GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT(GITAM)
(Deemed to be University)
VISAKHAPATNAM * HYDERABAD * BENGALURU

Accredited by NAAC with A^{++} Grade

CURRICULUM AND SYLLABUS

OF

UPHYS05 B.Sc. Physics

w.e.f. 2021-22 admitted batch

(Updated up to May 2024)

Academic Regulations

Applicable for the Undergraduate Programme in the Schools of Technology, Humanities & Social Sciences, Business and Sciences

https://www.gitam.edu/academic-regulations

VISION AND MISSION OF THE UNIVERSITY

VISION

To become a global leader in higher education.

MISSION

To impart futuristic and comprehensive education of global standards with a high sense of discipline and social relevance in a serene and invigorating environment.

UPHYS05 B.Sc. Physics

VISION AND MISSION OF THE SCHOOL

VISION

To nurture outstanding science education and to build a vibrant, world class research & innovation ecosystem.

MISSION

1. To provide a flexible and adaptive curriculum that emphasizes experiential learning to allow students to realize their full potential.

2. Develop high impact research knowledge and solutions to improve communities in which we live.

3. To promote a culture of healthy curiosity, enterprising mindset, and keen desire to contribute to society.

4. To inculcate empathy, integrity, trust with a strong commitment towards society and environment among the GITAM fraternity.

UPHYS05 B.Sc. Physics

(w.e.f. academic year 2021-22 admitted batch)

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1 Students pursuing program will be pioneered in their chosen area

PEO 2 Inculcate profession with social responsibility and contribute to academic community with ethics

PEO 3 Ability to develop interdisciplinary research work

PEO 4 Work in the infrastructure development projects

PEO 5 Pursue higher studies and secure academic excellence in competitive exams

PEO 6 Understand various theories how they are contributed to field of science

PEO 7 Acquire knowledge with understanding, demonstration and solving in the problem

PEO 8 Independent thinking towards scientific contribution conducting or participating in expos/seminars/workshops

Mapping of the Mission of the School with the PEOs

	PEO1	PEO2	PEO3	PEO4	PEO5	PEO6	PEO7	PEO8
M1	M	L	M	M	M	H	H	M
M2	H	L	H	L	H	H	M	L
M3	L	H	L	L	M	L	L	H
M4	M	L	L	H	M	L	L	L

PROGRAMME OUTCOMES(POs) AND PROGRAMME SPECIFIC OUTCOMES(PSOs):

At the end of the Programme the students would be able to:

PO1	Problem analysis: The ability to solve new and unfamiliar problems using critical thinking and effective problem-solving techniques in all of the fundamental fields of physics.
PO2	Professionals and society: analyse socioeconomic, health, safety, and cultural aspects relating to scientific processes using contextual knowledge.
PO3	Environment and sustainability: apply and show fundamental physics in an environmental setting for long-term sustainability.
PO4	Ethics: The graduate should be able to think and evaluate logically, identify ethical concerns relevant to their profession, and take objective, impartial, and honest acts in all parts of their work.
PO5	Individual or teamwork: Capable of working efficiently in a variety of teams in academics, research, and any activity
PO6	Communication: Competence to communicate complicated technical information concisely in writing and orally, as well as the ability to express complex and technical ideas in simple language for better comprehension
PO7	Life-long Learning: Capable of self-paced and self-directed independent and lifelong learning for personal growth, knowledge/skill development, and reskilling in all areas of Physics.
PSO1	Understand the core concept of Physics subjects and excel in Experimental and Theoretical Physics.
PSO2	Acquire analytical and logical skill for higher Education
PSO3	Students will develop attitude of writing scientific articles on their contributing to academic community
PSO4	Trained to take up jobs in allied fields and confident to take up competitive exams

Curriculum Structure

(Choice Based Credit System)

UNIVERSITY CORE (UC)								
Course code	**Level**	**Course title**	**L**	**T**	**P**	**S**	**J**	**C**
CSEN1001	1	IT Productivity Tools^	0	0	2	0	0	1*
CLAD1001	1	Emotional Intelligence & Reasoning Skills (Soft Skills 1)	0	0	2	0	0	1
CLAD1011	1	Leadership Skills & Quantitative Aptitude (Soft Skills 2)	0	0	2	0	0	1
CLAD1021	1	Verbal Ability & Quantitative Ability (Soft Skills 3)	0	0	2	0	0	1
CLAD1031	1	Practicing Verbal Ability & Quantitative Aptitude (Soft Skills 4)	0	0	2	0	0	1
CLAD20XX	2	Soft skills 5A/5B/5C	0	0	2	0	0	1
CLAD20XX	2	Soft skills 6A/6B/6C	0	0	2	0	0	1
DOSP10XX	1	Sports 1#	0	0	0	2	0	2*
DOSL10XX	1	Club Activity#	0	0	0	2	0	2*
DOSL10XX	1	Community Service#	0	0	0	0	2	2*
ENVS1001	1	Environmental Studies^	3	0	0	0	0	3*
FINA3001	3	Personal Financial Planning#	0	0	2	0	0	1*
LANG1001	1	Communication Skills in English - Beginners	0	0	4	0	0	2*
LANG1011	1	Communication Skills in English	0	0	4	0	0	2
LANG1021	1	Advanced Communication Skills in English	0	0	4	0	0	2
MFST1001	1	Health and Wellbeing#	0	0	2	0	0	1*
POLS1001	1	Indian Constitution and History	2	0	0	0	0	2*
PHPY1001	1	Gandhi for the 21st Century	2	0	0	0	0	2*
VEDC1001	1	Venture Development	0	0	0	2	0	2

* Pass/Fail courses
# Opt any three courses among the five
^ Online/Swayam/NPTEL Courses

Soft skills courses 5 and 6								
Course code	**Level**	**Course title**	**L**	**T**	**P**	**S**	**J**	**C**
CLAD2001	2	Preparation for Campus Placement-1 (Soft skills 5A)	0	0	2	0	0	1
CLAD2011	2	Preparation for Higher Education (GRE/ GMAT)-1 (Soft skills 5B)	0	0	2	0	0	1
CLAD2021	2	Preparation for CAT/ MAT - 1 (Soft skills 5C)	0	0	2	0	0	1
CLAD2031	2	Preparation for Campus Placement-2 (Soft skills 6A)	0	0	2	0	0	1
CLAD2041	2	Preparation for Higher Education (GRE/ GMAT)-2 (Soft skills 6B)	0	0	2	0	0	1
CLAD2051	2	Preparation for CAT/ MAT - 2 (Soft skills 6C)	0	0	2	0	0	1

Sports Courses								
Course code	**Level**	**Course title**	**L**	**T**	**P**	**S**	**J**	**C**
DOSP1001	1	Badminton	0	0	0	2	0	2
DOSP1011	1	Chess	0	0	0	2	0	2
DOSP1021	1	Carrom	0	0	0	2	0	2
DOSP1031	1	Football	0	0	0	2	0	2
DOSP1041	1	Volleyball	0	0	0	2	0	2
DOSP1051	1	Kabaddi	0	0	0	2	0	2
DOSP1061	1	Kho KHO	0	0	0	2	0	2
DOSP1071	1	Table Tennis	0	0	0	2	0	2
DOSP1081	1	Handball	0	0	0	2	0	2
DOSP1091	1	Basketball	0	0	0	2	0	2
DOSP1101	1	Tennis	0	0	0	2	0	2
DOSP1111	1	Throwball	0	0	0	2	0	2

Club Activity Courses								
Course code	**Level**	**Course title**	**L**	**T**	**P**	**S**	**J**	**C**
DOSL1001	1	Club Activity (Participant)	0	0	0	2	0	2
DOSL1011	1	Club Activity (Member of the Club)	0	0	0	2	0	2
DOSL1021	1	Club Activity (Leader of the Club)	0	0	0	2	0	2
DOSL1031	1	Club Activity (Competitor)	0	0	0	2	0	2
Community Service courses								
Course code	**Level**	**Course title**	**L**	**T**	**P**	**S**	**J**	**C**
DOSL1041	1	Community Services - Volunteer	0	0	0	0	2	2
DOSL1051	1	Community Services - Mobilizer	0	0	0	0	2	2

Faculty Core								
Course code	**Level**	**Course title**	**L**	**T**	**P**	**S**	**J**	**C**
MATH1151	1	Differential Calculus	3	0	0	0	0	3
CHEM1011	1	Chemistry I	3	0	0	0	0	3
CHEM1041	1	Chemistry Lab I	0	0	2	0	0	1
MATH1161	1	Differential Calculus Lab	0	0	2	0	0	1
PHYS1111	1	Mechanics	3	0	0	0	0	3
PHYS1121	1	Mechanics Lab	0	0	2	0	0	1
PHYS1131	1	Basic Circuit Theory	3	0	0	0	0	3
PHYS1141	1	Basic Circuit Theory Lab	0	0	2	0	0	1
PHYS1231	1	Basic Instrumentation Skills	2	0	0	0	0	2

Program Core courses for B.Sc. Physics								
Course code	**Level**	**Course Title**	**L**	**T**	**P**	**J**	**S**	**C**
PHYS1151	1	Waves and Optics	3	0	0	0	0	3
PHYS1171	1	Thermal Physics and Statistical Mechanics	3	0	0	0	0	3
PHYS1161	1	Waves and Optics Lab	0	0	2	0	0	1
PHYS1181	1	Thermal Physics and Statistical Mechanics Lab	0	0	2	0	0	1
PHYS2001	2	Electricity and Magnetism	3	0	0	0	0	3
PHYS2041	2	Elementary Mathematical methods of Physics	3	0	0	0	0	3
PHYS3001	2	Mechanics of System of Particles	3	0	0	0	0	3
PHYS2011	2	Electricity and Magnetism Lab	0	0	2	0	0	1
PHYS2051	2	Elementary Mathematical methods of Physics Lab	0	0	2	0	0	1
PHYS3011	2	Mechanics of System of Particles Lab	0	0	2	0	0	1
PHYS2021	3	Elements of Modern Physics	3	0	0	0	0	3
PHYS3021	3	Introduction to Electromagnetic Theory	3	0	0	0	0	3
PHYS3041	3	Introduction to Quantum Mechanics	3	0	0	0	0	3
PHYS2031	3	Modern Physics Lab	0	0	2	0	0	1
PHYS3031	3	Electromagnetic Theory Lab/ Tutorial	0	0	2	0	0	1
PHYS3051	3	Quantum Mechanics Lab/ Tutorial	0	0	2	0	0	1

Program Elective courses for B.Sc. Physics								
Course code	**Level**	**Course Title**	**L**	**T**	**P**	**J**	**S**	**C**
PHYS2131	2	Nuclear and Particle Physics	3	0	0	0	0	3
PHYS2151	2	Nuclear Physics and Solid-State Physics Lab	0	0	2	0	0	1

PHYS2201	2	Computational methods in Physics	3	0	0	0	0	3
PHYS2211	2	Computational methods in Physics Lab	0	0	2	0	0	1
PHYS3121	2	Astronomy and Astro Physics	3	0	0	0	0	3
PHYS2221	2	Mathematical Method and analysis with Simulation	3	0	0	0	0	3
PHYS3141	2	Environmental Physics	3	0	0	0	0	3
PHYS2241	2	Principles of Electrical Circuits, Machines and Transmission	3	0	0	0	0	3
PHYS2011	2	Electricity and Magnetism Lab	0	0	2	0	0	1
PHYS3171	3	Bio sensors	3	0	0	0	0	3
PHYS2121	3	Solid State Physics	3	0	0	0	0	3
PHYS2141	3	Physics of Nano Materials	3	0	0	0	0	3
PHYS3181	3	Materials Science	3	0	0	0	0	3
PHYS3131	3	Essentials of Biophysics	3	0	0	0	0	3
PHYS3451	3	Basics of Quantum Computing	3	0	0	0	0	3
**Students can choose any 5 courses from the program elective and should acquire a minimum of 16 credits.*								
**If students opt from PHYS2161 or xxxxx must choose the corresponding lab course also*								

Minor courses in Physics

Course code	Level	Course Title	L	T	P	J	S	C
PHYS1171	1	Thermal Physics and Statistical Mechanics	3	0	0	0	0	3
PHYS1181	1	Thermal Physics and Statistical Mechanics Lab	0	0	2	0	0	1
PHYS1151	2	Waves and Optics	3	0	0	0	0	3
PHYS3001	2	Mechanics of System of Particles	3	0	0	0	0	3
PHYS2001	2	Electricity and Magnetism	3	0	0	0	0	3
PHYS2021	2	Elements of Modern Physics	3	0	0	0	0	3
PHYS2031	2	Modern Physics Lab	0	0	2	0	0	1
PHYS2041	2	Elementary Mathematical methods of Physics	3	0	0	0	0	3
PHYS2051	2	Elementary Mathematical methods of Physics Lab	0	0	2	0	0	1
PHYS3041	3	Introduction to Quantum Mechanics	3	0	0	0	0	3
* Eligibility: This minor course is offered to the students of B.Sc. Electronics/Mathematics/Chemistry/Statistics/Data Science								

Eligible MINOR courses to be offered to the students of B.Sc. Physics Program		
Stream	**Major course**	**Minor course (Select one)**
Physical Science	Physics	Electronics
		Mathematics
		Statistics
		Chemistry
		Data Science

Students pursuing 4th year of the B.Sc. Physics programme need to choose either Honours or Honours with Research courses from the following tables respectively.

Honours Courses

Minimum number of credits to be earned is 40, out of which 8 credits must be earned through Minor Enhancement courses.

Minor Enhancement course to be chosen in the specialization the student has studied the Minor.

Course code	Level	Course Title	L	T	P	J	S	C
PHYS4061	400	Plasma Physics	4	0	0	0	0	4
PHYS4001	400	Condensed Matter Physics	4	0	0	0	0	4
PHYS4021	400	Soft Condensed Matter Physics	4	0	0	0	0	4
PHYS4071	400	Thin Film Technology	4	0	0	0	0	4
PHYS4031	400	Relativistic Physics	4	0	0	0	0	4
PHYS4041	400	Quantum Information and Computation	4	0	0	0	0	4
DIST4555	400	Research Project	0	0	0	16	0	8
		Total						**32**

Honours with Research Courses

Minimum number of credits to be earned is 40 out of which 20 credits must be earned through Research Project / Dissertation and 8 credit must be earned through Minor Enhancement course.

Minor Enhancement course to be chosen in the specialization the student has studied the Minor.

Course code	Level	Course Title	L	T	P	J	S	C
PHYS4061	400	Plasma Physics	4	0	0	0	0	4
PHYS4001	400	Condensed Matter Physics	4	0	0	0	0	4
DIST4666	400	Dissertation -I	0	0	0	16	0	8
PHYS4031	400	Relativistic Physics	4	0	0	0	0	4
DIST4777	400	Dissertation -II	0	0	0	24	0	12
		Total						**32**

Minor Enhancement Courses

Electronics								
Course code	**Level**	**Course Title**	**L**	**T**	**P**	**S**	**J**	**C**
PHYS4161	400	Advanced Embedded systems	4	0	0	0	0	4
PHYS4131	400	Energy storage Devices	4	0	0	0	0	4

Mathematics								
Course code	**Level**	**Course Title**	**L**	**T**	**P**	**S**	**J**	**C**
MATH4521	400	General Operations Research	4	0	0	0	0	4
MATH4421	400	Optimization Techniques and Decision Modelling	4	0	0	0	0	4

Statistics								
Course code	**Level**	**Course Title**	**L**	**T**	**P**	**S**	**J**	**C**
MATH4431	400	Advanced AI Techniques	4	0	0	0	0	4
MATH4451	400	Visual Analytics and Dashboard Design	4	0	0	0	0	4

Chemistry (Opt Any Two Courses)								
Course code	**Level**	**Course Title**	**L**	**T**	**P**	**S**	**J**	**C**
CHEM4001	400	Advanced Inorganic Chemistry-1	3	0	2	0	0	4
CHEM4011	400	Advanced Organic Chemistry -1	3	0	2	0	0	4
CHEM4021	400	Advanced Physical Chemistry -1	3	0	2	0	0	4
CHEM4031	400	Advanced Analytical Chemistry -1	3	0	2	0	0	4
CHEM4041	400	Advanced Inorganic Chemistry-2	3	0	2	0	0	4
CHEM4051	400	Advanced Organic Chemistry-2	3	0	2	0	0	4
CHEM4061	400	Advanced Physical Chemistry-2	3	0	2	0	0	4
CHEM4071	400	Advanced Analytical Chemistry-2	3	0	2	0	0	4
CHEM4081	400	Medicinal Chemistry	3	0	2	0	0	4
CHEM4131	400	Regulatory affairs and Quality assurance	3	1	0	0	0	4

Data Science (Choose Any Set from following Courses)								
Course code	**Level**	**Course Title**	**L**	**T**	**P**	**S**	**J**	**C**
SET A								
CSCI4021	400	Fundamentals of Big Data Analytics	3	0	0	0	0	3
CSCI4031	400	Fundamentals of Big Data Analytics Laboratory	0	0	2	0	0	1
SET B								
CSCI4041	400	Cryptography	3	0	0	0	0	3
CSCI4051	400	Cryptographic Laboratory	0	0	2	0	0	1
		SET C						
CSCI4061	400	Web Analytics	3	0	0	0	0	3
CSCI4071	400	Web Analytics Laboratory	0	0	2	0	0	1
SET D								
CSCI4081	400	Advanced Python Programming	3	0	0	0	0	3
CSCI4091	400	Advanced Python Programming Laboratory	0	0	2	0	0	1

Allocation of credits for 3-year and 4-year B.Sc. Program						
	3-year B.Sc. Program		4-year B.Sc. Program (Honours)		4-year B.Sc. Program (Honours with Research)	
Type of Course	**Credits**	**% Of Program (in credits)**	**Credits**	**% Of Program (in credits)**	**Credits**	**% Of Program (in credits)**
University Core	12	10%	12	7.5%	12	7.5%
Faculty Core	18	15%	26	16.25%	38	23.75%
Major Core	32	26%	56	35%	44	27.50%
Major Electives	16	14%	16	10%	16	10%
Program Minor	24	20%	32	20%	32	20%
Open elective	18	15%	18	11.25%	18	11.25%
Total	120	100%	160	100%	160	100%

Course PO Mapping

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2	PSO3	PSO4
PHYS111	Mechanics	M	H	M	L	M	M	H	M	M	M	M
PHYS1121	Mechanics Lab	M	L	H	L	M	L	H	M	M	L	M
PHYS1131	Basic Circuit Theory	M	H	M	L	M	M	H	M	M	L	M
PHYS1141	Basic Circuit Theory Lab	M	L	H	L	M	L	H	L	M	M	M
PHYS1231	Basic Instrumentation Skills	M	M	L	L	M	L	H	M	M	L	M
PHYS1151	Waves & Optics	H	L	L	L	H	L	M	L	L	M	M
PHYS1171	Thermal Physics and Statistical Mechanics	H	L	M	L	M	M	H	M	M	L	M

PHYS1161	Waves and Optics Lab	M	H	M	L	M	M	H	M	M	L	M
PHYS1181	Thermal and Statistical Mechanics Lab	M	L	H	L	M	L	H	M	M	L	M
PHYS2001	Electricity and Magnetism	H	L	M	L	H	L	L	L	M	L	M
PHYS2011	Electricity and Magnetism Lab	M	H	M	L	M	M	H	M	M	0L	M
PHYS2041	Elementary Mathematical methods of Physics	M	L	H	L	M	L	H	M	M	L	M
PHYS2051	Elementary Mathematical methods of Physics Lab	M	L	H	M	H	M	H	L	L	L	M
PHYS3001	Mechanics of System of Particles	M	L	M	L	L	M	M	M	M	0	M
PHYS3011	Mechanics of System of Particles Lab	M	H	M	L	M	M	H	M	M	L	M
PHYS2021	Modern Ph ysics Lab	M	L	H	L	M	L	H	M	M	H	M
PHYS3021	Introduction to Electromagnetic Theory	M	M	L	L	L	M	M	M	M	L	M
PHYS3031	Electromagnetic Theory Lab	M	M	L	L	L	M	M	M	M	L	M
PHYS3041	Introduction to Quantum Mechanics	M	L	L	L	L	M	M	M	M	L	M
PHYS3051	Introduction to Quantum Mechanics Lab	M	H	L	L	L	M	M	M	M	L	M
PHYS2131	Nuclear and Particle Physics	M	M	M	L	L	M	M	M	M	L	M
PHYS2151	Nuclear and Particle Physics Lab	M	L	L	L	L	M	M	M	M	L	M
PHYS2201	Computational methods in Physics	M	M	H	M	M	H	H	M	H	M	H
PHYS2221	Computational methods in Physics Lab	M	H	L	L	L	M	M	M	M	L	M
PHYS3121	Astronomy and Astro Physics	M	H	H	M	M	H	H	M	H	M	M
PHYS 2221	Mathematical Method and Analysis with Simulation	M	H	M	M	M	H	H	M	H	M	H

PHYS3141	Environmental Physics	M	M	M	M	M	M	M	L	L	L	H
PHYS 3171	Biosensors	M	L	L	L	L	L	M	L	L	L	M
PHYS2121	Solid State Physics	M	M	L	M	L	L	M	L	L	H	L
PHYS2141	Physics of Nano Materials	M	H	M	L	L	L	M	L	L	M	L
PHYS 3181	Materials Science	M	H	L	L	L	L	M	L	L	M	L
PHYS3131	Essentials of Biophysics	M	L	L	M	L	L	M	L	L	H	L

Syllabus

University Core

CSEN1001	IT PRODUCTIVITY TOOLS	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	Familiarity with Computer system and its operation.						

Course Description:

This course introduces all software tools that improve the productivity of a student in enhancing his learning experience with all the activities taken up as part of his coursework.

Course Educational Objectives:

- to impart the skill in preparing technical documents of professional quality using docs, sheets, and forms
- to involve the student in preparation of websites, analyzing data and acquaint the student with the skill of processing audio, images, documents etc.

List of Experiments:

1. Create a typical document consisting of text, tables, pictures, multiple columns, with different page orientations.
2. Create a technical paper / technical report consisting of table of contents, table of figures, table of tables, bibliography, index, etc.
3. Compose and send customized mail / e-mail using mail-merge.
4. Create / modify a power point presentation with text, multimedia using templates with animation.
5. Create spreadsheet with basic calculations with relative reference, absolute reference, and mixed reference methods.
6. Simple report preparation using filtering tool / advanced filtering commands / pivot tables in spreadsheet application.
7. Analyze the results of an examination student wise, teacher wise, course wise, institute-wise.
8. Collecting and consolidating data using collaborative tools like google docs, sheets, forms.
9. Create charts / pictures using online tools like: www.draw.io or smart draw
10. Create a website of his interest.

Text Books:

1. Katherine Murray, 'Microsoft Office 365 Connect and collaborate virtually anywhere, anytime', Microsoft Press, ISBN: 978-0-7356-5694-9
2. EXCEL 2021 The Comprehensive Beginners to Advanced Users Guide to Master Microsoft Excel 2021. Learn the Essential Functions, New Features, Formulas, Tips and Tricks, and Many More

3. https://drawio-app.com/tutorials/video-tutorials/
   Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics Fourth Edition ISBN-13: 978-1449319274

References

1. https://www.coursera.org/learn/introduction-to-computers-and-office-productivity-software
2. https://www.coursera.org/projects/analyze-data-pivot-tables-crosstabs-google-sheets
3. https://www.coursera.org/learn/excel-advanced#syllabus
4. https://www.coursera.org/learn/how-to-create-a-website
5. https://support.microsoft.com/en-us/office
6. https://www.diagrams.net/
7. https://edu.google.com/

Course Outcomes:

1. Create / alter documents / Technical Paper / Project report with text, pictures, graphs of different styles.
2. Create / modify power point presentations with text, multimedia and to add animation using / creating templates.
3. Perform basic calculations / retrieve data / create pivot tables / chart using a spreadsheet application.
4. Create simple diagrams / charts using online tools like: www.draw.io.
5. Manage documents, presentations, spreadsheets, and websites in collaborative mode.

Co-Po Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
CO1					2				1	1	
CO2					2				1	1	
CO3	2	1	1		2				1	1	
CO4					2				1	1	
CO5					2				3	3	

APPROVED IN:

BOS :06-09-2021 **ACADEMIC COUNCIL:17-09-201**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

Emotional Intelligence and reasoning skills are essential for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

CLAD1001	EMOTIONAL INTELLIGENCE & REASONING SKILLS (SOFT SKILLS 1)	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

Emotional intelligence is a set of skills that are thought to contribute to the appraisal of emotions in oneself and others. It can also help contribute to the effective regulation of emotions as well as feelings (Salovey & Mayer, 1990). In terms of emotional intelligence, self-awareness and self- management have to do with our ability to relate to ourselves. Social awareness and relationship management have to do with our ability to relate to others. Similarly, the ability to solve questions on Analytical Reasoning and Data Sufficiency is a critical area tested in all competitive examinations and admission tests. Upon completion, students should be able (1) to deal with their own emotions as well as the emotions of others and relate better with both. Using better knowledge of EI, students will also be able to set more meaningful goals for themselves, choose suitable time management techniques that work best for them and work in teams more effectively. (2) to apply different concepts, ideas, and methods to solve questions in reasoning and data sufficiency

Course Educational Objectives:

- Use EI to relate more effectively to themselves, their colleagues and to others. Apply self-awareness and self-assessment (SWOT) to better understand and manage their own emotions. Apply social awareness to empathize with others and build stronger relationships with others.
- Set meaningful goals based on their strengths and weaknesses and apply time management techniques, such as Q4 organizing to put first things first.
- Manage conflicts and work in teams in an emotionally intelligent manner.
- Solve questions on non-verbal and analytical reasoning, data sufficiency and puzzles

List of Activities & Tasks for Assessment:

Unit	Topics	Hours
1	Self-Awareness & Self-Regulation: Introduction to Emotional Intelligence, *Self-Awareness:* Self-Motivation, Accurate Self-Assessment (SWOT Analysis), Self-Regulation: *Self Control, Trustworthiness & Adaptability*	3
2	Importance, Practising Social Awareness, Building Relationships, Healthy and Unhealthy Relationships, Relationship Management Competencies-Influence, Empathy, Communication, Types of Conflicts, Causes, Conflict Management	3

3	Social Media: Creating a blog, use of messaging applications, creating a website to show case individual talent, creation of a LinkedIn Profile	2
4	Goal Setting & Time Management: Setting SMART Goals, Time Wasters, Prioritization, Urgent Vs Important, Q2 Organization	3
5	Teamwork: Team Spirit, Difference Between Effective and Ineffective Teams, Characteristics of High-Performance Teams, Team Bonding, Persuasion, Team Culture, Building Trust, Emotional Bank Account	4
6	Verbal Reasoning: Introduction, Coding-decoding, Blood relations, Ranking Directions, Group Reasoning	6
7	Analytical Reasoning: Cubes and Dices, Counting of Geometrical figures	3
8	Logical Deduction: Venn diagrams, Syllogisms, Data Sufficiency, Binary logic	4
9	Spatial Reasoning: Shapes, Paper Cutting/Folding, Mirror images, Water images and Rotation of figures	2

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, Career Launcher and IMS etc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. Students will be able to relate more effectively to themselves, their colleagues and to others
2. Students will be able to set their short term and long term goals and better manage their time
3. Students will be able to manage conflicts in an emotionally intelligent manner and work in teams effectively
4. Students will be able to solve questions based on non-verbal and analytical reasoning, data sufficiency and puzzle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1		3	3				3				
CO2		3	3				3				

CO3		3	3				3				
CO4	3						3				
CO5											

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-201**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

Emotional Intelligence and reasoning skills are essential for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

CLAD1011	LEADERSHIP SKILLS & QUANTITATIVE APTITUDE (SOFT SKILLS 2)	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

Communication Skills is having the ability to convey information to others so that messages are understood, and outcomes delivered. Some essential qualities of Communication Skills include understanding the needs of others, clearly communicating messages, adapting the communication style, and using a range of communication methods. Presentation Skills is having the ability to confidently deliver an engaging message to a group of people which achieves the objectives. Some essential qualities of Presentation Skills include a thorough preparation of content, structuring content logically, managing nerves, engaging your audience, delivering presentation objectives, positively influencing the audience, and responding to audience needs. Tackling questions based on numbers, arithmetic, data interpretation and puzzles requires the application of different rules and concepts of numerical computation, numerical estimation, and data estimation.

Course Educational Objectives:

- Learn and apply, through different individual and group activities, different ideas, and skills to communicate in a positive and impressive manner.
- Apply the goal setting process (based on SWOT) and Q2 organizing for effective time management.
- Apply different concepts in numbers, numerical computation, and numerical estimation to solve questions that often appear in various competitive examinations and admission tests.
- Apply different concepts for tackling questions based on data interpretation, progression and series that are frequently given in various competitive examinations and admission tests.

List of Activities & Tasks for Assessment:

Unit	Topics	Hours
1	Communication Skills: The Communication Process, Elements of Interpersonal Communication, Non-Verbal Communication: Body Language, Posture, Eye Contact, Smile, Tone of Voice, Barriers to Communication. Effective Listening Skills: Active Listening, Passive Listening, Asking Questions, Empathizing, Being Non-Judgmental, Being Open Minded, Mass Communication: Design of Posters, Advertisements, notices, writing formal and informal invitations	5
2	Focus on Audience Needs, focus on the Core Message, Use Body Language and Voice, Start Strongly, Organizing Ideas & Using Visual Aids: SPAM Model, Effective Opening and Closing Techniques, Guy Kawasaki's Rule (10-20-30 Rule), Overcoming Stage Fear, Story Telling	3
3	Problem Solving & Decision Making: Difference Between the Two, Steps in Rational Approach to Problem Solving: Defining the Problem, Identifying the Root Causes, Generating Alternative Solutions, Evaluating and Selecting Solutions, Implementing and Following-Up, Case Studies	3
4	Group Discussion: Understanding GD, Evaluation Criteria, Nine Essential Qualities for Success, Positive and Negative Roles, Mind Mapping, structuring a Response, Methods of Generating Fresh Ideas	4
5	Number Theory: Number System, Divisibility rules, Remainders and LCM & HCF	3
6	Numerical Computation and Estimation - I: Chain Rule, Ratio Proportions, Partnerships & Averages, Percentages, Profit-Loss & Discounts, Mixtures, Problem on Numbers & ages	6
7	Data Interpretation: Interpretation and analysis of data in Tables, Caselets, Line- graphs, Pie-graphs, Boxplots, Scatterplots and Data Sufficiency	3
8	Mental Ability: Series (Number, Letter and Alphanumeric), Analogy (Number, Letter and Alphanumeric) and Classifications	3

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay

2. Study material for CAT, SAT, GRE, GMAT by TIME, Career Launcher and IMS etc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. Students will be able to communicate 'one-on-one' and 'one-on-many' confidently using both verbal and non-verbal messages and deliver impressive talks/ presentations to a group both with and without the use of PPTs and create posters, advertisements, etc.
2. Students will be able to apply the rational model of problem solving and decision making in their problem solving and decision-making efforts.
3. Students will be able to solve questions based on numbers and arithmetic given in various competitive examinations
4. Students will be able to solve questions based on data interpretation, progressions, and series.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1		3	3				3				
CO2		3	3				3				
CO3	3						2				
CO4	3						2				
CO5											

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-2021**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

Leadership and quantitative aptitude skills are essential skills for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

CLAD1021	**VERBAL ABILITY & QUANTITATIVE ABILITY**	**L**	**T**	**P**	**S**	**J**	**C**
		0	**0**	**2**	**0**	**0**	**1**

	(SOFT SKILLS 3)						
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

Vocabulary is an important part of verbal ability. An understanding of word formation, prefixes, suffixes, and roots is necessary to remember and use a vast repository of words. Approaching words through word families and other ways of groupings is an effective way of gaining mastery over vocabulary. Understanding and getting acquainted with the different rules and exceptions in the use of grammar and structure, especially from the relevant examination point of view, is crucial to cracking questions given in many competitive tests. Similarly, improving reading comprehension skills and test taking abilities in this area takes time and effort, especially given the fact that most students do not possess strong reading habits. In so far as quantitative aptitude is concerned, students need to develop a strong foundation on the basic mathematical concepts of numerical estimation, geometry, mensuration, data sufficiency, etc. to be able to crack different round 1 tests of major recruiters and admission tests of top Indian and foreign universities.

Course Educational Objectives:

- List and discuss the different word formation methods, word denotation, connotation, collocation, etc. and introduce selected high frequency words, their antonyms, synonyms, etc.
- Apply different advanced reading skills to solve questions based on author's tone, main ideas and sub-ideas, inferences, Para jumbles, etc. that are frequently asked in various competitive exams and admission tests.
- Solve different types of questions based on vocabulary, such as word analogy; structure, grammar, and verbal reasoning; introduce common errors and their detection and correction.
- Solve questions on numerical estimation, mensuration, data sufficiency based on quantitative aptitude. This includes questions on time and work, time and distance, pipes and cisterns, lines and angles, triangles, quadrilaterals, polygons and circles, 2- & 3-dimensional mensuration.

‘

List of Activities & Tasks for Assessment:

1. **Vocabulary Builder:** Understanding Word Formation, Prefixes, Suffixes and Roots, Etymology, Word Denotation, Connotation and Collocation, Synonyms and Antonyms

2. **Reading Comprehension:** Advanced Reading Comprehension: Types of RC passages, Types of Text Structures, Types of RC Questions: Distinguishing Between Major Ideas and Sub Ideas, Identifying the Tone and Purpose of the Author, Reading Between the Lines and Beyond the Lines, Techniques for Answering Different Types of Questions
3. **Para Jumbles:** Coherence and Cohesion, Idea Organization Styles, Concept of Mandatory Pairs and Its Application: Transitional Words, Antecedent-Pronoun Reference, Article Reference, Cause and Effect, Chronological Order, General to Specify, Specify to General, Idea-Example, Idea-Explanation, Etc.
4. **Grammar Usage:** Rules Governing the Usage of Nouns, Pronouns, Adjectives, Adverbs, Conjunctions, Prepositions and Articles
5. **Numerical Computation and Estimation - II:** Time and Work, Pipes and Cisterns, Time and Distance, Problems on Trains, Boats and Streams, Races and Games of Skill, Simple Interest & Compound Interest
6. **Geometry:** Lines and Angles, Triangles, Quadrilaterals & Polygons, and Circles
7. **Mensuration:** 2-Dimensional Mensuration (Triangles, Quadrilaterals and Circles), 3-Dimensional Mensuration (Cubes, Cuboids, Cylinder, Cone, Sphere)

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, Career Launcher and IMS etc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. List and discuss word formation methods, selected high frequency words, their antonyms, synonyms, etc.
2. Analyze reading passages and quickly find out the correct responses to questions asked, including para jumbles, by using reading skills like skimming, scanning, reading between the lines, etc.
3. Solve different types of questions based on vocabulary, structure, grammar and verbal reasoning
4. Solve questions on numerical estimation, mensuration, data sufficiency based on quantitative aptitude

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1		2					2				
CO2		2					2				
CO3	3						2				
CO4	3						2				
CO5											

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-2021**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

English language and quantitative aptitude skills are essential skills for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

CLAD1031	PRACTICING VERBAL ABILITY & QUANTITATIVE APTITUDE (SOFT SKILLS 4)	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

A sound knowledge of the rules of English grammar, structure and style and its application in detecting errors in writing are important areas of Verbal Ability frequently tested as a part of the written test in many competitive examinations and admission tests of major recruiters and universities respectively. This module focuses on all important areas of grammar and structure commonly asked in major tests, such as GMAT, CAT, XLRI, CRT, etc. Similarly, in the area of Quantitative Aptitude, different kinds of questions are asked from Combinatorics (Permutations & Combinations, Probability], Cryptarithmetic & Modular Arithmetic (Cryptarithmetic, Application of base system (7, 24), Clocks (Base 24), Calendars (Base 7), and Mental Ability (Number series, Letter series & Alpha numeric series, Analogies (Numbers, letters), Classifications, Algebra (Exponents, Logarithms, Problems related to Equations, Special Equations, and Statistics) . This module focuses on all these areas by building on what the students already learnt in their earlier studies.

Course Educational Objectives:

- Apply the rules of grammar to solve questions in Error Detection, Sentence Correction and Sentence Improvement.
- Apply the rules of structure to solve questions in Error Detection, Sentence Correction and Sentence Improvement, Fill-in-blanks and Cloze Passages.
- Explain methods of solving problems in Combinatorics (Permutations & Combinations, Probability], Cryptarithmetic & Modular Arithmetic (Cryptarithmetic, Application of base system (7, 24), Clocks (Base 24), Calendars (Base 7)]
- Explain how to solve questions in Mental Ability (Number series, Letter series & Alpha numeric series, Analogies, Numbers, letters, Classifications] and Algebra (Exponents, Logarithms, Problems related to Equations, Special Equations, Statistics)

List of Activities & Tasks for Assessment:

1. Error Detection: Pronouns, Conjunctions, Prepositions and Articles
2. Error Detection: Tenses and their Uses
3. Sentence Correction: Subject-Verb Agreement, Antecedent-Pronoun Agreement, Conditional Clauses

4. Sentence Correction: Modifiers (Misplaced and Dangling) & Determiners, Parallelism & Word Order, and Degrees of Comparison
5. Combinatorics: Permutations & Combinations, Probability
6. Crypt arithmetic & Modular Arithmetic: Crypt arithmetic, Application of Base System (7, 24), Clocks (Base 24), Calendars (Base 7)
7. Algebra: Exponents, Logarithms, Word-problems related to equations, Special Equations, Progressions, Statistics

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, Career Launcher and IMS etc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. Identify and correct errors in English grammar and sentence construction
2. Identify and correct errors in Structure, Style and Composition
3. Solve problems in Combinatorics, Cryptarithmetic, and Modular Arithmetic
4. Solve problems in Mental Ability and Algebra

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1							3				
CO2							3				
CO3	3						3				
CO4	3						3				
CO5											

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-2021**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

English language and quantitative aptitude skills are essential skills for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

CLAD2001	PREPARATION FOR CAMPUS PLACEMENT -1 (SOFT SKILLS 5A)	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**None**						

Co-requisite	**None**
Preferable exposure	**None**

Course Description:

The course addresses all relevant areas related to campus placements and readies them to ace their upcoming/ ongoing recruitment drives. Specifically, it focuses on students' career preparedness, interview skills, test preparedness, etc.

Course Educational Objectives:

Prepare the students for their upcoming/ ongoing campus recruitment drives.

List of Activities & Tasks for Assessment:

1. Career Preparedness: Resume & Cover Letter Writing, Interview Skills: Elevator Pitch, Making the First Impression, Being Other-Oriented, Being Positive and Curious, communicating with Confidence and Poise, Frequently Asked Questions & How to Answer Them, Pitfalls to Avoid, Etc. Etiquette: Hygiene, Courtesy, Culture differences, Workplace, use of cell phone, Profanity, Slang, Protocol.
2. Verbal Ability: Practicing Reading Comprehension, Error Detection, Sentence Completion, MCQs, FIBs, Para jumbles, Cloze Test, Critical Reasoning.
3. Quantitative Aptitude: Number Systems, Algebra, Geometry, Data Handling, Data Sufficiency, Word Problems
4. Reasoning: Logical and Verbal Reasoning

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, Career Launcher and IMS etc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. Write a power resume and covering letter
2. Answer interview questions with confidence and poise
3. Exhibit appropriate social mannerisms in interviews
4. Solve placement test questions on verbal ability, quantitative aptitude and reasoning

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1		1					3				
CO2		3					3				
CO3	3						3				
CO4	3						3				
CO5											

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-2021**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

CLAD2011	**PREPARATION FOR HIGHER EDUCATION (GRE/ GMAT)-1 (SOFT SKILLS 5B)**	**L**	**T**	**P**	**S**	**J**	**C**
		0	**0**	**2**	**0**	**0**	**1**
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

The course offers a special track for students who aspire to go abroad in pursuit of their higher education for which a GRE/ GMAT score is a prerequisite. It covers all four topical areas of these tests and includes fully solved mock tests as well.

Course Educational Objectives:

- Prepare the students to solve questions from all four broad areas of GRE/ GMAT
- Orient the students for GRE/ GMAT through mock tests

List of Activities & Tasks for Assessment:

1. Verbal Reasoning: Reading Comprehension, Sentence Equivalence, Text Completion, Sentence Correction, Critical Reasoning
2. Quantitative Reasoning: Arithmetic, Algebra, Geometry, Data Analysis
3. Analytical Writing Assessment: Issue/ Argument
4. Integrated Reasoning

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, Career Launcher and IMS etc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. Solve questions from all four broad areas of GRE/ GMAT
2. Practice answering several mock tests

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3			2			3				
CO2	3			2			3				
CO3											
CO4											
CO5											

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-2021**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

Quantitative aptitude, reasoning, verbal and language skills practiced during the preparation for GRE/GMAT tests provide essential skills for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

CLAD2021	PREPARATION FOR CAT/ MAT – 1 (SOFT SKILLS 5C)	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

The course offers a special track for UG students who aspire to go for higher education in business management in India for which cracking CAT/ MAT/ other related test is mandatory. It covers all four topical areas of these tests and includes fully solved mock tests as well.

Course Educational Objectives:

- Prepare the students to solve questions from all four relevant areas of CAT/ XAT/ MAT, etc.
- Orient the students for CAT/ XAT, etc. through mock tests

List of Activities & Tasks for Assessment:

1. Quantitative Ability: Arithmetic, Algebra, Geometry, Mensuration, Calculus, Trigonometry
2. Data Interpretation: Data Interpretation and Data Sufficiency
3. Logical Reasoning: Data Management, Deductions, Verbal Reasoning and Non- Verbal Reasoning
4. Verbal Ability: Critical Reasoning, Sentence Correction, Para Completion, Para Jumbles, Reading Comprehension

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, Career Launcher and IMS etc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. Solve questions from all four relevant areas of CAT/ MAT as listed above
2. Practice test-cracking techniques through relevant mock tests

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3			2			3				
CO2	3			2			3				
CO3											
CO4											
CO5											

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-2021**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

Quantitative aptitude, reasoning, verbal and language skills practiced during the preparation for CAT/ MAT tests provide essential skills for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

		L	T	P	S	J	C
CLAD2031	**PREPARATION FOR CAMPUS PLACEMENT-2 (SOFT SKILLS 6A)**	**0**	**0**	**2**	**0**	**0**	**1**

Pre-requisite	**None**
Co-requisite	**None**
Preferable exposure	**None**

Course Description:

This course builds on the previous course and focuses on all four major areas of campus placements, including career preparedness, mock interviews, verbal ability, quantitative aptitude, and logical reasoning.

Course Educational Objectives:

- To comprehensively prepare all eligible and aspiring students for landing their dream jobs.
- To sharpen the test-taking skills in all four major areas of all campus drives

List of Activities & Tasks for Assessment:

1. Career Preparedness II: Mock Interviews, Feedback and Placement Readiness
2. Verbal Ability II: Practising Reading Comprehension, Error Detection, Sentence Completion, MCQs, FIBs, Para jumbles, Cloze Test, Critical Reasoning
3. Quantitative Aptitude II: Number Systems, Algebra, Geometry, Data Handling, Data Sufficiency, Word Problems
4. Reasoning II: Logical and Verbal Reasoning

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, CareerLauncher and IMS etc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. Demonstrate career preparedness and confidence in tackling campus interviews
2. Solve placement test questions of a higher difficulty level in verbal ability, quantitative aptitude and logical reasoning.
3. Practice test-taking skills by solving relevant questions accurately and within time.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1		3	3				3				

CO2							3				
CO3							3				
CO4											
CO5											

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-2021**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

Quantitative aptitude, reasoning, verbal and language skills practiced during the preparation for campus placement tests provide essential skills for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

CLAD2041	**PREPARATION FOR HIGHER EDUCATION (GRE/GMAT)-2 (SOFT SKILLS 6B)**	**L**	**T**	**P**	**S**	**J**	**C**
		0	**0**	**2**	**0**	**0**	**1**
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

The course offers a special track for students who aspire to go abroad in pursuit of their higher education for which a GRE/ GMAT score is a prerequisite. It covers all four topical areas of these tests at a higher difficulty-level and includes fully solved mock tests as well.

Course Educational Objectives:

- Prepare the students to solve higher level questions from all four broad areas of GRE/ GMAT
- Orient the students for GRE/ GMAT through mock tests

List of Activities & Tasks for Assessment:

1. Verbal Reasoning II: Reading Comprehension, Sentence Equivalence, Text Completion, Sentence Correction, Critical Reasoning
2. Quantitative Reasoning II: Arithmetic, Algebra, Geometry, Data Analysis
3. Analytical Writing Assessment II: Issue/ Argument
4. Integrated Reasoning II

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, Career Launcher and IMS etc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. Solve higher level questions from all four broad areas of GRE/ GMAT
2. Practice answering several mock tests

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2						3				
CO2	2						3				
CO3											

CO4											
CO5											

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-2021**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

Quantitative aptitude, reasoning, verbal and language skills practiced during the preparation for GRE/GMAT tests provide essential skills for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

CLAD2051	**PREPARATION FOR CAT/ MAT – 2 (SOFT SKILLS 6C)**	**L**	**T**	**P**	**S**	**J**	**C**
		0	**0**	**2**	**0**	**0**	**1**
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

The course offers a special track for UG students who aspire to go for higher education in business management in India for which cracking CAT/ MAT/ other related test is mandatory. It covers all four topical areas of these tests at a higher level of difficulty and includes fully solved mock tests as well.

Course Educational Objectives:

- Prepare the students to solve all types of questions from all four relevant areas of CAT/ XAT/ MAT, etc.

List of Activities & Tasks for Assessment:

1. Quantitative Ability II: Arithmetic, Algebra, Geometry, Mensuration, Calculus, Trigonometry
2. Data Interpretation II: Data Interpretation and Data Sufficiency
3. Logical Reasoning II: Data Management, Deductions, Verbal Reasoning and Non-Verbal Reasoning
4. Verbal Ability II: Critical Reasoning, Sentence Correction, Para Completion, Para Jumbles, Reading Comprehension

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay
2. Study material for CAT, SAT, GRE, GMAT by TIME, Career Launcher and IMS etc.
3. Quantitative Aptitude by R S Agarwal S Chand Publications
4. Quantitative Aptitude by Pearson Publications

Course Outcomes:

1. Solve higher difficulty level questions from all four relevant areas of CAT/ MAT as listed above
2. Practice test-cracking techniques through relevant mock tests

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2			2			3				
CO2	2			2			3				
CO3											
CO4											

CO5											

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :17-09-2021 **ACADEMIC COUNCIL:17-09-2021**

SDG No. & Statement:4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

Quantitative aptitude, reasoning, verbal and language skills practiced during the preparation for CAT/ MAT tests provide essential skills for achieving inclusive and equitable education and lifelong learning opportunities for oneself and others.

DOSL1001	CLUB ACTIVITY – PARTICIPANT	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course recognizes student participation in multiple activities organized by various student organizations that pursue specific co-curricular and extra-curricular interests. These activities allow students to engage in and identify and pursue their personal interests and hobbies.

Course Educational Objectives:

- Create opportunities for students to participate in a variety of non-academic experiences
- Interact with and learn from peers in a setting without an external performance pressure
- Allow exploration of interesting activities and reflection about these experiences
- Learn to manage time effectively

List of Student Club Activities:

1. Music (vocals, instruments, technical, recording, mixing, production, management)
2. Dance (Indian classical, western, jazz, Latin, contemporary, folk, production, event management)
3. Theatre (classical, experimental, one-act, street, production, direction, casting, etc.)
4. Arts (fine arts, painting, calligraphy, sketching, caricaturing, etc.)
5. Craft (origami, model making, sculpture, pottery, etc.)
6. Cooking (home-style, baking, confectionery, Indian, intercontinental, etc.)
7. Graffiti (street, mural, collage, multi media, etc.)
8. Workshops, quizzes, debates, elocution, etc.
9. Filmmaking (adventure, drama, film appreciation, documentary, etc.)
10. Photography (conventional, immersive (360), landscape, portrait, technical, editing, etc.)
11. College Fests
12. Designing (graphic design, landscape, interior, etc.)
13. Competitive coding
14. Recreational sports activities
15. Other club activities organized by student clubs

List of Activities:

1. Participation in various club-based activities

2. Weekly reflection paper
3. Portfolio (on social media using an Instagram account)
4. Two learning papers (one per semester)

Textbooks:

1. Small move: big Change (Caroline Arnold)
2. How to Win at College: Surprising Secrets for Success from the Country's Top Students (Cal Newport)

References:

1. Making the most of college: Students speak their minds (author - Richard Light)
2. Failing Forward: Turning Mistakes into Stepping Stones for Success (John C Maxwell)
3. The Last Lecture (Randy Pausch)
4. Lean in (Sheryl Sandberg)
5. YouTube- Introduction to various club activities

Course Outcomes:

Upon successful completion of the course, student will be able to

1. Identify personal interest areas
2. Learn from diverse perspectives and experiences
3. Gain exposure to various activities and opportunities for extra-curricular activities
4. Learn to manage time effectively
5. gain confidence

CO-PO Mapping:

	PO1		PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3		3	3	3	2		2				
CO2	3			3		2		2				
CO3			3	2		3	2					
CO4			3	3		2		3				
CO5	3			3		2		3				

Note: 1 - Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

This course recognizes student participation in non-academic events and activities which focus on inclusive partnerships and collaborations with all stakeholders by using all sustainable means to promote lifelong learning.

DOSL1011	CLUB ACTIVITY – MEMBER OF THE CLUB	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course encourages and acknowledges student members' work in organizing events and activities organized by various student organizations that pursue specific co-curricular and extra- curricular interests. These activities allow students to actively learn from the process of conceptualizing and organizing such activities as part of a team.

Course Educational Objectives:

- Create opportunities for students to learn from organizing club activities
- Learn teamwork, leadership, planning and management of events and activities
- Learn to appreciate multiple perspectives, cultures, and individual capabilities
- Learn to manage time effectively

List of Student Club Activities:

1. Music (vocals, instruments, technical, recording, mixing, production, management)
2. Dance (Indian classical, western, jazz, Latin, contemporary, folk, production, event management)
3. Theatre (classical, experimental, one-act, street, production, direction, casting, etc.)
4. Arts (fine arts, painting, calligraphy, sketching, caricaturing, etc.)
5. Craft (origami, model making, sculpture, pottery, etc.)
6. Cooking (home-style, baking, confectionery, Indian, intercontinental, etc.)
7. Graffiti (street, mural, collage, multimedia, etc.)
8. Workshops, quizzes, debates, elocution, etc.
9. Filmmaking (adventure, drama, film appreciation, documentary, etc.)
10. Photography (conventional, immersive (360), landscape, portrait, technical, editing, etc.)
11. College Fests
12. Designing (graphic design, landscape, interior, etc.)
13. Competitive coding
14. Recreational sports activities
15. Other club activities organized by student clubs

List of Activities:

1. Be a member of a club and organize activities in that particular interest area
2. Learn from diverse perspectives and experiences

3. Learn to design and execute extra-curricular activities
4. Develop management skills through hands on experience
5. Explore different managerial roles and develop competencies

Textbooks:

1. Small move: big Change (Caroline Arnold)
2. How to Win at College: Surprising Secrets for Success from the Country's Top Students (Cal Newport)

References:

1. Making the most of college: Students speak their minds (author - Richard Light)
2. Failing Forward: Turning Mistakes into Stepping Stones for Success (John C Maxwell)
3. The Last Lecture (Randy Pausch)
4. Lean in (Sheryl Sandberg)
5. Youtube- Introduction to various club activities

Course Outcomes:

Upon successful completion of the course, student will be able to

- Be a member of a club and organize activities in that particular interest area
- Learn from diverse perspectives and experiences
- Learn to design and execute extra-curricular activities
- Develop management skills through hands on experience
- Explore different managerial roles and develop competencies

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2		2				
CO2	3		3		2		2				
CO3		3	2		3	2					
CO4		3	3		2		3				
CO5	3		3		2		3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:

SDG 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

SDG17 : Strengthen the means of implementation and revitalize the global partnership for sustainable development

SDG Justification:

This course recognizes student participation in community service endeavours focussing on sustainable development, service to communities. This allows students to develop empathy, citizenship behaviour and inclusive community values.

DOSL1021	CLUB ACTIVITY – LEADER OF THE CLUB	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course encourages and recognizes student members' work in leading the student organizations through various leadership roles. As leaders they work not just to organize events and activities in specific co-curricular and extra-curricular interests, but also lead the teams that form the core members of the clubs. These activities allow students to learn and practice leadership and management skills through real world experience.

Course Educational Objectives:

- Create opportunities for students to learn from organizing club activities
- Learn teamwork, leadership, planning and management of events and activities
- Learn to appreciate multiple perspectives, cultures, and individual capabilities
- Learn to manage time effectively

List of Student Club Activities:

1. Music (vocals, instruments, technical, recording, mixing, production, management)
2. Dance (Indian classical, western, jazz, Latin, contemporary, folk, production, event management)
3. Theatre (classical, experimental, one-act, street, production, direction, casting, etc.)
4. Arts (fine arts, painting, calligraphy, sketching, caricaturing, etc.)
5. Craft (origami, model making, sculpture, pottery, etc.)
6. Cooking (home-style, baking, confectionery, Indian, intercontinental, etc.)
7. Graffiti (street, mural, collage, multimedia, etc.)
8. Workshops, quizzes, debates, elocution, etc.
9. Filmmaking (adventure, drama, film appreciation, documentary, etc.)
10. Photography (conventional, immersive (360), landscape, portrait, technical, editing, etc.)
11. College Fests
12. Designing (graphic design, landscape, interior, etc.)
13. Competitive coding
14. Recreational sports activities
15. Other club activities organized by student clubs

List of Activities:

1. Be the leader of the club and implement the charter, vision and mission of the club
2. Learn from diverse perspectives and experiences

3. Learn to lead the team, design and execute extra-curricular activities
4. Develop management skills through hands on experience
5. Explore different managerial roles and develop competencies

Textbooks:

1. Small move: big Change (Caroline Arnold)
2. How to Win at College: Surprising Secrets for Success from the Country's Top Students (Cal Newport)

References:

1. Making the most of college: Students speak their minds (author - Richard Light)
2. Failing Forward: Turning Mistakes into Stepping Stones for Success (John C Maxwell)
3. The Last Lecture (Randy Pausch)
4. Lean in (Sheryl Sandberg)
5. you tube- Introduction to various club activities

Course Outcomes:

Upon successful completion of the course, student will be able to

- Be the leader of the club and implement the charter, vision and mission of the club
- Learn from diverse perspectives and experiences
- Learn to lead the team, design and execute extra-curricular activities
- Develop management skills through hands on experience
- Explore different managerial roles and develop competencies

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2		2				
CO2	3		3		2		2				
CO3		3	2		3	2					
CO4		3	3		2		3				
CO5	3		3		2		3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:

SDG 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

SDG17 : Strengthen the means of implementation and revitalize the global partnership for sustainable development

SDG Justification:

This course recognizes student participation in community service endeavours focussing on sustainable development, service to communities. This allows students to develop empathy, citizenship behaviour and inclusive community values.

DOSL1031	CLUB ACTIVITY – COMPETITOR	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course encourages and recognizes student members' work in leading the student organizations through various leadership roles. As leaders they work not just to organize events and activities in specific co-curricular and extra-curricular interests, but also lead the teams that form the core members of the clubs. These activities allow students to learn and practice leadership and management skills through real world experience.

Course Educational Objectives:

- Create opportunities for students to learn from organizing club activities
- Learn teamwork, leadership, planning and management of events and activities
- Learn to appreciate multiple perspectives, cultures, and individual capabilities
- Learn to manage time effectively

List of Student Club Activities:

1. Music (vocals, instruments, technical, recording, mixing, production, management)
2. Dance (Indian classical, western, jazz, Latin, contemporary, folk, production, event management)
3. Theatre (classical, experimental, one-act, street, production, direction, casting, etc.)
4. Arts (fine arts, painting, calligraphy, sketching, caricaturing, etc.)
5. Craft (origami, model making, sculpture, pottery, etc.)
6. Cooking (home-style, baking, confectionery, Indian, intercontinental, etc.)
7. Graffiti (street, mural, collage, multimedia, etc.)
8. Workshops, quizzes, debates, elocution, etc.
9. Filmmaking (adventure, drama, film appreciation, documentary, etc.)
10. Photography (conventional, immersive (360), landscape, portrait, technical, editing, etc.)
11. College Fests
12. Designing (graphic design, landscape, interior, etc.)
13. Competitive coding
14. Recreational sports activities
15. Other club activities organized by student clubs

List of Activities:

1. Be the leader of the club and implement the charter, vision and mission of the club

2. Learn from diverse perspectives and experiences
3. Learn to lead the team, design and execute extra-curricular activities
4. Develop management skills through hands on experience
5. Explore different managerial roles and develop competencies

Textbooks:

1. Small move: big Change (Caroline Arnold)
2. How to Win at College: Surprising Secrets for Success from the Country's Top Students (Cal Newport)

References:

1. Making the most of college: Students speak their minds (author - Richard Light)
2. Failing Forward: Turning Mistakes into Stepping Stones for Success (John C Maxwell)
3. The Last Lecture (Randy Pausch)
4. Lean in (Sheryl Sandberg)
5. YouTube- Introduction to various club activities

Course Outcomes:

Upon successful completion of the course, student will be able to

1. Be the leader of the club and implement the charter, vision and mission of the club
2. Learn from diverse perspectives and experiences
3. Learn to lead the team, design and execute extra-curricular activities
4. Develop management skills through hands on experience
5. Explore different managerial roles and develop competencies

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2		2				
CO2	3		3		2		2				
CO3		3	2		3	2					
CO4		3	3		2		3				
CO5	3		3		2		3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:

SDG 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

SDG17 : Strengthen the means of implementation and revitalize the global partnership for sustainable development

SDG Justification:

This course recognizes student participation in community service endeavours focussing on sustainable development, service to communities. This allows students to develop empathy, citizenship behaviour and inclusive community values.

DOSL1041	COMMUNITY SERVICES - VOLUNTEER	L	T	P	S	J	C
		0	0	0	0	2	2
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course recognizes student participation in Community service activities organized by various student organizations and other Government and non-government organizations that exist for providing service to communities. These activities allow students to develop empathy, citizenship behavior and community values.

Course Educational Objectives:

- To help students develop empathy and citizenship behavior
- Enable students to develop an altruistic attitude and community development sensibility
- Allow exploration of community service activities and reflect about these experiences
- Learn to work in small and large teams for achieving community objectives

List of Community Service Activities:

1. Community Health Services
2. Swachh Bharat Abhiyan and other Cleanliness drives
3. Tree Plantation and similar environmental conservation initiatives
4. Rain water harvesting awareness and implementation
5. Fundraising and visits to Orphanages, Old-age homes, etc.
6. Health and disease awareness programs
7. Working with NGOs
8. Disaster mitigation and management training and relief work
9. Rural Upliftment projects
10. Campus awareness and action projects (cleanliness, anti-ragging, blood donation, etc)
11. Community investigations and surveys for development research
12. Educational support for underprivileged (remedial classes, coaching, training, etc)
13. Service camps
14. Advocacy and information literacy initiatives
15. Other activities serving local communities

List of Activities:

1. Participation in various community service activities
2. Weekly reflection paper

3. Portfolio (on social media using an instagram account)
4. Two learning papers (one per semester)

Text Books:

1. Soul of a citizen: living with conviction in Challenging times (author: Paul Roget Loeb)
2. Community Services intervention: Vera Lloyd

References:

1. A path appears: Transforming lives, creating opportunities (Nicholas Kristof and Sheryl Wu Dunn)
2. The story of My Experiments with Truth (author: M. K. Gandhi)

Course Outcomes:

1. Experience of volunteering in a variety of Community service activities
2. Gaining empathy for lesser privileged sections of society by experience
3. Understanding the process of generating community awareness
4. Understanding Disaster management and relief through training and experience
5. Developing environmental and sustainability awareness

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	3					2				
CO2		3	3				2				
CO3				3	3	2	2				
CO4		3	3								
CO5	3		3				3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:

SDG 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

SDG17 : Strengthen the means of implementation and revitalize the global partnership for sustainable development

SDG Justification:

This course recognizes student participation in community service endeavors focusing on sustainable development, service to communities. This allows students to develop empathy, citizenship behavior and inclusive community values.

DOSL1051	COMMUNITY SERVICES - MOBILIZER	L	T	P	S	J	C
		0	0	0	0	2	2
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course recognizes student leadership in mobilizing community service activities as members of various student organizations or other Government and non-government organizations that exist for providing service to communities. These activities allow students to develop leadership, management skills, empathy, citizenship behaviour and community values.

Course Educational Objectives:

- To help students understand leadership in a community environment
- Enable students to develop an altruistic attitude and community development sensibility
- Allow deep understanding of community service through practical experience
- Learn to lead small and large teams for achieving community objectives

List of Community Service Activities:

1. Community Health Services
2. Swachh Bharat Abhiyan and other Cleanliness drives
3. Tree Plantation and similar environmental conservation initiatives
4. Rain water harvesting awareness and implementation
5. Fundraising and visits to Orphanages, Old-age homes, etc.
6. Health and disease awareness programs
7. Working with NGOs
8. Disaster mitigation and management training and relief work
9. Rural Upliftment projects
10. Campus awareness and action projects (cleanliness, anti-ragging, blood donation, etc.)
11. Community investigations and surveys for development research
12. Educational support for underprivileged (remedial classes, coaching, training, etc.)
13. Service camps
14. Advocacy and information literacy initiatives
15. Other activities serving local communities

List of Activities:

1. Organizing and leading teams in various community service activities
2. Fortnightly reflection paper
3. Portfolio (on social media using an Instagram account)
4. Two learning papers (one per semester)

Textbooks:

1. Soul of a citizen: living with conviction in Challenging times (author: Paul Roget Loeb)
2. Community Services intervention: Vera Lloyd

References:

1. A path appears: Transforming lives, creating opportunities (Nicholas Kristof and

SherylWuDunn)
2. The story of My Experiments with Truth (author: M. K. Gandhi)
3. List of student run and other Government and non- government community service organizations

Course Outcomes:

1. Experience of mobilizing and executing Community service activities
2. Providing opportunities for community service volunteering for other fellow students
3. Understanding the process of mobilizing cash, kind and volunteer support
4. Building leadership and management skills
5. Building empathy and citizenship behavior

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	3					2				
CO2		3	3				2				
CO3				3	3	2	2				
CO4		3	3								
CO5	3		3				3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:

SDG 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

SDG17 : Strengthen the means of implementation and revitalize the global partnership for sustainable development

SDG Justification:

This course recognizes student participation in community service endeavours focussing on sustainable development, service to communities. This allows students to develop empathy, citizenship behaviour and inclusive community values.

DOSP1001	BADMINTON	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Badminton - History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills - Badminton: Grips - Racket, shuttle
4. Sports Specific fitness and warmup drills
5. Stances and footwork
6. Badminton Gameplay: Service, Forehand, Backhand
7. Preparatory Drills and Fun Games
8. Game Variations: Singles/ Doubles/ Mixed

References:

1. Handbook of the Badminton World Federation (BWF)

Course Outcomes:

1. Learn to play Badminton
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2				3				
CO2							2				
CO3							2				
CO4		3	3		2		2				
CO5				3	2		3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1011	**CHESS**	**L**	**T**	**P**	**S**	**J**	**C**
		0	**0**	**0**	**2**	**0**	**2**
Pre-requisite	**None**						

Co-requisite	**None**
Preferable exposure	**None**

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Chess - History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills - Chess: Pieces & functions, basic play
4. Chess board moves & terminology
5. Chess Gameplay: Openings, castling, strategies & tactics
6. Preparatory Drills and Fun Games
7. Game Variations & Officiating

References:

1. International Chess Federation (FIDE) Handbook

Course Outcomes:

1. Learn to play Chess
2. Understanding of the fundamental concepts such as rules of play, game variations

3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2				3				
CO2							2				
CO3							2				
CO4		3	3		2		2				
CO5				3	2		3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1021	**CARROM**	**L**	**T**	**P**	**S**	**J**	**C**
		0	**0**	**0**	**2**	**0**	**2**
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Carrom - History and development
2. Rules of the Game, Board components & dimensions
3. Fundamental Skills - Carrom: - Striking
4. Gameplay – General
5. Preparatory Drills and Fun Games
6. Game Variations: Singles/ Doubles/ Mixed
7. Preparatory Drills and Fun Games

References:

1. Indian Carrom Federation Handbook - Laws

Course Outcomes:

1. Learn to play Carrom
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4

CO1	3	2	2				3				
CO2							2				
CO3							2				
CO4		3	3		2		2				
CO5				3	2		3				

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1031	**Football**	**L**	**T**	**P**	**S**	**J**	**C**
		0	**0**	**0**	**2**	**0**	**2**
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as

appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Football – History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills – Kicking, heading, ball control, Keeping
4. Movement, throwing, tackling, defense, scoring, defense
5. Gameplay- Formations, passing, FKs, CKs, PK, tactics
6. Preparatory Drills and Fun Games
7. Game Variations: Small sided games, 7v7, 11v11

References:

1. FIFA Laws of the Game

Course Outcomes:

1. Learn to play Football
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2				3				

CO2							2				
CO3							2				
CO4		3	3		2		2				
CO5				3	2		3				

Note: 1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1041	**VOLLEYBALL**	**L**	**T**	**P**	**S**	**J**	**C**
		0	**0**	**0**	**2**	**0**	**2**
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Volley – History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills – Striking, Ball control, Lifting
4. Sports Specific fitness and warmup drills
5. Stances and footwork
6. Preparatory Drills and Fun Games
7. Gameplay: Jumps, strikes, layoffs, attack, defense

References:

FIVB – Official Volleyball Rules

Course Outcomes:

1. Learn to play Volleyball
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2				3				
CO2							2				
CO3							2				
CO4		3	3		2		2				
CO5				3	2		3				

Note: 1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1051	**KABADDI**	**L**	**T**	**P**	**S**	**J**	**C**
		0	**0**	**0**	**2**	**0**	**2**
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Kabaddi – History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills – Raiding, catching
4. Sports Specific fitness and warmup drills
5. Stances and footwork
6. Preparatory Drills and Fun Games
7. Gameplay: Chain system movement

References:

1. Amateur Kabaddi Federation of India (AKFI) – Official Rules
2. Rules of Kabaddi – International Kabaddi Federation

Course Outcomes:

1. Learn to play Kabaddi
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2				3				
CO2							2				
CO3							2				
CO4		3	3		2		2				
CO5				3	2		3				

Note: 1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1061	**KHO KHO**	**L**	**T**	**P**	**S**	**J**	**C**
		0	**0**	**0**	**2**	**0**	**2**
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical

fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Kho Kho – History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills: Sitting, giving Kho, Pole dive
4. Sports Specific fitness and warmup drills
5. Stances and footwork: Running, sitting
6. Gameplay: Running strategies, ring method, chain method
7. Preparatory Drills and Fun Games

References:

1. Khelo India Official Rulebook of Kho Kho

Course Outcomes:

1. Learn to play Kho Kho
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2				3				

CO2							2				
CO3							2				
CO4		3	3		2		2				
CO5				3	2		3				

Note: 1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1071	**TABLE TENNIS**	**L**	**T**	**P**	**S**	**J**	**C**
		0	**0**	**0**	**2**	**0**	**2**
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Table Tennis – History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills – TT: Grips – Racket, ball
4. Stances and footwork
5. TT Gameplay- Forehand, Backhand, Side Spin, High Toss. Strokes-Push, Chop, Drive, Half Volley, Smash, Drop-shot, Balloon, Flick, Loop Drive.
6. Preparatory Drills and Fun Games
7. Game Variations: Singles/ Doubles/ Mixed

References:

1. Handbook of the International Table Tennis Federation (ITTF)

Course Outcomes:

1. Learn to play Table Tennis
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO 1	3	2	2				3				

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

Note: 1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1081	HANDBALL	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Handball – History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills – Handball: Throwing, Ball control, Movement
4. Sports Specific fitness and warmup drills
5. Stances and footwork: Jumps, dribbles, catching, throws
6. Gameplay: Shots, throws, movements, attack, defines
7. Preparatory Drills and Fun Games

References:

1. International Handball Federation – Rules of the Game & Regulations

Course Outcomes:

1. Learn to play Handball
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2				3				
CO2							2				
CO3							2				
CO4		3	3		2		2				
CO5				3	2		3				

Note: 1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1091	**BASKETBALL**	**L**	**T**	**P**	**S**	**J**	**C**
		0	**0**	**0**	**2**	**0**	**2**
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Basketball – History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills – Passing, Receiving, Dribbling
4. Sports Specific fitness and warmup drills
5. Stances and footwork: Jumps, dribbles, catching, throws
6. Preparatory Drills and Fun Games
7. Gameplay: Shots, throws, movements, attack, defense

References:

1. FIBA Basketball Official Rules

Course Outcomes:

1. Learn to play Basketball
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2				3				
CO2							2				
CO3							2				
CO4		3	3		2		2				
CO5				3	2		3				

Note: 1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1101	**TENNIS**	**L**	**T**	**P**	**S**	**J**	**C**
		0	**0**	**0**	**2**	**0**	**2**
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Tennis – History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills – Tennis: Grips – Racket, ball

4. Stances and footwork
5. Gameplay- Forehand, Backhand, Service, volley, smash
6. Preparatory Drills and Fun Games
7. Game Variations: Singles/ Doubles/ Mixed

References:

1. Handbook of the International Tennis Federation (ITF)

Course Outcomes:

1. Learn to play Tennis
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2				3				
CO2							2				
CO3							2				
CO4		3	3		2		2				
CO5				3	2		3				

Note: 1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

DOSP1111	THROWBALL	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course provides instruction and the opportunity for participation in sports and physical fitness activities. Skills, strategies, rules, and personal wellness goals are included as appropriate. This course will provide students with an understanding of the fundamental concepts of the physiological functions and training principles associated with the chosen sport.

Course Educational Objectives:

- Understand training principles used in the sport
- Demonstrate knowledge of the game in a recreational /competitive play setting
- Organize an event around the sport
- Demonstrate concepts of warm up, game conditioning, training plans

List of Activities:

1. Watch a sport documentary / training video / game history
2. On field coaching and demonstration session
3. Guided practice and play
4. Event management & game officiating
5. Friendly competitions and structured matches

Instructional Plan:

1. Introduction to Throwball – History and development
2. Rules of the Game, Play Area & dimensions
3. Fundamental Skills – Throwing, Receiving
4. Sports Specific fitness and warmup drills
5. Stances and footwork
6. Preparatory Drills and Fun Games
7. Gameplay: Shots, throws, movements, control

References:

1. World Throwball Federation – Rules of the Game

Course Outcomes:

1. Learn to play Throwball
2. Understanding of the fundamental concepts such as rules of play, game variations
3. Understanding of the governing structure and administration of the sport
4. Understand the event management of the sport
5. Apply sport concepts into an active physical lifestyle

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2				3				
CO2							2				
CO3		3	3				2				
CO4					2		2				
CO5				3	2		3				

Note: 1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

APPROVED IN:

BOS :19-07-2021 **ACADEMIC COUNCIL:19-07-2021**

SDG No. & Statement:4

Good Health and Well-being: Ensure healthy lives and promote well-being for all at all ages.

SDG Justification:

The nature of the course facilitates students to engage in various forms of fitness activities and sports-related movements that work on their overall health and wellness. The course focuses on inculcating active living as a lifestyle by making sports fun, engaging and meaningful.

ENVS1001	ENVIRONMENTAL STUDIES	L	T	P	S	J	C
		3	0	0	0	0	3*
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

The course enables the students to adapt eco-centric thinking and actions rather than human-centric thinking on natural resources, their utilization and conservation. The course also focuses on the importance of ecosystems, biodiversity and their degradation led to pollution. This course helps in finding solutions through application of control measures to combat pollution and legal measures to achieve sustainable development.

Course Educational Objectives:

- To impart knowledge on natural resources and its associated problems.
- To familiarize learners about ecosystem, biodiversity, and their conservation.
- To introduce learners about environment pollution.
- To acquaint learners on different social issues such as conservation of water, green building concept.
- To make learners understand about the present population scenario, its impacts and role of informational technology on environment and human health.
- To make learners understand about the importance of field visit.

UNIT 1 Multidisciplinary nature of environmental studies & Natural Resources 10 hours

Multidisciplinary nature of environmental studies Definition, scope and importance. Need for public awareness. Natural resources and associated problems. Uses and over exploitation of Forest resources, Water resources, Mineral resources, Food resources, Energy resources. Role of an individual in conservation of natural resources.

Activity:

1. Planting tree saplings
2. Identification of water leakage in house and institute-Rectify or report
3. Observing any one day of a week as Car/bike/vehicle free day.

UNIT 2 Ecosystem and biodiversity 10 hours

Ecosystem: Structure components of ecosystem: Biotic and Abiotic components. Functional components of an ecosystem: Food chains, Food webs, Ecological pyramids, Energy flow in the ecosystem (10% law), Ecological succession.

Biodiversity: Definition, Biogeographical classification of India, Values of biodiversity: consumptive use, productive use, social, ethical, aesthetic. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching, man wildlife conflicts. Conservation of biodiversity: In – situ and Ex-situ

Activity:

1. Visit to Zoological Park-Noting different ecosystem
2. Biodiversity register- Flora and fauna in the campus

UNIT 3 Environmental Pollution 10 hours

Definition Causes, effects, and control measures of: -Air pollution. Water pollution. Soil pollution. Marine pollution. Noise pollution. Nuclear hazards. Solid waste Management: Causes, effects, and control measures. Role of an individual in prevention of pollution. Pollution case studies.

Activity:

1. Visit to treatment plant and documentation.
2. Documentation of segregation of solid waste-Dry and Wet

UNIT 4 Social Issues and the Environment 10 hours

From Unsustainable to Sustainable development Urban problems related to energy. Water conservation, rainwater harvesting, watershed management. Environmental ethics: Issues and possible solutions. Green building concept.

Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.

Activity:

1. Observing zero hour at individual level-documentation.
2. Eco friendly idols.
3. Rainwater harvesting-creating storage pits in nearby area.

UNIT 5 Human Population and the Environment and Environment Protection Act and Field work 10 hours

Population growth, variation among nations. Environment and human health. HIV/AIDS, Human rights. Value Education. Women and Child Welfare. Role of Information Technology in Environment and human health. Environment Legislation. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. Environmental Protection Act, Issues involved in enforcement of environmental legislation.

Activity:

1. Visit to a local polluted site-industry/agriculture
2. Identifying diseases due to inappropriate environmental conditions

Text Book(s):

1. Erach Bharucha. Textbook of environmental studies for undergraduates courses-Universities Press, India Private Limited. 2019.
2. Kaushik A and Kaushik C.P. Perspectives in Environmental Studies. New Age International Publishers Edition-VI. 2018.
3. Dave D Katewa S.S. Textbook of Environmental Studies, 2nd Edition. Cengage Learning India. 2012.

Additional Reading:

1. Benny Joseph. Textbook of Environmental Studies 3rd edition, McGraw Hill Publishing company limited. 2017.

Reference Book(s):

1. McKinney M.L., Schoch R.M., Yonavjak L. Mincy G. Environmental Science: Systems and Solutions. Jones and Bartlett Publishers. 6th Edition. 2017.
2. Botkin D.B. Environmental Science: Earth as a Living Planet. John Wiley and Sons. 5th edition. 2005.

Journal(s):

1. https://www.tandfonline.com/loi/genv20
2. https://library.lclark.edu/envs/corejournals

Website(s):

https://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf From Climate Science to Action | Coursera

Course Outcomes:

After the completion of the course student will be able to

1. List different natural resources and their uses

2. Summarize the structure and function of terrestrial and aquatic ecosystems.
3. Identify causes, effects, and control measures of pollution (air, water & soil).
4. Function of green building concept.
5. Adapt value education

CO-PO Mapping:

	PO2	PO1	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2							2		
CO2		2				1		2		
CO3			1						1	
CO4				2						1
CO5	1								1	
CO6					2					1

Note: 1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

APPROVED IN: BOS

BOS: 04-07-22 **ACADEMIC COUNCIL:14-07-22**

SDG No. & Statement:

1. SDG-6-Clean water and Sanitation
2. SDG-7-Affordable and clean energy
3. SDG-13 – Climate change
4. SDG-14 – Life below water
5. SDG-15 – Life on Land

SDG Justification:

1. The learner will understand the importance of clean water and sanitation through this course and apply in their daily activities – SDG-6
2. The learner will make use of renewable resources to reduce pollution achieves SDG-7
3. The learner will understand present situation in climate change and takes appropriate steps to combat climate change – SDG-13
4. The learner will understand the existence of life below water – SDG-14
5. The learner will understand to promote sustainable terrestrial ecosystem – SDG15

FINA3001	PERSONAL FINANCIAL PLANNING	L	T	P	S	J	C
		0	0	2	0	0	1*
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	Risk Management in personal financing Fundamentals of Investing Saving money for the future Personal and Family Financial Planning Introduction to Personal Finance Portfolio Selection and Risk Management						

Course Description:

Personal Financial Planning is one of the most significant factors in our lives. It is essential that funds are available as and when required at various stages of life. Unavailability of funds at critical stages of our life leads to financial distress and leads to many medical and non- medical problems. There are certain planned and unplanned events in our life. On the one hand, education of our children, their marriage, our retirement etc. are some of the planned events of our life, but at the same time, some medical urgency, accident or death of an earning member might be some unplanned events. Many of these events are beyond our control, but the availability of funds can be planned to avoid any financial distress. In other words, we cannot stop the rain but can plan for an umbrella.
This course looks at the many challenges an individual faces in a complex financial environment and the rising uncertainties of one's life. It focuses on achieving long-term financial comfort of individual and family through goal setting, developing financial and life strategies, acquiring personal financial planning knowledge and managing risk throughout one's life.

Course Educational Objectives:

- To build students' ability to plan for long-term financial comfort of individual and family through goal setting, developing financial and life strategies.
- To provide students with knowledge on terms, techniques to evaluate investment avenues.
- To build the skill set of the student to enable them to file their tax returns.

UNIT 1 **Basics of Financial Planning**

Financial Planning Meaning, Need, Objectives, Financial Planning Process, Time Value of

Money and its application using excel (NP)

UNIT 2 **Risk and Insurance Management**

Need for insurance, Requirement of insurance interest, Role of insurance in personal finance, Steps in insurance planning, Life and Non-life insurance products, Life insurance needs analysis (NP)

UNIT 3 **Investment Products and Measuring Investment Returns**

Investment Products: Small Saving Instruments, Fixed Income Instruments, Alternate Investments, Direct Equity

Measuring Investment Returns: Understanding Return and its concept, Compounding concept, Real vs Nominal Rate of Return, Tax Adjusted Return, Risk-Adjusted Return (NP)

UNIT 4 **Retirement Planning**

Introduction to the retirement planning process, estimating retirement corpus, Determining the retirement corpus, Retirement Products (NP)

UNIT 5 **Tax Planning**

Income Tax: Income tax principles: Heads of Incomes, Exemptions and Deductions, Types of Assesses, Rates of Taxation, Obligations for Filing and Reporting, Tax aspects of Investment Products, Wealth Tax

Textbooks:

1. National Institute of Securities Management (NISM) Module 1 & XA
2. Madhu Sinha, Financial Planning, 2 Edition, McGraw Hill India
3. Simplified Financial Management by Vinay Bhagwat, The Times Group

References:

1. Personal Financial Planning (Wealth Management) by S Murali and K R Subbakrishna, Himalaya Publishing House.
2. Mishra K.C., Doss S, (2009). Basics of Personal Financial Planning 1e. National Insurance Academy, New Delhi: Cengage Learning.
3. Risk Analysis, Insurance and Retirement Planning by Indian Institute of Banking and Finance.

Course Outcomes:

1. Describe the financial planning process and application of time value of money
2. Application of life and non-life insurance products in financial planning
3. Understand the investment avenues and analysis of investment returns
4. Understand the retirement planning and its application

5. Describe and analysis the Tax Planning

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	1	1	0	0	1	0	0	3	1	1	3
CO2	2	2	0	0	1	1	1	3	1	1	2
CO3	3	2	1	0	1	0	0	3	2	2	3
CO4	3	2	0	1	1	0	1	2	2	3	2
CO5	3	3	0	1	1	1	2	1	2	2	3

Note: 1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

APPROVED IN:

BOS :30-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

LANG1001	COMMUNICATION SKILLS IN ENGLISH – BEGINNERS	L	T	P	S	J	C
		0	0	4	0	0	2*
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

Communication Skills in English (Beginner) is the first of the three-level courses for a developmental enhancement of learners' communication skills in English. This course focuses on giving learners exposure to factual level of comprehension (listening and reading) and application of the learning (Speaking/Writing) with an awareness for social and personality-based variations in communication. In addition to the LSRW skills, the focus of the course is on schematic thinking skills. This course is activity-based and practice-oriented in terms of procedural knowledge of vocabulary and grammatical structure. This syllabus is carefully developed to enable learners to engage in communication in English avoiding errors and be prepared for next level of learning English.

Course Educational Objectives:

- Train learners to listen actively, follow what is spoken in standard English, and answer questions to demonstrate their understanding of the main points of the speech, repeat part of what someone has said to confirm mutual understanding, though occasionally, there may be a need to ask for repetition or clarification. (Bloom's Taxonomy Level/s: 2 & 3)
- Equip learners with the skills to read and comprehend straightforward texts and simple argumentative writing to identify the topic, the desired/relevant information, the main points of the argument, and the major conclusion/s. (Bloom's Taxonomy Level/s: 2 & 4)
- Help learners apply their knowledge and language skills to make mini oral presentations and produce short coherent written texts using appropriate cohesive devices, suitable vocabulary, and grammatical structures. (Bloom's Taxonomy Level/s:3)
- Enable learners to communicate with reasonable accuracy in familiar contexts with adequate fluency and generally good control by equipping them with a repertoire of frequently used vocabulary, structures, and speech patterns. (Bloom's Taxonomy Level/s: 2 & 3)

List of Activities & Tasks for Assessment:

1. Listening to others and getting to know their experiences, interests and opinions

2. Introducing oneself: Salutation, basic information, relating to the context
3. Starting a conversation: Salutation, expressing purpose, expressing gratitude
4. Sharing one's experiences, interests and opinions
5. Reading short newspaper articles for gist
6. Picking new words from an article and working on them to know the meaning and usage
7. Using the new (unknown) words in own sentences
8. Sharing news with others – initiate, sustain and conclude
9. Understanding the relevance of intonation to meaning from recorded conversations, and applying the learning in pair work (role play)
10. Writing a summary of a story/personal narrative after listening to it twice and making individual notes
11. Reading graphs, charts and maps for specific information, making note of the important information and talking briefly about it within a small peer group
12. Writing a paragraph about oneself: a brief profile including major successes, failures, and goals. Giving compliments/gratitude to others
13. Writing a paragraph (descriptive, complimentary) about others (Family, friends, role model, etc.)
14. Correcting each other's' drafts: errors in language – word choice, structure, and conventions/etiquette
15. Writing a short structured descriptive/narrative essay in 3 paragraphs, reading others' essays, and sharing feedback

References:

1. V. Sasikumar, P. Kiranmayi Dutt, Geetha Rajeevan. (2007). Listening and Speaking – Foundation Books Cunninhum, S. & Moor, P. (nd). New Cutting Hedge (Intermediate). Longman
2. Cambrdige Academic English: An Integrated Skills Course for EAP (Intermediate) By Craig Thaine, CUP (2012)
3. Rutherford, Andrea J. (2007). Basic Communication Skills for Technology: Second Edition. Delhi: Pearson Education.
4. McCarthy, M., O'Dell, F., Mark, G. (2005). English Vocabulary in Use. Spain: Cambridge University Press.
5. New Headway Academic Skills: Reading, Writing, and Study Skills Student's Book, Level-1 by Sarah Philpot. OUP
6. Philpot, S. & Curnick, L. (2017). Headway: Academic Skills: Reaing, Writing, and Study Skills. Introductory Level. OUP.
7. Thaine, C. (2012). Cambridge Academic English: An Integrated Skills for EAP.

Intermediate. CUP.

Online References:

- www.teachingenglish.org.uk
- learnenglishteens.britishcouncil.org
- https://eslflow.com/
- https://www.englishclub.com/
- https://www.oxfordlearnersdictionaries.com/
- https://dictionary.cambridge.org/
- learnenglishteens.britishcouncil.org
- https://freerice.com/categories/nglish-vocabulary

Course Outcomes:

1. Listen actively, understand and extract the essential information from short talks/conversations/discussions that are delivered in clear, standard speech. (Bloom's Taxonomy Level/s: 2 & 3)
2. Read, understand, and extract specific information from straightforward factual and simple argumentative texts on general topics and subjects of interest. (Bloom's Taxonomy Level/s: 2 & 3)
3. Speak clearly with some confidence on matters related to his/her interests and academic work and make short structured oral presentations on topics of personal interest. (Bloom's Taxonomy Level/s: 3)
4. Write short straightforward connected texts on a range of familiar/general topics using appropriate linking devices to achieve a clear sequence of ideas. (Bloom's Taxonomy Level/s: 3)
5. Acquire sufficient language competency to express oneself in speech and writing with some confidence, using appropriate vocabulary and simple grammatical structures though lexical limitations and/or difficulty with formulation might be evident at times. (Bloom's Taxonomy Level/s: 2 & 4)

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	0	2	2	3	0	0	0				
CO2	0	2	2	3	0	0	0				
CO3	0	0	0	3	0	0	0				
CO4	0	0	0	3	0	0	0				
CO5	0	4	2	0	2	2	4				

Note: 1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

APPROVED IN:

BOS :30-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG No. 4: Statement: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

The course aims to remove inequalities among admitted students with regard to basic communication skills in English and provide them communication as well as learning skills that are useful throughout their lives.

LANG1011	COMMUNICATION SKILLS IN ENGLISH	L	T	P	S	J	C
		0	0	4	0	0	2
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

Communication Skills in English (Intermediate) is the second of the three-level graded courses for a developmental enhancement of communication skills in English. Based on the learning outcomes set in the beginner level syllabus, this course focuses on giving learners more exposure to the use of language for communicative purposes and equip them with next level skills (ref. Bloom's taxonomy) and practice in terms of complexity and cognitive engagement. This course also includes inferential level of comprehension (listening and reading) that involves analysis and application of the language skills and decision-making skills while speaking/writing with an awareness for social and personality-based variations in communication. This course emphasizes guided writing through adequate tasks with pre and post context building. The focus is on stimulation and application of critical thinking in addition to schematic thinking for communication in real-life situations.

Course Educational Objectives:

- Train learners to actively listen to short audio texts with familiar content; guided activity like question-making and responding to others' questions based on the audio text would help learners engage in transactional dialogue; extended activities like extrapolating/critiquing the responses would help learners enhance their schematic thinking. (Bloom's Taxonomy Level/s: 2 & 4)
- Equip learners with strategies to read actively and critically and understand the writers' viewpoints and attitude by providing reading comprehension tasks using authentic texts such as op-ed articles from newspapers, and reports on contemporary problems. (Bloom's Taxonomy Level/s: 4 & 5)
- Help learners understand various aspects and techniques of effective presentations (group/individual) through demonstration and modelling, and enabling them to develop their presentation skills by providing training in using the tips and strategies given. Learners would be encouraged to observe and express opinion on teacher-modelling. Reflection on issues like anxiety, stage-fear, confidence, and levels of familiarity with topic and audience would be addressed. Practice would be given on tone, pitch, clarity and other speech aspects. Detailed peer feedback and instructor's feedback would cover all the significant aspects. (Bloom's Taxonomy Level/s: 2 & 4)
- Enable learners to become aware of the structure and conventions of academic writing through reading, demonstration, scaffolding activities, and discussion. Corrective individual feedback would be given to the learners on their writing. (Bloom's Taxonomy Level/s: 2 & 3)

List of Tasks and Activities:

S.No.	Tasks	Activities
1	Listening to subject related short discussions/ explanations/ speech for comprehension	Pre-reading group discussion, Silent reading (Note-making), Modelling (questioning), Post-reading reflection / Presentation
2	Asking for information: asking questions related to the content, context maintaining modalities	Group role-play in a con text (i.e. Identifying the situation and different roles and enacting their roles)
3	Information transfer: Verbal to visual (familiar context), demonstration by teacher, learners' task (guided with scaffolding), learners' task (free), presentation and feedback	Pair work for discussion & feedback, Presentations, question-answer
4	Information transfer: Visual to verbal (unfamiliar context); demonstration by teacher, learners' task (guided with scaffolding), learners' task (free), presentation and feedback	Pre-reading game/modelling, discussion in small groups, individual writing, and feedback
5	Introducing officials to peers and vice versa – Formal context	AV support, noticing, individual performance (3- 4), pair work (in context), teacher modelling, group work for Introducing self and others in a formal context
6	Introducing friends to family and vice versa – Informal context	Teacher modelling/AV support, noticing structure & note-taking, Introducing friends and family in an informal context
7	Vocabulary in context: Find clues in a text and use them to guess the meaning of words/ phrases. Apply the newly learnt vocabulary in communication (speaking and writing).	Comprehending verbal communication: Identifying the contextual clues in oral and written texts; guessing the meaning of words/phrases in context while reading texts and listening to discussions/talks

8	A five-day journal (diary) writing based on learners reading from newspaper on a single relevant/ current social issue. Individual oral presentation and feedback from peers and instructor.	Note-making (group work), Discussion, Feedback
9	Follow the essentials of lectures, talks, discussions, reports and other forms of academic presentations and mak2 individual and group presentations aided with images, audio, video, tabular data, etc.	Making power point presentation aided with images, audio, video, etc. with a small group by listening to academic lectures/talks/ discussions, etc.
10	Self-reflection: Re-reading one's own drafts, identifying errors, correcting the errors, and giving rationalize the changes	Pre-task discussion/modelling, Editing the texts by careful reading and identifying the errors, peer-exchange (Pair work), feedback/consolidation
11	Collaborative work (speaking and writing) in small groups of 3 or 4 learners: discussing a general/ discipline-specific topic: creating outline, assigning specific roles to members of the group; and group presentation followed by peer and instructor feedback	Pre-task modelling (peer/teacher), general discussion on structure, group work (collaboration), feedback
12	Independent reading of different text types using appropriate reference sources by adapting suitable reading styles and speed. Focus on active reading for vocabulary: low-frequency collocations and idiomatic expressions.	Brain-storming, mapping of key terms (content specific), reading and note-making (individual), oral questioning, discussion
13	Role-play (specific social and academic situations): planning (making notes), understanding nuances of speaking in context, coordinating with situational clues	Peer discussion for outline, A-V support, observing (teacher modelling), role play (guided), role-play (free), feedback

	and fellow speakers/participants	
14	Writing instructions: Guidelines – Flowcharts – Procedures to be followed	Pre-task reading, pair work, teacher/peer- discussion, feedback
15	Speaking spontaneously on topics of interest and writing short structured essays on the same topics adopting appropriate academic conventions and grammatical accuracy.	Reading for task preparation, note-making, speaking, reflection and corrective peer and teacher feedback

Reference Books:

1. P. Kiranmayi Dutt, Geetha Rajeevan. (2007). Basic Communication Skills. Foundation Books. CUP
2. Harmer, J. (1998). How to teach English. Longman
3. Sanjay Kumar & Pushp Lata. (2018). Communication Skills: A Workbook. OUP.
4. Cambridge IGCSE: English as a Second Language Teacher's Book Fourth Edition. By Peter Lucantoni. CUP (2014).
5. Cambrdige Academic English: An Integrated Skills Course for EAP (Upper Intermediate) By Martin Hewings, CUP (2012)
6. Richards, J.C. and Bohlke, D. (2012). Four Corners-3. Cambridge: CUP.
7. Headway Academic Skills: Reading, Writing, and Study Skills Student's Book, Level-2 by Sarah Philpot. OUP
8. Latham-Koenig, C. & Oxenden, C. (2014). American English File. Oxfor: OUP.
9. McCarthy, M. & O' Dell. F. (2016). Academic Vocabulary in Use. Cambridge: CUP

Online Resources:

1. https://www.grammarly.com/blog/
2. https://www.nationalgeographic.org/education/
3. https://www.bbc.co.uk/teach/skillswise/english/zjg4scw
4. https://www.englishclub.com/
5. https://www.oxfordlearnersdictionaries.com/
6. https://dictionary.cambridge.org/
7. learnenglishteens.britishcouncil.org
8. https://freerice.com/categories/nglish-vocabulary
9. http://www.5minuteenglish.com/
10. https://breakingnewsenglish.com/
11. https://www.digitalbook.io/

12. https://librivox.org/

Course Outcomes:

1. Understand the speaker's point of view in fairly extended talks on general or discipline-specific topics, and follow simple lines of argument in discussions on familiar contemporary issues. (Bloom's Taxonomy Level/s: 3)
2. "Read and demonstrate understanding of articles and reports on limited range of contemporary issues in which the writers adopt particular stances. Also provide samples of written communication containing fairly complex information and reasons for choices/opinions/stances. (Bloom's Taxonomy Level/s: 2 & 3)"
3. Make short presentations on a limited range of general topics using slides, and engage in small group discussions sharing experiences/views on familiar contemporary issues and give reasons for choices/opinions/plans. (Bloom's Taxonomy Level/s: 3 & 4)
4. Write clear, fairly detailed text (a short essay) on a limited range of general topics, and subjects of interest, and communicate clearly through email/letter to seek/pass on information or give reasons for choices/opinions/plans/actions. (Bloom's Taxonomy Level/s: 3)
5. Reflect on others' performance, give peer feedback on fellow learners' presentations, responses to writing tasks and reading comprehension questions. (Bloom's Taxonomy Level/s: 5)

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	0	3	0	3	0	3	0				
CO2	0	2	0	3	2	2	0				
CO3	4	3	3	3	3	3	4				
CO4	0	3	3	3	3	3	0				
CO5	5	0	5	0	0	0	0				

Note: 1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

APPROVED IN:

BOS :30-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG No. 4: Statement: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

The course aims to remove inequalities among admitted students with regard to basic communication skills in English and provide them communication as well as learning skills that are useful throughout their lives.

LANG1021	ADVANCED COMMUNICATION SKILLS IN ENGLISH	L	T	P	S	J	C
		0	0	4	0	0	2
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

Communication Skills in English (Advanced) is the third of the three-level graded courses for a developmental enhancement of communication skills in English. Based on the learning outcomes set in the upper-intermediate syllabus, this course focuses on giving learners exposure to higher level of skills/input processing (ref. Bloom's taxonomy) and practice in terms of complexity and cognitive engagement. This course includes advanced level of comprehension i.e. analytical, evaluative and extra-pollutive processing (listening and reading) and involves problem-solving, logical reasoning and decision-making skills in terms of application of the learning (speaking/writing) with an awareness for social and personality based variations in communication. This course provides opportunities with activity-based practice of advanced oral and written communicative skills besides building awareness on the finer nuances of language use for various purposes. This course emphasizes free writing through meaningfully engaging tasks with a pre and post context building. There is ample scope for application of critical thinking through simulated activities for effective communication in real life situations.

Course Educational Objectives:

- Enable learners to listen actively become aware of tone and attitude in speech, and demonstrate their comprehension of fairly complex lines of argument presented by a variety of speakers in talks/presentations/discussions. (Bloom's Taxonomy Level/s: 2 & 4)
- Enable learners to become aware of tone and attitude in written texts, and demonstrate their comprehension of fairly complex lines of argument and points of view presented in a variety of texts by equipping them with upper intermediate to advanced level reading skills and strategies. (Bloom's Taxonomy Level/s:2 & 3)
- Make effective presentations, engage in formal group discussions, and write structured essays/ short reports to highlight the significance of actions/decisions/experiences, and sustain views by providing relevant evidence and argument. (Bloom's Taxonomy Level/s: 3 & 4)
- Equip learners with the skills and strategies to communicate effectively in speech and writing using the language with a degree of fluency, accuracy and spontaneity,

and fairly good grammatical control adopting a level of formality appropriate to the context. Encourage learners to apply their knowledge of language and their communication skills in real life situations. (Bloom's Taxonomy Level/s:3 & 5)

List of Activities & Tasks for Assessment:

S.No.	Tasks	Activities	CO
1	Evaluative and extrapolative reading of a long text/short texts on a current topic related to technology and society, identifying and questioning the author's intention, post- reading discussion in small groups, maintaining group dynamics, arriving at a consensus	Pre-reading group discussion, silent reading (Note-making), modelling (questioning), post-reading reflection and brief presentation of thoughts/ideas/opinions on the theme of the text	3
2	Debate in pairs based on listening to two recorded contemporary speeches by well- known leaders in different fields. Peer feedback and instructor feedback.	Pre-recorded audio/video for listening, student checklist for noticing key words/concepts, pre-task orientation (by teacher), pair work, feedback	1
3	Information transfer: Verbal to visual (unfamiliar context); demonstration by teacher, learners' task (guided with scaffolding), learners' task (free), presentation, question-answer (among students), modification and feedback before the final version is done	Pair work for discussion and feedback, presentations, question-answer	2
4	Information transfer: Visual to verbal (unfamiliar context); demonstration by teacher, learners' task (guided with scaffolding), learners' task (free), presentation, question-answer(among students), modification, editing, proofreading, and feedback before the final version is done	Pre-reading game/ modelling, discussion in small groups, independent writing and feedback	4

5	Expressing opinion on a short argumentative text (e.g. a journal article or a newspaper editorial) and justifying one's opinion/stance; focus on the use of appropriate conventions of formal and polite speech, and managing bias	Listening to group discussions/ debates, reading news-paper articles on the current issues and expressing opinions in favour or against the topic (in GDs, debates or writing argumentative essays).	3
6	Role-play (complex social and academic/professional situations): Focus on significant aspects of delivery including clarity, tone, and use of contextually appropriate vocabulary and conventions, observation, reflective discussion, and self- reflective writing	Reading newspaper/ magazine articles/ blog posts on current social issues, listening to talks/ discussions/ debates etc. and participating in role-plays using expressions appropriate to the context.	1
7	Collaborative writing in groups of 3 - 4 on topics that would require data collection and reading followed by recorded peer-reflection and peer-feedback, group presentation and feedback	Pre-task modelling (peer), general discussion on structure, group work (collaboration), presentation, peer feedback, Open-class discussion	5
8	Formal Group Discussion on topics of current interest and relevance; focus on effective participation, reflection on control over argument/ counter argument, and adherence to the conventions of formal GD	Noticing strategies from AV modelling, teacher scaffolding though open-house discussion, Note-making (Group work), Group Discussion (free), post performance discussion, Feedback	2
9	Mind-mapping for advanced reading, making correlations across texts, extending author's point of view	Reading texts on abstract topics and comprehending the author's perspective by inferring the unknown words' meaning in the context and making notes using mind-map strategy and presenting it orally.	3
10	Handling question and answer sessions after presentations: justifying arguments, taking counter-arguments, agreeing and disagreeing	Listening to some lectures, talks, and presentations in the academic seminars and adapting some	1

	with rationale	strategies to handle the Q&A sessions using polite and formal expressions to agree or disagree with the statements.	
11	Modelling an interview: with a panel of four judges (peers)	Pre-task activity for orientation/ strategies (controlled/guided), Model interview (AV support), Group work (role play), interview in pair (one-to-one), Interview in group (many -to-one), oral corrective feedback (peer/ teacher)	2
12	Writing a short reflective report of an event – incident/ meeting/ celebration	Writing a report on meetings/ celebrations/ events etc. by actively involving in such events and giving a short oral presentation on the same.	4
13	Speaking on abstract and complex topics beyond his/her own area of interest/field of study, using the language flexibly and effectively.	Reading texts on abstract topics and comprehending the author's perspectives. Similarly, listening to talks and discussions on an abstract topic of other discipline and making short oral presentation by sharing views and opinions.	3
14	Self-reflection on own speech in context(recorded): tone, pitch, relevance, content; extending the reflections/ideas to others	Listening to selected general discussions (audios and videos) and observing the language production. Recording own speech on some general topic and providing a critical review (self-reflection) on it by focusing on the tone, expressions and relevance of the content, etc.	1
15	Collaborative and individual task: planning, preparing (preparing an outline, structure, setting objectives and presenting the plan of action) and executing a mini-project, and	Pre-task modelling (peer/teacher), general discussion on structure, group work (collaboration), oral corrective, task distribution, presentation, feedback	5

	submitting a brief report on the same peer and instructor feedback after the planning stage and on completion of the mini project		

Reference Books:

1. Latham-Koenig, C. & Oxenden, C. (2014). American English File-5. Oxford: OUPRichards,
2. J.C. and Bohlke, D. (2012). Four Corners-4. Cambridge: CUP.
3. Cambrdige Academic English: An Integrated Skills Course for EAP (Advanced) By Martin Hewings and Craig Thaine, CUP (2012)
4. Berlin, A. (2016). 50 Conversation Classes: 50 Sets of Conversation Cards with an Accompanying Activity Sheet Containing Vocabulary, Idioms and Grammar. Poland: CreateSpace Independent Publishing Platform
5. Zemach, D. E., Islam, C. (2011). Writing Paragraphs: From Sentence to Paragraph. Germany: Macmillan Education.
6. Stewart, J. P., Fulop, D. (2019). Mastering the Art of Oral Presentations: Winning Orals, Speeches, and Stand-Up Presentations. United Kingdom: Wiley.
7. Kroehnert, Gary. (2010). Basic Presentation Skills. Sidney: McGraw Hill.
8. Cunninghum, S. & Moor, P. (nd). Cutting Edge (Advanced) With Phrase Builder. Longman Publishers. CUP
9. McCarthy, M & O'Dell, F. (2017). English Idioms in Use (Advanced). Cambridge: CUP.

Online Resources:

1. https://www.grammarly.com/blog/
2. https://www.nationalgeographic.org/education/
3. https://www.bbc.co.uk/teach/skillswise/english/zjg4scw
4. https://www.englishclub.com/
5. https://www.oxfordlearnersdictionaries.com/
6. https://dictionary.cambridge.org/
7. learnenglishteens.britishcouncil.org
8. https://freerice.com/categories/nglish-vocabulary
9. http://www.5minuteenglish.com/
10. https://breakingnewsenglish.com/
11. https://www.digitalbook.io/
12. https://librivox.org/

Course Outcomes:

1. Listen to extended lectures, presentations, and discussions on a wide range of

contemporary issues and demonstrate understanding of relatively complex lines of argument. (Bloom's Taxonomy Level/s: 2)

2. Make presentations using suitable AV aids and engage in formal group discussions on a wide range of topics of contemporary interest, demonstrating awareness of standard/widely accepted conventions. (Bloom's Taxonomy Level/s: 3)
3. Read and demonstrate understanding of the writer's stance/viewpoint in articles and reports on a wide range of contemporary issues and discipline-specific subjects. (Bloom's Taxonomy Level/s: 2 & 4)
4. Write analytical essays on a wide range of general topics/subjects of interest, and engage in written communication (emails/concise reports) to exchange relatively complex information, giving reasons in support of or against a particular stance/point of view. (Bloom's Taxonomy Level/s: 3 & 4)
5. Complete a mini project that necessitates the use of fairly advanced communication skills to accomplish a variety of tasks and submit a report in the given format. (Bloom's Taxonomy Level/s: 4 & 5)

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	0	2	2	0	2	2	0				
CO2	3	3	0	3	0	0	3				
CO3	2	4	0	4	2	2	0				
CO4	3	4	0	4	0	0	3				
CO5	0	4	0	4	0	0	0				

Note: 1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

APPROVED IN:

BOS :30-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG No. 4: Statement: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG Justification:

The course aims to remove inequalities among admitted students with regard to basic communication skills in English and provide them communication as well as learning skills that are useful throughout their lives.

MFST1001	HEALTH & WELLBEING	L	T	P	S	J	C
		0	0	2	0	0	1*
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

The course provides the students a better understanding of the role of a proper diet in maintenance of human health. This course emphasizes the composition of the food, and will help to understand how to exercise, the role of sports and physical fitness in development of a good health. The course also focuses on the importance of emotional well-being and mindfulness. This course helps in teaching the role of yoga in maintenance of physical balance.

Course Educational Objectives:

- To provide an understanding of the relationship between food and nutrition
- To emphasize the role of exercise, sports and physical fitness in obtaining a good health
- To explain about the mindfulness and emotional well being
- To teach the role of yoga and meditation in maintaining the body balance

UNIT 1

Understand the relationship between Food and Nutrition and how food composition affects nutritional characteristics. Knowledge about regulatory principles in determining diets and recommended daily allowances. Understand how to create personalised diet/nutrition plans.

UNIT 2

Understand how exercise, activity and sports helps in developing good health. Experiential exposure to the role of proper, specific nutritional interventions along with structured activities on developing proper physical health. Practical exercises and assignments in sports and exercise regimes.

UNIT 3

Introduction to emotional wellbeing and mindfulness. Teaching of mindfulness practices to reduce stress, increase relaxation and improve mental wellbeing.

UNIT 4

Introduction to Yoga theory and how Yoga helps in maintaining balance in the body. Practice of Yoga and meditation to improve overall emotional and physical balance. Practical yoga exercises and meditation techniques

Course Outcomes:

By the end of the course, student will

1. Learn the role of nutrition and diet in maintaining a good health
2. understand how the exercise, sports and physical activities will improve health
3. learn mindfulness practices for reducing stress
4. know the importance of yoga and meditation

APPROVED IN:

BOS :30-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

PHPY1001	GANDHI FOR THE 21ST CENTURY	L	T	P	S	J	C
		2	0	0	0	0	2*
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course provides the students with basic knowledge on Gandhi's early life, transformations in South Africa and his entry into India's national movement. While going through the social-political, economic, and educational philosophies of Gandhi, the course analyses how his ideologies are relevant even in the 21st century.

Course Educational Objectives:

The objectives of the course are;

- To provide the students with the basic knowledge on Gandhi's life and his philosophies
- To understand the early influences and transformations in Gandhi
- To analyze the role of Gandhi in India's national movement
- To apply Gandhian Ethics while analyzing the contemporary social/political issues
- To appreciate the conflict resolution techniques put forward by Gandhi and its significance in the current scenario.

UNIT 1 MK Gandhi: Childhood and Education

M K Gandhi, Formative Years (1869-1893): Early childhood – study in England – Indian influences, early Western influences.

UNIT 2 From Mohan to Mahatma-South African Experiences

Gandhi in South Africa (1893-1914): South African Experiences – civil right movements in South Africa – invention of Satyagraha – Phoenix settlement- Tolstoy Farm – experiments in Sarvodaya, education, and sustainable livelihood.

UNIT 3 Gandhi and Indian National Movement

Gandhi and Indian National Movement (1915-1947): Introduction of Satyagraha in Indian soil -non- cooperation movement – call for women's participation – social boycott – Quit-India movement – fighting against un-touch ability – Partition of India- independence.

UNIT 4 Gandhi and Sustainable Development

Gandhian Constructive Programs-Eleven Vows-Sarvodaya-Seven Social Sins-Gandhian Economics and Sustainable Development

UNIT 5 Gandhi and Contemporary Issues

Conflict Resolution Techniques of Gandhi-Ecological Challenges and Gandhian solutions-Gandhian Ethics-An Analysis

References:

1. Gandhi, M K. (1941). *Constructive Programme*. Ahmadabad: Navjivan Publishing House
2. Gandhi, M. K. (1948). *The Story of My Experiments with Truth*. Ahmadabad: Navjivan Publishing House
3. Gandhi, M K. (1968). *Satyagraha in South Africa*. Ahmadabad: Navjivan Publishing House.
4. Khoshoo, T N (1995). *Mahatma Gandhi: An Apostle of Applied Human Ecology*. New Delhi:TERI
5. Kripalani, J.B. (1970). *Gandhi: His Life and Thought*. New Delhi: Publications Division.
6. Narayan, Rajdeva (2011). *Ecological Perceptions in Gandhism and Marxism*. Muzaffarpur: NISLS
7. Pandey, J. (1998). *Gandhi and 21st Century*. New Delhi: Concept.
8. Weber, Thomas (2007).Gandhi as Disciple and Mentor. New Delhi: CUP

Course Outcomes:

After the successful completion of the course the students will be able to;

1. Understand the life of Gandhi
2. Appreciate the role of Gandhian non-violence and Satyagraha in India's freedom struggle.
3. Critically examine the philosophy of Gandhi on Education, Sarvodaya, and Satyagraha
4. Analyse the contemporary significance of Gandhian constructive programmes and eleven vows
5. Examine the possible solutions for some of the contemporary challenges like environmental issues, moral degradation and ethical dilemmas.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3	3	3	3	3	3	2	2
CO2	3	3	2	3	2	3	3	3	3	2	3
CO3	3	3	3	2	3	2	2	3	3	2	2
CO4	3	2	2	3	3	2	2	3	3	2	3

CO5	3	3	2	2	3	3	3	3	3	3	2

Note: 1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

APPROVED IN:

BOS :30-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

POLS1001	INDIAN CONSTITUTION AND HISTORY	L	T	P	S	J	C
		2	0	0	0	0	2*
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

This course analyses the basic structure and operative dimensions of the Indian Constitution. It explores various aspects of the Indian political and legal system from a historical perspective highlighting the various events that led to the making of the Indian Constitution. The course also deals with various challenges faced by the constitution and its coping mechanisms. Broadly, the students would understand and explain the working of different institutions and political debates ensuing from the operation of the Indian constitution in action.

Course Educational Objectives:

- To introduce constitutional history of India.
- To explain the process of making Indian constitution
- To analyze Fundamental of Rights, Duties and other principles in constitution
- To create familiarity with political developments which shaped the constitution.

UNIT 1 **India as a Nation** **6 hours**

Khilani, S. (2004). *Introduction, The Idea of India*, Chapter 1. New Delhi: Penguin Books,

pp. 1-15.

Rowat, D. (1950). 'India: The Making of a Nation', International Journal, 5(2), 95-108. Doi:10.2307/40194264

Brass, P. (2018). 'Continuities and Discontinuities between pre- and post-Independence India', Chapter 1.

The Politics of Idea since independence, New Delhi: Cambridge University Press. Pp. 1-30.

UNIT 2 **Understanding the Constitution** **6 hours**

Mehta, U.S. (2011). 'Constitutionalism' in *The Oxford Companion to Politics in India*, (ed) by Nirja Gopal Jayal, and Pratap Bhanu Mehta, New Delhi: Oxford University Press. Pp. 15-27.

Austin, G. (2016), 'The Constituent Assembly: Microcosm in Action' *in The Indian Constitution: Cornerstone of a Nation*, New Delhi: Oxford University Press, pp. 1-25.

Beteille, Andre (2008): "Constitutional Morality," *Economic and Political Weekly*, Vol 43, Issue No 40

Prahladan, Vivek (2012): "Emergence of the Indian Constitution," *Economic and Political Weekly*, Vol 47, Issue No 07.

UNIT 3 The Preamble, Fundamental Rights and Directive Principles of State Policy **6 hours**

Bhakshi, P.M. (2011). 'Preamble' in *The Constitution of India*, New Delhi: Universal Law. Pp. 1-5. Laxmikanth, M. (2017). 'Chapter IV: Preamble of the Constitution' in *Indian Polity*, Chennai: McGraw Hills.

Kumar, Virendra (2007): "Basic Structure of The Indian Constitution: Doctrine of Constitutionally Controlled Governance [From Kesavananda Bharati to I.R. Coelho]" *Journal of the Indian Law Institute*, Vol 49, No 3, pp 365-398.

Austin, G (2016), ' ' in *The Indian Constitution: Cornerstone of a Nation*, New Delhi: Oxford University Press, pp.63-105.

Reddy, S (1980). Fundamental Ness of Fundamental Rights and Directive Principles in the Indian Constitution. *Journal of the Indian Law Institute*, 22(3), pp. 399-407.

Bhatia, Gautam (2017): "The Supreme Court's Right to Privacy Judgement," *Economic and Political Weekly*, Vol 52, Issue No 44

UNIT 4 Citizenship **6 hours**

Jayal, N.G. (2019). 'Reconfiguring citizenship in contemporary India' in *South Asia Journal of South Asian Studies*, pp.33-58.

Roy, Anupama. (2010). 'Chapter I: Enframing the citizen in contemporary times' in *Mapping Citizenship in India*, New Delhi: Oxford University Press.

Das, Veena (2010): "State, Citizenship and the Urban Poor," *Citizenship Studies,* Vol 15, pp 319- 333.Valerian Rodrigue

UNIT 5 Separation and Distribution of Powers **6 hours**

Pal, Ruma. (2016). 'Separation of Powers' in *The Oxford Handbook of the Indian Constitution*, (ed) by Sujit Choudhry, Madhav Khosla, and Pratap Bhanu Mehta, Delhi: Oxford University Press.

Bakshi, P. (1956). 'Comparative Law: Separation of Powers in India'. *American Bar Association Journal, 42*(6), 553-595.

Rao, P. (2005). 'Separation of Powers in a Democracy: The Indian Experience'. *Peace Research, 37*(1), 113-122.

Kumar, Ashwani (2019): "Constitutional Rights, Judicial Review and Parliamentary Democracy,"

Economic and Political Weekly, Vol 51, Issue 15

Tillin, Louise. (2015). 'Introduction' in *Indian Federalism*. New Delhi: Oxford University Press. Pp. 1-30.

Chakrabarty, Bidyut and Rajendra Kumar Pandey. (2008). *Federalism' in Indian Government and Politics*, New Delhi: Sage Publications. Pp. 35-53.

Arora, B. and Kailash, K. K. (2018). 'Beyond Quasi Federalism: Change and Continuity in Indian Federalism', in *Studies in Indian Politics*, pp. 1-7.

Agrawal, Pankhuri (2020): "COVID-19 and dwindling Indian Federalism," *Economic and Political Weekly,* Vol 55, Issue No 26

Recommended Readings:

De, Rohit. (2018). *A People's Constitution – The Everyday Life of Law in the Indian Republic*, USA: Princeton University Press.

Granville Austin, *The Indian Constitution: Cornerstone of a Nation*, Oxford University Press, Oxford, 1966.

Lahoti, R.C. (2004). *Preamble: The Spirit and Backbone of the Constitution of India*. Delhi: Eastern Book Company.

Rajeev Bhargava (ed), *Ethics and Politics of the Indian Constitution*, Oxford University Press, New Delhi, 2008.

Subhash C. Kashyap, *Our Constitution*, National Book Trust, New Delhi, 2011. Tillin, Louise. (2015). *Indian Federalism*. New Delhi: Oxford University Press.

Zoya Hassan, E. Sridharan and R. Sudarshan (eds), *India's Living Constitution: Ideas, Practices, Controversies*, Permanent Black, New Delhi, 2002.

Course Outcomes:

On the successful completion of the course students would be able to:

1. Demonstrate an understanding of the Constitution of India and how constitutional governance is carried out in India
2. Interpret knowledge of the Fundamental Rights and Duties of the Citizens as well as the Obligation of the state towards its citizens
3. Correlate familiarity with key political developments that have shaped the Constitution and amended it from time to time.

4. Equip themselves to take up other courses in law after having done a foundation course on Indian Constitution

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	1	2	1	2	2	3	3	2	3	1	2
CO2	1	1	2	1	2	2	3	2	3	1	2
CO3	1	2	1	2	2	2	3	1	3	1	1
CO4	1	1	1	2	2	2	3	1	3	1	1
CO5	1	1	1	2	2	2	3	2	3	1	2

Note: 1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

APPROVED IN:

BOS :30-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

SDG Justification:

VEDC1001	VENTURE DEVELOPMENT	L	T	P	S	J	C
		0	0	0	2	0	2
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

India as part of its "Make in India" initiative has been focusing on creating incubation centers within educational institutions, with an aim to generate successful start-ups. These start-ups will become employment creators than employment seekers, which is the need of the hour for our country. This common course (university core) for all the disciplines is a foundation on venture development. It is an experiential course that starts with students discovering their deeper self in terms of how they might contribute to society by creating exciting new products and services that can become the basis of real businesses. The students learn about the emerging areas of knowledge that are the foundations of any successful company. They will learn how to develop insight into the problems and desires of different types of target customers, and from this, to identify the design drivers for a specific innovation. Students will learn specific design methods for new products and services. The students will learn that as important as the product or service itself, is a strategy for monetizing the innovation – for generating revenue, structuring the operating costs, and creating the operating profit needed to support the business, hire new employees, and expand forward. This course is aimed to be the beginning of what might be the most important journey of personal and career discovery so far in a student's life, one with lasting impact. This is not just a course, but potentially, an important milestone in life that a student remembers warmly in the years to come.

Course Educational Objectives:

Students have the opportunity to:

- Discover who they are – Values, Skills, and Contribution to Society
- Understand how creativity works and permeates the innovation process
- Learn the basic processes and frameworks for successful innovation.
- Gain experience in going through the innovation process.
- Conduct field research to test or validate innovation concepts with target customers.

UNIT 1 **PERSONAL DISCOVERY** **4 hours**

Personal Values, Excite & Excel, Build a Team, Define Purpose, Mission Statement

UNIT 2 **IDEATION** **10 hours**

Ideation & Impact, User Insights - Frameworks, Customer Interviews, Interpreting Results

UNIT 3 **SOLUTION DISCOVERY** **8 hours**

Concept Design, Competitive Analysis, Product Line Strategy, Prototyping Solutions, Reality Check

UNIT 4 **BUSINESS MODEL DISCOVERY** **4 hours**

Understand the Industry, Types of Business Model, Define Revenue Models, Define Operating Models, Define Customer Journey, Validate Business Model

UNIT 5 **DISCOVERY INTEGRATION** **4 hours**

Define Company Impact, Create Value, Tell Your Story

Textbooks:

1. Meyer and Lee, "Personal Discovery through Entrepreneurship", The Institute for Enterprise Growth, LLC. Boston, MA., USA.

References:

1. Adi Ignatius (Editor-in-Chief), "Harvard Business Review", Harvard Business Publishing, Brighton, Massachusetts,2021

Course Outcomes:

1. Identify one's values, strengths and weaknesses and their will to contribute to the society
2. Formulate an idea and validate it with customers
3. Demonstrate prototyping and analyse the competition for the product
4. Create business models for revenue generation and sustainability of their business
5. Come up with a pitch that can used as the basis for actually starting a company based on an impactful innovation and societal impact

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1						3	1				
CO2		3		3	1	3	2				
CO3	1	3	3		3		3				
CO4					1	1	3				

CO5					3	3					

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :30-04-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement:

4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

17. Strengthen the means of implementation and revitalize the global partnership for sustainable development.

SDG Justification:

4. The course involves identifying one's personal values and working on real-life problems, thus forming the base to work on their passions even past the collegiate life.

17. The course is developed in collaboration with North-eastern University, USA and the training for the champions is being by North-eastern University.

FACULTY CORE

MATH1151	DIFFERENTIAL CALCULUS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Basic Calculus**						

Course Description:

Differential Calculus provides information about limits, continuity, differentiation and partial differentiation. The focus of the course is to study the limits and continuity, applications of partial differentiation, tracing of curves in Cartesian coordinates and Polar coordinates and mean value theorem on differentiation

Course Educational Objectives:

- Basic properties of continuity and differentiation
- Partial differentiation and application of Euler's theorem Tracing of curves and to find tangents and normals
- Rolle's theorem and mean value theorem
- Expansion of the function using taylor's series and Maclaurin's series

UNIT 1 **8 hours**

Limit and Continuity (i:: and o definition), Types of discontinuities, Differentiability of functions, Successive differentiation, Leibnitz's theorem

UNIT 2 **8 hours**

Partial differentiation, Euler's theorem on homogeneous functions.

UNIT 3 **8 hours**

Tangents and normals, Curvature, Asymptotes, Singular points, Tracing of curves, Parametric representation of curves and tracing of parametric curves, Polar coordinates, and tracing of curves in polar coordinates.

UNIT 4 **8 hours**

Rolle's theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's forms of remainder

UNIT 5 **8 hours**

Taylor's series, Maclaurin's series of sin x, cos x, ex, log(l+x), (l+x) m, Maxima and Minima, Indeterminate forms.

Textbooks:

1. Elements of Real Analysis, Shanthi Narayan and Dr. M.D. Raisinghania,S.Chand& Co.
2. A Text Book of B.Sc. Mathematics Volume-II, V.Venkateswara Rao, N Krishna Murthy,
3. B.V.S.S. Sarma and S. Anjaneya Sastry, S.Chand& Co.

References:

1. Calculus Single Variable, Howard Anton, Ir! Bivens and Stephen Davis, John Wiley and Sons, Inc., 2002.
2. Calculus and Analytic Geometry, George B. Thomas, Jr. and Ross L. Finney, Pearson Education, 2007, 9th edition.

Course Outcomes:

On successful completion of this course, students will be able to:

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	1	1	1	1	1	2	2	1	1	1
CO2	3	1	1	1	1	1	2	2	1	1	1
CO3	3	1	1	1	1	1	2	2	1	1	1
CO4	3	1	1	1	1	1	2	2	1	1	1
CO5	3	1	1	1	1	1	2	2	1	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

The modules and topics mentioned in this course are designed to ensure all-inclusive and thorough education with equity to all persons and promote learning opportunities at all times

CHEM1011	CHEMISTRY I	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

The students of undergraduate program in science in Chemistry need to be conversant with the various fields off chemistry. Therefore, one module each on in general, physical and organic chemistry is introduced which helps the student familiarize with the concepts of chemistry essential for allied and interdisciplinary fields of science.

Course Educational Objectives:

- To introduce the concepts of general chemistry. The students will be conversant with the chemistry of all the elements that is closely knitted with analytical chemistry, physical chemistry, and organic chemistry.

UNIT 1 Atomic Structure 8 hours

Atomic Structure: Review of: Bohr's theory and its limitations, dual behavior of matter and

radiation, de Broglie's relation, Heisenberg Uncertainty principle. What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of ψ and ψ2, Schrödinger equation for hydrogen atom. Graphical representation of 1s, 2s, 2p, 3s, 3p and 3d orbitals. Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy.

UNIT 2 Chemical Bonding and Molecular Structure 8 hours

Ionic Bonding: General characteristics of ionic bonding. Energy considerations in Ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation

of lattice energy. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the Basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.

UNIT 3 Fundamentals of Organic Chemistry 8 hours

Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals. Aromaticity: Benzenoids and Hückel's rule.

UNIT 4 Stereochemistry, Aliphatic Hydrocarbons and Alkanes 8 hours

Conformations with respect to ethane, butane and cyclohexane. Inter conversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; cis – trans nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems).

UNIT 5 Alkenes and Alkynes 8 hours

Aliphatic Hydrocarbons

Functional group approach for the following reactions (preparations & reactions) to be studied.

Alkanes: (Upto 5 Carbons). Preparation: Catalytic hydrogenation, Wurtz reaction. Reactions: Free radical Substitution: Halogenation.

Alkenes: (Upto 5 Carbons) Preparation: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). Addition of HX (Markownikoff's and anti-Markownikoff's addition.

Alkynes: (Upto 5 Carbons) Preparation: Acetylene from CaC2and conversion into Higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal dihalides.

Reactions: formation of metal acetylides, addition of bromine.

Textbooks:

1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd ed., Wiley.

References:

1. Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. Inorganic Chemistry:Principlesof Structure and Reactivity, Pearson Education India, 2006.
2. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition,

3. Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).

4. Eliel, E.L. Stereochemistry of Carbon Compounds, Tata McGraw Hill education,

2000.

5. Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S.
6. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
7. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.

Course Outcomes:

On successful completion of this course, students will be able to:

1. Explain the concepts of atomic theory and arrangement of electrons in orbital level
2. Compare/contrast the properties of molecular and ionic compounds.
3. Write the various reaction mechanisms in organic chemistry and concept of aromaticity.
4. Differentiate the properties of aromatic alcohol, aromatic and aliphatic ether, aldehydes and ketones.
5. To discuss synthetic reactions, mechanism and properties of aromatic alcohol, aromatic and aliphatic ether, aldehydes, and ketones

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	1	1	2	2	2	3	1	3	2	2
CO2	3	2	1	1	3	3	3	1	3	3	1
CO3	3	2	1	1	2	3	2	3	1	2	2
CO4	3	2	2	1	2	3	3	3	2	2	2
CO5	2	2	1	2	3	3	2	3	1	2	1

3 - High Correlation, 2 – Medium Correlation, 1- Low Correlation

APPROVED IN:

BOS : 27/08/2021 **ACADEMIC COUNCIL: 17/09/2021**

SDG 3: Ensure healthy lives and promote well-being for all at all ages.

Statement: The given modules and topics included in this course to design and development of new organic molecules as drugs to combat against diseases to establish sustainable health

CHEM1021	CHEMISTRY LAB I	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

The students of undergraduate program in science in Chemistry need to be conversant with the various basic methodologies of chemistry. Therefore, one module each on in inorganic, physical and organic chemistry is introduced which helps the student familiarize with the techniques essential for developing the foundation of practical chemistry

Course Educational Objectives:

To make student develop the fundamental skill required for quantitative and qualitative analysis in inorganic and organic chemistry.

List of Experiments

Section A: Inorganic Chemistry- Volumetric Analysis

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Estimation of oxalic acid by titrating it with KMnO4.
3. Estimation of water of crystallization in Mohr's salt by titrating with KMnO4.
4. Estimation of Fe (II) ions by titrating it with K2Cr2O7 using internal indicator.
5. Estimation of Cu (II) ions iodometrically using Na2S2O3.

Section B: Organic Chemistry

1. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing up to two extra elements)
2. Separation of mixtures by Chromatography: Measure the Rf value in each case (combination of two compounds to be given)
3. Identify and separate the components of a given mixture of 2 amino acids (glycine, asparticacid, glutamic acid, tyrosine or any other amino acid) by paper chromatography

4. Identify and separate the sugars present in the given mixture by paper chromatography.

Textbooks:

1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.

References:

1. Vogel, A.I., Tatchell, A.R., Fumis, B.S., Hannaford, A.J. & Smith, P.W.G., TextbookofPractical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
2. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.

Course Outcomes:

On successful completion of this course, students will be able to:

1. Estimations of unknown concentrations of acids or bases using neutralization reactions
2. Distinguish the permanganometry, dichrometry and Iodometry
3. Choose the method of detection of extra elements in organic compounds
4. To separate mixture of aminoacids using paper chromatography

Reference Books:

1. Svehla, G. Vogel’s Qualitative Inorganic Analysis, Pearson Education, 2012.

2. Mendham, J. Vogel’s Quantitative Chemical Analysis, Pearson, 2009.

3. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G.,

Textbookof Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.

4. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.

B.Sc. Physical Science

Co-Po Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	2	1	1	3	3	3	1	3	3	1
CO2	3	1	1	2	2	3	3	1	3	3	1
CO3	2	2	1	2	2	3	3	3	2	1	2
CO4	3	2	1	2	2	2	3	3	1	3	3
CO5	3	2	1	1	3	2	3	3	1	3	3

3 - High Correlation, 2 – Medium Correlation, 1- Low Correlation

APPROVED IN:

BOS : 27/08/2021 **ACADEMIC COUNCIL: 17/09/2021**

SDG 3: Ensure healthy lives and promote well-being for all at all ages.

Statement: The given modules and topics included in this course to design and development of new organic molecules as drugs to combat against diseases to establish sustainable health

MATH1151	DIFFERENTIAL CALCULUS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

Differential Calculus provides information about limits, continuity, differentiation, and partial differentiation. The focus of the course is to study the limits and continuity, applications of partial differentiation, tracing of curves in Cartesian coordinates and Polar coordinates and mean value theorem on differentiation.

Course Educational Objectives:

- To introduce Basic properties of continuity and differentiation
- Partial differentiation and application of Euler's theorem
- Tracing of curves and to find tangents and normal
- Rolle's theorem and mean value theorem
- Expansion of the function using Taylor's series and Maclaurin's series

UNIT 1 **8 hours**

Limit and Continuity (ε and δ definition), Types of discontinuities, Differentiability of functions, Successive differentiation, Leibnitz's theorem.

UNIT 2 **8 hours**

Partial differentiation, Euler's theorem on homogeneous functions

UNIT 3 **8 hours**

Tangents and normal, Curvature, Asymptotes, Singular points, Tracing of curves, Parametric representation of curves and tracing of parametric curves, Polar coordinates, and tracing of curves in polar coordinates.

UNIT4 **8 hours**

Rolle's theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's forms of remainder

UNIT 5 **8 hours**

Taylor's series, Maclaurin's series of sin x, cos x, ex, log(l+x), (l+x)m, Maxima and Minima, Indeterminate forms.

Textbooks:

1. "Elements of Real Analysis" by Shanthi Narayan and Dr. M.D. Raisinghania,published by S.Chand& Company Ltd., New Delhi
2. "A Text Book of B.Sc. Mathematics Volume-II" by V.Venkateswara Rao, N Krishna

Murthy, B.V.S.S. Sarma and S. AnjaneyaSastry, published by S.Chand& Company Ltd., New Delhi.

References:

1. "Calculus Single Variable" by Howard Anton, IrlBivens and Stephen Davis, published by John Wiley and Sons, Inc., 2002.
2. "Calculus and Analytic Geometry" by George B. Thomas, Jr. and Ross L. Finney, published by Pearson Education, 2007, 9th edition.

Course Outcomes:

On successful completion of this course, students will be able to:

- Define the basic properties of limits and continuity
- Explain different types of discontinuities
- Trace the parametric curves
- Evaluate Taylor's theorem with Lagrange's and Cauch's forms of remainder
- Evaluate Maxima and minima of a function

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	1	1	1	2	3	3	1	3
CO2	2	1	1	1	1	1	2	3	3	1	3
CO3	2	1	1	1	1	1	2	3	3	1	3
CO4	2	1	1	1	1	1	2	3	3	1	3
CO5	2	1	1	1	1	1	2	3	3	1	3

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:
BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4
Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:
The modules and topics mentioned in this course are designed to ensure all-inclusive and thorough education with equity to all persons and promote learning opportunities at all times

PHYS1111	MECHANICS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Laws of Motion**						

Course Description:

To introduce operators, simple coordinate systems and its relevance to particles, rigid bodies and extending to strings and bars. Introductory aspects of relativity were realized for energy and mass relation

Course Educational Objectives:

- The student will determine equation of motion for systems
- Equation of motion for rigid bodies
- Understand with concepts of Scalar and vector fields.
- Understand new concepts like Fourier coefficients
- Analyze special theory of relativity

UNIT 1 Vector Analysis 8 hours

Scalar and vector fields, gradient of a scalar field and its physical significance. Divergence and curl of a vector field with derivations and physical interpretation. Vector integration (line, surface, and volume), Statement and proof of Gauss and Stokes theorems., Cartesian, Curvilinear and Spherical coordinate systems.

UNIT 2 Mechanics of particles 8 hours

Laws of motion, motion of variable mass system, motion of a rocket. Conservation of energy and momentum, Collisions in two and three dimensions, Concept of impact parameter, scattering cross-section, Rutherford scattering-derivation.

UNIT 3 Mechanics of Rigid bodies and Complex vibrations 8 hours

Mechanics of Rigid bodies:

Definition of rigid body, rotational kinematic relations, equation of motion for a rotating body, angular momentum, Euler equation, precession of a top. Gyroscope, precession of the equinoxes**.**

Complex vibrations

Fourier theorem and evaluation of the Fourier coefficients, Fourier analysis of - square wave, triangular wave, saw tooth wave.

UNIT 4 Vibrating strings and Bars 8 hours

Transverse wave propagation and velocity along a stretched string, Energy transport and transverse impedance. Longitudinal vibrations in bars-wave equation and its general solution. Special cases

i) bar fixed at both ends ii) bar fixed at the midpoint iii) bar free at both ends iv) bar fixed at one end.

UNIT 5 Introduction to Relativity 8 hours

Frame of reference, Galilian transformations, Galilian invariance, Postulates of Special Theory of Relativity, Lorentz transformations of space and time(Qualitative), Length contraction. Time dilation. Relativistic addition of velocities. Variation of mass with velocity, Einstein's Mass energy relation.

Textbooks:

1. B.Sc. Physics Vol.I, Telugu Academy, Hyderabad
2. Mechanics & Properties of Matter, J.C. Upadhyaya, Himalaya Publishing House, Mumbai,2015.
3. Unified Physics Vol.I, Mechanics, Waves & Oscillations, S.L.Gupta and Sanjeev Gupta, JaiPrakash Nath& Co., Meerut

References:

1. Fundamentals of Physics Vol. I - Resnick-Halliday-Krane, Wiley India 2007
2. College Physics-I. T. Bhimasankaram and G. Prasad. Himalaya Publishing House.
3. University Physics-FW Sears, MW Zemansky& HD Young, Narosa Publications, Delhi
4. Mechanics, S.G.Venkatachalapathy, Margham Publication, 2003

Course Outcomes:

On successful completion of this course, students will be able to:

1. Applying different type of operators and understanding coordinate systems
2. Understand motion of particles and interpret its conservation laws
3. Realize rigid bodies for its equation of motion
4. Analyze equation of motion of strings and bars
5. Understand the concept of relativity

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	0	0	0	0	1	1	2	2	1	1
CO2	2	0	0	0	0	1	1	2	2	1	1
CO3	2	0	0	0	0	1	1	3	3	1	1
CO4	2	0	0	0	0	1	1	3	3	1	1
CO5	2	0	0	0	0	1	1	3	3	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 30-03-2022 **ACADEMIC COUNCIL: 01-04-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification: Student develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS1121	MECHANICS LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Laws of Motion**						

Course Description:

The course is intended to determine the various physical constants using simple experiments and understand the governing laws in these experiments.

Course Educational Objectives:

- Understand principle of acceleration due to gravity
- Determine physical constants
- Analyze and Interpret physical laws of motion

List of Experiments

1. Determination of' g' by compound/bar pendulum
2. Determination of the force constant of spring.
3. Time period of simple pendulum (L-T and L-T^2 graph)
4. Verification of laws of vibrations of stretched string -sonometer
5. Determination of velocity of transverse wave along a stretched string-sonometer
6. Determination of frequency of a electrically driven tuning fork -Melde's experiment.
7. Rigidity modulus of material of a wire-dynamic method (torsional pendulum) Flywheel
8. Determination o fY of bar (metal Scale) -cantilever.
9. Simple pendulum normal distribution of errors-estimation of time period and the error of the mean by statistical analysis

Course Outcomes

1. Understand the use of vernier caliper, screw gauge and travelling microscope.
2. Learn the concept of Moment of Inertia.
3. Understand use of Pendulums.
4. Understand the physical meaning of ‘g’.
5. After acquiring knowledge of how to handle measuring instruments student shall embark on verifying various principles learnt in theory.

CO-PO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PS O1	PS O2	PS O3	PS O4
CO 1	2	0	0	0	1	1	1	2	2	1	1
CO 2	2	0	0	0	1	1	1	2	2	1	1
CO 3	2	0	0	0	1	1	1	2	3	1	1
CO 4	2	0	0	0	1	1	1	3	3	1	1
CO 5	2	0	0	0	1	1	1	3	3	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :01-02-2022 **ACADEMIC COUNCIL:01-04-2022**

SDG No. & Statement: 4 & Quality Education

SDG Justification: Student develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS1131	BASIC CIRCUIT THEORY	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Analyze Electric circuits**						

Course Description:

Understanding of Basics of Electronic Circuits and mathematical and graphical solutions to Electrical Circuits.

Course Educational Objectives:

1. To explain the basics of Circuit theory and circuit analysis
2. To develop an understanding of the fundamental laws and elements of electrical circuits.
3. To learn the energy properties of electric elements and the techniques to measure voltage and current.
4. To develop the ability to apply circuit analysis to DC and AC circuits.
5. To understand RLC circuits.

UNIT 1 A.C Circuit Fundamentals and Passive Networks 8 hours

A.C Circuit Fundamentals

The sinusoidal voltage and current-Average and R.M.S values- phasor representation- T operator, polar and rectangular forms of complex numbers, AC applied to RC, RL and RLCcircuits, concept of impedance- power factor in a.c circuits, numerical problems.

Passive Networks

Concept of ideal as well as practical voltage and current sources, Regulation Kirchhoffs current

law - Kirchhoff's voltage law - Method of solving A.C and D.C circuits by Kirchhoffs laws - Loop analysis - Nodal analysis - numerical problems.

UNIT 2 **Network Theorems** **8 hours**

Maximum power transfer theorem -Super position theorem - Thevenin's theorem - Norton's theorem - Milliman theorem-Reciprocity theorem- problem solving applications for all the theorems.

UNIT 3 **RC And RL Circuits** 8 hours

Transient response of RL and RC circuits with step input, Time constants. Frequency response of RC and RL circuits, their action as low pass and high pass filters. Passive differentiating and integrating circuits numerical problems.

UNIT 4 **Resonance in Electric Circuits** **8 hours**

Resonance in series and parallel R- L- C circuits. Resonant frequency, Q-factor, Bandwidth, selectivity, Comparison of series and parallel resonance, Tank circuit-LC oscillations.

Numerical problems.

UNIT 5 **Cathode Ray Oscilloscope** **8 hours**

CRT and its working, Electron gun, electrostatic and magnetostatic deflections. Deflection sensitivity, Fluoroscent screen, CRO block diagram, Measurement of voltage, frequency and phase, Function generator-Block diagram and its description.

Textbooks:

1. Electric circuits by David A. Bell 7thedition Oxford higher education
2. Robert L Boylestad, "Introductory circuit analysis", Universal Book Stall Fifth edition,2003.
3. Circuit analysis by P.Gnanasivam-Pearson education.

References:

1. Networks, lines&fields by Ryder-PHI
2. Circuits and Networks-A.Sudhakar and Shyammohan-TMH
3. Unified electronics (Circuit analysis and electronic devices) by Agarwal-Arora.

Course Outcomes:

On successful completion of this course, students will be able to:

1. Understanding of How to generate AC and List the parameters and recall the concept of impedance.
2. Apply the concept of Kirchhoff laws to solve the circuit currents and make use of

network theorems.

3. Understand what the time response of RC networks is and apply to solve the transient analysis problems
4. Analysis of RLC series and parallel circuit, understand the frequency selection circuit and Compare series and parallel resonance
5. Understanding of How the CRO works and make use of CRO for measuring the frequency voltage and phase of AC

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	0	0	0	0	0	1	2	2	1	1
CO2	2	0	0	0	0	0	1	3	3	1	1
CO3	2	0	0	0	0	0	1	2	3	1	1
CO4	2	0	0	0	0	0	1	3	3	1	1
CO5	3	0	0	0	0	0	1	3	3	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 30-03-2022 **ACADEMIC COUNCIL: 01-04-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification: Student develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS1141	BASIC CIRCUIT THEORY LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Understanding and analyze Electric circuits**						

Course Description:

The course describes the basic electrical components, their combinations and the operation in DC and AC circuits.

Course Educational Objectives:

- To develop an understanding of measuring electrical parameters
- To provide hands on experience of electrical circuits
- To develop an understanding of LCR oscillators

List of Experiments

1. Measurement of D.C & A.C voltage, frequency using CRO.
2. Thevenin's theorem - Verification.
3. Norton's theorem - Verification.
4. Maximum power transfer theorem - Verification.
5. CR Circuit - Frequency response (Low pass and High pass)
6. LR Circuit- Frequency response (Low pass and High pass)
7. LCR Series resonance circuit - frequency response, Determination of Q and Band width
8. LCR parallel resonance circuit - frequency response, Determination of Q and Band width.
9. Verification of Kirchhof's laws**.**

Course Outcomes:

1. Understand what the time response of RC networks
2. apply to solve the transient analysis problems
3. Analysis of RLC series and parallel circuit
4. understand the frequency selection circuit and Compare series and parallel resonance
5. Understanding of How the CRO works and make use of CRO for measuring the frequency voltage and phase of AC

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	0	0	0	1	1	1	2	2	1	1
CO2	2	0	0	0	1	1	1	2	2	1	1
CO3	2	0	0	0	1	1	1	2	3	1	1
CO4	2	0	0	0	1	1	1	3	3	1	1
CO5	2	0	0	0	1	1	1	3	3	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :01-02-2022 **ACADEMIC COUNCIL:01-04-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification: Student develop their attributes and skills towards enhancing personality contributing towards scientific community

MATH1161	**DIFFERENTIAL CALCULUS LAB**	**L**	**T**	**P**	**S**	**J**	**C**
		0	**0**	**2**	**0**	**0**	**1**
Pre-requisite	**None**						

Co-requisite	**None**
Preferable exposure	**None**

Course Description:

Differential Calculus provides information about limits, continuity, differentiation, and partial differentiation. The focus of the course is to study the limits and continuity, applications of partial differentiation, tracing of curves in Cartesian coordinates and Polar coordinates and mean value theorem on differentiation.

Course Educational Objectives:

- To introduce Basic properties of continuity and differentiation
- Partial differentiation and application of theorem
- Tracing of curves and to find tangents and normal
- Rolle's theorem and mean value theorem
- Expansion of the function using series and series

1. Problems on Limits and Continuity
2. Problems on Partial differentiation
3. Problems on Euler's theorem
4. Problems on Tangents and normals
5. Tracing of curves
6. Problems on Rolle's theorem
7. Problems on Mean value theorems
8. Problems on Taylor's theorem
9. Problems on Taylor's and Maclaurin's series
10. Problems on Maxima and Minima

Course Outcomes:

On successful completion of this course, students will be able to:

1. Define the basic properties of limits and continuity
2. Explain different types of discontinuities
3. Trace the parametric curves
4. Evaluate Taylor's theorem with Lagrange's and Cauchy's forms of remainder
5. Evaluate Maxima and minima of a function

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	1	1	1	1	1	2	2	1	1	1
CO2	3	1	1	1	1	1	2	2	1	1	1
CO3	3	1	1	1	1	1	2	2	1	1	1
CO4	3	1	1	1	1	1	2	2	1	1	1
CO5	3	1	1	1	1	1	2	2	1	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 13-09-2021 **ACADEMIC COUNCIL: 17-09-2021**

SDG No. & Statement: 4

Ensuing an inclusive and equitable quality education for all persons and promoting lifelong learning opportunities

SDG Justification:

The modules and topics mentioned in this course are designed to ensure all-inclusive and thorough education with equity to all persons and promote learning opportunities at all times

PHYS1231	**BASIC INSTRUMENTATION SKILLS**	**L**	**T**	**P**	**S**	**J**	**C**
		2	**0**	**0**	**0**	**0**	**2**

Pre-requisite	**None**
Co-requisite	**None**
Preferable exposure	**Various aspects of Electronic Instruments and handling it**

Course Description:

To study and understand the basics of various electronic instruments

Course Educational Objectives:

- To know the basics of electronic and electrical components
- To get hands on experience with the electronic components
- To understand the basic operation and application of PN diode and BJT
- To learn construction and working of power supply
- To know the basics of electric motors and heaters.

UNIT 1 Fundamental quantities and components 8 hours

Fundamental and derived units, accuracy, precision, sensitivity. Electric Current and Voltage, DC current and Battery, AC generation, Resistance, Inductance, Capacitance, Ohms Law. Series and Parallel resistance circuits, voltage and current calculations in a resistive circuit.

UNIT 2 Measurement of electrical quantities 8 hours

Measurement of DC and AC Voltage and Frequency using CRO. Galvanometer basic principle, connection of Ammeter and Volt meter in a circuit. Difference between analog and Digital meters. Bridge circuits to measure R, L and C. Power calculation and maximum power transfer theorem.

UNIT 3 Basic electronic components 8 hours

Types of Materials: Conductors, Semiconductors and Insulators, N-type and P-Type Materials. Fabrication process of PN junction device, PN Diode, Zener diode characteristics and applications. BJT construction and types (no configurations), BJT as a simple Switch, Basic logic gates AND, OR and NOT using diodes and BJT.

UNIT 4 Rectifier and power supply 8 hours

Amperes Law, Faradays Law, Lenz's Law, Electromagnetic Induction, Transformer basic Principle and types. Half wave and Full Wave rectifiers (basic working only), Voltage regulator, Construction of Basic DC power supply.

UNIT 5 Basic Electrical components and devices 8 hours

Different types of conductor-cables and Insulation, Switches and Relays. Fuses and disconnect switches, Circuit breakers, Preparation of extension board. Electrical geyser construction working principle. Basic Principle of a motor it's working. Construction working principles of electric mixer,

Textbooks:

1. Principles of Electric circuits, Thomas L Floyed, 9th Edition. Pearson,
2. Electronic devices and circuit theory, Robert L Boylsted, 11th Ed. Pearson.
3. Electrical and Electronic Measurements and Instrumentation by Sawhney, 3rd Edition, Dhanpat Rai Publications.,

References:

1. A text book in Electrical Technology -B L Theraja -S Chand and Co.
2. Performance and design of AC machines-MG Say ELBS Edition
3. Digital Circuits and systems, Venugopal, 2011, Tata McGr

Course Outcomes:

On successful completion of this course, students will be able to:

1. Recall the fundamental Units, measurements and semiconductor Physics
2. Understand the currents and voltages in circuits
3. Calculate the currents and power and unknown component values
4. Applications of PN diode and BJT as switches
5. Understand basic Electrical wiring, switches and appliances

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	1	2	2	3	2	1	1	2	2	1	3
CO2	2	1	3	1	3	2	2	1	3	2	1
CO3	1	2	1	2	1	1	1	2	1	1	2
CO4	2	3	2	1	2	2	2	3	2	2	1
CO5	3	1	1	2	1	3	3	1	1	3	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :01-02-2022 **ACADEMIC COUNCIL:01-04-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification: Student develop their attributes and skills towards enhancing personality contributing towards scientific community

Programme Core

PHYS1151	WAVES AND OPTICS	L	T	P	S	J	C

		3	**0**	**0**	**0**	**0**	**3**
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Inherent phenomena of light and its activity**						

Course Description:

To introduce the concept of waves and understand the phenomena of light by division of amplitude and division of wave front

Course Educational Objectives:

- To visualize wave motion
- develop intuition about waves
- Interpret various light phenomena

UNIT 1 **8 hours**

Superposition of Two Collinear Harmonic oscillations: Linearity and Superposition Principle. (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats). **Superposition of Harmonic Oscillations**: Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses. **Waves Motion-General**: Group velocity, Phase velocity. Plane waves. Spherical waves (complex notation), Wave intensity.

UNIT 2 **Interference 1:(Division of wave front)** **8 hours**

Principle of superposition, Interference of light, types of interference, Young's experiment, Intensity at a point in a plane, coherence-temporal coherence and spatial coherence-conditions for interference of light, Frenel's Biprism, determination of wavelength of light, determination of thickness of thin film, Llyod's single mirror, Verification of change of phase on reflection.

UNIT 3 **Interference: (Division of Amplitude)** **8 hours**

Oblique incidence of a plane wave on a thin film due to reflected and transmitted light (cosine law)-colors of thin films. Interference by a film with two non-parallel reflecting surfaces (Wedge shaped film). Determination of diameter of wire, Newton's rings in reflected light. Determination of wavelength of monochromatic light, Michelson interferometer-types of fringes, Determination of wavelength of monochromatic light.

UNIT 4 **Diffraction** **8 hours**

Introduction, distinction between Fresnel and Fraunhoffer diffraction, Fraunhoffer diffraction - Diffraction due to single slit and circular aperture-Diffraction grating -Limit of resolution- Resolving power of grating.Fresnel's half period zones-area of the half period zones-zone plate-comparison of zone plate with convex lens-fresnel diffraction at a straight edge-difference between interference and diffraction.

UNIT 5 **Polarization** 8 hours

Polarized light: methods of polarization by reflection, refraction, double refraction, scattering of light-Brewster's law-Mauls law-Nicol prism polarizer and analyzer-Quarter wave plate, Half wave plate-optical activity and Babinet's compensator

Textbooks:

1. BSc Physics, Vol.2, Telugu Academy, Hyderabad
2. A Text Book of Optics-N Subramanyam, L Brijlal, S.Chand& Co.
3. Unified Physics Vol.II Optics & Thermodynamics - Jai Prakash Nath&Co.Ltd., Meerut

References:

1. Optics, F...A. Jenkins and H.G. White, Mc Graw-Hill
2. Optics, Ajoy Ghatak, Tata Mc Graw-Hill.
3. Fundamentals of Physics. Halliday/Resnick/Walker.C. Wiley India Edition 2007
4. Introduction of Lasers -Avadhanulu, S.Chand& Co.
5. Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publication
6. Principles of Optics- BK Mathur, Gopala Printing Press, 1995

Course Outcomes:

On successful completion of this course, students will be able to:

1. Understanding superposition principle and Analyze the relation between inherent parameters of wave
2. Applying and analyze interference of light for optical parameters and construct optical instruments
3. Applying and analyze interference of light for optical parameters and fringes
4. To demonstrate the concept of diffraction and applying to different zones of diffraction
5. To understand polarization of light and utilize to different optical instrument

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	0	0	1	2	2	3	2	2	0	2
CO2	3	0	0	1	2	2	3	2	2	0	2
CO3	3	0	0	1	2	2	3	2	2	0	2
CO4	3	0	0	1	2	2	3	2	2	0	2
CO5	3	0	0	1	2	2	3	2	2	0	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 30-03-2022 **ACADEMIC COUNCIL: 01-04-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification: Student develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS1171		**L**	**T**	**P**	**S**	**J**	**C**

	THERMAL PHYSICS AND STATISTICAL MECHANICS	3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Thermal systems and its inclusive phenomena**						

Course Description:

The course provides an introduction to the basic concepts in thermodynamics, various thermodynamic transport phenomena, general thermodynamic property relations and different law for energy spectrum emitted by black body. It develops the problem solving skills in problems in basic thermodynamics.

Course Educational Objectives:

To understand the basic laws of thermodynamics and their application to the non-flow and flow processes, thermodynamic properties of ideal and real gases and thermodynamic probability in gaseous medium

UNIT 1 Kinetic theory of gases: Introduction 8 hours

Deduction of Maxwell's law of distribution of molecular speeds, experimental verification. Toothed wheel experiment. Transport phenomena-Viscosity of gases-thermal conductivity-diffusion of gases.

UNIT 2 Thermodynamics 8 hours

Introduction- Isothermal and adiabatic process- Reversible and irreversible processes-Carnot's engine and its efficiency-Carnot's theorem-Second law of thermodynamics. Kelvin's and Claussius statements-Thermodynamic scale of temperature-Entropy, physical significance –Change in entropy in reversible and irreversible processes-Entropy and disorder- Entropy of Universe-Temperature-Entropy (T-S) diagram-Change of entropy of a perfect gas- change of entropy when ice changes into steam.

UNIT 3 Thermodynamic potentials and Maxwell's equations 8 hours

Thermodynamic potentials-Derivation of Maxwell's thermodynamic relations-Claussius-Clayperon's equation-Derivation for ratio of specific heats-Derivation for difference of two specific heats for perfect gas. Joule Kelvin effect-expression for Joule Kelvin coefficient for perfect and Vanderwaal's gas.

UNIT 4 Black body radiation 8 hours

Blackbody-Ferry's black body-distribution of energy in the spectrum of black body-Wien's displacement law, Wein's law and Stefan's law Rayleigh-Jean's law-Quantum theory of radiation-Planck's law-Measurement of radiation.

UNIT 5 Introduction to Statistical Mechanics 8 hours

Phase space, Microstate and Microstate Statistical basis, Probability, Principle of equal apriori probability, Maxwell-Boltzmann statistics, Bose-Einstein statistics, Fermi-Dirac statistics (qualitative treatment), and Entropy and Thermodynamic probability.

Textbooks:

1. BSc Physics, Vol.2, Telugu Academy, Hyderabad
2. Thermodynamics, R.C. Srivastava, Subit K. Saha&Abhay K. Jain Eastern Economy Edition.
3. Unified Physics Vol.2, Optics & Thermodynamics, Jai Prakash Nath&Co.Ltd., Meerut
4. Heat ,Thermodynamics and Statistical Physics, Brij lal, Dr.N Subrahmanyam,P.S. Hemne, S Chand & Co
5. A text Book of Heat J.B.Rajam

References:

1. Fundamentals of Physics. Halliday/Resnick/Walker.C. Wiley India Edition 2007
2. Heat, Thermodynamics and Statistical Physics-N Brij Lal, N Subrahmanyam, PS Hemne, S.Chand& Co.,2012
3. Heat and Thermodynamics- MS Yadav, Anmol Publications Pvt. Ltd, 2000
4. University Physics, HD Young, MW Zemansky,FW Sears, Narosa Publishers, New Delhi
5. Text Book of +3 Physics – Samal, Mishra &Mohanty, National Library, Min.of Culture, Govt of India.
6. Modern Engineering Physics, A.S. Vasudeva, S.Chand& Co.,

Course Outcomes:

On successful completion of this course, students will be able to:

1. Understanding molecular speed distribution and transport in gases.
2. Understanding basic concepts in thermodynamics and solve basic equations
3. Understanding and applying Maxwell thermodynamic relations and examine temperature change by using Joule – Kelvin effect
4. Understanding and measure energy spectrum emitted by black body.
5. Understanding basic concepts of statistical thermodynamics and analyzing the average distribution of non-interacting material particles
6. Enable to determine optical constants, estimate and illustrate

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	0	0	1	2	2	3	2	2	0	2
CO2	3	0	0	1	2	2	3	2	2	0	2
CO3	3	0	0	1	2	2	3	2	2	0	2
CO4	3	0	0	1	2	2	3	2	2	0	2
CO5	3	0	0	1	2	2	3	2	2	0	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 30-03-2022 **ACADEMIC COUNCIL: 01-04-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification: Student develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS1161	WAVES AND OPTICS LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Implementation of light phenomena**						

Course Description:

This lab focuses on experiments related to the properties and characteristics of waves to understand the phenomena of light by division of amplitude and division of wave front. This course also demonstrates the various phenomena of light such as interference, diffraction and polarization etc.

Course Educational Objectives:

- To visualize wave motion and develop intuition about waves for various light phenomena

List of Experiments

1. Determination of radius of curvature of a given convex lens-Newton's rings.
2. Resolving power of grating.
3. Dispersive power of a prism.
4. Determination of wavelength of light using diffraction grating- minimum deviation method.
5. Wavelength of light using diffraction grating-normal incidence method.
6. Determination of thickness of a thin fiber by wedge method
7. Spectrometer- i-d curve.
8. Cauchy's constants
9. Hallow prism

Course Outcomes:

1. Enable to determine optical constants, estimate and illustrate

1. Apply basic knowledge of principles and theories about the behavior of light and the physical environment to conduct experiments.

2: Explain several phenomena we can observe in everyday life that can be explained as wave phenomena.

3: Use the principles of wave motion and superposition to explain the Physics of polarisation, interference and diffraction.

4: Understand the working of selected optical instruments like biprism, interferometer, diffraction grating, and holograms.

5: In the laboratory course, student will gain hands-on experience of using various optical instruments and making finer measurements of wavelength of light using Newton Rings experiment, Fresnel Biprism etc. Resolving power of optical equipment can be learnt first-hand.

CO-PO Mapping:

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO 1**	**PSO 2**	**PSO3**	**PSO 4**
CO 1	2	0	0	0	1	1	1	2	2	1	1
CO 2	2	0	0	0	1	1	1	1	3	1	1
CO 3	2	0	0	0	1	1	1	2	2	1	1
CO 4	2	0	0	0	1	1	1	3	2	1	1
CO 5	2	0	0	0	1	1	1	2	3	1	1

APPROVED IN:

BOS :01-02-2022 **ACADEMIC COUNCIL: 01-04-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification: Student develop their attributes and skills towards enhancing

personality contributing towards scientific community

PHYS1181	THERMAL PHYSICS AND STATISTICAL MECHANICS LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Implementation and verification of thermal properties**						

Course Description:

This course focuses on basic laws of thermal properties of radiation

Course Educational Objectives:

To learn and perform the experiments to understand the laws of thermal radiation

List of Experiments

1. Specific heat of a liquid –Joule's calorimeter –Barton's radiation correction
2. Thermal conductivity of bad conductor-Lee's method
3. Measurement of Stefan's constant.
4. Specific heat of a liquid by applying Newton's law of cooling correction.
5. Heating efficiency of electrical kettle with varying voltages.
6. Thermoemf- thermo couple potentiometer
7. Coefficient of thermal conductivity of copper- Searle's apparatus.
8. Thermal behaviour of an electric bulb (filament/torch light bulb)
9. Temperature variation of resistance- thermistor.

Course Outcomes:

1. Learn the basic concepts of thermodynamics.

2: Learn the basic concepts of the Thermal Conductivity.

3: Have a knowledge of the real gas equations, Van der Waal equation of state, the Joule-Thompson effect.

4: Learn about the black body radiations, Stefan- Boltzmann's law, Rayleigh-Jean's law and Planck's law and their significances.

5: The students are expected to perform the experiments related to heat transfer.

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	2	0	0	0	1	1	1	2	3	1	1
CO 2	1	0	0	0	1	1	1	1	2	1	1
CO 3	2	0	0	0	1	1	1	1	2	1	1
CO 4	1	0	0	0	1	1	1	1	2	1	1
CO 5	2	0	0	0	1	1	1	2	2	1	1

APPROVED IN:

BOS :01-02-2022 **ACADEMIC COUNCIL: 01-04-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification: Student develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS2001	ELECTRICITY AND MAGNETISM	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**To understand, analyze and overcome technological importance**						

Course Description:

This course is an introduction to physics of electricity and magnetism. This course describes how the forces between the electric charges form the electric and magnetic fields. The course describes the analysis of simple electric circuits.

Course Educational Objectives:

- To introduce the concepts of electric charges, fields and potentials
- To familiarize the students with electric field and the magnetic field concepts
- To understand the relation between electricity and magnetism via electromagnetic induction
- To combine the understanding of fundamental concepts in Electricity and Magnetism more rigorously and their relation to understand the physical systems
- To analyze simple circuits like LR CR and LCR with AC and DC inputs

UNIT 1 **Electric field and potential** **9 hours**

Gauss's law statement and its proof- Electric field due to (1) Uniformly charged sphere (2) an infinite conducting sheet of charge and (3) Uniformly charged cylinder. Electrical potential equipotential surfaces- potential due to i) a point charge, ii) charged spherical shell and uniformly charged circular disc. Electric field strength due to an electric dipole

UNIT 2 Capacitance and dielectrics 9 hours

Electric capacitance - Derivation of expression for capacity of (i) a parallel plate capacitor (ii) a spherical capacitor. Dielectrics- effect of dielectric on the capacity of a condenser, Energy stored in a capacitor. Electric dipole moment and molecular polarizability- Electric displacement D , electric polarization P – relation between D,E and P- Dielectric constant and susceptibility

UNIT 3 Moving charges in electric and magnetic field 9 hours

Hall effect, cyclotron, synchrocyclotron and synchrotron- Force on a current carrying conductor placed in a magnetic field, force and torque on a current loop, Biot-Savart's law, explanation and calculation of B due to long straight wire, a circular current loop and solenoid. Electromagnetic induction: Faraday's law-Lenz's law-expression for induced emf-time varying magnetic field Betatron –Moving coil ballistic galvanometer-theory, working. Self and mutual inductance, coefficient of coupling.

UNIT 4 Varying and alternating currents 9 hours

Growth and decay of currents in LR, CR and LCR dc circuits-critical damping, Alternating current relation between current and voltage in pure R, C and L. LCR series and parallel resonant circuit, Q -factor

UNIT 5 Maxwell's equations and electromagnetic waves 9 hours

A review of basic laws of electricity and magnetism-displacement current. Maxwell's equations in differential form, Maxwell's wave equation, plane electromagnetic waves. Transverse nature of electromagnetic waves. Poynting theorem.

Textbooks:

1. BSc Physics, Vol.3, Telugu Academy, Hyderabad
2. Electricity and Magnetism, D.N. Vasudeva. S. Chand & Co.
3. Unified Physics Vol.3, Electricity, Magnetism and Electronics, S.L. Gupta and Sanjeev Gupta, Jai Prakash Nath& Co., Meerut.

References:

1. Fundamentals of Physics- Halliday/Resnick/Walker - Wiley India Edition2007.

2. Berkeley Physics Course – Vol. II - Electricity and Magnetism – Edward M Purcell–The McGraw-Hill Companies.
3. Electricity and Magnetism Brijlal and Subramanyam. RatanPrakashanMandir.
4. Electricity and Magnetism, C.J. Smith, Edward Arnold Ltd.

Course Outcomes:

On successful completion of this course, students will be able to:

1. Understands the concept of electric flux, interactions of point charges and apply Gauss's law to calculate electric flux.
2. Understand capacitor types and analyze the potential and energy stored in a capacitor.
3. Learns about different particle accelerators cyclotron, synchrotron, betatron
4. Interpret and examine RLC circuits with battery connected and battery Disconnected
5. Examines Maxwell's equations of electromagnetic theory and electromagnetic wave equation for the transfer of electromagnetic energy.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	0	0	1	2	2	3	2	2	0	2
CO2	3	0	0	1	2	2	3	2	2	0	2
CO3	3	0	0	1	2	2	3	2	2	0	2
CO4	3	0	0	1	2	2	3	2	2	0	2
CO5	3	0	0	1	2	2	3	2	2	0	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 01-02-2022 **ACADEMIC COUNCIL:01-04-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification: Student develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS2041	ELEMENTARY MATHEMATICAL METHODS OF PHYSICS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Implement physical phenomena with mathematical methods**						

Course Description:

The course discusses the mathematics required for developing and understanding of fundamental and advanced physics , with emphasis on mathematical structures like vectors, differential equations, complex numbers and functions. A unit on variational calculus is introduced.

Course Educational Objectives:

1. To understand and attribute various mathematics aspects for its application
2. To become familiarize with vector analysis, operators and integrals for application To understand various coordinate systems
3. Apply differential equations for certain specified systems and interpret its solution To understand representation of complex plane for its application

UNIT 1 **Vector Analysis** **12 hours**

Vector identities; scalar and Vector fields; Vector Differentiation: Directional derivatives and normal derivative, Gradient of a scalar field and its geometrical interpretation. Del and Laplacian operators, Divergence and curl ofa vector field; Vector Integration: Ordinary

Integrals of Vectors, Line, surface and volume integrals of Vector fields, Gauss' divergence theorem, Green's and Stokes Theorems.-Problems/applications

UNIT 2 Orthogonal Curvilinear Coordinates 10 hours

Derivation of Gradient, Divergence, Curl and Laplacian in orthogonal curvilinear coordinate system. Calculation of scale factor, calculation of line surface and volume integrals in three coordinate systems. Applications-Gauss Law; Stokes law;

UNIT 3 Applications of Differential Equations 8 hours

Introduction, Linear differential equations and their solution methodologies, Application of Linear differential equations: Harmonic Oscillator, LCR Circuit, Bending of Beams, Applications of Simultaneous Linear equations: Projectile motion with resistance, Coupled Oscillator.

UNIT 4 Complex numbers 15 hours

Brief Revision of Complex Numbers and their Graphical Representation on Argand's diagram. Euler's formula, De Moivre's theorem, Roots of Complex Numbers, Complex algebra, Complex functions: exponential, circular, hyperbolic, logarithmic and inverse of these, Derivative of complex functions, Cauchy- Riemann Equations and analytic functions. Singular functions: poles and branch points, order of singularity, branch cuts, Integration of complex functions, Cauchy Integral theorem and Cauchy integral formula-related problems

UNIT 5 Calculus of Variations 10 hours

Introduction, The Euler Equation, Using the Euler Equation, The Brachistochrone Problem, Cycloids Several Dependent Variables, Lagrange's Equations ,Isoperimetric Problems ,Variational Notation and Miscellaneous Problems

Textbooks:

1. Vector analysis, MR Spiegel, McGraw-Hill, 1974

References:

1. Mathematical Methods for Physicists by Arfken and Weber, Elsevier, Sixth Edition, 2005

Course Outcomes:

On successful completion of this course, students will be able to:

1. To choose various vector operators for its representation and execute to various Applications
2. Understand different coordinate systems and analyze to specific applications

3. Understand and Articulate to differential equations to determine solutions to specific problems
4. Summarize complex numbers for its representation and apply to specific problems
5. Recognize the fundamental concepts of important current mathematical theories.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	0	0	1	1	2	3	2	2	0	2
CO2	3	0	0	1	1	2	3	2	2	0	2
CO3	3	0	0	1	1	2	3	2	2	0	2
CO4	3	0	0	1	1	2	3	2	2	0	2
CO5	3	0	0	1	1	2	3	2	2	0	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 01-02-2022 **ACADEMIC COUNCIL:01-04-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification: Student develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS3001	**Mechanics of System of Particles**	**L**	**T**	**P**	**S**	**J**	**C**
		3	**0**	**0**	**0**	**0**	**3**
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Attributing principle of systems in terms of its configuration**						

Course Description:

Aims to understand particles and its behavior configured to system towards analysis of its equation of motion describing it.

Course Educational Objectives:

1. To understand and interpret with equation of motion the system of particles
2. To identify harmonic oscillators and analyze equations of motion
3. To define central forces and explain equation of motion
4. To understand different coordinate systems and determine its effects in non inertial frame
5. To interpret scattering phenomena for different properties and examine its parameters

UNIT 1 **Mechanics** **9 hours**

Newtonian Mechanics- Newton laws, Inertial and non-inertial frames, Motion under constant force, time- dependent force and velocity dependent force, conservative and non-conservative forces. Application of Newton Laws.

System of Particles- Centre of mass, Conservation of linear and Angular momentum, Relation between angular momentum (J) and angular momentum about centre of mass (JcM). Kinetic energy- work-energy Theorem. Lagrangian and Hamiltonian (Definitions only).

UNIT 2 **Harmonic Oscillators** **9 hours**

Linear oscillators- equation of motion and solutions, Energy of simple harmonic oscillators. Non-Linear Oscillators damped harmonic oscillator- Quality factor, Forced harmonic oscillator, Amplitude resonance and Energy resonance**.**

UNIT 3 **Central Force Motion** **9 hours**

Reduction to one body problem, Lagrangian in central force field in polar coordinates, General Properties of motion under central force. Centrifugal and Effective potential, Classification of orbits, Motion in a central force field- General solution(Energy method)- Inverse Square law force, Kepler's laws, Law of Gravitation from Kepler's Laws.

UNIT 4 **Noninertial coordinate system** **9 hours**

Translating coordinate systems-Fictitious force, Rotating coordinate systems-Coriolis theorem. Motion on rotating earth- static and dynamic effects. Foucault Pendulum- Earth as non-inertial system.

UNIT 5 **Scattering and Fluid Dynamics and Fluids dynamics** **9 hours**

Scattering and Fluid Dynamics

Elastic and Inelastic scattering, Expression for final velocities and value of scattering angle, scattering in central force field- differential and total scattering cross sections, scattering of charged particles by Coulom9 field. Relation between Lab and Centre of mass cross sections.

Fluids dynamics: Archimedes principle, Fluids in motion- Continuity equation, Equation of motion for an ideal fluid flow and Bernoulli's equation.

Textbooks:

1. A.Arya, Introduction to Classical Mechanics, 2nd edition (Pearson, Upper Saddle River, N.J, 1997).
2. G. Aruldhas, Classical Mechanics (PHI learning, Delhi, 2013).

References:

1. D.S. Mathur, Mechanics - for B.Sc. Pass and Honours Classes oflndian Universities (S. Chand & Company, New Delhi, 2009).
2. J.C. Upadhyaya, Classical Mechanics (Himalaya Publishing House, 2019).

Course Outcomes:

On successful completion of this course, students will be able to:

1. Understand Newtonian mechanics and extend to systems of particles for new formalism
2. Identify various types of harmonic oscillators and analyze equation of motion
3. Realize various central forces, classify and interpret the laws
4. Understand different coordinate systems, apply to systems for its solution
5. Understand scattering for various properties and understand new concept of fluid mechanics

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	0	0	1	1	2	2	2	2	0	2
CO2	2	0	0	1	1	2	2	2	2	0	2
CO3	2	0	0	1	1	2	2	2	2	0	2
CO4	2	0	0	1	1	2	2	2	2	0	2
CO5	2	0	0	1	1	2	2	2	2	0	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :01-02-2022 **ACADEMIC COUNCIL:01-04-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification: Student develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS2011	**ELECTRICITY AND MAGNETISM LAB**	**L**	**T**	**P**	**S**	**J**	**C**
		0	**0**	**2**	**0**	**0**	**1**
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Verification of technological phenomena**						

Course Description:

The course describes the experimental idea of simple electric circuits with resistors and capacitors with AC and DC powers. It also describes the working and analysis of circuits.

Course Educational Objectives:

- To verify laws of currents
- Implement network theorems for determination of electrical quantities
- Understand phenomena of conversion of current to voltage
- Analyze magnetic field for coil
- Implement electromagnet for determination of fields

List of Experiments:

1. Verification of Kirchhoff's laws
2. Maximum power transfer theorem
3. Internal resistance of a cell by potentiometer.
4. LCR circuit series resonance, Q factor
5. LCR circuit parallel resonance
6. Conversion of galvanometer into ammeter
7. Conversion of galvanometer into voltmeter.
8. Field along the axis of a circular coil carrying current.
9. Hall probes-Magnetic field measurement (electromagnet calibration

Course Outcomes:

On successful completion of this course, students will be able to:

1. Determine currents and voltages for electrical circuits
2. Analyze phenomena of magnetic field
3. Design of electrical circuits
4. Illustrate phenomena of electromagnet
5. 0bserve conversion of ammeter to voltmeter

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	0	0	0	1	1	1	1	0	0	1
CO2	2	0	0	0	1	1	1	1	0	0	1
CO3	2	0	0	0	1	1	1	1	0	0	1
CO4	2	0	0	0	1	1	1	1	0	0	1
CO5	2	0	0	0	1	1	1	1	0	0	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :01-02-2022 **ACADEMIC COUNCIL:01-04-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification: Student develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS2051	**ELEMENTARY MATHEMATICAL METHODS OF PHYSICS LAB**	**L**	**T**	**P**	**S**	**J**	**C**
		0	**0**	**2**	**0**	**0**	**1**
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Implement physical phenomena with using simulation**						

Course Description:

The course describes the experimental/simulation techniques to justify the mathematical laws.

Course Educational Objectives:

1: To create sets of simultaneous linear equations arising from physical problems.

2: To apply the required mathematical skills to solve problems in quantum mechanics, electrodynamics and other fields.

3: To understand the mathematical expressions which are useful for the development of equipment, structure, and techniques for mankind.

4: The student will be able to analyse advanced techniques of mathematical methods.

5. Analyze solutions

List of Experiments:

1. Determination of Divergence and curl of electric field due to charge
2. Verification of Gauss divergence theorem
3. Determination of Electric flux for spherical surface
4. Numerical solution of linear harmonic oscillator
5. Projectile motion
6. Numerical solution of LCR circuit
7. Numerical solution of damped harmonic oscillator
8. Simulation of LCR circuit

Course Outcomes

1. Learn and understand calculus. Starting with review of differentiation, exponential and logarithm functions, trigonometric functions, plotting functions, differentials and basics of integration.
2. Understand Gaussian integrals, integration by parts, differential and integral calculus for many variables, Lagrange multipliers and Jacobins, Taylor series and their applications in physics.
3. Understand math of complex number and application of Cauchy-Riemann Equations, Residue Theorem and Taylor Series for analytic functions.
4. Understand basics of vector calculus.
5. Understand divergence, gradient and curl and their physical interpretation.

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	0	0	0	1	1	2	2	3	1	1
CO2	3	0	0	0	1	1	2	2	3	1	1
CO3	3	0	0	0	1	1	3	2	3	1	1
CO4	3	0	0	0	1	1	3	2	3	1	1
CO5	3	0	0	0	1	1	3	3	3	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 01-02-2022 **ACADEMIC COUNCIL:01-04-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification: Student develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS3011	MECHANICS OF SYSTEM OF PARTICLES LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Verification with simulation of the systems**						

Course Description:

This course focuses on dynamics of rigid body and to determine the various physical parameters.

Course Educational Objectives:

- To familiarize with laws of motion
- To Understand systems of particles
- To analyze specific systems for characteristics
- Determine related parameters
- Understand collision and its principle

List of Experiments (Virtual Lab)

1. Torque and angular acceleration of a fly wheel
2. Torsional oscillations in different liquids
3. Moment of Inertia of Flywheel
4. Newton's Second Law of Motion

5. Ballistic Pendulum

6. Collision balls

7. Projectile Motion

8. Elastic and Inelastic Collision

Course Outcomes

1. Students should understand the drawbacks of Newtonian approach and necessity of new approaches to solve advanced problems involving the dynamic motion of classical mechanical systems.
2. The students will introduce about the forces, angular momentum and knowledge about the constraint.
3. The course provides the students about the knowledge of collision
4. Use differential equations for obtaining the solution
5. How to use conservation of energy and linear and angular momentum to solve dynamics problems.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	1	0	0	0	1	1	1	2	3	1	1
CO2	2	0	0	0	1	1	1	1	2	1	1
CO3	1	0	0	0	1	1	1	1	3	1	1
CO4	2	0	0	0	1	1	1	2	2	1	1
CO5	2	0	0	0	1	1	1	2	3	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 01-02-2022 **ACADEMIC COUNCIL:01-04-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification: Student develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS2021	ELEMENTS OF MODERN PHYSICS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Comphrensive knowledge of understanding principles developing analytical and Mathematical skills**						

Course Description:

This course imparts the knowledge on Modern Physics topics such as atomic models, atoms in fields, matter waves, Uncertainty principle and wave mechanics. The students will understand the concepts of Modern Physics which will help as a bridge to understand the advanced physics courses such as atomic and molecular physics, quantum mechanics.

Course Educational Objectives:

- To understand the concepts of Modern Physics
- To understand atomic spectra of atom
- Comparison of atomic and molecular spectra
- Analyze principles of LASER
- Understand role of optical fibre in communication

UNIT 1 **Atomic Physics** **9 hours**

Introduction -Drawbacks of Bohr's atomic model-Sommerfeld's elliptical orbits-relativistic correction (no derivation).Vector atom model and quantum numbers associated with it. L-

S and j-j coupling schemes. Selection rules, intensity rules- Pauli's Exclusion Principle, Larmor precision frequency. Fine structure of Sodium D lines. Stern and Gerlach experiment**.**

UNIT 2 Atoms in Electrical and Magnetic Fields 9 hours

Zeeman Effect, Normal Zeeman Effect, Experimental arrangement, Explanation of Normal Zeeman Effect by Vector Atom Model. Anomalous Zeeman Effect. Paschen- Back Effect, Stark Effect Explanations (Elementary ideas only). Vibrational Spectroscopy

UNIT 3 Matter waves and Uncertainty Principle 9 hours

Matter waves, de Broglie's hypothesis-wavelength of matter waves and their properties, Wave or Phase and group velocities- Davisson and Germer experiment-G.P.Thomson Experiment, de Broglie Standing waves of electron in Bohr orbits. Heisenberg's uncertainty principle for position and momentum (x and p), &energy and time (E and t).Gamma ray microscope. Diffraction by a single slit, position of electron in Bohr orbit, Complementary principle of Bohr.

UNIT 4 Wave mechanics 9 hours

Basic postulates of quantum mechanics-Schrodinger time independent wave equation derivation. Physical interpretation of wave function and its significance. Solution of Schrodinger Equations. Eigen functions, Eigen values. Application of Schrodinger wave equation to particle in one dimensional infinite box.

UNIT 5 Lasers and Fiber optics 9 hours

Lasers: introduction, spontaneous emission, stimulated emission, Population Inversion, Types of lasers-He-Ne laser, Ruby laser, Applications of lasers. Introduction- different types of fibers, rays and modes in an Fticalfiber, fiber material, advantages of fiber optic communication

Textbooks:

1. Introduction to Solid State Physics, CharlesKittel,8 thEd.,2004,Wiley India Pvt.Ltd.
2. Elements of Solid State Physics, J.P.Srivastava, 2nd Ed.,2006, PHI
3. Introduction to Solids, Leonid V.Azaroff, 2004, TataMc-Graw Hill

References:

1. Solid State Physics, Neil W. Ashcroft andN. David Mermin, 1976, Cengage Leaming
2. Elementary Solid State Physics: Principles and Applications Addison-Wesley Series 1993

Course Outcomes:

On successful completion of this course, students will be able to:

1. To develop the atomic models and understand underlying principles in it
2. Analyze influence of electric and magnetic effects on atomic models
3. Interpret the concept of wave and particle nature and related experimental studies
4. Interpretation of quantum mechanics for probability and its equation of motion
5. Compare the process in LASERS and outline optical fibers for application

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	0	0	1	1	2	2	2	2	0	2
CO2	2	0	0	1	1	2	2	2	2	0	2
CO3	2	0	0	1	1	2	2	2	2	0	2
CO4	2	0	0	1	1	2	2	2	2	0	2
CO5	2	0	0	1	1	2	2	2	2	0	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 01-02-2022 **ACADEMIC COUNCIL: 01-04-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification:	Student develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS3021	**INTRODUCTION TO ELECTROMAGNETIC THEORY**	**L**	**T**	**P**	**S**	**J**	**C**
		3	**0**	**0**	**0**	**0**	**3**
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Attribute static and dynamic properties of EM field**						

Course Description:

The course describes the theoretical aspects of electromagnetic fields. The course describes how Maxwell's equations establish the connection between electric and magnetic fields. The interaction of electromagnetic waves with matter is described in detail.

Course Educational Objectives:

- To introduce the basic mathematical concepts related to electromagnetic vector fields.
- To aspire the students regarding the computation of vector potential, electric field of a localized current distribution using multiple expansion problems.
- To acquaint the students regarding the concepts of electrodynamics and Maxwell equations and apply it in numerous problems.
- Understand Maxwell's equations; Gauge transformations; Concept of retarded potentials;
- Analyze Electromagnetic radiation from both localized and moving source

UNIT 1 **Vector Analysis** **8 hours**

Vector algebra: triple products, how vectors transform, position, displacement and separation vectors, Gradient of a scalar field, the divergence and the curl of vector fields, line, surface and volume integrals, spherical polar and cylindrical coordinates, dirac delta function in one dimension and three dimension, Laplacian operator.

UNIT 2 **Electric fields and potentials** **8 hours**

Divergence and curl of electric field, Poisson's equation and Laplace equation, Applications of Laplace equation: potential between two parallel planes, potential between two concentric cylinders and two concentric spheres, Boundary conditions at the dielectric surface, boundary conditions between a dielectric and a conductor

UNIT 3 **Electromagnetic Waves** **8 hours**

Review of Maxwell's equations, Displacement Current, electromagnetic (EM) wave equation, Poynting Theorem and Poynting Vector, EM Energy Density, momentum, nature and properties of EM waves, production and detection of EM waves, Hertz experiment, EM spectrum.

UNIT 4 **EM Waves in Matter - II** **8 hours**

Polarization of plane waves, Boundary conditions on the fields, transmission and reflection from a dielectric interface at normal and oblique incidence, p-polarization and s-polarization, critical angle, Brewster angle, reflection and transmission at a conducting surface, optical dispersion in materials, anomalous dispersion, Cauchy's relation, dispersion in solids and liquids, Free electrons in conductors and plasma, Introduction to waveguides.

UNIT 5 **EM Waves in Matter - II** **8 hours**

Polarization of plane waves, Boundary conditions on the fields, transmission and reflection from a dielectric interface at normal and oblique incidence, p-polarization and s-polarization, critical angle, Brewster angle, reflection and transmission at a conducting surface, optical dispersion in materials, anomalous dispersion, Cauchy's relation, dispersion in solids and liquids, Free electrons in conductors and plasma, Introduction to waveguides

Textbooks:

1. Electricity and Magnetism by D. C. Tayal (Himalaya Publishing)

References:

1. Introduction to Electrodynamics by D. J. Griffiths (Prentice Hall Publishers)

Course Outcomes:

On successful completion of this course, students will be able to:

1. Use Maxwell equations in analysing the nature of electromagnetic field due to time varying charge and current distribution.
2. Describe the nature of electromagnetic wave and its propagation
3. Analyse EM waves through different media and interfaces involved in different situations.
4. Simplify charged particle dynamics and radiation from localized time varying electromagnetic sources.
5. Attribute significance of Maxwell equations

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	0	0	1	1	2	2	2	2	1	2
CO2	2	0	0	1	1	2	2	2	2	1	2
CO3	2	0	0	1	1	2	2	2	2	1	2
CO4	2	0	0	1	1	2	2	2	2	1	2
CO5	2	0	0	1	1	2	2	2	2	1	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :01-02-2022 **ACADEMIC COUNCIL:01-04-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification:	Student develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS3041	**INTRODUCTION TO QUANTUM MECHANICS**	**L**	**T**	**P**	**S**	**J**	**C**
		3	**0**	**0**	**0**	**0**	**3**
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Able to describe matter and energy at atomic and subatomic level**						

Course Description:

This course imparts knowledge on the origin and basic level of quantum mechanics. And also discusses the applications of quantum mechanics.

Course Educational Objectives:

1. To understand the origin of Quantum Mechanics and failure of Classical Mechanics
2. To know the postulates of Quantum mechanics
3. To understand the Schrodinger equation and its interpretation
4. To understand the energy eigenvalue in ID potential well
5. To interpret zero point energy and wave function for lD harmonic oscillator

UNIT 1 **Origin of Quantum theory** **8 hours**

Failures of classical mechanics, Black body Radiations, Distribution of energy in the Spectrum of black body Radiation- wien's displacement law, Rayleigh Jeans's law, Planck's radiation law, Photoelectric effect, Laws of photoelectric emission, Compton effect, Shortcomings of old quantum theory.

UNIT 2 **De Broglie's Waves and Uncertainty Principle** **8 hours**

Two slit experiments with photons and particles, superposition Principle, Wave particle duality, De Broglie's hypothesis, De Broglie's model of the atom, wave Velocity and group velocity, Heisenberg uncertainty Principle. Application of uncertainty Principle - (1) Energy and radius of Bohr First Orbit (2) Nonexistence of electrons in the nucleus.

UNIT 3 **Wave function and operators** **8 hours**

Wave Function-definition Properties and physical significance of Wave function "'P"

Normalization condition, Operators - Parity operator, Hermitian operator, Unitary operator, Commutation relations, Eigenvalues and eigenfunctions, orthonormality and completeness, Kronecker delta and Dirac Delta functions

UNIT 4 **Schrodinger's Equation** **8 hours**

Schrodinger Equations- Time Independent and time dependent form, Expectation Value, Momentum and energy operators, Stationary states, Probability current density, Ehrenfest's theorem, boundary conditions at the surface of infinite potentials**.**

UNIT 5 **Applications of One-Dimensional Schrodinger Equation** **8 hours**

Energy and wave function of a free particle, Particle in an infinite rigid box rectangular potential barrier, Reflection and transmission at a Step potential, lD linear harmonic oscillator (no derivation required) eigenfunction, eigenvalues and zero-point energy.

Textbooks:

1. Concepts of Modem Physics by Arthur Beiser. Tata McGraw-Hill Edition.
2. Quantum Mechanics, Mahesh C Jain, Eastern Economy Edition.
3. Introduction to Quantum Mechanics, David J. Griffiths, 2005, Pearson Education

References:

1. Quantum Mechanics, A Textbook for Undergraduates, M. C. Jain, Prentice-Hall of India Private Limited
2. Quantum Mechanics, Arul das, PHI Leaming Pvt. Ltd, New Delhi, 2009.
3. Quantum Mechanics: Concept and Applications, NouredineZettili, Second Edition, Wiley

Course Outcomes:

On successful completion of this course, students will be able to:

1. Understand the basis of quantum mechanics and its applications
2. Realization of wave particle duality and Heisenberg uncertainty principle
3. Understand the wave function formalism and Quantum mechanical operators
4. Understand the expectation values and eigenfunctions for different physical observables
5. Understand the application of ID Schrodinger equations for the potentials barrier

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	0	0	0	1	1	1	2	3	1	1
CO2	2	0	0	0	1	1	1	2	1	1	1
CO3	1	0	0	0	1	1	1	2	2	1	1
CO4	2	0	0	0	1	1	1	3	2	1	1
CO5	1	0	0	0	1	1	1	2	1	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :01-02-2022 **ACADEMIC COUNCIL:01-04-2022**

SDG No. & Statement:	**4 & Quality Education**
SDG Justification:	Student develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS2031	**MODERN PHYSICS LAB**	**L**	**T**	**P**	**S**	**J**	**C**
		0	**0**	**2**	**0**	**0**	**1**
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Compressive knowledge of understanding principles developing practical skills**						

Course Description:

The course describes the experimental studies of the modern physics experiments related to lasers, optical fibers, determination of Planck's constant.

Course Educational Objectives:

1. To understand the dependence of equilibrium properties of various systems on their microscopic constituents

2. To learn to use methods of quantum mechanics

3. To grasp the concepts of some principles in modern physics

4. To understand optical fibres

5. To learn to obtain optical properties to some apertures.

List of Experiments:

1 .e/m of an electron by Thomson method.

2. Determination of Planck's constant (photocell)

3. Franck and Hertz Experiment

4. Laws of Photoelectric effect –

5. Numerical aperture of optical fiber

6. Characteristics of optical fibers

7. Bending losses in Optical Fiber

8. Diffraction due to single slit.

9. Diffraction due to circular aperture.

10. Wavelength of He-Ne laser-Diffraction grating.

Course Outcomes:

1. Use various concepts for determination of specific charge.
2. Compute parameters of light photons.
3. Classify laws of photoelectric effect.
4. Understand and determination of apertures.
5. Understand the and analyze in diffraction of light.

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	0	0	0	1	1	0	1	0	0	1

CO2	2	0	0	0	1	1	0	1	0	0	1
CO3	2	0	0	0	1	1	0	1	0	0	1
CO4	2	0	0	0	1	1	0	1	0	0	1
CO5	2	0	0	0	1	1	0	1	0	0	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :01-02-2022 **ACADEMIC COUNCIL: 01-04-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification: Student develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS3031	**ELECTROMAGNETIC THEORY LAB**	**L**	**T**	**P**	**S**	**J**	**C**
		0	**0**	**2**	**0**	**0**	**1**
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Verification of static and dynamic properties of EM field with simulation methods**						

Course Description:

The course demonstrates the experimental aspects of electromagnetic fields and determination of different constants in EM fields.

Course Educational Objectives:

- To familiarize with concepts related to electromagnetic vector fields.
- To impart knowledge on the concepts of electrostatics, electric potential, energy density and their applications.
- To impart knowledge on the concepts of magneto statics, magnetic flux density, scalar and vector potential and its applications.
- To impart knowledge on the concepts of Faraday‘s law, induced emf and Maxwell‘s Equations.
- To impart knowledge on the concepts of electromagnetic waves for specific application

List of Experiments (Virtual Lab)

1. Tangent Galvanometer
2. Magnetic Field along the Axis of A Circular Coil Carrying Current
3. Deflection Magnetometer
4. Van De Graff Generator
5. Barkhausen Effect
6. Temperature Coefficient of Resistance
7. Anderson’s Bridge
8. Quincke’s Method

Course Outcomes

1. Illustrate the physical concepts of static electric fields.
2. Describe the physical concepts of static magnetic fields.
3. Apply the Maxwell equations to solve problems in electromagnetic field theory.
4. Analyze the propagation of waves
5. Determine the parameters at given frequency

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	0	0	0	1	0	0	1	0	0	1

CO2	2	0	0	0	1	0	0	1	0	0	1
CO3	2	0	0	0	1	0	0	1	0	0	1
CO4	2	0	0	0	1	0	0	1	0	0	1
CO5	2	0	0	0	1	0	0	1	0	0	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :01-02-2022 **ACADEMIC COUNCIL:01-04-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification: Student develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS3051	**QUANTUM MECHANICS LAB**	**L**	**T**	**P**	**S**	**J**	**C**
		0	**0**	**2**	**0**	**0**	**1**
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Verifation with implementation of matter and energy with simple methods with simulation**						

Course Description:

The course describes the advanced experiments to understand the quantum mechanical phenomena at atomic level and understand the significance of obtained results.

Course Educational Objectives:

- To analyse quantum mechanical phenomena
- To interpret behavior of photons
- To determine constants of light
- To understand solar principle with pulse
- Analyze hysteresis of magnetic materials

List of Experiments (Virtual Lab)

1. Franck-Hertz Experiment
2. Photoelectric effect
3. Determination of Planck's constant
4. Abbe's Refractometer
5. Emission spectra
6. Millikan's oil drop experiment
7. Solar Panel Experiment (Remote Trigger)
8. Magnetic Material Characterization via Hysteresis (Remote Trigger)

Course Outcomes

1. To Understand quantum phenomena of waves
2. To attribute the threshold of photons
3. To analyse refraction of light
4. To interpret and analyse solar principle with pulse
5. To calculate hysteresis of magnetic materials

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	0	0	0	1	1	1	2	2	1	1
CO2	2	0	0	0	1	1	1	2	2	1	1
CO3	2	0	0	0	1	1	1	3	3	1	1
CO4	3	0	0	0	1	1	1	3	3	1	1
CO5	3	0	0	0	1	1	1	3	3	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

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Programme Elective

PHYS2131	NUCLEAR AND PARTICLE PHYSICS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Focus on constituents of of universe, its interaction and history**						

Course Description:

The course is an introductory level foundation of nuclear and particle physics with fundamental forces, interactions between nucleons. It introduces nuclear models and nuclear detectors and different elementary particles present in the nucleus.

Course Educational Objectives:

- To understand the origin of semi-empirical mass formula and shell model.
- To explain the different forms of radioactivity and to study alpha, beta and gamma decay at a basic particle physics level and perform calculations.
- To understand the mechanism of working of nuclear detectors.
- Learn the classification of elementary particles according to their quantum numbers
- Learns the basic concepts of Quark model

UNIT 1 General Properties of Nuclei 8 hours

Rutherford scattering experiment, Introduction to nuclear properties, Nuclear size, Mass, Density, Angular momentum, Nuclear magnetic dipole moment, Mass defect, Packing fraction, Binding energy, Binding energy per nucleon curve, Semi empirical mass formula.

UNIT 2 Radioactivity and Nuclear Decay 8 hours

The radioactive decay law, Natural radioactivity and radioactive series, Alpha decay: Basics of a-decay processes, Gamow's theory of a-decay, Geiger Nuttal law, P-decay, Energy kinematics for P-decay, Positron emission, Electron capture, Neutrino hypothesis.

UNIT 3 Nuclear Forces and Models 8 hours

Introduction to nuclear forces, Properties of nuclear forces, Meson exchange theory of nuclear forces, Liquid drop model, Nuclear magic numbers, basic ideas of nuclear shell model.

UNIT 4 **Nuclear Detectors** **8 hours**

Introduction, Interaction of nuclear radiation with matter - Compton effect, Pair production and Photo-electric effect, Detectors of nuclear radiation - Ionization chamber, Proportional counter, Geiger-Muller counter, Scintillation counter.

UNIT 5 **Introduction to Particle Physics** **8 hours**

Discovery of cosmic rays, Latitude effect, Altitude effect, Cosmic ray showers, Classification of elementary particles, Particles and antiparticles, Fundamental particle interactions, Conservation laws of energy and momentum, Angular momentum, Parity, Baryon number, Lepton number, Isospin, Strangeness quantum number, Basics of Quark model.

Textbooks:

1. Introductory Nuclear Physics-Kenneth S. Krane
2. Nuclear Physics by D.C.Tayal, Himalaya publishing Co.,

References:

1. Introduction to Nuclear Physics by Harald A. Enge
2. Atomic Nucleus by RD Evans

Course Outcomes:

On successful completion of this course, students will be able to:

1. Basic characteristics of the nucleus will be explored
2. Nucleoinc configurations will be understood
3. A clear insight on working mechanism of nuclear radiation detectors will be achieved Attribute classification of particles
4. Explain interaction of particles
5. Understand the concepts of particle physics

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	0	0	1	1	2	2	2	2	1	2
CO2	2	0	0	1	1	2	2	2	2	1	2
CO3	2	0	0	1	1	2	2	2	2	1	2
CO4	2	0	0	1	1	2	2	2	2	1	2
CO5	2	0	0	1	1	2	2	2	2	1	2

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :01-02-2022	**ACADEMIC COUNCIL:01-04-2022**
SDG No. & Statement:	**4 & Quality Education**
SDG Justification:	Student develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS2151	NUCLEAR PHYSICS AND SOLID-STATE PHYSICS LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Measurement of radiation with radioactive sources**						

Course Description:

The course describes the basic knowledge about the experimental studies of radioactive emission and the measurement and counting radiation. The experimental aspects of solid state devices.

Course Educational Objectives:

- Provide an overview of the fundamental applications of the physics of solids
- Describe of crystal and electronic structure and lattice dynamics
- Determine losses of materials
- Characterize properties of radiation

List of Experiments

1. Characteristics of Zener diode
2. Characteristics of Thermistor
3. Resistivity by Four Probe Method
4. B-H Curve
5. Hall effect experiment:- Determination of charge carrier density
6. Zener Diode as Voltage Regulator
7. Crystal Structure
8. Geiger Muller Tube
9. Intensity Variation of GM tube

Course Outcomes

1. Experimental techniques pertinent to studies in condensed matter physics.
2. Interpreting results, error analysis, writing reports, analyzing data.
3. Learning more advanced physics topics, not encountered at the introductory level
4. Evaluate properties of different materials
5. Characterize radioactive materials

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	0	0	0	0	0	1	1	2	1	0
CO2	2	0	0	0	0	0	1	1	2	1	0
CO3	2	0	0	0	0	0	1	1	2	1	0
CO4	2	0	0	0	0	0	1	1	2	1	0
CO5	2	0	0	0	0	0	1	1	2	1	0

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :01-02-2022 **ACADEMIC COUNCIL:01-04-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification: Student develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS2201	COMPUTATIONAL METHODS IN PHYSICS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Methods of understanding and Analyzing physical principles of complex systems**						

Course Description:

Enables to understand and the use of various computational tools for its applicability

Course Educational Objectives:

- To introduce salient tools of computational methods in problem solving in contemporary Physics.
- To calculate differentiation and definite integrals of various functions with desired accuracy
- To write programs for solving ordinary differential equations with desired order of accuracy
- To introduce the theory and application of Density Functional Theory (DFT) of solids
- Analyze its solution

UNIT 1 Introduction to Computational Physics 8 hours

Definition, Scope of computational methods in sciences, Contemporary interest and applications, the role of programming. Visualization of the data, Curve fitting: Least square method, Linear method, and polynomial, exponential. Errors and Uncertainties: Types of errors: Blunders and bad theory, random error, approximation errors, round off errors; error assessment.

UNIT 2 Numerical Calculus 8 hours

Numerical differentiation: first-order and second-order differentiation using two-point formula, three-point formula and five-point formula. Numerical integration: Definite integrals using trapezoid rule, Simpson rule, Gaussian quadrature rule. Application of these methods: centroid calculation.

UNIT 3 Solution of Ordinary Differential Equations 8 hours

Solution methodologies of initial value problems: Euler and Picard methods, Predictor-Corrector method, Runge-Kutta method. Applications to the harmonic oscillator, Newton's law of motion, Projectile motion, driven pendulum under damping. Solution of methodology for boundary value problem: relaxation method. Application to the one-dimensional diffusion equation, two-dimensional Poisson equation.

UNIT 4 Molecular Mechanics 8 hours

History and Fundamental Assumptions; Potential Energy Functional Forms-Bond Stretching; Valence Angle Bending; Torsions; van der Waals Interactions; Electrostatic Interactions; Cross Terms and Additional Non- bonded Terms. Parameterization Strategies; Force-field Energies and Geometry Optimization. Quantum Mechanics and the Wave Function; Hamiltonian operator; variational principle and Born-Oppenheimer Approximation; LCAO approach. Approach to various molecules for optimization.

UNIT 5 DFT and Plane Waves 8 hours

Introduction to Electronic Structure, Independent Particle Approximation (Hartree; Hartree-Fock), Crystal Symmetry and Bloch States, Basic Understanding of Bands in Solids, Density Functional Theory: Kohn-Sham Theory; LDA, Beyond the LDA: GGAs; nonlocal functionals, Pseudopotentials, Plane Wave Calculations in Crystals, self-consistent DFT

Textbooks:

1. Computational Physics, Problem Solving with Computers, Enlarged e-textbook Python 3rd Edition by Rubin H. Landau, Manuel J. Paez, Cristian C. Bordeianu, WILEY-VCH Verlag GmbH & Co. KGaA
2. An Introduction to Computational Physics (Second Edition), 2006, Tao Pang, Cambridge University Press, Link: https://www.physics.unlv.edu/-pang/cp2.html
3. Essentials of Computational Chemistry-Theories and Models 2nd ed., 2004, Christopher J Cramer, Wiley

Online material

http://cmt.dur.ac.uk/sjc/thesis_ppr/node14.html;

https://courses.engr.illinois.edu/mse404ela/sp2019/5.DFT-_practice.pdf

References:

1. Solid State Physics, 2003, Ashcroft and Mermin, Cengage Learning India Private Limited
2. Electronic Structure: Basic Theory and Practical Methods (2nd ed.), 2020, Richard M. Martin, Cambridge University Press;

Course Outcomes:

On successful completion of this course, students will be able to:

1. Understands the importance of programming, visualization tools, errors assessment
2. Perform numerical differentiation and definite integrals for a given function with programs
3. perform numerical solution of ordinary differential equations associated with initial value and boundary value problems
4. Understand and apply the principles of DFT in determining the electronic structure of solids
5. Analyze solutions for interpretation

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	0	0	2	2	3	3	2	3	2	0
CO2	2	0	0	2	2	3	3	2	3	2	0
CO3	2	0	0	2	2	3	3	2	3	2	0
CO4	2	0	0	2	2	3	3	2	3	2	0
CO5	2	0	0	2	2	3	3	2	3	2	0

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :01-02-2022 **ACADEMIC COUNCIL:01-04-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification: Student develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS2211	COMPUTATIONAL METHODS IN PHYSICS LAB	L	T	P	S	J	C
		0	0	2	0	0	1
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**verification of physical principles of complex systems with suitable methods**						

Course Description:

Provide ability to solve physical parameters with simulation methods

Course Educational Objectives:

- Understand programming tactics and numerical methods for its implementation
- Analyze computational methods to specific systems or problems
- Apply high performance methods for significance
- Visualize properties of specific systems
- Comparison of methods

List of Experiments

1. Determination of band gap of Silicon and ZnO through SCF calculation (Quantum espresso) using LDA pseudo potentials

2. Determination of DOS and Band structure of Silicon (Quantum espresso) using LDA and GGA pseudo potentials

3. Comparison of band gap values of Silicon obtained using GGA and metaGGA pseudo potentials

4. Determination of centroid of an isosceles triangular shaped thin sheet using trapezoid rule, Simpson rule and Gaussian quadrature rule

5. Determination of position and velocity of a harmonic oscillator using Runge-Kutta method

6. Solution of 2D Laplace equation with relaxation method

7. Determination of the position and velocity of a particle moving in 1D under elastic force f(x)=-kx (k is constant) using predictor-corrector scheme.

8. Comparison of second order differentiation results of exp(x) at a given x using two point formula, three point formula and five point formula.

9. Plotting the function

10. Least squares method for given data

11. Exponential methods to fit a given data using polynomial

Course Outcomes

1. Identify modern programming methods and describe the extent and limitations of computational methods in physics,
2. Identify and describe the characteristics of various numerical methods.
3. .formulate and computationally solve a selection of problems in physics
4. Use the tools, methodologies, language and conventions of physics to test and communicate ideas and explanations.
5. Understand the electronic structure of materials

Software required:

Quantum espresso: https://www.quantumvitas.org/download/Gnuplot: http://www.gnuplot.info/ or any other plotting software

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	1	2	1	3	2	1	2	2	3	1	1
CO2	2	1	3	2	3	1	3	1	3	1	1
CO3	2	3	1	2	2	1	2	2	2	1	1
CO4	3	1	2	3	1	2	2	1	1	3	3
CO5	1	2	3	2	3	2	1	3	3	1	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :01-02-2022 **ACADEMIC COUNCIL:01-04-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification: Student develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS3121	ASTRONOMY AND ASTRO PHYSICS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Study of universe past present and future from its orign**						

Course Description:

The course describes the fundamentals of Astrophysics with emphasis on solar system , stellar and star structure and develops the mechanics of the celestial objects.

Course Educational Objectives:

- To understand the celestial sphere and the coordinate system to locate the astronomical objects in space and time, and the observational mechanisms.
- To apply gravitational laws and calculate the elliptic orbits of astronomical objects
- To gain detailed knowledge on the planets, their physical structure and other constituents of solar system
- To able to calculate the equilibrium configuration of a star and learn it's evolution with time
- To develop detail understanding of a main sequence star and it's end stage

UNIT 1 **Introduction to Astronomy and Astrophysics** **9 hours**

History: Plato, Copernican model, Coordinates: Altitude-Azimuth Coordinate System, Equatorial Coordinate System, Distance measurement: AU, lightyear, parallax method, parsec, Time measurement: Modified Julian Date, Photometric concept, Magnitude of star: Apparent Magnitude, Absolute Magnitude, Opacity, Luminosity, Overview of electromagnetic spectrum and different types of telescopes

UNIT 2 **Celestial mechanics** **9 hours**

Newton's law of motion and gravitation, Equations of Motion, Kepler's law, Derivation of Kepler's law, Escape velocity, Virial theorem

UNIT 3 **Solar system** **9 hours**

Planetary configuration, Orbit of the Earth and Visibility of the Sun, The Orbit of the Moon, Eclipses and Occultations, The Structure and Surfaces of Planets, Albedos, Overview of all planets, Minor Bodies of the Solar System, Origin of the Solar System

UNIT 4 **Stellar Structure and Evolution** **9 hours**

Internal Equilibrium Conditions, Stellar Energy Sources, Different chains and energy production mechanisms, Stellar Models, HR Diagram, Evolutionary Time Scales, Different stages of evolution, Evolution of Close Binary Stars

UNIT 5 **Structure of star** **9 hours**

Internal structure of Sun, Solar Atmosphere, Solar Activity, Variable Star, Brief overview of pulsating, eruptive and eclipsing variables, Compact stars: White Dwarfs, Neutron Star, Black Holes, X-ray binaries

Textbooks:

1. Astrophysics for Physicists (2010), Arnab Rai Choudhuri, Cambridge University Press
2. An Introduction to Modem Astrophysics (second edition 2014), Bradley Carroll and Dale Ostlie, Pearson New International Edition

Link: https://nptel.ac.in/courses/115/105/115105046/

References:

1. Introductory Astronomy and Astrophysics (Fourth edition), Michael Zeilik and Stephen A. Gregory, Thomson Leaming

Course Outcomes:

On successful completion of this course, students will be able to:

1. Ability to understand the astronomical measurement systems and calculate the distance using parallax method
2. Understand an object's motion in gravitational field of another object
3. Understand the solar system: the planets, satellites and other minor objects
4. Understand the evolutionary phase of stellar structure
5. Develop understanding of main sequence stars and their end states

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	0	0	2	2	3	3	2	3	2	0
CO2	2	0	0	2	2	3	3	2	3	2	0
CO3	2	0	0	2	2	3	3	2	3	2	0
CO4	2	0	0	2	2	3	3	2	3	2	0
CO5	2	0	0	2	2	3	3	2	3	2	0

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS : 01-02-2022 **ACADEMIC COUNCIL: 01-04-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification: Student develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS2221	Mathematical Method and Analysis with Simulation	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Understanding algorithmic approach to physical problems**						

Course Description:

The course describes the introduction to MATLAB programming and its usage in graphics, Laplace/Fourier transforms, circuit analysis, solving ODE and curve fitting of data.

Course Educational Objectives:

- To introduce the syntax, features and MATLAB programming fundamentals with basic mathematical operations.
- To provide an insight into the essential plotting features and handling different file formats of MATLAB.
- To familiarize MATLAB functions for Laplace and Fourier Transforms.
- To appraise the circuit analysis applications with MATLAB.
- To acquaint mathematical and regression methods using MATLAB.

UNIT 1 Introduction to MATLAB 8 hours

Scope of the course, introduction to MATLAB workspace, variables, simple arithmetic problems, symbolic calculations: writing expressions and equations. Matrix operations: addition, multiplication, inverse operation, adjoint matrix; Differentiation, integration.

UNIT 2 Graphics and handling files with MATLAB 8 hours

Introduction to graphics: Plotting in MATLAB: types & features. 2-D plots: line plot, scatter plot, bar plot. 3- D plots: scatter plot, surface plot, and contour plot. Fplot function: y= sin(x),

y=x2. Overlays, scripts and functions. M-files. Conditions: if and if-else; special function variable loops: for, while. File handling (input and output): text, csv, excel.

UNIT 3 Laplace and Fourier Transforms using MATLAB. 8 hours

CT and DT plotting. Laplace transforms, and inverse Laplace transforms of a given function in MATLAB.Evaluation of Fourier Co-efficient, Fourier series for Sine, Square, and Triangular waves. Fourier Transforms and inverse Fourier transforms of a given function in MATLAB. DFT and FFT using MATLAB.

UNIT 4 DC Circuit Analysis using MATLAB 8 hours

Circuit analysis: Parallel and series combination of Resisters and capacitors. Nodal analysis (KCL), Loop analysis (KVL). Transient Response: Charging of capacitor. Series RC circuit, RL circuit, RLC circuit. Problems on KCL, KVL, and transient response.

UNIT 5 Mathematical Application 8 hours

MATLAB ode function. Real root of algebraic equation-matrix method. Solution of differential equation using separation of variable method. Curve fitting: introduction, least-square method, fitting Straight line for discrete data set, polynomial fit, and Exponential fit.

Textbooks:

1. Electronics and Circuit Analysis using MATLAB by John 0. Attia
2. Getting Started with MATLAB by RudraPratap,7th Edition Oxford University Press N Delhi

References:

1. MATLAB and Simulink for engineers, Agam kumar tyagi-Oxford University press.
2. MATLAB: An introduction with applications by Amos Gilat, Wiley India

Course Outcomes:

On successful completion of this course, students will be able to:

1. Demonstrate arithmetic operations and matrix operations in MATLAB .
2. Visualize basic 2D and 3D plots, and handle csv, excel files in MATLAB .
3. Compute the Laplace, Fourier transforms and their inverse transforms
4. Perform basic circuit analysis using MATLAB .
5. Write MATLAB codes to perform curve fitting, and solve algebraic and differential equations

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	0	0	2	2	3	3	2	3	2	0
CO2	2	0	0	2	2	3	3	2	3	2	0
CO3	2	0	0	2	2	3	3	2	3	2	0
CO4	2	0	0	2	2	3	3	2	3	2	0
CO5	2	0	0	2	2	3	3	2	3	2	0

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :01-02-2022 **ACADEMIC COUNCIL:01-02-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification: Student develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS3141	ENVIRONMENTAL PHYSICS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Understand the physical process in environment and its measures to overcome**						

Course Description:

This course deals with the Physics of the interaction of living organism with the earth system. The underlying physics of atmosphere, ground, water, radiation in connection with the biology, chemistry, and geology. This helps the effective management of human interaction with an environmental system

Course Educational Objectives:

1. To understand the basic concepts of thermodynamics of the atmosphere, and human thermal environments
2. To comprehend the radiation corning from sun, radioactivity in relation with the biosphere.
3. To appreciate the basic physics of the elements of water cycle, soil types and relevant adverse side of development.
4. To understand the laws of weather, climate to extreme weather events.
5. To appreciate the basic Physics of different renewable power plants and their environmental concerns.

UNIT 1 Physics of the Atmosphere 8 hours

Scope of the course, structure of atmosphere, composition. Conduction, Convection, Evaporation, Newton's law of cooling, Laws of thermodynamics, Hydrostatic equation- lapse rate, stability of the atmosphere. Human thermal environments: temperature, relative humidity, and the heat balance equation of human body. Survival in cold and hot climates**.**

UNIT 2 Environment and Radiation 8 hours

Solar spectrum, Radiative balance and temperature of Earth's atmosphere, Global warming and radiative forcing, Solar UV radiation and life. Radioactivity: cosmic radiation and cosmogenic radionuclides- naturally occurring long-lived, Biological effects of radiation, manmade radiation sources in the environment - radioactive waste.

UNIT 3 Elements of Hydrologic cycle and underlying Physics: 8 hours

Hydrosphere, Hydrologic cycle, Water in the atmosphere, Clouds, Physics of cloud formation, growing droplets in cloud. Thunderstorms. Elementary concepts of monsoons.

Soils: types of soils and hydrologic cycle, Surface tension and soils, Water flow, Water evaporation, Soil temperature. Water pollution, and Soil pollution: Land fill (Plastic and electronic waste).

UNIT 4 Elements of Weather, climate and underlying Physics 8 hours

Weather conditions for different living organism, Measuring the wind, Physics of wind creation, Principal forces acting on air masses, Gravitational force, Pressure gradient, Cyclones and anticyclones, Global convection, Global wind patterns. Urbanization and challenges: air pollution, Greenhouse effect, Ozone layer depletion and extreme weather events.

UNIT 5 Energy for living 8 hours

Urbanization: Energy demand and Crisis. Energy from Fossil fuels, nuclear power generation (Fission), Renewable resources - Photovoltaic effect and Solar power, Hydroelectric power, Tidal power, Wind power, biomass. Recent advances: Hydrogen fuel cells, nuclear fusion. Energy equilibrium between biotic and abiotic environmental components.

Textbooks:

1. Physics of Environment by A. W. Brinkmen
2. Principles of Environmental Physics, fourth Edition by John L. Monteith and Mike H. Unsworth
3. Environmental Physics by M. Dzelalija
4. Introduction to Environmental Soil Physics by Daniel Hillel

References:

1. Human Thermal Environments: The Effects of Hot, Moderate, and Cold Environments on Human Health, Comfort and Performance, Second Edition, By Ken Parsons.
2. Environmental Pollution and Control, 4th ed. by J. Jeffrey Peirce, P. Aarne Vesilind, Ruth F. Weiner

3. Environmental Studies: The earth as a living planet by Botkin, D.B and Kodler E.A., John Wiley and Sons Inc.,2000
4. The nature and properties of Soils by Brady, N.C. Tenth Edition. Mac Millan Publishing Co., New York,1990

Course Outcomes:

On successful completion of this course, students will be able to:

1. Interpret the role of the concepts of heat and thermodynamics m connection with the atmosphere, and human being.
2. Understand the earth's radiation budget, its elements and interconnection.
3. familiarize with water cycle of Earth's environment, and pollution of water and soil
4. Articulate the physics of elements of hydrological cycle; water pollution, soil pollution, and their concerns).
5. to identify the future concerns of energy crisis and understand underlying science

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2	2	2	2	1	1	1	0
CO2	2	2	2	2	2	2	2	1	1	1	0
CO3	2	2	2	2	2	2	2	1	1	1	0
CO4	2	2	2	2	2	2	2	1	1	1	0
CO5	2	2	2	2	2	2	2	1	1	1	0

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :01-02-2022 **ACADEMIC COUNCIL:01-04-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification: Student develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS3171	BIO SENSORS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Understand and analyze bioprocess to implement devices**						

Course Description:

This course focuses on the principle and design of Bio-sensors. The applications of biosensors and nanomaterials in biosensors are also discussed.

Course Educational Objectives:

- Learn about the standard structure of Biosensor
- Use mathematical methods of biosensors.
- Use circuit analysis models for the Biosensors.
- The conceptual study on Bio-sensing elements.
- Familiarize with the advancements in the designing of biosensor for various applications

UNIT 1 **Introduction** **8 hours**

Definitions, Biological inspiration (Advantages and limitations), various components of biosensors, types of sensors, structure of biosensor, components and design, ideal requirements.

UNIT 2 **Basic Design and Characterization** **8 hours**

Considerations calibration, dynamic Range, signal to noise, sensitivity, selectivity, stability, Interference, Recognition/Transduction membrane protein sensors: ion channels. Characterization techniques for surface and interface analysis.

UNIT 3 Transducers and Biosensors 8 hours

Various types of transducers; principles and applications - Calorimetric, Optical, Electrochemical, carbon nanotube, Piezoelectric, Semiconductor, Impedimetric, cantilever.

UNIT 4 Applications of Biosensors 8 hours

Electrochemical and optical sensors, Biosensors in clinical chemistry, Microfabricated biosensors and point- of-care diagnostics systems, Surface plasmon resonance and evanescent wave biosensors, Biosensor in cancer and HIV early diagnosis.

UNIT 5 Applications of Nanomaterial's in Biosensors 8 hours

Production of nanomaterials, Nano Materials in biosensors; Carbon based Nano Material, Metal oxide and nano particle, Quantum dots, Role of nano material in Signal Amplifications.

Textbooks:

1. Introduction to Biosensors by Jeong-Yeo! Yoon; Publisher: Springer-Verlag New York EdI
2. Novel Approaches in Biosensors and Rapid Diagnostic Assays by ZviLiron; Publisher: Springer US Ed. I

References:

1. I. Electrochemical Sensors, Biosensors and their Biomedical Applications, X. Zhang, H. Ju J. Wang, Publisher: Elsevier, 2008.
2. Recognition Receptors in Biosens.by Mohammed Zourob; Publisher: Springer-Verlag New York Ed. l

Course Outcomes:

On successful completion of this course, students will be able to:

1. Understand the basics of bio sensing technology
2. Understand the various characterization techniques of biosensors
3. Understand the several types of biosensors

4. Understand the biosensor for specific application
5. Analyze the gap between the conventional technology and the biosensor

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	1	1	1	2	1	1	1	0
CO2	2	1	1	1	1	1	2	1	1	1	0
CO3	2	1	1	1	1	1	2	1	1	1	0
CO4	2	1	1	1	1	1	2	1	1	1	0
CO5	2	1	1	1	1	1	2	1	1	1	0

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :01-02-2022 **ACADEMIC COUNCIL:01-04-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification: Students develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS2121	SOLID STATE PHYSICS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Attribute materials and its types for responsible phenomena**						

Course Description:

This course is designed to introduce the structure, electronic, and other fundamental properties of solids to the students. It is supposed to be the fundamental course on solid state physics, covering in detail the representation of crystal structure, x-ray diffraction, dielectric properties of materials, outline of magnetism, and superconductivity.

Course Educational Objectives:

- will enable the student to employ classical and quantum mechanical theories needed to.
- Understand the physical properties of solids
- Emphasis is put on building models able to explain several different phenomena in the solid state.
- Analyze various properties of magnetic materials
- Understand materials related to present day technologies

UNIT 1 **Crystallography** **8 hours**

Classification of solids, fundamental concepts of crystals, lattice points and space lattice, crystal systems, Bravais lattices, directions, planes, and Miller indices, atomic packing

fraction, the structure of simple cubic, body-cantered cubic (CsCI), face-cantered cubic (NaCl), hexagonal closed packed (HCP), diamond structure, X-ray diffraction, Bragg's law.

UNIT 2 Dielectric Properties 8 hours

Introduction, fundamental definitions, local field, Clausius-Mossotti relation, different types of electric polarization, electronic, ionic, and dipolar polarization (qualitative), dielectric loss, dielectric breakdown, piezoelectricity and ferroelectricity, spontaneous polarization in BaTiO3, applications of dielectrics and ferroelectrics.

UNIT 3 Magnetic Properties 8 hours

Introduction, fundamental definitions, classification of magnetic materials, Weiss theory of ferromagnetism, and domain theory of ferromagnetism, hysteresis, soft and hard magnetic materials, eddy current losses, ferrites (structure and magnetic properties), Applications: transformer cores, magnetostrictive sensors, data storage.

UNIT 4 Superconductors 8 hours

Introduction, Superconducting phenomenon- Occurrence, BCS theory (qualitative), Meissner Effect, The magnetic penetration length, the thermodynamic critical magnetic field of a superconductor, Type I and Type II superconductors, Josephson effects (qualitative), High-temperature superconductors, Applications of Superconductivity.

UNIT 5 Nanomaterials 8 hours

Introduction, nanoparticles, metal nanoclusters, semiconductor nanoparticles, nanotubes, quantum nanostructures-Applications of nanomaterials.

Textbooks:

1. Elements of Solid-State Physics, J.P. Srivastava, Prentice Hall of India Pvt., Ltd.
2. Modem Physics, R. Murugeshan and Kiruthiga Siva Prasath, S. Chand& Co.
3. Unified Physics, Vol.4. Modern Physics, S.L. Gupta & Sanjeev Gupta, Jai Prakash Nath &Co. Meerut.
4. M.N.Avadhanulu, P.G. Kshirsagar, A Textbook of Engineering Physics, S. Chand, 2014

References:

1. Simon M. Sze, Kwok K. Ng, Physics of Semiconductor Devices, 3/e, John Wiley, 2006.
2. S. 0. Pillai, Solid State Physics, 7/e, New Age International, 2014
3. B.G. Streetman, S. Banerjee, Solid State Electronic Devices, 6/e, PHI 2006
4. P. K. Palanisamy, Applied Physics, SciTech Publications, 2009.
5. Marius Grundmann, The Physics of Semiconductors, 2/e, Springer, 2010.

Course Outcomes:

On successful completion of this course, students will be able to:

1. Explain properties of solid matter and connect these to crystals
2. Interpret polarization phenomena in dielectrics
3. Know the basic physics behind dia, para and ferromagnetism.
4. Know what superconductivity is and qualitatively relate it to lattice vibrations and the density of state
5. Understand various naanomaterials for applications

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	0	0	0	1	1	2	1	1	0	1
CO2	2	0	0	0	1	1	2	1	1	0	1
CO3	2	0	0	0	1	1	2	1	1	0	1
CO4	2	0	0	0	1	1	2	1	1	0	1
CO5	2	0	0	0	1	1	2	1	1	0	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN: BoS and Academic Council

BOS :01-02-2022 **ACADEMIC COUNCIL:01-04-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification: Student develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS2141	PHYSICS OF NANO MATERIALS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	None						
Co-requisite	None						
Preferable exposure	Enrich the science in understanding inherent phenomena of materials with suitable approaches						

Course Description:

Understand physics of nanomaterials with synthesis approaches, characterization and its application

Course Educational Objectives:

- Foundational knowledge of Nanoscience and related fields.
- To make students understand the influence of dimensionality of the object at nanoscale on their properties
- Understand the microstructural changes that arise at nanoscale
- Understand the synthesis ofnanomaterials
- Know their future applications in industry.

UNIT 1 **Nanotechnology** **8 hours**

Introduction, significance of nanotechnology, finite size effects and properties; classification of nanostructure materials, challenges and future prospects.

UNIT 2 Properties of Nonmaterial's 8 hours

Microstructure and defects in nanomaterials, dislocations, twins, stacking faults and voids, grain boundaries, effect of nano-dimension on material behaviour, mechanical properties, melting point, diffusivity, grain growth characteristics, solubility, magnetic, electrical and thermal properties of nonmaterial's.

UNIT 3 Growth Techniques in Nonmaterial's 8 hours

Introduction, top down and bottom up approaches, lithographic process, Laser ablation, non lithographic processes plasma arc discharge, Thermal evaporation, Sputtering, chemical vapor deposition, sol-gel technique, electrodeposition

UNIT 4 Characterization techniques of Nanomaterials 8 hours

X-ray diffraction, small angle X-ray scattering, scanning electron microscopy with EDS, transmission electron microscope, scanning tunnelling microscope, Atomic force microscopy, Raman spectroscopy, UV-Vis absorption spectrometer, Photoluminescence spectroscopy.

UNIT 5 Application of Nanomaterials 8 hours

Sectors influenced by nonmaterial- health (drug delivery agents), communication, energy, environment, safety, security and defense, nanophotonic devices, nano sensors (bio-sensors), Quantum dots, MEMS & NEMS.

Textbooks:

1. P.P. Charles, J.O. Frank Introduction to Nanotechnology, Wiley InterScience, 2003.
2. K.K Chattopadhyay, and A.N Banerjee, Introduction to Nanoscience and Nanotechnology, PHI, 2011.

References:

1. L.W. Edward, Nanophysics and Nanotechnology, An Introduction to Modern Concepts in Nanoscience, 2/e, Wiley - VCH, 2006
2. C. Guozhong, Ying Wang, Nanostructures and Nanomaterials: Synthesis, Properties, and Applications, 2/e. 3.Mitin, V., Sementsov, D., &Vagidov, N. (2010). Quantum Mechanics for Nanostructures. Cambridge: Cambridge University Press. doi:10.10 l

7/CBO97805l l 845l 61

Course Outcomes:

On successful completion of this course, students will be able to:

1. Understand the influence of dimensionality of the object at nanoscale on their properties
2. Relate the structural changes to the size and shape of nanoparticles
3. Synthesize nonmaterial's using various methods
4. Use various characterization techniques to study the nanomaterials
5. Understand the careful application ofnanomaterials

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	0	0	1	1	1	2	1	1	0	1
CO2	2	0	0	1	1	1	2	1	1	0	1
CO3	2	0	0	1	1	1	2	1	1	0	1
CO4	2	0	0	1	1	1	2	1	1	0	1
CO5	2	1	2	1	1	1	2	1	1	0	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :01-02-2022 **ACADEMIC COUNCIL:01-04-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification:	Student develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS3181	**MATERIALS SCIENCE**	**L**	**T**	**P**	**S**	**J**	**C**
		3	**0**	**0**	**0**	**0**	**3**
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Exposure to various materials, its characterization, its processes and structure properties**						

Course Description:

The course describes the fundamentals of crystalline materials, the different techniques to understand the structural and morphological properties, followed by mechanical behavior and phase transitions in materials.

Course Educational Objectives:

- Give basic knowledge of science behind materials
- Introduce the concept of structure property relations.
- Provide methods for characterization
- Understand studies in fields such as solid-state physics and mechanical behaviour of

materials

- Analyze phase & phase diagram, heat treatment, failure of materials and its applications

UNIT 1 **Crystallography** **10 hours**

Crystallography: Forces between atoms, bonding in solids ionic, covalent and metallic bonding; Fundamental concepts of crystals, lattice points and space lattice, crystal systems, Bravais lattices, directions, planes and Miller indices, atomic packing fraction, structure of simple cubic, body centred cubic (CsCl), face centred cubic (NaCl), hexagonal closed packed (HCP), diamond structure.

UNIT 2 **Characterization Techniques** **8 hours**

Characterization Techniques: Xray diffraction, Bragg's law, powder X ray diffractometer construction and working, crystalline phase analysis; transmission electron microscopy construction and working; scanning electron microscopy construction and working; atomic force microscopy construction and working, scanning tunnelling microscope construction and working.

UNIT 3 **Crystal Imperfections** **8 hours**

Crystal Imperfections: Point defects vacancies, impurities, Frankel defect, Schott key defects; linear defects- edge and screw dislocation; surface and grain boundary defect-grain boundaries, tilt boundaries, twin boundaries, stacking faults.

UNIT 4 **Mechanical Behavior** **8 hours**

Mechanical Behavior: Elastic behavior of metals, atomic model of elastic behavior; plastic deformation- stress-strain curve, plastic deformation by slip; ductile and brittle materials, tensile strength, hardness, fatigue; creep-mechanism of creep, creep resistant materials; fracture types of fracture (elementary concepts only)- ductile fracture, brittle fracture.

UNIT 5 **Diffusion and phase transformation in solids** **10 hours**

Diffusion and phase transformation in solids: Classification of diffusion; diffusion mechanisms-Vacancy mechanism, interstitial mechanism, direct interchange mechanism; Fick'slaws of diffusion; factors effing the diffusion coefficient-self diffusion, inter diffusion, diffusion couple. Mechanism of phase transformation, homogeneous nucleation, heterogeneous nucleation, nucleation andgrowth.

Textbooks:

1. V. Raghavan, Materials Science and Engineering: A First Course PHI publishing, 2007
2. G.K.Narula, K.S.Narula and V.K.Gupta, Materials Science: Tata-McGraw Hill,2011

References:

1. S.O.Pillai, Solid State Physics, New Age International, 2008.
2. M. Arumugam, Materials Science, Anuradha Agencies, Kumbhakonam, 2007.
3. Callister's Materials science and engineering (adapted by R.Subramaniam), Willey India, 2013.

Course Outcomes:

On successful completion of this course, students will be able to:

1. Analyze the Structure of materials at different levels
2. Experimental methods for determination of properties of materials
3. Understand and categorize defects in crystals
4. Understand concept of mechanical behavior of materials and calculations
5. Explain the concept of phase & phase diagram & understand the basic terminologies

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	0	0	0	1	1	2	1	1	0	1
CO2	2	0	0	0	1	1	2	1	1	0	1
CO3	2	0	0	0	1	1	2	1	1	0	1
CO4	2	0	0	0	1	1	2	1	1	0	1
CO5	2	0	0	0	1	1	2	1	1	0	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS :01-02-2022 **ACADEMIC COUNCIL:01-04-2022**

SDG No. & Statement: **4 & Quality Education**

SDG Justification: Student develop their attributes and skills towards enhancing personality contributing towards scientific community

PHYS3131	ESSENTIALS OF BIOPHYSICS	L	T	P	S	J	C
		3	0	0	0	0	3
Pre-requisite	**None**						
Co-requisite	**None**						
Preferable exposure	**Understand the structure, functionality of biological phenomena**						

Course Description:

To understand and analyze biological phenomena with principles of physics

Course Educational Objectives:

- To understand and interpret radiation and its effects on biological materials.
- To identify diffusion related phenomena and biophysical properties in biological systems.
- To understand different types of light and electron microscopes.
- To understand different spectroscopic techniques and laser theory.
- To understand and interpret XRD and XAFS spectra.

UNIT 1 **Radiation Biology** **9 hours**

Radioactivity-Natural, Artificial and induced Radioactivity and applications, radioactive disintegration, Units of radioactivity, physical and biological half-life and relative biological effectiveness. Measurement of Radioactivity-Geiger Muller counter, proportional counter, scintillation counter, biological effects of radiation and radiation energy.

UNIT 2 **Transport process** **9 hours**

Diffusion -factors effecting diffusion, Ficks law, diffusion of electrolytes, accelerated diffusion and biological significance. Biophysical phenomena in biochemical studies-pH meter- principle, electrode system and factors effecting in its measurement and centrifugation. Hemodynamics: Rheology biophysical properties of plasma, viscosity of blood, comparison of Newtonian and Non-Newtonian fluids and dielectric constant.

UNIT 3 Microscopy in biology and Medicine 9 hours

Light characteristics, microscopes- compound, phase contrast, interference, polarization, ultraviolet, fluorescent and electron microscopes - Transmission Electron Microscope, Scanning Electron Microscope, and its probe analysis, centrifuge microscope with biological applications. Bioacoustics-ultrasound-physical and biological effects.

UNIT 4 Spectroscopic studies in biology 9 hours

Interaction of EM radiation with matter Ultraviolet & Visible spectroscopy, fluorescence and phosphorescence methods, Infrared spectroscopy- bending, near, mid & far infrared region. Raman spectra- principle and instrumentation. NMR, ESR Instrumentation and Laser-characteristics, population inversion, stimulated and spontaneous and relation.

UNIT 5 Advanced Spectroscopic Techniques 9 hours

Atomic spectroscopy-Atomic absorption spectroscopy and double beam atomic absorption spectroscopy-ray spectroscopy Absorption spectroscopy, diffraction spectroscopy, transmission photographic method, ray ionization spectrometer, rotating crystal spectrometer and powder crystal diffraction spectrometer

Textbooks:

1. Introductory Bio Physics F.R. Hallet, P.A.Speight, R.H.Stinson, Chapman & Hall.
2. Bio Physics Principles and Applications. M.A. Subrahmaniam-MJP Publishers
3. A Text book of Biophysics R.N.Roy, New central Book Agency

References:

1. Basic Bio Physics- M.Daniel Student Edition
2. Bio Physics- Rodney Cotterill John Wiley & Sons, Ltd.

Course Outcomes:

On successful completion of this course, students will be able to:

1. Understanding of nuclear radiation, its measurement and effects of samples

2. To analyze diffusion related processes in biological fluids and blood.
3. To attribute different light and electron microscopes.
4. Analyze spectroscopic techniques and their usage
5. Understand the different absorption spectroscopy and diffraction techniques.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	0	1	1	2	1	1	0	1
CO2	2	1	1	0	1	1	2	1	1	0	1
CO3	2	0	0	0	1	1	2	1	1	0	1
CO4	2	0	0	0	1	1	2	1	1	0	1
CO5	2	0	0	0	1	1	2	1	1	0	1

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

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