinger, *Thermodynamics, Kinetic Theory & Statistical Thermodynamics*, Narosa, 1988.
4. S. Garg, R. Bansal and Ghosh, *Thermal Physics*, 2nd Edition, Tata McGraw-Hill, 1993.
5. D.S. Mathur, *Heat and Thermodynamics*, Fifth Edition, Sultan Chand & Sons Educational publishers, New Delhi.

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Semester	Course Code			Title of the Course				Hours	Credit	
IV	21UPH43CC06			CORE-6: THERMAL PHYSICS				4	3	
Course Outcomes (COs)	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	2	3	2	3	2	1	2.3
CO-2	3	3	2	2	3	3	2	2	2	1	2.3
CO-3	3	2	2	3	3	2	3	3	2	1	2.4
CO-4	3	2	2	3	3	2	2	3	2	1	2.3
CO-5	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	Credits
IV	21UPH43CP02	PHYSICS PRACTICAL – II	3	2

Any 16 Experiments

1. Jolly's bulb - pressure coefficient
2. Thermal conductivity – Lee's disc.
3. Thermal Conductivity – Forbes' method.
4. y, n, ó – Searles method.
5. n and M.I – Torsional pendulum.
6. Compound pendulum.
7. Kater's pendulum
8. Kundt's tube.
9. Frequency – Melde's apparatus.
10. Young's modulus – uniform bending - scale and telescope method.
11. Young's modulus – Koenig's method.
12. Rigidity modulus - static method.
13. Rankine's method.
14. Spectrometer – i-d curve.
15. Spectrometer – i-i' curve.
16. Field along the axis of a coil – Vibration magnetometer.
17. Potentiometer – Ammeter calibration.
18. Resistance by Potentiometer – R and ρ.
19. B.G. – comparison of mutual inductance.
20. B.G. – Resistance and figure of merit (condenser method).
21. Absolute determination of M and H.
22. Junction diode and Zener diode characteristics.
23. Study of basic and universal logic gates (IC's).

Semester	Course Code	Title of the Course	Hours	Credits
IV	21UPH43AO04A	ALLIED OPTIONAL: CHEMISTRY–II	4	3

CO No.	CO–Statements	Cognitive Levels (K –level)
	On successful completion of this course, students will be able to	
CO–1	list out the different types of carbohydrates, amino acids and proteins.	K1
CO–2	explain the concepts in coordination chemistry and apply them to infer the properties of complexes.	K2
CO–3	outline the principles and applications of electrochemistry.	K2
CO–4	illustrate phase rule and relate the applications of adsorption.	K3
CO–5	classify silicates and understand their industrial applications.	K4

Unit–I: Carbohydrates, Amino Acids, Proteins (12 Hours)

Synthesis of 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–preparations (Gabriel synthesis, Strecker synthesis and Koop synthesis)–zwitter ion formation– isoelectric point and its importance in the separation of amino acids– chemical properties (reactions involving both amine group and carboxyl group) of glycine and alanine only. Proteins – peptide linkage – primary, secondary and tertiary structure of proteins.

Unit–II: Coordination Chemistry (12 Hours)

Coordination compounds– Werner's theory– central metal atom– types of ligands – nomenclature and isomerism of coordination compounds– effective atomic number– VBT – prediction of structure and calculation of spin only magnetic moment–crystal field theory of octahedral, tetrahedral and square planar complexes– effects of crystal field splitting– chelates– important biological complexes– haemoglobin, chlorophyll, cis–platin (representative structure and functions).

Unit–III: Silicates and Group 18 Elements (12 Hours)

Silicates–principles of silicate structures– classification–silicates in technology–silicones.

Group 18– Noble gas– physical properties– special properties of helium–clathrates– structure and bonding in xenon compounds (XeF_2, XeF_4 and XeF_6).

Unit–IV: Phase Rule and Adsorption (12 Hours)

Phases– components– degree of freedom– derivation of Gibbs phase rule– phase diagram of H_2O, CO_2, S and Pb–Ag systems. Adsorption – Langmuir and Frendluich adsorption isotherms– applications of adsorption.

Principles of TLC and column chromatography.

Unit–V: Electrochemistry (12 Hours)

Difference between Galvanic cell and electrolytic cell– types of electrodes – metal – metal ion electrode– Gas electrode (hydrogen electrode)– metal – insoluble metal salt electrodes (calomel electrode)– oxidation – reduction electrode (quinhydrone electrode)– single

electrode potential, oxidation potential and reduction potential– sign of electrode potential, Nernst equation, reference electrode, electrochemical series– electromotive force, potentiometric titrations – acid – base titrations– redox and precipitation titrations.

Books for study

1. Morrison R T, Boyd R N and Bhattacharjee S K, *Organic Chemistry*, 7th Edition, New Delhi, Pearson, 2010.
   Unit I *Chapter 34 and 36*
2. Lee J D, *Concise Inorganic Chemistry*, 5th Edition, New Delhi, Wiley–India, 2010.
   Unit II *Chapter 7*
   Unit III *Chapter 13 and 17*
3. Puri B R, Sharma L R and Pathania M S, *Principles of Physical Chemistry*, 23rd Edition, New Delhi, ShobanLalNagin Chand and Co., 1993.
   Unit IV *Chapter 18 and 33*
   Unit V *Chapter 23*

Books for Reference

1. Atkins P W, *Physical Chemistry*, 7th Edition, Oxford University Press, London, 2009.
2. Finar I L, *Organic Chemistry*, Vol 1and 2, 6th Edition, Addison Wesley Longman Ltd., London. 1996.
3. Miessler G L, Fischer P J and Tarr D A, *Inorganic Chemistry*, 5th Edition, Pearson Education, Inc., New York, 2014.
4. Bruice P Y, *Organic Chemistry*, 8th Edition, Pearson Ltd., University of California, Santa Barbara, 2011.
5. Huheey J E, Keiter E A, Keiter R L and Medhi O K, *Inorganic Chemistry:Principles of Structure and Reactivity*, 4th Edition, Pearson Education, New Delhi, 2006.

Web Resources

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

Coordination Chemistry

Silicate Structure

Phase rule

Electrochemistry

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course code			Title of the Course				Hours		Credits
IV	21UPH43AO04A			ALLIED OPTIONAL: CHEMISTRY–II				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	
CO–1	2	3	2	2	2	2	3	1	3	2	2.2
CO–2	2	3	2	3	2	2	2	3	2	3	2.4
CO–3	2	3	2	2	2	2	2	3	3	1	2.2
CO–4	2	3	1	3	3	2	3	1	3	3	2.4
CO–5	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	Credits
IV	21UPH43AP01A	ALLIED OPTIONAL: CHEMISTRY PRACTICAL	2	2

CO No.	CO–Statements	Cognitive Levels (K – level)
	On successful completion of this course, students will be able to	
CO–1	know about the handling of chemicals and safety measures in the laboratory.	K1
CO–2	estimate the principle of volumetric analysis and various types of titration.	K2
CO–3	illustrate the theoretical aspects of organic analysis.	K2
CO–4	detect various elements present in the organic compounds.	K3
CO–5	demonstrate various techniques of volumetric analysis.	K4

Unit –I: Safety Rules in the Laboratory (4 Hours)

Introduction – personal protection – nature of chemicals – toxic, corrosive, explosive, inflammable, carcinogenic, 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 equipment's like bunsen burner–centrifuge– Kipp's apparatus.

Unit–II: Volumetric Analysis (3 Hours)

Volumetric analysis – principle – standard solutions – normality and molarity – principles of titrations– primary standard and secondary standard solutions– acid–base titration– redox titration–complexometric titration– precipitation titration and example of each with indicators used.

Unit –III: Theory of Organic Qualitative Analysis (3 Hours)

Qualitative analysis of organic substances: solubility test in $NaHCO_3$ – NaOH and HCl– test for saturation and unsaturation– aliphatic and aromatic– acidic– basic and neutral nature– element test for N, S and halogens.

Unit – IV: Volumetric Analysis (25 Hours)

1. Estimation of HCl (Std. oxalic acid x NaOH x HCl).
2. Estimation of NaOH (Std. Na_2CO_3 x HCl x NaOH).
3. Estimation of oxalic acid (Std. FAS x $KMnO_4$ x oxalic acid).
4. Estimation of FAS (Std. oxalic acid x $KMnO_4$ x FAS).
5. Estimation of $KMnO_4$ (Std. $K_2Cr_2O_7$ x FAS x $KMnO_4$).
6. Estimation of $K_2Cr_2O_7$ by Thio solution.
7. Estimation of Na_2CO_3 by HCl using a standard Na_2CO_3 solution.
8. Estimation of zinc (EDTA titration).
9. Estimation of magnesium (EDTA titration).
10. Estimation of hardness of water (EDTA titration).

Unit – V Organic Analysis (25 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.

Books for Study

1. Puri B R, Sharma L R and Kalia K K, *Principles of Inorganic Chemistry*, 23rd Edition, ShobanLal, Nagin Chand and Co, New Delhi, 1993.
   Unit–II*Chapter 41*
2. Gnanapragasam N S and Ramamurthy G, *Organic Chemistry Lab Manual*, 2nd Edition, S. Viswanathan Printers and Publishers (P) Ltd., Chennai, 2007.
   Unit–III*Part A*
3. *Allied Practical Manual*, Department of Chemistry, St. Joseph's College, Tiruchirappalli, 2021. (Private circulation).

Books for Reference

1. Venkateswaran V, Veeraswamy R andKulandaivelu A R, *Basic Principles of Practical Chemistry*, 2nd Edition, Sultan Chand and Sons, New Delhi, 1997.
2. Furniss B S, *Vogel's Textbook of Practical Organic Chemistry*, 7th Edition, ELBS Longman, London, 1984.

Web Resource

1. https://www.youtube.com/watch?v=FUo428guKt0
2. https://www.youtube.com/watch?v=_G6_OEa1BjA

Detection of Elements

Acid– Base Titration

Note:

1. Mono–functional compounds are given for organic analysis.
2. Each student is expected to practice the analysis of at least 10 different organic substances.
3. Apart from the TWO CIA tests, one MODEL TEST comprising both volumetric and organic analysis is to be conducted to enable the students ready for semester examination.

Scheme of Valuation
ALLIED: CHEMISTRY PRACTICAL
(For B.ScPhysics)

Continuous Internal Assessment **(100 marks)**

1. Regular Practical Sessions 50 (Based on his observation and record notes)
2. CIA I + CIA II tests 50 (conducted for 100 marks each and converted to 25 each)

Scheme for CIA tests I and II **(100 mark each)**

I. Analysis **40 marks**

1. Acid/base/neutral 5 marks
2. Aliphatic/aromatic 10 marks
3. Saturated/unsaturated 10 marks
4. Elements test
   a) Test for N present/absent 5 marks
   b) Tests for S present/absent 5 marks
   c) Tests for halogens present/absent 5 marks

II. Volumetric analysis **50marks**

Error upto2% 50 marks
1.1–3.0 % 45 marks
3.1–4.0 % 40 marks
>4.0 % 20 marks

III. Observation and Record note–book **10marks**

Scheme for Semester examination **100 marks**

I. Analysis **40 marks**

1. Acid/base/neutral 5 marks
2. Aliphatic/aromatic 5marks
3. Saturated/unsaturated 5marks
4. Tests for elements
   a) Test for N present/absent 5 marks
   c)Tests for S present/absent 5marks
   d)Tests for halogens present/absent 5marks
5. Correct procedure 10 marks

II. Volumetric analysis **50marks**

Error upto 2% 50marks
2.1–3.0 % 45marks
3.1-4.0 % 40marks
5.0 % 30marks
>5.0% 20marks

III. Theory behind practical **10 marks**

Semester	Course Code	Title of the Course	Hours	Credits
IV	21UPH43AO04B	ALLIED OPTIONAL: COMPUTER SCIENCE-II (Data And Communication Networks)	4	3

CO No.	CO- Statements	Cognitive Level (K- level)
	After successful completion of the course, the student will be able to	
CO-1	understand the foundations of data communications	K2
CO-2	appraise the classification and basic concepts of Switching and Routing	K5
CO-3	analyze the concepts of LAN Network	K4
CO-4	use the concepts of Wireless LAN Technology	K3
CO-5	acquire the basic knowledge on IoT	K1

Unit – I: **(12 Hours)**

Introduction to Computer Networks and Data Communication: Need for Computer Networks – Evolution – Data Communication Fundamentals – Data Transmission– Transmission Media.

Unit – II: **(12 Hours)**

Network Classification, Communication and Components: Classification of Computer Networks – Switching and Routing – Routing – Multiplexing and Concentration – Concentrator – Terminal Handling – Components of Computer Network.

Unit – III: **(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: **(12 Hours)**

Wireless LAN and VSAT: Wireless LANs – Components of Wireless LAN – Working of Wireless LANs –Infrared Technology – Wireless LAN Types – Protocols for Wireless LAN – Uses of Wireless LANs – Bluetooth Technology.

Unit – V: **(12 Hours)**

Introduction to Internet of Things: Definition of Internet of Things –Application Areas of IoT – Characteristics of IoT – Things in IoT – IoT Stack – Enabling Technologies – IoT Challenges.

Books for Study

1. Rajesh, Eswarakumar and Balasubramanian, *Computer Networks, Fundamentals and Applications*, Vikas Publishing House Pvt. Ltd.,2002.
   Unit I: Chapter-1
   Unit II: Chapter-2
   Unit III: Chapter-3 (Sec.3.1 & 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 & 7.12)

2. Shriram K Vasudevan, Abhishek S. Nagarajan and R.M.D., Sundaran, *Internet of Things,* Wiley Publication, 2nd Edition, 2020.
   Unit V: Chapter-1 (Sec.1.1, 1.3 to 1.8)

Books for Reference

1. William Stallings, "Data and Computer Communications", Prentice Hall of India, Seventh Edition, 2004.
2. Andrew S Tanenbaum, "Computer Networks", Prentice Hall of India, New Delhi 1999.
3. Arshdeep Bahga and Vijay Madisetti, "Internet of Things- A Hands-on Approach", Universities Press Private Limited, India, 2015.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credit
IV	21UPH43AO04B	ALLIED OPTIONAL: COMPUTER SCIENCE-II (Data And Communication Networks)	4	3

Course Outcomes (COs)	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	2	2	2	3	3	2	2	3	2.4
CO-2	2	3	2	1	2	3	3	2	2	3	2.3
CO-3	1	2	3	2	3	2	3	2	3	3	2.4
CO-4	2	2	2	3	2	2	3	2	2	3	2.3
CO-5	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	Credits
IV	21UPH43AP01B	ALLIED: COMPUTER SCIENCE PRACTICAL	2	2

CO No.	CO- Statements After successful completion of the course, the student will be able to	Cognitive Level (K- level)
CO-1	understand the various text formatting tags, adding images to web page, presenting list of information.	K1, K2
CO-2	apply the knowledge in creating a simple web page with links to other web page and display information in table form.	K3
CO-3	design a form in a web page and divide the browser window in multiple sections using frames.	K3, K6
CO-4	categorize various commands in SQL.	K4, K5
CO-5	analyze and build a web page.	K4, K6

1. Simple web page with all the Text Formatting tags
2. Adding Images to Web Pages
3. Creating Lists (Ordered and Unordered List)
4. Adding Links to Web Pages
5. Creating Tables using various attributes
6. Creating Frames
7. Designing forms (DDL)
8. Implementation of Data Definition language commands
9. Implementation of DML, TCL and DCL commands

Simple Projects using HTML

1. Web blogs creation.
2. Department Website creation.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credit
IV	21UPH43AP01B	ALLIED: COMPUTER SCIENCE PRACTICAL	2	2

Course Outcomes (COs)	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	2	2	1	2	3	3	2	2	2.3
CO-2	2	3	2	2	1	2	3	3	2	2	2.2
CO-3	3	2	2	2	2	2	3	3	2	2	2.3
CO-4	3	3	2	3	2	2	2	3	2	1	2.3
CO-5	3	3	2	3	2	2	3	3	2	2	2.5
Mean Overall Score											2.32 (High)

Semester	Course Code	Title of the Course	Hours	Credits
IV	21UPH44SE02A	SEC - 2 (BS): WEATHER PHYSICS	2	1

CO No.	CO- Statements	Cognitive Levels (K-Levels)
	On the successful completion of the course, student will be able to	
CO-1	acquire the knowledge on concepts in weather physics, climatic changes and basics of weather station.	K1
CO-2	understand the fundamentals and determine the basic parameters of the atmosphere through various weather devices	K2
CO-3	apply the knowledge on weather physics and categorize weather and climate and its changes and predict the natural disaster to alert people.	K3
CO-4	analyze the measurement systems through the modern tools and process of measurement using basic weather station.	K4
CO-5	evaluate general ethics for the human society with awareness on pollution and weather changes through mobile apps.	K4

Unit- I: Introduction to Atmosphere (6 Hours)

Weather and climate - structure and composition of the atmosphere - Atmospheric pressure - temperature - wind - relative humidity - solar and terrestrial radiation - clouds - different forms of precipitation - diurnal variation of surface pressure and variation of pressure with height - diurnal variation of surface temperature and variation of temperature with height - Categorization of wind and circulation.

Unit - II: Measuring the Weather (6 Hours)

Forces acting to produce wind - wind speed direction - units - direction - measuring wind speed and direction - humidity - clouds and rainfall - radiation - absorption - emission and scattering in atmosphere - radiation laws.

Unit - III: Weather Systems (6 Hours)

Wind systems - Cyclone - Thunder - Tornado - Hurricanes.

Unit - IV: Climate and Climate Change (6 Hours)

Classification of climate - causes of climate change - global warming - air pollution - aerosols – Ozone depletion - acid rain.

Unit -V: Basics of Weather Forecasting (6 Hours)

Principles of satellite motion - satellite attitude and its control - types of orbits - polar and geostationary – Earth - and sun synchronous - orbit optimization - Meteorological satellites - multi-scanner radiometers and their applications in the observation of weather parameters - Forecasting Mobile apps

Book for Study

Text Prepared by the Department

Books for Reference

1. I.C. Joshi, *Aviation Meteorology*, 3rd edition, Himalayan Books, 2014.
2. Stephen Burt, *The weather Observers Hand book*, Cambridge University Press, 2012.
3. S.R. Ghadekar, *Meteorology*, Agromet Publishers, Nagpur, 2001.
4. S.R. Ghadekar, *Text Book of Agrometeorology*, Agromet Publishers, Nagpur, 2005.
5. Charls Franklin Brooks, *Why the weather*, Chapman & Hall, London, 1924.
6. John G. Harvey, *Atmosphere and Ocean*, 1995.

Web Resources*

1. https://en.wikipedia.org/wiki/Atmospheric_physics#:~:text=In%20order%20to%20model%20weather,mathematical%20and%20related%20to%20physics.
2. https://www.iop.org/education/school-and-college-students/Qubit/physics-weather-forecast
3. https://physicstoday.scitation.org/doi/10.1063/PT.3.4365

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

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credit
IV	21UPH44SE02A	SEC - 2 (BS): WEATHER PHYSICS	2	1

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	2	3	2	2	2.4
CO-2	3	2	3	2	2	3	2	2	3	2	2.4
CO-3	3	2	2	2	2	3	2	2	3	2	2.3
CO-4	3	3	2	2	2	3	2	2	2	2	2.3
CO-5	3	2	2	2	2	3	3	2	2	3	2.4
Mean Overall Score											2.36 (High)

Semester	Course Code	Title of the Course	Hours	Credits
IV	21UPH44SE02B	SEC - 2 (BS): ELECTRICAL WIRING	2	1

CO No.	CO- Statements	Cognitive Levels (K-Levels)
	On the successful completion of the course, student will be able to	
CO-1	acquire the knowledge and understand the basics of electricity, electrical components and wiring methods and troubleshooting.	K1, K2
CO-2	classify various electrical components and its applications.	K3
CO-3	identify and assess the need, design and wire the panel	K4, K5, K6
CO-4	illustrate and explain the wiring circuits.	K3, K4
CO-5	recommend and plan to wire a house and industry.	K5, K6

Unit - I: Basics of Electricity **(6 Hours)**

Electricity and generation - Electrical Terms - Electrical Circuits - Grounding and Polarization - Home wiring Tools - Power Station and Substation - IEE Rules - Safety and precautions.

Unit - II: Electrical Components **(6 Hours)**

Wire and Cable - Conduit - Boxes - Panels - Switches - Sockets - control switches - MCB - ELCB - RCD - GFCI and AFCI Breakers - House Surge Arrestors - Service Panels.

Unit - III: House Wiring **(6 Hours)**

Household Circuits - Single Phase wiring - Three Phase Wiring - Open and Concealed wiring - Grounding and Bonding a wire system - Lights - Motor - Fans - wiring a room - wiring a kitchen - Staircase Wiring.

Unit - IV: Panel Wiring **(6 Hours)**

Types of Panels - panel diagrams - circuit breakers - switches on the panel - Emergency Shut Down reset - PLC wiring - control panel components - Connections and routing - Conductor and cable runs - EMC compliant panel - layout of equipment in a panel - reference regulations and standards.

Unit - V: Trouble Shooting **(6 Hours)**

Electrical faults - main board - distribution board - socket, plug and cord - Light fixtures - LED lamps - Ceiling Fans - Heater.

Book for Study

Text Prepared by the Department.

Books for Reference

1. Black Decker, *The complete guide to wiring*, Updated 7th Edition, Quarto Publishing Group USA, 2018.
2. Ray C. Mullin, Phil Simmons, *Electrical Wiring Residential*, 17th Edition, Delmar, Cengage Learning, 2012.

Web Resources*

1. https://www.hplindia.com/wire-cables/domestic-wires.php
2. https://www.contractorbhai.com/basics-of-how-your-home-electrical-works/
3. https://www.primecabindia.com/all-about-house-electrical-wiring-system-a-small-guide

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

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credit
IV	21UPH44SE02B	SEC - 2 (BS): ELECTRICAL WIRING	2	1

Course Outcomes (COs)	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	3	2	2	3	3	2	2	3	2.6
CO-2	2	3	3	3	2	3	3	3	2	2	2.6
CO-3	3	3	3	3	2	3	3	3	3	2	2.8
CO-4	3	2	3	2	2	3	3	2	2	2	2.4
CO-5	2	3	3	3	2	2	3	3	3	3	2.7
Mean Overall Score											2.62 (High)

Semester	Course Code	Title of the Course	Hours	Credits
IV	21UHE44VE04A	PROFESSIONAL ETHICS–II: SOCIAL ETHICS - II	2	1

Co. No.	CO- Statements	Cognitive Levels (K-Levels)
	On completion of this course the graduates will be able to	
CO-1	know the value of natural recourses and to live in a harmony with nature.	K1
CO-2	comprehend the importance of a healthy life.	K2
CO-3	apply the plans of disaster management in the society.	K3
CO-4	analyse the importance and differences of science and religion.	K3
CO-5	apply counseling skills and solve their problems.	K4

Unit-I Harmony with Nature (6-Hours)

What is environment, Why should we think of harmony, Principles to conserve environmental resources, Causes of disharmony, The fruits of harmony with nature, Natural 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 and Technology 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 - 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, Drug Addiction and Drug abuse

Unit-IV Disaster Management (6-Hours)

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

Unit-V Counselling for Adolescents (6-Hours)

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

Books for Study

Department of Human Excellence, *Formation of Youth*, St Joseph's College (Autonomous), Tiruchirappali 02, 2021.

Books for Reference

1. Albert, D. and Steinberg, L, *Judgment and decision making in adolescence*: Journal of Research on Adolescence, page no: 211-224. 2011
2. Larry R. Collins, *Disaster Management and Preparedness,* Lewis Publications, 22 November 2000.
3. Elizabeth B. Hurlock, *Developmental Psychology: A: Life-Span Approach*, New Delhi: Tata McGraw-Hill, 1981, 5th Edition, August 18, 2001.
4. Sangha, Kamaljit. *Ways to Live in Harmony with Nature: Living Sustainably and Working with Passion.* Australia, Woodslane Pty Limited, 2015.

Web Sources

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

Semester	Course Code	Title of the Course	Hours	Credits
IV	21UHE44VE04B	PROFESSIONAL ETHICS II: RELIGIOUS DOCTRINE - II	2	1

CO.No.	CO-Statements	Cognitive Levels (K-Levels)
	On completion of this course, the graduates will be able to:	
CO-1	Understand the history of the Catholic Church	K1
CO-2	Examine and grasp the Sacraments of the Catholic Church	K2
CO-3	Apply the Christian Prayer to their everyday life	K3
CO-4	Analyze themselves in the light of Sacraments & Christian Prayer	K4
CO-5	Create a harmonious society learning values from all religions	K5 & K6

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	**Christian Prayer**	**(6 Hours)**
Unit-V	**Harmony of Religions**	**(6 Hours)**

Books for Study

Department of Human Excellence, *Life in the Lord: Religious Doctrine.* St. Joseph's College, Trichirappalli 02, 2021.

Books for Reference

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

Semester	Course Code	Title of the Course	Hours	Credits
V	21UPH53CC07	CORE-7:OPTICS	4	2

CO No.	CO- Statements	Cognitive Levels (K-Levels)
	On the successful completion of the course, student will be able to	
CO-1	acquire and understand the concepts of Geometrical optics and Wave optics.	K1, K2
CO-2	obtain the fundamental knowledge of nodal points in an optical system and analyse the combination of lenses using matrix formulation.	K1, K4
CO-3	gain knowledge on interference, diffraction, polarization and Optical fibers and understand basic principles behind fiber optic sensors	K1, K2
CO-4	apply the knowledge to analyse the interference and diffraction pattern and evaluate the functions of an optical instrument.	K3, K4, K5
CO-5	design and align optical elements to set up new optical system	K6

Unit- I: Geometrical Optics (12 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 (12 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: Wave Optics (12 Hours)

Origin of refractive index - Rayleigh scattering - Huygen's theory - rectilinear propagation - application of Huygen's principle to study refraction and reflection - Huygen's principle in inhomogeneous media.

Interference of light waves - Fresnel Biprism - Interference by a plane parallel film when illuminated by a plane wave - cosine law - Non-reflecting films (only) - Fiber Bragg Gratings - Newton's rings - The Michelson interferometer.

Unit- IV: Diffraction and Polarization (12 Hours)

Fraunhofer diffraction - diffraction by a circular aperture - resolving power of a microscope - two slit Fraunhofer diffraction pattern - the diffraction grating - oblique incidence - Fresnel diffraction - Fresnel half period zones - the zone plate.

Polarization - Malus' Law - production of polarized light - superposition of two disturbances - the phenomenon of double refraction - interference of polarized light: Quarter wave plate and half wave plate - analysis of polarized light - optical activity - Faraday rotation.

Unit- V: Optical Fiber **(12 Hours)**

Total internal reflection - the optical fiber - glass fibers - the coherent bundle - the numerical aperture - attenuation in optical fibers - multimode fibers - pulse dispersion in multimode opticalfibers - material dispersion - plastic optical fibers - fiber optic sensors - physical understanding of modes.

Book for Study

1. Ajoy Ghatak, *Optics*, 6th Edition, McGraw Hill Education (India) Private Limited, 2017.

UNIT	CHAPTERS	SECTIONS
I	3 & 4	3.2-3.5, 4.1-4.4, 4.6, 4.8
II	5 & 6	5.1-5.5, 6.1-6.4
III	7, 12, 14 & 15	7.5, 7.6, 12.1-12.5, 14.4, 14.8, 15.2-15.4, 15.10, 15.11
IV	18, 20 & 22	18.1, 18.3, 18.6, 18.8, 18.9, 20.1-20.3, 22.1-22.8, 22.15
V	28 & 29	28.3-28.10, 28.13, 28.14, 29.3

BOOKS FOR REFERENCE

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

WEB RESOURCES*

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)

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credit
V	21UPH53CC07	CORE-7: OPTICS	4	2

Course Outcomes (COs)	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	3	2	1	3	2	3	3	1	2.2
CO-2	3	3	3	2	1	3	2	2	3	1	2.3
CO-3	3	2	2	3	1	3	3	3	2	1	2.3
CO-4	3	3	2	3	1	3	3	2	2	1	2.3
CO-5	3	2	2	3	1	3	2	3	3	1	2.3
Mean Overall Score											2.28 (High)

Semester	Course Code	Title of the Course	Hours	Credits
V	21UPH53CC08	CORE-8: CONCEPTS OF MODERN PHYSICS	4	2

CO No.	CO- Statements	Cognitive Levels (K-Levels)
	On the successful completion of the course, student will be able to	
CO-1	acquire conceptual knowledge of space-time, frames of references and creating changes of physical parameters, their behaviour as a particulate and matter waves and to differentiate the size of the matter.	K1
CO-2	explain and demonstrate various theoretical and experimental methods in relativity, quantum physics and cosmology.	K2
CO-3	apply suitable methods to solve problems in physics of subatomic structure, matter waves and relativistic speeds.	K3
CO-4	examine the existence of solution to a problem.	K4, K5
CO-5	connect the concepts of modern physics to a real-life problem under different situations.	K6

Unit - I: Special Theory of Relativity -I (12 Hours)

Frames of reference - The Need for Ether - The Michelson-Morley Experiment - Einstein's Postulates - The Lorentz Transformation - Time Dilation and Length Contraction - Addition of Velocities - Experimental Verification - Muon Decay - Atomic Clock Measurement - Velocity Addition - Testing Lorentz Symmetry - Twin Paradox – Space-time.

Unit - II: Special Theory Of Relativity -II (12 Hours)

Doppler Effect - Applications of the Doppler Effect - Relativistic Momentum - Relativistic Energy - Total Energy and Rest Energy - Equivalence of Mass and Energy - Relationship of Energy and Momentum - Massless Particles - Computations in Modern Physics - Binding Energy - Electromagnetism and Relativity.

Unit - III: Particle Properties of Waves (12 Hours)

Electromagnetic Waves - Blackbody Radiation, Ultraviolet catastrophe, Planck’s radiation formula - Photoelectric Effect, quantum theory of light - Thermionic emission - Dual nature of light - X-Rays - X-Ray Diffraction - Compton Effect: Theory and experiment-Pair Production - Photon absorption - Photons and Gravity - Gravitational red shift.

Unit - IV: Wave Properties of Particles (12 Hours)

De Broglie Waves - Probability Waves - Describing a Wave - Phase and Group Velocities - Particle Diffraction, Davisson and Germer experiment - Particle in a Box - Uncertainty Principle I(wave) - Gaussian function - Uncertainty Principle II (particle) - Application of the Uncertainty Principle, Energy and time - Interferometry with electrons and atoms - Quantum interference with electron beam.

Unit - V: The Big and The Small: Cosmology and Nanoscience (12 Hours)

Evidence of the Big Bang - Hubble's Measurements - Cosmic Microwave Background Radiation Nucleosynthesis - Olbers' Paradox - The Big Bang - Stellar Evolution - The Ultimate Fate of Stars - Planck's Time, Length, and Mass - Active Galactic Nuclei and Quasars - Novae and Supernovae - Problems with the Big Bang - The Inflationary Universe - The Lingering Problems - Nanoscale: Carbon Nanotubes - Graphene - Nano Electronics- Quantum wires - Quantum dots.

Books for Study

1. Stephen T. Thornton, Andrew Rex, *Modern Physics for Scientists and Engineers*, 4th Edition, Brooks/Cole, Cengage Learning, 2013.
2. Arthur Besier, Shobhit Mahajan and S. Rai Choudhury, *Concepts of Modern Physics*, 7th Edition, McGraw Hill Education, 2017.
3. Chris Binns, *Introduction to Nanoscience and Nanotechnology*, John Wiley & Sons, 2010.

Unit	Book	Chapters	Sections
I	1	2	2, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9
II	1	2	2.10, 2.11, 2.12, 2.13, 2.14
III	2	2	2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9
IV	2	3	3.1, 3.2, 3.3, 3.4, 3.5, 3.5, 3.6, 3.7, 3.8, 3.9
V	1	16	16.1, 16.2, 16.3, 16.4, 16.5
	3	1 3 5	1.1 3.1, 3.8, 3.9, 3.10 5.1, 5.2, 5.3, 5.4

Books for Reference

1. R.A. Serway, C.J. Moses and C.A. Moyer, *Modern Physics*, 3rd Edition. Brooks/Cole Publications 2004.
2. P.A. Tipler and R. Llewellyn, *Modern Physics*, 5th Edition, W.H. Freeman 2007.
3. R. Resnick, *Introduction to Special Relativity*, 1st Edition, Wiley, 2007.
4. K.D. Sattler, *Handbook of Nanophysics*, CRC Press, 2011.

Web Resources*

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)

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credit
V	21UPH3CC08	CORE-8: CONCEPTS OF MODERN PHYSICS	4	2

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

Semester	Course Code	Title of the Course	Hours	Credits
V	21UPH53CP03	PHYSICS PRACTICAL – III	6	4

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. Conversion of galvanometer into an ammeter.
13. Conversion of galvanometer into voltameter.
14. Transistor characteristics – CB mode.
15. Transistor characteristics – CE mode.
16. FET – characteristics.
17. Hartley oscillator using BJT – f and Inductance
18. Colpitt's oscillator using BJT – f and Inductance
19. Study the frequency response of transistor CE amplifier.
20. Study the frequency response of FET amplifier.
21. Logic gates using Diodes and Transistors – construction and operation.
22. De-Morgan's theorem and Boolean algebra – verification using logic gates
23. Specific Rotation of Sugar solution by Polarimeter.
24. Two port network analysis – admittance, transmission and h parameters.
25. PWM using IC555 – construction and performance study
26. Thevenin's and Norton theorems – verification and measurement
27. Study of transistor biasing
28. Solar Characteristics measurement
29. Study of Diamagnetism, Paramagnetism and Ferromagtism.
30. Verification of Biot-Savart's law
31. Faraday effect – rotation of the plane polarized light beam, Verdet constant and e/m
32. BH loop – Retentivity, Permeability, Residual Magnetism and Reluctance
33. Determination of Transistor h-parameter
34. Anderson's Bridge – self-inductance and inductive reactance.
35. Determination of Planck's constant using LED and Photo diode

Semester	Course Code	Title of the Course	Hours	Credits
V	21UPH53ES01A	DSE - 1: ANALOG AND DIGITAL ELECTRONICS	5	3

CO No.	CO- Statements	Cognitive Levels (K-Levels)
	On the successful completion of the course, student will be able to	
CO-1	describe semiconductor devices and outline the concepts of analog and digital circuits	K1, K2
CO-2	understand the concepts and analyze the analog and digital circuits for various applications.	K2, K3
CO-3	examine real time problems, implement with analog and digital circuits by employing modern tools.	K3, K4
CO-4	assess the need of modern society with professional ethics in electronics and recommend solutions for the same	K5
CO-5	design and construct the electronic project to plan an eco-friendly environment.	K6

Unit - I: Diode Applications, BJT and FET Amplifier (15 Hours)

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

Unit - II: Oscillators (15 Hours)

Positive Feedback - Barkhausen Criterion - classification of oscillators - Phase shift oscillator - Wien Bridge oscillator - Tuned oscillator - Hartley oscillator - Crystal oscillator - Clock generator; Modulation: PWM - PAM - PCM - ASK - FSK.

Unit - III: Operational Amplifiers (15 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 - Logarithmic amplifier - Error amplifier - Schmitt Trigger - fixed frequency, pulse width modulation control circuit (IC TL494).

Unit - IV: Combinational Logic Circuits (15 Hours)

Basic and Universal gates - K-map simplification - 4:1 and 16:1 Multiplexer - 1:4 and 1:16 Demultiplexer - Encoder - Decoder - Priority Encoder - Parity generator and checker; Electrical characteristics: TTL, CMOS, NMOS.

Unit - V: Sequential Logic Circuits **(15 Hours)**

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

Book for Study

1. U A. Bakshi and A P Godse, *Analog and Digital Electronics*, Technical Publications Pune, 2009.

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. Jerry Luecke, *Analog and Digital Circuits for Electronic Control System Applications*, Elsevier, 2005.
2. Anil Kumar Maini, *Digital Electronics*, John Wiley & Sons Ltd, 2007.

Web References*

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)

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credit
V	21UPH53ES01A	DSE - 1: ANALOG AND DIGITAL ELECTRONICS	5	3

Course Outcomes (COs)	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	2	3	2	3	3	2	3	2	2.6
CO-2	3	3	3	2	2	3	3	3	3	2	2.7
CO-3	3	3	3	2	2	3	3	3	3	2	2.7
CO-4	3	3	3	2	2	3	3	2	3	2	2.6
CO-5	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	Credit
V	21UPH53ES01B	DSE - 1: DESIGN OF ANALOG AND DIGITAL CIRCUITS	5	3

CO No.	CO- Statements	Cognitive Levels (K-Levels)
	On the successful completion of the course, student will be able to	
CO-1	acquire the knowledge of basic network concepts emphasizing series and parallel combination of passive components, discuss working principle and biasing concepts of JFET's and MOS FET's, and outline the concepts of op amp and its basic circuit operation.	K1, K2
CO-2	experimenting the configuration of Op-amp into its application to solve various circuit parameters.	K3
CO-3	examine the working principle of various analog and digital instruments and analyse them in the measurement of physical parameters	K3, K4
CO-4	assess the need of automatic electronics devices by the society and recommend solutions by inventing the circuits.	K5
CO-5	design and construct analog and digital circuits for social needs.	K6

Unit - I: Network Analysis (15 Hours)

Networks and Kirchhoff's law - Series resistors - Parallel resistors - Voltage - Thevenin's - Voltage Divider - Connected Circuits and Power Transfer - Matrix Solution of Resistor Networks - Matrix Form of the Resistance Network and Example - Solution for the Effective Resistance - CircuitPractice - Reflection-Symmetric Network - Series and Parallel Light Bulbs - Thevenin Circuit.

Unit - II: Design of Amplifiers and Oscillators (15 Hours)

Common - Emitter Amplifier - Bias Network (AC Coupling) - Transistor Differential Amplifier - Ebers - Moll Equation - JFET voltage amplifier - MOSFET - Transistor phase shift oscillator - JFET Wein's bridge oscillator - Transistor astable multivibrator.

Unit - III:Operational Amplifiers: Design of ADC, DAC and Analog Computer (15 Hours)

Op-amp basics - Op-amp circuits - Op-amp (closed and open loop) - Filters - Instrumentation amplifier - Finite gain analysis - Bandwidth - Comparator - PID Control - R-2R ladder DAC - Successive Approximation Register ADC - analog computation.

Unit - IV: Design of Combinational Logic Circuits (15 Hours)

K-map Simplification - Design of 4:1 and 16:1 Multiplexer - Design of 1:4 and 1:16 Demultiplexer - Encoder - Decoder - 1-bit full Adder - 1-bit full subtractor - Design of Multiplexer case study: thermocouple monitor.

Unit -V: Design of Sequential Logic Circuits **(15 Hours)**

Flip-flops - 4-bit Asynchronous Counter - 4-bit Synchronous Counter - Shift register - State machine programmable logic device - SRAM - DRAM - Design of pulse-area stabilizer - Design of counter divide by 2 and 3.

Book for Study

1. Daniel Adam Steck, "Analog and Digital Electronics", Department of Physics, University of Oregon, 2015.

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. Anant Agarwal and Jeffrey H. Lang, "Foundations of Analog and Digital Electronic Circuits", Elsevier, 2005.
2. Johan H. Huijsing, Michiel Steyaert and Arthur van Roermund, "Analog Circuit Design", Kluwer Academic Publishers, 2003.
3. Mark Balch, "Complete Digital design", McGraw-Hill, 2003.
4. John E. Ayers, "Digital Integrated Circuits", CRC Press, 2005.

Web Resources*

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)

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credit
V	**21UPH53ES01B**	**DSE - 1: DESIGN OF ANALOG AND DIGITAL CIRCUITS**	**5**	**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	3	3	3	2	2	3	3	3	3	2	2.7
CO-2	3	3	3	2	2	3	3	2	3	2	2.6
CO-3	3	3	2	3	2	3	3	2	3	2	2.6
CO-4	3	3	3	2	2	3	3	2	3	2	2.6
CO-5	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	Credit
V	21UPH53ES02A	DSE – 2: CLASSICAL MECHANICS	5	3

CO No.	CO- Statements On the successful completion of the course, student will be able to	Cognitive Levels (K-Levels)
CO-1	acquire the knowledge of laws of motion, momentum, energy, Lagrange's Equations, and motion of rigid bodies.	K1
CO-2	understand the concept of momentum, energy and classify the laws of motion and the different systems of energy.	K2 & K3
CO-3	apply and explain the Lagrange's Equations for different energy systems and rotational motion of a rigid body.	K3 & K2
CO-4	analyze and discuss the conservation of momentum and angular momentum, variation and Hamilton's principles, and phase space.	K2 & K4
CO-5	discuss about the conservative forces, central forces, constrained systems and rotational motion of rigid bodies	K3

Unit - I: Laws of Motion and Momentum (15 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 (15 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 PotentialEnergy - 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 (15 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 (15 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 (15 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.

Books for Study

1. John R. Taylor, *Classical mechanics*, University Science Books, Edwards Brothers, Inc 2005.
2. R. Douglas Gregory, *Classical Mechanics an Undergraduate text*, Cambridge University Press, Cambridge, 2006.

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 References

1. H. Goldstein, C.P. Poole, J.L. Safko, *Classical Mechanics*, 3rd edition. 2002, Pearson Education.
2. P.S. Joag, N.C. Rana, *Classical Mechanics*, McGraw Hill, 1991.
3. A.K. Raychaudhuri, *Classical Mechanics: A Course of Lectures*, Oxford University Press, 1983.
4. J.C.Upadhaya, *Classical Mechanics*, second revised edition, Himalaya Publishing House.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credit
V	21UPH53ES02A	DSE – 2: CLASSICAL MECHANICS	5	3

Course Outcomes (COs)	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	2	3	2	3	2	1	2.3
CO-2	3	3	2	2	2	3	2	2	2	1	2.2
CO-3	3	2	2	3	2	2	3	3	2	1	2.3
CO-4	3	2	2	3	3	2	2	3	2	1	2.3
CO-5	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	Credit
V	21UPH53ES02B	DSE – 2: SOLID STATE PHYSICS	5	3

CO No.	CO- Statements	Cognitive Levels (K-Levels)
	On the successful completion of the course, student will be able to	
CO-1	acquire the knowledge of fundamental principles, phenomena and concepts in solid state physics.	K1
CO-2	understand and describe the different experimental X-ray diffraction methods and lattice vibration, free-electron, band theories of solids.	K1, K2
CO-3	explain the theories underlying dielectric, optical, magnetic and superconductive properties.	K2
CO-4	classify the properties of semiconductors, dielectrics, optical, magnetic and superconductive materials.	K3
CO-5	apply the theories to explain the properties of solids.	K4

Unit - I: Crystal Structure and X-Ray Diffraction (15 Hours)

The Crystalline State – Basic definitions- Bravais lattices and crystal systems - Symmetry - Millerindices- Crystal structures: FCC, BCC, NaCl, Diamond - Interatomic Forces - Types of Bonding - Bragg's Law - The reciprocal lattice - first Brillouin zone - Experimental X-ray diffraction Techniques: The Rotating - Crystal Method, The Laue Method, The Powder Method.

Unit - II: Lattice Vibrations and Free-Electron Model (15 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 - Effects of fermi surface: electrical and thermal conductivity - The Hall effect - Failure of the free electron model.

Unit - III: Semiconductors (15 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 - Impurity states - Semiconductor statistics: intrinsic and extrinsic regions - Electrical conductivity: mobility and temperature dependence- the Hall effect.

Unit - IV: Dielectric and Optical Properties (15 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 - the microscopic model - Ferroelectric domains.

Unit - V: Magnetic Properties and Superconductivity (15 Hours)

Magnetic susceptibility - classification of materials - Langevin theory of diamagnetism - paramagnetism: classical theory - Ferromagnetism - antiferromagnetism and Ferrimagnetism - Ferromagnetic domains: magnetization process - Superconductivity - zero resistance - The Meissner effect - critical field - BCS theory - Josephson effect - Type I and II superconductors.

Book for Study

1. M. A. Omar, *Elementary Solid State Physics*, Pearson India, 2010.

Unit	Chapters	Sections
I	1 & 2	1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.9, 1.10, 2.3, 2.6, 2.9,
II	3 & 4	3.2, 3.3, 3.4, 3.5, 4.3, 4.4, 4.6, 4.7, 4.8, 4.9, 4.10, 4.13
III	5 & 6	5.2, 5.3, 5.4, 5.5, 5.10, 5.15, 5.17, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8
IV	8	8.2, 8.3, 8.4, 8.5, 8.7, 8.8, 8.9, 8.10, 8.11
V	9 & 10	9.3, 9.4, 9.5, 9.6, 9.7, 9.8, 9.9, 9.11, 10.2, 10.3, 10.4, 10.7, 10.8, 10.9

Books for Reference

1. N. W. Ashcroft, N. D. Mermin, *Solid State Physics*, Brooks/Cole; New edition, 1976.
2. C. Kittel, *Introduction to Solid State Physics*, India edition. Wiley, 2019.
3. S. H. Simon,*The Oxford Solid State Basics*, Oxford University Press, 2013.
4. S. A. Holgate, *Understanding solid state physics*, CRC Press, 2010.
5. S.O. Pillai, *Solid State Physics*, 5th edition, New Age International Publishers, 2002.
6. A. J. Dekkar, *Solid State Physics*, Campus book house, Indian Institute of Science (TBH).

Web Resources*

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)

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credit
V	21UPH53ES02B	DSE – 2: SOLID STATE PHYSICS	5	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	3	3	2	2	2	3	2	2	2	2	2.3
CO-2	3	3	3	2	2	3	2	2	2	2	2.4
CO-3	3	3	2	2	2	3	3	2	2	1	2.3
CO-4	3	3	3	2	2	3	3	2	2	1	2.4
CO-5	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	Credit
V	21UPH53SP01	Self Paced Learning: ASTRONOMY	-	2

CO No.	CO-Statements	Cognitive Levels (K-Levels)
	On the successful completion of the course, student will be able to	
CO-1	acquire the knowledge on the solar systems, Eclipses, Lunar and Solar calendars.	K1
CO-2	describe the features of an astronomical instruments, a variety of calendars and the planets in the solar systems	K1
CO-3	understand the various physical phenomena exercised in the astronomical instruments	K2
CO-4	apply astronomical telescopes to examine the features of Moon and plants in the solar systems	K3
CO-5	analyse the changes observed in the sky and understand the causes responsible for any observed changes.	K4

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 solar eclipse - 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.

Book for Study

1. S. Kumaravelu, Susheela Kumaravelu, Astronomy, Revised Edition 2013.

Books for References

1. V.B. Bhatia, Text book for Astronomy and Astrophysics with elements of Cosmology, 2nd Edition, Narosa Publishing House, New Delhi, 2001.
2. H. Karttunen, P. Kroger, H. Oja, M. Poutanen, K. J. Donner, Fundamental Astronomy, 5th Edition, Springer Berlin Heidelberg, New York, 2007.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credit
V	21UPH53SP01	Self Paced Learning: ASTRONOMY	-	2

Course Outcomes (COs)	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	3	3	2	2	3	3	2	2	2.5
CO-2	3	2	2	2	2	2	3	2	3	2	2.3
CO-3	3	2	2	2	2	3	3	2	2	2	2.3
CO-4	3	2	2	2	2	3	3	2	1	2	2.2
CO-5	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	Credits
V	21USS54SE03	SEC-3: SOFT SKILLS	2	1

POs (Programme outcomes)

- To provide a focused training on soft skills for students in colleges for better job prospects
- To create and interface between industries and educational institutions in order to match the expectations of employers and abilities of the employees
- To bring a transformation in interpersonal and societal living guided by value laden principals
- To explore and analyze personal attributes that enhance the individual's Interactions, Job Performance and Career Prospects
- To foster teamwork (synergy) that increases productivity and brings benefits to the individuals and the society

PSOs (Programme Specific Outcomes)

After the successful completion of the course, students will learn:

- the various concepts of communication skills as job seekers
- to write a Professional resume as required by the employers
- to demonstrate interview skills and actively participate in GD preparations and presentations in peer groups
- to discover various aspects of self and set short tem and long term goals for successful career and creates a congenial atmosphere
- to have access to solve simple and day to day Arithmetic problems and Verbal and Non- verbal reasoning formulas

COs (Course Outcomes)

Upon completion of the course, Students will:

- be keen on developing and sustaining Soft Skills required of an educated youth
- be trained to present the best of themselves as job seekers to deal with any problem and conflict situations
- be able to transfer the skills learnt for concrete outcomes and increased productivity of companies
- be able to develop people skills, life skills that are required to be a good human in the long run and set a living standard
- be embedded with Employability skills such as "communication", "teamwork" ,"initiative , "enterprise" , the attributes of "reliability", "balance between work -life", "commitment" and continuous learning

Module 1**: Effective Communication**

Definition of communication, Barriers of Communication, Verbal and Non-verbal Communication; Self introduction matrix, Conversation Techniques, Good manners and Etiquettes, Introduction to Professional Communication, Professional Grooming and Presentation Skills and exercises

Module II: **Resume Writing & Interview skills**
Resume Writing: Basic Resume Formats. Types of Resume - Chronological, Functional and Mixed Resume**,** Steps in preparation of Resume, Sample objectives, Model Resumes. **Interview Skills:** Preparation for interview, Common interview questions, Attitude, Body Language, Mock interviews and Practicum, Figuring out common interview questions and answers

Module III: **Group Discussion:** Definition of GD. The salient features of GD,Factors that influence GD, Outcome of GD, Tips for success in GD, Parameters of GD, Essential Points for GD preparation, GD Topics, Model GD and Practicum.

Module IV: **Personal Effectiveness:** Self Discovery: Personality, Traits of Personality; Personality Tests; Intelligence and Skill Assessment Form. **Goal Setting**: Goal setting Process, Questioneers & Presentations

Module V: **Numerical Ability:** Average, Percentage; Profit and Loss**,** Area, Volume and Surface Area. (Simple Interest, Compound Interest; Time and Work, Pipes and Cisterns; Time and Distance**,** Problems on Trains**,** Illustrations, Boats and Streams; Illustrations-Optional)

Module VI: **Test of Reasoning - Verbal Reasoning:** Series Completion, Analogy. **Non-Verbal Reasoning**

Text Book

1. Melchias G, Balaiah John, John Love Joy (Eds), 2018. *Straight from the Traits: Securing Soft Skills*, SJC, Trichy.

References

1. Aggarwal, R.S. 2010. *A Modern Approach to Verbal and Non Verbal Reasoning*. S.Chand, New Delhi. Covey, Stephen. 2004. *7 Habits of Highly effective people*, Free Press. Egan, Gerard. (1994).
2. *The Skilled Helper* (5th Ed). Pacific Grove, Brooks/Cole.
3. Khera ,Shiv 2003. *You Can Win.* Macmillan Books , Revised Edition.
4. Melchias G, Balaiah John, John Love Joy (Eds), 2018. Winners in the Making: A primer on soft skills. SJC, Trichy.

Other books

1. Murphy, Raymond. 1998. *Essential English Grammar*. 2nd ed., Cambridge University Press. Sankaran, K., & Kumar, M. *Group Discussion and Public Speaking*. M.I. Pub, Agra, 5th ed., Adams, Media.
2. Trishna's 2006. *How to do well in GDs & Interviews*, Trishna Knowledge Systems.
3. Yate, Martin. 2005. H*iring the Best: A Manager's Guide to Effective Interviewing and Recruiting**

Semester	Course Code	Title of the Course	Hours	Credit
V	21UPH53EG01A	GE – 1: EVERYDAY PHYSICS	4	3

CO No.	CO- Statements	COGNITIVE LEVELS (K-Levels)
	On the successful completion of the course, student will be able to	
CO-1	acquire knowledge and understand basic Physics and its Applications	K1,K2
CO-2	explain the Operation of the Human Ears and Eyes and its defects and methods to correct them.	K3,K4
CO-3	describe the function of the Electric Home Appliances and estimate their ratings, power consumptions and bill costs.	K5
CO-4	understand the requirement of Renewable energy resources and design of equipments for fruitful energy conversions	K2, K6
CO-5	acquire knowledge of Heat and temperature and conversion of Temperature among the different scales of temperature.	K1,K4

Unit - I: General Physics (12 Hours)

Mechanics: Newton's Laws of Motion – Work - Power and Energy - Rotational Motion – Torque – couple - Simple Machines - I, II & III orders - inclined plane – pulley - wheel and axle.

Gravity and Gravitation: Kepler's Laws - factors affecting 'g' - free fall.

Fluid Mechanics: Archimede's Principle - principle of floatation - centre of gravity and centre of buoyancy - Hydraulic machines.

Unit - II: Heat (12 Hours)

Temperature: Different scales of temperature – thermometers - expansion due to heating - anomalous expansion of water and its applications.

Calorimetry: Principle - specific heat capacity and its applications.

Transmission of heat: Conduction - Convection and Radiation of heat - Latent heat - Pressure Cooker - Black body and Green - House effect.

Unit - III: Sound and Light (12 Hours)

Sound: Waves and Vibrations: Important definitions - Propagation of sound - velocity of sound - Musical sound and noise – Beats - Echoes and Resonances - Musical instruments - human ear - Doppler Effect - Ultrasonics and Sonar.

Light: Important definitions - Umbra and Penumbra - Reflection – Mirrors - Refraction – Lenses - Dispersion – Prisms - Total internal reflection - Human eye and its defects - Simple Optical Devices - fibre optic cable - Colours and Pigments.

Unit - IV: Electricity and Domestic Appliances (12 Hours)

Definitions and units of Electrical Parameters - electric cells and their combinations - Household wiring and Earthing - Common electrical devices – fuse – switch – sockets – plugs – Heaters – Bulbs - electric iron – kettle - Turning Effect of Electricity - motors and fan, Magnetic Effect of Electric Current - transformers, electric bell and electric generators.

Unit - V: Energy Physics **(12 Hours)**

Different forms of Energy - Transformation of Energy - Need for New strategies regarding Energy - Different sources of Energy - Solar energy - Hydrostatic Energy - Thermal Energy - Electrical Energy – Biomass - Wind Energy - Ocean Energy - Nuclear Energy and its Hazards.

Book for Study

1. *Everyday Physics*, Dept. of Physics, St. Joseph's College, Trichy-2.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course Code			Title of the Course				Hours		Credit
V	21UPH53EG01A			GE – 1: EVERYDAY PHYSICS				4		3
Course Outcomes (COs)	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	2	3	2	3	2	1	2.3
CO-2	3	3	2	2	3	3	2	2	2	1	2.3
CO-3	3	2	2	3	3	2	3	3	2	1	24
CO-4	3	2	2	3	3	2	2	3	2	1	2.3
CO-5	3	3	2	3	3	2	2	3	2	1	2.3
Mean Overall Score											2.32 (High)

Semester	Course Code	Title of the Course	Hours	Credit
V	21UPH53EG01B	GE -1: RENEWABLE ENERGY PHYSICS	4	3

CO No.	CO- Statements On the successful completion of the course, student will be able to	Cognitive Levels (K-Levels)
CO-1	understand the importance of energy to the society	K2
CO-2	acquire knowledge on wind, solar energy and their utilization	K1, K3
CO-3	recall and infer the hydro power and the photovoltaic solar energy	K1, K2
CO-4	acquire knowledge on energy conversion and efficiency of solar cells	K1
CO-5	analysis the solar photovoltaic system and the solar efficiency	K4

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.

Book for Study

Robert Ehrlich, *Renewable energy: A first course*, CRC press, by Taylor & Francis Group, LLC, 2013.

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 For problems: Page no: 369

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credit
V	21UPH53EG01B	GE -1: RENEWABLE ENERGY PHYSICS	4	3

Course Outcomes (COs)	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	2	3	1	3	3	3	2	1	2.4
CO-2	3	2	3	3	1	2	3	2	3	1	2.3
CO-3	3	3	2	3	1	3	2	3	3	1	2.4
CO-4	3	2	3	3	1	3	2	2	3	1	2.3
CO-5	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	Credit
VI	21UPH63CC09	CORE-9: QUANTUM MECHANICS	4	2

CO No.	CO- Statements On the successful completion of the course, student will be able to	Cognitive Levels (K-Levels)
CO-1	describe the Schrodinger theory and the fundamental postulates of quantum mechanics and explain various quantum systems.	K1, K2
CO-2	interpret the wave function statistically and distinguish between the classical and quantum physics.	K2, K3
CO-3	apply the Schrodinger theory to study various one-dimensional quantum systems.	K3, K4
CO-4	apply the separation of variables technique to solve Hydrogen atom problem.	K3, K4
CO-5	analyse and compare the eigenvalues and eigen functions of various quantum systems.	K3, K4

Unit – I: The Time-Dependent Schrodinger Equation (12 Hours)

Schrodinger'**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.

Unit - II: The Time-Independent Schrodinger Equation and Formalism (12 Hours)

The Time - Independent Schrodinger equation - Stationary States - Conditions on the Wavefunction - Postulates of Quantum Mechanics: Wavefunction, operators, expectation value, Eigen values, time development of a quantum system - Simultaneous Measurability of Observables.

Unit - III: Exactly Solvable Quantum System – I (12 Hours)

The Zero Potential - The Step Potential (Energy less than step Height) - The Step Potential (Energy greater than step Height) - The Barrier Potential - Examples of Barrier Penetration by Particles

Unit - IV: Exactly Solvable Quantum System – II (12 Hours)

The Square Well Potential - Analytical Solution for square well potential - The Infinite Square Well Potential - The Simple Harmonic Oscillator Potential - Series Solution for a Simple Harmonic Oscillator Potential

Unit - V: The Hydrogen Atom (12 Hours)

Introduction - Development of the Schrodinger Equation - Separation of the Time - independent Equation - Solution of the Equations - Eigenvalues, Quantum Numbers and Degeneracy - Eigen functions - Probability Densities.

Books for Study

1. G. Aruldhas, *Quantum Mechanics*, 2nd Edition, PHI Learning Pvt. Ltd., 2008
2. R. Eisberg and R. Resnick, *Quantum physics of atoms, molecules, solids, nuclei, and particles*, 2nd Edition, Wiley, 2006.

Unit	Book	Chapters	Sections
I	1	2	2.5 (all sub sections), 2.6(all), 2.7(all)
II	1	2,3	2.8, 2.9, 2.10, 3.5, 3.6
III	2	6	6.1, 6.2, 6.3, EX. 6.1, EX 6.2, 6.4, EX 6.3, 6.5, 6.6
IV	2	6	6.7, AP.H, 6.8, EX. 6.5, EX 6.6, 6.9, AP.I, 6.10
V	2	7	7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7

EX: example, AP: appendix

Books for Reference

1. P.M. Mathews and K. Venkatesan, *A text book of Quantum mechanics*, 2nd Edition, Tata McGraw Hill, 2017.
2. B. Bransden, C. Joachain, *Quantum Mechanics*, 2nd Edition, Pearson, 2004.
3. David J. Griffiths and Darrell F. Schroeter, *Introduction to Quantum mechanics*, 3rd Edition, Cambridge University Press. 2019.

Web Resources *

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)

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credits
VI	21UPH63CC09	CORE-9: QUANTUM MECHANICS	4	2

Course Outcomes (COs)	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	3	2	1	3	3	3	2	2	2.5
CO-2	3	3	3	2	1	3	3	3	2	2	2.5
CO-3	3	3	3	2	1	3	3	3	2	2	2.5
CO-4	3	3	3	2	1	3	3	3	2	2	2.5
CO-5	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	Credit
VI	21UPH63CC10	CORE-10: ATOMIC, NUCLEAR AND PARTICLE PHYSICS	4	2

CO No.	CO- Statements	Cognitive Levels (K-Levels)
	On the successful completion of the course, student will be able to	
CO-1	understand and describe the structure of atom and nucleus using different models.	K1, K2
CO-2	explain the properties of atom under external field, radioactive decay, nuclear reactions, and experimental methods to detect and accelerate particles.	K1, K2
CO-3	interpret the atomic spectra and periodic table based on the atomic models.	K3
CO-4	classify elementary particles based on various physical properties.	K4
CO-5	examine the applications of atomic and nuclear physics.	K4

Unit- I: Atomic Structure **(12 Hours)**

The Nuclear Atom - Rutherford Scattering - Scattering Formula derivation - Electron Orbits - Atomic Spectra - Ritz combination principle - The Bohr Atom - Energy Levels and Spectra- Correspondence Principle - The Sommerfeld Atom - Nuclear Motion - Atomic Excitation.

Unit - II: Electronic Structure of Atoms **(12 Hours)**

Zeeman effect: EM moment - Magnetic energy - Bohr magnetron - Zeeman experiment - Paschen - Back effect - Stark effect - Electron spin - Exclusion Principle - Stern-Gerlach Experiment - The periodic table - Atomic structures - Spin orbit coupling - Total Angular Momentum - LS coupling - X-ray Spectra - Auger effect.

Unit - III: Nuclear Structure **(12 Hours)**

Nuclear composition - Nuclear Properties - Stable Nuclei - Binding Energy - the strong - interaction - Liquid drop model - Shell Model - Meson theory of nuclear forces - Nuclear Matter - two nucleon potential.

Unit - IV: Nuclear Transformations **(12 Hours)**

Radioactive decay - Half life - Radioactive series - Alpha decay: Tunnel theory (alpha decay constant derivation) - Beta decay - Gamma - decay - Cross section - Nuclear reactions - Nuclear fission - Nuclear reactors - Nuclear fusion in stars - Fusion reactors.

Unit - V: Particle Detectors, Particle Accelerators and Elementary Particles **(12 Hours)**

Particle Detectors: Wilson Cloud chamber - ionization chamber - Geiger Muller Counter - solid state detectors.

Particle Accelerators: Cyclotron - Betatron - Synchrotron - electron synchrotron and proton synchrotron.

Elementary Particles: Interactions and particles - Leptons - Hadrons - Elementary Particle Quantum numbers - Quarks - Field Bosons.

Books for Study

1. A. Besier, S. Mahajan and S. R. Choudhury, *Concepts of Modern Physics*, 7th Edition, Mcgraw Hill Education, 2017.
2. H. Kolanoski and N. Wermes, *Particle Detectors*, Oxford University Press, 2020.
3. Irving Kaplan, *Nuclear Physics*, 2nd Edition, Addison-Wesley, 1977.

Unit	Book	Chapters	Sections
I	1	4	4.1, 4.2, 4.3, 4.5, 4.6, 4.7, 4.8, 4.9
II	1	6 7	6.10, 6.11 7.13, 7.14, 7.1, 7.2, 7.5, 7.6, 7.7, 7.8, 7.9, 7.10
III	1	11	11.1, 11.2, 11.3, 11.4, 11.5, 11.6, 11.7, 11.8, 11.9
IV	1	12	12.1, 12.2, 12.3, 12.4, 12.5, 12.6, 12.7, 12.8, 12.9, 12.10, 12.11, 12.12
V	2 3 1	6, 7, 8 21 13	6.1, 7.2.1, 7.2.2, 7.6.2, 8.1 21.3, 21.4, 21.5, 21.6 13.1, 13.2, 13.3, 13.4, 13.5, 13.6

Books for Reference

1. R. Eisberg and R. Resnick, *Quantum physics of atoms, molecules, solids, nuclei, and particles*, 2nd Edition, Wiley, 2006.
2. R. A. Serway, C. J. Moses and C. A. Moyer, *Modern Physics*, 3rd Edition, Brooks/Cole Publications 2004.
3. P.M. Mathews and K. Venkatesan, *A text book of Quantum mechanics*, 2nd Edition, Tata McGraw Hill, 2017.
4. H. Semat and J. R. Albright, *Introduction to Atomic and Nuclear Physics*, 5th Edition, Chapman and Hall, 1985.

Web Resources*

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)

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credit
VI	21UPH63CC10	CORE-10: ATOMIC, NUCLEAR AND PARTICLE PHYSICS	4	2

Course Outcomes (COs)	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	3	2	2	3	2	2	2	2	2.4
CO-2	3	3	3	2	2	3	2	2	2	2	2.4
CO-3	3	3	3	2	2	3	3	2	2	2	2.4
CO-4	3	3	3	2	2	3	3	2	2	2	2.4
CO-5	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	Credit
VI	21UPH63CP04	PHYSICS PRACTICAL – IV	6	4

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 – Basics
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	Credit
VI	21UPH63ES03A	DSE – 3: STATISTICAL MECHANICS	5	3

CO No.	CO- Statements	Cognitive Levels (K-Levels)
	On the successful completion of the course, student will be able to	
CO-1	acquire the knowledge about macroscopic and microscopic systems with a description of temperature, entropy and free energy and understand their probabilities	K1, K2
CO-2	obtain the knowledge of classical statistics and understand the applications of Maxwell-Boltzmann distributions	K1, K2
CO-3	acquire knowledge about the quantum statistics and understand its importance in macroscopic systems	K1, K2
CO-4	analysis the strength and limitations of the different microscopic models and be able to compare different microscopic models	K4
CO-5	apply the statistical laws to understand gases and solids	K3

Unit - I: Statistical Thermodynamics (15 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 (15 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, Saha's Ionisation formula.

Unit - III: Quantum Statistics (15 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, radiation from other objects, Sun and Earth - Debye theory of solids

Unit - IV: Bose-Einstein Statistics (15 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 (15 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, White Dwarf Stars, Chandrasekhar mass limit.

Books for Study

1. S C Garg, R. K. Bansal, C. K. Ghosh, *Thermal Physics: with Kinetic Theory, Thermodynamics and Statistical Mechanics*, 2nd edition, McGraw Hill Education India, 2013.
2. Daniel V. Schroeder, *An introduction to thermal physics*, 1st edition, Pearson Education India, 2014.

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. R.K. Pathria, Butterworth Heinemann, *Statistical Mechanics*, 2nd Edition, Oxford University Press, 1996.
2. Berkeley Physics Course, F. Reif, *Statistical Physics*, Tata McGraw-Hill, 2008.
3. F. W. Sears and G. L. Salinger, *Thermodynamics, Kinetic Theory, and Statistical Thermodynamics*, 3rd edition, Addison-Wesley Publishing Company, 1982.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credit
VI	21UPH63ES03A	DSE – 3: STATISTICAL MECHANICS	5	3

Course Outcomes (COs)	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	2	3	2	3	3	2	2	1	2.3
CO-2	2	3	2	3	2	3	3	2	3	1	2.4
CO-3	3	2	2	3	2	3	3	3	2	1	2.4
CO-4	3	3	2	3	2	2	2	3	2	1	2.2
CO-5	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	Credit
VI	21UPH63ES03B	DSE – 3: SPECTROSCOPY AND LASER	5	3

CO No.	CO- Statements	Cognitive Levels (K-Levels)
	On the successful completion of the course, student will be able to	
CO-1	know the basic concepts in different spectroscopic methods and fundamental of laser.	K1
CO-2	understand the different physical phenomena in various spectroscopic techniques.	K2
CO-3	explain the theory, principles, different types and applications of laser.	K2
CO-4	describe the various experimental techniques in different spectroscopies.	K3
CO-5	differentiate spectroscopy methods based on interaction of light with matter and classify lasers and its application.	K4

Unit - I: Microwave and Infrared Spectroscopy (15 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 (15 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 (15 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 (15 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 (15 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.

Books for Study

1. G. Aruldhas, *Molecular Structure and Spectroscopy*, 2nd ed., PHI learning, 2008.
2. M.N. Avadhanulu and P.S. Memne, *An introduction to Lasers*, S. Chand 2012.

Unit	Book	Chapters	Sections
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. Atomic and Molecular Spectroscopy, S. Svanberg, Springer-Verlag, 2004.
2. Basic Atomic and Molecular Spectroscopy, J M. Hollas, Royal Society of Chemistry, 2002.
3. Fundamentals of Molecular Spectroscopy, C. Banwell, 4th ed. McGraw Hill Education, 2017.
4. Lasers, K. Thyagarajan and Ajoy Ghatak, 2nd ed., Springer, 2010.

Web Resources*

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)

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course Code			Title of the Course				Hours		Credit
VI	21UPH63ES03B			DSE – 3: SPECTROSCOPY AND LASER				5		3
Course Outcomes (COs)	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	2	2	2	3	2	2	1	2	2.2
CO-2	3	3	3	2	2	3	2	2	1	1	2.2
CO-3	3	3	2	2	2	3	3	2	1	1	2.2
CO-4	3	3	3	2	2	3	3	2	1	1	2.3
CO-5	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	Credit
VI	21UPH63ES04A	DSE - 4: EMBDED SYSTEM AND MICROCONTROLLER	5	3

CO No.	CO- Statements	Cognitive Levels (K-Levels)
	On the successful completion of the course, student will be able to	
CO-1	acquire the knowledge on fundamentals of c-programming and explain C programs for embedded systems and microcontrollers	K1, K2
CO-2	predict the automatic solutions and complete the embedded system for day-to-day activities.	K2, K3
CO-3	identify the suitable microcontroller along with appropriate interfacing circuits and use the same for an application with C program.	K3, K4
CO-4	assess the global need of the embedded system and recommend solutions by inventing the circuits.	K5
CO-5	find the features of microcontrollers, design and construct the embedded system for social needs.	K1, K6

Unit - I: C Language **(15 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 **(15 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 - System Clock and Clock Options - Low Power Crystal Oscillator - Calibrated Internal RC Oscillator - Power Management and Sleep Modes.

Unit - III: Arduino IDE and AVR Programming **(15 Hours)**

Embedded System - Boot Loader - Arduino IDE - Installing IDE - Description - Commands - LOAD - interfacing and programming LED, LCD, Keypad and Relay.

Unit - IV: AVR Peripheral Programming **(15 Hours)**

Analog Comparator - ADC - Interrupts - Timers - Volt, Current, Resistance, Capacitance and conductivity measurement - light intensity measurement - interrupt program - delay using timer - counter using timer/counter

Unit - V: Communication Protocols **(15 Hours)**

SPI - Serial Peripheral Interface - USART - 2-wire Serial Interface (I2C) - Simple programs: serial monitor - I2C LCD.

Books for Study

1. Easy Programming Publisher, *The C Programming Language*, 2016.
2. ATmega328P DATASHEET, 2019.
3. 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

Book for Reference

1. Muhammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, "The AVR Microcontroller and Embedded System", Pearson Prentice Hall, 2012.

Web Resources*

1. https://www.arduino.cc/
2. https://www.totalphase.com/blog/2020/12/differences-between-embedded-system-vs-microcontroller/
3. https://www.tutorialspoint.com/embedded_systems/es_microcontroller.htm

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

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credit
VI	21UPH63ES04A	DSE - 4: EMBDED SYSTEM AND MICROCONTROLLER	5	3

Course Outcomes (COs)	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	3	2	2	3	3	3	3	2	2.7
CO-2	3	3	3	2	2	3	3	3	3	2	2.7
CO-3	3	3	3	2	2	3	3	3	3	2	2.7
CO-4	3	3	2	2	2	3	3	3	3	2	2.6
CO-5	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	Credit
VI	21UPH63ES04B	DSE - 4B: SENSOR, TRANSDUCERS AND IoT	5	3

CO No.	CO- Statements	Cognitive Levels (K-Levels)
	On the successful completion of the course, student will be able to	
CO-1	describe and discuss the analog and digital sensors, its applications, IOT Architecture and Platforms.	K1, K2
CO-2	classify the sensors and transducers and identify its applications.	K3, K4
CO-3	list various sensors and use them to identify different physical parameters.	K1, K3, K4
CO-4	assess the global need of the IoT system and recommend solutions by designing the circuits.	K5
CO-5	find the suitable sensors and transducers, design and construct the IoT projects.	K6

Unit - I: Analog and Digital Sensor (15 Hours)

Resistive - Capacitive - Voltage-Generating - Hall effect Sensor - LVDT - Load cell - Ionizing Radiation Sensors - Electrochemical Sensors - Mechano-Optical Sensors - Temperature sensor - DS1820.

Unit - II: Strain, Pressure, Position, Distance and Motion Transducers (15 Hours)

Accelerometer - Magnetometer - Gyro Sensor - Pressure Sensor - Rotation - Smart sensor - Sound - Gravitational Sensing - Sensor Fusion.

Unit - III: Sensor, Transducer Application Circuit Design (15 Hours)

Digital filters - Volt, Current, Resistance, Capacitance, Inductance, magnetic Field, Distance, Position, Temperature meters.

Unit - IV: IoT Architecture and Platforms (15 Hours)

Internet of Things - Importance - Architecture - IoT data - MQTT protocols - Industrial IoT - Security - Applications.

Unit - V: IoT Weather Forecasting Station - Case Study (15 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 rain water level - Raindrop sensor for detecting rainfall or snow fall - System Architecture - Analysis.

Books for Study

1. M.J. Usher and D.A. Keating, *Sensors and Transducers*, Second Edition, Palgrave Macmillan; 1996.
2. Dimitrios Serpanos, Marilyn Wolf, *Internet of Things (IoT) Systems*, Springer International Publishing, First Edition, 2018.
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. Ian Sinclair, *Sensors and Transducers*, Third Edition, Newnes, 2000.
2. IFSA Publishing, *Sensors & Transducer*, S.L., Barcelona Toronto, 2000.

WEB RESOURCES*

1. https://www.electronics-tutorials.ws/io/io_1.html
2. https://www.variohm.com/news-media/technical-blog-archive/difference-between-a-sensor-and-a-transducer
3. https://internetofthingsagenda.techtarget.com/definition/Internet-of-Things-IoT

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

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credit
VI	21UPH63ES04B	DSE - 4: SENSOR, TRANSDUCERS AND IoT	5	3

Course Outcomes (COs)	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	3	2	2	3	3	2	2	2	2.5
CO-2	3	3	2	2	2	3	3	3	3	2	2.6
CO-3	3	3	2	2	2	3	3	3	2	2	2.5
CO-4	3	3	2	2	2	3	3	3	2	2	2.5
CO-5	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	Credit
VI	21UPH63CE01	COMPREHENSIVE EXAM	-	2

Unit - I: Mechanics and Properties of Matter

Kinematics and Dynamics - Work and Energy - Conservation of Linear and Angular momentum - Dynamics of rigid bodies - Inverse square law force - Elasticity - Viscosity - Surface tension – Diffusion - osmosis and low pressure.

Unit - II: Mathematical Physics

Matrices - Vector calculus - Differential equation - Multiple integrals - Fourier series - Errors, approximations and extremum of functions - Special functions - Laplace transforms and its applications - Complex analysis - Numerical methods.

Unit - III: Electromagnetism and Thermal Physics

Electrostatics - Electric field in matter - Magnetostatics - Magnetostatic field in matter - Electrodynamics - Laws of thermodynamics - Thermodynamic potential and phase transitions - Thermal properties of solids - Thermodynamical behavior of real gas - Advanced thermodynamics.

Unit - IV: Concepts of Modern Physics and Quantum Mechanics

Special theory of relativity - Particle properties of waves - Wave properties of particles - Cosmology and nano science - Time dependent Schrodinger equation - Time independent Schrodinger equation and formalism - Exactly solvable quantum system - The hydrogen atom.

Unit - V: Optics, Atomic Nuclear and Particle Physics

Geometrical optics - The matrix method - Wave optics - Diffraction and Polarization - Optical fiber - Atomic structure - Electronic structure of atoms - Nuclear structure - Nuclear transformations - Detectors, accelerators and elementary particles.

Book for Study

Text by the Department

Books for Reference

1. Satyendra Nath Maithi, Debi Prasath Raychaudhuri - *Classical mechanics and general properties of Matter* - New Age International Publishers, 2008.
2. Kleppner and Kolenkow, *An Introduction to Mechanics*, 1ST Edition, McGraw Hill Education, 2017.
3. Erwin Kreyszig, *Advanced Engineering Mathematics*, 9th edition, Wiley; by 2010.

Semester	Course Code	Title of the Course	Hours	Credit
VI	21UPH64SE04A	SEC - 4 (WS): RADIATION PHYSICS AND SAFETY	2	1

CO No.	CO- Statements	Cognitive Levels (K-Levels)
	On the successful completion of the course, student will be able to	
CO-1	list and relate fundamental concepts in Radiation Physics and apply them to overcome radiation hazards.	K1
CO-2	compare radiation detection and measuring devices.	K2
CO-3	illustrate various nuclear radiations produced by various reactors and other sources and categorize them based on principles	K3, K4
CO-4	analyse the importance of radiation safety management, biological effects and ICRP principles.	K4
CO-5	adapt better solutions for dosimetry standards in a human society.	K3

Unit - I: Nuclear Physics and Accelerators (6 Hours)

X-rays - characteristics and production - concept of Bremsstrahlung and Auger electron, Radioactivity - General Properties of radioactive rays (alpha, beta and gamma) - Laws of Radioactivity - Internal Conversion - Orbiting electron capture - Isomerism - Artificial Radioactivity.

Elementary ideas on fission and reactors - Particle Accelerators for industrial - medical and research application - Details of Accelerator facilities in India.

Unit - II: Interaction of Radiation with Matter (6 Hours)

Interaction of Photons with matter: Mechanisms - Photo electric effect - Compton Effect - pair production - Photo-nuclear reactions - attenuation coefficients.

Interaction of electron particles: Energy Loss Mechanisms - Collision Stopping Power - Radiation Stopping power and yield - Range - Continuous slowing-down time - Example of Electrons tracks in Water

Unit - III: Radiation Detection and Measurement (6 Hours)

Principles of Radiation detection - Gas Filled radiation detectors - Scintillation (Inorganic and Organic Scintillators) and Semiconducting radiation measuring devices - Slow Neutron detection - Other types: Cerenkov Detectors, Optically Stimulated Luminescence

Unit - IV: Radiation Dosimetry and Standards (6 Hours)

Free-Air Ionization Chamber - The Air-Wall Chamber - Measurement of Absorbed Dose - Measurement of X - and Gamma - Ray Dose - Neutron Dosimetry - Dose Measurements for Charged - Particle Beams - Linear Energy Transfer: Determination - Dose Calculations - Alpha and Low energy Beta Emitters Distributed in Tissue Charged - Particle Beams - Point Source of Gamma Rays.

Unit -V: Radiation Effects And Safety: Justification, Optimizationand Dose Limits(6 Hours)

External Dosimetry: Distance, time and Shielding - X-ray and Neutron Shielding.

Internal Dosimetry: Biological Effects - Radiation Syndrome - Somatic effects - Dose-response relationship and factors affecting it - references values of ICRP Publication 89 - ICRP 30 Model.

General Radiation injuries - Radioactive Waste Classification and Disposal in medical - industrial - agricultural and research labs - Guide on Medical Management of Persons Exposed in Radiation Accidents.

Book for Study

Text by the Department

Books for Reference

1. W.J. Meredith and J.B. Massey (Auth.), *Fundamental Physics of Radiology*, Butterworth-Heinemann Ltd, 1977.
2. *W.E. Burcham, M. Jobes, Nuclear and Particle Physics, John Wiley & Sons Inc, 1995.*
3. *James E. Turner, Atoms, Radiation, and Radiation Protection, Third Edition, Wiley-VCH Verlag GmbH & Co. KGaA, 2007.*
4. *AERB reports on* Guide on Medical Management of Persons Exposed in Radiation Accidents, 1989.

Web References*

1. https://www.healthcareers.nhs.uk/
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6580815/
3. https://www.ncnr.nist.gov/summerschool/ss03/lectures/health_physics.pdf

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

Unit	Book	Chapters	Sections
I	1	1,2,5	1.5.3, 2.4, 2.5, 5.1.1, 5.2.1, 5.2.4, 5.3.1
	2	1,2,3,4	1.1, 1.2, 2.11, 3.6, 4.3, 4.5
II	2	6,8	8.1, 8.2, 8.4, 8.5, 8.6, 8.7; 6.1-6.7
III	2	10	10.1, 10.3, 10.2*, 10.6*, 10.7*
IV	2	12	12.1-12.5*, 12.6-12.10
V	2	13,15,16	15.1, 15.3, 15.5*; 13.6, 13.9, 13.13, 13.14, 16.1, 16.6
	3		General radiation injuries and safety*

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credit
VI	21UPH64SE04A	SEC - 4 (WS): RADIATION PHYSICS AND SAFETY	2	1

Course Outcomes (COs)	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	2	2	2	3	3	2	3	2	2.4
CO-2	3	1	3	1	2	3	2	3	3	2	2.3
CO-3	3	2	2	2	2	3	2	3	2	2	2.3
CO-4	3	2	3	2	2	3	3	2	2	2	2.4
CO-5	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	Credit
VI	21UPH64SE04B	SEC - 4 (WS): NON-DESTRUCTIVE TESTING	2	1

CO No.	CO- Statements	Cognitive Levels (K-Levels)
	On the successful completion of the course, student will be able to	
CO-1	describe and discuss different NDT techniques as per requirements.	K1, K2
CO-2	use modern tools to examine flaw in the materials.	K3
CO-3	solve various manufacturing defects by comparing thew results of tests.	K3, K4
CO-4	apply accurate testing method for materials using NDT.	K3
CO-5	examine and explain environment friendly solutions to achieve organizational sustainability with ethical values.	K3, K4

Unit - I: Visual Inspection and Acoustic Emission Testing (6 Hours)

Fundamentals - Vision and light - Ambient Conditions - Test object characteristics - EquipmentAccessories - 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 (6 Hours)

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 - Equipment and Materials - Interpretation and Evaluation of Signals - Procedures.

Unit - III: Leak Testing and Liquid Penetrant Testing (6 Hours)

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

units - Methods of measurement - Lighting for liquid penetrant testing - Materials for liquid penetrant testing - Testing and maintenance of materials - Interpretation - Factor affecting indications - Indications from discontinuities - Relevant and Non-relevant indications - Liquid penetrant testing procedures - specifications - Safety and Health.

Unit - IV: Magnetic Flux Leakage and Magnetic Particle Testing (6 Hours)

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 - Standardization - Interpretation - 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 (6 Hours)

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 - Evaluation of weldments - Evaluation of bonded structures - Variables affecting test results - Evaluation - Procedures - Specific Applications - Codes - Safety and Health.

Book for Study

Text by the Department.

Book for Reference

1. Dr. Baldev Raj, Jayakumar and M. Thavasimuthu, “Practical Non- Destructive testing”, Narosa Publications, New Delhi, 2009.

Web Resources*

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)

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course Code			Title of the Course				Hours		Credit
VI	21UPH64SE04B			SEC - 4 (WS): NON-DESTRUCTIVE TESTING				2		1
Course Outcomes (COs)	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	2	2	3	3	3	2	2	2	2.4
CO-2	3	2	3	2	3	3	3	2	2	2	2.5
CO-3	3	3	2	2	2	3	3	2	2	2	2.4
CO-4	3	2	3	2	2	3	3	2	2	3	2.5
CO-5	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	Credit
VI	21UPH63EG02A	GE – 2: LASER TECHNOLOGY AND ITS APPLICATION	4	3

CO No.	CO- Statements	Cognitive Levels (K-Levels)
	On the successful completion of the course, student will be able to	
CO-1	describe the fundamentals of light and their properties, Explain the basic principle of Laser emission	K1, K2
CO-2	illustrate and explain the principles and design considerations of various lasers, Categorize modes of their operation.	K2, K4
CO-3	describe the applications of laser in industries, Execute the obtained knowledge in various technology of applications of Lasers.	K1, K3
CO-4	compare the different types of lasers, Check the work ethics and work place safety.	K4
CO-5	implement the significance of modern lasers in communication networking system. Develop the knowledge in production of laser of various types.	K3

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 - Semi conductor 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 - Optic 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 Medicine and Surgery - LASER in ophthalmology - LASER endoscopy - photocoagulation - LASER safety and hazard.

Books for Study

1. Avadhanulu M.N. Hemne P.S, *An introduction to LASERS theory and applications*. (Second Edition). S. Chand & Company, New Delhi, 2012.
2. N. Subrahmanyam Brijlal, M. N. Avadhanulu, *A Textbook of Optics*, 2008.

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. *LASER: Principles, Types and Applications*.2004.
2. S. Nagabhushana, N. Sathyanarayana. *Lasers and optical instrumentation*, Reprint. 2013.

Web Resources*

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)

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course Code	Title of the Course	Hours	Credit
VI	21UPH63EG02A	GE – 2: LASER TECHNOLOGY AND ITS APPLICATION	4	3

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

Semester	Course Code	Title of the Course	Hours	Credit
VI	21UPH63EG02B	GE - 2: PHYSICS OF EARTH	4	3

CO No.	CO- Statements	Cognitive Levels (K-Levels)
	On the successful completion of the course, student will be able to	
CO-1	envisage and frame the whole earth structure with its subsystem's atmosphere, biosphere, hydrosphere, lithosphere, mantle and core.	K1
CO-2	explore their physical characteristics and geological functions of macro earth in scientific method.	K4
CO-3	estimate the earth's age and temperature by applying the laws of thermodynamics	K2, K3
CO-4	understand the gravity, electric and magnetic fields of the earth	K2
CO-5	predict the events like earthquake, landslide, Valona through geophysical techniques and to step to save life.	K2

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: Geothermics 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 green house effect: A Planet without Greenhouse Gases - Earth's Greenhouse Atmosphere - Geologic cycling of water - Hydrology of ground water - Hydrology and climate.

Books for Study

1. J.P. Grotzinger, *Understanding Earth*, 7th Edition, W.H. Freeman and Company, 2014.
2. William Lowrie, *Fundamentals of Geophysics*, 2nd Edition, Cambridge University Press, 2007.
3. J.S. Monroe, *Physical Geology*, 6th Edition, Thomson Corporation, 2007.

Books for References

1. F.D. Stacey, P.M. Davis, *Physics of the Earth*, 4th Edition, Cambridge University Press, 2008.
2. A.E. Mussett, *Looking into the Earth*, 1st Edition (2000), Cambridge University Press, Reprint 2009.

Unit	Book	Chapters	Sections
I	1	1, 2, 13, 14	Page No. 4-17, 28-38, 356-361, 383-390.
II	1 2 3	14 4 5	Page No. 390-394. 4.1.1, 4.1.2 5.1, 5.2, 5.3
III	1 2	1 4,5	Page No. 17-18. 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	Page No. 407-414, 469-488.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester	Course Code			Title of the Course					Hours	Credit
VI	21UPH63EG02B			GE - 2: PHYSICS OF EARTH					4	3
Course Outcomes (COs)	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	3	2	2	2	2	2	2	3	2.3
CO-2	2	2	1	2	3	3	2	3	2	2	2.2
CO-3	3	3	3	2	3	2	2	2	2	2	2.4
CO-4	3	2	2	2	3	2	2	3	2	2	2.3
CO-5	2	3	2	2	2	3	2	2	3	2	2.3
Mean Overall Score											2.3 (High)