

AMITY UNIVERSITY PUNJAB, MOHALI

Program structure for Integrated B.Sc.-M.Sc. Computational Physics- 5 year

Semester-Wise Programme structure for B.Sc. Computational Physics [3 year]						
Sr. No.	Year 1		Year 2		Year 3	
	Semester 1	Semester 2	Semester 3	Semester 4	Semester 5	Semester 6
1	INTRODUCTION TO COMPUTERS [CU:4; L-4, P-0] {MCC}	OOPs USING C++ (CSE205) [CU:4; L-3, P-1] {MCC}	PROGRAMMING USING PYTHON (CAS221) [CU:4; L-3, P-1] {MCC}	PROGRAMMING USING MATLAB [CU:4; L-3, P-1] {MCC}	R PROGRAMMING [CU:4; L-3, P-1] {MCC}	DATA SCIENCE AND ANALYTICS [CU:6; L-4, P-2] {MCC}
2	Mechanics (PHY105) [CU:4; L-3, P-1] {MCC}	OSCILLATIONS AND WAVES [CU:4; L-3, P-1] {MCC}	ELEMENTS OF MODERN PHYSICS [CU:4; L-3, P-1] {MCC}	THERMAL PHYSICS [CU:4; L-3, P-1] {MCC}	Solid State Physics [CU:6; L-4, P-2] {MCC}	Statistical Physics [CU:6; L-4, P-2] {MCC}
3				QUANTUM PHYSICS [CU:4; L-3, P-1] {MCC}	ANALOG SYSTEMS AND APPLICATIONS [CU:6; L-4, P-2] {MCC}	DIGITAL SYSTEMS AND APPLICATIONS [CU:6; L-4, P-2] {MCC}
4	MATHEMATICAL PHYSICS-I (PHY 104) [CU:4; L-3, P-1] {MC}	MATHEMATICAL PHYSICS-II [CU:4; L-3, P-1] {MC}	SPECIAL THEORY OF RELATIVITY [CU:4; L-3, P-1] {MC}	ASTRO-PHYSICS [CU:6; L-5, T-1] {MC}	BIO-PHYSICS [CU:6; L-5, T-1] {MC}	NUCLEAR AND PARTICLE PHYSICS [CU:6; L-6] {MC}

5	Environmental Science I(ENV 101) [CU:2; L-2, P-0] {VAC}	Environmental Science II(ENV 102) [CU:2; L-2, P-0] {VAC}				
	Understanding Self for effectiveness (PSY 101) [CU:1: L-1, P-0] {VAC}	Individual, Society and Nation (PSY 111) [CU:1: L-1, P-0] {VAC}				
6	Introduction to French Culture and Language/Introduction to German Culture and Language (FOL 101/102)[CU:1; L-1, P-0] {AECC}	Introduction to French Culture and Language/Introduction to German Culture and Language FOL 103/104) [CU:1; L-1, P-0] {AECC}	Fundamentals of Communication (ENG104) [CU:2; L-2, P-0] {AECC}	Professional Etiquette and Workplace Communication [CU:2; L-2, P-0] {AECC}		
	History culture of Punjab/ Punjabi[CU:1; L-1, P-0] {AECC}	History culture of Punjab/ Punjabi[CU:1; L-1, P-0] {AECC}				
7	Basic of Computational physics (PHY 106) [CU:3, L-2, P-0] {SEC}	Renewable energy & Harvesting (PHY113) [CU:3, L-2, P-0] {SEC}	Basic Instrumentation Skill / Electrical circuits & Network Skills [CU:3, L-2, P-1] {SEC}	Basic Instrumentation Skill / Electrical circuits & Network Skills [CU:3, L-2, P-1] {SEC}		
8	General Chemistry (CHE 103) [CU:3, L-2, P-1] [MDC]	Weather Forecasting [CU:3, L-3, P-0] [MDC]	MOOC [MDC]			
Credits	23	23	20	21	22	22
Total Credit: Credit Layout as per Curriculum and Credit Framework Guidelines - UGC 2022						
AC	Allied Course					
AEC	Ability Enhancement Course					

CC	Core Course			
GE	General Elective			
OE	Open Elective			
SC	Skill component			
SE	Specialization Elective Course			
SEC	Skill Enhancement Course			
VAC	Value Added Course			
MOOC	MOOC Courses			

List of MOOC Courses:

Sem.	MOOC COURSES	Lecture (L)	Tutorial (T)	Practical P	Contact Hour	Credits
MOO C-I	Introduction to LASERS	3	0	0	3	3
MOO C-II	Applied Optics	3	0	0	3	3

Core Course (PH) Introduction to Computers

L	T	P	Total Credits
4	0	0	4

Course Outcomes

CO1	Explanation on the knowledge of mathematics required to learn electrostatics and magnetostatics
CO2	Explanation of differential analysis of the electric force and field vectors as well as on scalar quantities such as potential and potential energy
CO3	Articulate knowledge of electric current, resistance and capacitance in terms of electric field and electric potential. Demonstrate a working understanding of capacitors
CO4	Understand the dielectric properties, magnetic properties of materials and the phenomena of electromagnetic induction
CO5	Understanding on magnetostatics and its applications

Unit-1-Basic Understanding of Computers	Lectures: 18 h
Introduction to computers, characteristics of computer; History of computers; Classification of computers on size: (Micro, Mini, Mainframe and super computers), Working Principles, Generations; Applications of computers; commonly used terms– Hardware, Software, Firmware. Basic Computer Organization: Block diagram of computer system, Input unit, Processing Unit and Output Unit; Description of Computer input devices: Keyboard, Mouse, Trackball, Pen, Touch screens, Scanner, Digital Camera; Output devices: Monitors, Printers, Plotters.	
Unit-2- Computer Memory and software	Lectures: 18 h
Representation of information: BIT, BYTE, Memory, Memory size; Units of measurement of storage; Main memory: Storage evaluation criteria, main memory organization, RAM, ROM, PROM, EPROM; Secondary storage devices: Sequential Access Memory, Direct Access Memory Magnetic Tapes, Magnetic disks, Optical disks: CD, DVD; Memory storage devices: Flash Drive, Memory card. System and Application software; Programming Languages: Generation of Languages; Translators - Interpreters, Compilers, Assemblers and their comparison.	
Unit-3- Understanding Operating System using DOS	Lectures: 18 h
Introduction to operating systems and its functions, DOS and versions of DOS, Booting sequence; Warm and Cold Boot; Concepts of files and directories, Redirecting command input and output using pipes, Wildcard characters, Types of DOS commands: Internal and External; Internal Commands: DIR, MD, CD, CLS, COPY, DATE, DEL, PATH, PROMPT, REN, RD, TIME, TYPE, VER, VOL; External Commands: XCOPY, ATTRIB, BACKUP, RESTORE, FIND, SYS, FORMAT, CHKDSK, DISKCOPY, LABEL, MOVE, TREE, DELTREE, DEFRAG, SCANDISK, UNDELETE. Batch Files: Introduction to simple batch files; Introduction to CONFIG.SYS and AUTOEXEC.BAT files.	
Unit-4- Introduction to MS Office:	Lectures: 18 h
Creating a new document with templates & Wizard -Creating own document Opening/modifying a saved document -converting files to and from other document formats Using keyboard short-cuts & mouse -Adding symbols & pictures to documents -headers and footers -Finding and replacing text -spell check and Grammar check - Formatting text -paragraph formats -adjusting margins, line space - character space -Changing front type, size -Bullets and numbering - Tables -Adding, editing, deleting tables -Working within tables Adding, deleting, modifying rows and columns -merging & splitting cells. Mail Merge usage. Working with worksheets -cells -Entering, editing, moving, copying, cutting, pasting, transforming data -Inserting and deleting of cells, rows & columns -Working with multiple worksheets -switching between worksheets -moving, copying, inserting & deleting worksheets -Using formulas for quick Calculations -Working & entering a Formula - Formatting a worksheet -Creating and editing charts -elements of an EXCEL chart -Selecting data	

to a Chart -Types of chart -chart wizard -Formatting chart elements -Editing a chart – Printing charts.Creating new presentations -Auto content wizard -Using template – Blank presentation -Opening existing presentations -Adding, editing, deleting, copying, hiding slides -Presentations -Applying new design - Adding graphics -Using headers and footers Animating text -Special effects to create transition slides - Controlling the transition speed Adding sounds to slides -Using action buttons

Text/Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Basandra, S.K	Computers Today,	Galgotia Publications Pvt Ltd	2012	9788186340745
Sinha P.K. & Sinha Priti	Computer Fundamentals	BPB Publications	2004	978-8176567527
E. Balagurusa my	Fundamentals of Computers	Tata McGraw	2009	978-0070141605

Course Title: PHY105 (Mechanics)

L	T	P	Total Credits
3	0	1	4

Course Outcomes

CO1	Students must get the ability to understand the fundamentals of dynamics with the revision of Newton’s laws of motion and their applications in various advanced dynamical situations. The ability to explain different reference frames and accordingly the various conservation theorems
CO2	Understanding the transition from single particle to the system of particles, concept of centre of mass and collisions
CO3	Learning of the expressions of Moment of Inertia for different- different uniformly distributed mass systems with the application of parallel and

	perpendicular axis theorems
CO4	Understanding the general properties of matter such as fluid motion (principle and governing equations), elasticity, modulus of elasticity and rigidity
CO5	Understanding of central force field and gravitational law to define the motion of planets and satellites

Course Contents/syllabus:

	Time (H)
Unit I: Particle Dynamics	14
Reference frames. Inertial frames; Review of Newton's Laws of Motion. Galilean transformations; Galilean invariance. Momentum of variable-mass system: motion of rocket. Motion of a projectile in Uniform gravitational field Dynamics of a system of particles. Centre of Mass. Principle of conservation of momentum. Impulse. Work and Energy: Work and Kinetic Energy Theorem. Conservative and non-conservative forces. Potential Energy. Energy diagram. Stable and unstable equilibrium. Elastic potential energy. Force as gradient of potential energy. Work & Potential energy. Work done by non- conservative forces. Law of Conservation of Energy, Collisions: Elastic and inelastic collisions between particles. Centre of Mass and Laboratory frames	
Unit II: Rotational Dynamics	13
Angular momentum of a particle and system of particles. Torque. Principle of conservation of angular momentum. Rotation about a fixed axis. Moment of Inertia. Calculation of moment of inertia for rectangular, cylindrical and spherical bodies. Kinetic energy of rotation. Motion involving both translation and rotation.	
Unit III: Fluid Motion & Elasticity	13
Kinematics of Moving Fluids: Poiseuille's Equation for Flow of a Liquid through a Capillary Tube. Hooke's law Stress strain diagram, Elastic moduli, Relation between Elastic constants. Twisting torque on a Cylinder or Wire	
Unit IV: Gravitation and Central Force Motion	14
Law of gravitation. Gravitational potential energy. Inertial and gravitational mass. Potential and field due to spherical shell and solid sphere. Motion of a particle under a central force field. Two-body problem and its reduction to one-body problem and its solution. The energy equation and energy diagram. Kepler's Laws. Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS).	
Practicals	72 hours
List of Experiments -with basic instructions	
● Use of Vernier callipers, Screw gauge, Spherometer, Barometer, Sphygmomanometer, Lightmeter, dry and wet thermometers, TDS/conductivity meter and other measuring instruments based on applications of the experiments.	

Use of Plumb line and Spirit level.

- To study the random error in observations.
- Determination of height (of inaccessible structure) using sextant.
- To study the Motion of Spring and calculate (a) Spring constant, (b) g and © Modulus of rigidity.
- To determine the Moment of Inertia of a Flywheel.
- To determine g and velocity for a freely falling body using Digital Timing Technique.
- To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
- To determine the value of g using Kater's Pendulum.
- To study the variation of time period with distance between centre of suspension and centre of gravity for a bar pendulum and to determine: (i) Radius of gyration of the bar about an axis through its C.G. and perpendicular to its length. (ii) The value of g in the laboratory.
- Determination of coefficient of viscosity of a given liquid by Stoke's method. Study its temperature dependence.
- To determine the Young's Modulus of a Wire by Optical Lever Method.
- To determine the Young's modulus by (i) bending of beam using traveling microscope/laser, (ii) Flexural vibrations of a bar.
- Determination of modulus of rigidity by (i) dynamic method Maxwell's needle/Torsional pendulum; (ii) Forced torsional oscillations excited using electromagnet.
- To determine the elastic Constants of a wire by Searle's method.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Kittel, C. and Knight, W.	Mechanics, Berkeley Physics, vol.1	Tata McGraw-Hill	2007.	978-0521198110
Feynman, Leighton and M. Sands	Feynman Lectures, Vol. I	Pearson Education	2008	9780465023820
Kleppner, D Kolenkow, R J	An introduction to mechanics	Mcgraw hill	2017	978-0521198110
Mathur, D S	Mechanics	S Chand	1981	9788121905992
Flint, B L Worsnop, T	Advanced practical physics for students	Asia Publishing House	1971	978-0423738902

Course Title: PHY104 (Mathematical Physics-I)

L	T	P	Total Credits
3	0	1	4

Course Outcomes

CO 1	Revision of vectors, calculus, vector calculus, probability and statistical distribution functions
CO 2	Understand the differential equation applications to many Physics problems
CO 3	Appreciates the physics behind the vector differentiation, vector integrations and its analogy
CO 4	Learning of Cartesian, spherical and cylindrical coordinate systems
CO 5	Introduce the concept of Dirac delta functions which have applications in quantum mechanics

Course Contents/syllabus:

	Time (H)
Unit I: Vectors, Limits and Probability	8
Properties of vectors under rotations. Scalar product and its invariance under rotations. Vector product, Scalar triple product and their interpretation in terms of area & volume respectively. Scalar and Vector fields. Limits, continuity, average and instantaneous quantities, differentiation. Plotting functions. Intuitive ideas of continuous, differentiable, etc. functions and plotting of curves. Approximation: Taylor and binomial series (statements only).	
Unit II: Introduction to Probability	4
Independent random variables: Probability distribution functions; binomial, Gaussian, and Poisson, with examples. Mean and variance. Dependent events: Conditional Probability. Bayes' Theorem and the idea of hypothesis testing.	
Unit III: Ordinary Differential Equations	15

<p>First Order and Second Order Differential equations: First Order Differential Equations and Integrating Factor. Homogeneous Equations with constant coefficients. Wronskian and general solution. Statement of existence & Uniqueness Theorem for Initial Value Problems. Particular Integral. Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials. Integrating factor, with simple illustration. Constrained Maximization using Lagrange Multipliers.</p>	
Unit IV: Vector Calculus	18
<p>Vector Differentiation: Directional derivatives and normal derivatives. Gradient of a scalar field and its geometrical interpretation. Divergence and curl of a vector field. Del & Laplacian operators. Vector identities.</p> <p>Vector Integration: Ordinary Integrals of Vectors. Multiple integrals, Jacobian. Notion of infinitesimal line, surface and volume elements. Line, surface and volume integrals of Vector fields. Flux of a vector field. Gauss' divergence theorem, Green's and Stokes Theorems and their applications (no rigorous proofs).</p>	
Unit-5- Orthogonal Curvilinear Coordinates	6
<p>Orthogonal Curvilinear Coordinates. Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems. Components of Velocity and Acceleration in Cylindrical and Spherical Coordinate Systems.</p>	
Unit-6- Dirac Delta function and its Properties	3
<p>Definition of Dirac delta function. Representation as limit of a Gaussian function and rectangular function. Properties of Dirac delta function</p>	
Practicals	36 hours
<p>List of Experiments -with basic instructions</p> <ul style="list-style-type: none"> ● Introduction: Computer architecture and organization, memory and Input/output devices. ● Basics of scientific computing: Binary and decimal arithmetic, Floating point numbers, algorithms, Sequence, Selection and Repetition, single and double precision arithmetic, underflow & overflow- emphasize the importance of making equations in terms of dimensionless variables, Iterative methods ● Errors and error Analysis: Truncation and round off errors, Absolute and relative errors, Floating point computations. ● C & C++ Programming fundamentals: Introduction to Programming, constants, variables and data types, operators and Expressions, I/O statements, scanf and printf, c in and c out, Manipulators for data formatting, Control statements (decision making and looping statements). (If statement. If else Statement. Nested if Structure. Else-if Statement. Ternary Operator. Goto Statement. Switch Statement. Unconditional and Conditional Looping. While Loop. Do-While Loop. FOR Loop. Break and Continue Statements. Nested Loops), Arrays (1D & 2D) and strings, 	

user defined functions, Structures and Unions, Idea of classes and objects.

- Programs: Sum & average of a list of numbers, largest of a given list of numbers and its location in the list, sorting of numbers in ascending descending order, Binary search
- Random number generation: Area of circle, area of square, volume of sphere, value of pi (π).
- Solution of Algebraic and Transcendental equations: Using Bisection, Newton Raphson and Secant methods find the Solution of linear and quadratic equation and solve $\alpha = \tan \alpha$, $I = I_0 \left[\frac{\sin \alpha}{\alpha} \right]^2$ in optics
- Solution of Ordinary Differential Equations (ODE) :First order differential equation, Radioactive decay, Current in RC, LC circuits with DC source, Newton's law of cooling, Classical equations of motion.
- Solution of Algebraic and Transcendental equations by Bisection, Newton Raphson and Secant methods:
- Interpolation: Evaluation of trigonometric functions e.g. $\sin \theta$, $\cos \theta$, $\tan \theta$ etc. using Newton Gregory Forward and Backward difference formula.
- Numerical differentiation and Integration: Using Forward and Backward difference formula for differentiation and Trapezoidal and Simpson rules for integration and Monte Carlo method solve the following problems.
 - Given Position with equidistant time data to calculate velocity and acceleration and vice versa.
 - Find the area of B-H Hysteresis loop
- Runge Kutta Method Problems :
 - Solve the coupled differential equations

$$\frac{dx}{dt} = y + x - \frac{x^3}{3}; \quad \frac{dy}{dt} = -x$$
 for four initial conditions
 - $x(0) = 0, y(0) = -1, -2, -3, -4.$
 - Plot x vs y for each of the four initial conditions on the same screen for $0 \leq t \leq 15$
 - The differential equation describing the motion of a pendulum is. $\frac{d^2 \theta}{dt^2} = -\sin \theta$
 - $\frac{d^2 \theta}{dt^2} = -\sin \theta$ he pendulum is released from rest at an angular displacement α and $\theta'(0) = 0$. Solve the equation for $\alpha = 0.1, 0.5$ and 1.0 and plot θ as a function of time in the range $0 \leq t \leq 8\pi$. Also plot the analytic solution valid for small α ($\sin \alpha = \alpha$)

Text / Reference Books:

Author	Title	Publisher	Year of publication	ISBN
Arfken, G B & Weber, F E	Mathematical Methods for Physicists	Elsevier	7 th edition, 2013	9780120598328
K.F.Riley & M.P.Hobson	Essential Mathematical Methods	Cambridge Univ. Press	2011	9780521761147

Zill, D G and Wright, W S	Advanced Engineering mathematics	Jones and bartlett Learning	5 Ed., 2012,	9780471021407
Atkinson, K E	Elementary Numerical Analysis	Wiley India	3 Ed., 2007	9780471433378
Walker, Darren	Computational Physics	Scientific Int. Pvt. Ltd.	2015	9781942270737

Reference Books:

Author	Title	Publisher	Year of publication	ISBN
C.L.Arora	Refresher Course in B.Sc. Physics (Vol I)	S Chand & Company	2010	978-8121904650
C.L.Arora	Refresher Course in B.Sc. Physics (Vol II)	S Chand & Company	2010	978-8121904667
C.L.Arora	Refresher Course in B.Sc. Physics (Vol III)	S Chand & Company	2013	978-8121906265

Course Title: ENV101 (Environmental Studies-I)

L	T	P	Total Credits
2	0	0	2

Course Contents/syllabus:

	Teaching hours
Unit-1- Multidisciplinary nature of environmental studies	8 h
Multidisciplinary nature of environmental studies: Definition, scope and importance; components of environment –atmosphere, hydrosphere, lithosphere and biosphere. Concept of sustainability and sustainable development.	
Unit-2-Natural Resources	10 h
Natural resources: Land resources and land use change, land degradation, soil erosion and desertification. Deforestation: causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal population. Water Resources-Use and over-exploitation of surface and groundwater, floods, drought, conflicts over water (international and inter-state). Heating of earth and circulation of	

air; air mass formation and precipitation. Energy resources- renewable and non-renewable energy sources, use of alternate energy sources, Growing energy needs, Case studies. .	
Unit-3- Ecosystems	9 h
Ecosystem: What is an ecosystem; Structure and function of an ecosystem; Energy flow in the ecosystem; Food chains, food webs and ecological succession. Case studies of the following ecosystems: Forest ecosystem, Grassland ecosystem, Desert ecosystem Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).	
Unit-4- Biodiversity and its conservation	9 h
Biodiversity: Levels of biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India; biodiversity patterns and global biodiversity hot spots. India as a mega-biodiversity nation; endangered and endemic species of India. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; conservation of biodiversity: in-situ and ex-situ conservation of biodiversity. Ecosystem and biodiversity services: ecological, economic, social, ethical, aesthetic and information value.	

Course Learning Outcomes: At the end of this course, the students will be able to develop:

- Appreciate the multi-disciplinary nature of environmental science
- Understand natural resources and evaluate limitations surrounding renewable and non-renewable resources
- Understand the nuances of ecosystem and learn about behaviour of various ecosystem
- Learn about the types, services and threats to our biodiversity and importance of conserving it.

Text / Reference Books:

Course Title: PSY101 (Understanding Self for Effectiveness)

L	T	P	Total Credits
1	0	0	1

Course Contents/syllabus:

	Teaching time
Unit I: Self: Core Competency	4.5 h
Understanding of Self, Components of Self – Self identity , Self concept, Self confidence , Self image , BIG5 Factors	
Unit II: Techniques of Self Awareness	4.5 h
Exploration through Johari Window, Mapping the key characteristics of self, Framing a charter for self Stages – self awareness, self acceptance and self realization	
Unit III: Self Esteem & Effectiveness	4.5 h
Meaning, Importance, Components of self esteem, High and low self esteem, Measuring your self esteem	
Unit IV: Building Positive Attitude and Emotional Competence	4.5 h
Meaning and nature of attitude, Components and Types of attitude ,Importance and relevance of attitude Emotional Intelligence – Meaning, components, Importance and Relevance Positive and negative emotions, Healthy and Unhealthy expression of emotions	

Course Learning Outcomes: At the end of this course, the students will be able to:

- The student will apply self-introspection as a tool for self-awareness.
- The student will understand self-concept for self-recognition, self-improvement and perception of others.
- The student will be able to analyze their physical self, social self, the competent self and psychological self.

The student will be able to analyze what motivates his/her actions and the actions of others

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN

Singh A.	Achieving Behavioural Excellence for Success	Wiley Publication	2012	978812 658027
Towers, Marc	Self Esteem	American Media	1995	978188 492629 7
Pedler Mike, Burgoyne John, Boydell Tom	A Manager's Guide to Self-Development	McGraw-Hill	2006	978-007711 4701
Covey, R. Stephen	Seven habits of Highly Effective People	Simon & Schuster Ltd	2013	978-145163 9612
Khera Shiv	You Can Win	Macmillan	2005	978-033393 7402
Gegax Tom	Winning in the Game of Life	Harmony Books	1999	978-060960 3925
Singh, Dalip	Emotional Intelligence at Work	Publications	2006	978076 193532 2
Goleman, Daniel	Emotional Intelligence	Bantam Books	2007	978055 309503 6
Goleman, Daniel	Working with E.I	Bantam Books	1998	978055 310462 2

Course Title: FOL101 (Introduction to French Culture & Language)

L	T	P	Total Credits
1	0	0	1

Course Contents/syllabus:

	Teaching hours
Unit-I Introduction to French language	4 h
<ul style="list-style-type: none"> ● Brief introduction of French and Francophone countries ● Presenting oneself ● Getting information about someone else ● Greeting and taking leave ● Asking/giving personal information 	
Unit-II- A rendez-vous ; Visiting a place	5 h
<ul style="list-style-type: none"> ● Pronouncing and writing numbers in French ● Spell and count numbers 	

<ul style="list-style-type: none"> ● Telling the time ● Temporal expressions ● Communicating in class ● Fixing an hour, place for a meeting. ● Describing a person. ● Identifying a person, object and place ● Describing relation in a family ● A specific person, object and place 	
Unit-III- An interview	4.5 h
<ul style="list-style-type: none"> ● Description of objects, people and places ● Nationalities ● Speaking about one's professions ● Expressing Actions using regular –er ending verbs; avoir, être; reflexive verbs – usage, conjugation ● Interview of celebrity 	
Unit-IV- At the discotheque	4.5 h
<ul style="list-style-type: none"> ● Portrait by a journalist ● Giving a positive or negative reply ● Asking questions ● Discussion with a person ● Activities in a day 	

Course Learning Outcomes: At the end of this course, the students will be able to express themselves in writing and orally in basic French. This course content focuses on the speech of the students in a lucid and a concurrent manner using appropriate vocabulary and pronunciation techniques. Extra stress will be given on their understanding of grammatical structures and the foreign accent of the language. At the end of the course, the student shall be able to:

- Understand information; Express in his own words; Paraphrase; Interpret and translate.
- Apply information in a new way in a practical context
- Analyse and break-down information to create new ideas
- Evaluate and express opinion in a given context

Text / Reference Books:

Author	Title	Publisher	Year	ISBN No
Christine Andant, Chaterine Metton, Annabelle Nachon, Fabienne Nugue	A Propos – A1 Livre De L'Eleve, Cahier D' Exercices	Langers Int. Pvt. Ltd.	2010	978- 9380809069
<u>Manjiri Khandekar</u> and <u>Roopa Luktuke</u>	Jumelage – 1 Methode De	Langers International	2020	978- 9380809854

	Fraincais – French	Private Limited		
<u>Michael Magne, Marie-Laure Lions-Olivieri</u>	Version Originale 1: Cahier d'exercices	Maison Des Langues	2010	9788484435617

Course Title: FOL102 (Introduction to German Culture & Language)

L	T	P	Total Credits
1	0	0	1

Course Contents/syllabus:

	Teaching hours
Unit-I Introduction to German Language (Einführung)	3 h
● Introduction to German as a global language, Self-introduction and Greetings, Die Alphabeten, Phonetics: the sound of consonants and vowels, Wie buchstabieren Sie Ihren Name?	
Unit-II- Numbers and everyday conversation (die Zahl und Gespräche)	6 h
● Counting in German from 1-100, Simple Calculation and verb 'kosten' – Wie viel kostet das? Plural Forms, Vocabulary: Wochentage, Monate, Jahreszeiten, Ordinal numbers and the question – Wann haben Sie Geburtstag?	
Unit-III- Regular verbs and nominative case: articles and pronouns (Regelmässige Verben und Nominativ Kasus: Artikel und Pronomen)	4.5 h
● Introduction to all personal pronouns and conjugation of Regular verbs Detailed exercise on regular verbs. Reading a text on regular verbs. Introduction to definite. Vocabulary: Schulsachen und Getränke, Nominative case/ Articles (der, die, das) Nominative Pronouns: - Applicability of pronouns for both persons and things. Usage of nominative Personal Pronouns Introduction of nominative possessive pronouns usage of nominative possessive pronouns	
Unit-IV- The Family, Work-life and Professions (Familienmitglieder und Berufe) & Interrogative sentences (W-Fragen)	4.5 h
The Family, Work-life and Professions (Familienmitglieder und Berufe)	

<ul style="list-style-type: none"> ● Vocabulary: Professions and conjugation of the verb 'sein' Introduction to simple possessive pronouns with the help of the verb 'haben' Usage of possessive pronouns. Interrogative sentences (W-Fragen) W-Fragen: who, what, where, when, which, how, how many, how much, etc. Exercises on the question pronouns 	
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Course Learning Outcomes: At the end of this course, the students will be able to express themselves in writing and orally in basic German. This course content focuses on the speech of the students in a lucid and a concurrent manner using appropriate vocabulary and pronunciation techniques. Extra stress will be given on their understanding of grammatical structures and the foreign accent of the language. At the end of the course, the student shall be able to:

- Understand information; Express in his own words; Paraphrase; Interpret and translate.
- Apply information in a new way in a practical context
- Analyse and break-down information to create new ideas
- Evaluate and express opinion in a given context

Text / Reference Books:

Author	Title	Publisher	Year	ISBN
<u>Rolf Bruseke</u>	Starten Wir A 1	Langers Int. Pvt Ltd	2017	978-3190160006
<u>Giorgio Motta</u>	Wir Plus Grundkurs Deutsch fur Junge Lerner Book	Ernst Kleit Verlag	2011	978-8183072120
Heimy Taylor, <u>Werner Haas</u>	Station en Deutsch Self Study Course German Guide	Wiley	2007	978-0470165515

Course Title: INL103 (History and Culture of Punjab)

L	T	P	Total Credits
1	0	0	1

Course Contents/syllabus

	Teaching hours
Unit I:	4.5 h
1. Harappan Civilization: extent and town planning and socio-economic	

life. 2. Life in Vedic Age: socio-economic and religious; 3. Growth and impact of Jainism and Buddhism in Panjab.	
Unit II:	4.5 h
4. Society and Culture under Maurayas and Guptas. 5. Bhakti movement: Main features; prominent saints and their contribution. 6. Origin and development of Sufism	
Unit III:	4.5 h
7. Evolution of Sikhism: teaching of Guru Nanak; Institutional Development- Manji, Masand, Sangat and Pangat 8. Transformation of Sikhism: Martyrdom of Guru Arjan; New policy of Guru Hargobind, martyrdom of Guru Tegh Bahadur. 9. Institution of Khalsa: New baptism; significance	
Unit IV:	4.5 h
10. Changes in Society in 18 th century: social unrest; emergence of misls and other institutions – rakhi, gurmata, dal iophy. 11. Society and Culture under Maharaja Ranjit Singh. 12. MAP (of undivided physical geographical map of Punjab): Major Historical Places: Harappa, Mohenjodaro, Sanghol, Ropar, Lahore, Amritsar, Kiratpur, Anandpur Sahib, Tarn Taran, Machhiwara, Goindwal, Khadur Sahib.	

Course Learning Outcomes:

- Understand the history of various cultures in Punjab.
- Interpret the importance of Maurayan, Gupta and Bhakti influences on Punjab
- Apply the teaching of Sikhism on the emergence of the Khalsa.
- Examine the impact societal changes on socio-cultural and physical landscape of Punjab

Text / Reference Books:

Author	Title	Publisher	Ed/ year	ISBN No
L.M Joshi,	History and Culture of the Punjab, Part-I	Punjabi University, Patiala	1989, 3 rd	-
Buddha Prakash	Glimpses of Ancient Punjab	Punjabi University, Patiala,	1983	-
Khushwant Singh	A History of the Sikhs, vol I: 1469-1839,	oxford University Press, Delhi	1991	-

Course Title: PHY106 (Basics of Computational Physics)

L	T	P	Total Credits
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1	0	2	3
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Course Outcomes

CO1	Learn the basics including the need and design, architecture of the computer system, Learning the possibilities and limitations of computational methods in physics
CO2	Understand the error analysis, approximation errors, interpolations methods
CO3	Understand the methods to analysis the data: Least square method
CO4	Learning the software and languages

Course Contents/syllabus:

	Time (H)
Unit I: Introduction to Fortran	4.5
Importance of computers in Physics, paradigm for solving physics problems for solution. Usage of linux as an Editor. Algorithms and Flowcharts: Algorithm: Definition, properties and development. Flowchart: Concept of flowchart, symbols, guidelines, types. Examples: Cartesian to Spherical Polar Coordinates, Roots of Quadratic Equation, Sum of two matrices, Sum and Product of a finite series, calculation of $\sin(x)$ as a series, algorithm for plotting (1) iophysical figures and (2) trajectory of a projectile thrown at an angle with the horizontal. Some fundamental Linux Commands (Internal and External commands). Development of FORTRAN, Basic elements of FORTRAN: Character Set, Constants and their types, Variables and their types, Keywords, Variable Declaration and concept of instruction and program. Operators: Arithmetic, Relational, Logical and Assignment. Expressions: Arithmetic, Relational, Logical, Character and Assignment Expressions. Fortran Statements: I/O Statements (unformatted/formatted), Executable and Non- Executable Statements, Layout of Fortran Program, Format of writing Program and concept of coding, Initialization and Replacement Logic. Examples from physics problems.	
Unit II: Control Statement and its Types	4.5
Types of Logic(Sequential, Selection, Repetition), Branching Statements (Logical IF, Arithmetic IF, Block IF, Nested Block IF, SELECT CASE and ELSE IF Ladder statements), Looping Statements (DO-CONTINUE, DO-ENDDO, DO-WHILE, Implied and Nested DO Loops), Jumping Statements (Unconditional GOTO, Computed GOTO, Assigned GOTO) Subscripted Variables (Arrays: Types of Arrays, DIMENSION Statement, Reading and Writing Arrays), Functions and Subroutines (Arithmetic Statement Function, Function Subprogram and Subroutine), RETURN, CALL, COMMON and EQUIVALENCE Statements), Structure, Disk I/O Statements, open a file, writing in a file, reading from a file. Examples	

<p>from physics problems as mentioned below</p> <ul style="list-style-type: none"> ● Exercises on syntax on usage of FORTRAN ● Usage of GUI Windows, Linux Commands, familiarity with DOS commands and working in an editor to write sources codes in FORTRAN. ● To print out all natural even/ odd numbers between given limits. ● To find maximum, minimum and range of a given set of numbers. ● Calculating Euler number using $\exp(x)$ series evaluated at $x=1$ 	
Unit III: Introduction to LaTeX	4.5
TeX/LaTeX word processor, preparing a basic LaTeX file, Document classes, Preparing an input file for LaTeX, Compiling LaTeX File, LaTeX tags for creating different environments, Defining LaTeX commands and environments, Changing the type style, Symbols from other languages. Formulae and equations, Figures and other floating bodies, Lining in columns- Tabbing and tabular environment, Generating table of contents, bibliography, citation, Making an index and glossary, List making environments, Fonts, Picture environment and colors, errors.	
Unit IV: Analysis and Visualization	4.5
Introduction to graphical analysis and its limitations. Introduction to Gnuplot. Importance of visualization of computational and computational data, basic Gnuplot commands: simple plots, plotting data from a file, saving and exporting, multiple data sets per file, physics with Gnuplot (equations, building functions, user defined variables and functions), Understanding data with Gnuplot. Using the above concepts, write a code for the following problems.	
Practicals	72 hours
<p>List of Experiments -with basic instructions</p> <ul style="list-style-type: none"> ● To compile a frequency distribution and evaluate mean, standard deviation etc. ● To evaluate the sum of finite series and the area under a curve. ● To find the product of two matrices ● To find a set of prime numbers and Fibonacci series. ● To write a program to open a file and generate data for plotting using Gnuplot. ● Plotting trajectory of a projectile projected horizontally. ● Plotting trajectory of a projectile projected making an angle with the horizontal. ● Creating an input Gnuplot file for plotting data and saving the output for seeing on the screen. Saving it as an eps file and as a pdf file. ● To find the roots of a quadratic equation. 	

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
S. Sastry	Introductory	Prentice Hall	5 th edition,	978-

	Methods of Numerical Analysis	Pvt. Ltd.	2012	8120345928
R.C. Verma	Computational Physics	Newage publishers	1 st edition, 2005	978-8122416596
Atkinson, K E	Elementary Numerical analysis	Wiley India	3 rd edition, 2003	9780471433378
V. Rajaraman	Computer Programming Fortran 90 and 95	Prentice Hall Pvt. Ltd.	1997	978-8120311817

Course Title: CHE103 (General Chemistry-I)

L	T	P	Total Credits
2	0	1	3

Course Learning Outcomes

CO 1	Knowledge of evolution of scientific theories to explain the atomic structure, molecular geometry and physico-chemical behaviour of atomic matter made from elements in periodic table.
CO 2	Focus on fundamentals of organic molecules, structure, stereochemistry, bonding, reactivity and reaction mechanisms.
CO 3	Familiarization with solid and liquid states of matter and its physical laws related to describe them

Course Contents/syllabus:

	Teaching hours
Unit I: Atomic Structure	9 h
Bohr's theory, Wave mechanics: de' Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, Quantum numbers and their significance. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of s, p, d and f orbitals. Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number.	
Unit II: Periodic Properties of Elements	9 h
s, p, d, f block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to s and p-block. (a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic	

<p>table.</p> <p>(b) Atomic radii (Van'der Waals), (c) Ionic and crystal radii.</p> <p>(d) Covalent radii (octahedral and tetrahedral)</p> <p>I Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy.</p> <p>(f) Electron gain enthalpy, trends of electron gain enthalpy.</p> <p>(g) Electronegativity, Pauling, Mullikan, Allred Rachow scales, electronegativity and bond order, partial charge</p>	
Unit III: Basics of Organic Chemistry and Stereochemistry	9 h
<p>a)Organic Compounds:__Classification, and Nomenclature, Hybridization, Shapes of molecules, Influence of hybridization on bond properties. Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment; Organic acids and bases; their relative strength. Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges; Electrophiles and Nucleophiles; Nucleophilicity and basicity; Types, shape and relative stabilities of reaction intermediates (Carbocations, Carbanions, Free radicals and Carbenes). Organic reactions and their mechanism: Addition, Elimination and Substitution reactions.</p> <p>b)Stereochemistry:_Concept of asymmetry, Fischer Projection, Newmann and Sawhorse projection formulae and their interconversions; Geometrical isomerism: cis–trans and, syn-anti isomerism E/Z notations with C.I.P rules. Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres, Distereoisomers, meso structures, Racemic mixtures, Relative and absolute configuration: D/L and R/S designations.</p>	
Unit IV: States of matter : Gases and Liquids	9 h
<p>a)Gases: Deviations from ideal gas behavior, compressibility factor, and its variation with pressure for different gases. Causes of deviation from ideal behavior. Van der Waals equation of state, its derivation and application in explaining real gas behaviour; van der Waals equation expressed in virial form, Boyle temperature. Isotherms of real gases and their comparison with van der Waals isotherms, continuity of states, critical state, critical and van der Waals constants, law of corresponding states. Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path and viscosity of gases, including their temperature and pressure dependence, relation between mean free path and coefficient of viscosity, calculation of σ from η; variation of viscosity with temperature and pressure. Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities.</p> <p>B)Liquids: Structure and physical properties of liquids; vapour pressure, surface tension, viscosity, and their dependence on</p>	

temperature, Effect of addition of various solutes on surface tension, cleansing action of detergents. Structure of water.	
Practical:	36 Hours Total
<p><u>Inorganic Chemistry Practicals</u></p> <ul style="list-style-type: none"> ● Titrimetric Analysis <ul style="list-style-type: none"> (i) Calibration and use of apparatus. (ii) Preparation of solutions of different Molarity/Normality of titrants. (iii) Use of primary and secondary standard solutions. ● Acid-Base Titrations <ul style="list-style-type: none"> (i) Estimation of carbonate and hydroxide present together in mixture. (ii) Estimation of carbonate and bicarbonate present together in a mixture. Checking the calibration of the thermometer. <p><u>Organic Chemistry Practicals</u></p> <ul style="list-style-type: none"> ● Determination of the melting points of given organic compounds and unknown organic compounds (using Kjeldahl method and electrically heated melting point apparatus). ● Chromatography <ul style="list-style-type: none"> a. Separation of a mixture of two amino acids by ascending and horizontal paper chromatography b. Separation of a mixture of two sugars by ascending paper chromatography c. Separation of a mixture of o-and p-nitrophenol or o-and p-aminophenol by thin layer chromatography (TLC). <p><u>Physical Chemistry Practicals</u></p> <ul style="list-style-type: none"> ● Surface tension measurements. <ul style="list-style-type: none"> a. Determine the surface tension by (i) drop number (ii) drop weight method. b. Study the variation of surface tension of detergent solutions with concentration. ● Viscosity measurements using Ostwald's viscometer. <ul style="list-style-type: none"> a. Determination of viscosity of aqueous solutions of (i) polymer (ii) ethanol and (iii) sugar at room temperature. b. Viscosity of sucrose solution with the concentration of solute. 	

Text Books/literature

AUTHOR	TITLE	Publisher	Year of publication	ISBN
J.D. Lee	Concise Inorganic Chemistry	John Wiley and Sons	2016	978-8126515547

M. B. Smith, J. March	, March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure	Wiley- Interscienc e	2015	978-8126556588
Atkins P.W, Julio de Paula	Physical Chemistry	Oxford University Press	2018	978-0198814740
J. Mendham, R.C. Denney, J. D. Barnes, M.J.K. Thomas	Vogel's Quantitative Chemical Analysis	Longman	1999	978-582226289
Shoemaker, D.P Garland, C.W Nibler, J.W	Experiments in Physical Chemistry	McGraw Hill Inc	2008	978-0070570078

Semester-II

[Course Title: OOPS using C++](#)

L	T	P	Total Credits
3	0	1	4

Course content and syllabus

	Teachin g Hours
Unit I: Introduction	14 h

Difference between C and C++, Procedure Oriented and Object-Oriented Approach, Basic Concepts: Objects, classes, Principals like Abstraction, Encapsulation, Inheritance and Polymorphism. Dynamic Binding, Message Passing, Characteristics of Object-Oriented Languages	
Unit II: Classes & Objects	13 h
Abstract data types, Object & classes, attributes, methods, C++ class declaration, Scope resolution operator, Friend Functions, Inline functions, Constructors and destructors, instantiation of objects, Types of Constructors, Static Class Data, Array of Objects, Constant member functions and Objects, Memory management Operators	
Unit III: Inheritance and Polymorphism	17 h
Inheritance, Types of Inheritance, access modes – public, private & protected, Abstract Classes, Ambiguity resolution using scope resolution operator and Virtual base class, Aggregation, composition vs classification hierarchies, Overriding inheritance methods, Constructors in derived classes, Nesting of Classes. Polymorphism, Type of Polymorphism – Compile time and runtime, Function Overloading, Operator Overloading (Unary and Binary), this pointer, Virtual Functions, Pure virtual functions.	
Unit IV: Strings, Files and Exception Handling	10 h
Manipulating strings, Streams and files handling, Formatted and Unformatted Input output Exception handling: Try, Catch and Block Introduction to Generic Programming – function template, class Template	

List of Experiments:

1. Creation of objects in programs and solving problems through them
2. WAP in C++ to find the sum of individual digits of a positive integer.
3. WAP in C++ to generate the first n terms of the sequence
4. WAP to find both the largest and smallest number in a list of integers.
5. WAP to illustrate New and Delete Keywords for dynamic memory allocation
6. Different use of private, public member variables and functions and friend functions.
7. Use of constructors and destructors.

8. Operator overloading
9. Use of inheritance and accessing objects of different derived classes.
10. Illustrate the concept of multilevel and multiple inheritance.
11. Programs of pointers
12. Program on array pointer using its own name as pointer.
13. Polymorphism and virtual functions (using pointers).
14. Programs on Exception Handling

Course Learning Outcomes:

The student will be able to

1. Articulate the principles of object-oriented problem solving and programming.
2. Outline the essential features and elements of the C++ programming language.
3. Explain programming fundamentals, including statement and control flow and recursion.
4. Apply the concepts of data abstraction, function abstraction, inheritance, overriding, overloading, and polymorphism.
5. Apply the concepts using objects and data abstraction, class, and methods in function abstraction.
6. Analyze, write, debug, and test basic C++ codes using the approaches introduced in the course.
7. Analyze problems and implement simple C++ applications using an object-oriented software engineering approach.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
E Balagurusamy	Object Oriented Programming with C++ (2017) 7 th ed.	McGraw Hill Education	2017	9352607996
Schildt H.	C++: The Complete Reference,	Tata McGraw Hill	2003	007053246X
Robert Lafore	Object Oriented Programming in Turbo C++	Galgotia Publications	1991	8185623228

Walter Savitch	Problem solving with C++ :The Object of Programming	Pearson Education.	2002	0321136640
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[Course Title : Oscillations and Waves](#)

L	T	P	Total Credits
3	0	1	4

Course Outcomes

CO 1	Understand the fundamental principles underlying wave phenomena using a mathematical description for certain systems
CO 2	To acquire the fundamental properties of wave and its application in mechanical waves and electromagnetic radiation such as light
CO 3	Study of two perpendicular oscillators (Lissajous figures) and behaviour of transverse, longitudinal waves
CO 4	Understand the principle of superposition and its role in understanding the interference, diffraction and polarization with their everyday life observation
CO 5	Understand the mechanism of few optical instruments like biprism, interferometer, diffraction grating, and holograms

Course Content

Unit-1-Simple Harmonic Free Oscillations	Lectures: 14 h
Simple harmonic oscillations (SHO) and its equation, Energy of SHO, spring- mass systems, simple and compound pendulum, torsion pendulum, Electrical Oscillations, Plasma Vibrations, Lattice Vibrations, Superposition Harmonic oscillations: Standing (Stationary) Waves in a String: Fixed and Free Ends of the same period and of periods in ratio 1:2, Lissajous and their uses.	
Unit-2-Damped and forced oscillations	Lectures: 16 h
Damped Harmonic oscillations and its equation, different cases of damping: heavy, critical and light, Determination of damping coefficients – Logarithmic decrement, relaxation time and Q-factor. Electromagnetic damping, collision damping –	

Ionosphere and metals. Free and forced oscillations, A forced oscillator, Transient and Steady State Oscillations, velocity versus driving force frequency, Resonance, power supplied to forced oscillator by the driving force, Q-factor of a forced oscillator, Electrical (series and parallel) , nuclear and nuclear-magnetic resonances, coupled oscillations, Normal coordinates and modes of vibrations. Normal frequencies	
Unit-3-Waves in physical media	Lectures: 18 h
Wave motion in one dimension, Transverse and longitudinal waves, progressive harmonic waves and their energy, Transverse waves on a string, longitudinal waves on a rod, Electrical transmission lines, characteristic impedance of a string and a transmission line, superposition of harmonic waves: interference and beats, stationary waves, Acoustic waves, waves in dispersive and adsorptive media, spherical waves	
Unit-4- Reflection and Transmission	Lectures: 18 h
Reflection and transmission of transverse waves on a string at the discontinuity, Energy considerations of reflected and transmitted waves, Impedance matching, eigenfrequencies and eigenfunctions for stationary waves on a string. Normal modes in three dimensions, Planck's Law, Debye's T ³ Law, Conduction electrons in a metal, transmission of non-monochromatic waves, Bandwidth Theorem.	

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Francis Crawford	Waves: Berkeley Physics Course, vol. 3	Tata McGraw-Hill.	2007	9780070048607
H. J. Pain	The Physics of Vibrations and Waves	John Wiley and Sons	2013	9780470012956
N.K. Bajaj	The Physics of Waves and Oscillations	Tata McGraw Hill	1998	9780074516102
Ajoy Ghatak	Optics	Tata McGraw Hill	2008	9789339220907

Max Born and Emil Wolf	Principles of Optics	Pergamon Press	1999	978-1108477437
S.P.Puri	Text Book of Vibrations and Waves	Tata McGraw Hill	2004	978-1403924032

Oscillations and Waves	Practicals: 36 h
<p>Objective: The aim of this section of the course is to build an understanding about various components of an optical instrument and to develop skill to measure the related physical quantities.</p> <ul style="list-style-type: none"> ● To determine the frequency of an electric tuning fork by Melde's experiment and verify $\lambda^2 - T$ law. ● To investigate the motion of coupled oscillators. ● To study Lissajous Figures. ● Familiarization with: Schuster's focusing; determination of angle of prism. ● To determine refractive index of the Material of a prism using sodium source. ● To determine the dispersive power and Cauchy constants of the material of a prism using mercury source. ● To determine the wavelength of sodium source using Michelson's interferometer. ● To determine wavelength of sodium light using a plane diffraction grating. ● To determine wavelength of sodium light using Newton's Rings. ● To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film. ● To determine wavelength of (1) Na source and (2) spectral lines of Hg source using plane diffraction grating. ● To determine dispersive power and resolving power of a plane diffraction grating. 	

Course Title:(PHY201) Mathematical Physics-II

L	T	P	Total Credits
3	0	1	4

Course Outcomes

CO1	Understand the partial differential equation and its applications to physics problems
CO2	Gets familiar to Fourier analysis of periodic functions and Fourier transformation and appreciates its applications to physics problems
CO3	Become familiar to special functions such as the Hermite polynomial, the Legendre polynomial, the Laguerre polynomial and Bessel functions and their differential equations with their applications
CO4	Learning of beta, gamma and the error functions and their applications in doing integrations

Course Contents

Unit-1- Partial Differential Equations and Frobenius Method	Lectures: 14
Solutions to partial differential equations, using separation of variables: Laplace's Equation in problems of rectangular, cylindrical and spherical symmetry. Wave equation and its solution for vibrational modes of a stretched string, rectangular and circular membranes. Diffusion Equation. Singular Points of Second Order Linear Differential Equations and their importance. Frobenius method and its applications to differential equations.	
Unit-2-Fourier Series	Lectures: 13
Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only). Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients. Complex representation of Fourier series. Expansion of functions with arbitrary period. Expansion of non-periodic functions over an interval. Even and odd functions and their Fourier expansions. Application. Summing of Infinite Series. Term-by-Term differentiation and integration of Fourier Series. Parseval Identity.	
Unit-3- Special Functions and Integrals	Lectures: 14
Legendre, Bessel, Hermite and Laguerre Differential Equations. Properties of Legendre Polynomials: Rodrigues Formula, Generating Function, Orthogonality. Simple recurrence relations. Expansion of function in a series of Legendre Polynomials. Bessel Functions of the First Kind: Generating Function, simple recurrence relations. Zeros of Bessel Functions ($J_0(x)$ and $J_1(x)$) and Orthogonality. Beta and Gamma Functions and Relation between them. Expression of Integrals in terms of Gamma Functions. Error Function (Probability Integral).	
Unit-4- Theory of Errors	Lectures: 13
Systematic and Random Errors. Propagation of Errors. Normal Law of Errors. Standard and Probable Error. Least-squares fit. Error on the slope and intercept of a fitted line.	

Objective: The aim of this Lab is to use the computational methods to solve physical problems. Course will consist of lectures (both theory and practical) in the Lab. Evaluation done not on the programming but on the basis of formulating the problem

- Introduction to Scilab, Advantages and disadvantages, Scilab environment, Command window, Figure window, Edit window, Variables and arrays, Initialising variables in Scilab, Multidimensional arrays, Subarray, Special values, Displaying output data, data file, Scalar and array operations, Hierarchy of operations, Built in Scilab functions, Introduction to plotting, 2D and 3D plotting (2), Branching Statements and program design, Relational & logical operators, the while loop, for loop, details of loop operations, break & continue statements, nested loops, logical arrays and vectorization (2) User defined functions, Introduction to Scilab functions, Variable passing in Scilab, optional arguments, preserving data between calls to a function, Complex and Character data, string function, Multidimensional arrays (2) an introduction to Scilab file processing, file opening and closing, Binary I/o functions, comparing binary and formatted functions, Numerical methods developing the skills of writing a program (2)
- Curve fitting: Ohms law to calculate R, Hooke’s law to calculate spring constant
- Linear system of equations: Solution of mesh equations of electric circuits (3 meshes) Solution of coupled spring mass systems (3 masses) using Gauss elimination method & Gauss Seidal method. Diagonalization of matrices, Inverse of a matrix, Eigen vectors, eigen values problems
- Solution of Ordinary Differential Equations (ODE) :Second Differential Equations for
 - Harmonic oscillator (no friction)
 - Damped Harmonic oscillator (Over damped, Critical damped, Oscillatory)
 - Forced Harmonic oscillator (Transient and • Steady state solution)
 - Apply above to LCR circuits
- Using Scicos / xcos :
 - Generating square wave, sine wave, sawtooth wave
 - Solution to harmonic oscillator
 - Study of beat phenomenon
 - Phase space plots

Text/Reference Books

Authors	Title	Publisher	Ed/ year	ISBN No
M.R. Spiegel	Fourier Analysis	Tata McGraw Hill	2004	978-0070588837

George F. Simmons	Differential Equations	Tata McGraw-Hill	2006	978-8126515370
S.J. Farlow	Partial Differential Equations for Scientists & Engineers	Dover Pub	1993	978-0486676203
Arfken, Weber, and Harris,	Mathematical Methods for Physicists	Elsevier	2005	978-9381269558
D.A. McQuarrie	Mathematical methods for Scientists & Engineers	Viva Books	2003	978-8130909974
K.F.Riley M.P.Hobson	Essential Mathematical Methods	Cambridge Univ. Press	2011	978-0521761147
Susan M. Lea,	Mathematics for Physicists	Thomson Brooks/Cole	2004	978-0534424763

Course Title: ENV102 (Environmental Studies-II)

L	T	P	Total Credits
2	0	0	2

Course Contents/syllabus:

	Teaching hours
Unit-1- Environmental Pollution	11 h
Environmental Pollution: types, Cause, effects and controls –Air, water, soil, chemical and noise pollution. Nuclear hazard and human health risk. Solid waste Management-control measures of urban and industrial	

waste. Pollution case studies .	
Unit-2-Environmental Policies and practices:	11 h
Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture. Environment laws: Environment Protection Act; Air (Prevention and Control of Pollution) Act; Water (Prevention and Control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act, international agreements: Montreal and Kyoto protocols and convention on biological diversity (CBD), The Chemical Weapons Convention (CWC). Natural reserves, tribal population and rights and Human-wildlife conflict in Indian context	
Unit-3- Human communities and the Environment	10 h
Impacts on environment, human health and welfare. Carbon footprint. Resettlements and rehabilitation of project affected persons, case studies. Disaster management: floods, earthquake, cyclone and landslides. Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan. Environmental ethics: Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi	
Unit-4- Field Work	4 h
<ul style="list-style-type: none"> · Visit to an area to document environmental assets: river/forest/flora/fauna, etc. · Visit to local polluted Site-Urban/Rural/Industrial/Agricultural · Study of common plants, insects, birds and basic principles of identification. · Study of simple ecosystems-pond, river, Delhi Ridge, etc. 	

Course Learning Outcomes: At the end of this course, the students will be able to develop:

1. Understanding the types of pollution and their impact on environment and human health.

2. Understand the environmental concerns and their impact on humans and agriculture.
3. Sensitization about the environmental issues and concerns leading to proactive actions to improve the environmental conditions in our daily life.
4. Able to analyze the impacts of natural and manmade disaster on human population and settlements and the role of movements and environmental ethics in minimizing environmental disasters
5. Able to imbibe practical approaches and solution to solve environmental concerns.

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
William P. Cunningham, Mary Ann Cunningham	Principles of Environmental Science	McGraw-Hill	2019	9781260219715
Dash and Dash	Fundamentals of ecology	Tata McGraw	2009	978-0070083660
William P. Cunningham, Mary Ann Cunningham, Barbara Woodworth Saigo	Environmental Science: A global concern,	McGraw-Hill	2021	9781260363821
Gaston K.J. and Spicer, J. I.	Biodiversity – An Introduction 2 nd edition	Blackwell Publishing	2004	978-1-405-11857-6

Course Title: PSY111- Individual, Society and Nation (Behavioural Sciences)

L	T	Total Credit
1	0	1

List of Professional Skill Development Activities (PSDA):

- Project on Understanding Diversity
- Term Paper on Patriotism among Youth

Course Learning Outcomes: On completion of the course:

- To recognize individual differences
- To manage individual differences
- To develop patriotic feelings
- To recognized their self in relation to society & nation

Course Contents/syllabus:

	Hours
Unit-1- Individual differences & Personality	5 H
<ul style="list-style-type: none"> ● Personality: Definition & Relevance ● Importance of nature & nurture in Personality Development ● Importance and Recognition of Individual differences in Personality ● Accepting and Managing Individual differences Intuition, Perception & Sensation (MBTI) BIG5 Factors 	Judgment,
Unit-2- Managing Diversity	5 H
<ul style="list-style-type: none"> ● Defining Diversity ● Affirmation Action and Managing Diversity ● Increasing Diversity in Work Force ● Barriers and Challenges in Managing Diversity 	
Unit-3- Socialization, Patriotism and National Pride	4 H
<ul style="list-style-type: none"> ● Nature of Socialization ● Social Interaction ● Interaction of Socialization Process ● Contributions to Society and Nation ● Sense of pride and patriotism ● Importance of discipline and hard work ● Integrity and accountability 	
Unit-4- Human Rights, Values and Ethics	4 H
<ul style="list-style-type: none"> ● Meaning and Importance of human rights ● Human rights awareness ● Values and Ethics- Learning based on project work on Scriptures like- Ramayana, Mahabharata, Gita etc. 	

Text / Reference Books:

AUTHOR	TITLE	Publisher	Year of publication	ISBN
Department of English, Univ. of Delhi	The Individual & Society	Pearson Education	2010	978-8131704172
Umang Malhotra	Individual, Society, and the World	Universe	2004	978-0595662401
Tonja R. Conerly & Kathleen Holmes	Introduction to Sociology 3e	Openstax	2015	9781711493978
Daksh Tyagi	"A Nation of Idiots"	Every Protest	2019	978-8194275015

Course Title: French Grammar (FOL-103)

L	T	Total Credit Units
1	0	1

Course Learning Outcomes: At the end of the course, the student shall be able to:

- Understand information; Express in his own words; Paraphrase; Interpret and translate.
- Apply information in a new way in a practical context
- Analyze and break-down information to create new ideas
- Evaluate and express opinion in a given context

Course Contents/syllabus:

	Teaching Hours
Unit-I : My family and my house	5 H
Descriptors/Topics <ul style="list-style-type: none"> ● Talk about your family members ● Usage of possessive adjectives ● Describe your house/apartment ● Prepositions of location ● Negation 	
Unit-II- Lifestyle	4 H
Descriptors/Topics <ul style="list-style-type: none"> ● Talk about your hobbies and pastimes ● Usage of appropriate articles : definite and contracted ● Talk about your daily routine ● Usage of pronominal verbs 	
Unit-III- In the city	4 H
Descriptors/Topics <ul style="list-style-type: none"> ● Filling up a simple form ● Ask for personal information ● Usage of interrogative adjectives ● Give directions about a place ● Ordinal numbers ● Usage of demonstrative adjectives 	
Unit-IV- Week-end	5 H
Descriptors/Topics <ul style="list-style-type: none"> ● Talk about your week-end plans ● Usage of disjunctive pronouns ● Usage of Near Future tense ● Talk about weather ● Write a simple post card 	

Text / Reference Books:

Author	Title	Publisher	Year of Publication	ISBN No
Christine Andant, Catherine Metton,	A Propos – A1, Livre de l'élève et Cahier	Langers International Pvt. Ltd.	2010	978-9380809069

Annabelle Nachon, Fabienne Nugue,	d'exercices.			
Collins Dictionaries	Easy Learning French Complete Grammar, Verbs and Vocabulary	Collins	2016	978-0008141721
Nikita Desai, Samapita Dey Sarkar	Apprenons La Grammaire Ensemble – French	Langers International Pvt. Ltd.	2017	978-8193002681

Course Title: German Grammar (FOL-104)

L	T	Total Credit Units
1	0	1

Course Outcome:

At the end of the course, the student shall be able to:

- Understand information; Express in his own words; Paraphrase; Interpret and translate.
- Apply information in a new way in a practical context
- Analyze and break-down information to create new ideas
- Evaluate and express opinion in a given context

Course Contents/syllabus:

	Teaching Hours
Module I: Time (Uhrzeit); People and the World: Land, Nationalität und Sprache	5 H
<ul style="list-style-type: none"> ● Introduction of time ● Read text related to time and teach the students the time expressions ● Exercises related to Time ● Adverbs of time and time related prepositions ● Vocabulary: Countries, Nationalities, and their languages ● Negation: "nicht/ kein" ● Ja/Nein Fragen. ● All the colors and color related vocabulary, adjectives, and opposites ● Exercises and comprehension for the same. 	
Module II: Irregular verbs (unregelmässige Verben)	4 H
<ul style="list-style-type: none"> ● Introduction to irregular verbs and their conjugation e.g. fahren, essen, iophy etc ● Read a text related to the eating habits of Germans ● Vocabulary: Obst, Gemüse, Kleiderstück with usage of irregular verbs ● Free time and hobbies 	

● Food and drinks	
Module III: Accusative case: articles and pronouns (Akkusativ Kasus: Artikel und Pronomen)	5 H
<ul style="list-style-type: none"> ● Introduction to the concept of object (Akkusativ) ● Formation of sentences along with the translation and difference between nominative and accusative articles ● Usage of accusative Definite articles ● Usage of accusative Indefinite articles 	
Module IV: Accusative case: possessive pronouns (Akkusativ Kasus: Possessivpronomen) Family and Relationship	4 H
<ul style="list-style-type: none"> ● Accusative Personal Pronouns: - Revision of the nominative personal pronouns and introduction of accusative. Applicability of pronouns for both persons and things. ● Usage of accusative Personal Pronouns ● Introduction of accusative possessive pronouns ● Difference between nominative and accusative possessive pronouns ● usage of accusative possessive pronouns 	

Text / Reference Books:

Author	Title	Publisher	Year	ISBN No
Dora Schulz, Heinz Griesbach	Deutsche Sprachlehre Für Ausländer	Max Hueber Verlag	1984	978- 3190010066
Hartmut Aufderstrasse, Jutta Müller, Helmut Müller	Themen Aktuell: Glossar Deutsch	Max Hueber Verlag	2003	978- 3190816903
Giorgio Motta	Wir Plus Grundkurs Deutsch für Junge Lerner Book German Guide	Goyal Publishers	2011	9788183072 120

[Course Title: \(PHY113\) Renewable Energy and Energy Harvesting](#)

L	T	P	Total Credits
3	0	0	3

SEC4: Renewable Energy and Energy Harvesting	Theory: 36 h
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Course Outcomes

CO1	Knowledge of alternative resources of energy.
CO2	Evaluation of the solar energy and its application involving the conversion process.
CO3	Learning the various technologies to generate geothermal and hydro energy.
CO4	Exploring the concept of piezoelectric energy.
CO5	Analyzing the techniques and methods to harvest electromagnetic energy

Course Content:

Unit-1-Alternate Energy Sources	Lectures: 5
Fossil fuels and nuclear energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.	
Unit-2-Solar Energy	Lectures: 7
Solar energy, its importance, storage of solar energy, solar pond, non-convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.	
Unit-3-Geothermal & Hydro-Energy	Lectures: 5
Geothermal Resources, Geothermal Technologies. Hydropower resources, hydropower technologies, environmental impact of hydro power source.	
Unit-4-Wind and Ocean Energy	Lectures: 8
Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies. Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass.	
Unit-5-Piezoelectric Energy	Lectures: 5
Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energy harvesting applications, Human power	
Unit-6-Electromagnetic Energy Harvesting	Lectures: 6
Linear generators, physics mathematical models, recent applications. Carbon captured technologies, cell, batteries, power consumption. Environmental issues and Renewable sources of energy, sustainability.	

Text Books/Reference Books

AUTHOR	TITLE	Publisher	Year of	ISBN
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			publication	
G.D Rai	Non-conventional energy sources	Khanna Publishers, New Delhi	1 January 1988	978-8174090737
M P Agarwal	Solar energy	S Chand and Co. Ltd.	January 1, 1983	OCLC Number: 11572325
Suhas P Sukhative	Solar energy	Tata McGraw - Hill Publishing Company Ltd.	1997	9780074624531
Godfrey Boyle	Renewable Energy:Power for a sustainable future	Oxford University Press	2004	978-0199545339
Jan Kleissl	Solar Energy Forecasting and Resource Assessment	Elsevier Publications	2013	9780123977724

Course Title: Weather Forecasting

L	T	P	Total Credits
3	0	0	3

Course Outcomes

CO1	Learning of atmospheric structure and processes related to it.
CO2	Understanding the different weather systems and issues related to them.
CO3	Analyzing the causes of climate change and its impact on the Earth
CO4	Learning the various experimental methods for the measurements of different factors related to atmosphere, weather and climate.
CO5	Knowledge of working principle of weather satellites and weather maps.

Course Content

Unit-1-Introduction to Atmosphere	Lectures: 10 h
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Elementary idea of atmosphere: physical structure and composition, compositional layering of the atmosphere, variation of pressure and temperature with height, air temperature; requirements to measure air temperature; temperature sensors and types, atmospheric pressure: its measurement, cyclones and anticyclones: its characteristics.	
Unit-2-Weather Systems	Lectures: 8 h
Wind, forces acting to produce wind; wind speed direction: units, its direction; measuring wind speed and direction, humidity, clouds and rainfall, radiation: absorption, emission and scattering in atmosphere, radiation laws. Global wind systems, air masses and fronts: classifications; jet streams, local thunderstorms, tropical cyclones: classification; tornadoes, hurricanes.	
Unit-3-Climate Change	Lectures: 8
Climate: its classification; causes of climate change, global warming and its outcomes, air pollution, aerosols, ozone depletion, acid rain, environmental issues related to climate.	
Unit-4-Weather Forecasting	Lectures: 10
Weather forecasting: analysis and its historical background; need of measuring weather, types of weather forecasting; weather forecasting methods, criteria of choosing weather station; basics of choosing site and exposure, satellites observations in weather forecasting, weather maps; uncertainty and predictability, probability forecasts.	

Text Books/ Reference Books

AUTHOR	TITLE	Publisher	Year	ISBN
Stephen Burt	The weather Observers Hand book	Cambridge University Press	2012	9781139152167
S.R. Ghadekar	Meteorology	Agromet Publishers, Nagpur	2001	
Resnick, Halliday and Walker	Fundamentals of Physics, Vol I	Wiley	2008	978-1119801191
G.R. Fowles and G.L.	Analytical Mechanics	Cengage Learning	2005 □	978-0534494926

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