MANAV RACHNA
vidyanatariksha

MANAV RACHNA UNIVERSITY
(FORMERLY MANAV RACHNA COLLEGE OF ENGINEERING
NAAC ACCREDITED 'A' GRADE INSTITUTION)
Declared as State Private University under section 2f of the UGC act, 1956

PROGRAMME BOOKLET

B.Sc.(Hons.) Physics (PHU01)
(Batch: 2018-2021)

Department of Physics
Faculty of Applied Sciences
Manav Rachna University

MANAV RACHNA UNIVERSITY

Vision

To educate students in frontier areas of knowledge enabling them to take up challenges as ethical and responsible global citizens

Mission

- **To impart outcome based holistic education**
- **To disseminate education in frontier areas**
- **To produce globally competitive, ethical and socially responsible human resources**
- **To produce human resources sensitive to issues of Environment and Sustainable Development**
- **To develop Environment and Sustainable development as a thrust area of research and development.**

Quality Policy

To continuously learn from the best practices, study role models and develop transparent procedures for empowerment of stakeholders.

Strategic Objectives

- **To facilitate, enhance & promote innovation in curriculum design and delivery and have Outcome-oriented Learning Culture.**
- **To promote Research Environment and Management Practices.**
- **To enhance the quality of the student learning experience.**
- **To provide Resources and Infrastructure for Academic Excellence.**

DEPARTMENT OF PHYSICS

Vision

- **To educate the students in frontier areas of Physics enabling them to take challenges to solve the problem of the society.**

Mission

- **To inculcate outcome based holistic education in frontier areas of Physics.**
- **To develop competent physicists who address future issues of the society.**
- **To conduct interdisciplinary research in thrust areas.**
- **To produce good quality human resources sensitive to environmental and sustainable development issues.**
- **To produce globally competitive, ethical and socially responsible young minds.**

Programme Structure (Complete Structure)

Semester -1

COURSE CODE	COURSE NAME	Course Type	Course Nature	PERIODS				CREDITS
		Core(Departmental/Allied)/ Elective (Departmental/ Open) / University Compulsory	Hard/Soft / Workshop/ NTCC	L	T	P	O	
MAH113-T	Essential of Mathematics	Core	Hard	3	1	0	0	4
MAH113-P	Essential of Mathematics Lab	Core	Hard	0	0	2	0	1
PHH107-T	Essentials of Physics	Core	Hard	3	1	0	0	4
PHH107-P	Essentials of Physics Lab	Core	Hard	0	0	2	0	1
CHH101-T	Green Chemistry	Core	Hard	3	1	0	0	4
CHH101-P	Green Chemistry Lab	Core	Hard	0	0	2	0	1
CSH101-T	Structured Programming	Core	Hard	3	1	0	0	4
CSH101-P	Structured Programming Lab	Core	Hard	0	0	2	0	1
CSW151	Computing Workshop	Core	WS	0	0	3	0	2
HLS101	Business English	Core	Soft	1	0	2	0	2
CHH137	Environmental Science	UCC	Audit	1	0	2	0	0
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)			14	4	15	1	24

Semester -II

COURSE CODE	COURSE NAME	Course Type	Course Nature	PERIODS				CREDITS
		Core(Departmental/Allied)/ Elective (Departmental/ Open) / University Compulsory	Hard/Soft / Workshop/ NTCC	L	T	P	O	
PHH109-T	Mathematical Physics	Core	Hard	3	1	0	0	4
PHH109-P	Mathematical Physics Lab	Core	Hard	0	0	2	0	1
PHH110-T	Mechanics	Core	Hard	3	1	0	0	4
PHH110-P	Mechanics Lab	Core	Hard	0	0	2	0	1
PHH108-T	Modern Physics	Core	Hard	3	1	0	0	4
PHH108-p	Modern Physics lab	Core	Hard	0	0	2	0	1
CHH108-T	Essentials of Chemistry	Core	Hard	3	1	0	0	4
CHH108-P	Essentials of Chemistry Lab	Core	Hard	0	0	2	0	1
MEW102	Engineering Workshop (Mechanical)	Core	WS	0	0	3	0	2
HLS102	Communicative English	Core	Soft	1	0	2	0	2
PHO109	Summer Training							3
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)			13	4	13	0	27

Semester -III

COURSE CODE	COURSE NAME	Course Type	Course Nature	PERIODS				CREDITS
		Core(Departmental/Allied)/ Elective (Departmental/ Open) / University Compulsory	Hard/Soft / Workshop/ NTCC	L	T	P	O	
PHH211-T	Electricity and Magnetism	Core	Hard	3	1	0	0	4

PHH211-P	**Electricity and Magnetism Lab**	**Core**	**Hard**	**0**	**0**	**2**	**0**	**1**
PHH212-T	**Quantum Mechanics**	**Core**	**Hard**	**3**	**1**	**0**	**0**	**4**
PHH212-P	**Quantum Mechanics Lab**	**Core**	**Hard**	**0**	**0**	**2**	**0**	**1**
PHH213-T	**Mathematical Physics**	**Core**	**Hard**	**3**	**1**	**0**	**0**	**4**
PHH213-P	**Mathematical Physics Lab**	**Core**	**Hard**	**0**	**0**	**2**	**0**	**1**
PHH214-T	**Statistical Mechanics**	**Core**	**Hard**	**3**	**1**	**0**	**0**	**4**
PHH214-P	**Statistical Mechanics Lab**	**Core**	**Hard**	**0**	**0**	**2**	**0**	**1**
EDS288	**Applied Philosophy**	**Elective**	**Soft**	**1**	**0**	**2**	**0**	**2**
EDS289	**Applied Psychology**							
EDS290	**Applied sociology**							
MCS231	**Basics of Economics**		**Soft**	**1**	**0**	**2**	**0**	
MCS232	**Introduction to Finance**							
FLS103	**French I**	**UCC**	**Soft**	**1**	**1**	**0**	**0**	**0**
FLS101	**Spanish I**							
FLS102	**German I**							
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)			**15**	**5**	**12**	**0**	**24**

Semester -IV

COURSE CODE	COURSE NAME	Course Type	Course Nature	PERIODS				CREDITS
		Core(Departmental/Allied)/ Elective (Departmental/ Open) / University Compulsory	Hard/Soft / Workshop/ NTCC	L	T	P	O	
MAH411-T	Numerical Analysis	Core	Hard	3	1	0	0	4
MAH411-P	Numerical Analysis Lab	Core	Hard	0	0	2	0	1
PHH215-T	Solid State Physics	Core	Hard	3	1	0	0	4
PHH215-P	Solid State Physics Lab	Core	Hard	0	0	2	0	1
PHH217-T	Thermal Physics	Core	Hard	3	1	0	0	4
PHH217-P	Thermal Physics Lab	Core	Hard	0	0	2	0	1
PHH216-T	Digital Electronics	Core	Hard	3	1	0	0	4
PHH216-P	Digital Electronics Lab	Core	Hard	0	0	2	0	1
MAS230	Quantitative Aptitude	Core	Soft	1	0	2	0	2
CHS234	Environmental Sustainable development	Elective	Soft	1	0	2	0	2
ECS249	e Waste Management							
PHW218	Workshop Open Source (Software)	Elective	WS	0	0	3	0	2
PHO219	Summer Training							3
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)			14	4	15	0	29

Semester -V

COURSE CODE	COURSE NAME	Course Type	Course Nature	PERIODS				CREDITS
		Core(Departmental/Allied)/ Elective (Departmental/ Open) / University Compulsory	Hard/Soft / Workshop/ NTCC	L	T	P	O	
PHH320-T	Electronic Devices	Core	Hard	3	1	0	0	4
PHH320-P	Electronic Devices Lab	Core	Hard	0	0	2	0	1
MEH206-T	Engineering Materials and their Behavior	Elective	Hard	3	1	0	0	4
EDH374-T	Pedagogy of Physical Sciences							
EDH374-P	Pedagogy of Physical Sciences Lab	Elective	Hard	0	0	2	0	1
MEH206-P	Engineering Materials and their Behavior Lab							
ECW330	Electrical Technology	Core	WS	0	0	3	0	2
	Discipline Specific elective-I	Core Elective	Hard	3	1	0	0	4
	Discipline Specific elective-I Lab	Core Elective	Hard	0	0	2	0	1
	Discipline Specific elective-II	Core Elective	Hard	3	1	0	0	4
	Discipline Specific elective-II Lab	Core Elective	Hard	0	0	2	0	1
PHS321	Seminar			0	0	0	2	1
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)			12	4	11	1	23

List of Electives

COURSE CODE	COURSE NAME	Course Type	Course Nature	PERIODS				CREDITS
		Core(Departmental/Allied)/	Hard/Soft/	L	T	P	O	

		Elective (Departmental/ Open) / University Compulsory	**Workshop/ NTCC**					
PHH324-T	**Renewable Energy-I**	**Core Elective**	**Hard**	**3**	**1**	**0**	**0**	**4**
PHH324-P	**Renewable Energy-I Lab**	**Departmental Elective**	**Hard**	**0**	**0**	**2**	**0**	**1**
PHH326-T	**Atmospheric Physics-I**	**Departmental Elective**	**Hard**	**3**	**1**	**0**	**0**	**4**
PHH326-P	**Atmospheric Physics-I Lab**	**Departmental Elective**	**Hard**	**0**	**0**	**2**	**0**	**1**
PHH328-T	**Condensed Matter Physics –I**	**Departmental Elective**		**3**	**1**	**0**	**0**	**4**
PHH328-P	**Condensed Matter Physics-I Lab**	**Departmental Elective**		**0**	**0**	**2**	**0**	**1**

Semester –VI

COURSE CODE	**COURSE NAME**	**Course Type**	**Course Nature**	**PERIODS**				**CREDITS**
		Core(Departmental/Allied)/ Elective (Departmental/ Open) / University Compulsory	**Hard/Soft / Workshop/ NTCC**	**L**	**T**	**P**	**O**	
PHH322-T	**Electromagnetic Theory**	**Core**	**Hard**	**3**	**1**	**0**	**0**	**4**
PHH322-P	**Electromagnetic Theory Lab**	**Core**	**Hard**	**0**	**0**	**2**	**0**	**1**
	Discipline Specific elective-I	**Core Elective**	**Hard**	**3**	**1**	**0**	**0**	**4**
	Discipline Specific elective-I Lab	**Core Elective**	**Hard**	**0**	**0**	**2**	**0**	**1**
	Discipline Specific elective-II	**Core Elective**	**Hard**	**3**	**1**	**0**	**0**	**4**

	Discipline Specific elective-II Lab	**Core Elective**	**Hard**	**0**	**0**	**2**	**0**	**1**
PHN323	**Project**			**0**	**0**	**0**	**5**	**5**
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)			**9**	**3**	**6**	**5**	**20**

List of Electives

COURSE CODE	**COURSE NAME**	**Course Type**	**Course Nature**	**PERIODS**				**CREDITS**
		Core(Departmental/Allied)/ Elective (Departmental/ Open) / University Compulsory	**Hard/Soft/ Workshop/ NTCC**	**L**	**T**	**P**	**O**	
PHH325-T	**Renewable Energy-II**	**Core Elective**	**Hard**	**3**	**1**	**0**	**0**	**4**
PHH325-P	**Renewable Energy-II Lab**	**Departmental Elective**	**Hard**	**0**	**0**	**2**	**0**	**1**
PHH327-T	**Atmospheric Physics-II**	**Departmental Elective**	**Hard**	**3**	**1**	**0**	**0**	**4**
PHH327-P	**Atmospheric Physics-II Lab**	**Departmental Elective**	**Hard**	**0**	**0**	**2**	**0**	**1**
PHH329-T	**Condensed Matter Physics-II**	**Departmental Elective**		**3**	**1**	**0**	**0**	**4**
PHH329-P	**Condensed Matter - Physics-I ILab**	**Departmental Elective**		**0**	**0**	**2**	**0**	**1**

Total Credits Scheme

S. No.	**Semester**	**Contact Hours**	**Credits**
1	**I**	**33**	**24**
2	**II**	**30**	**27**
4	**III**	**32**	**24**

5	**IV**	**33**	**29**
6	**V**	**29**	**23**
7	**VI**	**23**	**20**
Total		**180**	**147**

B.Sc. (Hons.) Physics - PHU01
Semester-I

COURSE CODE	COURSE NAME	Course Type	Course Nature	PERIODS				CREDITS
		Core(Departmental/Allied)/ Elective (Departmental/ Open) / University Compulsory	Hard/Soft/ Workshop/ NTCC	L	T	P	O	
MAH113-T	Essential of Mathematics	Core	Hard	3	1	0	0	4
MAH113-P	Essential of Mathematics Lab	Core	Hard	0	0	2	0	1
PHH107-T	Essentials of Physics	Core	Hard	3	1	0	0	4
PHH107-P	Essentials of Physics Lab	Core	Hard	0	0	2	0	1
CHH101-T	Green Chemistry	Core	Hard	3	1	0	0	4
CHH101-P	Green Chemistry Lab	Core	Hard	0	0	2	0	1
CSH101-T	Structured Programming	Core	Hard	3	1	0	0	4
CSH101-P	Structured Programming Lab	Core	Hard	0	0	2	0	1
CSW151	Computing Workshop	Core	WS	0	0	3	0	2
HLS101	Business English	Core	Soft	1	0	2	0	2
CHH137	Environmental Science	UCC	Audit	1	0	2	0	0
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)			14	4	15	1	24

B.Sc. (Hons.) Physics - PHU01
Detailed Syllabus
Semester-I

Course Title/ Code	ESSENTIALS OF MATHEMATICS (MAH113-T)
Course Type:	Core (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-0-0)
Objectives	The students would be able to apply the mathematical concepts of matrices, calculus of single and several variables, vector and integral calculus required for solving the mathematical problems and their applications.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Learning Outcomes:
Students will have the Ability to:

1) Perform elementary transformation for finding the inverse of a matrix, rank of a matrix, to reduce into normal form and solution of system of linear equations.
2) Find successive differentials and their applications.
3) Find multiple integrals and their applications in finding area and volumes.
4) To apply the concept of De Moivre theorem and various trigonometric series.

SECTION - A

MATRICES AND ITS APPLICATIONS: Elementary Transformations, Elementary Matrices, Inverse using Elementary Transformations, Rank of a matrix, Normal form of a matrix, Linear Dependence and Independence of vectors, Consistency of Linear System of Equations, Eigen Values and Eigen Vectors, Properties of Eigen Values, Cayley Hamilton theorem, Linear Transformation, Orthogonal Transformation, Complex Matrices.

SECTION - B

DIFFERENTIAL CALCULUS: Successive Differentiation, Leibnitz Theorem, Mean Value Theorems: Rolle's Theorem, Cauchy's Theorem, Lagrange's theorem, Taylor's and Maclaurin's Series, Partial differentiation, Euler's theorem, Total differential, Jacobian.

SECTION - C

INTEGRAL CALCULUS: Double and Triple Integral, Evaluation of Double Integral over the region, Evaluation of Double Integral by Changing the Order of Integration, Evaluation of Double & Triple Integral by Changing the Variable. Beta and Gamma Functions, Error Function (Probability Integral).

SECTION - D

De Moivre's Theorem and its Applications. Expansion of Trigonometrical Functions. Direct Circular and Hyperbolic Functions and their properties. Inverse Circular and Hyperbolic Functions and their Properties, Logarithm of a Complex Quantity, Gregory's series, Summation of Trigonometry series.

Course Title/ Code	ESSENTIALS OF MATHEMATICS LAB (MAH113- P)
Course Type:	Core (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(0-0-2-0)
Objectives	The students would be able to apply the mathematical concepts of matrices, calculus of single and several variables, vector and integral calculus required for solving the mathematical problems and their applications.

LIST OF EXPERIMENTS:

1. Introduction to MATLAB and use of some simple MATLAB commands.
2. Introduction to some of the fundamentals of MATLAB: Variables, operators, expressions and Arrays(including vectors and matrices)
3. Introduction to graphics: Basic Two-Dimensional Graphs, Labels, Multiple plots on the same axes, Line styles, Markers and color, Axis limits and Subplots.
4. To find the Rank of a matrix, Inverse of a Square matrix and to reduce a matrix into Normal Form.
5. To solve the system of simultaneous linear equations.
6. To find the Eigen values and Eigenvectors of a square matrix.
7. Evaluation of Single integral (Definite & Indefinite) and its application.
8. Evaluation of Double integral and its application.
9. To find the n^{th}derivative of a function.
10. To find the total derivative.

Suggested Books:

1) Shanti Narayan: *Differential Calculus*, S. Chand & Co.
2) Shanti Narayan: *Integral Calculus*, S. Chand & Co.
3) K. B. Dutta: *Matrix and Linear Algebra*.
4) David Widder: *Advanced Calculus*, Prentice- Hall of India.

Course Title/ Code	**ESSENTIALS OF PHYSICS (PHH107-T)**
Course Type:	Core (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-0-0)
Objectives	To apply the concepts of physics to 1) different optical phenomena 2) devices based on these phenomena, lasing in gases and solids **3)** quantum mechanics and its simple application**s**

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Learning Outcomes:

Students will have the Ability to:

1) Produce and Analyze the Interference Pattern Due to Division of Amplitude and Wave front.

2) Produce Required Quality Spectrum and analyze it Using Appropriate Diffraction Grating.

3) Measure the Concentration/Purity of Optically Active Materials Using Optical Devices.

4) Explain the Construction, Working and Applications of Lasers and Optical Fibers.

5) Able to solve problem of one dimensional Box using concepts of Quantum Mechanics.

SECTION-A

Interference of Light: Conditions for Sustained Interference, Coherent Sources, Interference Based on the Division of Wave Front: Young's Double Slit Experiment, Fresnel Bi-Prism and its Applications, Interference Based Upon Division Of Amplitude: Interference in Thin Films, Newton's Ring and its Applications, Michelson Interferometer and its Applications.

Diffraction of Light: Fraunhofer Diffraction at Single Slit, Plane Transmission Grating, Dispersive and Resolving Power of a Grating, Rayleigh Criterion

Polarization of Light: Polarized and Un-Polarized Light, Malus's Law, Double Refraction, Nicol Prism, Quarter and Half Wave Plates, Detection and Production of Different Types of Polarized Light,Polarimetry:Bi-Quartz and Laurent's Half Shade Polarimeters

SECTION-B

Electromagnetic Theory : Electric Flux Density, Gauss's Law and its Applications to a Spherical Symmetry and Uniformly Charged Infinite Plane Sheet, Energy Per Unit Volume, Ampere's Law and its Modification for Non-Steady Currents, Maxwell's Equations, Wave Propagation in Free Space, Dielectrics and Conducting Medium, Poynting Theorem and its Significance

SECTION – C

Laser and Fiber Optics: Stimulated Absorption, Spontaneous and Stimulated Emission,Population Inversion, Conditions for Laser Action, Laser Properties and Laser Applications, Types of Laser: He-Ne Laser, Dye Laser, Semiconductor Laser.

Fiber Optics: Introduction, Propagation of Light Through a Fiber, Numerical Aperture, Types of Fiber, Modes of Propagation (Simple Idea), V-Number, Applications of Optical Fibers

SECTION - D

Quantum Physics: Introduction to quantum mechanics, Discovery of Planck's constant, Group velocity and phase velocity, Schrodinger wave equations-time dependent and time independent, Physical significance of wave function, Particle in one dimensional box.

Course Title/ Code	**ESSENTIALS OF PHYSICS LAB (PHH107-P)**
Course Type:	Core (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(0-0-2-0)
Objectives	To apply the concepts of physics to 1) different optical phenomena 2) devices based on these phenomena, lasing in gases and solids 3) quantum mechanics and its simple applications

List of Experiments:

1. To determine the wavelength of sodium light by Newton's rings experiment. Describe the interference pattern using polychromatic source of light.
2. To determine the wavelength of sodium light by Fresnel's biprism experiment.
3. To determine the wavelength of various colors of white light with the help of a plane transmission diffraction grating.
4. Determination of dispersive power of the given grating.
5. To determine the refractive index and Cauchy's constants of a prism by using spectrometer.
6. To determine the wavelength of sodium light by Michelson interferometer.
7. To determine the resolving power of a telescope.
8. To determine the pitch of a screw using He-Ne laser
9. To determine the specific rotation of optically active solution by using Laurent’s half shade polarimeter.
10. To determine the numerical aperture of an optical fiber using laser light.

Suggested Books:

1. Fundamentals of Engineering Physics , M S Khurana, MR Pub, Delhi (**Text Book)**
2. Modern Physics for Engineers I & II, S P Taneja; R Chand Publication **(Text Book)**
3. Engineering Physics, Satya Prakash, Pragati Prakashan.
4. Concepts of Modern Physics, A. Beiser
5. Optics, A. Ghatak

Course Title/ Code	GREEN CHEMISTRY (CHH101-T)
Course Type:	Core (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-0-0)
Objectives	• To demonstrate the necessity and viability of the methods of green chemistry • To demonstrate how to evaluate a reaction or process and determine "greener" alternatives. • To focus on the application of innovative technology the development of "greener" routes to improve industrial processes and to produce important products.

	Sections	Weightage
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION-A

INTRODUCTION TO GREEN CHEMISTRY

Definition, history, need and goals of green chemistry, Green Chemistry in sustainable development, Importance of Green Chemistry, Limitations/Obstacles in the pursuit of the goals of Green Chemistry

BASIC PRINCIPLES OF GREEN CHEMISTRY

Twelve Principles in Green Chemistry with their explanations and examples, Prevention of waste/by products, Atom Economy, Prevention/Minimization of hazardous/toxic products, Designing safer chemicals, Selection of safer solvents and auxiliaries, Design for energy efficiency (use of microwave and ultrasonic radiations), Use of renewable Feedstocks, Avoidance of unnecessary derivatization,Use of catalytic reagents in preference to stoichiometric reagents, Designing

biodegradable products, Prevention of chemical accidents (including releases, explosions and fires), Strengthening/Development of green techniques to prevent hazardous substances in chemical process.

SECTION-B

GREEN LUBRICANTS & POLYMERS

Introduction, Properties and Applications of conventional and green lubricants, Synthesis of Green Lubricants
Introduction & Classification of polymers, Biodegradable and non-biodegradable polymers, Synthesis of Green Polymers, Polymer Composites

SECTION-C

GREEN SYNTHESIS: COMPARISION WITH CONVENTIONAL SYNTHESIS

Green starting materials, Green reagents, Green solvents and reaction conditions: water as green solvent, Properties of water and their estimation (Hardness, Alkalinity, Dissolved Oxygen), Green catalyst (Biocatalysts, polymer supported & recoverable catalysts, etc.), Synthesis involving basic principles of green chemistry- Synthesis of Biodiesel and other green compounds, Quantitative Solid-solid synthesis.

SECTION-D

GREEN ENGINEERING & ITS APPLICATIONS

Need and scope of green engineering, Basic principles of green engineering, Elimination of hazardous compounds by green compounds, Eco-friendly materials for computing case studies ofReal World/ Indian Cases: Sony Ericsson: Bromine- and Chlorine-Free Mobile Phones, Bio-based composite resins design for electronic materials: Soy Plastics, US Presidential Green Chemistry Challenge Award Winners.

Course Title/ Code	GREEN CHEMISTRY LAB(CHH101-P)
Course Type:	Core (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(0-0-2-0)
Objectives	• To demonstrate the necessity and viability of the methods of green chemistry • To demonstrate how to evaluate a reaction or process and determine "greener" alternatives. • To focus on the application of innovative technology the development of "greener" routes to improve industrial processes and to produce important products.

List of Experiments

1. Synthesis of Green compounds (Biodiesel from vegetable oil).
2. Characterization of Bio-diesel by using Spectrophotometer.
3. Determination of Flash and Fire Point & Viscosity Index of Green Liquid Compounds.
4. To determine Hardness of water sample.
5. To determine Alkalinity & dissolved oxygen of water sample.
6. Synthesis of green reagent Tetra butyl ammonium tribromide (TBATB)
7. Solvent free Aldol Condensation between 3, 4-dimethoxybenzaldehyde and 1-indanone.
8. Preparation of gold nanoparticles using tea.
9. Solvent-free and one-pot synthesis of Phthalocyanine Complex of Copper (II).
10. Extraction of D-limonene from orange peel using liquid carbon dioxide as a solvent.

Suggested Books:

S. No	Author	Title	Publisher
1	P. T. Anastas, J. C. Warner	**Green Chemistry: Theory and Practice, 1998.**	Oxford **University Press**
2	**Concepcion Jimenez Gonzalez, David JC Constable,**	**Green Chemistry and Engineering. 2011**	**John Wiley & Sons**
3	**EMO Chiellini and Roberto Solaro**	**Biodegradable Polymers and Plastics. 2002**	**Kluwer Academic Publishers.**

4	Paul T. Anastas, Robert H. Crabtree	Green Catalysis. 2009	Wiley-VCH.
5	James H. Clark, Duncan J. Macquarrie	Handbook of green chemistry and technology. 2002.	John Wiley & Sons,
6.	Roger A. Sheldon, Isabel Arends, Ulf Hanefeld	Green Chemistry and Catalysis. First Edition, 2007	Wiley-VCH

Course Title/ Code	Structured Programming (CSH101-T)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	(3-1-0-0)
Objectives	Students are able to construct a program of moderate complexity from a specification

Section-A

Programming and UNIX : Students will learn the basics of programming using Scratch; they will learn to use statements, expressions, conditions, selection, iteration, variables, functions, arrays, threads and events. In addition, they will be introduced to basic UNIX commands under Bash and the Integrated Development Environment (IDE), Eclipse.

Introduction to Programming, test driven development

Scratch: Introduction, statements, expressions, conditions, selection, iteration, variables, functions, arrays, threads and events.

UNIX: Basic commands- pwd, ls, cd, rm, cat, less, mkdir, rmdir; permissions, root

Eclipse: Integrated Development Environment (IDE)

C language: Character set, Variables and Identifiers, Built-in Data Types, Variable Definition, Arithmeticoperators and Expressions, Constants and Literals, Simple assignment statement, Basic input/output statement, Simple 'C' programs.

Section-B

Applying programming constructs: Students will learn how to write programs that satisfy unit tests. The instructor will build the unit tests, demonstrating how to break a problem down into smaller components. In the labs and homework, students will construct programs that satisfy the unit tests. Students become familiar with the constructs of the C programming language.

Types, constants, and variables, Statements, Expressions, Conditions, Selection, iteration, Functions and recursion.

Decision making within a program, Conditions, Relational Operators, Logical Connectives, if statement, if-else statement, Loops: while loop, do while, for loop, Nested loops, Infinite loops, Switch statement, structured Programming.

One dimensional arrays: Array manipulation; Searching, Insertion, Deletion of an element from an array; Finding the largest/smallest element in an array; Two dimensional arrays, Addition/Multiplication of two matrices, Transpose of a square matrix; Null terminated strings as array of characters, Standard library string functions.

Introduction to Top-down approach of problem solving, Modular programming and functions, Standard Library of C functions, Prototype of a function: Formal parameter list, Return Type, Function call, Block structure, Passing arguments to a Function: call by reference, call by value, Recursive Functions, arrays as function arguments Structure variables, initialization, structure assignment, nested structure, structures and functions, structures and arrays: arrays of structures, structures containing arrays, unions. Students will become familiar with the concepts.

Section-C

Practical programming: During the third quarter of the class, students will begin building their own programs by decomposing problems into smaller tasks and writing unit tests that will check to see that the program accurately accomplishes the task using Test Driven Development. They will then write the program that satisfies their own unit tests. Students will learn to apply the constructs of the C programming language to create programs.
Application of Top-down approach of problem solving, Modular programming and functions, Standard Library of C functions, Prototype of a function: Formal parameter list, Return Type, Function call, Block structure, Passing arguments to a Function: call by reference, call by value, Recursive Functions, arrays as function arguments.

Students will learn to apply these programming techniques: Structure variables, initialization, structure assignment, nested structure, structures and functions, structures and arrays: arrays of structures, structures containing arrays, unions. Students will be able to use these techniques to develop programs. Concept of Files, File opening in various modes and closing of a file, Reading from a file, writing onto a file.

Section-D

Memory Management and Abstraction: During the final quarter, students will be introduced to dynamic memory allocation and dynamic data structures including: dynamic arrays, linked lists, and stacks. They will consolidate their ability to use the C programming techniques they have learned in the earlier sections.
Address operators, pointer type declaration, pointer assignment, pointer initialization, pointer arithmetic, functions and pointers, Arrays and Pointers, pointer arrays, pointers and structures, dynamic memory allocation.
Linked list, Stack.

Course Title/ Code	Structured Programming Lab (CSH101-P)
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	(0-0-2-0)
Objectives	Students are able to construct a program of moderate complexity from a specification

List of Experiments

1. Swap two numbers
2. Sum an array of numbers
3. Parse program parameters from the Unix command line
4. Fibonacci series, Factorial
5. GCD
6. Sieve of Eratosthenes
7. Square Root
8. Sorting
9. Decimal to binary conversion
10. Linked lists
11. Program to support humans playing chess against each other.
12. Stacks and queues
13. Manipulating files

Text Books:

1. Working with C, YashwantKanetkar Publication
2. Let us C, YashwantKanetkar Publication

Help Pages:

1. Eclipse C/C++ Development Guide

Wikipedia Pages:

1. Test-driven development, http://en.wikipedia.org/wiki/Test-driven_development
2. Unit testing, http://en.wikipedia.org/wiki/Unit_testing

Tool Web Sites:

1. Eclipse, https://eclipse.org/users/
2. Git, http://git-scm.com/

Web tutorials:

1. Harvard's CS50, https://courses.edx.org/courses/HarvardX/CS50x3/2015/info

Course Title/ Code	Computing Workshop (CSW151)
Course Type	Core
Course Nature	WS
L-T-P-O Structure	(0-0-3-0)

Introduction to Computer Systems

Characteristics and Components of a computer system, Memory – Primary & Secondary, Input Devices, Output Devices, Hardware and Software

Operating System

Microsoft Windows - Versions of Windows, Basic Windows elements, Folder and File management, Using essential accessories: Calculator, Notepad, Paint, WordPad. Utility of My Computer, My Documents, Recycle bin, My Network Places, Control Panel, Searching Files

Introduction to Internet

Introduction to internet, www, urls, portals, web browsers, ip addresses, searching and downloading content, e-mail, intranet.

Word Processing

Creating and handling documents, Editing, Spellcheck, Formatting, Tables, Macros, Mail merge, Page setting, Headers and footers, Printing documents

Spreadsheet Package

Creating and handling workbook and spreadsheet, Editing, Formatting, Cell referencing, Formulae and Functions, Charts and Graphs, Macros, Views, Sorting, Page setting, Headers and footers, Printing worksheets

Presentation Package

Creating and handling presentations, Using templates, Views, Handling Master slide - Notes and Handouts, Slide Design and layout, Animations, Transition, Slide Show, Custom Show, Timing, Headers and footers, Printing Presentations and handouts.

Course Title/ Code	**BUSINESS ENGLISH (HLS101)**
Course Type:	Core (Departmental/Allied)
Course Nature:	Soft
L-T-P-O Structure	(1-0-2-0)
Objectives	• To make the students well-versed in the basics of English Language, grammar and communication skills. • To enhance the interactive learning skills • To emphasize on group as well as individual performance of students. • To enhance written as well as oral performance of students. To prepare students as per society and industry need.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Learning Outcomes:

Directly taken from Infosys designed Lesson plans of Business English, the paper attempts to execute the modules over the course of a semester, by end of which students will be well-versed in the basics of English Language grammar and communication skills. The lab-activities that go hand-in-hand with the lessons will help in enhancing the interactive aspect of the paper.

SECTION- A

Introduction to Grammar

Adverbs, Adjectives, Articles, Noun (Compound, Countable, Uncountable) Active -Passive Voice

SECTION - B

Tenses, Subject- Verb Agreement, Introduction to Verbs (Auxiliary and Modals, non-finite), Prepositions, Modifiers, Collocation,

Synonym, Antonym, Phrasal Verbs, Idioms and Phrases.

SECTION - C

Speech Pattern-1 (Intonation, Word Stress), Speech Pattern-2 (Indianisms, Sentence Stress, Connected Speech), Link Expressions, Question Tags.

SECTION - D

ABC of Writing, KISS Concept, Essay Writing, Report Writing, Email Etiquette, Circular Précis Writing, Memos and Notices.

Lab Exercises:

1. Exercises based on Grammar
2. Exercises based on Semantics
3. Introduction to Articulation Skills (Conversation: Telephonic and Face-to-Face)
4. Exercise based on Email & Report
5. Business QUIZ &Idioms and Phrases
6. Techniques & Levels of Reading Comprehension
7. Group Discussion
8. Exercise Based on Tense & S-V Agreement
9. Exercise based on Active & Passive Voice
10. Exercise Based on Intonation & Word Stress
11. Circular, Memos and Notice Writing
12. Presentation

Suggested Text Book Reading:

A Practical Course for Developing Writing Skills in English. J K Gangal: PHI Learning Pvt.

High School English Grammar and Composition. Wren and Martin: S.Chand and Co.

A Textbook of English Phonetics for Indian Students. T.Bala Subhrmaniam: Macmillan

English Vocabulary in Use. MaCarthy: Foundation Books, OUP

English Grammar, Competition and Correspondence. M.A. Pink and A.C.Thomas: S.Chand and Co.

Course Title/Code	**Environmental Science (CHH137)**
Course Type	Audit
Course Nature	Soft
L-T-P-O Structure	1-0-2-0
Objectives	• To make the student identify the areas of environmental degradation • To make the student identify the impact of environmental degradation on the surroundings • To apply the concepts such as sustainable development in real life. • To help the engineering student to correlate his field with various aspects of environment.

SYLLABUS	**SECTION**	**WEIGHTAGE**
	A	**25%**
	B	**25%**
	C	**25%**
	D	**25%**
	TOTAL	**100%**

SECTION-A

SCOPE & IMPORTANCE OF EVS

Definition and Scope of Environmental Sciences, Importance of EVS in Various Branches of Engineering & Sciences: Computer Science and Technology, Mechanical Engineering, Electronics & Communications Engineering, Civil Engineering and Applied Sciences

SECTION - B

ECOSYSTEM DYNAMICS

STRUCTURE AND FUNCTIONS OF ECOSYSTEM: Trophic Level, Food Chain, Food Web, Ecological Pyramids, Energy Flow, Biogeochemical Cycles, Ecological Succession: Basic Concept, Types, Stages

TYPES OF ECOSYSTEMS: Aquatic Ecosystem (Lake), Terrestrial Ecosystem (Grassland)

BIODIVERSITY: Hot Spots, Threats, In Situ and Ex Situ Conservation,

POPULATION AND ITS CHARACTERISTICS: Population Growth, Age Structure Pyramids

SECTION - C

POLLUTION PREVENTION AND SUSTAINABILITY

AIR POLLUTION: Sources of Air Pollution, Methods of Monitoring and Control of Air Pollution. Effect of Air Pollution on Human Beings, Plants, Animals, Materials and Atmosphere. Photochemical Smog, Ozone Layer Depletion, Green House Effect, Acid Rain

WATER POLLUTION: Sources and Consequences of Water Pollution, Physio-Chemical and Biological Monitoring of Water Quality (TDS, TSS, BOD, COD). Eutrophication.

SOIL POLLUTION: Control Measures, Over Usage of Chemical Pesticides, Bio- Magnification

SUSTAINABLE DEVELOPMENT: Definition, Energy Conservation In Agriculture And Industrial Sectors, Smart City Concept, Petro-Crops

SECTION - D

ENVIRONMENTAL TECHNIQUES & ASSESSMENT:

Flame Photometry, Paper Chromatography, Remote Sensing and its Applications, Role of GIS in Disaster Management.

Statistical Analysis: Mean, Median, Mode, and Standard Deviation

Environmental Impact Analysis (EIA): Aims & Objectives, ISO- 14000 and ISO- 18000 Standards and Certification, National Green Tribunal Act, Environmental Priorities in India and Environmental Regulations for Small and Large Scale Industries.

FIELD VISITS & PROJECT WORK

Visit To Waste Water Treatment Plants & Report
Visit To Any Industry For Pollution Control Methods & Report
Vermi composting & Solid Waste Management Techniques
A Report On Biodiversity In Campus And Their Different Uses

LIST OF EXPERIMENTS:

1. To analyse the tds, tss in given sample of water
2. To determine bod in a water sample
3. To determine cod in water sample
4. To analyse a sample for metal ions using flame photometer
5. To separate the components in a mixture using paper chromatography

6. To study vegetation abundance and frequency of an ecological sample using quadrant method
7. Calculate mean, mode, median of the given data
8. Calculate standard deviation of the given data
9. To study the various acts: Wildlife Protection Act 1972, The Water (Prevention and Control of Pollution) Act 1974, Prevention and Control of Air Pollution Act 1981, Forest Conservation Act 1981, Environment (protection) Act 1986, Hazardous waste (Management and Handling) Rules, 1989, Bio-Medical Waste (Management and Handling) Rules, 1998.
10. Case studies of eco-marketing: kfc, coca cola, mc d, tropicana, nestle, ceres fruit juice (methodologies for sustainable environment & advantages)
11. Herbarium preparation of biodiversity in a given sample area
12. To study the efficacy of different bioadsorbents: saw dust, vegetable waste, fruit peels, tea waste.
13. Air sampling and its quality analysis

Suggested Books:

S. No.	Book	Author	Publisher
1.	Environmental Chemistry	C. Baird and M. Cann	W. H. Freeman and Company, New York, 2012.
2.	Green Chemistry and engineering: A practical Design Approach	C.J-Gonzalez and D.J.C. Constable	A John Wiley & Sons, INC., publication, New Jersey, 2011
3.	Environmental Chemistry	S.E. Manahan	CRC Press, 2005
4.	Perspectives in Environmental Studies	Kaushik & Kaushik	New age international publishers Ltd.-New Delhi
5.	The Green marketing Manifesto	John Grant	Wiley Pub.

Semester-II

COURSE CODE	COURSE NAME	Course Type	Course Nature	PERIODS				CREDITS
		Core(Departmental/Allied)/ Elective (Departmental/ Open) / University Compulsory	Hard/Soft / Workshop/ NTCC	L	T	P	O	
PHH109-T	Mathematical Physics	Core	Hard	3	1	0	0	4
PHH109-P	Mathematical Physics Lab	Core	Hard	0	0	2	0	1
PHH110-T	Mechanics	Core	Hard	3	1	0	0	4
PHH110-P	Mechanics Lab	Core	Hard	0	0	2	0	1
PHH108-T	Modern Physics	Core	Hard	3	1	0	0	4
PHH108-p	Modern Physics lab	Core	Hard	0	0	2	0	1
CHH108-T	Essentials of Chemistry	Core	Hard	3	1	0	0	4
CHH108-P	Essentials of Chemistry Lab	Core	Hard	0	0	2	0	1
MEW102	Engineering Workshop (Mechanical)	Core	WS	0	0	3	0	2
HLS102	Communicative English	Core	Soft	1	0	2	0	2
PHO121	Summer Training							3
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)			13	4	13	0	27

Detailed Syllabus

Course Title/ Code	Mathematical Physics (PHH109-T)
Course Type:	Core (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-0-0)
Objectives	• To study differential equations of first and second order • To study vector and integral calculus in different coordinate systems • To study complex variables

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Learning Outcomes:

Students will have the Ability to:

1. Solve differential equations of first and second order
2. Do vector operations in Cartesian and Curvilinear coordinate systems
3. Integrate functions in one, two and three dimensions
4. Solve problems of complex variables

SECTION - A

Differential Calculus

Limits, Continuity, Average and Instantaneous Quantities, Differentiation, Functions and Plotting of Curves, First Order Differential Equations, Second Order Differential Equations: Homogeneous Equations with Constant Coefficients, Wronskian and General Solution, Calculus of Functions of More Than One Variable: Partial Derivatives, Exact and Inexact Differentials

SECTION - B

Vector Calculus

Properties of Vectors under Rotations, Scalar Product and Its Invariance under Rotations, Vector Product, Scalar Triple Product and Their Interpretation in Terms of Area and Volume Respectively, Scalar and Vector Fields, Vector Differentiation: Directional Derivatives and Normal Derivative, Gradient of A Scalar Field and Its Geometrical Interpretation, Divergence and Curl of A Vector Field, Del and Laplacian Operators, Vector Identities, Gradient, Divergence, Curl and Laplacian in Spherical and Cylindrical Coordinates

SECTION - C

Integral Calculus

Surface and Volume Integrals of Vector Fields, Gauss' Divergence Theorem, Green's and Stokes Theorems and Their Applications (No Rigorous Proofs), Line, surface and volume integrals of Vector fields, Definition of Dirac Delta Function, Representation as Limit of A Gaussian Function and Rectangular Function. Properties of Dirac Delta Function

SECTION - D

Complex Variables

Review of Complex Arithmetic; Complex Differentiation: Analyticity of Complex Functions, Cauchy Riemann Conditions; Complex Integration: Cauchy Integral Theorem, Cauchy Integral Formula, Derivative as Integral; Complex Series: Taylor and Laurent Series; Residues and Its Applications

Course Title/ Code	Mathematical Physics Lab (PHH109-P)
Course Type:	Core (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(0-0-2-0)
Objectives	• To study differential equations of first and second order • To study vector and integral calculus in different coordinate systems • To study complex variables

List of Experiments

Topics	Description with Applications
Introduction and Overview	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.
Random number generation	Area of circle, area of square, volume of sphere, value of π
Solution of Algebraic and Transcendental equations by Bisection, Newton Raphson	Solution of linear and quadratic equation, solving $\alpha = \tan\alpha$; $I = Io\ [(\sin\alpha)/\alpha]^2$ in optics

and Secant methods	

Suggested Books:

• Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7th Edn., Elsevier (Text Book)

• An introduction to ordinary differential equations, E.A. Coddington, 2009, PHI learning

• Differential Equations, George F. Simmons, 2007, McGraw Hill.

• Mathematical Tools for Physics, James Nearing, 2010, Dover Publications.

Course Title/ Code	**MECHANICS (PHH110-T)**
Course Type:	Core (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-0-0)
Objectives	• To study mechanics of particles and system of particles in Galilean reference frames. • To study rotational dynamics, Oscillations and Motion under central forces using laws of mechanics. .

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Learning Outcomes:

Students will have the Ability to:

1. Describe the dynamics of system of particles and calculate center of mass etc.
2. Describe rotational behavior of particle and system of particles by applying the conservation laws
3. Describe Simple Harmonic Motion (SHM), damped and forced oscillations
4. Apply on problems of central forces in radial coordinate system.

SECTION-A

Fundamentals of Dynamics

Dynamics of A System of Particles, Inertial Frames; Galilean Transformations; Galilean Invariance, Review of Newton's Laws of Motions, Dynamics of A System of Particles, Centre of Mass, Principle Conservation of Momentum, Impulse, Momentum of Variable-Mass System: Motion of Rocket.

Work and Energy

Work and Kinetic Energy Theorem, Conservative and Non-Conservative Forces, Potential Energy, Energy Diagram, Stable and Unstable Equilibrium, Force As Gradient of Potential Energy, Work and Potential Energy, Work Done By Non-Conservative Forces, Law of Conservation of Energy.

SECTION-B

Rotational Dynamics

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 of Flywheel

SECTION-C

Oscillations

Simple Harmonic Oscillations, Differential Equation of SHM and its Solution, Kinetic energy, Potential energy, and Total Energy and their Time Average Values, Damped oscillation, Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and quality Factor

SECTION-D

Motion under Central Forces

Concepts of Central Forces, Kepler's Laws of Planetary Motion, Gravitational Law, Gravitational Potential and Fields due to Spherical Shells and Solid Sphere, Gravitational Potential Energy and Escape Velocity, Two Particle Central Force Problem and Reduced Mass, Motion of Planets and Satellites.

Course Title/ Code	MECHANICS LAB (PHH110-P)
Course Type:	Core (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(0-0-2-0)
Objectives	• To study mechanics of particles and system of particles in Galilean reference frames. • To study rotational dynamics, Oscillations and Motion under central forces using laws of mechanics. .

LIST OF EXPERIMENTS:

1. To determine the acceleration due to gravity and velocity for a freely falling body, using Digital Timing Techniques
2. To determine the Moment of Inertia of a Flywheel
3. To determine the coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method)
4. To determine the Young's Modulus of a wire by Optical Lever Method
5. To determine the Modulus of Rigidity of a wire by Maxwell's needle
6. To determine the Electic Constants of a Wire by Searle's Method.
7. To study simple harmonic motion of mass spring system.
8. To study simple harmonic motion of compound pendulum.
9. To determine value of g using bar pendulum.
10. To determine the moment of inertia of a disc using Trosional pendulum.
11. To study damped oscillations of series LCR circuit.

Suggested Books:

1. An introduction to mechanics by Daniel Kleppner, Robert J. Kolenkow (McGraw-Hill, 1973)

2. Mechanics Berkeley physics course, v.1: By Charles Kittel,Walter Knight, Malvin Ruderman,Carl Helmholz,Burton Moyer, (Tata McGraw-Hill, 2007)(Text Book)
3. Mechanics by D S Mathur (S. Chand & Company Limited, 2000)(Text Book)
4. Mechanics by Keith R. Symon (Addison Wesley; 3 edition, 1971)
5. University Physics by F W Sears, M W Zemansky and H D Young (Narosa PublishingHouse, 1982)

Course Title/ Code	**MODERN PHYSICS(PHH108-T)**
Course Type:	Core (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-0-0)
Objectives	• To study the relativistic effects • To study and analyze different types of spectra • To study nuclear models and detectors .

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Learning Outcomes:

Students will have the Ability to:

1) Apply concept of Length Contraction, Time Dialation, Velocity addition, Energy mass conversion, variation of mass with velocity.

2) Calculate wavelength of different series of hydrogen atom and explain fine structure of the spectrum

3) Explain much electron system

4) Explain nuclear properties and detection of nuclear radiation

SECTION - A

Inertial and Non inertial frame of references, Michelson-Morley Experiment (Qualitative), Einstein's Postulates of Special Theory of Relativity, Lorentz Transformations, Length Contraction, Time dilation, velocity Addition Theorem, Variation of mass with velocity, Mass – Energy Equivalence Relation

SECTION - B

Bohr's Model of Hydrogen Atom, Spectral Series, Schrodinger Equation in Spherical Polar Coordinates, Hydrogen Atom (Qualitatively), Quantum Numbers and Selection Rules (Qualitative). Stern-Gerlach Experiment, Spin as An Intrinsic Quantum Number, Fine Structure

SECTION - C

Magnetic Moment of the Electron, Lande g-Factor, Vector Model – Space Quantization, Zeeman Effect, Pauli Exclusion Principle, Shell Structure. Hund's Rule, Spectroscopic Terms of Many Electron Atoms in the Ground State Diatomic Molecules–Rotational and Vibrational Energy Levels, Basic Ideas About Molecular Spectra, Raman Effect and Its Application to Molecular Spectroscopy (Qualitatively).

SECTION - D

Structure of nuclei

Basic Properties of Nuclei: Mass, Radii, Charge, Angular Momentum, Spin, Magnetic Moment (μ), Stability and Binding Energy.

Nuclear Models

Liquid Drop Model, Mass formula, Shell Model, Meson Theory of Nuclear Forces

Detectors of Nuclear Radiations

Interaction of Energetic particles with matter, Ionization chamber, GM Counter, Cloud Chambers, Wilson Cloud Chamber, Bubble Chamber, Scintillation Detectors, Semiconductor Detectors (Qualitative Discussion Only)

Course Title/ Code	**MODERN PHYSICS LAB(PHH108-P)**
Course Type:	Core (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(0-0-2-0)
Objectives	• To study the relativistic effects • To study and analyze different types of spectra • To study nuclear models and detectors .

List of Experiments

1. Verification of Stefan's Law and Wien's displacement law by constructing Black Body Spectrum
2. Measurement of sodium doublet using Michelson Interferometer
3. Construction of Wave Packet by superposition of waves
4. Hydrogen spectra using Transmission Grating
5. Measurement of e/m of an electron
6. Measurement of Charge of an electron using Millikan Oil Drop method.
7. Measurement of energy Band Gap of intrinsic semiconductor by Four Probe Method
8. Measurement of Hall Effect.
9. Thermionic emission of electron
10. Energy band measurement for semiconductor diode/ diode laser.
11. To determine the wavelengths of Hydrogen spectrum and hence to determine the value of Rydberg's Constant.
12. To determine the value of Boltzmann Constant by studying Forward Characteristics of a Diode.
13. To determine the value of Planck's constant by using a Photoelectric Cell.
14. To determine the value of Planck's constant by using LEDs of at least 4 Different Wavelengths.

Suggested Books:

1. Concepts of modern Physics A Beiser, S Mahajan & S R Chaudhary (Text Book)
2. Modern Physics-R A Serway, C J Moses & C A Moyer
3. Atomic and Molecular Spectra: Laser-R Kumar (Text Book)
4. Fundamentals of Molecular Spectroscopy-C N Banwell & E M Mccash

5. Introduction to Molecular Spectra – H E White

Course Title/Code	**Essentials of Chemistry (CHH108-T)**
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	3-1-0-0
Objectives	• To introduce concepts and phenomenon related to electronic structure of atom. • To calculate concentration of solutions. • To understand various types of titration and their applications. • To derive and calculate pH of hydrolysis of salts. • To understand concept and application of colloids and catalysis. • To calculate adsorption isotherms.

SYLLABUS	**SECTION**	**WEIGHTAGE**
	A	**25%**
	B	**25%**
	C	**25%**
	D	**25%**
	TOTAL	**100%**

SECTION - A

Atomic Structure

Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and $\psi 2$. Quantum numbers and their significance. Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of *s, p, d* and *f* orbitals. Contour boundary and probability diagrams. Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number.

SECTION - B

Analytical Chemistry

Titrations: Terminology- equivalence point and end point, primary and secondary standards, reactions used for titrations, molarity and normality, some examples of stoichiometric calculations.

Acid-base titration, Acid-base indicators, theory of acid base indicators, calculation of pH values at different stages of the acid base titration and titration curve.

Precipitation and Complexometric Titration: indicator theory, effect of complexing agents and their advantages, examples including EDTA based titration and titration curve.

Back and blank titration with examples, Gravimetric Method of Analysis with examples Electrochemistry in Analysis: Redox titrations, Redox indicators, their use in volumetric analysis, iodometry and iodimetry, example of titration from other redox systems.

SECTION - C

Ionic Equilibria

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect; dissociation constants of mono-, di-and triprotic acids.

Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions; derivation of Henderson equation and its applications; buffer capacity, buffer range, buffer action and applications of buffers in analytical chemistry and biochemical processes in the human body. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle. Theory of acid–base indicators; selection of indicators and their limitations. Hydrolysis and hydrolysis constants.

SECTION - D

Surface and Colloids Chemistry

Physical adsorption, chemisorption, nature of adsorbed state. Adsorption- Langmuir and Freundlich isotherms. Multilayer adsorption-BET equation (no derivation) and its application to surface area measurement. Sols (reversible and irreversible), emulsions and emulsifiers, association colloids (micelles), gels. Applications of colloids.

Catalysis:Types of catalysts, specificity and selectivity, mechanisms of catalyzed reactions at solid surfaces. Enzyme catalysis, Michaelis-Menten mechanism, acid-base catalysis and mechanism.

Course Title/Code	**Essentials of Chemistry Lab (CHH108-P)**
Course Type	Core
Course Nature	Hard
L-T-P-O Structure	0-0-2-0
Objectives	• To introduce concepts and phenomenon related to electronic structure of atom. • To calculate concentration of solutions. • To understand various types of titration and their applications. • To derive and calculate pH of hydrolysis of salts. • To understand concept and application of colloids and catalysis. • To calculate adsorption isotherms.

LIST OF EXPERIMENTS:

1. To determine strength of unknown HCl by titrating it against N/10 NaOH
2. To estimate the amount of Zinc present in a given solution by EDTA method.
3. To estimate the amount of Magnesium present in a given solution by EDTA method.
4. To estimate the amount of copper present in given solution by EDTA method.
5. To determine amount of Cu(II) in an unknown sample by iodometric titration.
6. To determine strength of given solution of ferrous ammonium sulphate (mohr salt) being provided with N/30 $KMnO_4$.
7. To estimate amount of Barium gravimetrically.
8. To find the Strength of an acid (Strong Acid -HCl OR Weak acid- CH_3 COOH) conductometrically.
9. To determine the adsorption of aqueous acetic acid by activated charcoal and study adsorption isotherm
10. To determine the solubility of a salt (KCl or NaCl) in water at room temperature
11. To determine the solubility of organic acid (oxalic acid) in water at room temperature
12. To determine the solubility product of calcium hydroxide using common ion effect of sodium hydroxide or any other strong alkali.

Suggested Books:

1. Atkins, P. W. & Paula, J. de *Atkin's Physical Chemistry* 10th Ed., Oxford University 12 Press (2014).
2. Qualitative Analysis Day and Underwood, 5th edition, Prentice-Hall (1986).
3. Fundamentals of Analytical Chemistry Douglas A. Skoog, Donald M. West, F. James Holler and Stanley R. Crouch, 9th Edition,Cengage Learning(2013).
4. F. A. Cotton, G. Wilkinson, P. G. Gauss, Basic Inorganic Chemistry, 3rd Edition, John Wiley, 1995
5. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
6. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

Course Title	**WORKSHOP**

Course Code	**MEW102**
Course Type	Core
Course Nature	Workshop
L-T-P-O structure	0-0-3-0
Objective	To develop necessary skills to perform manufacturing operations in the Workshops
Outcomes	Students will be able to demonstrate safety precautions while performing manufacturing operations. Students will be able to perform basic manufacturing operations in the workshops
Prerequisites	None

List of exercises/experiments in workshop:

1. **Introduction to plant layout and safety measures.**
2. **Measuring Instruments:** To operate and study different type of measuring tools used in meteorology and determine least count of verniercallipers, micrometers and vernier height gauge.
3. **Introduction to Jigs and Fixtures of Different types and their uses**
4. **Machine tools/ Metal cutting:** To prepare Jobs and study different types of machine tools (Lathe, Shaper, Milling, Drilling, Grinding machines) with regards to their construction and operations.
5. **Lathe process:** To prepare a job on a lathe involving facing, outside turning, step turning, Taper Turning, and study of Tool Signature (i.e. Geometry of cutting tool).
6. **Shaping Process:** To prepare a horizontal surface/ vertical surface/ slot or V-grooves on shaping machine.
7. **Milling Process:** To prepare a job involving side and face milling on milling machine.
8. **Sheet Metal Process:** To prepare sheet metal job giving knowledge of development of layout and introduction to gauge thickness of sheets.

9. **Introduction of Drilling, Reaming and Tapping operations along with the related cutting tools**

10. **Fitting shop:** To study different types of fitting tools and marking tools used in fitting processes, along with their operations and to prepare a job.
11. **Welding Shop: Introduction of Various aspects of Welding .**To prepare joints for welding suitable for butt welding, Lap welding and V-Joint.
12. **Carpentry Shop:** To study different types of carpentry tools and introduction to pattern making, pattern allowances, types of patterns and preparation of simple types of at least two wooden joints.
13. **Foundry Shop: Introduction to Foundry and its different Tools used.**To prepare a mould and core assembly ; to pour metal in the mould and fettle the casting

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Suggested Books:

Metal, Materials, Numerical Quantity, Forms - Westermann tables.

Course Title/Code	Communicative English (HLS102)
Course Type	Allied Core
Course Nature	Soft
Semester	II
L-T-P-O Structure	1-0-2-0
Objectives	• To equip the students with effective communication skills. • To deal extensively with the requirements of Industry. • To equip students with the nuances of technical writing. • To bridge the gap between college and work-place • To understand the genres of English Literature.

SYLLABUS	UNIT	WEIGHTAGE
	I	**30%**
	II	**20%**
	III	**25%**
	IV	**25%**
	TOTAL	**100%**

Learning Outcomes:

This course aims to take off from the threshold of the previous paper dealt in Semester I. Dealing extensively with requirements of Industry, the paper aspires to equip students with the nuances of technical writing, excellent communication flair and presentation skills. Eventually, the agenda is to bridge the gap between college and work-place.

SECTION - A

Lexis and Syntax

Homonym, Homophones, Words Often Confused, Foreign Words, Sentence, Kinds Of Sentence, Parts Of Sentence, The Phrase, The Clause, Synthesis Of Simple Sentence, Spotting The Errors (Articles, Pronoun, Preposition, Adjective, Verb)

SECTION - B

Oral Communication-II

Importance of Speech Sounds, IPA Symbols (Vowels and Consonants), Phonetic Transcription, Phoneme and Syllables

SECTION - C

Technical Writing-II

Business Letters, Job Application and CV Writing, Paraphrasing, Punctuation, Situation Writing, Paragraph Writing, Developing Outlines.

SECTION - D

Literature

Goodbye Party for Miss. PushpaT S - Nissim Ezekiel, *Why Scientists and Engineers Need Literature*- Troy Camplin *The Time Machine* - H. G.Wells

LAB ACTIVITIES

1. Exercise on Lexis.
2. Exercise on Syntax
3. Exercise on Spotting the Errors
4. One- Man Task
5. Role-Play Activities
6. Mock-Interview
7. Paragraph Writing
8. Situation Writing
9. Slogan Writing
10. Phonetic Transcription
11. Synthesizing Sentences
12. Presentation (Book Review/ Movie Review)

Suggested Books:

- *High School English Grammar and Composition*. Wren and Martin: S.Chand and Co.
- *A Textbook of English Phonetics for Indian Students*. T.Bala Subhrmaniam: Macmillan
- *English Vocabulary in Use*. MaCarthy: Foundation Books, OUP
- *English Grammar, Competition and Correspondenc.* M.A. Pink and A.C.Thomas: S.Chand and Co.
- *Reading Between the Line: Students Book.* MacRae: Foundation Books. CUP, New Delhi.

Semester-III

COURSE CODE	COURSE NAME	Course Type	Course Nature	PERIODS				CREDITS
		Core(Departmental/Allied)/ Elective (Departmental/ Open) / University Compulsory	Hard/Soft / Workshop/ NTCC	L	T	P	O	
PHH211-T	Electricity and Magnetism	Core	Hard	3	1	0	0	4
PHH211-P	Electricity and Magnetism Lab	Core	Hard	0	0	2	0	1
PHH212-T	Quantum Mechanics	Core	Hard	3	1	0	0	4
PHH212-P	Quantum Mechanics Lab	Core	Hard	0	0	2	0	1
PHH213-T	Mathematical Physics	Core	Hard	3	1	0	0	4
PHH213-P	Mathematical Physics Lab	Core	Hard	0	0	2	0	1
PHH214-T	Statistical Mechanics	Core	Hard	3	1	0	0	4
PHH214-P	Statistical Mechanics Lab	Core	Hard	0	0	2	0	1
EDS288	Applied Philosophy	Elective	Soft	1	0	2	0	2
EDS289	Applied Phycology							
EDS290	Applied sociology							
MCS231	Basics of Economics	Elective	Soft	1	0	2	0	2
MCS232	Introduction to Finance							
FLS103	French I	UCC	Soft	1	1	0	0	0
FLS101	Spanish I							
FLS102	German I							
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)			15	5	12	0	24

Detailed Syllabus

Course Title/ Code	**ELECTRICITY AND MAGNETISM (PHH211-T)**
Course Type:	Core (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-0-0)
Objectives	• To study Electric field and Potential for system of charges • To study magnetic fields and magnetic properties of materials • To study basic electrical circuits .

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Learning Outcomes:

Students will have the Ability to:

1) Calculate the electric field and potential for system of charges and solve Laplace and Poisson's equation for simple cases.

2) Calculate magnetic field arising out of current carrying conductors and torque on current carrying loop.

3) Calculate complex reactance and describe LCR series and parallel resonant circuits

SECTION-A

Electric Field and Electric Potential

Electric Field: Electric Field Lines, Electric Flux. Gauss' Law with Applications to Charge Distributions with Spherical, Cylindrical and Planar Symmetries, Conservative Nature of Electrostatic Field, Electrostatic Potential, Laplace's and Poisson Equation, The Uniqueness Theorem, Potential

and Electric Field of a Dipole, Force and Torque on a Dipole

SECTION-B

Electrostatic Energy

Electrostatic Energy of System of Charges, Electrostatic Energy of a Charged Sphere, Conductors in an Electrostatic Field, Surface Charge and Force on a Conductor, Capacitance of a System of Charged Conductors, Parallel-Plate Capacitor, Capacitance of an Isolated Conductor, Method of Images and its Application

Dielectric Properties of Matter

Electric Field in Matter, Polarization, Electrical Susceptibility and Dielectric Constant, Capacitor (Parallel Plate, Spherical, Cylindrical) Filled with Dielectric, Displacement Vector **D**, Relations between **E**, **P** and **D**, Gauss' Law in Dielectrics

SECTION-C

Magnetic Field

Magnetic Force between Current Elements and Definition of Magnetic Field **B**; Biot-Savart's Law and its Simple Applications: Straight Wire and Circular Loop, Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole), Ampere's Circuital Law and its Application to (1) Solenoid and (2) Toroid; Properties of **B**: Curl and Divergence, Vector Potential, Magnetic Force on (1) Point Charge (2) Current Carrying Wire (3) Between Current Elements, Torque on a Current Loop in a Uniform Magnetic Field.

SECTION-D

Magnetic Properties of Matter

Magnetization Vector (**M),** Magnetic Intensity (**H),** Magnetic Susceptibility and Permeability, Relation between **B, H, M**, Ferromagnetism,B-H Curve and Hysteresis.

Electromagnetic Induction

Faraday's Law, Lenz's Law, Self Inductance and Mutual Inductance, Reciprocity Theorem, Energy Stored in a Magnetic Field, Charge Conservation and Displacement Current.

Electrical Circuits

AC Circuits: Kirchhoff's Laws for AC Circuits, Complex Reactance and Impedance, Series LCR Circuit: Resonance, Power Dissipation, Quality Factor and Band Width, Parallel LCR Circuit

Course Title/ Code	ELECTRICITY AND MAGNETISM LAB (PHH211-P)
Course Type:	Core (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(0-0-2-0)
Objectives	• To study Electric field and Potential for system of charges • To study magnetic fields and magnetic properties of materials • To study basic electrical circuits .

List of Experiments

1. Use of a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.
2. To study the characteristics of a series RC Circuit.
3. To determine an unknown Low Resistance using Potentiometer.
4. To determine an unknown Low Resistance using Carey Foster's Bridge.
5. To compare capacitances using De'Sauty's bridge.
6. Measurement of field strength B and its variation in a solenoid (determine dB/dl)
8. To verify the Superposition, and Maximum power transfer theorems.
9. To determine self inductance of a coil by Anderson's bridge.
10. To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width.
11. To study the response curve of a parallel LCR circuit
12. To determine self-inductance of a coil by Rayleigh's method.
13. To determine the mutual inductance of two coils by Absolute method.

Suggested Books:

1. Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw (Text Book)
2. Electricity and Magnetism, Edward M. Purcell, 1986 McGraw-Hill Education (Text Book)
3. Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., 1998, Benjamin Cummings.
4. Feynman Lectures Vol.2, R.P.Feynman, R.B.Leighton, M. Sands, 2008, Pearson Education
5. Elements of Electromagnetics, M.N.O. Sadiku, 2010, Oxford University Press.

6. Electricity and Magnetism, J.H.Fewkes & J.Yarwood. Vol. I, 1991, Oxford Univ. Press.

Practical Reference Books

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2. A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
4. A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub.

Course	Quantum Mechanics (PHH 212-T)

Title/ Code	
Course Type:	Core (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-0-0)
Objectives	• To study Quantum phenomena in microscopic objects • To study Quantum Mechanics in one and three dimensional cases .

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Learning Outcomes:

Students will have the Ability to:

1) Explain physical phenomena describing dual nature of particle and photon

2) Apply Quantum Mechanics to simple one dimensional potentials

3) Apply Quantum Mechanics to spherically symmetric potential of one electron atom

SECTION-A

Particles and Waves

Inadequacies in Classical Physics, Blackbody Radiation: Quantum Theory of Light, Photoelectric Effect, Compton Effect; Wave Nature of Matter : de Broglie Hypothesis, Wave-Particle Duality, Davisson-Germer Experiment, Wave description of Particles by Wave Packets, Group and Phase Velocities and Relation between them, Heisenberg's Uncertainty Principle :Derivation from Wave Packets

SECTION-B

Quantum Mechanics

Basic Postulates and Formalism : Energy, Momentum and Hamiltonian Operators, Time dependent and Time-independent Schrödinger Wave Equation, Properties of Wave Function. Interpretation of Wave Function, Probability Density and Probability, Normalization, Linearity and Superposition Principles, Eigenvalues and Eigenfunctions, Expectation Values, Wave Function of a Free Particle, Particle in a one Dimensional Box

SECTION-C

Bound State Problems

General Features of a Bound Particle System, One Dimensional Simple Harmonic Oscillator : Energy Levels and Wave Functions, Zero Point Energy; Quantum Theory of Hydrogen Atom : Particle in a Spherically Symmetric Potential, Separation of Variables, Radial Solutions and Principal Quantum Number, Orbital and Magnetic Quantum Numbers, Quantization of Energy and Angular Momentum, Space Quantization, Electron Probability Density

SECTION-D

Finite Potential

Radiative Transitions, Selection Rules, Scattering Problems in one Dimension: Finite Potential Step: Reflection and Transmission, Stationary Solutions, Probability Current, Attractive and Repulsive Potential Barriers,Quantum Phenomenon of Tunneling: Tunnel Effect, Finite Potential Well

Course Title/ Code	**Quantum Mechanics LAB (PHH 212-P)**

Course Type:	Core (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(0-0-2-0)
Objectives	• To demonstrate Quantum phenomena in microscopic objects • To study and demonstrate Quantum Mechanics in one and three dimensional cases .

List of Experiments

1. Solve the s-wave Schrodinger equation for the ground state and the first excited state of the hydrogen atom.
2. Solve the s-wave radial Schrodinger equation for an atom for screened coulomb potential.
3. Solve the s-wave radial Schrodinger equation for an anharmonic oscillator.
4. Solve the s-wave radial Schrodinger equation for the vibrations of hydrogen molecule

Laboratory based experiments:

5. Study of Electron spin resonance- determine magnetic field as a function of the resonance frequency
6. Study of Zeeman effect: with external magnetic field; Hyperfine splitting
7. To show the tunneling effect in tunnel diode using I-V characteristics.
8. To measure quantum efficiency of CCDs

Suggested Books:

L. I. Schiff, Quantum Mechanics, 3rd edition, (McGraw Hill Book Co., New York 1968). (Text Book)

A. Beiser, Concepts of Modern Physics (Text Book)

E. Merzbacher, Quantum Mechanics, 3rd edition, (John Wiley & Sons, Inc1997)

J.L. Powell & B. Crasemann, Quantum Mechanics, (Addison-Wesley Pubs.Co.,1965)

A. Ghatak & S. Lokanathan, Quantum Mechanics: Theory and Applications, 5th Edition, (Macmillan India , 2004)

E. M. Lifshitz and L. D. Landau, Quantum Mechanics: Non-Relativistic Theory (Course of Theoretical Physics, Vol 3), 3rd Edition, Butterworth-Heinemann (1981).

Quantum Mechanics: Foundations and Applications by Arno Bohm.--3rd ed.—(New York: Springer-Verlag, 2003).

Course Title/ Code	Mathematical Physics II (PHH 213-T)
Course Type:	Core (Departmental/Allied)

Course Nature:	Hard
L-T-P-O Structure	(3-1-0-0)
Objectives	• To study special functions, Fourier and Laplace Transforms • To study partial differential equations and tensors

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Learning Outcomes:

Students will have the Ability to:

- Solve problems based on special functions
- Use Fourier and Laplace Transforms for solving problems
- Use partial differential equations for different problems
- Use tensors for different applications

SECTION- A

Special Functions

Legendre, Bessel, Hermite & Laguerre Differential Equations, Properties of Legendre Polynomials: Rodrigues Formula, Orthogonality, Simple Recurrence Relations, Beta and Gamma Functions and

Relation between them. Expression of Integrals in terms of Gamma Functions

SECTION - B

Fourier and Laplace Transforms

Fourier Transforms: Fourier Integral theorem, Fourier Transform, Fourier Transform of Derivatives, Inverse Fourier Transform, Properties of Fourier Transforms (Translation, Change of Scale, Complex Conjugation, etc.), Application of Fourier Transforms to differential equations: One dimensional Wave and Diffusion/Heat Flow Equations

Laplace Transform (LT) of Elementary Functions, Properties of Laplace Transforms: Change of Scale Theorem, Shifting Theorem. LTs of Derivatives and Integrals of Functions, Inverse LT. Application of Laplace Transforms to Differential Equations: Damped Harmonic Oscillator, Simple Electrical Circuits

SECTION- C

Partial Differential Equations

Solutions of 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.

SECTION-D

Tensors

Transformation Properties of Vectors, Covariant and Contra Variant Vectors; Tensors: Definition, Algebraic Properties; Numerical Tensors (Kronecker Delta and Levi-Civita Symbols), Metric Tensor, Index Raising, Lowering, Contraction; Electromagnetic Field Tensor; Covariant Differential, Covariant Derivative, Metric Connection; Riemann Curvature Tensor, Bianchi Identity, Ricci Tensor, Einstein Equation and Curvature Tensor.

Course Title/ Code	Mathematical Physics IILab (PHH 213-P)
Course Type:	Core (Departmental/Allied)

Course Nature:	Hard
L-T-P-O Structure	(0-0-2-0)
Objectives	• To study special functions, Fourier and Laplace Transforms • To solve partial differential equations and tensors using sci lab

List of Experiments

Topics	Description with Applications
Introduction to Numerical computation software Scilab	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 and developing the skills of writing a program (2).
Curve fitting, Least square fit, Goodness of fit, standard deviation	Ohms law to calculate R, Hooke's law to calculate spring constant
Solution of Linear system of equations by Gauss elimination method and Gauss Seidal method. Diagonalization of matrices, Inverse of a matrix, Eigen vectors,	Solution of mesh equations of electric circuits (3 meshes) Solution of coupled spring mass systems (3 masses)

eigen values problems	
Solution of ODE First order Differential equation Euler, modified Euler and Runge-Kutta second order methods Second order differential equation Fixed difference method	First order differential equation • Radioactive decay • Current in RC, LC circuits with DC source • Newton's law of cooling • Classical equations of motion Second order Differential Equation • 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 also

Suggested Books:

1. A Text Book of Differential Equations By N. M. Kapoor (Pitambar Publishing, 2006)
2. Schaum's outline of theory and problems of differential equations By Richard Bronson (McGraw-Hill Professional, 1994)
3. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Limited,1985)
4. Higher Engineering Mathematics by B S Grewal, Khanna Publishers (2000)
5. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7th Edn., Elsevier.(Text Book)

Course Title/	Statistical Mechanics (PHH214-T)

Code	
Course Type:	Core (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-0-0)
Objectives	• Acquire fundamental knowledge of classical and quantum statistical mechanics • Construct a bridge between macroscopic thermodynamics and microscopic statistical mechanics by using mathematical methods and fundamental physics for individual particles.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Learning Outcomes:

Students will have the Ability to:

1. Learn different statistical ensembles, their distribution functions, ranges of applicability and the corresponding thermodynamic potentials
2. Apply classical and quantum distributions in circumstances varying from standard examples to statistics of charge carriers
3. Learn relationship between equilibrium distributions and kinetic processes leading to equilibrium
4. Become aware of the richness and complexity of statistical behavior exhibited by interacting systems and various approaches (phenomenological and microscopic) developed to comprehend such systems

SECTION - A

Classical Statistics

Concept of Phase Space, Entropy and Thermodynamic Probability, Maxwell-Boltzmann Distribution Law, Ensemble Concept, Partition Function, Thermodynamic Functions of Finite Number of Energy Levels, Negative Temperature, Thermodynamic Functions of an Ideal Gas, Classical Entropy Expression, Gibbs Paradox, Law of Equipartition of Energy-Applications to Specific Heat and its Limitations.

SECTION - B

Classical and Quantum Theory of Radiation

Properties of Thermal Radiation, Blackbody Radiation, Pure temperature dependence, Radiation Pressure, Kirchhoff's law, Stefan-Boltzmann law: Thermodynamic proof, Wien's Displacement law, Wien's Distribution Law, Saha's Ionization Formula, Rayleigh-Jean's Law, Spectral Distribution of Black Body Radiation, Planck's Quantum Postulates, Planck's Law of Blackbody Radiation: Deduction of Wien's Distribution Law, Rayleigh-Jeans Law, Stefan-Boltzmann Law and Wien's Displacement Law from Planck's Radiation Law.

SECTION - C

Bose-Einstein Statistics

B-E Distribution Law, Thermodynamic Functions of a Strongly Degenerate Bose Gas, Bose Einstein Condensation, Properties of Liquid He (Qualitative Description), Radiation as a Photon Gas and Thermodynamic Functions of Photon Gas, Bose Derivation of Planck's Law.

SECTION - D

Fermi-Dirac Statistics

Fermi-Dirac Distribution Law, Thermodynamic Functions of a Completely and Strongly Degenerate Fermi Gas, Fermi Energy, Electron Gas in a Metal, Specific Heat of Metals, Relativistic Fermi Gas, White Dwarf Stars, Chandrasekhar Mass Limit

Course Title/ Code	Statistical Mechanics Lab (PHH214-P)
Course	Core (Departmental/Allied)

Type:	
Course Nature:	Hard
L-T-P-O Structure	(0-0-2-0)
Objectives	• Acquire fundamental knowledge of classical and quantum statistical mechanics • Construct a bridge between macroscopic thermodynamics and microscopic statistical mechanics by using mathematical methods and fundamental physics for individual particles.

List of Experiments

Use C/C++/Scilab for solving the problems based on Statistical Mechanics like

1. Plot Planck's law for Black Body radiation and compare it with Wein's Law and Raleigh- Jeans Law at high temperature (room temperature) and low temperature.
2. Plot Specific Heat of Solids by comparing (a) Dulong-Petit law, (b) Einstein distribution function, (c) Debye distribution function for high temperature (room temperature) and low temperature and compare them for these two cases.
   6133459274
3. Plot Maxwell-Boltzmann distribution function versus temperature.
4. Plot Fermi-Dirac distribution function versus temperature.
5. Plot Bose-Einstein distribution function versus temperature.

Suggested Books:

1. Statistical Mechanics, R.K. Pathria, Butterworth Heinemann: 2nd Ed., 1996, Oxford University Press.
2. Statistical Physics, Berkeley Physics Course, F. Reif, 2008, Tata McGraw-Hill (Text Book)
3. Thermodynamics, Kinetic Theory and Statistical Thermodynamics, Francis W. Sears and Gerhard L. Salinger, 1986, Narosa.
4. Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer

5. An Introduction to Statistical Mechanics & Thermodynamics, R.H. Swendsen, 2012, Oxford Univ. Press
6. Scilab by example: M. Affouf, 2012. ISBN: 978-1479203444
7. Scilab Image Processing: L.M.Surhone. 2010, Betascript Pub., ISBN: 978-

Course Title/Code	**APPLIED PHILOSOPHY (EDS 288)**
Course Type	**Elective**
Course Nature	**Soft**

L-T-P-O Structure	**(1-0-2)**
Objectives	To enable students to - confront the philosophical problems implicit in the experience of self, others and the society. - read critically the philosophy of influential philosophers with respect to society, Science and success in life - understand and apply concepts and theories of moral philosophy. - reflect philosophically and ethically on their own personal, professional and civic lives. -formulate for himself or herself a philosophy of life or world-view consistent with the objectives of liberal society.

SECTION - A

INTRODUCTION TO PHILOSOPHY

- Philosophy: Meaning, Nature and Scope, Practical uses of Philosophy, Branches of Philosophy

SECTION - B

THOUGHTS OF PHILOSOPHERS AND THEIR IMPLICATIONS

- General Philosophy of John Dewey, Swami Vivekananda and Rabindra Nath Tagore
- Philosophy of life and success: Steve Jobs, N.R. Narayana Murthi, Dr. A.P.J. Abdul Kalam and Muhammad Yunus
- Philosophy of Science and technology- Francis Bacon and Martin Heidegger.

SECTION - C

PHILOSOPHICAL PERSPECTIVES OF SOCIO-POLITICAL SCENARIO IN INDIA

- Nature of Democracy and its implications.
- Meaning and requirements of National Integration
- Universal Human Rights
-

SECTION - D

PHILOSOPHICAL PERSPECTIVES OF RELIGIOUS SCENARIO IN INDIA

•Secularism—its nature and implications, Moral Philosophy of religion with special reference to Hinduism, Jainism, Buddhism, Islam, Christianity, Sikhism.

• Religious pluralism and Religious tolerance.

Reference Books and Readings:

1. Bhatia, K. & Bhatia, B. (1974) *The Philosophical and Sociological Foundations of Education*. Delhi: Doaba House.
2. Brubacher, John. S. (1969). *Modern Philosophies of Education*, New Delhi: Tata McGraw-Hill
3. Dewey, J. (1966). *Democracy in Education*, New York: Macmillan.
4. Ferre, F.(1995). *Philosophy of Technology*. University of Georgia Press.
5. Gandhi, M. K. (1956). *Basic Education*. Ahmedabad, Navajivan.
6. Goel, A. & Goel S. L. (2005). *Human values and Education*. New Delhi: Deep and Deep Publications Pvt. Ltd.
7. Palmer, Joy A. et.al. (2001). *Fifty major thinkers on education from confucious to Dewey*. New Delhi: Rutledge.
8. Rajput, J.S. (2006). *Human Values and Education*. New Delhi: Paragon Publications.
9. Walia, J.S. (2011). *Philosophical, Sociological and Economic Bases of Education.* Jalandhar: Ahim Paul Publishers.

Applied Philosophy Practical (EDS 288)

Suggested activities:

•Prepare and present a report on 'philosophy of life' from the perspective of a young adult.

•Quiz and interactive sessions on various philosophical perspectives of contemporary philosophers.

•Organization of and participation in street plays /dramas/ declamation/ debates/ any other suitable activity on any theme of Philosophical perspectives of Socio-Political scenario in India.

•Group discussions on any suitable topics concerning contemporary society like aggression among youth, Over-ambitiousness in young generation, misuse of democracy, implications of secularism etc. and to reflect upon different viewpoints.

•Preparation of quotation boards to display quotes of great philosophers in the college premises.

•Picture interpretation and philosophical reflection on social themes like juvenile crime, begging in India, Social networking etc.

•Readings from the autobiographies and other publications of great philosophers e.g. ‘Wings of Fire’ followed by discussion session.

•Showing Videos on Unique personalities: life and philosophies followed by reflection exercises.

•Any other suitable activity.

Course Title/Code	**Applied Psychology (EDS289)**
Course Type	**Elective**

Course Nature	Soft
L-T-P-O Structure	**(1-0-2-0)**
Objectives	-To define psychology and its application across various fields. -To understand the conceptual framework of attitude and personality along with cherishing out their attitude and personality development. -To conceptualize psychology in social and organizational settings. -To maintain and reform group dynamics.

SECTION - A

PSYCHOLOGY: ATTITUDE FORMATION

Psychology: Meaning, nature, and scope, Role of psychology across multi-disciplinary aspects, Introduction: Attitude, Stereotypes, Prejudice, and Discrimination, Formation of attitude and attitude change

SECTION - B

PERSONALITY AND PERSONALITY DEVELOPMENT

Definition of personality and personality development, State/ Trait approach to personality, Bandura's Social- Cognitive theory of personality

SECTION - C

SOCIAL PSYCHOLOGY

Introduction to social identity, social cognition, and social influence, social conflicts and its resolutions, Group dynamics: Introduction, formation, types of groups, cooperation, competition, and conflict in groups

SECTION - D

ORGANIZATIONAL PSYCHOLOGY

Organizational Psychology: Definition, fundamental concepts and importance, Introduction to job satisfaction, work motivation, and organizational commitment

Introduction to participation, empowerment, and team work

References Books and Readings:

- Arrow, K. J. (1995). *Barrier to Conflict Resolution.* NY: W. W. Norton.
- Bandra, A., & Walters, R. H. (1963). *Social Learning and Personality Development*. New York: Holt, Rinehart, & Winston.

- Bandra, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice- Hall, Inc.
- Baron, R. A., Byrne, D. (1997). *Social Psychology* (8th Ed.). Boston, MA: Allyn & Bacon.
- Baron, R. A. (2001). *Psychology* (5th ed.). London: Pearson.
- Cialdini, R. B. (2001). *Influence: Science and Practice* (4th Ed.). Boston, MA: Allyn & Bacon.
- Feldman, R. S. (2008). *Essentials of Understanding Psychology*. New Delhi: Tata McGraw Hill.
- Friedkin, N. (1998). *A structural theory of social influence.* Cambridge: Cambridge University Press.
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- Hall, C. S., Lindzey, G. & Campbell, J. B. (2004). *Theories of Personality* (4th Ed.). New York: Wiley.
- Hunt, R. R., & Ellis, H. C. (2006). *Fundamentals of Cognitive Psychology*. New Delhi: Tata McGraw Hill.
- McDavid, J. M., & Harari, H. (1994). *Social Psychology: Individuals, Groups, and Societies*. New Delhi: CBS Publishers.
- Millward, L. (2005). *Understanding Occupational and Organizational Psychology.* London: Sage Publications.
- Morgan, C. T., King, R. A., Weisz, J. R., & Schopler, J. (1993). *Introduction to Psychology*. (7th Ed.). New Delhi: Tata McGraw Hill.
- Woolfork, A. E. (2014). *Educational Psychology*(12th Ed.).Boston: Allyn & Bacon.

Applied Psychology Practical (EDS 289)

1. Prepare a story using different pictures in order to understand the personality
2. Prepare a SWOT Chart to identify strength and weakness of oneself
3. Role of psychology be proved as an asset in professional development
4. Give a brief account of your personality before and after the transaction of course content.
5. Identify different stereotype present in our Society and present your views on it.
6. Collect any five articles on discrimination prevalent in Society
7. List out Company incentives provided to their employee for work motivation.
8. Prepare a street play on social issues to understand the group dynamics
9. Reflection activities to understand the emotions and personality

10. List out the Do's and Don'ts of the Interview
11. Role of body language in attitude formation.
12. Situational Activities: Suppose you are captain of your football team. Draw out inputs to motivate your team, and maintain the team- spirit.
13. Write a brief note on any one attitude you want to change in yourself and the strategies to accomplish it.
14. The psychometric tests to be conducted by learners:
    - Sociometry test
    - Personality testing (16PF)
    - Vineland Social Maturity Scale
    - Rorschach inkblot test
    - Thematic Appreciation Test
    - Color personality Test
15. Any other suitable activities.

Course Type	**Elective**
Course Nature	**Soft**
L-T-P-O Structure	**(1-0-2)**
Objectives	To develop the skills to think "objectively" and analytically about ways in which social forces affect our everyday lives. To understand the perspectives of persons with different cultural, ethnic and social background. through Social Change To be able to identify and discuss the differences between the three major theoretical paradigms used by sociologies in the analysis of society. To be able to know about fundamental concepts of sociology

UNIT-1

Introduction

Sociology: Meaning, Nature and Scope; Relationship of Sociology with other subjects; Application of Sociology in corporate world

UNIT -2

Social change and social processes

Social Change: Meaning, Concept and nature of Social Change

Processes : Urbanization; Modernization; Globalization; Industrialization; Liberalization

UNIT-3

THEORIES AND APPROACHES OF SOCIOLOGY

Different Theories and approaches: Positivist Approach; Labeling Theory, Structural Function Theory, Social /Conflict Theory, Social Darwinism Theory

UNIT-4

FUNDAMENTAL CONCEPTS

Fundamental Concepts in Sociology: Social Stratification, Social Change, Social Control, Equality, Equity, Co-operation and Conflict, Association, Social Structure, Family, Caste , Ethnicity

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2. Barnes,H.E.1959. Introduction to the history of sociology, Chicago: The University of Chicago Press.
3. Coser, Lewis A 1979. Masters of sociological thought. New York: Harcourt Brace Jovanovich.
4. Cotterell.Roger,1992. Oxford University Press, New Delhi
5. Fletcher, Ronald. 1994. The making of sociology (2 volumes) Jaipur:Rawat
6. Freeman, Michael 2006. Law and Sociology. Oxford University Press, New Delhi
7. Lucy Mair, 1997 An Introduction to social anthropology, Oxford University Press, New Delhi (chapter 1 & 2)
8. Marrison, Ken 1995. Marx Durkheim. Weber: Formation of modern social though. London: Sage.
9. Ritzer. George 1996. Sociological theory, New Delhi: Tata MeGraw Hill Singh, Yogendra. 1986. Indian sociology; conditioning and emerging trends, New Delhi: vistaar.
10. Zeitlin, Irving 1998(Indian edition); Rethinking sociology: A critique of contemporary theory; Jaipur:Rawat 90
11. Bottomore, T.B.1986 Introduction to Sociology(Revised edition), London: Alien and Unwin.
12. Firth, R 1056 Human Types:London:Thokas Nelson and Sons Ltd.
13. Giddens, A 1997 Sociology Cambridge: Polity Press
14. Radeliffe Brown A.R.1976 Structure and function in primitive society.
15. London:Routledge and Kegan Paul Merton, R.K.1968, Social theory and social structure Glencoe, III Free Pre3ss and New Delhi:American Publishing Co(Pvt) Ltd.
16. Henslin M.James, 1996 Essential of Sociology: A down to Earth Approach, Allyn and Bacon, Massachussetts.

Applied Sociology Practical

- Prepare and present a report on "importance of sociology in relation with the corporate sector'' with the perspective of a young adult.
- Preparation of quotation board with the help of displaying the pictures and quotes of famous sociologists
- Case study

- Discuss the impact of modernization, industrialization and globalization on the day-today life.
- Showing Videos on the life and philosophies of Famous sociologists to tell the students about their different theories
- Field Study

Course Title/ Code	**BASICS OF ECONOMICS/MCS-231**
Course Type	**Allied Elective**
Course Nature	**SOFT**
L-T-P-O Structure	**1-0-2-0**

Unit I

Definition of Economics - various definitions, Nature of Economic problem, Production possibility curve, Concepts and measurement of utility, Law of Diminishing Marginal Utility, Law of equi-marginal utility - its practical application and importance.

Unit II

Meaning of Demand, Individual and Market demand schedule, Law of demand, shape of demand curve, Elasticity of demand, degrees of Price elasticity of demand, factors effecting elasticity of demand, practical importance & applications of the concept of elasticity of demand.

Unit III

Meaning of production and factors of production, laws of production, various concepts of cost - Fixed cost, variable cost, average cost, marginal cost, money cost, real cost and opportunity cost. Shape of short run cost curves.

Unit IV

Meaning of Market, Types of Market -Perfect Competition, Monopoly, Oligopoly, Monopolistic Competition (Main features of these markets). Supply and Law of Supply, Role of Demand & Supply in Price Determination and effect of changes in demand and supply on prices.

TEXT BOOKS:

1. Principles of Economics: P.N. Chopra (Kalyani Publishers).
2. Economics for Engineers- T R Jain & O P Khanna
3. Micro Economic Theory – M.L. Jhingan (S.Chand) .
4. Micro Economic Theory - H.L. Ahuja (S.Chand) .

5. Modern Micro Economics : S.K. Mishra (Pragati Publications).
6. Economic Theory - A.B.N. Kulkarni & A.B. Kalkundrikar (R.Chand & Co.).
7. Indian Economy: Rudar Dutt & K.P.M. Sundhram

Course Title/ Code	**Introduction to Finance /MCS-232**
Course Type	**Allied Elective**
Course Nature	**SOFT**
L-T-P-O Structure	**1-0-2-0**

Unit 1

Financial Management : An Overview—forms of business organization, financial decision in a firm, Financial System , Financial Markets and Intermediaries

Unit 2

Financial Analysis and Planning : Financial Statements-Balance sheet, Statement of Profit and Loss, Taxes and Cash Flow , Financial Ratios, Break Even Analysis.

Unit 3

Sources of Long term Finance – Equity Capital, Preference Capital, Terms Loans, Debentures; Raising Long term Finance

Unit 4

Time Value of Money, Capital Budgeting- Techniques of Capital Budgeting, Net Present Value and Payback Period , Capital Structure and Cost of Capital

Suggested Readings:

1. Pandy, I.M., Financial Management, Vikas Publishing House, New Delhi

2. Khan M.Y, and Jain P.K., Financial Management, Tata McGraw Hill, New Delhi

3. Keown, Arthur J., Martin, John D., Petty, J. William and Scott, David F, Financial Management, Pearson Education

4. Chandra, Prasanna, Financial Management, TMH, New Delhi

5. Van Horne, James C., Financial Management and Policy, Prentice Hall of India

6. Brigham & Houston, Fundamentals of Financial Management, Thomson Learning, Bombay.

7. Kishore, R., Financial Management, Taxman's Publishing House, New Delhi

Course Title/ Code	**French (FLS103)**
Course Type:	**Elective**
Course Nature:	Soft
L-T-P-O Structure	(1-1-0-0)
Objectives	At the end of the course, students will be able to 1. Exchange greetings and do introductions using formal and informal expressions 2. Understand and use interrogative and answer simple questions 3. Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary 4. Express their likes and dislikes. Also will have understanding of simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed 5. Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. 6. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary 7. Provide basic information about familiar situations and topics of interest 8. Express or/and justify opinions using equivalents of different verbs 9. Differentiate certain patterns of behavior in the cultures of the French-speaking world and the student's native culture

Syllabus	**Sections**	**Weightage**
	A	25%
	B	25%
	C	25%

	D	25%
	TOTAL	**100%**

Section-A

- Les Salutations & forms of politeness
- Alphabets
- Taking leave expressions

Section-B

- Les pronoms sujets
- Les verbes ER
- Self introduction

Section-C

- Les noms
- Verbes Avoir, Etre, Aller & Faire
- Les articles define et indefini

Section-D

- Les moin de l'annee
- les jours de la semaine

Repondez aux questions

Course Title/ Code	**Spanish (FLS101)**
Course Type:	**Elective**
Course Nature:	Soft
L-T-P-O Structure	(1-1-0-0)
Objectives	At the end of the course, students will be able to 10. Exchange greetings and do introductions using formal and informal expressions 11. Understand and use interrogative and answer simple questions 12. Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary 13. Express their likes and dislikes. Also will have understanding of simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed 14. Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. 15. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary 16. Provide basic information about familiar situations and topics of interest 17. Express or/and justify opinions using equivalents of different verbs 18. Differentiate certain patterns of behavior in the cultures of the French-speaking world and the student's native culture

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION-A

- Presentation on Spanish language

- Greetings and goodbye's
- Spanish letter
- Introduction of VerboSER

SECTION-B

- Uses of Verbo SER
- Introduction of Nationality
- Professions and vocabulary related to professions.
- Adjectives related to Verbo SER.
- Counting till number 20.

SECTION-C

- Introduction of Articles and Indefinite articles
- Interrogatives
- Adjectives to describe things and place and Counting till number 90
-

SECTION-D

- Introduction of Verbo ESTAR
- Uses of Verbo ESTAR with respect to positioning of objects
- Prepositions related to the positioning of an object

Suggested Books:

Note: Kindly Mention the number of copies available in University Library. The compiled information may be used by the department for procurement.

Course Title/ Code	**German (FLS102)**
Course Type:	**Elective**
Course Nature:	Soft
L-T-P-O Structure	(1-1-0-0)
Objectives	At the end of the course, students will be able to 1. Exchange greetings and do introductions using formal and informal expressions 2. Understand and use interrogative and answer simple questions 3. Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary 4. Express their likes and dislikes. Also will have understanding of simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed 5. Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. 6. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary 7. Provide basic information about familiar situations and topics of interest 8. Express or/and justify opinions using equivalents of different verbs 9. Differentiate certain patterns of behavior in the cultures of the French-speaking world and the student's native culture

	Sections	**Weightage**
Syllabus	A	20%
	B	20%
	C	20%
	D	20%
	E	20%
	TOTAL	**100%**

Section-A

- Salutations/Greetings
- Introduction

Section-B

- Introduction cntd.
- Alphabets
- Numbers 1-20

Section-C

- Personal pronouns
- Hobbies and professions

Section-D

- Café related vocabulary and dialogues
- Revision personal pronouns

Section-E

- Café related vocabulary and dialogues cntd.
- Common verbs and their conjugations

Semester-IV

COURSE CODE	COURSE NAME	Course Type	Course Nature	PERIODS				CREDITS
		Core(Departmental/Allied)/ Elective (Departmental/ Open) / University Compulsory	Hard/Soft / Workshop/ NTCC	L	T	P	O	
MAH411-T	Numerical Analysis	Core	Hard	3	1	0	0	4
MAH411-P	Numerical Analysis Lab	Core	Hard	0	0	2	0	1
PHH215-T	Solid State Physics	Core	Hard	3	1	0	0	4
PHH215-P	Solid State Physics Lab	Core	Hard	0	0	2	0	1
PHH217-T	Thermal Physics	Core	Hard	3	1	0	0	4
PHH217-P	Thermal Physics Lab	Core	Hard	0	0	2	0	1
PHH216-T	Digital Electronics	Core	Hard	3	1	0	0	4
PHH216-P	Digital Electronics Lab	Core	Hard	0	0	2	0	1
MAS230	Quantitative Aptitude	Core	Soft	1	0	2	0	2
CHS234	Environmental Sustainable development	Elective	Soft	1	0	2	0	2
ECS249	e Waste Management							
PHW218	Workshop Open Source (Software)	Elective	WS	0	0	3	0	2
PHO219	Summer Training							3
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)			14	4	15	0	29

Detailed Syllabus

Course Title	**Numerical Analysis**
Course Code	MAH4 11-T
Course Type	Core
Course Nature	Hard
L-T-P-O structure/ Credits	3-1-0-0 4
Objective	The students would be able to apply the concepts of numerical techniques required for solving the mathematical problems and their applications.

	SECTION	WEIGHTAGE
SYLLABUS	**A**	**25%**
	B	**25%**
	C	**25%**
	D	**25%**
	TOTAL	**100%**

SECTION - A

Solution of nonlinear & transcendental equations bracketing methods for locating a root, initial approximations and convergence criteria, bisection method, Regula Falsi, Newton- Raphson and secant method.

Interpolation and curve fitting: introduction to interpolation, Lagrange approximation, Newton's formula for equispaced & non equispaced points (forward, backward and divided difference), Hermite interpolation. Curve fitting by a straight line and a second degree curve and laws reducible to linear law.

SECTION - B

Numerical differentiation and integration: approximating the derivatives, numerical differentiation formulas (forward, backward and central), introduction to numerical quadrature, Newton- cotes formula, Gaussian quadrature - Gauss Legendre & Gauss Chebyshev's.

SECTION - C

Solution of linear systems: direct methods, Gaussian elimination, matrix inversion, iterative methods for linear systems (Gauss Seidel & Gauss Jacobi), LU decomposition. Eigen value problems: Jacobi, Given's and Householder's methods for symmetric matrices, power and inverse power methods.

SECTION - D

Solution of differential equations: Introduction to differential equations, Initial value problems, Picard's method, Taylor series method , Euler's methods, classical method of Runge-Kutta method of order IV , Predictor-Corrector methods(Milne's & Adam's Bashforth).

Course Title	**Numerical Analysis**Lab
Course Code	MAH4 11-P
Course Type	Core
Course Nature	Hard
L-T-P-O structure/ Credits	0-0-2-0 1
Objective	The students would be able to apply the concepts of numerical techniques required for solving the mathematical problems and their applications.

LIST OF EXPERIMENTS:

1. To find roots of an equation using Bisection method.
2. To find roots of an equation using RegulaFalsi method.
3. To find roots of an equation using Newton Raphson method.
4. To find roots of an equation using Secant method.
5. To find the value of a dependent variable for a given value of an independent variable using Lagrange's interpolation method for a given set of data.
6. To find the value of a dependent variable for a given value of an independent variable using Newton divided difference interpolation for a given set of data.
7. To find the value of a definite integral using Trapezoidal rule of integration.
8. To find the value of a definite integral using Simpson's 1/3 rule of integration.
9. To find the value of a definite integral using Simpson's 3/8 rule of integration.
10. To find the solution of an ordinary differential equation of first order by R-K method

REFERENCE BOOKS:

1. M.K. Jain, S.R.K. Iyengar and R.K.Jain, "Numerical Methods for Scientific and Engineering Computation", New Age international Publishers.
2. Laurene V, Fausett, "Applied Numerical Analysis using MATLAB", Pearson.
3. S.S. Sastry, "Introductory Methods of Numerical Analysis", Published by Prentice Hall of India.

Course Title/ Code	Solid State Physics (PHH215-T)
Course Type:	Core (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-0-0)
Objectives	• To study and analyze different types of crystal structures. • To study athe electrical, magnetic, dielectric and superconducting properties of materials. .

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Learning Outcomes:

Students will have the Ability to:

1) Analyze the XRD pattern and determine the crystal structure of a material.

2) Measure the electrical, magnetic and dielectric properties of materials.

3) Describe the properties of materials in superconducting state.

SECTION-A

Crystal Structure

Crystalline Solids – Polycrystalline and Single Crystal Form, Amorphous Solids, Lattice and Basis, Unit Cell, Crystal Systems, Crystal Symmetry, Space Groups, Bravais Space Lattices, Miller Indices, Lattice Planes, Inter-planar Spacing, Some Simple Crystal Structures (SC, BCC, FCC, HCP and Diamond), X-ray Diffraction, Bragg's Law, Determination of Crystal Structure with X-rays Using Powder Method.

SECTION-B

Electrical Properties of Solids

Classical Free Electron Theory of Metals, Wiedeman-Franz's Law, Quantum Theory of Free Electrons, Band Theory of Solids: Periodic Potential and Bloch Theorem, Kronig-Penney Model, E-k Curves, Brillouin Zones, Effective Mass, Band Structure in Conductors, Semiconductors and Insulators, Direct & Indirect Band gap Semiconductors, Drift Current, Mobility and Conductivity, Hall Effect

SECTION-C

Magnetic properties of materials

Review of Basic Concepts (origin of magnetism, magnetic moment, Magnetization and Magnetic susceptibility) Dia, Para and Ferro-magnetic Properties of Solids, Langevin's Theory of Diamagnetism and Paramagnetism, Quantum Theory of Paramagnetism, Curie's Law, Ferromagnetism : Spontaneous Magnetization and Domain Structure; Temperature Dependence of Spontaneous Magnetization; Curie-Weiss Law, Hysteresis Curve, Antiferromagnetism, Ferrimagnetism

SECTION-D

Dielectric properties of materials and superconductivity

Review of Basic Concepts, Classification ofDielectric Materials, Concept of Polarization, Three Electric Vectors, Local Field, Electronic, Ionic and Dipolar Polarization, Behavior of Dielectrics in A.C. Field, Concept of Local Field, Polarizability, Claussius-Mosotti Relation, Ferroelectricity, Piezoelectricity, Applications.

Introduction (Kamerlingh-Onnes experiment), Effect of Magnetic Field, Type-I and Type-II Superconductors, Isotope Effect, Meissner Effect, Heat Capacity, Energy Gap, London Equations and Explanation of Persistent Current and Meissner Effect, BCS Theory, Applications of Superconductivity.

Course Title/ Code	Solid State PhysicsLab (PHH215-P)
Course Type:	Core (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(0-0-2-0)
Objectives	• To study and analyze different types of crystal structures. • To study athe electrical, magnetic, dielectric and superconducting properties of materials. .

LIST OF EXPERIMENTS:

1. To verify Richardson – Dushmann equation and to determine work function of the cathode material.
2. To determine carrier concentration of a semiconductor using Hall Effect setup.
3. Determination of retentivity and coercivity of a ferromagnetic substance by plotting B-H curve.
4. To determine crystal structure and lattice parameters of a material by analyzing XRD Data.
5. To determine dielectric constant of a material using De-Sauty Bridge.
6. To determine energy band gap using reverse biased P-N junction diode.
7. To determine energy band gap of a semiconductor using four probe method.
8. To measure the Dielectric Constant of a dielectric Materials with frequency.
9. To determine the susceptibility of a paramagnetic material.
10.

Suggested Books:

1. Introduction to Solid State Physics, Charles Kittel, 8th Edition, 2004, Wiley India
2. Pvt. Ltd.(Text Book)
3. Elements of Solid State Physics, J.P. Srivastava, 2nd Edition, 2006, Prentice-Hall of India(Text Book)
4. Solid State Physics, S.O. Pillai(Text Book)
5. Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill

6. Solid State Physics, N.W. Ashcroft and N.D. Mermin, 1976, Cengage Learning
7. Solid-state Physics, H. Ibach and H. Luth, 2009, Springer
8. Elementary Solid State Physics, 1/e M. Ali Omar, 1999, Pearson India
9. Solid State Physics, M.A. Wahab, 2011, Narosa Publication

Course Title/ Code	**THERMAL PHYSICS** (PHH217-T)
Course Type:	Core (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-0-0)
Objectives	• To study laws of thermodynamics and thermodynamic relations. • To study kinetic theory of gases.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Learning Outcomes:

The students will have the ability to:

- To apply laws of thermodynamics for simple cases
- To apply Maxwell relations to calculate different thermodynamic parameters
- To explain properties of gases using kinetic theory

SECTION-A

Zeroth and First Law of Thermodynamics: Extensive and Intensive Thermodynamic Variables, Thermodynamic Equilibrium, Concept of Work and Heat, State Functions, First Law of Thermodynamics and its Differential Form, Internal Energy, General Relation between C_P and C_V, Work Done During Isothermal and Adiabatic Processes, Reversible and Irreversible Process with Examples

SECTION-B

2^{nd} Law of Thermodynamics: Kelvin-Planck and Clausius Statements and Their Equivalence, Carnot Engine & Efficiency Carnot's Theorem, Concept of Entropy, Second Law of Thermodynamics in Terms of Entropy, Principle of Increase of Entropy, Entropy and Disorder, Entropy Changes in Reversible and Irreversible Processes with Examples, Third Law of Thermodynamics, Unattainability of Absolute Zero

SECTION-C

Derivations and Applications of Maxwell's Relations, Expressions for (C_P–C_V) and C_P/C_V, Tds Equations, Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy, Cooling due to Adiabatic Demagnetization, First and Second Order Phase Transitions with Examples, Claussius - Clapeyron Equation

SECTION-D

Distribution of Velocities: Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas, Mean, RMS & Most Probable Speeds, Mean Free Path (Zeroth Order), Transport Phenomenon in Ideal Gases: Viscosity, Thermal Conductivity, Deviations from the Ideal Gas Behavior, Van der Waal's Equation of State for Real Gases, Free Adiabatic Expansion of a Perfect Gas, Joule-Thomson Coefficient

Course Title/	**THERMAL PHYSICS Lab** (PHH217-P)

Code	
Course Type:	Core (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(0-0-2-0)
Objectives	• To study laws of thermodynamics and thermodynamic relations. • To study kinetic theory of gases.

List of Experiments

1. To determine J by Callender and Barne's constant flow method
2. To determine the Coefficient of Thermal Conductivity of Copper by Searle's Apparatus
3. To determine the Coefficient of Thermal Conductivity of Copper by Angstrom's Method
4. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee and Charlton's disc method
5. To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT)
6. To calibrate a Resistance Temperature Device (RTD) to measure temperature in a specified range using Null Method/ Off-Balance Bridge with Galvanometer based Measurement
7. To study the variation of Thermo-E.M.F. of a Thermocouple with Difference of Temperature of its Two Junctions
8. To Calibrate a Thermocouple to measure Temperature in a Specified Range using (1) Null Method (2) Direct Measurement using an Op-Amp Difference Amplifier and to determine Neutral Temperature
9. To determine the viscosity of a fluid

Suggested Books:

1. Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill.

2. A Treatise on Heat, Meghnad Saha, and B.N.Srivastava, 1958, Indian Press

3. Thermal Physics, S. Garg, R. Bansal and Ghosh, 2nd Edition, 1993, Tata McGraw-Hill

4. Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer.

5. Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger.

1988, Narosa.

6. Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, 2nd Ed., 2012, Oxford University Press.

Course Title/ Code	Digital Electronics (PHH216-T)

Course Type:	Core (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-0-0)
Objectives	• To introduce number systems and codes • To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions • To introduce the methods for simplifying Boolean expressions • To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Learning Outcomes:

Students will have the Ability to:

1. Design combinational and sequential digital logic circuits.
2. They will have knowledge on Programmable Logic devices and its usage.

SECTION- A

Basic Digital Circuits and Operational Amplifier

Difference between Analog and Digital Circuits, Binary Numbers, Decimal to Binary and Binary to Decimal Conversion, BCD, Octal and Hexadecimal numbers, AND, OR and NOT Gates (realization using Diodes and Transistor), NAND and NOR Gates as Universal Gates, XOR and XNOR Gates and Application as Parity Checkers, Basic Characteristics of Op-Amps, Characteristics of an Ideal Op-Amp, Feedback in Amplifiers, Open-loop and Closed-loop Gain, Frequency Response, CMRR, Virtual ground, Applications of Op-Amps

SECTION – B

Boolean algebra and Data processing circuits

De Morgan's Theorems, Boolean Laws, Simplification of Logic Circuit using Boolean Algebra, Fundamental Products, Idea of Minterms and Maxterms, Conversion of a Truth table into Equivalent Logic Circuit by Sum of Products Method and Karnaugh Map, Basic idea of Multiplexers, De-multiplexers, Decoders, Encoders

SECTION – C

Arithmetic and Sequential Circuits

Binary Addition, Binary Subtraction using 2's Complement, Half and Full Adders, Half & Full Subtractors, 4-bit binary Adder/Subtractor, SR, D, and JK Flip-Flops, Clocked (Level and Edge Triggered) Flip-Flops, Preset and Clear operations, Race-around conditions in JK Flip-Flop, Master Slave JK Flip-Flop

Section – D

Shift registers and Computer Organization

Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only up to 4 bits),Ring Counter, Asynchronous Counters, Decade Counter, Synchronous Counter Input/Output Devices, Data storage (idea of RAM and ROM), Computer Memory, Memory organization & addressing, Memory interfacing Memory Map, Main features and Components of 8085 Microprocessor, Block diagram.

Course Title/ Code	Digital ElectronicsLab (PHH216-P)
Course	Core (Departmental/Allied)

Type:	
Course Nature:	Hard
L-T-P-O Structure	(0-0-2-0)
Objectives	• To introduce number systems and codes • To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions • To introduce the methods for simplifying Boolean expressions • To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits

LIST OF EXPERIMENTS:

1. To verify and design AND, OR, NOT and XOR gates using NAND gates.
2. To design a combinational logic system for a specified Truth Table.
3. To convert a Boolean Expression into Logic Gate Circuit and assemble it using logic gate ICs.
4. To minimize a given Logic Circuit.
5. To design a Seven segment display driver
6. Half Adder, Full Adder and 4-bit Binary Adder.
7. Half Subtractor, Full Subtractor, Adder-Subtractor using Full Adder I.C.
8. To build Flip-Flop Circuits using elementary gates (RS, Clocked RS, D-type, and JK Flip-Flop).
9. To build a 4-bit Counter using D-type/JK Flip-Flop.
10. To make a Shift Register from D-type/JK Flip-Flop.
11. Serial and Parallel shifting of data.
12. To design an Inverting Amplifier of given gain using Op-amp 741 and to study its Frequency Response.
13. To design a Non-Inverting Amplifier of given gain using Op-amp 741 and to study its Frequency Response.
14. To design and study a precision Differential Amplifier of given I/O specification using Op-amp 741.

Suggested Books:

1. Digital principles and applications By Donald P. Leach & Albert Paul Malvino, (Glencoe, 1995).(Text Book)
2. Digital Fundamentals, 3rd Edition by Thomas L. Floyd (Universal Book Stall, India, 1998).
3. Digital Electronics by R.P. Jain,
4. Operational Amplifiers and Linear Integrated Circuits, 4th Edition by Robert F Coughlin and Frederick F Driscoll (P.H.I. 1992)
5. Op-Amps and Linear Integrated Circuits by R. A. Gayakwad (Pearson Education Asia, 2000)

Course Title/ Code	**QUNATITATIVE APTITUDE (MAS230)**
Course Type:	Core (Departmental/Allied)
Course Nature:	Soft
L-T-P-O Structure	(1-0-2-0)
Objectives	The students would be able to apply the Quantitative techniques concepts and their applications.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Learning Outcomes:

Students will have the Ability to:

1) Apply concept of H.C.F. & L.C.M. of Numbers , Permutations & Combinations, ProbabilityRaces & Games of Skill.

2) Calculate Roots & Cube Roots , Average Simple Interest, Compound Interest, Area, Volume & Surface Areas ,Calendar, Clocks .

SECTION - A

H.C.F. & L.C.M. of Numbers, Square Roots & Cube Roots Average, Problems on Ages, Percentage, Profit & Loss

SECTION - B

Ratio & Proportion, Numbers, Time & work. , Time & Distance, Problems on Trains

SECTION - C

Simple Interest, Compound Interest, Area, Volume & Surface Areas, Races & Games of Skill

SECTION - D

Calendar, Clocks, Permutations & Combinations, Probability

Practice Worksheets:

1. (a)To solve the problems of H.C.F. & L.C.M. of Numbers.
   (b) To solve the problems of Square Roots & Cube Roots.
2. (a) To solve the problems of Average
   (b) To solve the Problems on Ages
3. To solve the problems of . Percentage, Profit & Loss
4. To solve the problems of Ratio & Proportion, Numbers
5. To solve the problems of Time & work.
6. To solve the problems of Time & Distance, Problems on Trains
7. To solve the problems of Simple Interest and Compound Interest
8. To solve the problems of Area, Volume & Surface Areas
9. To solve the problems of Races & Games of Skill
10. To solve the problems of Calendar and Clocks.
11. To solve the problems of Permutations & Combinations and Probability

Suggested Books:

1. Quantitative Aptitude –R.S. Aggarwal

Course Title/ Code	UNIX & Shell Programming PHW218 P
Course Type	Core
Course Nature	Workshop
L-T-P-O Structure	**0-0-3-0**
Objectives	Student shall be able to formulate commands and scripts in UNIX operating system to meet the stated functional requirements of the operating system.

Section-A

Introduction to UNIX: UNIX architecture and command usage, Internal and external commands, Command structure, browsing the manual pages, learning about UNIX file system, file naming, parent-child relationship. Commands for: displaying calendar, system date, knowing the terminal, and displaying terminal characteristics knowing the login name, host name, name of the operating system, version of the operating system.

File and Directory Commands : Knowing about HOME directory, checking for the current directory, learning about absolute and relative pathnames and difference between them, changing the current directory, making and removing directories, conditions for removing directories, listing the directory contents in varied ways, displaying and creating files, copying, deleting and renaming files, comparing two files, converting one file to another, compressing and archiving files, listing file attributes, listing directory attributes, Changing Permissions on Files and Directories

Section-B

Operating on files: Locating files, applying simple filters on file, paginating files, displaying the beginning and end of a file, splitting a file vertically, pasting files, ordering a file, Locating repeated and non repeated lines, transliteration sorting and searching a file, pattern matching-the wild-cards.

Standard I/O redirection: Standard files, standard output; Standard input, standard error; filters and pipelines, creating a tree.

Process In Unix: Learning about customizing the environment: environment variables, the common environment variables, aliases, Command history, in-line command editing, Process basics, process status, system processes, mechanism of process creation, internal and external commands, process states, running jobs in background, killing processes, Running jobs periodically, timing processes

Section-C

Shell scripts: Types of shells, Shell functionality ,Displaying – using echo, Using Expr Using Test ,Getting input – using read, Writing script & executing basic script ,Debugging script, Making interactive script,Variables (default Variables), Mathematical expressions

Conditional statements: If-else-elif, Test command, Logical operators-AND, OR, NOT, case –esac

Loops: While, For, Until

Command line arguments Positional parameters Set & shift IF, Break & continue

Functions & file manipulations Processing file line by line, Functions

Section-D

AWK programming: Splitting a line into fields, formatting output, variables and expressions, Comparison operators, number processing, variables, storing programs in a file, BEGIN and END sections, built-in variables. Arrays, functions, control flow, loop programming

Text Books:

1. UNIX concepts and applications, Fourth Edition, Sumitabha Das, TMH
2. Unix Shell Programming-Yashwant Kanetkar

Reference Book:

- Introduction to UNIX & SHELL programming, M.G. Venkatesh Murthy, Pearson Education.
- UNIX and shell Programming –A text book, B.A. Frozen& R.F. Giberg, Thomson

Course Title	**ENVIRONMENTALSUSTAINABLE DEVELOPMENT (CHS234)**
L-T-P	**1-0-2**
Credit	**2**
Course Level	**UG**

COURSE OBJECTIVE

The students would be able to describe, explain and analyse the sustainable development concerns and challenges.

LEARNING OUTCOMES

At the end of the course, the students would be able to

- develop an inter-disciplinary understanding of sustainable development concerns;
- recognise the challenges of sustainable development; the opportunities and limits in meeting these challenges; and
- defend or criticise the sustainability initiatives adopted by different enterprises.

COURSE CONTENTS

Section - A

Introduction to Sustainable Development

Definition of Sustainable Development; Triple Bottom Line, Components of TBL, Changing Perspective & Debates in Sustainable Development - Need for Sustainable Development, Evolution of the concept of Sustainable Development: Stockholm Conference, The Brundtland Commission, Earth Summit, Agenda 21; Millennium Development Goals

Section- B

Challenges to Sustainable Development and Sustainable Development Goals (SDGs)

Challenges to Sustainable Development - Agriculture, Population & Food Security, Public Health and Nutrition, Education, Natural Resources (Forests, Energy, Water), Climate Change Sustainable Development Goals (SDGs) - Introduction, Challenges to SDGs, Indian Scenario.

Section - C

Sustainability Strategies

Sustainability Strategies - Introduction, Rationale and Mechanisms, Key Principles, Sustainability Strategies Adopted by Different Enterprises – Case Studies

Section - D

Sustainable Development and Contemporary Issues

Sustainable Consumption, Indigenous Knowledge, Gender Issues, Population & Sustainable Agriculture, Sustainable Tourism

Tools: Video lecture**;** research papers or articles, survey, presentations, white board

LAB EXPERIMENTS/ACTIVITIES

1. **Survey**- Business and non-business students' perception towards TBL (based on the readings listed above); inferences on the basis of survey; http://www.aabri.com/manuscripts/121249.pdf
2. Workshop based - Sustainable agriculture- Mushroom farming
3. Workshop based - Back to nature - DIY composting bin
4. Review - Sustainable Consumption in India: Challenges and Opportunities; Divesh Kumar,Praveen Goyal, Zillur Rahman, Ishwar Kumar; IJMBs Vol. 1, Issue 3, September 2011; http; ://www.ijmbs.com/13/devesh.pdf
5. Calculate Carbon Footprint/Ecological footprint
6. Stimulus Activity (Piece of writing) - Sustainable Consumption
7. CSR - Workshop for Village school children
8. Simulation Activity - Challenges to Sustainable Development
9. Case Studies - Sustainability initiatives @ TATA Motors, CAIRN INDIA, Mahindra & Mahindra, Subaru Isuzu, Disney, Novo Nordisk, etc.

VIDEO LECTURES:

- Triple Bottom Line (TBL) - https://www.youtube.com/watch?v=2f5m-jBf81Q
- How Humans Made Malaria So Deadly - https://www.youtube.com/watch?v=64pvlCtH-O
- Ocean Confetti! - https://www.youtube.com/watch?v=qVoFeELi_vQ&spfreload=5
- Sustainability explained through animation - https://www.youtube.com/watch?v=B5NiTN0chj0

- SDGs - https://www.youtube.com/watch?v=uHEfRAooih8
- Micro-plastics - https://www.youtube.com/watch?v=UpGt5L3GC7o
- Sustainable Consumption - http://www.ijmbs.com/13/devesh.pdf.

BOOKS/READING MATERIAL

- Environmental Management for Sustainable Development; C.J. Barrow; Routledge Publishers
- Roberts, J.T., and Hite, A., 2000, From Modernization to Globalization - Perspectives on Development and Social Change, Blackwell Publishing
- Sachs, J., 2004, Stages of Development, Speech at the Chinese Academy of Arts and Sciences
- Giddings, B., Hopwood, B., and Geoff O'Brien, 2002, Environment, Economy and Society: Fitting Them Together into Sustainable Development, Published online in Wiley Inter Science (www.interscience.wiley.com). DOI: 10.1002/sd.199
- IPCC, Adaptation to Climate Change in the context of Sustainable Development and Equity, www.ipcc.ch/ipccreports/tar/wg2/pdf/wg2TARchap18.pdf
- Brundtland Commission, 1987, "Our Common Future", Oxford University Press
- Food Insecurity Atlas of Rural India (2001) MS Swaminathan Research Foundation and World Food Programme. http://home.wfp.org/stellent/groups/public/documents/ena/wfp076968.pdf.
- Maternal and Child Undernutrition 1 Maternal and child undernutrition: global and regional
- exposures and health consequences http://www.who.int/nutrition/topics/Lancetseries_Undernutrition1.pdf.

Course Title/ Code	**E-Waste: Environmental Problems and Management (ECS249)**
Course Type	Domain Elective
Course Nature	Soft
L-T-P-O Structure	(1-0-2-0)
Objectives	• Gain a better understanding and appreciation for the challenges related to waste management. • Create awareness about environmental impacts of e-waste. • Identify various components of e-waste

SECTION - A

INTRODUCTION: What is E-Waste, Indian and global scenarioof e-Waste, Growth of Electrical and Electronics industry in India, E-waste generation in India, Composition of e-waste, Possible hazardous substances present in e-waste, Environmental and Health implications.

SECTION - B

E-WASTE LEGISLATION: Regulatory regime for e-waste in India, The hazardous waste(Management and Handling) rules 2003, E- waste management rules 2015, Regulatory compliance including roles and responsibility of different stakeholders – producer, manufacturer, consumer etc., Proposed reduction in the use of hazardous substances (RoHS), Extended producer responsibility (EPR).

SECTION - C

END OF LIFE MANAGEMENT OF E-WASTE: Historic methods of waste disposal – dumping, burning, landfill; Recycling and recovery technologies – sorting, crushing, separation; Life cycle assessment of a product – introduction; Case study – optimal planning for computer waste.

SECTION - D

ENVIRONMENTALLY SOUND E-WASTE MANAGEMENT: Emerging recycling and

recovery technologies, Guidelines for environmentally sound management of e-waste, Environmentally sound treatment technology for e-waste, Guidelines for establishment of integrated e-waste recycling and treatment facility, Case studies and unique initiatives from around the world.

REFERENCE BOOKS:

S.No.	Book	Author	Publisher
1.	Electronic Waste Management	R E Hester, R M Harrison	RSC
2.	E-waste: Implications, regulations, and management in India and current global best practices	Rakesh Johri	TERI PRESS

LAB EXPERIMENTS:

SECTION A

1. **Video Lecture**:

- E-Waste: A Big Issue- https://www.youtube.com/watch?v=d5oi4QOeQ3I&t=21s
- The Electronic Wasteland- https://www.youtube.com/watch?v=cVORBbZBbOk
- E Waste in India- https://www.youtube.com/watch?v=sFfaYc_pIx8

2. Reading (articles/research papers):

- Step: Solving the E-Waste Problem. White Paper: One Global Definition of E- waste. **http://www.step-initiative.org**
- E-waste management in India – Electronics For You, **http://electronicsforu.com/technology-trends/e-waste-management-india**

3. Identify the hazardous materials present in printed circuit boards.

SECTION B

4. Extraction of copper of printed circuit boards in etching solution.
5. Demo of recycling process through videos.
6. Invited guest lecture.
7. Field visit to a waste management initiative in NCR.
8. Activity based learning: survey of the household practice of e-waste disposal and awareness.
9. Case study – presentation and group discussion.

Semester-V

COURSE CODE	COURSE NAME	Course Type	Course Nature	PERIODS				CREDITS
		Core(Departmental/Allied)/ Elective (Departmental/ Open) / University Compulsory	Hard/Soft / Workshop/ NTCC	L	T	P	O	
PHH320-T	Electronic Devices	Core	Hard	3	1	0	0	4
PHH320-P	Electronic Devices Lab	Core	Hard	0	0	2	0	1
	Physical Instruments	Elective	Hard	3	1	0	0	4
MEH206-T	Engineering Materials and their Behavior							
EDH374-T	Pedagogy of Physical Sciences							
	Physical Instruments Lab	Elective	Hard	0	0	2	0	1
EDH374-P	Pedagogy of Physical Sciences Lab							
MEH206-P	Engineering Materials and their Behavior Lab							
ECW330	Electrical Technology	Core	WS	0	0	3	0	2
	Discipline Specific elective-I	Core Elective	Hard	3	1	0	0	4
	Discipline Specific elective-I Lab	Core Elective	Hard	0	0	2	0	1
	Discipline Specific elective-II	Core Elective	Hard	3	1	0	0	4
	Discipline Specific elective-II Lab	Core Elective	Hard	0	0	2	0	1
PHS321	Seminar			0	0	0	2	1
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)			12	4	11	1	23

Detailed Syllabus

Course	ELECTRONIC DEVICES (PHH318-T)

Title/ Code	
Course Type:	Core (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-0-0)
Objectives	• Study the working of diodes and transistors. • Study the application of different electronic devices and simple circuits

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Learning Outcomes:

Students will have the Ability to:

- Analyze and design amplifier circuits employing BJT, JFET, MOSFET devices
- Explain the semiconductor fabrication technology

SECTION-A

Semiconductor Basics: Energy Bands in Solids, Density of States, Carrier Concentration at Normal Equilibrium in Intrinsic Semiconductors, Majority Carriers (electrons and holes), Dependence of Fermi Level on Temperature and Doping Concentration, Diode: P-N Junction Diode, Formation of Depletion Layer, and Space Charge at a Junction, Derivation of Electrostatic Potential Difference at Thermal Equilibrium, Depletion Width and Depletion Capacitance of Abrupt p-n Junction, Diode Equations and the I-V Characteristic, Zener Diode and Avalanche mechanism,
Diode as rectifier

SECTION – B

Metal Semiconductor Junctions and Bipolar Junction Transistors (BJT):

Ohmic & Rectifying Contacts, PNP and NPN Transistors, Basic Transistor Action, Energy Band Diagram of Transistor in Thermal Equilibrium, Early Effect, Input and Output Characteristics of CB, CE and CC Configurations, CE Transistor as an Amplifier, Uni-Junction Transistor (UJT): Construction, Working and I-V Characteristics of UJT, Thyristor Devices: Basic Construction and Characteristics of Thyristor, Semiconductor Controlled Device (SCR), Characteristics and Two Transistor Model Of SCR

SECTION - C

Field Effect Transistors (FET)

Construction and Working of JFET, Idea of Channel Formation, Pinch-off Voltage, Transfer and Output Characteristics, MOSFET: MOS Diode, Basic Construction of MOSFET and Working, I-V Characteristics, Enhancement and Depletion Modes, Complimentary MOS(CMOS).

SECTION-D

Semiconductor Fabrication Technology

Introduction to Semiconductor Technology, Basic Fabrication Steps: Wafer, Epitaxial Growth, Oxidation, Photolithography, Etching, Diffusion, Ion Implantation, Film Deposition and Metallization, Moore's Law, Medium Scale Integration (MSI), Large Scale Integration (LSI), Very Large Scale Integration (VLSI), Ultra Large Scale Integration (ULSI), Giant Scale Integration(GSI)

Course Title/ Code	ELECTRONIC DEVICES LAB (PHH318-P)

Course Type:	Core (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(0-0-2-0)
Objectives	• Study the working of diodes and transistors. • Study the application of different electronic devices and simple circuits

LIST OF EXPERIMENTS

1. To study (a) Half-wave Rectifier and (b) Full-wave Bridge Rectifier.
2. To investigate the effect of C, L and π filters.
3. To study the Forward and Reverse characteristics of a Zener Diode and to study its use as a Voltage Regulator.
4. To study the V-I Characteristics of p-n junction diode and hence to determine static and dynamic resistance.
5. To study the Characteristics of a Photo-diode.
6. To study the CE Characteristics of a Transistor.
7. To study the various Transistor Biasing Configurations as an amplifier
8. To design a CE Amplifier of a given gain (mid-gain) using Voltage Divider Bias.
9. To study the Frequency Response of Voltage Gain of a RC-Coupled Amplifier.
10. To study the Characteristics of a FET and design a common source amplifier.

Suggested Books:

1. S. M. Sze, Semiconductor Devices: Physics and Technology, John Wiley & Sons (2002)

2. Ben Streetman and S. Banerjee, Solid State Electronic Devices, Pearson Education (2006)

3. Jasprit Singh, Semiconductor Devices: Basic Principles, John Wiley and Sons (2001)

4. Kanaan Kano, Semiconductor Devices, Pearson Education (2004)

Course Title/Code	**Pedagogy of Physical Sciences (EDH 374)**
Course Type	**Elective**

Course Nature	Hard
L-T-P-O Structure	(3-0-2-0)
Objectives	-To understand the epistemology of science as a school subject in the school curriculum. -To implement various pedagogical approaches to teaching of science at different stages of school. -To plan units and lessons through thematic approach in a holistic manner. -To critically examine teaching-learning process that incorporate enquiry, discovery, activity based learning, problem solving situations and investigatory projects etc within the classroom. -To integrate knowledge of science with other school subjects -To facilitate self-assessment in children with insights about meta-learning.

SECTION - A

NATURE AND SCOPE OF SCIENCE

Definition of Science, Nature of Science. Concept, facts, theories and generalizations. Contributions of Indian and International Physicists and Chemist (Issac Newton, John Dalton, J.C. Bose, Albert Einstein, Niel Bohr, C.V. Raman to name a few) to the knowledge domain of Physical Science with special reference to the methods of discovery/ Investigation adopted.

Science as a process of constructing knowledge; Scientific methods: A critical view, How science works; role of science teacher. Integration and Application of knowledge of Physical Sciences with other school subjects and in daily life.

SECTION - B

PLANNING, DESIGNING AND TRANSACTION

Aims and objectives of teaching physical science, Development of scientific attitude and temper, Development of Unit plan, Lesson Plan, Concept maps using variety of approaches. Developing and writing Learning Objectives: Anderson and Krathwohl's Taxonomy.

Teaching Learning Process with a focus on: Lecture cum demonstration method, Heuristic/ Inquiry approach, Problem solving approach, Project method, Constructivist approach, peer learning/ group learning, team teaching, Experiential learning, Cognitive conflict, Analogy strategy.

Appreciating every child's natural curiosity of observation and drawing conclusion, facilitating lifelong learning in students with special educational needs.

Science Laboratory: Organization and Management, Using Laboratory as a learning resource approaches to laboratory work, safety in laboratory, handling hurdles in utilization of resources.

SECTION - C

PEDAGOGICAL SHIFT IN PHYSICAL SCIENCES

Each learner is Unique, Pedagogical shift from science as a fixed body of knowledge to the process of constructing Knowledge. Content cum methodology, Pedagogical Analysis (any three topics from physics and chemistry)

Need of Inclusion in all aspects of teaching-learning of Physical sciences-science curriculum, approaches, ICT and professional development of teachers. Improvisation of Apparatus, identifying some inexpensive sources of chemicals

SECTION - D

ASSESSMENT FOR LEARNING

Continuous and Comprehensive Evaluation (CCE): need and importance; Assessment and evaluation as intertwined process of classroom experience.

Learning Indicators (LIs) and its types, developing LIs for activity, presentation, group work, assignments etc.

Tools and techniques of Assessment: assessment of written and oral work, project work, laboratory work, field trips, journal writing, concept map; Assessment of learners with special needs.

Recording and reporting of learning evidences- measurement of achievement, process skills and aptitude of learners; Portfolio- its role in evaluating students' performances. Role of reflection in students' achievement.

Reference Books and Readings:

1. Alsop, S. and Hicks, K. (2007): *Teaching Science: A Handbook for Primary and Secondary school teachers,* Kogan Page, N.Delhi .
2. CBSE (2009). Teacher's manual on CCE. New Delhi: CBSE.
3. Chikara, M.S. and Sarma, S. (1985). Teaching Science. Ludhiana: Prakash Brothers.
4. Das, R.C. (1985). *Science teaching in Schools.* New Delhi: Sterling Publications Private Ltd.
5. Krathwohl, D.R., Bloom B.S. and Maria B.B. (1964) *Taxonomy of Educational Objectives, Handbook II, Affective Domain*, New York: David McKay.
6. Lindfors, J. (1984). *How children learn or how teachers teach?* A Profound confusion: Language Arts, 61 (6), 600-606.
7. National Curriculum Framework 2005, NCERT, New Delhi.
8. Ramakrishna, A. (2012). *Methodology of Teaching Integrated Sciences.* New Delhi: Pearson.
9. Steffe, L. and Gale, J. (Eds.) 1995). *Constructivism in Education*, New Jersey : Lawrence Erlbaum Associates Inc.

Pedagogy of Physical Sciences Practical (EDH 374)

1. Science Text Book Analysis
2. Concept Mapping: How Children learn Science?
3. Toys from Trash: innovative low cost/No Cost Teaching Aids to demonstrate scientific concepts.
4. Designing laboratory experiences for using in teaching-learning process in classroom situation- two innovative activities and two improvised apparatus.
5. Prepare a First Aid box equipped with all the essential things in it.
6. *Report of one Action Research carried out in the practising school.
7. Report on measures being taken for inclusive teaching-learning in practicing schools.
8. Concept mapping in selected units in Physical Science Planning learning situations for constructing knowledge in Physical Science.
9. Learned Paper presentation on pedagogical issues.

Course Title/Code	**ENGINEERING MATERIALS AND THEIR BEHAVIOR (MEH206-T)**
Course Type	Elective
Course Nature	Hard

L-T-P-O structure	3-1-0-0
Prerequisites	NIL

SECTION - A

Introduction: Historical perspective, classification of materials.

Crystallography: Review of crystal structure, space lattice, crystal planes and crystal directions, co-ordination number, number of atoms per unit cell, atomic packing factor, Imperfection in metal crystals: Crystal imperfections and their classifications, point defects, line defects, edge & screw dislocations, surface defects, volume defects & effects of imperfections on metal properties. Problems

SECTION - B

Solid solutions and phase diagram: Introduction to single and multiphase solid solutions and types of solid solutions, importance and objectives of phase diagram, systems, phase and structural constituents, cooling curves, unary & binary phase diagrams, Gibbs's phase rule, Lever rule, eutectic and eutectoid systems, peritectic and peritectoid systems, iron carbon equilibrium diagram, and TTT diagram, Allotropic transformation of iron and steel, Properties of austenite, ferrite, pearlite, martensite

Heat Treatment: Principles, purpose, classification of heat treatment processes, annealing, normalizing, stress relieving, hardening, tempering, carburizing, nitriding, cyaniding, flame and induction hardening.

SECTION - C

Deformation of Metal: Elastic and plastic deformation, mechanism of plastic deformation, twinning, conventional and true stress strain curves for polycrystalline materials, yield point phenomena, strain ageing, work hardening, Bauschinger effect, season cracking. Recovery, re-crystallization and grain growth.

Fracture & its Prevention: Fracture - Mechanism of brittle fracture (Griffith's theory) and ductile fracture - Difference between brittle and ductile fractures - Fatigue failure and its prevention

Creep - different stages in creep curve - Factors affecting creep resistant materials - Mechanism of creep fracture, Mechanical properties.

SECTION -D

Plastics: Various types of polymers/plastics and its applications. Mechanical behavior and processing of plastics, future of plastics

Ceramics: Structure types and properties and applications of ceramics. Mechanical/Electrical behavior and processing of Ceramics.

Other materials: Brief description of other material such as optical and thermal materials concrete, Composite Materials and its uses. Brief introduction to Smart materials& Nano-materials and their potential applications Corrosion & its Prevention: Various types of corrosion, factors effecting corrosion and methods of preventing corrosion

TEXT BOOKS & REFERENCES:

1. Material Science & Engineering by V. Raghvan, Prentice Hall of India Pvt. Ltd, NewDelhi
2. Material Science by Narula, Narula and Gupta. New Age Publishers
3. A Text Book of Material Science & Metallurgy by O.P. Khanna, Dhanpat Rai &Sons

Course Title/Code	**ENGINEERING MATERIALS AND THEIR BEHAVIOR LAB (MEH206-P)**
Course Type	Elective
Course Nature	Hard
L-T-P-O structure	0-0-2-0
Prerequisites	NIL

LIST OF EXPERIMENTS:

1. Preparation of mild steel specimen and metallographic examination of the preparedspecimen
2. To study solidification curve for a givenspecimen.
3. Determine the hardness of given sample before & after the Heat Treatment (Hardening (water as quenching media), Annealing &Normalizing)
4. Study the effect of different quenching media on the hardness (Rockwell Hardness) of given mild steelsamples.
5. Preparation of mild steel specimen and metallographic examination of the preparedspecimen
6. To study solidification curve for a givenspecimen.
7. Determine the hardness of given sample before & after the Heat Treatment (Hardening (water as quenching media), Annealing &Normalizing)
8. Study the effect of different quenching media on the hardness (Rockwell Hardness) of given mild steelsamples.
9. Study of microstructure of welded component and HAZ (Heat Affected Zone) macro and microexamination
10. Determine the izod impact strength of given acrylic sheets and study the effect of thickness of the sheet on the impactstrength
11. To study the creep behavior of a givenspecimen
12. To measure the hardness of the sample by varying distance from quenching medium by Jominy end quench test apparatus.
13. To illustrate the effects of fatigue on a metal.
14. To study effect of different media on the rate ofcorrosion

Course Title/	**ELECTRICAL WORKSHOP (ECW330)**

Code	
Course Type:	Core (Allied)
Course Nature:	Workshop
L-T-P Structure	(0-0-3)
Objectives	To provide a platform for students for practical implementation of Electrical Circuits and Projects. To develop technical skills in students up-to the level of industrial standards.

LIST OF EXPERIMENTS:

1. Familiarization with the components, breadboard, resistor coding and various types of meters.
2. To verify KCL and KVL in a circuit.
3. To study and verify Thevenin's and Norton's Theorem.
4. To obtain the characteristics of Incandescent and Fluorescent Lamps.
5. Measurement of various parameters of different AC waveforms (average , RMS, peak value, Form factor, Peak factor)
6. Measurement of parameters at series and parallel resonance.
7. Single phase AC Power measurement.
8. Efficiency and voltage regulation of single phase transformer.
9. Open circuit and short circuit test on single phase transformer.
10. Project

Text Book

1. Basic Electrical Engineering, T.K. Nagsarkar, M S Shukhija; Oxford University Press
2. A Textbook of Electrical Technology, Vol- I, B L Theraja, S Chand and Company
3. Principles of Electrical Engineering, Del. Toro, PHI Publication.

Reference Books:

1. Electrical & Electronics Technology, Edward Hughes, Seventh Edition, Pearson Education
2. Elements of Electrical Technology, H Cotton, C B S Publications
3. Electric circuits, Nahvi, John Edminister, Schaums series, Tata McGraw Hill
4. Theory and problems of Basic Electrical Engineering, Nagrath and Kothari, Prentice-Hall of India.

LIST OF EXPERIMENTS:

1. To find roots of an equation using Bisection method.
2. To find roots of an equation using RegulaFalsi method.
3. To find roots of an equation using Newton Raphson method.
4. To find roots of an equation using Secant method.
5. To find the value of a dependent variable for a given value of an independent variable using Lagrange's interpolation method for a given set of data.
6. To find the value of a dependent variable for a given value of an independent variable using Newton divided difference interpolation for a given set of data.
7. To find the value of a definite integral using Trapezoidal rule of integration.
8. To find the value of a definite integral using Simpson's 1/3 rule of integration.
9. To find the value of a definite integral using Simpson's 3/8 rule of integration.
10. To find the solution of an ordinary differential equation of first order by R-K method

REFERENCE BOOKS:

1. M.K. Jain, S.R.K. Iyengar and R.K.Jain, "Numerical Methods for Scientific and Engineering Computation", New Age international Publishers.
2. Laurene V, Fausett, "Applied Numerical Analysis using MATLAB", Pearson.
3. S.S. Sastry, "Introductory Methods of Numerical Analysis", Published by Prentice Hall of India

Semester-VI

COURSE CODE	COURSE NAME	Course Type	Course Nature	PERIODS				CREDITS
		Core(Departmental/Allied)/ Elective (Departmental/ Open) / University Compulsory	Hard/Soft/ Workshop/ NTCC	L	T	P	O	
PHH322-T	Electromagnetic Theory	Core	Hard	3	1	0	0	4
PHH322-P	Electromagnetic Theory Lab	Core	Hard	0	0	2	0	1
	Discipline Specific elective-I	Core Elective	Hard	3	1	0	0	4
	Discipline Specific elective-I Lab	Core Elective	Hard	0	0	2	0	1
	Discipline Specific elective-II	Core Elective	Hard	3	1	0	0	4
	Discipline Specific elective-II Lab	Core Elective	Hard	0	0	2	0	1
PHN323	Project			0	0	0	5	5
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)			9	3	6	5	20

Detailed Syllabus

Course Title/ Code	**Electromagnetic Theory(PHH322-T)**
Course Type:	Core (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-0-0)
Objectives	• To study formulation of Maxwell's Equations • To study transmission of E-M waves in different media and in transmission lines

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Learning Outcomes:

Students will have the Ability to:

1. convert to different coordinate system
2. explain the properties of Maxwell equations and apply to simple systems.
3. explain transmission of E M waves in transmission lines

SECTION - A

Elements of Vector Calculus

Spherical, Cylindrical and CartesianCoordinate Systems and Transformation, Vector calculus: Differential length, area and volume, line surface and volume integrals, del operator, gradient of a scalar, divergence of a vector and divergence theorem, curl of a vector and Stoke's theorem, Laplacian of a scalar.

SECTION - B

Maxwell's Equations

Maxwell Equations in differential form, Displacement Current, Vector and Scalar Potentials, Boundary Conditions at Interface between Different Media, Wave Equations, Time-varying potentials, Time-Harmonic Fields, Waves in general, Plane waves in free space,

SECTION - C

Time Dependent Fields & Waves

Wave propagation in lossy dielectrics, Plane waves in lossless dielectrics, plane waves in good conductors, power and the pointing vector Electromagnetic Energy Density., Reflection of a plain wave in a normal incidence, Reflection of a Plane Wave at Oblique Incidence.

SECTION - D

Transmission Lines: Transmission Line Parameters, Transmission Line Equations, Smith chart; Input Impedance, SWR and Power, S-parameters, Some Applications of Transmission Lines, Transients on Transmission Lines, EM spectrum.

Course Title/ Code	**Electromagnetic Theory Lab (PHH322-P)**
Course Type:	Core (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(0-0-2-0)
Objectives	• To study formulation of Maxwell's Equations • To study transmission of E-M waves in different media and in transmission lines

List of Experiments

1. To verify the law of Malus for plane polarized light.
2. To determine the specific rotation of sugar solution using Polarimeter.
3. To analyze elliptically polarized Light by using a Babinet's compensator.
4. To study dependence of radiation on angle for a simple Dipole antenna.
5. To determine the wavelength and velocity of ultrasonic waves in a liquid (Kerosene Oil, Xylene, etc.) by studying the diffraction through ultrasonic grating.
6. To study the reflection, refraction of microwaves.
7. To study Polarization and double slit interference in microwaves.
8. To determine the refractive index of liquid by total internal reflection using Wollaston's air-film.
9. To determine the refractive Index of (1) glass and (2) a liquid by total internal reflection using a Gaussian eyepiece.
10. To study the polarization of light by reflection and determine the polarizing angle for air-glass interface.
11. To verify the Stefan`s law of radiation and to determine Stefan's constant.
12. To determine the Boltzmann constant using V-I characteristics of PN junction diode.

Suggested Books:

1. Introduction to Electrodynamics by A.Z.Capri & P.V.Panat.(New Delhi: Narosa Pub.House, 2002) (Text Book).
2. Electromagnetics by Joseph A.Edminister 2nd ed.(New Delhi: Tata Mc Graw Hill, 2006) (Text Book).
3. Fundamentals of electromagnetics by M.A.W.Miah.(Tata Mc Graw Hill,1992)
4. Applied electromagnetism By Liang Chi Shen, Jin Au Kong (PWS Pub. Co., 1995)
5. David J. Griffiths, Introduction to Electrodynamics, 3rd edition, (Benjamin Cummings 1998).
6. J. D. Jackson, Classical Electrodynamics, 3rd edition, (Wiley, New York 1998)

ELECTIVE COURSES FOR Vth and VIth SEMESTER

Renewable Energy I

COURSE CODE	COURSE NAME	Course Type	Course Nature	PERIODS				CREDITS
		Core(Departmental/Allied) / Elective (Departmental/ Open) / University Compulsory	Hard/Soft/ Workshop / NTCC	L	T	P	O	
PHH 324-T	Renewable Energy I	Elective (Departmental)	Hard	3	1	0	0	4
PHH 324-P	Renewable Energy I Lab	Elective (Departmental)	Hard	0	0	2	0	1

Course Title/ Code	Renewable Energy I

Course Type:	Elective (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	• To study Solar Energy Through Photosynthesis • To study Production of Wind Energy

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Learning Outcomes:

Students will have the Ability to:

1) analyze energy harvesting through Biomass production
2) explain conversion of Biomass to usable form of fuel
3) explain and perform energy production using wind energy

Section - A

Solar Energy

Sun as Source of Energy, Availability of Solar Energy, Nature of Solar Energy, Solar Energy & Environment, Various Methods of Using Solar Energy – Photothermal, Photovoltaic, Photosynthesis, Present & Future Scope of Solar energy.

Section - B

Bio-mass

Biomass: Generation and Utilization, Properties of Biomass, Agriculture Crop & Forestry Residues Used as Fuels, Biochemical and Thermo-Chemical Conversion, Combustion, Gasification, Biomass Gasifiers and Types etc.

Applications of Gasifiers to Thermal Power and Engines, Biomass as a Decentralized

Power Generation Source for Villages, Concept of Bio-Energy**:** Photosynthesis Process, Bio-fuels, Biomass Resources Bio Based Chemicals and Materials Thermo-Chemical Conversion: Pyrolysis, Combustion, Gasification, Liquification. Bio-Chemical Conversion: Aerobic and Anaerobic Conversion, Fermentation etc. Bio-Fuels: Importance, Production and Applications. Bio-fuels: Types of Bio-Fuels, Production Processes and Technologies, Bio-Fuel Applications, Ethanol as a Fuel for I.C. Engines, Relevance with Indian Economy. Bio-Based Chemicals and Materials: Commercial and Industrial Products, Biomass, Feed stocks, Chemicals, Plastics, Fibers etc. Government Policy and Status of Bio Fuel Technologies

Section - C

Biomethanation

Importance of Biogas Technology, Different Types of Biogas Plants,Aerobic and Anaerobic Bioconversion Processes, Various Substrates Used to Produce Biogas (cow dung, human and other agricultural waste, municipal waste etc.) Individual and Community Biogas Operated Engines and their Use, Removal of CO_2 and H_2O, Application of Biogas in Domestic, Industry and Vehicles, Bio-Hydrogen Production, Isolation of Methane from Biogas and Packing and its Utilization.

Section - D

Wind Energy

Wind Energy: Basics & Power Analysis, Wind Resource Assessment, Power Conversion Technologies and Applications, Wind Power Estimation Techniques, Principles of Aerodynamics of Wind Turbine Blade, Various Aspects of Wind Turbine Design, Wind Turbine Generators: Induction, Synchronous Machine, Constant V & F and Variable V & F generations, Reactive Power Compensation, Site Selection, Concept of Wind Form & Project Cycle, Cost Economics & Viability of Wind Farm.

List of Experiments

1. Determining efficiency of lighting system, calculation of loads
2. Measurement of Intensity of solar radiation
3. Energy Content in Wind. (Prototype Wind Mill of 500W)
4. Bio-gas Production from Kitchen waste.
5. Performance of Gasifire
6. Determination of "Star Rating" of Refrigerator.

7. Flue gas analysis of petrol, diesel and LPG Engines.

8. Wind power and annual energy estimation from wind data

Suggested Books:

1. Biomass Renegerable Energy D.O.hall and R.P. Overeed
   (John Wiley and Sons, New york, 1987)
2. Biomass for energy in the developing countries – D.O.Hall, G.W.barnard and
   P.A.Moss (Pergamon Press Ltd. 1982)
3. Thermo chemical processing of Biomass, Bridgurater A V.
4. Biomass as Fuel – L.P.White (Academic press1981)
5. Biomass Gasification Principles and Technology, Energy technology review No. 67, -
   T.B. Read (Noyes Data Corp. , 1981)
6. Wind energy Conversion Systems – Freris L.L. (Prentice Hall1990)
7. Wind Turbine Technology: Fundamental concepts of wind turbine technology
   Spera D.A. (ASME Press, NY, 1994)
8. Wind Energy Systems – G.L. Johnson (Prentice Hall, 1985)

PHH 325 - Renewable Energy -II

COURSE CODE	COURSE NAME	Course Type	Course Nature	PERIODS				CREDITS
		Core(Departmental/Allied) /	Hard/Soft/ Workshop	L	T	P	O	

		Elective (Departmental/ Open) / University Compulsory	**/ NTCC**					
PHH 325-T	**Renewable Energy - II**	**Elective (Departmental)**	**Hard**	**3**	**1**	**0**	**0**	**4**
PHH 325-P	**Renewable Energy - II**	**Elective (Departmental)**	**Hard**	**0**	**0**	**2**	**0**	**1**

Course Title/ Code	**Renewable Energy-II**
Course Type:	Elective (Departmental/Allied)

Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	• To study direct and indirect conversion of solar energy • To study different aspect of harnessing solar energy

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Learning Outcomes:

Students will have the Ability to:

1) construct power system for generation using Thermal and photo voltaic system

2) explain power generation using hydrogen fuel cell

3) explain power production from small hydro projects

Renewable Energy Systems-II

Section - A

Solar Energy Direct Conversion

Solar Water Heating System, Evacuated Solar Heater, Solar Air Heater, Solar Drier, Photovoltaic System: p-n Junction and its Characteristics, Photovoltaic Materials, Single Crystal Solar Cell, Amorphous Solar Cell, Thin Film Solar Cell, Tandem Solar Cell, Solar Cell Module

Section - B

Geothermal, Tide and Wave Energy

Availability of Geothermal Energy-Size and Distribution, Recovery of Geothermal Energy, Various Types of Systems to Use Geothermal Energy, Direct Heat Applications, Power

Generation Using Geothermal Heat, Sustainability of Geothermal Source, Status of Geothermal Technology, Economics of Geothermal Energy

Section - C

Hydrogen Energy

Hydrogen as a Renewable Energy Source, Sources of Hydrogen, Fuel for Vehicles,

Hydrogen Production: Direct Electrolysis of Water, Thermal Decomposition of Water, Biological and Biochemical Methods of Hydrogen Production

Storage of Hydrogen: Gaseous, Cryogenic and Metal hydride

Fuel Cell: Principle of working, Construction and Applications

Section - D

Hydro power: Potential, Hydropower Generation and Distribution, Mini and Micro-Hydel Power (MHP) Generation: Classification of Hydel Plants, Concept of Micro Hydel, Merits, MHP Plants: Components, Design and Layout, Status in India, Integrated Energy Systems and their Cost Benefit Analysis, Energy Storage System

List of Experiments

1. Study of solar collector.
2. Study of solar hot water systems (FPC and ETC)
3. Study of solar hot air collector/ solar dryer.
4. Performance evaluation of box type and concentrating type solar cooker.
5. Study of heat pipe
6. Characteristics of SPV system.
7. Determination of efficiency of DC/AC inverter.
8. Study of Chulla and Gas Stove.
9. Study of Lead Acid Battery as a energy storage.
10. Study of Performance of Solar Lamp.

Reference Books :

1. Solar Energy- G N Tewari – Narosa Publishing House
2. Renewable Sources of Energy and Conversion Systems: N.K.Bansal and M.K.Kleeman.
3. Principles of Thermal Process : Duffie -Beckman.
4. Solar Energy Handbook: Kreith and Kreider (McGrawHill)

5. Solar Cell : Marteen A. Green
6. Solar Hydrogen Energy Systems -T. Ohta (Ed.) (Pergamon Press)
7. Hydrogen Technology for Energy – D.A.Maths (Noyes Data Corp.)
8. Handbook: Batteries and Fuel cell – Linden (Mc.Graw Hill)
9. Batteries Volume (I) and (II) – Collins

Atmospheric Physics-I

COURSE CODE	COURSE NAME	Course Type	Course Nature	PERIODS				CREDITS
		Core(Departmental/Allied)/ Elective (Departmental/ Open) / University Compulsory	Hard/Soft/ Workshop / NTCC	L	T	P	O	
PHH 326-T	Atmospheric Physics-I	Elective (Departmental)	Hard	3	1	0	0	4
PHH 326-P	Atmospheric Physics-I Lab	Elective (Departmental)	Hard	0	0	2	0	1

Course Title/ Code	**Atmospheric Physics-I**
Course Type:	Elective (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section-A

Essentials of Atmospheric Physics

Structure of the atmosphere: troposhere, stratopshere, mesosphere, thermosphere, Composition of air, Greenhouse effect and enhanced greenhouse effect, Transport of matter, energy and momentum in nature, Stratification and stability of atmosphere, Laws of motion, hydrostatic equilibrium. Elements of weather and climate of India.

Section-B

Solar and Terrestrial Radiation

Physics of radiation, Interaction of light with matter, Rayleigh- and Mie-scattering, Laws of radiation (Kirchoffs law, Planck's law, Wien's displacement law, etc.), Solar and terrestrial spectra, UV radiation, Ozone depletion problem, IR absorption energy balance of the earth atmosphere system.

Section-C

Atmospheric Pollution and Degradation

Elementry fluid dynamics, Diffusion. Turbulence and turbulent diffusion, Factors governing air, water and noise pollution air and water quality standards, Waste disposal, Heat island dffect, Land and sea breeze Puffs and plumes, Gaseous and particulate matters, Wet and dry deposition Residence time and reaction rates of pollutants, sulphur compounds, nitrogen compounds, carbon compounds, organic compounds, aerosols, toxic gases and radio active particles trace gases.

Section-D

Global and Regional Climate

Elements of weather and climate. Stability and vertical motion of air, Horizontal motion of air and water, General circulation & climate, Pressure gradient forces, Viscous forces, Inertia, Reynolds number, Energy balance-a zero-dimensional Greenhouse model, Global climate models.

Reference and Text Books:

1. Meteorology for Scientists & Engineers: Ronald B. Still, Brooks/ Cole Cengage Learning 1995.

2. Environmental Physics : Edbert B and Reink V Groundelle, John Wiley

3. The Physics of Atmosphere : J.T. Hougtion, Cambridge Univ. Press, 1977.

Atmospheric Physics -II

COURSE CODE	COURSE NAME	Course Type	Course Nature	PERIODS				CREDITS
		Core(Departmental/Allied)/ Elective (Departmental/ Open) / University Compulsory	Hard/Soft/ Workshop / NTCC	L	T	P	O	
PHH 327-T	Atmospheric Physics -II	Elective (Departmental)	Hard	3	1	0	0	4
PHH 327-P	Atmospheric Physics – II Lab	Elective (Departmental)	Hard	0	0	2	0	1

Course Title/ Code	**Atmospheric Physics II**
Course Type:	Elective (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

ATMOSPHERIC PHYSICS-II

Section-A

Atmospheric Thermodynamics

Gas laws: virtual temperature, Hydrostatic equation: geopotential, scale height, constant pressure surfaces, reduction of pressure to sea level, First law of thermodynamics: joule's law, specific heats & enthalpy, Adiabatic processes: air parcel & dry adiabaic lapse rate, potential temperature, thermodynamic diagrams, Water vapour in air: moisture parameters, Pseudoadiabatic processes & saturated adiabatic lapse rate, equivalent and wet bulb potential temperatures, normand's rule, ascent decent effect, Static Stability: unsaturated & saturated air, conditional & convective stability, Second law of thermodynamics: Carnot cycle, entropy

Section-B

Cloud Formation and Microphysics of Cloud

Theory of nucleation of water vapour & cloud condensation nuclei. Microstructure of warm clouds. Cloud liquid water content & entrainment. Growth of cloud droplets in warm clouds: by condensation, by collection, by collission-coalescence, Microphysics of cold clouds: nucleation, growth & concentration of ice particles, formation of precipitation in cold clouds, Artificial modification of clouds & precipitation: modification of warm & cold clouds

Section-C

Atmospheric Electricity and Lightning

Fair weather atmospheric electric fields and currents, Mechanisms of cloud electrification: precipititation powdered & connective mechanisms, electrochemical charge separation, charge structure of the clouds, thundercloud electric fields, Lightning initiation in a thundercloud, Cloud to ground and intracoud lightning, Positive lightning, lightning superbolts, Lightning fields: electric & magnetic fields, ratiations from lightning, application of the lightning electric field measurements, Lightning sprites.

Section-D

Ionosphere and its Importance

Ionosphere classification and formation, solar radiations and phenomena: solar flares, solar wind and corona mass ejection, Chemical composition of ionosphere, Ion Production in the Lower Atmosphere & Ionosphere, Photochemical Processes, transportation of ions, Ionospheric temperatures and densities, Global structure of the Earth's ionosphere & its variability: day-to-day, seasonal and annual, latitudinal and longitudinal, solar cycle variations.

Reference and Text Books:

1. Atmospheric Science: John M. Wallace & Peter V. Hobbs, Academic Press (2006)
2. Meteorology for Scientists and Engineers: Ronald B. Stull, Brocks/Cole Cengage Learning (1995)
3. The Lightning Discharge: Martin A. Uman, Academic Press (1987)
4. Dynamic Meteorology : Holton, J.R., 3rd edition,Academic PressN.Yf. (1992).

Condensed Matter Physics I

COURSE CODE	COURSE NAME	Course Type	Course Nature	PERIODS				CREDITS
		Core(Departmental/Allied) / Elective (Departmental/ Open) / University Compulsory	Hard/Soft/ Workshop / NTCC	L	T	P	O	
PHH 328-T	Condensed Matter Physics I	Elective (Departmental)	Hard	3	1	0	0	4
PHH 328-P	Condensed Matter Physics I Lab	Elective (Departmental)	Hard	0	0	2	0	1

Course Title/ Code	**Condensed Matter Physics -I (PHH328)**
Course Type:	Elective (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objective	Our objective is to train students in the field of condensed matter physics and materials science. The course gives an introduction to the physics of condensed matter, including crystalline and amorphous solids.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Condensed Matter Physics I

Section - A

Amorphous and crystalline state of matter. Crystal systems.Bonding in crystals: covalent, ionic, metallic, hydrogen bond, van der Waal's bond and the Madelung constant. Crystalline solids, unit cell, primitive cell, Bravais lattices,Miller indices, closed packed structures. Atomic radius, lattice constant and density. Liq-uid crystals. X-ray diffraction—Bragg equation.

Section - B

Free electrons in solids, density of states, Fermi surface, Fermi gas at T=0 K, Fermi statistics, specic heat capacity of electrons in metals, thermionic emission of electrons from metals.

Section C

Lattice dynamics of atoms in crystals, vibrations of monoatomic and diatomic linear chains, acoustic and optical phonon modes, density of states, thermal properties of crystal lattices, thermal energy of the harmonic Oscillator

Section - D

Basic of characterization techniques: FTIR, NMR,Powder XRD, UV-Vis.

References

•Dekker A.J., Solid state physics, Prentice Hall, 1985.

•Kittel C., Introduction to solid state physics, 7th Edn., John Wiley, New York, 1996.

COURSE OUTCOMES

Students will be able to

- Recognize common crystal structures and describe their symmetries.
- Describe diffraction using the reciprocal lattice.
-
- Determine the structure of crystalline materials by x-ray diffraction.
-
- Describe the formation of band-structure in crystals.
-
- Describe the experimental methods to understand the Fermi surface in crystals.

Lab

1.Temperature coefficient of resistance of a thermister

2.Analysis of the powder X-ray photograph of a simple cubic crystal

3.Thermionic work function of a metal (Richardson-Dushmann formula)

4.Energy gap of a semiconductor

5.Determination of Stefan’sconstant

6.Frank Hertz experiment

7.Magnetic Hysterisis

8.Measurement of magneto resistance of semiconductor

Condensed Matter Physics II

COURSE CODE	COURSE NAME	Course Type	Course Nature	PERIODS				CREDITS
		Core(Departmental/Allied) / Elective (Departmental/ Open) / University Compulsory	Hard/Soft/ Workshop / NTCC	L	T	P	O	
PHH 329-T	Condensed Matter Physics I	Elective (Departmental)	Hard	3	1	0	0	4
PHH 329-P	Condensed Matter Physics I Lab	Elective (Departmental)	Hard	0	0	2	0	1

Course Title/ Code	**Condensed Matter Physics- II (PHH329)**
Course Type:	Elective (Departmental/Allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	The course focuses on learning the principles of theoretical condensed matter physics. Both molecular mechanical and quantum mechanical models are covered. Students will learn a variety of commonly used techniques, such as molecular dynamics and density functional theory for the Pediction of various properties of matter.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Condensed Matter Physics II

Section - A

Foundations of the MO theory, The Huckel method, Huckel theory and the LCAO approximation, Semi-empirical MO theory, Molecular mechanics calculations, energy minimization, vibrational frequencies, and normal mode analysis.

Section - B

Ensembles: Canonical, microcanonical and Grand-Canonical Ensemble, Classical potentials, molecular dynamics Simulations,

Section - C

Introduction to basis-set, The Hartree equation, Density functional theory

Section - D

Introduction to linux, Installation and running a program, Preparation of input for different open source codes, calculation of various properties of molecules, clusters, crystals and surfaces, vizualization of output,

LAB

1- Introduction to ghemical: input, output

2- Preparation of input of molecules, cluster for GAMESS (detail description of different keywords

3- Structural, vibrational study of water using DFT.

4-Vibrational study of water using DFT.

5-Structural, vibrational study of benzene using DFT.

6-Vibrational study of benzene using DFT.

7-Study of structural change in quartz under pressure, by classical molecular dynamics.

8- UV-vis spectrum of dye by DFT.